MX480 3D Universal Edge Router

Hardware Guide

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Juniper Networks, Inc.
1194 North Mathilda Avenue
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

MX480 3D Universal Edge Router Hardware Guide

Revision History
March 2014—Added new topics for SCBE2. Added the upgrade procedure for the SCBE2.
August 2013—Added new topics for CLI hardware terminology and port and interface numbering.
September 2011—Added the upgrade procedure for the MX SCBE and information for the new SCB
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July 2009—Updated product names. Updated information about securing power lugs.
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15 May 2008—530-020794-01. Revision 3. Corrected the procedures to replace AC power cords and DC power cables, and to install the router without a lift. Updated the AC and power requirements and specifications, host subsystem OFFLINE LED description, chassis grounding points description, and clearance requirements. Added recommendation to replace the air filter every 6 months.
19 October 2007—530-020794-01. Revision 2. Added cable management brackets installation procedure. Fixed unresolved cross-references.
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The information in this document is current as of the date on the title page.

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Junos Documentation and Release Notes

For a list of related Junos documentation, see http://www.juniper.net/techpubs/software/junos/.

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

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Documentation Conventions

Table 1 on page xx defines the 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 xx 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**.

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PART 1

MX480 3D Universal Edge Router Overview

CHAPTER 1

MX480 Router Overview

MX480 Router Description

The MX480 3D Universal Edge Router is an Ethernet-optimized edge router that provides both switching and carrier-class Ethernet routing. The MX480 router has a capacity of up to 720 gigabits per second (Gbps), full duplex. The MX480 router enables a wide range of business and residential applications and services, including high-speed transport and VPN services, next-generation broadband multiplay services, and high-volume Internet data center internetworking.

The MX480 chassis provides redundancy and resiliency. The hardware system is fully redundant, including power supplies, Routing Engines, and Switch Control Boards (SCBs).

The MX480 router is eight rack units (U) tall. Five routers can be stacked in a single floor-to-ceiling rack, for increased port density per unit of floor space. The router provides eight slots that can be populated with up to six Dense Port Concentrators (DPCs) or Modular Port Concentrators (MPCs), three Flexible PIC Concentrators (FPCs), and two SCBs. Each FPC holds up to two PICs and each MPC holds up to two Modular Interface Cards (MICs).

Fully populated, the MX480 router provides an aggregate throughput of up to 720 Gbps, with line-rate throughput on 72 10-Gigabit Ethernet ports, or oversubscribed forwarding at a gross ratio of 3:4 on all 96 10-Gigabit Ethernet ports.

Each DPC includes either two or four Packet Forwarding Engines. Each Packet Forwarding Engine enables a throughput of 10 Gbps. Many types of DPCs are available. For a list of the DPCs supported, see the *MX Series Interface Module Reference*.

The MX480 supports up to 3 FPCs containing up to 6 PICs or up to 6 MPCs containing up to 12 MICs. For a list of the supported line cards, see the *MX Series Interface Module Reference*.

The connections between DPCs, FPCs, MPCs, and SCBs are organized in three groups:

- Switch fabric—Connects the interface cards and provides for packet transport between DPCs, FPCs, and MPCs.
- Control plane—Gigabit Ethernet links between the combined SCBs/Routing Engines and each DPC, FPC, or MPC. All board-to-board information is passed over Ethernet except for low-level status and commands.
- Management signals—Provide for low-level status diagnostic support.

Related Documentation

- MX480 Component Redundancy on page 6
- MX480 Chassis Description on page 9
- MX480 Host Subsystem Description on page 30
- MX480 Craft Interface Description on page 44
- MX480 Power System Description on page 49
- MX480 Cooling System Description on page 55
- MX480 Router Physical Specifications on page 281

MX480 Router Hardware and CLI Terminology Mapping

The MX480 router supports the components in Table 3 on page 4.

Table 3: MX480 Router Hardware Components and CLI Terminology

Component	Hardware Model Number	CLI Name	Description
Chassis	CHAS-BP-MX480	**MX480**	"MX480 Router Physical Specifications" on page 281 "MX480 Chassis Description" on page 9
Craft Interface Panel	CRAFT-MX480-S	**Front Panel Display**	"MX480 Craft Interface Description" on page 44
Cooling System			
Fan tray	FFANTRAY-MX480	**Left Fan tray**	"MX480 Cooling System Description" on page 55
High-capacity fan tray	FFANTRAY-MX480-HC	**Enhanced Left Fan Tray**	
Filter kit	FLTR-KIT-MX480	N/A	
Host Subsystem			"MX480 Host Subsystem Description" on page 30
Routing Engine	See *Supported Routing Engines by Router*.		"MX480 Routing Engine Description" on page 40

Table 3: MX480 Router Hardware Components and CLI Terminology *(continued)*

Component	Hardware Model Number	CLI Name	Description
SCB	SCB-MX960	**MX SCB**	"MX480 SCB Description" on page 31
	SCBE-MX	**Enhanced MX SCB**	
Interface Modules			
DPC	See *DPCs Supported on MX240, MX480, and MX960 Routers* in the *MX Series Interface Module Reference*.		"MX480 Dense Port Concentrator (DPC) Description" on page 12
FPC	MX-FPC2	**MX FPC Type 2**	"MX480 Flexible PIC Concentrator (FPC) Description" on page 24
	MX-FPC3	**MX FPC Type 3**	
MIC	See *MICs Supported by MX Series Routers* in the *MX Series Interface Module Reference*.		"MX480 Modular Interface Card (MIC) Description" on page 20
MPC	See *MPCs Supported by MX240, MX480, MX960, MX2010, and MX2020 Routers* in the *MX Series Interface Module Reference*.		"MX480 Modular Port Concentrator (MPC) Description" on page 18
PIC	See *PICs Supported by MX240, MX480, and MX960 Routers* in the *MX Series Interface Module Reference*.		"MX480 PIC Description" on page 27
Interface module blank panel	DPC-SCB-BLANK MIC-BLANK	N/A	
Transceiver	See *MX Series Interface Module Reference*	**Xcvr**	"Installing an SFP or XFP Transceiver into an MX480 DPC, MPC, MIC, or PIC" on page 230
Power System			"MX480 Power System Description" on page 49
AC power supply	PWR-MX480-AC	**AC Power Entry Module**	"MX480 AC Power Supply Description" on page 50
	PWR-MX480-1200-AC	**PS 1.2-1.7kW 100-240V AC in**	
	PWR-MX480-2520-AC	**PS 1.4-2.52kW; 90-264V AC in**	
DC power supply	PWR-MX480-DC	**DC Power Entry Module**	"MX480 DC Power Supply Description" on page 52
	PWR-MX480-1600-DC	**DC Power Entry Module**	
	PWR-MX480-2400-DC	**DC 2.4kW Power Entry Module**	

Table 3: MX480 Router Hardware Components and CLI Terminology *(continued)*

Component	Hardware Model Number	CLI Name	Description
Power supply blank panel	PWR-BLANK-MX480	N/A	"MX480 Power System Description" on page 49

Related Documentation

- MX480 Router Description on page 3
- MX480 DPC Port and Interface Numbering on page 14
- MX480 MIC Port and Interface Numbering on page 21
- MX480 PIC Port and Interface Numbering on page 28
- *MX Series Router Interface Names*

MX480 Component Redundancy

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

- Host subsystem—The host subsystem consists of a Routing Engine functioning together with an SCB. The router can have one or two host subsystems. If two host subsystems are installed, one functions as the master and the other functions as the backup. If the master host subsystem (or either of its components) fails, the backup can take over as the master. To operate, each host subsystem requires a Routing Engine installed directly into in an SCB.

  If the Routing Engines are configured for *graceful switchover*, the backup Routing Engine automatically synchronizes its configuration and state with the master Routing Engine. Any update to the master Routing Engine state is replicated on the backup Routing Engine. If the backup Routing Engine assumes mastership, packet forwarding continues through the router without interruption. For more information about graceful switchover, see the *Junos OS Administration Library for Routing Devices*.

- Power supplies—In the low-line (110 V) AC power configuration, the router contains three or four AC power supplies, located horizontally at the rear of the chassis in slots **PEM0** through **PEM3** (left to right). Each AC power supply provides power to all components in the router. When three power supplies are present, they share power almost equally within a fully populated system. Four AC power supplies provide full power redundancy. If one power supply fails or is removed, the remaining power supplies instantly assume the entire electrical load without interruption. Three power supplies provide the maximum configuration with full power for as long as the router is operational.

  In the high-line (220 V) AC power configuration, the router contains two or four AC power supplies located horizontally at the rear of the chassis in slots **PEM0** through **PEM3** (left to right). Each AC power supply provides power to all components in the router. When two or more power supplies are present, they share power almost equally

within a fully populated system. Four AC power supplies provide full power redundancy. If one power supply fails or is removed, the remaining power supplies instantly assume the entire electrical load without interruption. Two power supplies provide the maximum configuration with full power for as long as the router is operational.

In the DC configuration, two power supplies are required to supply power to a fully configured router. One power supply supports approximately half of the components in the router, and the other power supply supports the remaining components. The addition of two power supplies provides full power redundancy. If one power supply fails or is removed, the remaining power supplies instantly assume the entire electrical load without interruption. Two power supplies provide the maximum configuration with full power for as long as the router is operational.

- Cooling system—The cooling system has redundant components, which are controlled by the host subsystem. If one of the fans fails, the host subsystem increases the speed of the remaining fans to provide sufficient cooling for the router indefinitely.

Related Documentation

- MX480 Router Description on page 3
- MX480 Chassis Description on page 9

CHAPTER 2

MX480 Hardware Components

MX480 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components (see Figure 1 on page 10, Figure 2 on page 10, and Figure 3 on page 11). The chassis measures 14.0 in. (35.6 cm) high, 17.45 in. (44.3 cm) wide, and 24.5 in. (62.2 cm) deep (from the front to the rear of the chassis). The chassis installs in standard 800-mm (or larger) enclosed cabinets, 19-in. equipment racks, or telco open-frame racks. Up to five routers can be installed in one standard 48-U rack if the rack can handle their combined weight, which can be greater than 818 lb (371.0 kg).

Figure 1: Front View of a Fully Configured Router Chassis

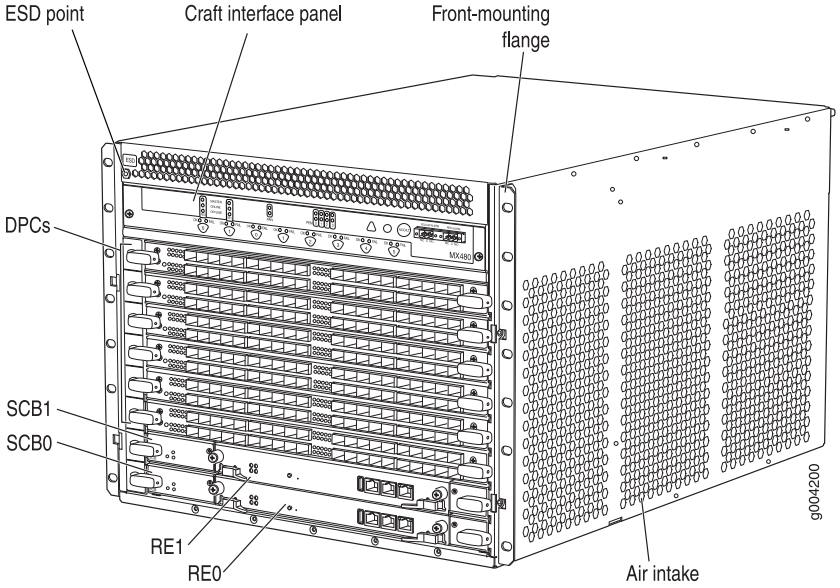


Figure 2: Rear View of a Fully Configured AC-Powered Router Chassis

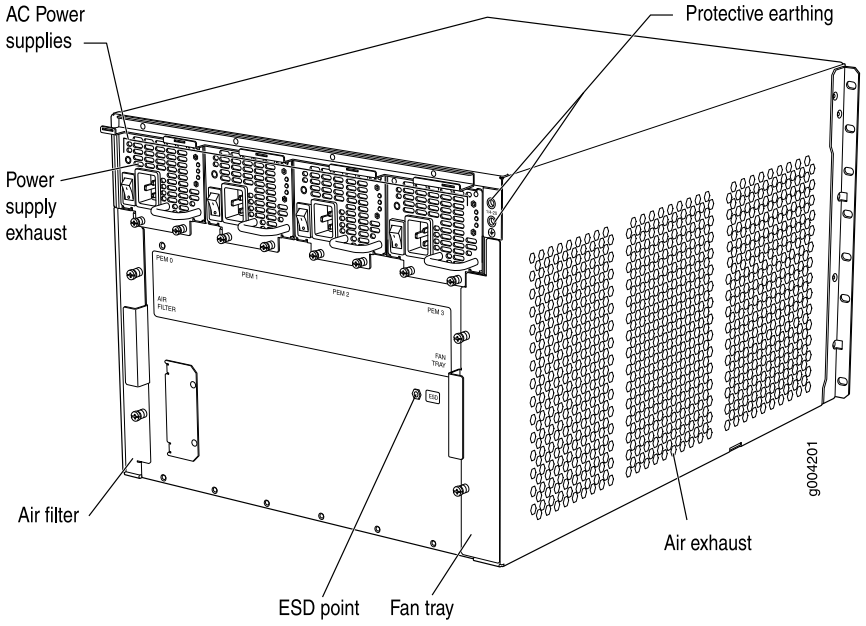
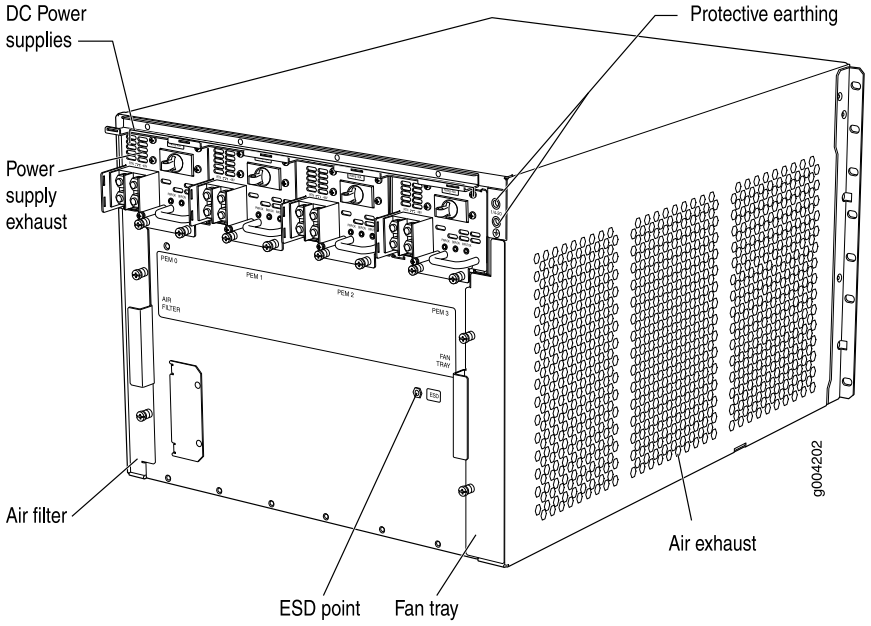


Figure 3: Rear View of a Fully Configured DC-Powered Router Chassis



Related Documentation

- MX480 Router Description on page 3
- MX480 Midplane Description on page 11
- MX480 Router Physical Specifications on page 281

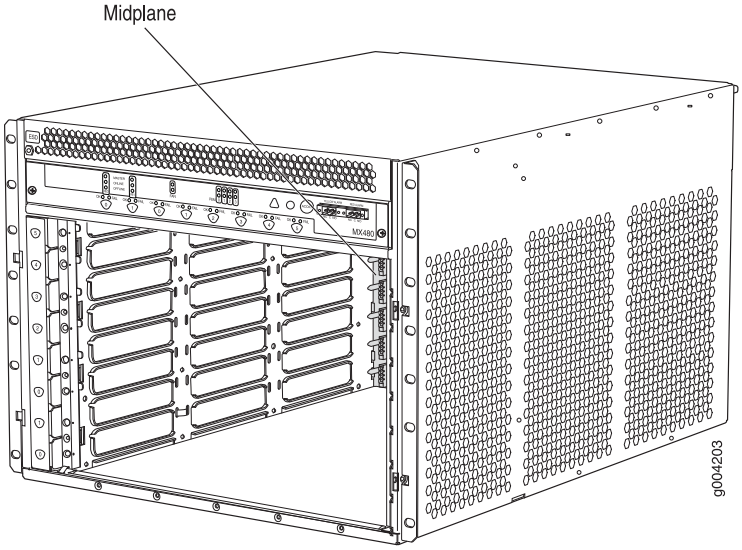
MX480 Midplane Description

The midplane is located toward the rear of the chassis and forms the rear of the card cage (see Figure 4 on page 12). The line cards and SCBs install into the midplane from the front of the chassis, and the power supplies install into the midplane from the rear of the chassis. The cooling system components also connect to the midplane.

The midplane performs the following major functions:

- Data path—Data packets are transferred across the midplane between the line cards through the fabric ASICs on the SCBs.
- Power distribution—The router power supplies connect to the midplane, which distributes power to all the router components.
- Signal path—The midplane provides the signal path to the line cards, SCBs, Routing Engines, and other system components for monitoring and control of the system.

Figure 4: Midplane



Related Documentation

- MX480 Router Description on page 3
- MX480 Chassis Description on page 9
- MX480 Dense Port Concentrator (DPC) Description on page 12
- MX480 Modular Port Concentrator (MPC) Description on page 18
- MX480 SCB Description on page 31
- MX480 Flexible PIC Concentrator (FPC) Description on page 24
- MX480 Power System Description on page 49

MX480 Dense Port Concentrator (DPC) Overview

- MX480 Dense Port Concentrator (DPC) Description on page 12
- MX480 Dense Port Concentrator (DPC) LEDs on page 14
- MX480 DPC Port and Interface Numbering on page 14

MX480 Dense Port Concentrator (DPC) Description

A Dense Port Concentrator (DPC) is optimized for Ethernet density (see Figure 5 on page 13). The DPC assembly combines packet forwarding and Ethernet interfaces on a single board, with either two or four 10-Gbps Packet Forwarding Engines. Each Packet Forwarding Engine consists of one I-chip for Layer 3 processing and one Layer 2 network processor. The DPCs interface with the power supplies and Switch Control Boards (SCBs).

The DPC slots are located in the front of the router (see Figure 5 on page 13). The router has six dedicated DPC slots that are numbered **0** through **5**. A DPC can be installed in any DPC slot on the router. You can install any combination of DPC types in the router.

If a slot is not occupied by a DPC, a DPC blank panel must be installed to shield the empty slot and to allow cooling air to circulate properly through the router.

DPCs are hot-removable and hot-insertable, as described in "MX480 Field-Replaceable Units (FRUs)" on page 169. When you install a DPC in an operating router, the Routing Engine downloads the DPC software, the DPC runs its diagnostics, and the Packet Forwarding Engines housed on the DPC are enabled. Forwarding on other DPCs continues uninterrupted during this process.

Figure 5 on page 13 shows typical DPCs supported on the MX480 router. For more information about DPCs, see the *MX Series Interface Module Reference*.

Figure 5: Typical DPCs Supported on the Router

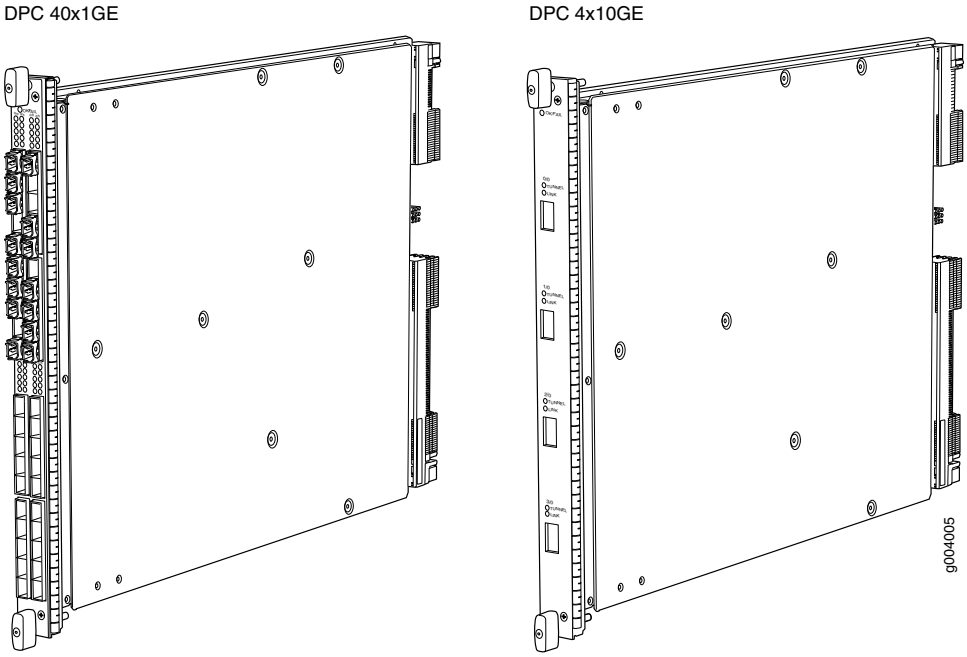
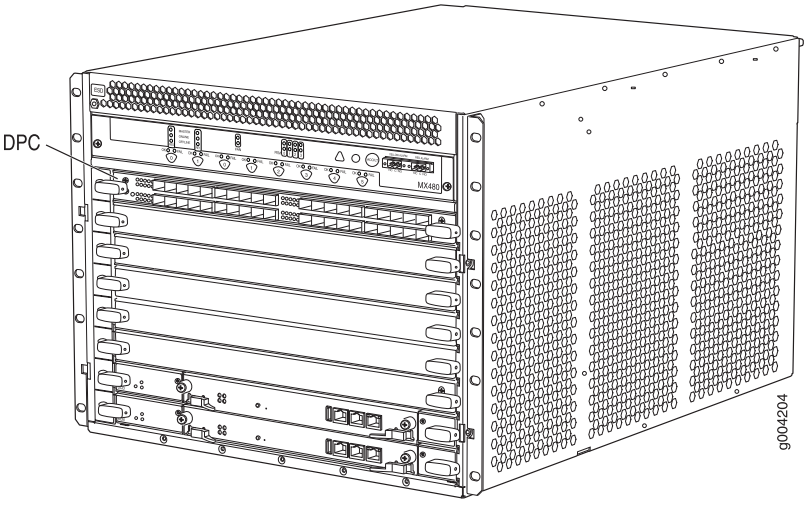


Figure 6: DPC Installed Horizontally in the Router



DPC Components

Each DPC consists of the following components:

- DPC cover, which functions as a ground plane and a stiffener.
- Fabric interfaces.
- Two Gigabit Ethernet interfaces that allow control information, route information, and statistics to be sent between the Routing Engine and the CPU on the DPCs.
- Two interfaces from the SCBs that enable the DPCs to be powered on and controlled.
- Physical DPC connectors.
- Two or four Packet Forwarding Engines.
- Midplane connectors and power circuitry.
- Processor subsystem, which includes a 1.2-GHz CPU, system controller, and 1 GB of SDRAM.
- Online button—Takes the DPC online or offline when pressed.
- LEDs on the DPC faceplate. For more information about LEDs on the DPC faceplate, see the *MX Series Interface Module Reference*.

Two LEDs, located on the craft interface above the DPC, display the status of the DPC and are labeled **OK** and **FAIL**.

Related Documentation

- MX480 Dense Port Concentrator (DPC) LEDs on page 14
- DPC and MPC LEDs on the MX480 Craft Interface on page 47
- Replacing an MX480 DPC on page 202

MX480 Dense Port Concentrator (DPC) LEDs

Two LEDs, located on the craft interface above the DPC, display the status of the DPC and are labeled **OK** and **FAIL**. For more information about the DPC LEDs on the craft interface, see "DPC and MPC LEDs on the MX480 Craft Interface" on page 47.

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

Related Documentation

- MX480 Dense Port Concentrator (DPC) Description on page 12
- Maintaining MX480 DPCs on page 138
- Replacing an MX480 DPC on page 202

MX480 DPC Port and Interface Numbering

Each port on a DPC corresponds to a unique interface name in the CLI.

In the syntax of an interface name, a hyphen (-) separates the media type from the DPC number (represented as an **FPC** in the CLI). The DPC slot number corresponds to the first number in the interface. The second number in the interface corresponds to the logical PIC number. The last number in the interface matches the port number on the DPC. Slashes (/) separate the DPC number from the logical PIC number and port number.

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

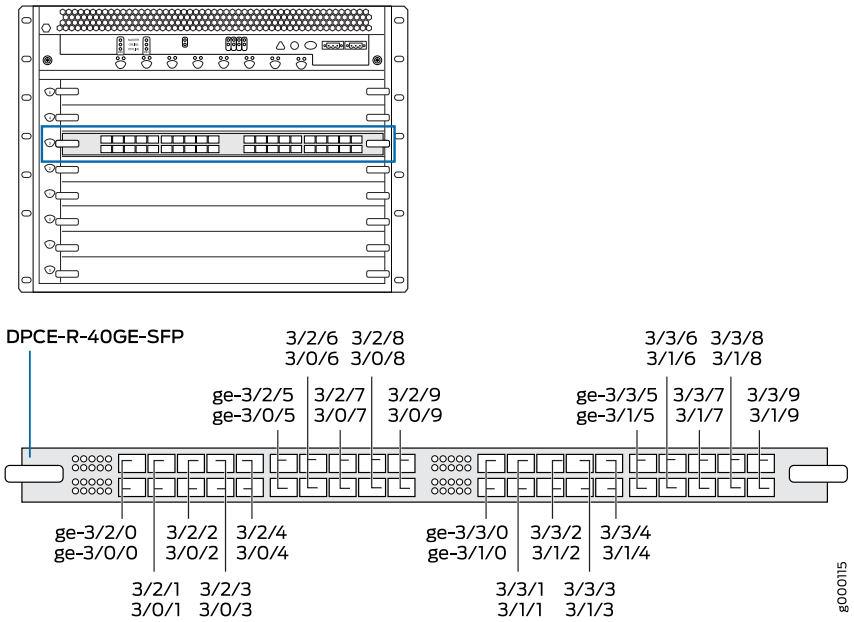
  For a complete list of media types, see *Interface Naming Overview*.
- *fpc*—Slot in which the DPC is installed. On the MX480 router, the DPCs are represented in the CLI as **FPC 0** through **FPC 5**.
- *pic*—Logical PIC on the DPC. The number of logical PICs varies depending on the type of DPC. For example, a:
  - 20-port Gigabit Ethernet DPC has two logical PICs, numbered 0 through 1.
  - 40-port Gigabit Ethernet DPC has four logical PICs, numbered 0 through 3.
  - 2-port 10-Gigabit Ethernet DPC has two logical PICs, numbered 0 through 1.
  - 4-port 10-Gigabit Ethernet DPC has four logical PICs, numbered 0 through 3.

  For more information on specific DPCs, see *DPCs Supported on MX240, MX480, and MX960 Routers* in the *MX Series Interface Module Reference*.
- *port*—Port number.

The MX480 router supports up to six DPCs that install horizontally and are numbered 0 through 5 from bottom to top.

Figure 7 on page 16 shows a 40-port Gigabit Ethernet DPC with SFP installed in slot **3** on the MX480 router.

Figure 7: MX480 DPC Interface Port Mapping



The DPC contains four logical PICs, numbered **PIC 0** through **PIC 3** in the CLI. Each logical PIC contains 10 ports numbered **0** through **9**.

The **show chassis hardware** command output displays a 40-port Gigabit Ethernet DPC with SFP (**DPCE-R-40GE-SFP**) installed in DPC slot **3**. The DPC (**DPCE 40x 1GE R**) is shown as **FPC 3** in the CLI. The DPC's four logical PICs — **10x 1GE(LAN)** — are shown as **PIC 0** through **PIC 3**.

```
user@host> show chassis hardware

...
FPC 3            REV 07   750-018122   KB8222           DPCE 40x 1GE R
  CPU            REV 06   710-013713   KA9010           DPC PMB
  PIC 0                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0       REV 01   740-011782   PCH2NU4          SFP-SX
    Xcvr 1       REV 01   740-011782   PCH2P4R          SFP-SX
    Xcvr 2       REV 01   740-011782   PCH2NYL          SFP-SX
    Xcvr 3       REV 01   740-011782   PCH2UW6          SFP-SX
    Xcvr 4       REV 01   740-011782   PCH2P4N          SFP-SX
    Xcvr 5       REV 01   740-011782   PCH2UME          SFP-SX
    Xcvr 6       REV 01   740-011613   PCE1H5P          SFP-SX
    Xcvr 7       REV 01   740-011782   PCH2UFG          SFP-SX
    Xcvr 8       REV 02   740-011613   AM0947SEYU2      SFP-SX
    Xcvr 9       REV 02   740-011613   AM0947SEYTQ      SFP-SX
  PIC 1                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0       REV 01   740-011782   PCH2UYF          SFP-SX
    Xcvr 1       REV 01   740-011782   PCH2P4L          SFP-SX
    Xcvr 2       REV 01   740-011782   PCH2UCL          SFP-SX
    Xcvr 3       REV 01   740-011782   PCH2P4X          SFP-SX
    Xcvr 4       REV 01   740-011782   PCH2P1E          SFP-SX
    Xcvr 5       REV 01   740-011782   PCH2UD2          SFP-SX
    Xcvr 6       REV 01   740-011782   PCH2PLC          SFP-SX
    Xcvr 7       REV 01   740-011782   PCH2UDJ          SFP-SX
    Xcvr 8       REV 02   740-011613   AM0947SEX7S      SFP-SX
```

```
  PIC 2                 BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0      REV 01  740-011782   PCH2NV7          SFP-SX
    Xcvr 1      REV 01  740-011782   PCH2P6Q          SFP-SX
    Xcvr 2      REV 01  740-011782   PCH2NUG          SFP-SX
    Xcvr 3      REV 01  740-011782   PCH2P10          SFP-SX
    Xcvr 9      REV 02  740-011613   AM0947SEXBT      SFP-SX
  PIC 3                 BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0      REV 01  740-011782   PCH2PL4          SFP-SX
    Xcvr 1      REV 01  740-011782   PCH2P1K          SFP-SX
    Xcvr 2      REV 01  740-011782   PCH2PLM          SFP-SX
    Xcvr 3      REV 01  740-011782   PCH2UFF          SFP-SX
    Xcvr 8      REV 02  740-011613   AM1003SFV5S      SFP-SX
    Xcvr 9      REV 02  740-011613   AM0947SEXBX      SFP-SX
...
```

The **show interfaces terse** command output displays the Gigabit Ethernet interfaces that correspond to the 40 ports located on the DPC.

```
user@host>show interfaces terse ge-3*

Interface               Admin Link Proto    Local                 Remote
ge-3/0/0                up    up
ge-3/0/1                up    down
ge-3/0/2                up    up
ge-3/0/3                up    up
ge-3/0/4                up    up
ge-3/0/5                up    up
ge-3/0/6                up    up
ge-3/0/7                up    up
ge-3/0/8                up    up
ge-3/0/9                up    up
ge-3/1/0                up    down
ge-3/1/1                up    down
ge-3/1/2                up    down
ge-3/1/3                up    down
ge-3/1/4                up    up
ge-3/1/5                up    up
ge-3/1/6                up    up
ge-3/1/7                up    up
ge-3/1/8                up    up
ge-3/1/9                up    down
ge-3/2/0                up    down
ge-3/2/1                up    down
ge-3/2/2                up    down
ge-3/2/3                up    down
ge-3/2/4                up    down
ge-3/2/5                up    down
ge-3/2/6                up    down
ge-3/2/7                up    down
ge-3/2/8                up    down
ge-3/2/9                up    down
ge-3/3/0                up    down
ge-3/3/1                up    down
ge-3/3/2                up    down
ge-3/3/3                up    down
ge-3/3/4                up    down
ge-3/3/5                up    down
ge-3/3/6                up    down
ge-3/3/7                up    down
ge-3/3/8                up    down
ge-3/3/9                up    down
```

Related Documentation
- MX480 Router Hardware and CLI Terminology Mapping on page 4

MX480 Modular Port Concentrator (MPC) Overview

MX480 Modular Port Concentrator (MPC) Description

Modular Port Concentrators (MPCs) provide packet forwarding services. The MPCs are inserted into a slot in a router. Modular Interface Cards (MICs) provide the physical interfaces and install into the MPCs. You can install up to two MICs of different media types on the same MPC as long as the MPC supports those MICs.

A specialized fixed configuration MPC provides higher port density over MICs and combines packet forwarding and Ethernet interfaces onto a single line card. The fixed configuration MPC is inserted into a slot in a router and contains no slots for MICs.

MICs receive incoming packets from the network and transmit outgoing packets to the network. During this process, each MIC performs framing and high-speed signaling for its media type. Before transmitting outgoing data packets through the MIC interfaces, the MPCs encapsulate the packets received. Each MPC is equipped with up to four Junos Trio chipsets, which perform control functions tailored to the MPC's media type. The MPCs interface with the power supplies and Switch Control Boards (SCBs). You must install redundant SCBs to support full line-rate.

The MX480 router supports up to six MPCs. You must install a high-capacity fan tray to use an MPC. For power requirements, see "Calculating Power Requirements for MX480 Routers" on page 285.

The router has six dedicated line card slots for DPCs, MPCs, or FPCs that are numbered **0** through **5** bottom to top. An MPC can be installed in any slot on the router that supports MPCs. You can install any combination of line card types in the router.

When a slot is not occupied by an MPC or other line card, you must insert a blank DPC panel to fill the empty slot and ensure proper cooling of the system.

MPCs are hot-removable and hot-insertable. When you install an MPC in an operating router, the Routing Engine downloads the MPC software, the MPC runs its diagnostics, and the Packet Forwarding Engines housed on the MPC are enabled. Forwarding on other MPCs continues uninterrupted during this process.

Figure 9 on page 19 shows a typical MPC supported on the MX480 router. For more information about MPCs, see the *MX Series Interface Module Reference*.

Figure 8: Typical MPC Supported on the MX Series Router

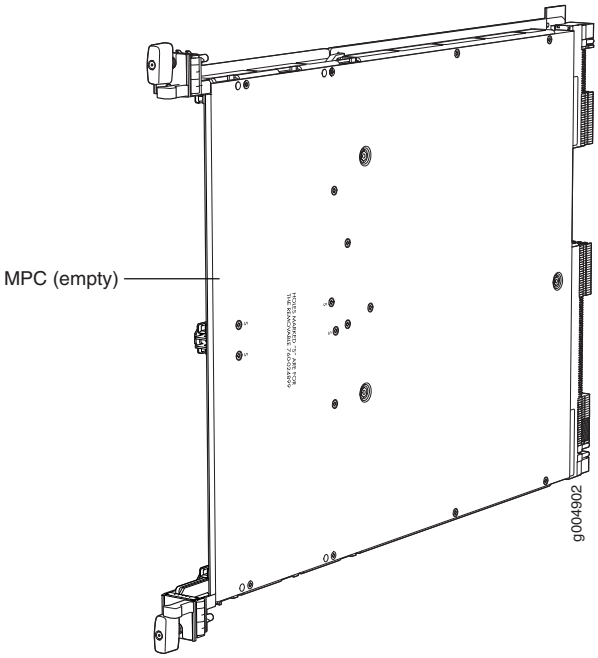
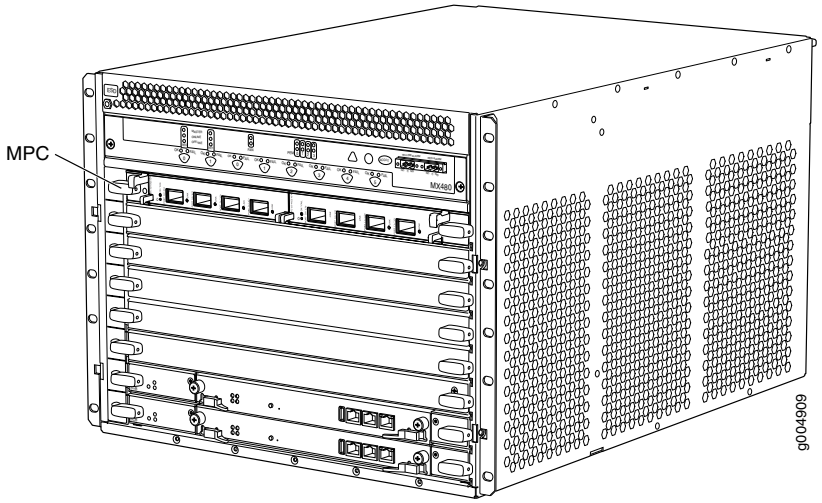


Figure 9: MPC Installed Horizontally in the MX480 Router



MPC Components

Each MPC consists of the following components:

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

- Physical MPC connectors.
- Up to four Junos Trio chipsets, which perform control functions tailored to the MPC's media type.
- Midplane connectors and power circuitry.
- Processor subsystem, which includes a 1.5-GHz CPU, system controller, and 1 GB of SDRAM.
- Online button which takes the MPC online or offline when pressed.
- **OK/Fail** LED on the MPC faceplate. For more information about LEDs on the MPC faceplate, see the *MX Series Interface Module Reference*.

Two LEDs, located on the craft interface above the MPC, display the status of the line cards and are labeled **OK** and **FAIL**.

Related Documentation

- *MPCs Supported by MX240, MX480, MX960, MX2010, and MX2020 Routers*
- MX480 Modular Port Concentrator (MPC) LEDs on page 20
- MX480 Field-Replaceable Units (FRUs) on page 169
- Replacing an MX480 MPC on page 215

MX480 Modular Port Concentrator (MPC) LEDs

Two LEDs, located on the craft interface above the MPC, display the status of the line cards and are labeled **OK** and **FAIL**. For more information about the line card LEDs on the craft interface, see "DPC and MPC LEDs on the MX480 Craft Interface" on page 47.

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

Related Documentation

- MX480 Modular Port Concentrator (MPC) Description on page 18
- Maintaining MX480 MPCs on page 143
- Troubleshooting the MX480 MPCs on page 164
- Replacing an MX480 MPC on page 215

MX480 Modular Interface Card (MIC) Overview

- MX480 Modular Interface Card (MIC) Description on page 20
- MX480 Modular Interface Card (MIC) LEDs on page 21
- MX480 MIC Port and Interface Numbering on page 21

MX480 Modular Interface Card (MIC) Description

Modular Interface Cards (MICs) install into Modular Port Concentrators (MPCs) and provide the physical connections to various network media types. MICs allow different

physical interfaces to be supported on a single line card. You can install MICs of different media types on the MPC as long as the MPC supports those MICs.

MICs receive incoming packets from the network and transmit outgoing packets to the network. During this process, each MIC performs framing and high-speed signaling for its media type. Before transmitting outgoing data packets through the MIC interfaces, the MPCs encapsulate the packets received.

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

Related Documentation

- *MICs Supported by MX Series Routers*
- MX480 Modular Interface Card (MIC) LEDs on page 21
- Maintaining MX480 MICs on page 145
- Troubleshooting the MX480 MICs on page 166
- Replacing an MX480 MIC on page 220

MX480 Modular Interface Card (MIC) LEDs

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

Related Documentation

- *MICs Supported by MX Series Routers*
- MX480 Modular Interface Card (MIC) Description on page 20
- Maintaining MX480 MICs on page 145
- Troubleshooting the MX480 MICs on page 166
- Replacing an MX480 MIC on page 220

MX480 MIC Port and Interface Numbering

Each port on a MIC corresponds to a unique interface name in the CLI.

NOTE: **Fixed configuration MPCs, that is, MPCs with built-in MICs follow the port numbering of DPCs.**

In the syntax of an interface name, a hyphen (-) separates the media type from the MPC number (represented as an **FPC** in the CLI). The MPC slot number corresponds to the first number in the interface. The second number in the interface corresponds to the logical PIC number. The last number in the interface matches the port number on the MIC. Slashes (/) separate the MPC number from the logical PIC number and port number:

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 MX480 router, the MPCs are represented in the CLI as **FPC 0** through **FPC 5**.
- *pic*—Logical PIC on the MIC, numbered 0 or 1 when installed in MIC slot 0 and 2 or 3 when installed in MIC slot 1. The number of logical PICs varies depending on the type of MIC. For example, a:
  - 20-port Gigabit Ethernet MIC has two logical PICs, numbered 0 and 1 when installed in MIC slot 0, or 2 and 3 when installed in MIC slot 1.
  - 4-port 10-Gigabit Ethernet MIC has two logical PICs numbered 0 and 1 when installed in MIC slot 0, or 2 and 3 when installed in MIC slot 1.
  - 100-Gigabit Ethernet MIC with CFP has one logical PIC numbered 0 when installed in MIC slot 0 or 2 when installed in MIC slot 1.

  For more information on specific MICs, see *MICs Supported by MX Series Routers* in the *MX Series Interface Module Reference*.

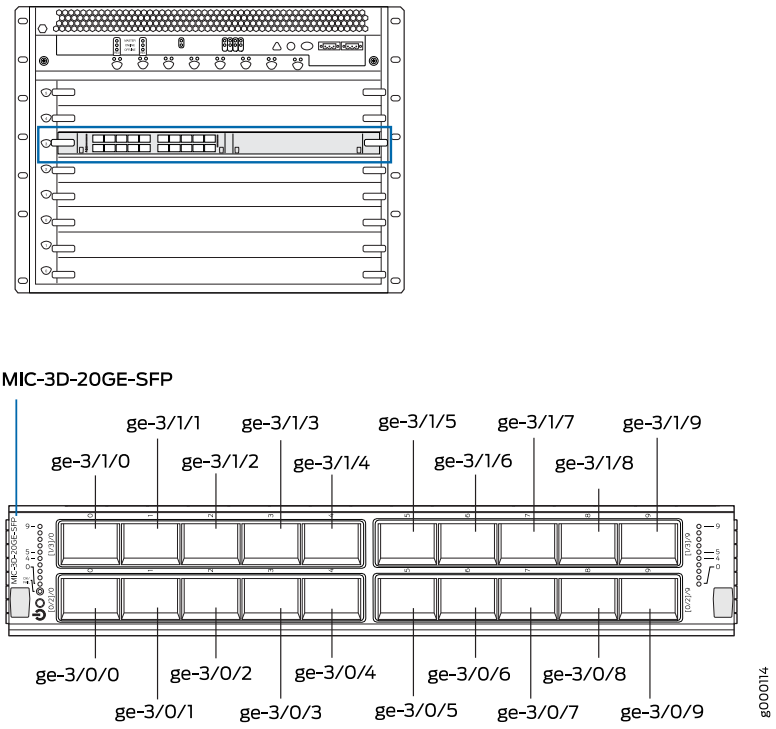
- *port*—Port number.

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

The MX480 router supports up to six MPCs that install horizontally and are numbered from bottom to top. Each MPC accepts up to two MICs.

Figure 10 on page 23 shows a 20-port Gigabit Ethernet MIC with SFP installed in MIC slot **0**of an MPC in slot **3**.

Figure 10: MX480 MIC Interface Port Mapping



The MIC contains two logical PICs, numbered **PIC 0** through **PIC 1** in the CLI. Each logical PIC contains 10 ports numbered **0** through **9**.

The following sample CLI output displays a 20-port Gigabit Ethernet MIC with SFP — **3D 20x 1GE(LAN) SFP** — installed in MIC slot 0 of an MPC in slot **3**.

```
user@host> show chassis hardware

...
FPC 3            REV 28   750-031090   YH8181           MPC Type 2 3D EQ
  CPU            REV 06   711-030884   YH9437           MPC PMB 2G
  MIC 0          REV 22   750-028392   YD0439           3D 20x 1GE(LAN) SFP
    PIC 0                 BUILTIN      BUILTIN          10x 1GE(LAN) SFP
      Xcvr 0     REV 01   740-011613   PCE14D5          SFP-SX
      Xcvr 1     REV 01   740-011782   P9C280T          SFP-SX
      Xcvr 2     REV 01   740-011782   P9C2512          SFP-SX
      Xcvr 3     REV 02   740-011613   AM0951SFF3Z      SFP-SX
      Xcvr 4     REV 02   740-011613   AM0951SFF33      SFP-SX
      Xcvr 5     REV 02   740-011613   AM0951SFF3Y      SFP-SX
      Xcvr 6     REV 02   740-011613   AM0951SFF4B      SFP-SX
      Xcvr 7     REV 01   740-011613   E08H01273        SFP-SX
      Xcvr 8     REV 02   740-011613   AM0951SFFWK      SFP-SX
    PIC 1                 BUILTIN      BUILTIN          10x 1GE(LAN) SFP
      Xcvr 0     REV 01   740-011613   E08H00516        SFP-SX
      Xcvr 1     REV 01   740-011613   E08G03648        SFP-SX
      Xcvr 2     REV 01   740-011613   E08H00514        SFP-SX
...
```

The **show chassis hardware** command output shows an MPC (**MPC Type 2 3D EQ**) installed in slot **3** and is shown as **FPC 3** in the CLI. The MIC's two logical PICs — **10x 1GE(LAN) SFP** — are shown as **PIC 0** and **PIC 1**.

The **show interfaces terse** command output displays the Gigabit Ethernet interfaces, that correspond to the 20 ports located on the MIC.

```
user@host>show interfaces terse ge-3*

Interface               Admin Link Proto    Local                 Remote
ge-3/0/0                up    down
ge-3/0/1                up    down
ge-3/0/2                up    down
ge-3/0/3                up    up
ge-3/0/4                up    up
ge-3/0/5                up    up
ge-3/0/6                up    up
ge-3/0/7                up    up
ge-3/0/8                up    up
ge-3/0/9                up    down
ge-3/1/0                up    up
ge-3/1/1                up    up
ge-3/1/2                up    up
ge-3/1/3                up    down
ge-3/1/4                up    down
ge-3/1/5                up    down
ge-3/1/6                up    down
ge-3/1/7                up    down
ge-3/1/8                up    down
ge-3/1/9                up    down
```

Related Documentation

- MX480 Router Hardware and CLI Terminology Mapping on page 4

MX480 Flexible PIC Concentrator (FPC) Overview

- MX480 Flexible PIC Concentrator (FPC) Description on page 24
- MX480 Flexible PIC Concentrator (FPC) LEDs on page 26
- FPCs Supported by the MX480 Router on page 27

MX480 Flexible PIC Concentrator (FPC) Description

A Flexible PIC Concentrator (FPC) occupies two DPC slots on an MX Series router. The router has six dedicated DPC slots that are numbered **0** through **5**, bottom to top. Up to three FPCs can be installed horizontally on the front of the router (see Figure 11 on page 25). The interface corresponds to the lowest numbered DPC slot for which the FPC is installed.

Figure 11: FPC Installed in the MX480 Router Chassis

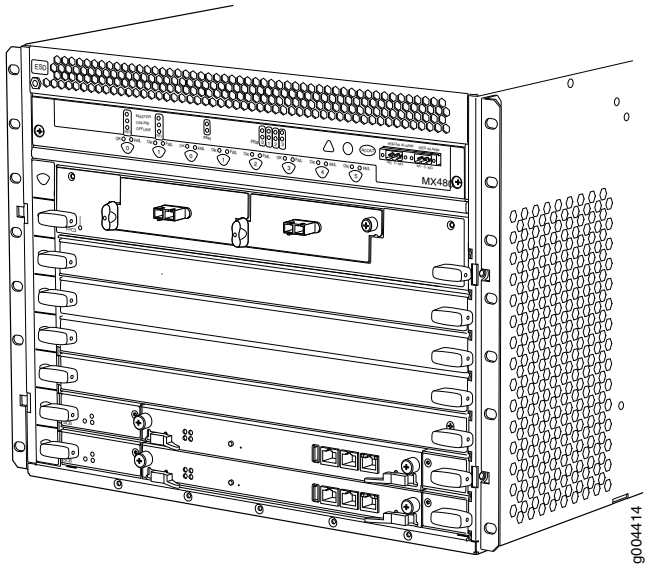
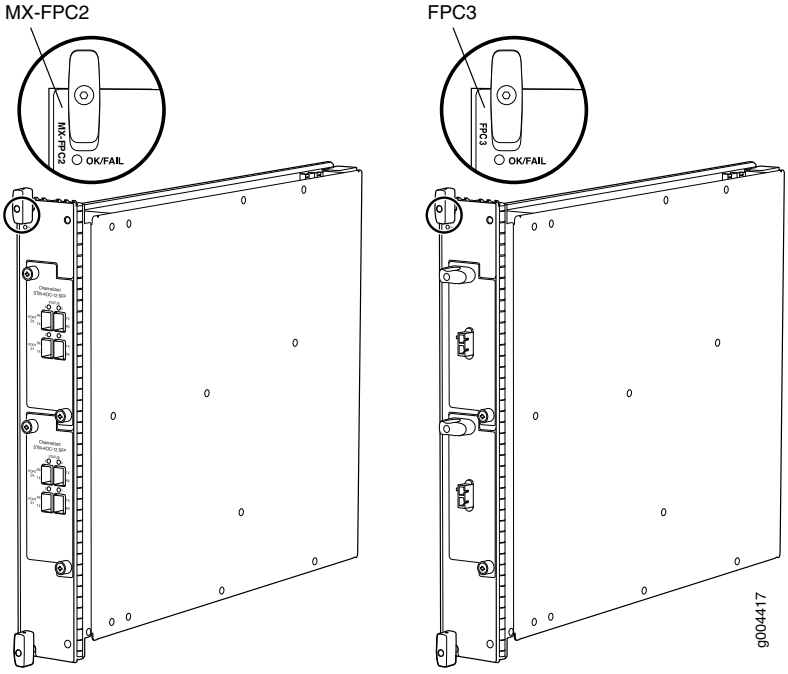


Figure 12 on page 25 shows the typical FPCs supported on the MX480 router.

Figure 12: Typical FPCs Supported on the MX480 Router



If a slot is not occupied by a DPC, an FPC, or an SCB, a blank panel must be installed to shield the empty slot and to allow cooling air to circulate properly through the router.

Each FPC supports up to two PICs. On an FPC2, one Packet Forwarding Engine receives incoming packets from the PICs installed on the FPC and forwards them through the switch planes to the appropriate destination port. On an FPC3, two Packet Forwarding

Engines receive incoming packets from the PICs installed on the FPC and forwards them through the switch planes to the appropriate destination port. The FPCs interface with the power supplies and SCBs.

FPCs are hot-removable and hot-insertable, as described in "MX480 Component Redundancy" on page 6. When you install an FPC into a functioning router, the Routing Engine downloads the FPC software, the FPC runs its diagnostics, and the PICs, housed on the FPC, are enabled. Forwarding continues uninterrupted during this process. When you remove or install an FPC, packet forwarding between other DPCs or FPCs is not affected.

FPC Components

Each FPC consists of the following components:

- FPC card carrier, which includes two PIC slots
- Up to two Packet Forwarding Engines, each consisting of one I-chip for Layer 3 processing and one Layer 2 network processor
- Midplane connectors and power circuitry
- Processor subsystem (PMB), which includes a 1.2-GHz CPU, system controller, 1 GB of SDRAM, and two Gigabit Ethernet interfaces
- Two LEDs, located on the craft interface above the FPC, that display the status of the FPC and are labeled **OK** and **FAIL**
- FPC online/offline button, located on the craft interface above the FPC

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) LEDs on page 26
- Maintaining MX480 FPCs on page 140
- MX480 FPC Terminology on page 150
- Troubleshooting the MX480 FPCs on page 162
- Replacing an MX480 FPC on page 206

MX480 Flexible PIC Concentrator (FPC) LEDs

Two LEDs, located on the craft interface above the FPC, that display the status of the FPC and are labeled **OK** and **FAIL**. For more information about the FPC LEDs located on the craft interface, see "FPC LEDs on the MX480 Craft Interface" on page 47.

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) Description on page 24
- Maintaining MX480 FPCs on page 140
- MX480 FPC Terminology on page 150
- Troubleshooting the MX480 FPCs on page 162
- Replacing an MX480 FPC on page 206

FPCs Supported by the MX480 Router

An FPC occupies two slots when installed in an MX Series router. The MX480 router supports up to three FPCs. Table 4 on page 27 lists FPCs supported by MX Series routers.

Table 4: FPCs Supported by MX480 Routers

FPC Type	FPC Name	FPC Model Number	Maximum Number of PICs Supported	Maximum Throughput per FPC (Full-duplex)	First Junos OS Release
3	FPC3	MX-FPC3	2	20 Gbps	9.4
2	FPC2	MX-FPC2	2	10 Gbps	9.5

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) LEDs on page 26
- Maintaining MX480 FPCs on page 140
- MX480 FPC Terminology on page 150
- Troubleshooting the MX480 FPCs on page 162
- Replacing an MX480 FPC on page 206

MX480 PIC Overview

- MX480 PIC Description on page 27
- MX480 PIC LEDs on page 28
- MX480 PIC Port and Interface Numbering on page 28

MX480 PIC Description

PICs provide the physical connection to various network media types, receiving incoming packets from the network and transmitting outgoing packets to the network. During this process, each PIC performs framing and line-speed signaling for its media type. Before transmitting outgoing data packets, the PICs encapsulate the packets received from the FPCs. Each PIC is equipped with an ASIC that performs control functions specific to the media type of that PIC.

PICs are hot-removable and hot-insertable. Up to two PICs can be installed in the slots in each FPC. Up to three FPCs can be installed in an MX480 router. PICs used in a Type 2 FPC have captive screws at their upper and lower corners. PICs used in a Type 3 FPC have an upper ejector handle and a lower captive screw.

Related Documentation

- *PICs Supported by MX240, MX480, and MX960 Routers*
- Replacing an MX480 PIC on page 211

MX480 PIC LEDs

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

Related Documentation

- *PICs Supported by MX240, MX480, and MX960 Routers*
- MX480 PIC Description on page 27
- Replacing an MX480 PIC on page 211
- Maintaining MX480 PICs on page 142

MX480 PIC Port and Interface Numbering

Each port on a PIC corresponds to a unique interface name in the CLI.

In the syntax of an interface name, a hyphen (**-**) separates the media type from the FPC number (represented as an **FPC** in the CLI). The FPC slot number corresponds to the first number in the interface. The second number in the interface corresponds to the PIC number. The last number in the interface matches the port number on the PIC. Slashes (**/**) separate the FPC number from the PIC number and port number:

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

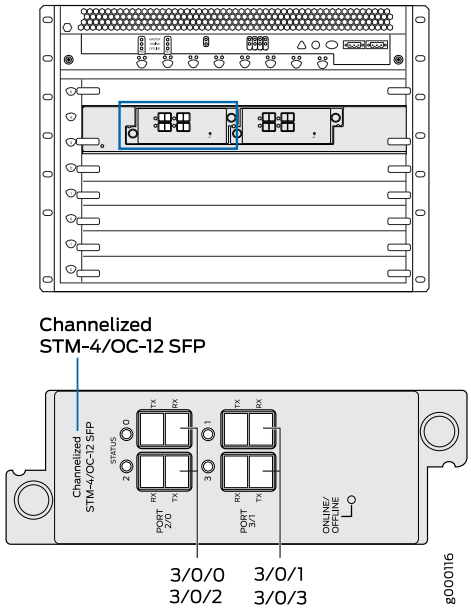
  For a complete list of media types, see *Interface Naming Overview*.
- *fpc*—Lowest slot number in which the FPC is installed. On the MX480 router, FPCs occupy two line card slots and are represented in the CLI as **FPC 0** through **FPC 4**.
- *pic*—PIC number, 0 or 1 depending on the FPC slot.

  For more information on specific PICs, see *PICs Supported by MX240, MX480, and MX960 Routers* in the *MX Series Interface Module Reference*.
- *port*—Port number.

The MX480 supports up to three FPCs that install horizontally and are numbered from bottom to top.

Figure 13 on page 29 shows a Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP installed in PIC slot **0** of an FPC installed in slot **3** and slot **4**.

Figure 13: MX480 PIC Interface Port Mapping



The **show chassis hardware** command output displays a Channelized OC12/STM4 Enhanced IQ (IQE) PIC (**4x CHOC12 IQE SONET**) installed in **MX FPC Type 2**.

```
user@host> show chassis hardware

...
FPC 3            REV 01   710-024386   JW9571           MX FPC Type 2
  CPU            REV 03   710-022351   KE2986           DPC PMB
  PIC 0          REV 00   750-022630   DS1284           4x CHOC12 IQE SONET
    Xcvr 0       REV 01   740-011782   PB821SG          SFP-SX
    Xcvr 1       REV 01   740-011782   PB829Q6          SFP-SX
    Xcvr 2       REV 01   740-011613   P9F15NQ          SFP-SX
    Xcvr 3       REV 01   740-011782   P7N036X          SFP-SX...
```

The **show interfaces terse** command output displays the channelized SONET OC12 interfaces (**coc12**), that correspond to the four ports located on the PIC.

```
user@host>show interfaces terse

...
coc12-3/0/0             up    up
lc-3/0/0                up    up
lc-3/0/0.32769          up    up   vpls
pfe-3/0/0               up    up
pfe-3/0/0.16383         up    up   inet
                                   inet6
pfh-3/0/0               up    up
pfh-3/0/0.16383         up    up   inet
coc12-3/0/1             up    up
coc12-3/0/2             up    up
coc12-3/0/3             up    up
...
```

Related Documentation
- MX480 Router Hardware and CLI Terminology Mapping on page 4

MX480 Host Subsystem Overview

- MX480 Host Subsystem Description on page 30
- MX480 Host Subsystem LEDs on page 30

MX480 Host Subsystem Description

The host subsystem provides the routing and system management functions of the router. You can install one or two host subsystems on the router. Each host subsystem functions as a unit; the Routing Engine must be installed directly into the Switch Control Board.

NOTE: We recommend that you install two host subsystems for redundant protection. If you install only one host subsystem, we recommend that you install it in slot 0.

Each host subsystem has three LEDs that display its status. The host subsystem LEDs are located on the upper left of the craft interface.

Related Documentation
- MX480 Host Subsystem LEDs on page 30
- Maintaining the MX480 Host Subsystem on page 136
- Taking an MX480 Host Subsystem Offline on page 180

MX480 Host Subsystem LEDs

Each host subsystem has three LEDs that display its status. The host subsystem LEDs are located on the upper left of the craft interface. For more information, see "Host Subsystem LEDs on the MX480 Craft Interface" on page 46.

Related Documentation
- MX480 Host Subsystem Description on page 30
- Maintaining the MX480 Host Subsystem on page 136
- Taking an MX480 Host Subsystem Offline on page 180

MX480 Switch Control Board (SCB) Overview

- Supported Switch Control Boards on page 31
- MX480 SCB Description on page 31
- MX480 SCB LEDs on page 33
- MX480 SCBE Description on page 33
- MX480 SCBE LEDs on page 35

- MX480 SCBE2 Description on page 36
- MX480 SCBE2 LEDs on page 38

Supported Switch Control Boards

The MX480 router supports the following Switch Control Boards:

- SCB
- SCBE
- SCBE2

Related Documentation

- MX480 SCB Description on page 31
- MX480 SCBE Description on page 33
- MX480 SCBE2 Description on page 36

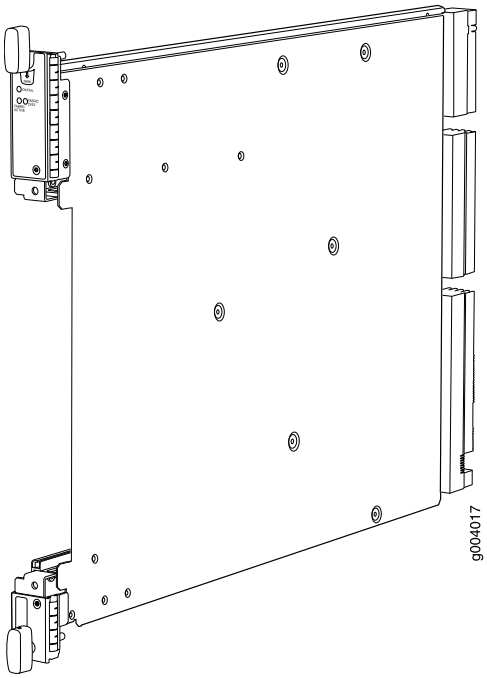
MX480 SCB Description

The SCB provides the following functions:

- Powers on and powers off DPCs, FPCs, and MPCs
- Controls clocking, system resets, and booting
- Monitors and controls system functions, including fan speed, board power status, PDM status and control, and the craft interface
- Provides interconnections to all the DPCs, FPCs, and MPCs within the chassis through the switch fabrics integrated into the SCB

The Routing Engine installs directly into a slot on the SCB (see Figure 14 on page 32).

Figure 14: SCB



SCB Slots

You can install one or two. The SCBs install horizontally into the front of the chassis in the slots labeled **0** and **1**. If any slots are empty, you must install a blank panel.

SCB Redundancy

If two SCBs are installed, one SCB functions as the master SCB and the other as its backup. If the master fails or is removed, the backup restarts and becomes the master.

SCB Components

Each SCB consists of the following components:

- Chassis management Ethernet switch
- I2C bus logic, used for low-level communication with each component
- Component redundancy circuitry
- Control Board/Routing Engine mastership mechanism
- Gigabit Ethernet switch that is connected to the embedded CPU complex on all components
- Switch fabric—Provides the switching functions for the DPCs, FPCs, and MPCs
- Control field-programmable gate array (FPGA)—Provides the Peripheral Component Interconnect (PCI) interface to the Routing Engine
- 1000Base-T Ethernet controller—Provides a 1-Gbps Ethernet link between the Routing Engines

- Ethernet switch—Provides 1-Gbps link speeds between the Routing Engine and the DPCs, FPCs, and MPCs
- Circuits for chassis management and control
- Power circuits for the Routing Engine and SCB
- LEDs—Provide status

Related Documentation

- MX480 Host Subsystem Description on page 30
- MX480 Routing Engine Description on page 40
- MX480 SCB LEDs on page 33

MX480 SCB LEDs

Three LEDs on the SCB indicate the status of the SCB. The LEDs, labeled **FABRIC ACTIVE**, **FABRIC ONLY**, and **OK/FAIL**, are located directly on the SCB. Table 5 on page 33 describes the functions of the SCB LEDs.

Table 5: SCB LEDs

Label	Color	State	Description
FABRIC ACTIVE	Green	On steadily	Fabric is in active mode.
FABRIC ONLY	Green	On steadily	SCB operates in fabric-only mode.
	–	Off	SCB operates in fabric/control board mode.
OK/FAIL	Green	On steadily	SCB is online.
	Red	On steadily	SCB has failed.
	–	Off	SCB is offline.

Each SCB also has two LEDs on the craft interface that indicate its status. The SCB LEDs, labeled **0** and **1**, are located along the bottom of the craft interface. For more information about the SCB LEDs on the craft interface, see "SCB LEDs on the MX480 Craft Interface" on page 48.

Related Documentation

- MX480 SCB Description on page 31
- MX480 Host Subsystem Description on page 30
- Replacing an MX480 SCB on page 182

MX480 SCBE Description

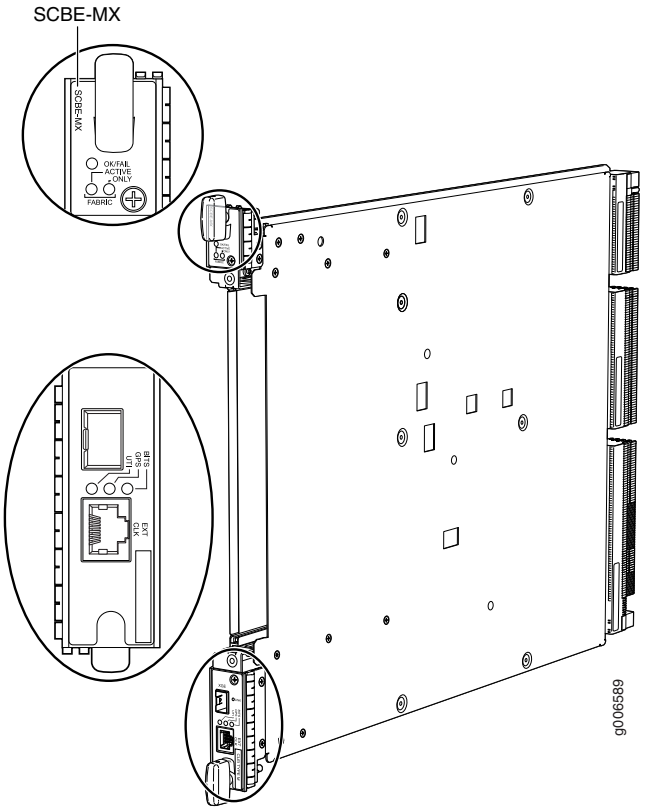
The MX SCBE serves the carrier Ethernet services router and carrier Ethernet transport markets that require higher-capacity traffic support demanding greater interface density

(slot and capacity scale), as well as improved services. The upgraded SCB is supported on MX960, MX480, and MX240 routers. Some key attributes of the MX SCBEs are:

- 160 Gbps/slot bandwidth with redundant fabric support, and improved fabric performance by using the next-generation fabric (XF) chip
- A central clocking module and a centralized clocking architecture that supports clock cleanup and distribution. The Stratum 3 clock module performs clock monitoring, filtering, and holdover in a centralized chassis location
- Full performance with fabric redundancy for higher capacity line cards such as 16x10GE and MPC3

The Routing Engine installs directly into a slot on the MX SCBE (see Figure 15 on page 34).

Figure 15: MX SCBE



MX SCBE Slots

You can install one or two MX SCBEs. The MX SCBEs install horizontally into the front of the chassis in the slots labeled **0** and **1**. If any slots are empty, you must install a blank panel.

MX SCBE Redundancy

If two MX SCBEs are installed, one MX SCBE functions as the master MX SCBE and the other as its backup. If the master fails or is removed, the backup restarts and becomes the master.

MX SCBE Components

Each MX SCBE consists of the following components:

- I2C bus logic, used for low-level communication with each component
- Component redundancy circuitry
- Control Board/Routing Engine mastership mechanism
- Gigabit Ethernet switch that is connected to the embedded CPU complex on all components
- External clock interface—Allows BITS or GPS clock source input to the centralized timing circuit, or allows centralized timing to be output to BITS or GPS
- Switch fabric—Provides the switching functions for the DPCs, FPCs, and MPCs
- Control field-programmable gate array (FPGA)—Provides the Peripheral Component Interconnect (PCI) interface to the Routing Engine
- 1000Base-T Ethernet controller—Provides a 1-Gbps Ethernet link between the Routing Engines
- Circuits for chassis management and control
- Power circuits for the Routing Engine and SCBE
- LEDs—Provide status of the SCBE and clocking interface

Related Documentation

- MX480 SCB Description on page 31
- MX480 SCBE LEDs on page 35
- Upgrading an MX480 SCB on page 185

MX480 SCBE LEDs

The **FABRIC ACTIVE**, **FABRIC ONLY**, and **OK/FAIL** LEDs indicate the status of the MX SCBE. The **BITS**, **GPS**, and **UTI** LEDs, located next to the **EXT CLK** port, indicate the status of the respective clocking interface. Table 6 on page 35 describes the functions of the MX SCBE LEDs.

Table 6: MX SCBE LEDs

Label	Color	State	Description
FABRIC ACTIVE	Green	On steadily	Fabric is in active mode.

Table 6: MX SCBE LEDs *(continued)*

Label	Color	State	Description
FABRIC ONLY	Green	On steadily	MX SCBE operates in fabric-only mode.
	–	Off	MX SCBE operates in fabric/control board mode.
OK/FAIL	Green	On steadily	MX SCBE is online.
	Red	On steadily	MX SCBE has failed.
	–	Off	MX SCBE is offline.
	Red	On steadily	GPS clocking interface has failed.
	–	Off	GPS clocking interface is offline.
NOTE: The LEDs **BITS**, **GPS**, and **UTI** are not currently supported.			
BITS	Green	On steadily	Building-integrated timing supply (BITS) clocking interface is active.
	Red	On steadily	BITS clocking interface has failed.
	–	Off	BITS clocking interface is offline.
GPS	Green	On steadily	Global positioning system (GPS) clocking interface is active.
	Red	On steadily	GPS clocking interface has failed.
	–	Off	GPS clocking interface is offline.
UTI	Green	On steadily	Universal Timing Interface (UTI) clocking interface is active.
	Red	On steadily	UTI clocking interface has failed.
	–	Off	UTI clocking interface is offline.

Related Documentation

- MX480 SCBE Description on page 33
- MX480 Host Subsystem Description on page 30
- Upgrading an MX480 SCB on page 185

MX480 SCBE2 Description

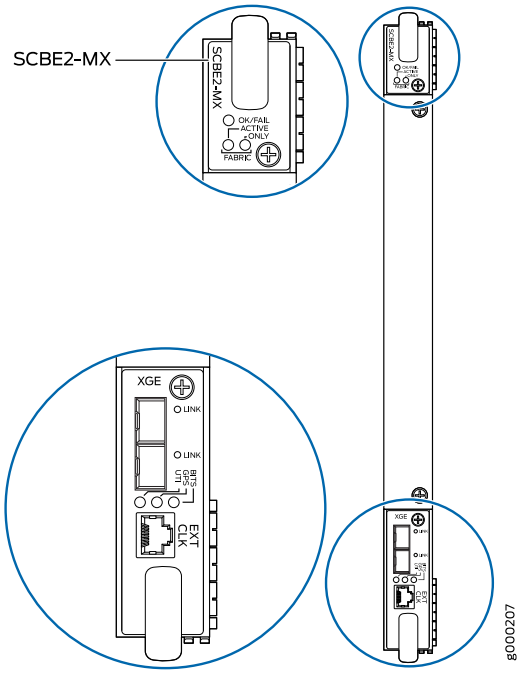
The Switch Control Board (SCBE2) serves the carrier Ethernet services router and carrier Ethernet transport markets that require higher-capacity traffic support, demanding

greater interface density (slot and capacity scale) as well as improved services. The upgraded SCB is supported on MX960, MX480, and MX240 routers. Some key attributes of the SCBE2 are:

- A bandwidth of up to 320 Gbps per slot with redundant fabric support and 480 Gbps per slot without redundancy, and improved fabric performance on account of using the next-generation fabric (XF2) chip.
- A central clocking module and a centralized clocking architecture that support clock cleanup and distribution. The Stratum 3 clock module performs clock monitoring, filtering, and holdover at a centralized chassis location.
- Full performance with fabric redundancy for higher-capacity line cards such as MPC4.
- Support for MPC line cards only
- Two 10-Gigabit Ethernet SFP+ ports
- Support for cross-coupling of clock input (which requires an enhanced midplane: CHAS-BP3-MX480-S). You can configure the system such that one SCBE2 supports a GPS interface, and the other SCBE2 supports a BITS interface.

The Routing Engine is installed directly into a slot on the SCBE2 (see Figure 16 on page 37).

Figure 16: SCBE2



SCBE2 Slots

You can install either one or two SCBE2s. SCBE2s are installed horizontally into the front of the chassis in the slots labeled **0** and **1**. If any slots are empty, you must install a blank panel.

SCBE2 Redundancy

The control boards operate in redundancy fabric mode by default. You can configure the control board to be in redundancy mode or in increased fabric bandwidth mode.

For the MX480 router in redundant fabric mode, four of the fabric planes from the first SCBE2 will be in Active mode, and four from the second SCBE2 will be in Spare mode. Whereas, in an increased fabric bandwidth mode, all the eight fabric planes will be in Active mode.

SCBE2 Components

Each SCBE2 consists of the following components:

- I2C bus logic, used for low-level communication with each component
- Component-redundancy circuitry
- Control Board/Routing Engine mastership mechanism
- Gigabit Ethernet switch that is connected to the embedded CPU complex on all components
- External clock interface—Allows BITS or GPS clock source input to the centralized timing circuit, or allows centralized timing to be output to BITS or GPS
- Switch fabric—Provides switching functions for the MPCs
- Control field-programmable gate array (FPGA)—Provides the Peripheral Component Interconnect (PCI) interface to the Routing Engine
- 1000Base-T Ethernet controller—Provides a 1-Gbps Ethernet link between the Routing Engines
- Circuits for chassis management and control
- Power circuits for the Routing Engine and SCBE2
- LEDs—Provide status of the SCBE2 and clocking interface

Related Documentation

-

MX480 SCBE2 LEDs

FABRIC ACTIVE, **FABRIC ONLY**, and **OK/FAIL** LEDs indicate the status of the SCBE2. The **BITS**, **GPS**, and **UTI** LEDs, located next to the **EXT CLK** port, indicate the status of the respective clocking interface. The **LINK** LED located next to the two Ethernet ports, indicate the status of the respective SFP+ interface. Table 7 on page 39 describes the functions of the SCBE2 LEDs.

Table 7: SCBE2 LEDs

Label	Color	State	Description
FABRIC ACTIVE	Green	On steadily	Fabric is in active mode.
FABRIC ONLY	Green	On steadily	SCBE2 operates in fabric-only mode.
	–	Off	SCBE2 operates in fabric or control-board mode.
OK/FAIL	Green	On steadily	SCBE2 is online.
	Red	On steadily	SCBE2 has failed.
	–	Off	SCBE2 is offline.
BITS	Green	On steadily	Building-integrated timing supply (BITS) clocking interface is active.
	Red	On steadily	BITS clocking interface has failed.
	–	Off	BITS clocking interface is offline.
GPS	Green	On steadily	Global positioning system (GPS) clocking interface is active.
	Red	On steadily	GPS clocking interface has failed.
	–	Off	GPS clocking interface is offline.
UTI	Green	On steadily	Universal Timing Interface (UTI) clocking interface is active.
	Red	On steadily	UTI clocking interface has failed.
	–	Off	UTI clocking interface is offline.
LINK	Green	On steadily	Port is enabled and link is established.
	–	Off	Port is disabled or no link is established.

Related Documentation

-

MX480 Routing Engine Overview

- MX480 Routing Engine Description on page 40
- RE-S-1800 Routing Engine Description for MX Series on page 41

- RE-S-1800 Routing Engine LEDs on page 43
- MX480 Routing Engine LEDs on page 44

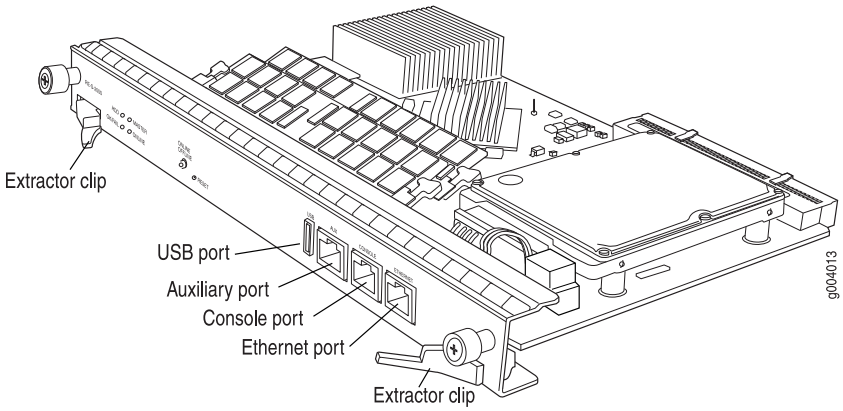
MX480 Routing Engine Description

The Routing Engine is an Intel-based PC platform that runs Junos OS. Software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router.

You can install one or two Routing Engines in the router. The Routing Engines install into the front of the chassis in horizontal slots in the SCBs labeled **0** and **1**. If two Routing Engines are installed, one functions as the master and the other acts as the backup. If the master Routing Engine fails or is removed, and the backup is configured appropriately, the backup takes over as the master.

The Routing Engines are hot-pluggable. Each Routing Engine must be installed directly into an SCB. A USB port on the Routing Engine accepts a USB memory card that allows you to load Junos OS.

Figure 17: Routing Engine



Routing Engine Components

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

Routing Engine Interface Ports

Three ports, located on the right side of the routing engine, connect the Routing Engine to one or more external devices on which system administrators can issue Junos OS command-line interface (CLI) commands to manage the router.

The ports with the indicated labels function as follows:

- **AUX**—Connects the Routing Engine to a laptop, modem, or other auxiliary device through a serial cable with an RJ-45 connector.
- **CONSOLE**—Connects the Routing Engine to a system console through a serial cable with an RJ-45 connector.
- **ETHERNET**—Connects the Routing Engine through an Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for out-of-band management. The port uses an autosensing RJ-45 connector to support 10-Mbps or 100-Mbps connections. Two small LEDs on the top of the port indicate the connection in use: the LED flashes yellow or green for a 10-Mbps or 100-Mbps connection, and the LED is light green when traffic is passing through the port.

Routing Engine Boot Sequence

The Routing Engine boots from the storage media in this order: the USB device (if present), then the CompactFlash card, then the hard disk, then the LAN. The disk from which the router boots is called the *primary boot device*, and the other disk is the *alternate boot device*.

NOTE: If the router boots from an alternate boot device, a yellow alarm lights the LED on the router's craft interface.

If the Routing Engines are configured for *graceful switchover*, the backup Routing Engine automatically synchronizes its configuration and state with the master Routing Engine. Any update to the master Routing Engine state is replicated on the backup Routing Engine. If the backup Routing Engine assumes mastership, packet forwarding continues through the router without interruption. For more information about graceful switchover, see the *Junos OS Administration Library for Routing Devices*.

NOTE: If two Routing Engines are installed, they must both be the same hardware model.

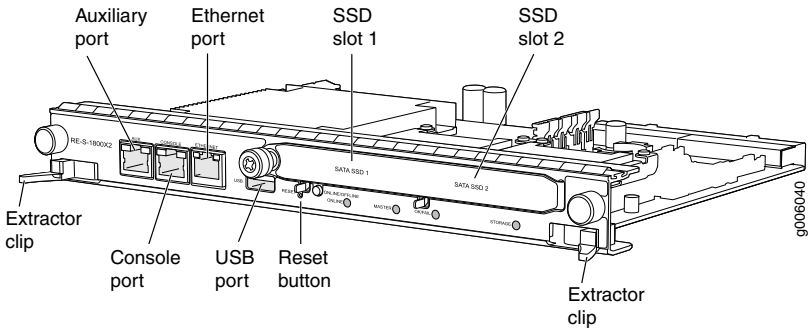
Related Documentation

- MX480 Router Description on page 3
- MX480 Routing Engine LEDs on page 44
- MX480 Host Subsystem Description on page 30
- MX480 SCB Description on page 31

RE-S-1800 Routing Engine Description for MX Series

Figure 18 on page 42 shows the Routing Engine 1800.

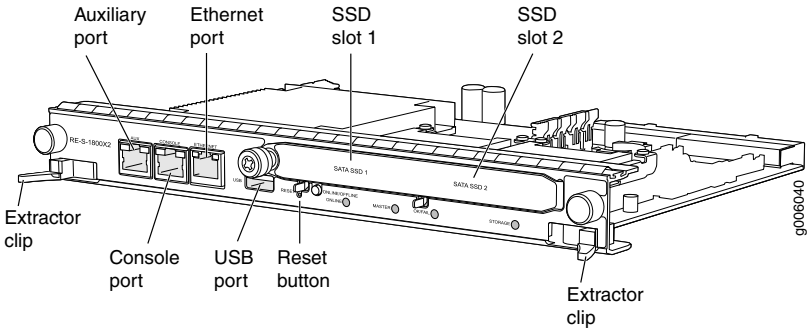
Figure 18: RE-S-1800 Front View



- RE-S-1800 Routing Engine Components on page 42
- RE-S-1800 Routing Engine Boot Sequence on page 43

RE-S-1800 Routing Engine Components

Figure 19 on page 42 shows the RE-S-1800 Routing Engine.



Each Routing Engine consists of the following components:

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols..
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- USB port—Provides a removable media interface through which you can install the Junos OS manually. Junos OS supports USB version 1.0.
- CompactFlash card—Provides primary storage for software images, configuration files, and microcode. The CompactFlash card is fixed and is inaccessible from outside the router.
- Solid State Disk (SSD)—Provides secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.
- Interface ports—The **AUX**, **CONSOLE**, and **ETHERNET** provide access to management devices. Each Routing Engine has one 10/100/1000-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.
- EEPROM—Stores the serial number of the Routing Engine.

- Reset button—Reboots the Routing Engine when pressed.
- Online/Offline button—Takes the Routing Engine online or offline when pressed.
- Extractor clips—Used for inserting and extracting the Routing Engine.
- Captive screws—Secure the Routing Engine in place.

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

RE-S-1800 Routing Engine Boot Sequence

The router is shipped with the Junos OS preinstalled on the Routing Engine. There are three copies of software:

- One copy on the CompactFlash card in the Routing Engine.
- One copy on the hard disk in the Routing Engine.
- One copy on a USB flash drive that can be inserted into the slot on the Routing Engine faceplate.

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

Related Documentation

- *RJ-45 Connector Pinouts for MX Series Routing Engine AUX and CONSOLE Ports*
- *RJ-45 Connector Pinouts for an MX Series Routing Engine ETHERNET Port*
- *Replacing an MX960 Routing Engine*
- *Supported Routing Engines by Router*

RE-S-1800 Routing Engine LEDs

Each Routing Engine has four LEDs that indicate its status. The LEDs, labeled **MASTER**, **STORAGE**, **ONLINE**, and **OK/FAIL**, are located directly on the faceplate of the Routing Engine. Table 8 on page 43 describes the functions of the Routing Engine LEDs.

Table 8: Routing Engine LEDs

Label	Color	State	Description
MASTER	Blue	On steadily	Routing Engine is the Master.
STORAGE	Green	Blinking	Indicates activity on the SSD or Compact Flash.
ONLINE	Green	Blinking	Routing Engine is transitioning online.
		On steadily	Routing Engine is functioning normally.

Table 8: Routing Engine LEDs *(continued)*

Label	Color	State	Description
OK/FAIL	Red	On steadily	Routing Engine has failed.

Related Documentation

- *MX240 Routing Engine Description*
- MX480 Routing Engine Description on page 40
- *MX960 Routing Engine Description*

MX480 Routing Engine LEDs

Each Routing Engine has four LEDs that indicate its status. The LEDs, labeled **MASTER**, **HDD**, **ONLINE**, and **FAIL**, are located directly on the faceplate of the Routing Engine. Table 9 on page 44 describes the functions of the Routing Engine LEDs.

Table 9: Routing Engine LEDs

Label	Color	State	Description
MASTER	Blue	On steadily	Routing Engine is the Master.
HDD	Green	Blinking	Indicates activity on the hard disk drive.
ONLINE	Green	Blinking	Routing Engine is transitioning online.
		On steadily	Routing Engine is functioning normally.
FAIL	Red	On steadily	Routing Engine has failed.

Related Documentation

- MX480 Routing Engine Description on page 40
- Replacing an MX480 Routing Engine on page 197

MX480 Craft Interface Overview

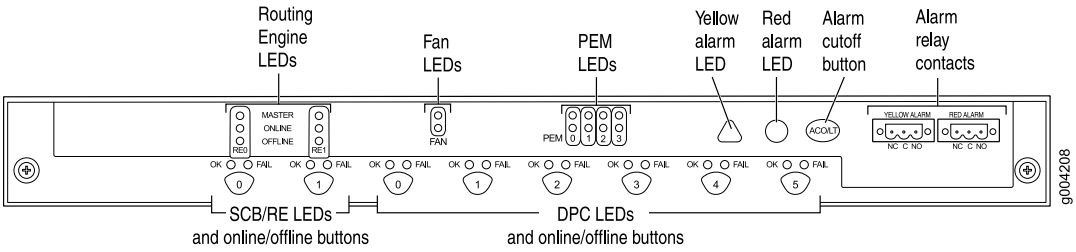
- MX480 Craft Interface Description on page 44
- Alarm LEDs and Alarm Cutoff/Lamp Test Button on the MX480 Craft Interface on page 45
- MX480 Component LEDs on the Craft Interface on page 46
- Alarm Relay Contacts on the MX480 Craft Interface on page 48

MX480 Craft Interface Description

The craft interface allows you to view status and troubleshooting information at a glance and to perform many system control functions. It is hot-insertable and hot-removable. The craft interface is located on the front of the router above the DPC card cage and

contains LEDs for the router components, the alarm relay contacts, and alarm cutoff button.

Figure 20: Front Panel of the Craft Interface



NOTE: **At least one SCB must be installed in the router for the craft interface to obtain power.**

Related Documentation

- Alarm LEDs and Alarm Cutoff/Lamp Test Button on the MX480 Craft Interface on page 45
- MX480 Component LEDs on the Craft Interface on page 46
- Alarm Relay Contacts on the MX480 Craft Interface on page 48

Alarm LEDs and Alarm Cutoff/Lamp Test Button on the MX480 Craft Interface

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

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

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

Table 10 on page 46 describes the alarm LEDs and alarm cutoff button in more detail.

Table 10: Alarm LEDs and Alarm Cutoff/Lamp Test Button

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.
	–	–	Alarm cutoff/lamp test button—Deactivates red and yellow alarms. Causes all LEDs on the craft interface to light (for testing) when pressed and held.

Related Documentation

- MX480 Craft Interface Description on page 44
- MX480 Component LEDs on the Craft Interface on page 46
- Alarm Relay Contacts on the MX480 Craft Interface on page 48

MX480 Component LEDs on the Craft Interface

- Host Subsystem LEDs on the MX480 Craft Interface on page 46
- Power Supply LEDs on the MX480 Craft Interface on page 47
- DPC and MPC LEDs on the MX480 Craft Interface on page 47
- FPC LEDs on the MX480 Craft Interface on page 47
- SCB LEDs on the MX480 Craft Interface on page 48
- Fan LEDs on the MX480 Craft Interface on page 48

Host Subsystem LEDs on the MX480 Craft Interface

Each host subsystem has three LEDs, located on the upper left of the craft interface, that indicate its status. The LEDs labeled **RE0** show the status of the Routing Engine in slot **0** and the SCB in slot **0**. The LEDs labeled **RE1** show the status of the Routing Engine and SCB in slot **1**. Table 11 on page 46 describes the functions of the host subsystem LEDs.

Table 11: Host Subsystem LEDs on the Craft Interface

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

Power Supply LEDs on the MX480 Craft Interface

Each power supply has two LEDs on the craft interface that indicate its status. The LEDs, labeled **0** through **3**, are located on the upper left of the craft interface next to the **PEM** label. Table 12 on page 47 describes the functions of the power supply LEDs on the craft interface.

Table 12: Power Supply LEDs on the Craft Interface

Label	Color	State	Description
PEM	Green	On steadily	Power supply is functioning normally.
	Red	On steadily	Power supply has failed or power input has failed.

DPC and MPC LEDs on the MX480 Craft Interface

Each DPC or MPC has LEDs on the craft interface that indicate its status. The LEDs, labeled **0** through **5**, are located along the bottom of the craft interface. Table 13 on page 47 describes the functions of the LEDs.

Table 13: DPC and MPC LEDs on the Craft Interface

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

FPC LEDs on the MX480 Craft Interface

An FPC takes up two DPC slots when installed in an MX Series router. The LEDs, labeled **0** through **5**, are located along the bottom of the craft interface. The LED corresponds to the lowest DPC slot number in which the FPC is installed. Table 14 on page 47 describes the functions of the FPC LEDs.

Table 14: FPC LEDs on the Craft Interface

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

SCB LEDs on the MX480 Craft Interface

Each SCB has two LEDs on the craft interface that indicates its status. The SCB LEDs, labeled **0** and **1**, are located along the bottom of the craft interface. Table 15 on page 48 describes the functions of the SCB LEDs.

Table 15: SCB LEDs on the Craft Interface

Label	Color	State	Description
OK	Green	On steadily	SCB: Fabric and control board functioning normally.
		Blinking	SCB is transitioning online or offline.
	–	Off	The slot is not online.
FAIL	Red	On steadily	SCB has failed.

Fan LEDs on the MX480 Craft Interface

The fan LEDs are located on the top left of the craft interface. Table 16 on page 48 describes the functions of the fan LEDs.

Table 16: Fan LEDs on the Craft Interface

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

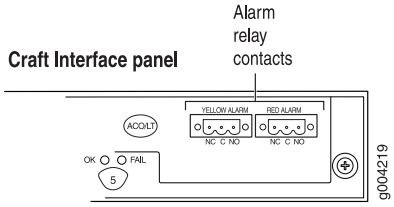
Related Documentation

- MX480 Craft Interface Description on page 44
- Alarm LEDs and Alarm Cutoff/Lamp Test Button on the MX480 Craft Interface on page 45
- Alarm Relay Contacts on the MX480 Craft Interface on page 48

Alarm Relay Contacts on the MX480 Craft Interface

The craft interface has two alarm relay contacts for connecting the router to external alarm devices (see Figure 21 on page 49). Whenever a system condition triggers either the red or yellow alarm on the craft interface, the alarm relay contacts are also activated. The alarm relay contacts are located on the upper right of the craft interface.

Figure 21: Alarm Relay Contacts



Related Documentation

- MX480 Craft Interface Description on page 44
- Alarm LEDs and Alarm Cutoff/Lamp Test Button on the MX480 Craft Interface on page 45
- MX480 Component LEDs on the Craft Interface on page 46

MX480 Power Supply Overview

- MX480 Power System Description on page 49
- MX480 AC Power Supply Description on page 50
- MX480 AC Power Supply LEDs on page 52
- MX480 DC Power Supply Description on page 52
- MX480 DC Power Supply LEDs on page 54

MX480 Power System Description

The MX480 router uses either AC or DC power supplies. The MX480 router is configurable with two, three, or four AC power supplies or two or four DC power supplies. The power supplies connect to the midplane, which distributes the different output voltages produced by the power supplies to the router components, depending on their voltage requirements. Each power supply is cooled by its own internal cooling system.

CAUTION: The router cannot be powered from AC and DC power supplies simultaneously. The first type of power supply detected by the router when initially powered on determines the type of power supply allowed by the router. All installed power supplies of the other type are disabled by the router. If you install a power supply of the other type while the router is operating, the router disables the power supply and generates an alarm.

NOTE: Routers configured with DC power supplies are shipped with a blank panel installed over the power distribution modules. Routers configured with AC power supplies have no blank panel.

Related Documentation

- MX480 AC Power Supply Description on page 50
- MX480 DC Power Supply Description on page 52

- Connecting Power to an AC-Powered MX480 Router with Normal-Capacity Power Supplies on page 113
- Connecting Power to a DC-Powered MX480 Router with Normal Capacity Power Supplies on page 116
- Replacing an MX480 AC Power Supply on page 231
- MX480 Chassis Grounding Specifications on page 296
- *MX480 Router Grounding Cable Lug Specifications*

MX480 AC Power Supply Description

Each AC power supply weighs approximately 5.0 lb (2.3 kg) and consists of one AC appliance inlet, an AC input switch, a fan, and LEDs to monitor the status of the power supply. Figure 22 on page 50 shows the power supply. For existing power supplies, each inlet requires a dedicated AC power feed and a dedicated 15 A (250 VAC) circuit breaker.

For high-capacity power supplies, each inlet requires a dedicated AC power feed and a dedicated 16.0 A @ 100 VAC or 16.0 A @ 200 VAC circuit breaker, or as required by local code.

The maximum inrush current for a high-capacity AC power supply is 49A at 264VAC.

Figure 22: AC Power Supply

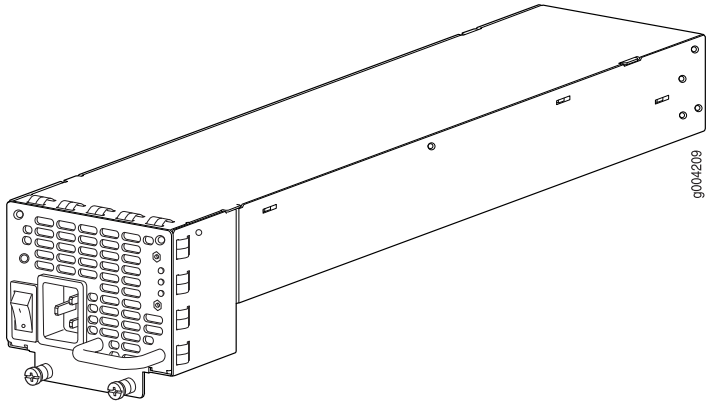
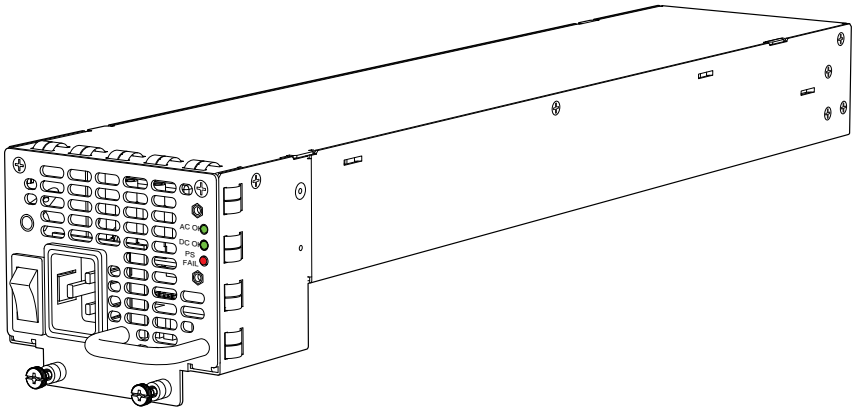


Figure 23: High-Capacity AC Power Supply



For more information about the AC power specifications, see the *MX480 3D Universal Edge Router Hardware Guide*.

WARNING: The router is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for UNC 1/4-20 ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal must be permanently connected to earth.

AC Power Supply Configurations

The MX480 high-capacity and normal-capacity power supplies each support either of the following AC power configurations:

- In the low-line (110 V) AC power configuration, the MX480 router contains three or four AC power supplies (see Figure 22 on page 50), located horizontally at the rear of the chassis in slots **PEM0** through **PEM3** (left to right). Each AC power supply provides power to all components in the router. When three power supplies are present, they share power almost equally within a fully populated system. Four AC power supplies provide full power redundancy. If one power supply fails or is removed, the remaining power supplies assume the entire electrical load without interruption. Three power supplies provide the maximum configuration with full power for as long as the router is operational. The low-line configuration requires three power supplies and the fourth power supply provides redundancy. With high-capacity power supplies, you must have a minimum of three power supplies installed in the router.
- In the high-line (220 V) AC power configuration, the MX480 router contains two or four AC power supplies (see Figure 22 on page 50), located horizontally at the rear of the chassis in slots **PEM0** through **PEM3** (left to right). In a high-line AC power configuration, each AC power supply provides power to all components in the router. When two or more power supplies are present, they share power almost equally within a fully populated system. Four AC power supplies provide full power redundancy. If one power supply fails or is removed, the remaining power supplies assume the entire electrical load without interruption.Two power supplies provide the maximum

configuration with full power for as long as the router is operational. In the two-PEM high-line configuration, slots **PEM0** and **PEM1** or **PEM2** and **PEM3** are used. The high-line configuration requires two power supplies, with the third and fourth providing redundancy. With high-capacity power supplies, you must have a minimum of two power supplies installed in the router.

Related Documentation

- MX480 Chassis Description on page 9
- MX480 Power System Description on page 49
- MX480 AC Power Supply LEDs on page 52

MX480 AC Power Supply LEDs

Each AC power supply faceplate contains three LEDs that indicate the status of the power supply (see Table 17 on page 52). The power supply status is also reflected in two LEDs on the craft interface. In addition, a power supply failure triggers the red alarm LED on the craft interface.

Table 17: AC Power Supply LEDs

Label	Color	State	Description
AC OK	Yellow	Off	AC power input voltage is below 78 VAC.
	Green	On	AC power input voltage is within 78–264 VAC.
DC OK	Green	Off	DC power outputs generated by the power supply are not within the normal operating ranges.
		On	DC power outputs generated by the power supply are within the normal operating ranges.
PS FAIL	Red	Off	Power supply is functioning normally.
		On	Power supply is not functioning normally and its output voltage is out of regulation limits. Check **AC OK** and **DC OK** LEDs for more information.

Related Documentation

- MX480 Chassis Description on page 9
- MX480 Power System Description on page 49
- MX480 AC Power Supply Description on page 50

MX480 DC Power Supply Description

Each DC power supply weighs approximately 3.8 lb (1.7 kg) and consists of one DC input (–48 VDC and return), one 40 A (–48 VDC) circuit breaker, a fan, and LEDs to monitor the status of the power supply. Figure 24 on page 53 shows the power supply. Each DC power supply has a single DC input (–48 VDC and return) that requires a dedicated circuit breaker.

For high capacity power supplies, we recommend that you provision 60 A or 75A per feed, depending on the selected DIP switch setting.

Figure 24: DC Power Supply

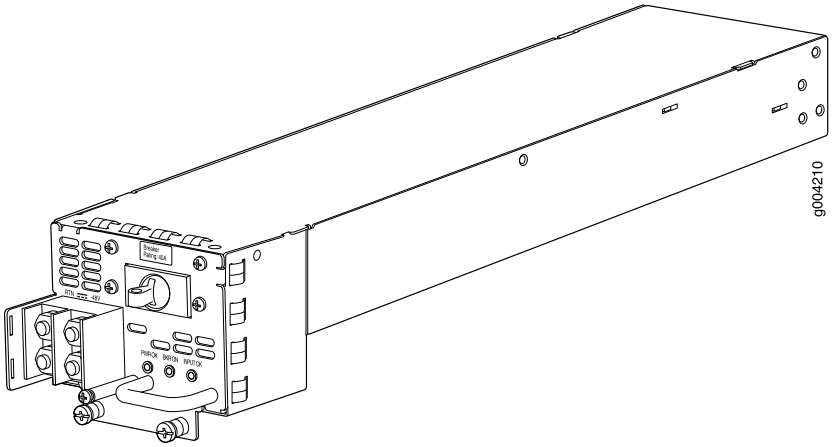
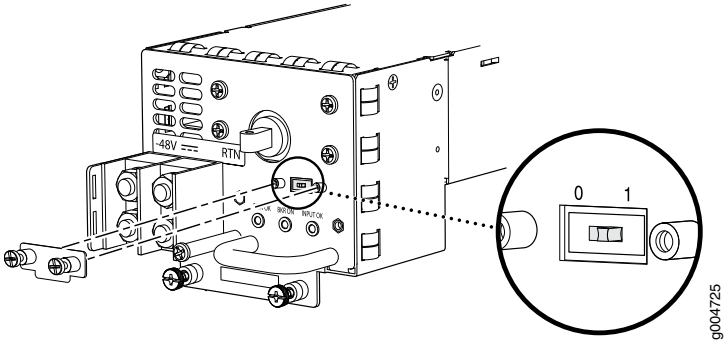


Figure 25: High-Capacity DC Power Supply



DC Power Supply Configurations

In the DC power configuration, the MX480 router contains either two or four DC power supplies (see Figure 24 on page 53) located at the rear of the chassis in slots **PEM0** through **PEM3** (left to right). You can upgrade your DC power system from two to four power supplies.

Four power supplies provide full redundancy. If a DC power supply in a redundant configuration is removed or fails, its redundant power supply takes over without interruption. The DC power supply in **PEM2** serves as redundant to the DC power supply in slot **PEM0**, and the DC power supply in **PEM3** serves as redundant to the DC power supply in slot **PEM1**. If only two DC power supplies are installed, they must be installed in slots **PEM0** and **PEM1** or in slots **PEM2** and **PEM3**.

Table 18 on page 54 shows the components that are powered by each DC power supply slot. It applies to existing and high-capacity power supplies.

Table 18: Power Supply Redundancy and Power Distribution

DC Power Supply Slot	Power Supply Provides Power to the Following Components
PEM0	Fan tray, DPC slots **0** and **1**, and SCB slots **0** and **1**
PEM1	Fan tray and DPC slots **2** through **5**
PEM2	Fan tray, DPC slots **0** and **1**, and SCB slots **0** and **1**
PEM3	Fan tray and DPC slots **2** through **5**

Related Documentation

- Power Supply LEDs on the MX480 Craft Interface on page 47
- MX480 Power System Description on page 49
- MX480 AC Power Supply Description on page 50
- MX480 DC Power Supply LEDs on page 54
- DC Power Supply Electrical Specifications for the MX480 Router on page 302

MX480 DC Power Supply LEDs

Each DC power supply faceplate contains three LEDs that indicate the status of the power supply (see Table 19 on page 54). The power supply status is also reflected in two LEDs on the craft interface.In addition, a power supply failure triggers the red alarm LED on the craft interface.

NOTE: An SCB must be present for the PWR OK LED to go on.

Table 19: DC Power Supply LEDs

Label	Color	State	Description
PWR OK	Green	Off	Power supply is not functioning normally. Check the **INPUT OK** LED for more information.

Table 19: DC Power Supply LEDs *(continued)*

Label	Color	State	Description
		On	Power supply is functioning normally.
	Yellow	On	The main output voltage is out of range (lower limit: 37.5 V to 39.5 V; upper limit: 72.5 V to 76 V).
BRKR ON	Green	Off	DC power supply circuit breaker is turned off.
		On	DC power input is present and the DC power supply circuit breaker is turned on.
INPUT OK	Green	Off	DC input to the PEM is not present.
		On	DC input is present and is connected in correct polarity.
	Yellow	On	DC input is present, but not in valid operating range or connected in reverse polarity.

Related Documentation

- Power Supply LEDs on the MX480 Craft Interface on page 47
- MX480 Power System Description on page 49
- MX480 AC Power Supply Description on page 50
- MX480 DC Power Supply Description on page 52
- DC Power Supply Electrical Specifications for the MX480 Router on page 302

MX480 Cooling System Overview

- MX480 Cooling System Description on page 55
- MX480 Fan LED on page 57

MX480 Cooling System Description

The cooling system consists of the following components:

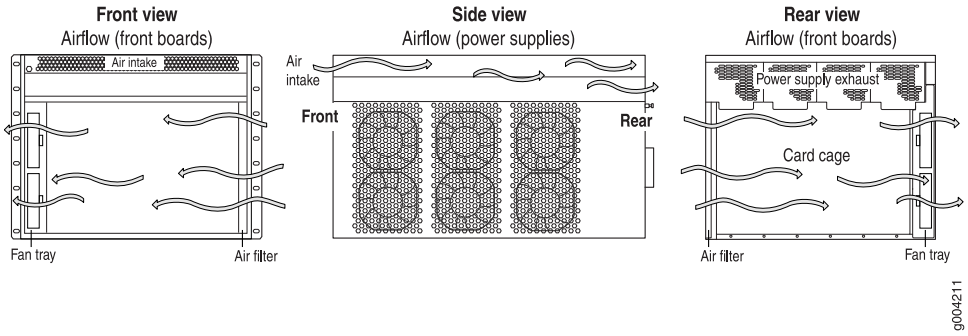
- Fan tray
- Air filter

The cooling system components work together to keep all router components within the acceptable temperature range (see Figure 26 on page 56, Figure 27 on page 56, and Figure 28 on page 57). The router has one fan tray and one air filter that install vertically in the rear of the router. The fan tray contains six fans. The MX Series high-capacity fan trays satisfy cooling requirements for high-density DPCs and MPCs, and must be upgraded for proper cooling.

The air intake to cool the chassis is located on the side of the chassis next to the air filter. Air is pulled through the chassis toward the fan tray, where it is exhausted out the side of the system. The air intake to cool the power supplies is located in the front of the router

above the craft interface. The exhaust for the power supplies is located on the rear bulkhead power supplies.

Figure 26: Airflow Through the Chassis



The host subsystem monitors the temperature of the router components. When the router is operating normally, the fans function at lower than full speed. If a fan fails or the ambient temperature rises above a threshold, the speed of the remaining fans is automatically adjusted to keep the temperature within the acceptable range. 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 27: Fan Tray

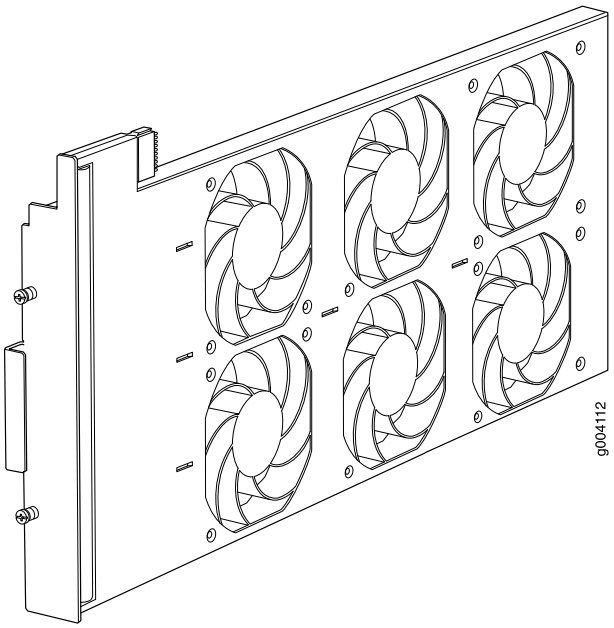
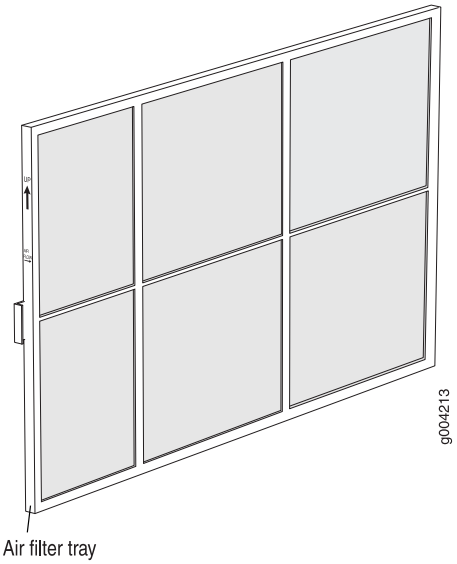


Figure 28: Air Filter



Related Documentation

- MX480 Fan LED on page 57
- Maintaining the MX480 Air Filter on page 132
- Maintaining the MX480 Fan Tray on page 132
- Troubleshooting the MX480 Cooling System on page 160

MX480 Fan LED

Each fan has an LED that displays its status. The fan LEDs are located on the top left of the craft interface. For more information, see "Fan LEDs on the MX480 Craft Interface" on page 48.

Related Documentation

- MX480 Cooling System Description on page 55
- Maintaining the MX480 Fan Tray on page 132
- Troubleshooting the MX480 Cooling System on page 160

MX480 Cable Management Brackets

The cable management brackets (see Figure 29 on page 58) consist of plastic dividers located on the left and right sides of each DPC, FPC, or MPC slot, and SCB slot. The cable management brackets allow you to route the cables outside the router and away from the DPCs, MPCs, MICs, PICs, and SCBs.

Figure 29: Cable Management Brackets

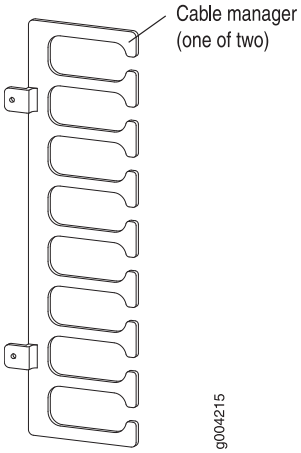
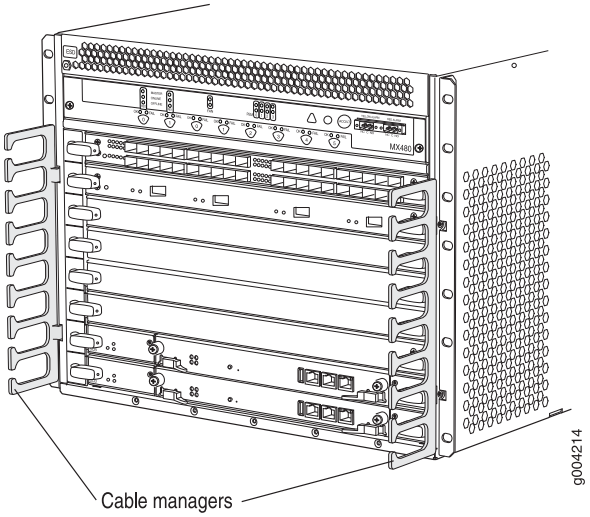


Figure 30: Cable Management Brackets Installed on the Router



Related Documentation

- Maintaining Cables That Connect to MX480 DPCs, MPCs, MICs, or PICs on page 146
- Replacing the MX480 Cable Management Brackets on page 242

PART 2

Setting Up the MX480 Router

CHAPTER 3

Preparing the Site for MX480 Router Installation

MX480 Site Preparation Checklist

The checklist in Table 20 on page 61 summarizes the tasks you must perform when preparing a site for router installation.

Table 20: Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	"MX480 Router Environmental Specifications" on page 283		
Select the type of rack or cabinet.	"MX480 Router Rack Requirements" on page 62, "MX480 Router Cabinet Size and Clearance Requirements" on page 65		
Plan rack or cabinet location, including required space clearances.	"MX480 Router Rack Requirements" on page 62, "MX480 Router Clearance Requirements for Airflow and Hardware Maintenance" on page 64, "MX480 Router Cabinet Size and Clearance Requirements" on page 65		
If a rack is used, secure rack to floor and building structure.	"MX480 Router Rack Requirements" on page 62		
Acquire cables and connectors.			

Table 20: Site Preparation Checklist *(continued)*

Item or Task	For More Information	Performed By	Date
Locate sites for connection of system grounding.	"MX480 Chassis Grounding Specifications" on page 296, *MX480 Router Grounding Cable Lug Specifications*, *MX480 Router Grounding Cable Specifications*		
Measure distance between external power sources and router installation site.			
Calculate the optical power budget and optical power margin.	"Calculating Power Budget and Power Margin for Fiber-Optic Cables" on page 308		

Related Documentation

- MX480 Router Rack Requirements on page 62
- MX480 Router Clearance Requirements for Airflow and Hardware Maintenance on page 64
- MX480 Router Cabinet Size and Clearance Requirements on page 65

MX480 Router 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 31 on page 63.

- Rack Size and Strength on page 62
- Spacing of Mounting Bracket Holes on page 63
- Connection to Building Structure on page 64

Rack Size and Strength

The router is designed for installation in 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).

With the use of adapters or approved wing devices to narrow the opening between the rails, the router fits into a 600-mm-wide rack or cabinet , as defined in the four-part *Equipment Engineering (EE); European telecommunications standard for equipment practice* (document number ETSI EN 300 119) published by the European Telecommunications Standards Institute (http://www.etsi.org).

The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions: 14.0 in. (356 mm) high, 24.5 in. (622 mm) deep, and 17.45 in. (443 mm) wide. The spacing of rails and adjacent racks must also allow for the clearances around the router and rack that are specified in "MX480 Router Clearance Requirements for Airflow and Hardware Maintenance" on page 64.

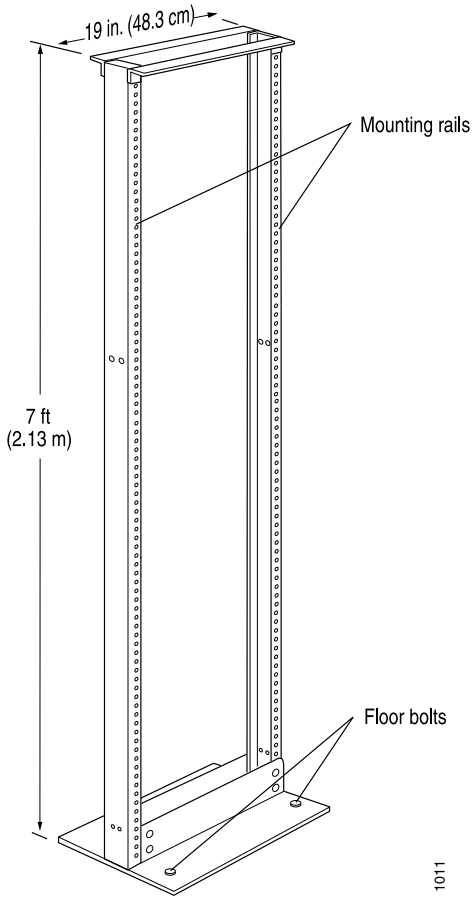
In general, a center-mount rack is preferable to a front-mount rack because the more even distribution of weight in the center-mount rack provides greater stability.

For instructions about installing the mounting hardware, see "Installing the MX480 Router Mounting Hardware for a Rack or Cabinet" on page 73.

The chassis height of 14.0 in. (35.6 cm) is approximately 8 U. A **U** is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Industry Association. You can stack five MX480 routers in a rack that has at least 48 U (84 in. or 2.13 m) of usable vertical space.

The rack must be strong enough to support the weight of the fully configured router, up to 163.5 lb (74.2 kg). If you stack five fully configured routers in one rack, it must be capable of supporting up to 818 lb (371.0 kg).

Figure 31: Typical Open-Frame Rack



Spacing of Mounting Bracket Holes

The router can be mounted in any rack that provides holes or hole patterns spaced at 1 U (1.75 in.) increments. The mounting brackets used to attach the chassis to a rack are designed to fasten to holes spaced at those distances.

Connection to Building Structure

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

Related Documentation

- MX480 Site Preparation Checklist on page 61
- Installation Safety Warnings for Juniper Networks Devices on page 252

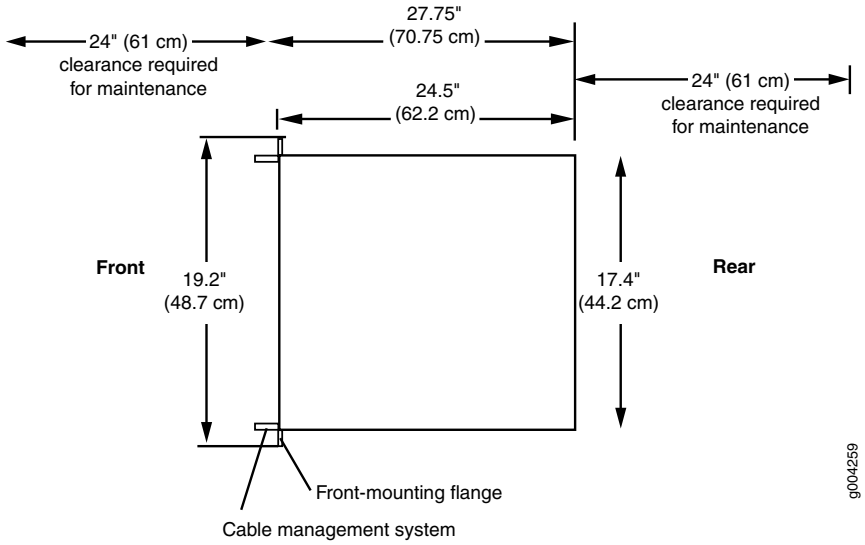
MX480 Router Clearance Requirements for Airflow and Hardware Maintenance

When planning the installation site, you need to allow sufficient clearance around the rack (see Figure 32 on page 65):

- 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) is required both in front of and behind the router. NEBS GR-63 recommends that you allow at least 30 in. (72.6 cm) in front of the rack and 24 in. (61.0 cm) behind the rack.

  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 that no leakage of air in situations where recirculation may result.

Figure 32: Clearance Requirements for Airflow and Hardware Maintenance for an MX480 Router Chassis



Related Documentation

- MX480 Site Preparation Checklist on page 61
- Installation Safety Warnings for Juniper Networks Devices on page 252

MX480 Router Cabinet Requirements

- MX480 Router Cabinet Size and Clearance Requirements on page 65
- MX480 Router Cabinet Airflow Requirements on page 66

MX480 Router Cabinet Size and Clearance Requirements

The minimum size cabinet that can accommodate the router is 482 mm wide and 800 mm deep. A cabinet larger than the minimum requirement provides better airflow and reduces the chance of overheating. To accommodate a single router, the cabinet must be at least 13 U high. If you provide adequate cooling air and airflow clearance, you can stack five routers in a cabinet that has at least 48 U (84 in. or 2.13 m) of usable vertical space.

The minimum front and rear clearance requirements depend on the mounting configuration you choose. The minimum total clearance inside the cabinet is 30.7 in. between the inside of the front door and the inside of the rear door.

Related Documentation

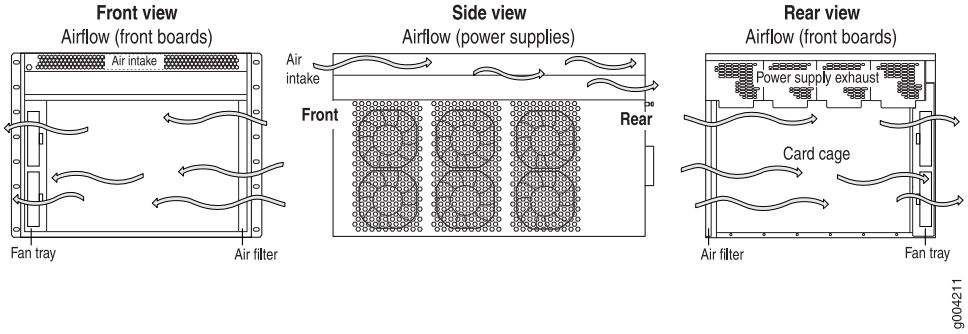
- MX480 Site Preparation Checklist on page 61
- MX480 Router Cabinet Airflow Requirements on page 66
- Installation Safety Warnings for Juniper Networks Devices on page 252

MX480 Router Cabinet Airflow Requirements

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

- Ensure that the cool air supply you provide through the cabinet can adequately dissipate the thermal output of the router.
- Ensure that the cabinet allows the chassis hot exhaust air to exit from the cabinet without recirculating into the router. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. For an illustration of chassis airflow, see Figure 33 on page 66.
- Install the router as close as possible to the front of the cabinet so that the cable management brackets just clear the inside of the front door. This maximizes the clearance in the rear of the cabinet for critical airflow.
- Route and dress all cables to minimize the blockage of airflow to and from the chassis.

Figure 33: Airflow Through the Chassis



Related Documentation

- MX480 Site Preparation Checklist on page 61
- Installation Safety Warnings for Juniper Networks Devices on page 252

CHAPTER 4

MX480 Router Installation Overview

Installing an MX480 Router Overview

To install the router:

1. Prepare the installation site.

   See "MX480 Site Preparation Checklist" on page 61.

2. Review the safety guidelines and warnings.

   - General Safety Guidelines for Juniper Networks Devices on page 247
   - General Safety Warnings for Juniper Networks Devices on page 248

3. Unpack the router and verify that all parts have been received.

   a. See "Unpacking the MX480 Router" on page 69.

   b. See "Verifying the MX480 Router Parts Received" on page 71.

4. Install the mounting hardware.

   See "Installing the MX480 Router Mounting Hardware for a Rack or Cabinet" on page 73.

5. Install the router.

   See "Installing the MX480 Router Using a Mechanical Lift" on page 82.

6. Connect cables to external devices.

   See "Connecting the MX480 Router to Management and Alarm Devices" on page 105.

7. Connect the grounding cable.

   See "Grounding the MX480 Router" on page 112.

8. Connect the power cables.

   - Connecting Power to an AC-Powered MX480 Router with Normal-Capacity Power Supplies on page 113
   - Connecting Power to a DC-Powered MX480 Router with Normal Capacity Power Supplies on page 116

9. Power on the router.
   - Powering On an AC-Powered MX480 Router on page 115
   - Powering On a DC-Powered MX480 Router on page 121
10. Perform the initial system configuration.

    See "Initially Configuring the MX480 Router" on page 125.

Related Documentation

- Tools and Parts Required to Unpack the MX480 Router on page 69

CHAPTER 5

Unpacking the MX480 Router

Tools and Parts Required to Unpack the MX480 Router

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

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

Related Documentation

- Unpacking the MX480 Router on page 69
- Verifying the MX480 Router Parts Received on page 71

Unpacking the MX480 Router

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

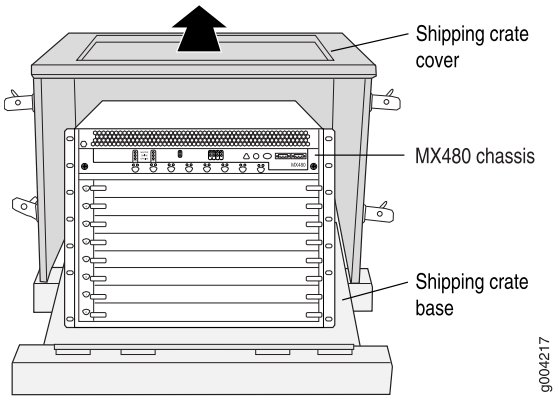
The shipping container measures 25.0 in. (63.5 cm) high, 28 in. (71.1 cm) wide, and 33.5 in. (85.0 cm) deep. The total weight of the container containing the router and accessories can range from 153 lb (70 kg) to 351 lb (159.2 kg).

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

To unpack the router (see Figure 34 on page 70):

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

Figure 34: Contents of the Shipping Crate



Related Documentation

- Verifying the MX480 Router Parts Received on page 71
- Installing the MX480 Router Mounting Hardware for a Rack or Cabinet on page 73
- Installing the MX480 Router Using a Mechanical Lift on page 82
- *Tools Required to Install the MX480 Router with a Mechanical Lift*
- Tools Required to Install the MX480 Router Without a Mechanical Lift on page 91

Verifying the MX480 Router 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 21 on page 71, and an accessory box, which contains the parts listed in Table 22 on page 72. The parts shipped with your router can vary depending on the configuration you ordered.

Table 21: Parts List for a Fully Configured Router

Component	Quantity
Chassis, including midplane, craft interface, and center-mounting brackets	1
DPCs	Up to 6
FPCs	Up to 3
MPCs	Up to 6
MICs	Up to 12
PICs	Up to 6
Routing Engines	1 or 2
SCBs	1 or 2
Power supplies	Up to 4
Fan tray	1
Air filter	1
Air filter tray	1
Quick start installation instructions	1
Small mounting shelf	1
Blank panels for slots without components installed	One blank panel for each slot not occupied by a component

Table 22: Accessory Box Parts List

Part	Quantity
Screws to mount chassis and small shelf	22
DC power terminal Lugs, 6-AWG	9
RJ-45-to-DB-9 cable to connect the router through the serial port	1
Cable management brackets	2
Terminal block plug, 3–pole, 5.08 mm spacing, 12A, to connect the router alarms	2
Label, accessories contents, MX480	1
USB flash drive with Junos OS	1
Read me first document	1
Affidavit for T1 connection	1
Juniper Networks Product Warranty	1
End User License Agreement	1
Document sleeve	1
3 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/RJ-45, 4-pair stranded UTP, Category 5E, 15'	1
ESD wrist strap with cable	1

Related Documentation

- Tools and Parts Required to Unpack the MX480 Router on page 69
- Unpacking the MX480 Router on page 69

CHAPTER 6

Installing the MX480 Router Mounting Hardware

Installing the MX480 Router Mounting Hardware for a Rack or Cabinet

The router can be installed in a four-post rack or cabinet or an open-frame rack. Install the mounting hardware on the rack before installing the router.

Install the mounting shelf, which is included in the shipping container, before installing the router. We recommend that you install the mounting shelf because the weight of a fully loaded chassis can be up to 163.5 lb (74.2 kg).

Table 23 on page 73 specifies the holes in which you insert cage nuts and screws to install the mounting hardware required (an **X** indicates a mounting hole location). The hole distances are relative to one of the standard U divisions on the rack. The bottom of all mounting shelves is at 0.02 in. above a U division.

Table 23: Four-Post Rack or Cabinet Mounting Hole Locations

Hole	Distance Above U Division		Mounting Shelf
4	2.00 in. (5.1 cm)	1.14 U	X
3	1.51 in. (3.8 cm)	0.86 U	X
2	0.88 in. (2.2 cm)	0.50 U	X
1	0.25 in. (0.6 cm)	0.14 U	X

To install the mounting shelf on the front rails of a four-post rack or cabinet, or the rails of an open-frame rack:

1. If needed, install cage nuts in the holes specified in Table 23 on page 73.
2. On the back of each rack rail, partially insert a mounting screw into the lowest hole specified in Table 23 on page 73.

3. Install the mounting shelf on the back of the rack rails. Rest the bottom slot of each flange on a mounting screw.
4. Partially insert the remaining screws into the open holes in each flange of the mounting shelf (see Figure 35 on page 74 or Figure 36 on page 75).
5. Tighten all the screws completely.

Figure 35: Installing the Front Mounting Hardware for a Four-Post Rack or Cabinet

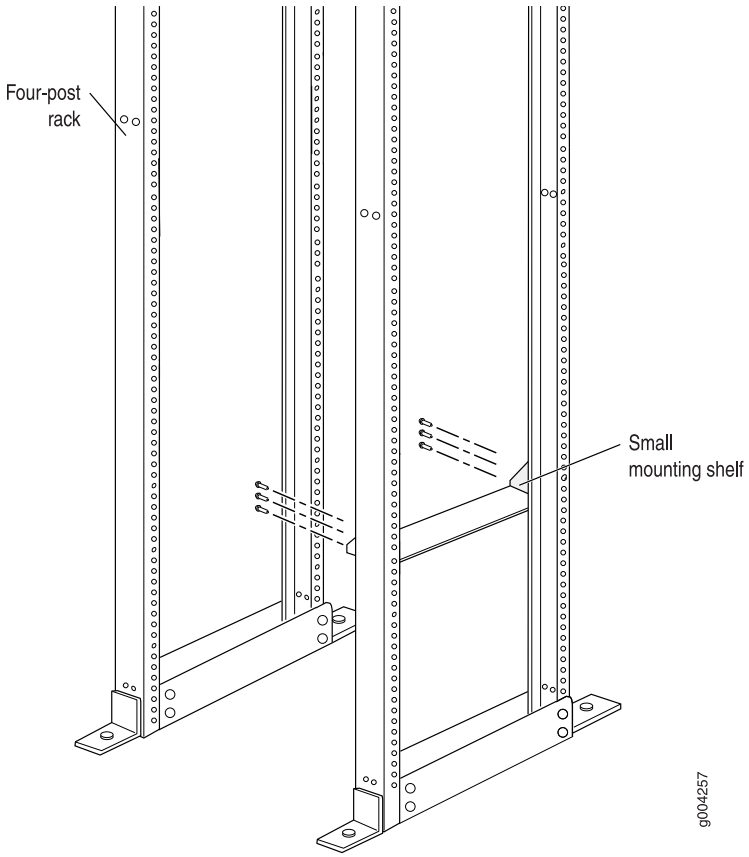
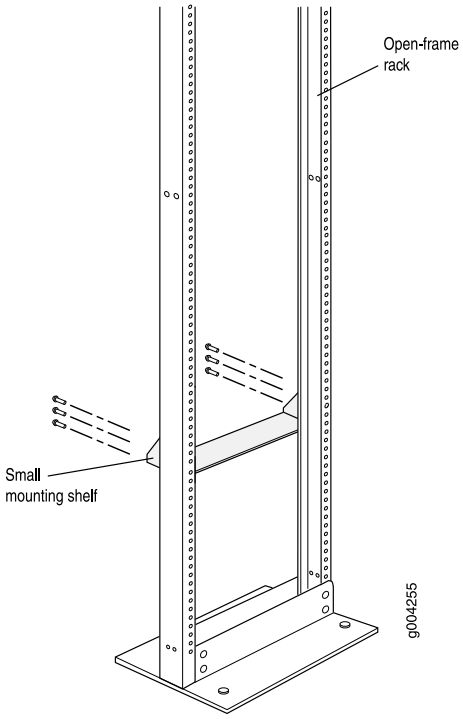


Figure 36: Installing the Mounting Hardware for an Open-Frame Rack



Related Documentation

- Installing the MX480 Router Using a Mechanical Lift on page 82
- Tools Required to Install the MX480 Router Without a Mechanical Lift on page 91

Moving the Mounting Brackets for Center-Mounting the MX480 Router

Two removable mounting brackets are attached to the mounting holes closest to the front of the chassis. 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:

1. Remove the three screws at the top and center of the bracket.
2. Pull the top of the bracket slightly away from the chassis. The bottom of the bracket contains a tab that inserts into a slot in the chassis.
3. Pull the bracket away from the chassis so that the tab is removed from the chassis slot.
4. Insert the bracket tab into the slot in the bottom center of the chassis.
5. Align the bracket with the two mounting holes located toward the top center of the chassis.

   There is no mounting hole in the center of the chassis that corresponds to the hole in the center of the bracket.

6. Insert the two screws at the top of the bracket and tighten each partially.

   Two screws are needed for mounting the bracket on the center of the chassis. You do not need the third screw.

7. Tighten the two screws completely.

8. Repeat the procedure for the other bracket.

Related Documentation

- Installing the MX480 Router Using a Mechanical Lift on page 82
- Tools Required to Install the MX480 Router Without a Mechanical Lift on page 91

CHAPTER 7

Installing the MX480 Router with a Mechanical Lift

Tools Required to Install the MX480 Router with a Mechanical Lift

To install the router, you need the following tools:

- Mechanical lift
- Phillips (+) screwdrivers, numbers 1 and 2
- 7/16-in. (11 mm) nut driver
- ESD grounding wrist strap

Related Documentation

- Installing the MX480 Router Using a Mechanical Lift on page 82
- Removing Components from the MX480 Router Before Installing It with a Lift on page 77
- Installing the MX480 Router Using a Mechanical Lift on page 82
- Reinstalling Components in the MX480 Router After Installing It with a Lift on page 84

Removing Components from the MX480 Router Before Installing It with a Lift

To make the router light enough to install with a lift, you must first remove most components from the chassis. The procedures for removing components from the chassis are for initial installation only, and assume that you have not connected power cables

to the router. The following procedures describe how to remove components from the chassis, first from the rear and then from the front:

1. Removing the Power Supplies Before Installing the MX480 Router with a Lift on page 78
2. Removing the Fan Tray Before Installing the MX480 Router with a Lift on page 79
3. Removing the SCBs Before Installing the MX480 Router with a Lift on page 79
4. Removing the DPCs Before Installing the MX480 Router with a Lift on page 80
5. Removing the FPCs Before Installing the MX480 Router with a Lift on page 81

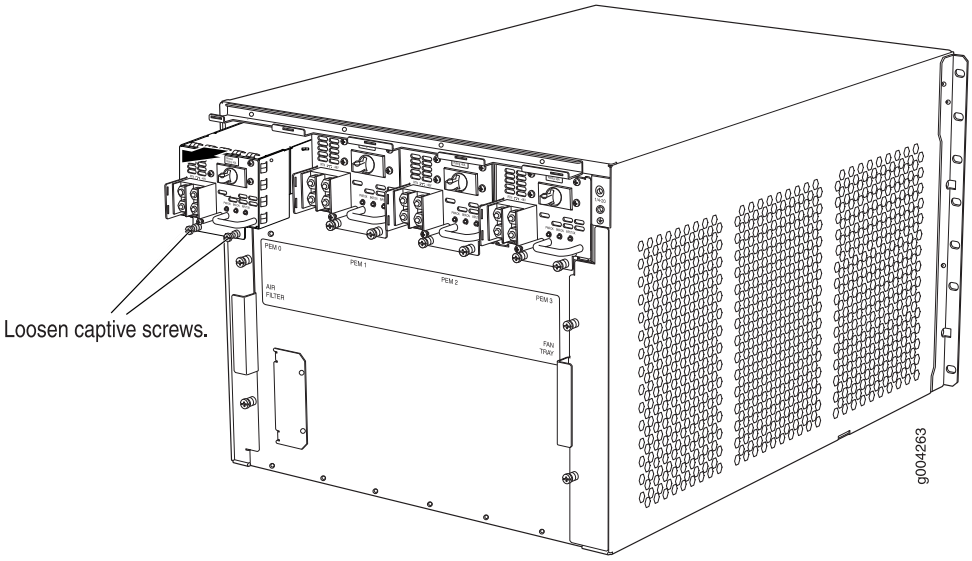
Removing the Power Supplies Before Installing the MX480 Router with a Lift

Remove the leftmost power supply first and then work your way to the right. To remove the AC or DC power supplies for each power supply (see Figure 37 on page 78):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. On an AC-powered router, switch the AC input switch on each power supply to the off (**O**) position. On a DC-powered router, Move the DC circuit breaker on each DC power supply to the off (**O**) position.

   We recommend this even though the power supplies are not connected to power sources.
3. Loosen the captive screws on the bottom edge of the power supply faceplate.
4. Pull the power supply straight out of the chassis.

Figure 37: Removing a Power Supply Before Installing the Router

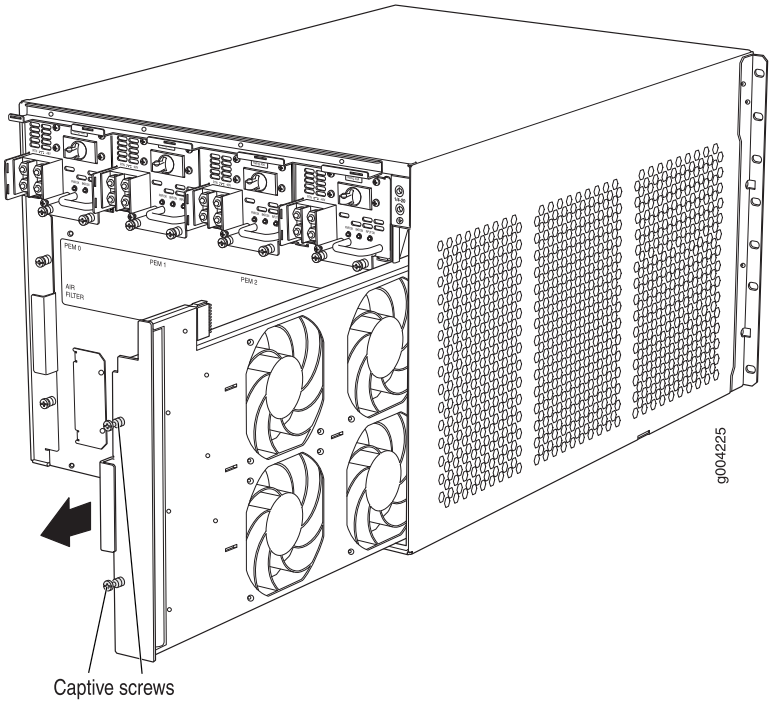


Removing the Fan Tray Before Installing the MX480 Router with a Lift

To remove the fan tray (see Figure 38 on page 79):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Loosen the captive screws on the fan tray faceplate.
3. Grasp the fan tray handle, and pull it out approximately 1 to 3 inches.
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 38: Removing the Fan Tray



Removing the SCBs Before Installing the MX480 Router with a Lift

To remove the SCBs (see Figure 39 on page 80):

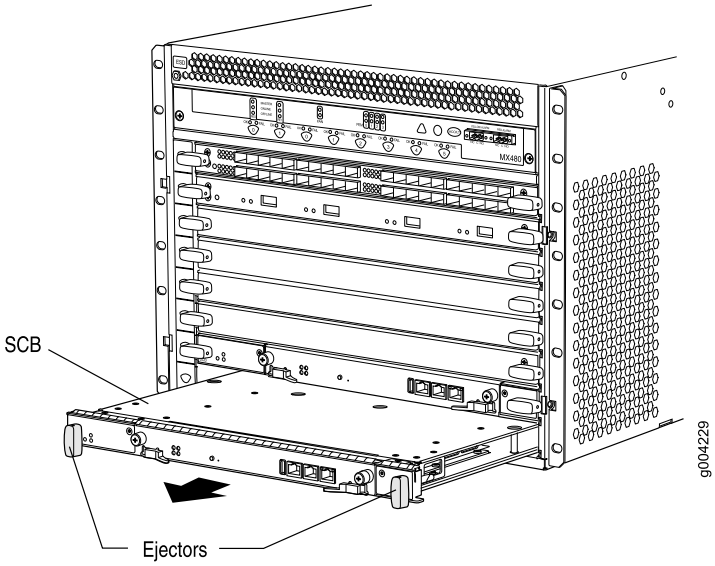
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Rotate the ejector handles simultaneously counterclockwise to unseat the SCB.
4. Grasp the ejector handles, and slide the SCB about halfway out of the chassis.

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

CAUTION: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

6. Repeat the procedure for each SCB.

Figure 39: Removing an SCB



Removing the DPCs Before Installing the MX480 Router with a Lift

To remove a DPC (see Figure 40 on page 81):

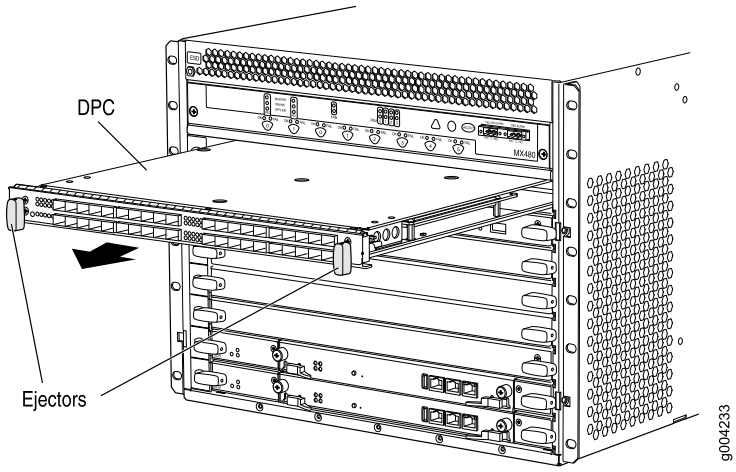
1. Have ready an antistatic mat for the DPC. Also have ready rubber safety caps for each DPC using an optical interface on the DPC that you are removing.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Simultaneously turn both the ejector handles counterclockwise to unseat the DPC.
4. Grasp the handles, and slide the DPC straight out of the card cage halfway.
5. Place one hand around the front of the DPC and the other hand under it to support it. Slide the DPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the DPC is concentrated in the back end. Be prepared to accept the full weight—up to 13.1 lb (5.9 kg)—as you slide the DPC out of the chassis.

When the DPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Do not stack DPC on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

Figure 40: Removing a DPC



Removing the FPCs Before Installing the MX480 Router with a Lift

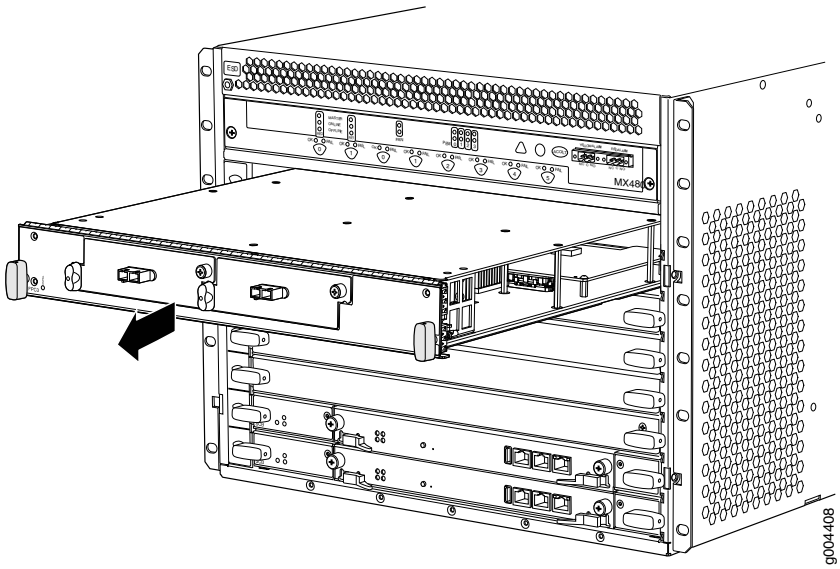
To remove an FPC (see Figure 41 on page 82):

1. Have ready an antistatic mat for the FPC. Also have ready rubber safety caps for each PIC using an optical interface on the PIC that you are removing.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.
4. Grasp the handles, and slide the FPC straight out of the card cage halfway.
5. Place one hand around the front of the FPC and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 18 lb (8.2 kg)—as you slide the FPC out of the chassis.

When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Figure 41: Removing an FPC



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Tools Required to Install the MX480 Router with a Mechanical Lift on page 77
- Installing the MX480 Router Using a Mechanical Lift on page 82
- Reinstalling Components in the MX480 Router After Installing It with a Lift on page 84

Installing the MX480 Router Using a Mechanical Lift

Because of the router's size and weight—up to 163.5 lb (74.2 kg) depending on the configuration—we strongly recommend that you install the router using a mechanical lift. To make the router light enough to install with a lift, you must first remove most components from the chassis.

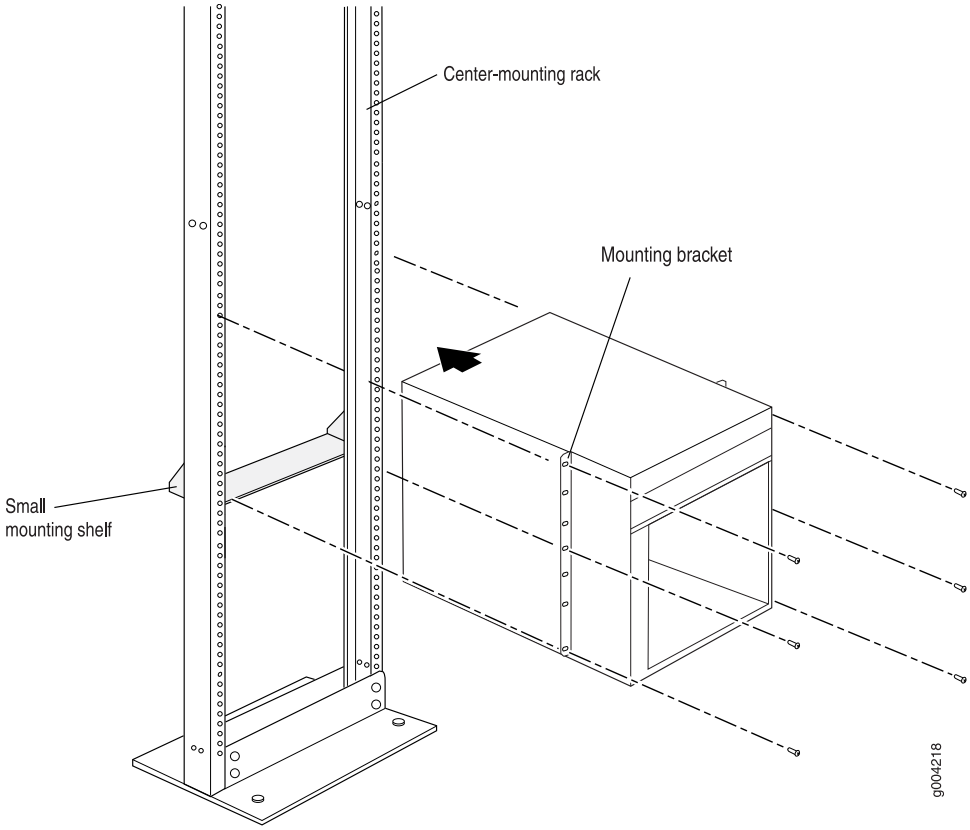
CAUTION: **Before front mounting the router in a rack, have a qualified technician verify that the rack is strong enough to support the router's weight and is adequately supported at the installation site.**

To install the router using a lift (see Figure 42 on page 83):

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. Load the router onto the lift, making sure it rests securely on the lift platform.
3. Using the lift, position the router in front of the rack or cabinet, centering it in front of the mounting shelf.
4. Lift the chassis approximately 0.75 in. above the surface of the mounting shelf and position it as close as possible to the shelf.

5. Carefully slide the router onto the mounting shelf so that the bottom of the chassis and the mounting shelf overlap by approximately two inches.
6. Slide the router onto the mounting shelf until the mounting brackets contact the rack rails. The shelf ensures that the holes in the mounting brackets of the chassis align with the holes in the rack rails.
7. Move the lift away from the rack.
8. Install a mounting screw into each of the open mounting holes aligned with the rack, starting from the bottom.
9. 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 42: Installing the Router in the Rack



NOTE: This illustration depicts the router being installed in an open-frame rack. For an illustration of the mounting hardware required for a four-post rack or cabinet.

Related Documentation

- MX480 Site Preparation Checklist on page 61
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

- Tools Required to Install the MX480 Router with a Mechanical Lift on page 77
- Removing Components from the MX480 Router Before Installing It with a Lift on page 77
- Reinstalling Components in the MX480 Router After Installing It with a Lift on page 84

Reinstalling Components in the MX480 Router After Installing It with a Lift

After the router is installed in the rack, you reinstall the removed components before booting and configuring the router. The following procedures describe how to reinstall components in the chassis, first in the rear and then in the front:

1. Reinstalling the Power Supplies After Installing the MX480 Router with a Lift on page 84
2. Reinstalling the Fan Tray After Installing the MX480 Router with a Lift on page 85
3. Reinstalling the SCBs After Installing the MX480 Router with a Lift on page 86
4. Reinstalling the DPCs After Installing the MX480 Router with a Lift on page 87
5. Reinstalling the FPCs After Installing the MX480 Router with a Lift on page 88

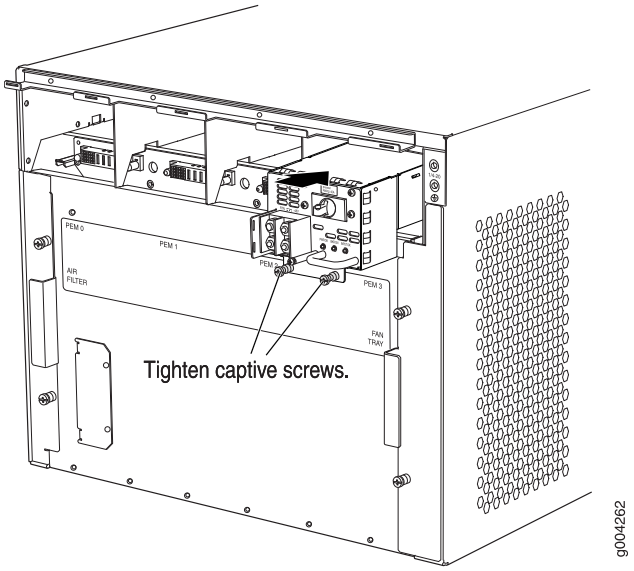
Reinstalling the Power Supplies After Installing the MX480 Router with a Lift

Reinstall the rightmost power supply first and then work your way to the left. To reinstall the AC or DC power supplies, follow this procedure for each power supply (see Figure 43 on page 85, which shows the installation of the DC power supplies):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. On an AC-powered router, switch the AC input switch on each power supply to the off (**O**) position. On a DC-powered router, Move the DC circuit breaker on each DC power supply to the off (**O**) position.

   We recommend this even though the power supplies are not connected to power sources.
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. Tighten the captive screws.

Figure 43: Reinstalling a Power Supply

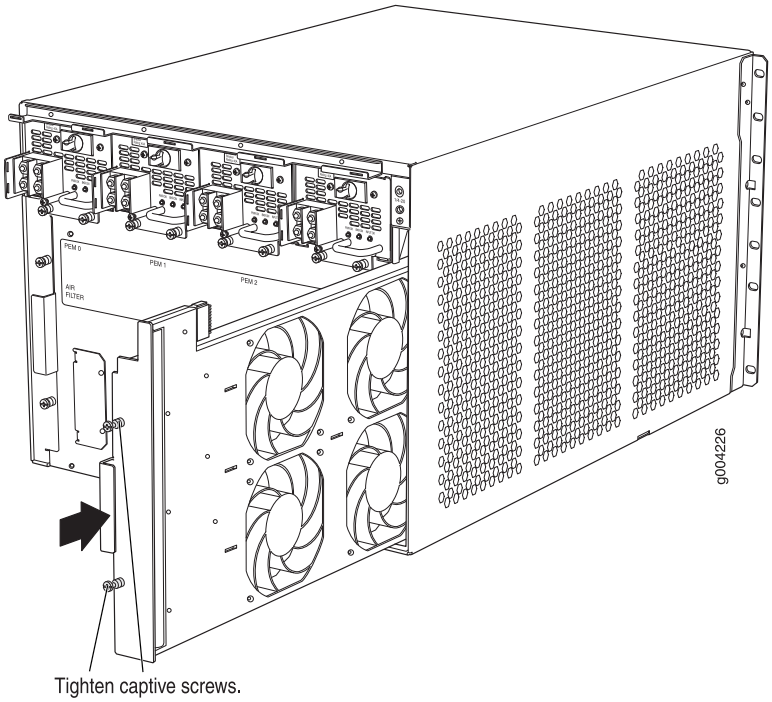


Reinstalling the Fan Tray After Installing the MX480 Router with a Lift

To reinstall the fan tray (see Figure 44 on page 86):

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 on each side, and insert it straight into the chassis. Note the correct orientation by the "this side up" label on the top surface of the fan tray.
3. Tighten the captive screws on the fan tray faceplate to secure it in the chassis.

Figure 44: Reinstalling a Fan Tray



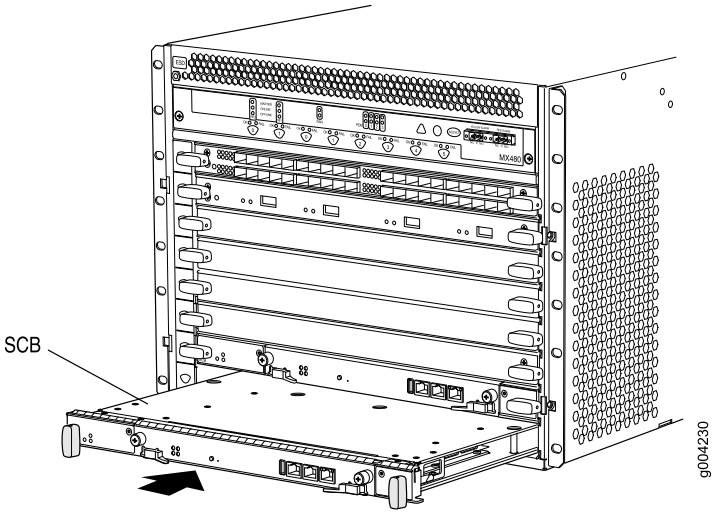
Reinstalling the SCBs After Installing the MX480 Router with a Lift

To reinstall an SCB (see Figure 45 on page 87):

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

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Carefully align the sides of the SCB with the guides inside the chassis.
3. Slide the SCB into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
4. Grasp both ejector handles, and rotate them simultaneously clockwise until the SCB is fully seated.
5. Place the ejector handles in their proper position, horizontally and toward the center of the board. To avoid blocking the visibility of the LEDs position the ejectors over the PARK icon.

Figure 45: Reinstalling an SCB

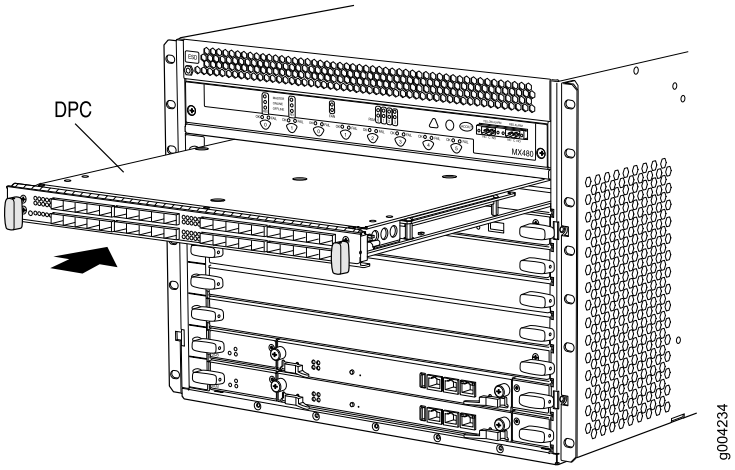


Reinstalling the DPCs After Installing the MX480 Router with a Lift

To reinstall a DPC (see Figure 46 on page 88):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Place the DPC on an antistatic mat, or remove it from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Verify that each fiber-optic transceiver is covered by a rubber safety cap. If it does not, cover the transceiver with a safety cap.
5. Orient the DPC so that the faceplate faces you.
6. Lift the DPC into place, and carefully align the sides of the DPC with the guides inside the card cage.
7. Slide the DPC all the way into the card cage until you feel resistance.
8. Grasp both ejector handles, and rotate them clockwise simultaneously until the DPC is fully seated.

Figure 46: Reinstalling a DPC

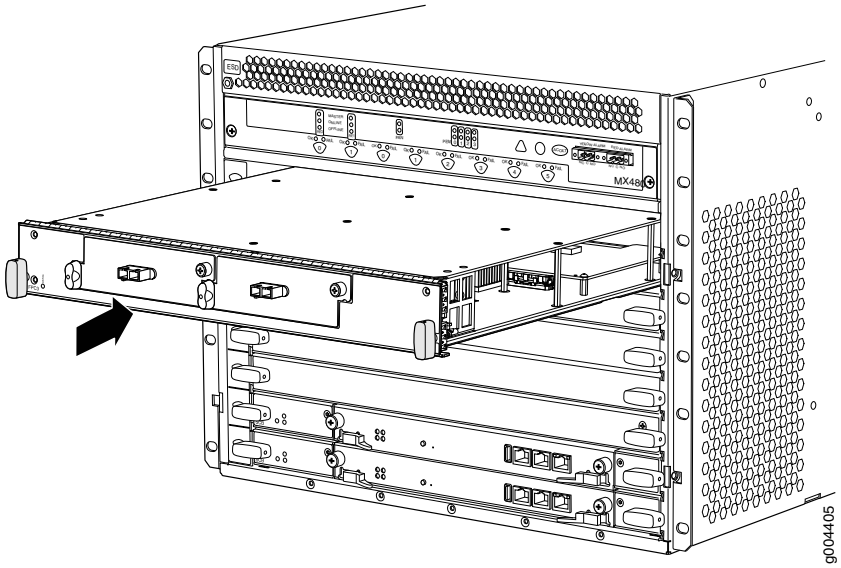


Reinstalling the FPCs After Installing the MX480 Router with a Lift

To reinstall an FPC (see Figure 47 on page 89):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Place the FPC on an antistatic mat, or remove it from its electrostatic bag.
3. Identify the two DPC slots on the router where the FPC will be installed.
4. Verify that each fiber-optic transceiver on the PIC is covered by a rubber safety cap. If it does not, cover the transceiver with a safety cap.
5. Orient the FPC so that the faceplate faces you.
6. Lift the FPC into place, and carefully align the sides of the FPC with the guides inside the card cage.
7. Slide the FPC all the way into the card cage until you feel resistance.
8. Grasp both ejector handles, and rotate them clockwise simultaneously until the FPC is fully seated.

Figure 47: Reinstalling an FPC



Related Documentation

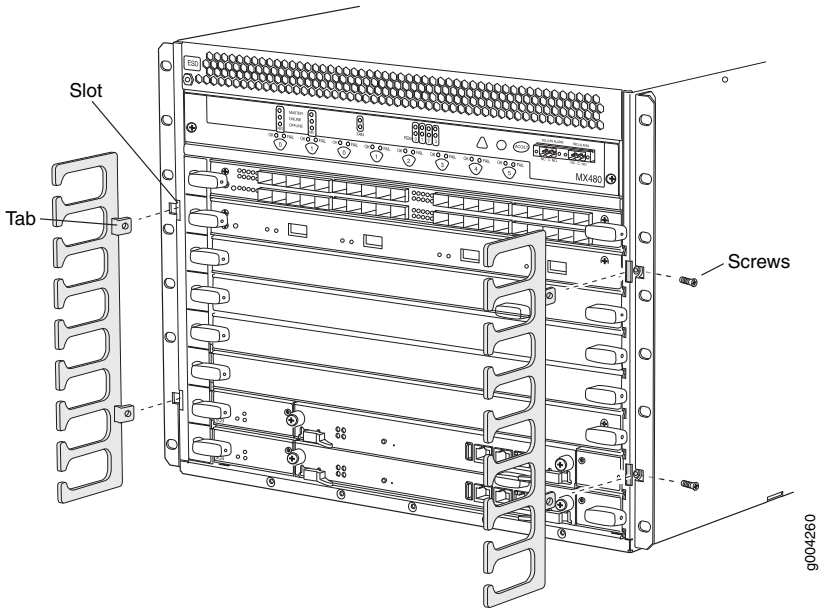
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Tools Required to Install the MX480 Router with a Mechanical Lift on page 77
- Removing Components from the MX480 Router Before Installing It with a Lift on page 77
- Installing the MX480 Router Using a Mechanical Lift on page 82
- Installing the MX480 Router Cable Management Bracket on page 89

Installing the MX480 Router Cable Management Bracket

The cable management brackets attach to both sides of the router. To install the cable management brackets (see Figure 48 on page 90):

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 brackets on the front sides of the chassis.
3. Insert the tabs into the slots.
4. Tighten the captive screws completely.

Figure 48: Installing the Cable Management Brackets



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Tools and Parts Required for MX480 Router Connections on page 105

CHAPTER 8

Installing the MX480 Router Without a Mechanical Lift

Tools Required to Install the MX480 Router Without a Mechanical Lift

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

- Phillips (+) screwdrivers, numbers 1 and 2
- 7/16-in. (11 mm) nut driver
- ESD grounding wrist strap

Related Documentation

- Removing Components from the MX480 Router Before Installing It Without a Lift on page 91
- Installing the MX480 Chassis in the Rack Manually on page 97
- Reinstalling Components in the MX480 Router After Installing It Without a Lift on page 99

Removing Components from the MX480 Router Before Installing It Without a Lift

If you cannot use a mechanical lift to install the router (the preferred method), you can install it manually. To make the router light enough to install manually, you first remove most components from the chassis. The procedures for removing components from the chassis are for initial installation only, and assume that you have not connected power

cables to the router. The following procedures describe how to remove components from the chassis, first from the rear and then from the front:

1. Removing the Power Supplies Before Installing the MX480 Router Without a Lift on page 92
2. Removing the Fan Tray Before Installing the MX480 Router Without a Lift on page 93
3. Removing the SCBs Before Installing the MX480 Router Without a Lift on page 93
4. Removing the DPCs Before Installing the MX480 Router Without a Lift on page 94
5. Removing the FPCs Before Installing the MX480 Router Without a Lift on page 95

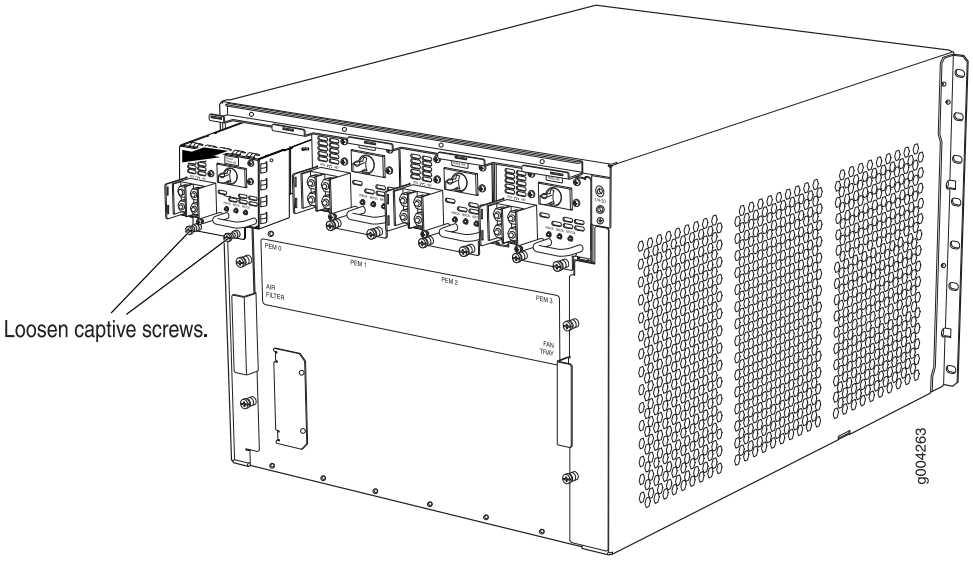
Removing the Power Supplies Before Installing the MX480 Router Without a Lift

Remove the leftmost power supply first and then work your way to the right. To remove the AC or DC power supplies for each power supply (see Figure 49 on page 92):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. On an AC-powered router, switch the AC input switch on each power supply to the off (**O**) position. On a DC-powered router, Move the DC circuit breaker on each DC power supply to the off (**O**) position.

   We recommend this even though the power supplies are not connected to power sources.
3. Loosen the captive screws on the bottom edge of the power supply faceplate.
4. Pull the power supply straight out of the chassis.

Figure 49: Removing a Power Supply Before Installing the Router

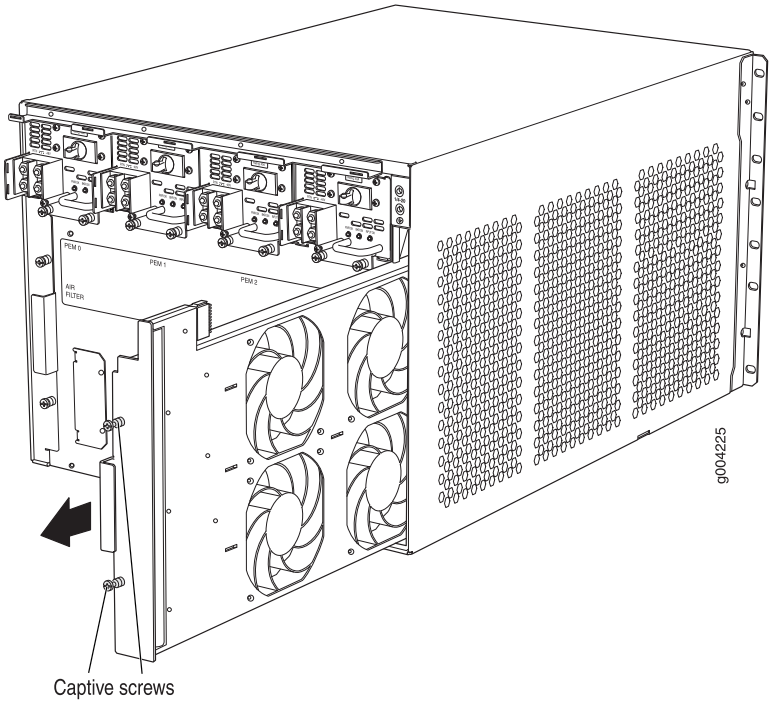


Removing the Fan Tray Before Installing the MX480 Router Without a Lift

To remove the fan tray (see Figure 50 on page 93):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Loosen the captive screws on the fan tray faceplate.
3. Grasp the fan tray handle, and pull it out approximately 1 to 3 inches.
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 50: Removing the Fan Tray



Removing the SCBs Before Installing the MX480 Router Without a Lift

To remove the SCBs (see Figure 51 on page 94):

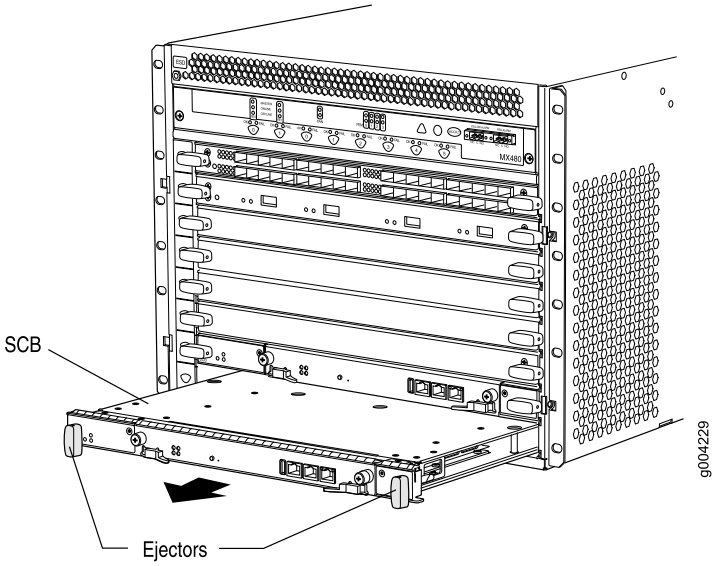
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Rotate the ejector handles simultaneously counterclockwise to unseat the SCB.
4. Grasp the ejector handles, and slide the SCB about halfway out of the chassis.

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

CAUTION: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

6. Repeat the procedure for each SCB.

Figure 51: Removing an SCB



Removing the DPCs Before Installing the MX480 Router Without a Lift

To remove a DPC (see Figure 52 on page 95):

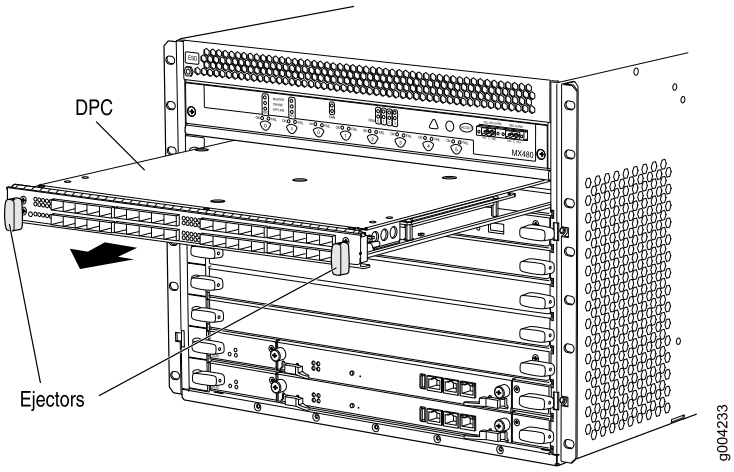
1. Have ready an antistatic mat for the DPC. Also have ready rubber safety caps for each DPC using an optical interface on the DPC that you are removing.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Simultaneously turn both the ejector handles counterclockwise to unseat the DPC.
4. Grasp the handles, and slide the DPC straight out of the card cage halfway.
5. Place one hand around the front of the DPC and the other hand under it to support it. Slide the DPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the DPC is concentrated in the back end. Be prepared to accept the full weight—up to 13.1 lb (5.9 kg)—as you slide the DPC out of the chassis.

When the DPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Do not stack DPC on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

Figure 52: Removing a DPC



Removing the FPCs Before Installing the MX480 Router Without a Lift

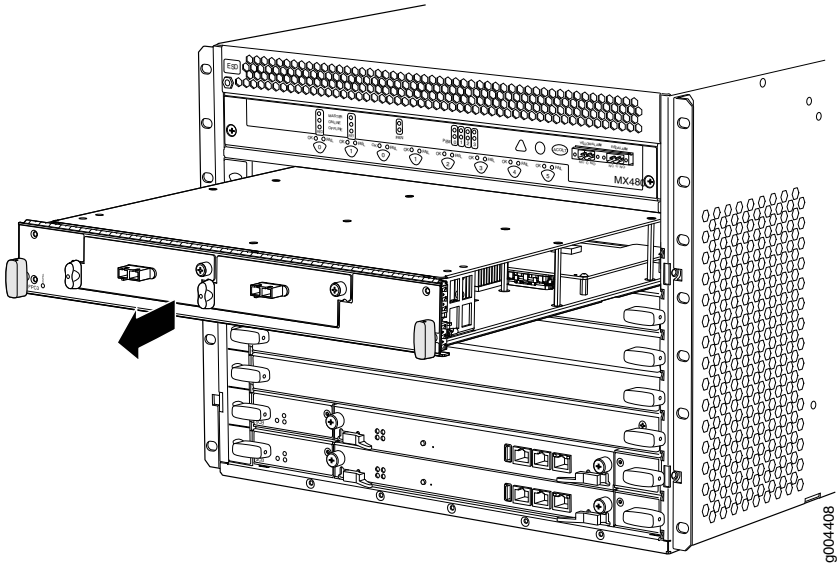
To remove an FPC (see Figure 53 on page 96):

1. Have ready an antistatic mat for the FPC. Also have ready rubber safety caps for each PIC using an optical interface on the PIC that you are removing.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.
4. Grasp the handles, and slide the FPC straight out of the card cage halfway.
5. Place one hand around the front of the FPC and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 18 lb (8.2 kg)—as you slide the FPC out of the chassis.

When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Figure 53: Removing an FPC



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Tools Required to Install the MX480 Router Without a Mechanical Lift on page 91
- Installing the MX480 Chassis in the Rack Manually on page 97
- Reinstalling Components in the MX480 Router After Installing It Without a Lift on page 99

Installing the MX480 Chassis in the Rack Manually

To install the router in the rack (see Figure 54 on page 98):

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.

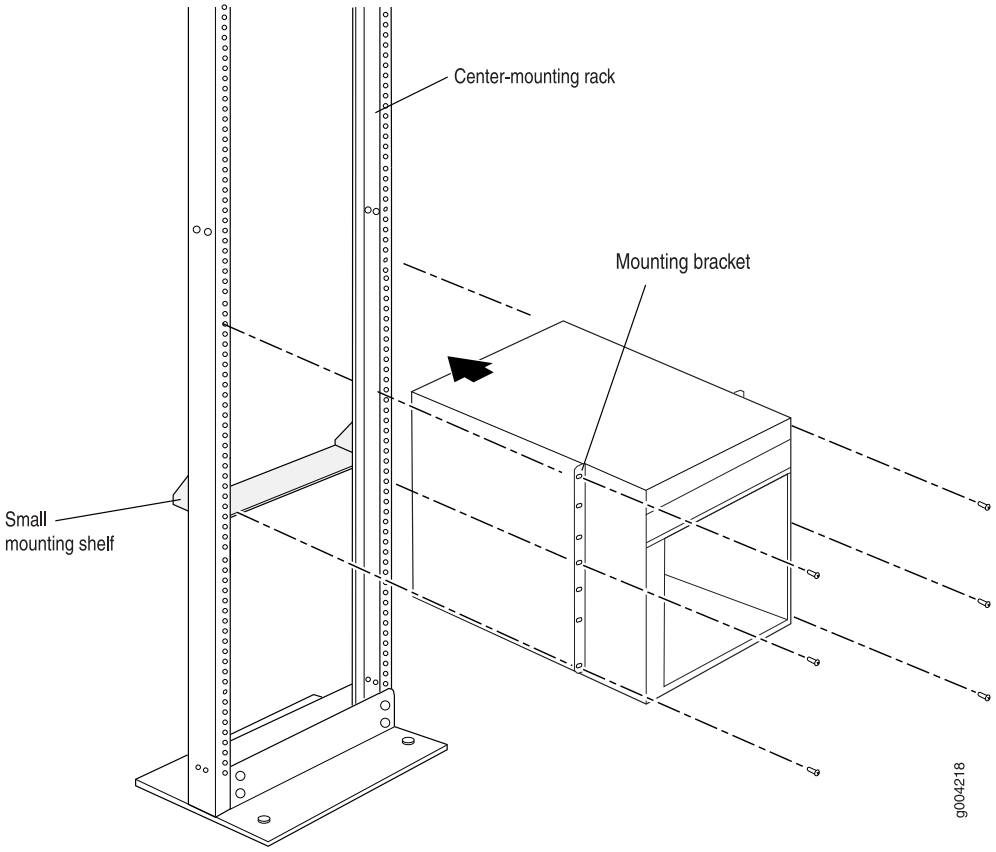
CAUTION: Before front mounting the router in a rack, have a qualified technician verify that the rack is strong enough to support the router's weight and is adequately supported at the installation site.

CAUTION: Lifting the chassis and mounting it in a rack requires two people. The empty chassis weighs approximately 65.5 lb (29.7 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, centering it in front of the mounting shelf. Use a pallet jack if one is available.
3. With one person on each side, hold onto the bottom of the chassis and carefully lift it onto the mounting shelf.

   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. Slide the router onto the mounting shelf until the mounting brackets contact the rack rails. The shelf ensures that the holes in the mounting brackets of the chassis align 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 54: Installing the Router in the Rack



NOTE: This illustration depicts the router being installed in an open-frame rack.

Related Documentation

- MX480 Site Preparation Checklist on page 61
- Tools Required to Install the MX480 Router Without a Mechanical Lift on page 91
- Removing Components from the MX480 Router Before Installing It Without a Lift on page 91
- Reinstalling Components in the MX480 Router After Installing It Without a Lift on page 99

Reinstalling Components in the MX480 Router After Installing It Without a Lift

After the router is installed in the rack, you reinstall the removed components before booting and configuring the router. The following procedures describe how to reinstall components in the chassis, first in the rear and then in the front:

1. Reinstalling the Power Supplies After Installing the MX480 Router Without a Lift on page 99
2. Reinstalling the Fan Tray After Installing the MX480 Router Without a Lift on page 100
3. Reinstalling the SCBs After Installing the MX480 Router Without a Lift on page 101
4. Reinstalling the DPCs After Installing the MX480 Router Without a Lift on page 102
5. Reinstalling the FPCs After Installing the MX480 Router Without a Lift on page 103

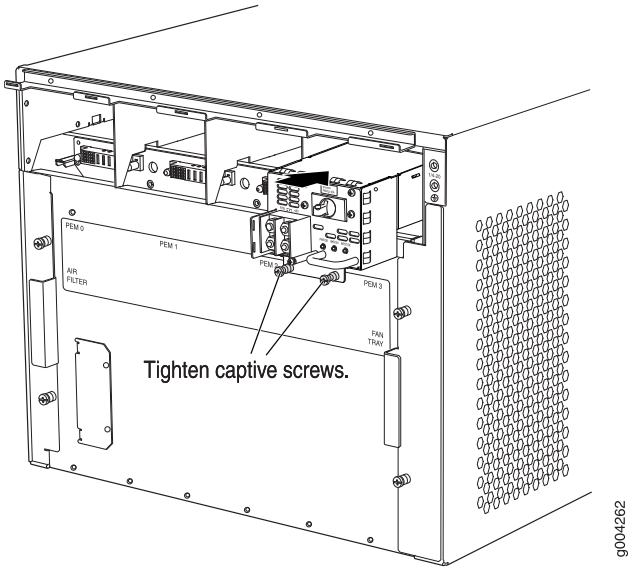
Reinstalling the Power Supplies After Installing the MX480 Router Without a Lift

Reinstall the rightmost power supply first, and then work your way to the left. To reinstall the AC or DC power supplies, follow this procedure for each power supply (see Figure 55 on page 100, which shows the installation of the DC power supplies):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. On an AC-powered router, switch the AC input switch on each power supply to the off (**O**) position. On a DC-powered router, Move the DC circuit breaker on each DC power supply to the off (**O**) position.

   We recommend this even though the power supplies are not connected to power sources.
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. Tighten the captive screws.

Figure 55: Reinstalling a Power Supply

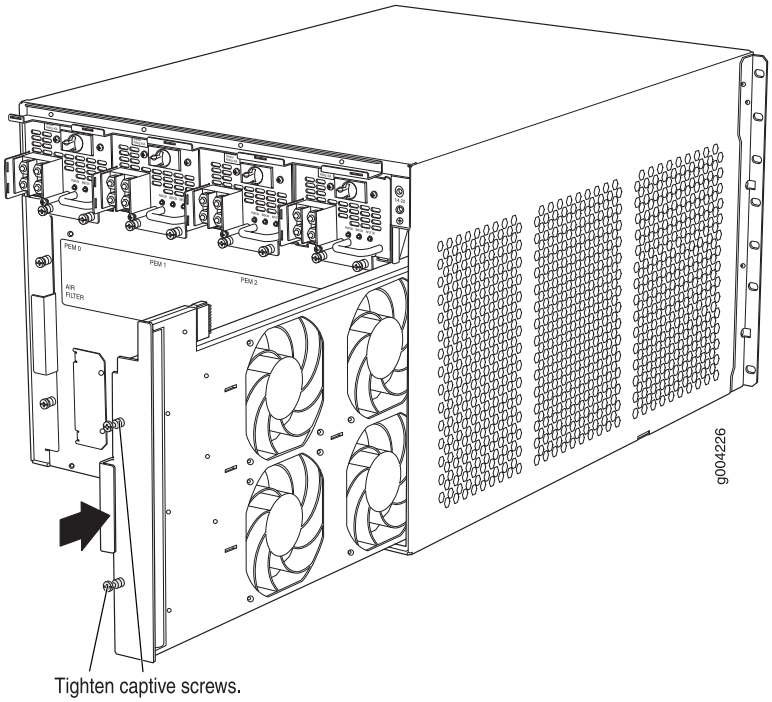


Reinstalling the Fan Tray After Installing the MX480 Router Without a Lift

To reinstall the fan tray (see Figure 56 on page 101):

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 on each side, and insert it straight into the chassis. Note the correct orientation by the "this side up" label on the top surface of the fan tray.
3. Tighten the captive screws on the fan tray faceplate to secure it in the chassis.

Figure 56: Reinstalling a Fan Tray



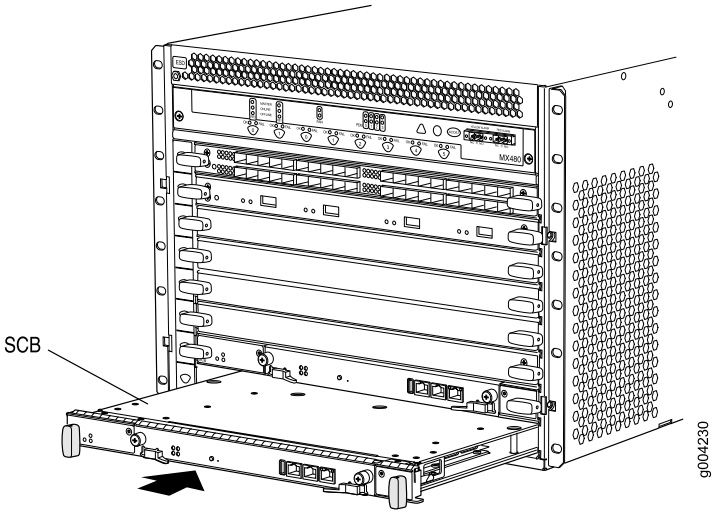
Reinstalling the SCBs After Installing the MX480 Router Without a Lift

To reinstall an SCB (see Figure 57 on page 102):

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

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Carefully align the sides of the SCB with the guides inside the chassis.
3. Slide the SCB into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
4. Grasp both ejector handles, and rotate them simultaneously clockwise until the SCB is fully seated.
5. Place the ejector handles in their proper position, horizontally and toward the center of the board. To avoid blocking the visibility of the LEDs position the ejectors over the PARK icon.

Figure 57: Reinstalling an SCB

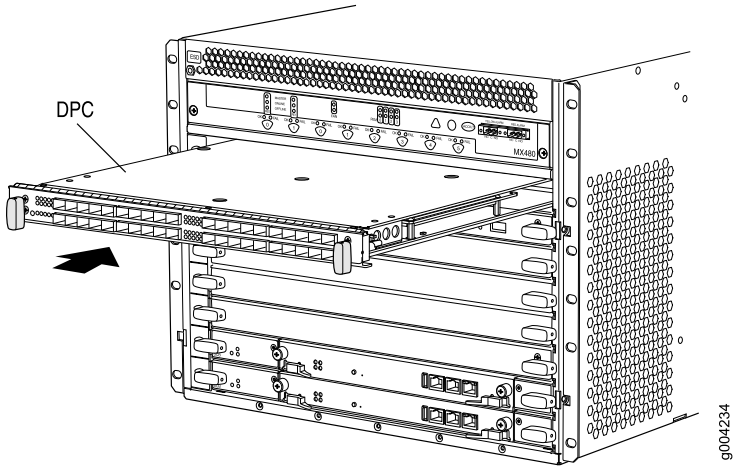


Reinstalling the DPCs After Installing the MX480 Router Without a Lift

To reinstall a DPC (see Figure 58 on page 103):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Place the DPC on an antistatic mat, or remove it from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Verify that each fiber-optic transceiver is covered by a rubber safety cap. If it does not, cover the transceiver with a safety cap.
5. Orient the DPC so that the faceplate faces you.
6. Lift the DPC into place, and carefully align the sides of the DPC with the guides inside the card cage.
7. Slide the DPC all the way into the card cage until you feel resistance.
8. Grasp both ejector handles, and rotate them clockwise simultaneously until the DPC is fully seated.

Figure 58: Reinstalling a DPC

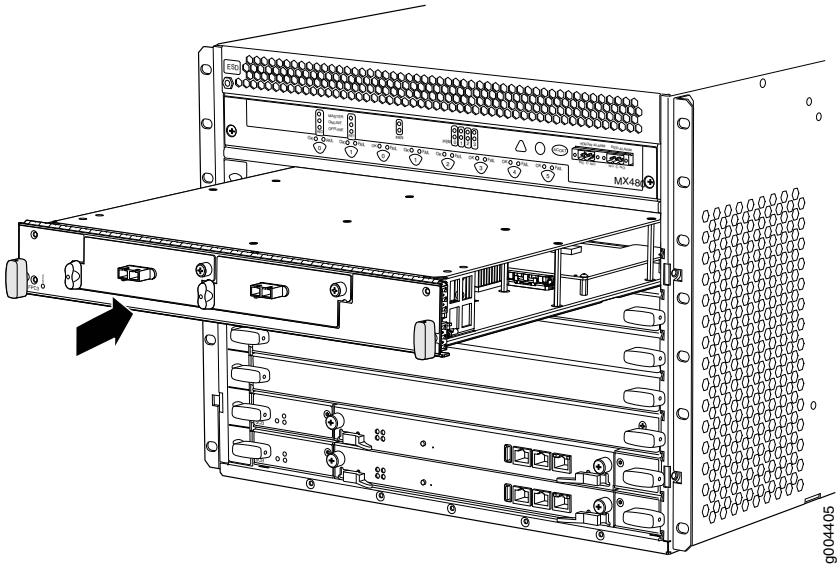


Reinstalling the FPCs After Installing the MX480 Router Without a Lift

To reinstall a DPC (see Figure 59 on page 104):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Place the FPC on an antistatic mat, or remove it from its electrostatic bag.
3. Identify the two DPC slots on the router where the FPC will be installed.
4. Verify that each fiber-optic transceiver on the PIC is covered by a rubber safety cap. If it does not, cover the transceiver with a safety cap.
5. Orient the FPC so that the faceplate faces you.
6. Lift the FPC into place, and carefully align the sides of the FPC with the guides inside the card cage.
7. Slide the FPC all the way into the card cage until you feel resistance.
8. Grasp both ejector handles, and rotate them clockwise simultaneously until the FPC is fully seated.

Figure 59: Reinstalling an FPC



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Tools Required to Install the MX480 Router Without a Mechanical Lift on page 91
- Removing Components from the MX480 Router Before Installing It Without a Lift on page 91
- Installing the MX480 Chassis in the Rack Manually on page 97

CHAPTER 9

Connecting the MX480 Router

Tools and Parts Required for MX480 Router Connections

To connect the router to management devices and line cards, you need the following tools and parts:

- Phillips (+) screwdrivers, numbers 1 and 2
- 2.5-mm flat-blade (–) screwdriver
- 2.5-mm Phillips (+) screwdriver
- Wire cutters
- Electrostatic discharge (ESD) grounding wrist strap

Related Documentation

- Connecting the MX480 Router to Management and Alarm Devices on page 105

Connecting the MX480 Router to Management and Alarm Devices

Connecting the MX480 Router to a Network for Out-of-Band Management

To connect the Routing Engine to a network for out-of-band management, connect an Ethernet cable with RJ-45 connectors to the **ETHERNET** port on the Routing Engine. One Ethernet cable is provided with the router. 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 61 on page 106 shows the connector) into the **ETHERNET** port on the Routing Engine. Figure 60 on page 106 shows the port.

3. Plug the other end of the cable into the network device.

Figure 60: Ethernet Port

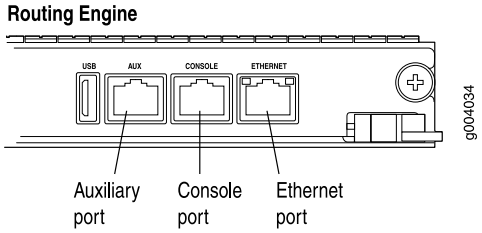
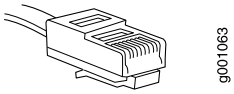


Figure 61: Routing Engine Ethernet Cable Connector



Connecting the MX480 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 Routing Engine. To use a laptop, modem, or other auxiliary device, connect it to the **AUX** port on the Routing Engine. 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 63 on page 107 shows the connector) into the **AUX** port or **CONSOLE** port on the Routing Engine. Figure 62 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

Figure 62: Auxiliary and Console Ports

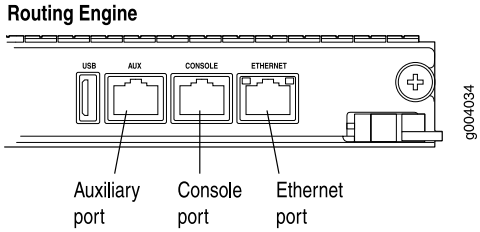
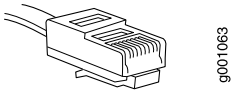


Figure 63: Routing Engine Console and Auxiliary Cable Connector



Connecting the MX480 Router to an External Alarm-Reporting Device

To connect the router to external alarm-reporting devices, attach wires to the **RED** and **YELLOW** relay contacts on the craft interface. (See Figure 64 on page 107.) A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

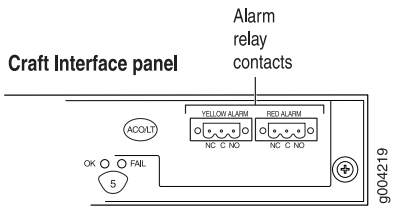
The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2), which is not provided. Use the gauge of wire appropriate for the external device you are connecting.

To connect an external device to an alarm relay contact (see Figure 64 on page 107):

1. Prepare the required length of wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2).
2. While the terminal block is not plugged into the relay contact, use a 2.5-mm flat-blade screwdriver to loosen the small screws on its side. With the small screws on its side facing left, insert wires into the slots in the front of the block based on the wiring for the external device. Tighten the screws to secure the wire.
3. Plug the terminal block into the relay contact, and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.
4. Attach the other end of the wires to the external device.

To attach a reporting device for the other kind of alarm, repeat the procedure.

Figure 64: Alarm Relay Contacts



Related Documentation

- Tools and Parts Required for MX480 Router Connections on page 105
- Routing Engine Interface Cable and Wire Specifications for MX Series Routers on page 310

Connecting DPC, MPC, MIC, or PIC Cables to the MX480 Router

To connect the DPCs, MPCs, MICs, or PICs to the network (see Figure 65 on page 109 and Figure 66 on page 109):

1. Have ready a length of the type of cable used by the component. For cable specifications, see the *MX Series Interface Module Reference*.
2. Remove the rubber safety plug from the cable connector port.

WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

3. Insert the cable connector into the cable connector port on the faceplate.

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 in the cable management brackets to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

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

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

Figure 65: Attaching a Cable to a DPC

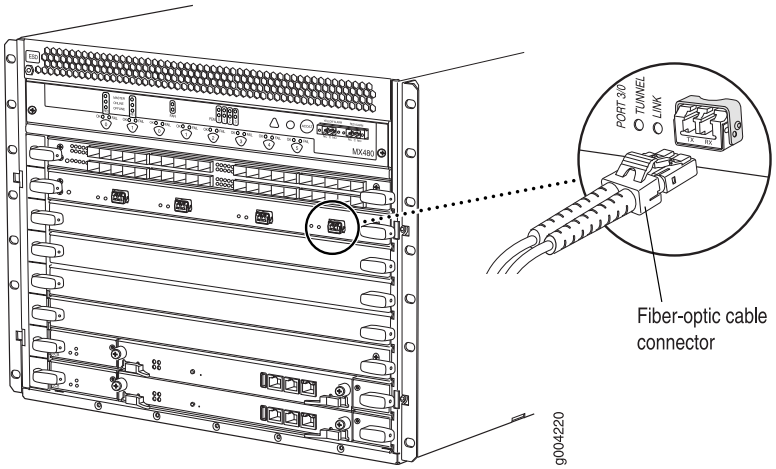
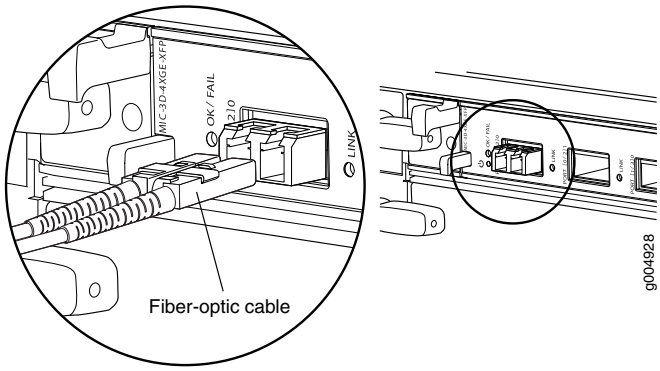


Figure 66: Attaching a Cable to a MIC



Related Documentation

- Tools and Parts Required for MX480 Router Connections on page 105

CHAPTER 10

Grounding and Providing Power to the MX480 Router

Tools and Parts Required for MX480 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
- 7/16-in. (11 mm) hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) tightening torque, for tightening nuts to terminal studs on each power supply on a DC-powered router.
- Wire cutters
- Electrostatic discharge (ESD) grounding wrist strap

CAUTION: The maximum torque rating of the terminal studs on the DC power supply is 36 lb-in. (4.0 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC power supply terminal studs. Use an

appropriately-sized driver or socket wrench, with a maximum torque capacity of 50 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.

Related Documentation

- Grounding the MX480 Router on page 112
- MX480 Chassis Grounding Specifications on page 296
- Connecting Power to an AC-Powered MX480 Router with Normal-Capacity Power Supplies on page 113
- Connecting Power to a DC-Powered MX480 Router with Normal Capacity Power Supplies on page 116

Grounding the MX480 Router

You ground the router by connecting a grounding cable to earth ground and then attaching it to the chassis grounding points using UNC 1/4-20 two screws. You must provide the grounding cable (cable lugs are supplied with the router). 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. The bolts are sized for UNC 1/4-20 bolts.
8. Secure the grounding cable lug to the grounding points, first with the washers, then with the 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.

Related Documentation

- MX480 Chassis Grounding Specifications on page 296
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

Connecting Power to an AC-Powered MX480 Router with Normal-Capacity Power Supplies

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. For power cord and AC power specifications, see "AC Power Cord Specifications for the MX480 Router" on page 300.

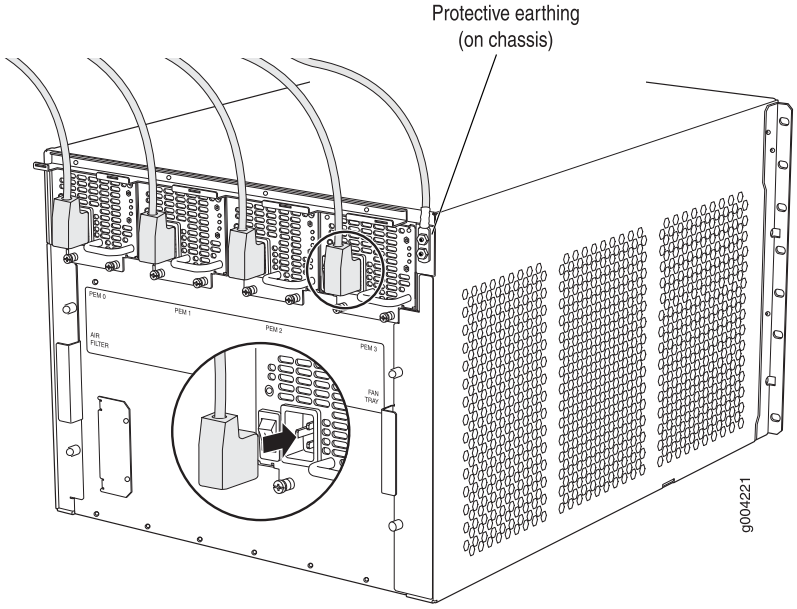
To connect the AC power cords to the router (see Figure 67 on page 114):

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 power cords shipped with the router, which should have a plug appropriate for your geographical location (see "AC Power Cord Specifications for the MX480 Router" on page 300).
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 external circuit breaker.

6. Route the power cord along the cable restraint toward the left or right corner of the chassis. If needed to hold the power cord in place, thread plastic cable ties, which you must provide, through the openings on the cable restraint.
7. Verify that the power cord does not block the air exhaust and access to router components, or drape where people could trip on it.
8. Repeat Step 2 through Step 6 for the remaining power supplies.

Figure 67: Connecting AC Power to the Router (110V)



Related Documentation

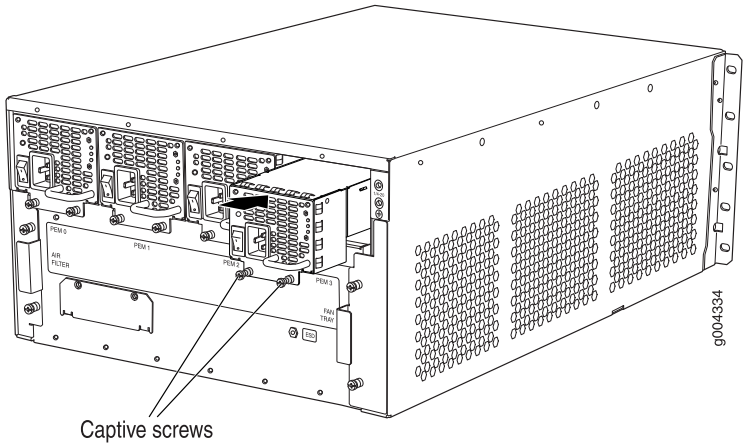
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

Installing the MX480 AC High-Capacity Power Supplies

To install a high-capacity AC power supply:

1. Move the AC input switch next to the appliance inlet on the power supply to the off (**O**) position.
2. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot as shown in Figure 68 on page 115. The power supply faceplate should be flush with any adjacent power supply faceplate or blank installed in the power supply slot.
3. Tighten both captive screws at the bottom of the power supply.
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 LEDs on the power supply faceplate. If the power supply is correctly installed and functioning normally, the **AC OK** and **DC OK** LEDs light steadily and the **PS FAIL** LED is not lit.

Figure 68: Installing an AC Power Supply



Powering On an AC-Powered MX480 Router

To power on an AC-powered router:

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Verify that the power supplies are fully inserted in the chassis.
3. Verify that each AC power cord is securely inserted into its appliance inlet.
4. Verify that an external management device is connected to one of the Routing Engine ports (**AUX**, **CONSOLE**, or **ETHERNET**).
5. Turn on the power to the external management device.
6. Switch on the dedicated customer site circuit breakers for the power supplies. Follow the ESD and safety instructions for your site.
7. Move the AC input switch on each power supply to the on (**|**) position and observe the status LEDs on each power supply faceplate. If an AC power supply is correctly installed and functioning normally, the **AC OK** and **DC OK** LEDs light steadily, and the **PS FAIL** LED is not lit.

   If any of the status LEDs indicates that 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

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Connecting the MX480 Router to Management and Alarm Devices on page 105
- Replacing an MX480 AC Power Supply on page 231

Connecting Power to a DC-Powered MX480 Router with Normal Capacity Power Supplies

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 studs on the power supply faceplates. You must provide the power cables (the cable lugs are supplied with the router).

To connect the DC source power cables to the router:

1. Switch off the dedicated customer site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Move the DC circuit breaker on the power supply faceplate to the off (**O**) position.
4. Remove the clear plastic cover protecting the terminal studs 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 nut and washer from each of the terminal studs. (Use a 7/16-in. [11 mm] nut driver or socket wrench.)
7. Secure each power cable lug to the terminal studs, first with the flat washer, then with the nut (see Figure 69 on page 118). Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut. Do not overtighten the nut. (Use a 7/16-in. [11 mm] torque-controlled driver or socket wrench.)
   a. Secure each positive (+) DC source power cable lug to the **RTN** (return) terminal.
   b. Secure each negative (–) DC source power cable lug to the **–48V** (input) terminal.

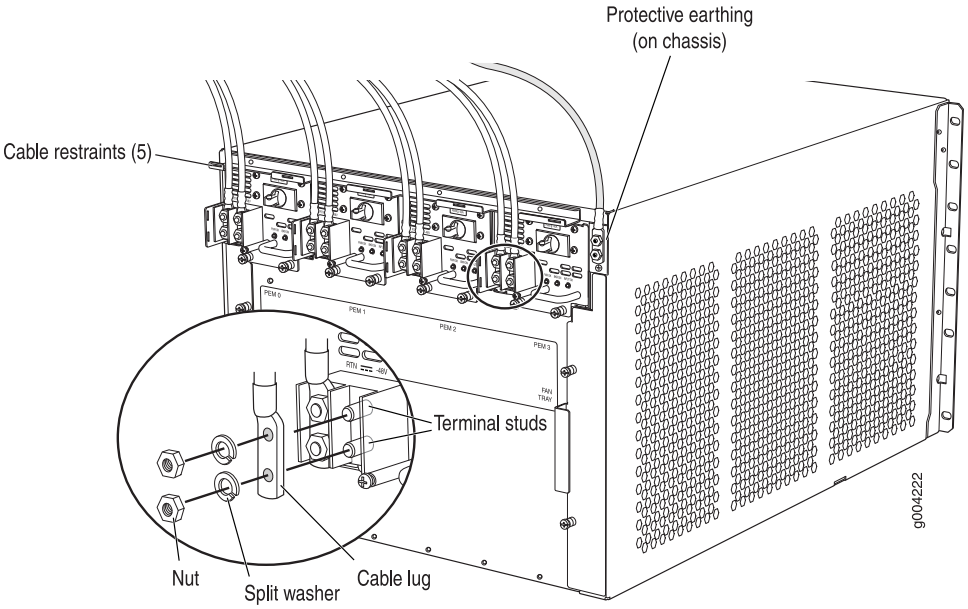
   CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying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

CAUTION: The maximum torque rating of the terminal studs on the DC power supply is 36 lb-in. (4.0 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC power supply terminal studs.

The DC power supplies in slots **PEM0** and **PEM1** must be powered by dedicated power feeds derived from feed **A**, and the DC power supplies in slots **PEM2** and **PEM3** must be powered by dedicated power feeds derived from feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system.

8. Route the power cables along the cable restraint toward the left or right corner of the chassis. If needed, thread plastic cable ties, which you must provide, through the openings on the cable restraint to hold the power cables in place.
9. Replace the clear plastic cover over the terminal studs on the faceplate.
10. 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.
11. Repeat Steps 3 through 10 for the remaining power supplies.

Figure 69: Connecting DC Power to the Router



Related Documentation

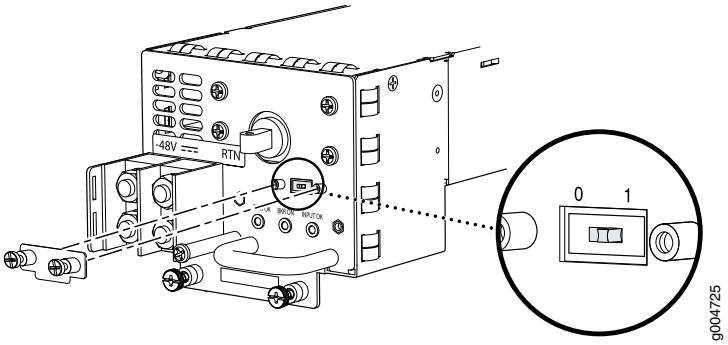
- DC Power Cable Specifications for the MX480 Router on page 305
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

Installing an MX480 DC High-Capacity Power Supply

To install a DC power supply:

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. Move the power switch on the power supply faceplate 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. Using a screwdriver, loosen the captive screw holding the metal cover over the input mode switch. Rotate the metal cover away from the input mode switch to expose the switch.
5. Check the setting of the input mode switch. Use a sharp, nonconductive object to slide the switch to the desired position. Set the input mode switch to position 0 for 60-A input and position 1 for 70-A input. This setting is used by the power management software and needs to be set before on the power supply. See Figure 70 on page 119.

Figure 70: DC High-Capacity Power Supply Input Mode Switch



6. Rotate the metal cover over the input mode switch, and use a screwdriver to tighten the captive screw.
7. Tighten the captive screws on the lower edge of the power supply faceplate.
8. Remove the clear plastic cover protecting the terminal studs on the faceplate.
9. Remove the nut and washer from each of the terminal studs.
10. Secure each power cable lug to the terminal studs, first with the flat washer, then with the split washer, and then with the nut (see Figure 71 on page 121). Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut. Do not overtighten the nut. (Use a 7/16-in. [11 mm] torque-controlled driver or socket wrench.)
    a. Secure 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 nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when improperly threaded may result in damage to the terminal stud.

CAUTION: The maximum torque rating of the terminal studs on the DC power supply is 36 lb-in. (4.0 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC power supply terminal studs.

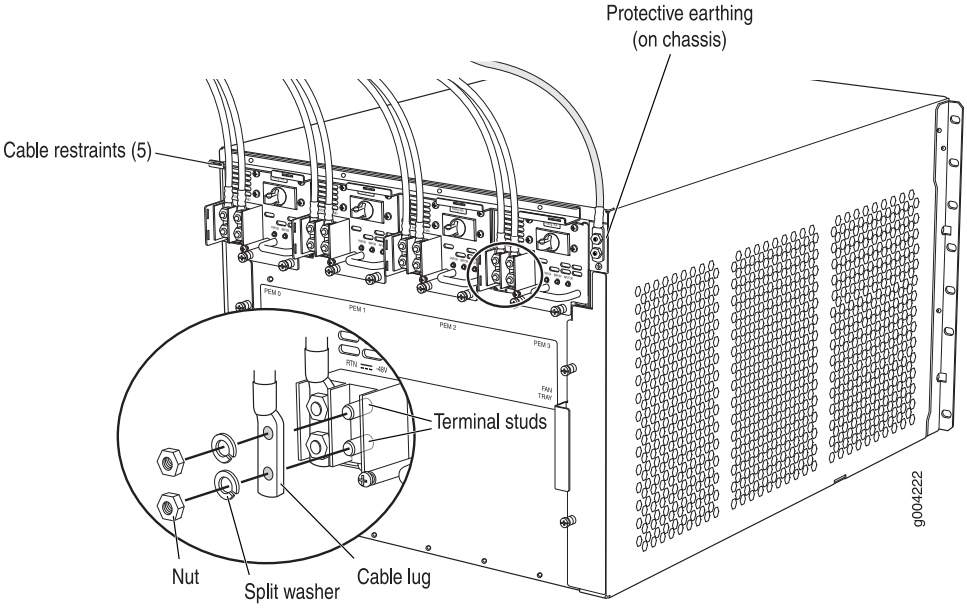
NOTE: The DC power supplies in **PEM0** and **PEM1** must be powered by dedicated power feeds derived from feed **A**, and the DC power supplies in **PEM2** and **PEM3** must be powered by dedicated power feeds derived from feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system.

11. Replace the clear plastic cover over the terminal studs on the faceplate.
12. Route the power cables along the cable restraint toward the left or right corner of the chassis. If needed to hold the power cables in place, thread plastic cable ties, which you must provide, through the openings on the cable restraint.
13. 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.
14. Switch on the dedicated customer site circuit breakers. Follow your site's procedures for safety and ESD.

    Verify that the **INPUT OK** LED on the power supply is lit green.
15. On each of the DC power supplies, turn the power switch to the on (—) position.

    Observe the status LEDs on the power supply faceplate. If the power supply is correctly installed and functioning normally, the **PWR OK**, **BRKR ON**, and **INPUT OK** LEDs light green steadily.

Figure 71: Connecting DC Power to the Router



Powering On a DC-Powered MX480 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. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Verify that the power supplies are fully inserted in the chassis.
5. Verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminal (labeled **RETURN**) and the negative (–) source cable to the input terminal (labeled **–48V**).
6. Switch on the dedicated customer site circuit breakers to provide power to the DC power cables.
7. Check the **INPUT OK** LED is lit steadily green to verify that power is present.
8. 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.
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.

If any of the status LEDs indicates that the power supply is not functioning normally, repeat the installation and cabling procedures described in "Replacing an MX480 DC Power Supply" on page 233.

10. Verify that the **BREAKER ON** LED is lit green steadily.
11. Verify that the **PWR OK** LED is lit green steadily, indicating the power supply is correctly installed and functioning normally.

    If the power supply is not functioning normally, repeat the installation and cabling procedures described in "Replacing an MX480 DC Power Supply" on page 233.

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.

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

Related Documentation

- Connecting the MX480 Router to Management and Alarm Devices on page 105
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

Powering Off the MX480 Router

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 both-routing-engines** operational mode command. The command shuts down the Routing Engines cleanly, so their state information is preserved. (If the router contains only one Routing Engine, issue the **request system halt** command.)

   ```
   user@host> request system halt both-routing-engines
   ```

2. Wait until a message appears on the console confirming that the operating system has halted. 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. Move 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

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

CHAPTER 11

Configuring Junos OS

Initially Configuring the MX480 Router

The MX480 router is shipped with the Junos OS preinstalled and ready to be configured when the MX480 router is powered on. There are three copies of the software: one on a CompactFlash card in the Routing Engine, one on a rotating hard disk in the Routing Engine, and one on a USB flash drive that can be inserted into the slot in the Routing Engine faceplate.

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 Routing Engine or the attempt otherwise fails, the router next tries the CompactFlash card (if installed), and finally the hard disk.

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

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>
```

NOTE: To reinstall the Junos OS, you boot the router from the removable media. Do not insert the removable media during normal operations. The router does not operate normally when it is booted from the removable media.

When the router boots from the storage media (removable media, CompactFlash card, or hard disk) it expands its search in the **/config** directory of the routing platform for the following files in the following order: **juniper.conf** (the main configuration file), **rescue.conf** (the rescue configuration file), and **juniper.conf.1** (the first rollback configuration file). When the search finds the first configuration file that can be loaded properly, the file loads and the search ends. If none of the file can be loaded properly, the routing platform does not function properly. If the router boots from an alternate boot device, the Junos OS displays a message indication this when you log in to the router.

Related Documentation

- Powering On an AC-Powered MX480 Router on page 115
- Powering On a DC-Powered MX480 Router on page 121

PART 3

Hardware Maintenance, Troubleshooting, and Replacement Procedures

CHAPTER 12

Maintaining MX480 Router Hardware Components

This chapter describes how to maintain hardware components installed in the router. Some components, such as the craft interface, require no maintenance.

For information about returning a part to Juniper Networks for repair or replacement, see "Contacting Customer Support and Returning MX480 Hardware" on page 315.

Tools and Parts Required to Maintain the MX480 Router

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

- ESD grounding wrist strap
- Flat-blade (–) screwdriver
- Phillips (+) screwdriver, number 1
- Phillips (+) screwdriver, number 2

Related Documentation

- Routine Maintenance Procedures for the MX480 Router on page 131

Routine Maintenance Procedures for the MX480 Router

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 craft interface—System alarms and LEDs.

- Inspect the air filter at the left rear of the router, replacing it every 6 months for optimum cooling system performance. Do not run the router for more than a few minutes without the air filter in place.

Related Documentation
- Maintaining the MX480 Air Filter on page 132

Maintaining the MX480 Cooling System Components

Maintaining the MX480 Air Filter

Purpose For optimum cooling, verify the condition of the air filters.

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
- Replacing the MX480 Air Filter on page 171
- Routine Maintenance Procedures for the MX480 Router on page 131

Maintaining the MX480 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 host subsystem adjusts the speed of the remaining fans to maintain proper cooling. A red alarm is triggered when a fan fails, and a yellow alarm and red alarm is 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         40 degrees C / 104 degrees F

        PEM 1                         OK         40 degrees C / 104 degrees F

        PEM 2                         Absent
        PEM 3                         Absent
        Routing Engine 0              OK         36 degrees C / 96 degrees F
        Routing Engine 0 CPU          OK         32 degrees C / 89 degrees F
        Routing Engine 1              OK         35 degrees C / 95 degrees F
        Routing Engine 1 CPU          OK         32 degrees C / 89 degrees F
        CB 0 Intake                   OK         33 degrees C / 91 degrees F
        CB 0 Exhaust A                OK         32 degrees C / 89 degrees F
        CB 0 Exhaust B                OK         36 degrees C / 96 degrees F
        CB 0 ACBC                     OK         35 degrees C / 95 degrees F
        CB 0 SF A                     OK         49 degrees C / 120 degrees F

        CB 0 SF B                     OK         43 degrees C / 109 degrees F

        CB 1 Intake                   OK         33 degrees C / 91 degrees F
        CB 1 Exhaust A                OK         30 degrees C / 86 degrees F
        CB 1 Exhaust B                OK         37 degrees C / 98 degrees F
        CB 1 ACBC                     OK         34 degrees C / 93 degrees F
        CB 1 SF A                     OK         46 degrees C / 114 degrees F

        CB 1 SF B                     OK         43 degrees C / 109 degrees F

        FPC 1 Intake                  OK         37 degrees C / 98 degrees F
        FPC 1 Exhaust A               OK         32 degrees C / 89 degrees F
        FPC 1 Exhaust B               OK         35 degrees C / 95 degrees F
        FPC 1 QX 0 TSen               OK         50 degrees C / 122 degrees F

        FPC 1 QX 0 Chip               OK         58 degrees C / 136 degrees F

        FPC 1 LU 0 TCAM TSen          OK         50 degrees C / 122 degrees F

        FPC 1 LU 0 TCAM Chip          OK         43 degrees C / 109 degrees F

        FPC 1 LU 0 TSen               OK         50 degrees C / 122 degrees F

        FPC 1 LU 0 Chip               OK         51 degrees C / 123 degrees F

        FPC 1 MQ 0 TSen               OK         50 degrees C / 122 degrees F

        FPC 1 MQ 0 Chip               OK         53 degrees C / 127 degrees F

        FPC 1 QX 1 TSen               OK         48 degrees C / 118 degrees F

        FPC 1 QX 1 Chip               OK         51 degrees C / 123 degrees F

        FPC 1 LU 1 TCAM TSen          OK         48 degrees C / 118 degrees F

        FPC 1 LU 1 TCAM Chip          OK         47 degrees C / 116 degrees F

        FPC 1 LU 1 TSen               OK         48 degrees C / 118 degrees F

        FPC 1 LU 1 Chip               OK         53 degrees C / 127 degrees F

        FPC 1 MQ 1 TSen               OK         48 degrees C / 118 degrees F

        FPC 1 MQ 1 Chip               OK         54 degrees C / 129 degrees F
```

```
FPC 2 Intake                    OK          34 degrees C / 93 degrees F
FPC 2 Exhaust A                 OK          38 degrees C / 100 degrees F

FPC 2 Exhaust B                 OK          34 degrees C / 93 degrees F
FPC 2 QX 0 TSen                 OK          47 degrees C / 116 degrees F

FPC 2 QX 0 Chip                 OK          51 degrees C / 123 degrees F

FPC 2 LU 0 TCAM TSen            OK          47 degrees C / 116 degrees F

FPC 2 LU 0 TCAM Chip            OK          47 degrees C / 116 degrees F

FPC 2 LU 0 TSen                 OK          47 degrees C / 116 degrees F

FPC 2 LU 0 Chip                 OK          51 degrees C / 123 degrees F

FPC 2 MQ 0 TSen                 OK          47 degrees C / 116 degrees F

FPC 2 MQ 0 Chip                 OK          51 degrees C / 123 degrees F

FPC 3 Intake                    OK          30 degrees C / 86 degrees F
FPC 3 Exhaust A                 OK          39 degrees C / 102 degrees F

FPC 3 Exhaust B                 OK          47 degrees C / 116 degrees F

FPC 3 I3 0 TSensor              OK          46 degrees C / 114 degrees F

FPC 3 I3 0 Chip                 OK          51 degrees C / 123 degrees F

FPC 3 I3 1 TSensor              OK          43 degrees C / 109 degrees F

FPC 3 I3 1 Chip                 OK          46 degrees C / 114 degrees F

FPC 3 I3 2 TSensor              OK          42 degrees C / 107 degrees F

FPC 3 I3 2 Chip                 OK          45 degrees C / 113 degrees F

FPC 3 I3 3 TSensor              OK          40 degrees C / 104 degrees F

FPC 3 I3 3 Chip                 OK          41 degrees C / 105 degrees F

FPC 3 IA 0 TSensor              OK          41 degrees C / 105 degrees F

FPC 3 IA 0 Chip                 OK          40 degrees C / 104 degrees F

FPC 3 IA 1 TSensor              OK          41 degrees C / 105 degrees F

FPC 3 IA 1 Chip                 OK          43 degrees C / 109 degrees F

FPC 4 Intake                    OK          31 degrees C / 87 degrees F
FPC 4 Exhaust A                 OK          38 degrees C / 100 degrees F

FPC 4 Exhaust B                 OK          47 degrees C / 116 degrees F

FPC 4 I3 0 TSensor              OK          49 degrees C / 120 degrees F

FPC 4 I3 0 Chip                 OK          53 degrees C / 127 degrees F

FPC 4 I3 1 TSensor              OK          48 degrees C / 118 degrees F
```

```
                FPC 4 I3 1 Chip                 OK          50 degrees C / 122 degrees F
                FPC 4 I3 2 TSensor              OK          48 degrees C / 118 degrees F
                FPC 4 I3 2 Chip                 OK          51 degrees C / 123 degrees F
                FPC 4 I3 3 TSensor              OK          44 degrees C / 111 degrees F
                FPC 4 I3 3 Chip                 OK          45 degrees C / 113 degrees F
                FPC 4 IA 0 TSensor              OK          48 degrees C / 118 degrees F
                FPC 4 IA 0 Chip                 OK          42 degrees C / 107 degrees F
                FPC 4 IA 1 TSensor              OK          47 degrees C / 116 degrees F
                FPC 4 IA 1 Chip                 OK          47 degrees C / 116 degrees F
                FPC 5 Intake                    OK          37 degrees C / 98 degrees F
                FPC 5 Exhaust A                 OK          45 degrees C / 113 degrees F
                FPC 5 Exhaust B                 OK          31 degrees C / 87 degrees F
                FPC 5 QX 0 TSen                 OK          54 degrees C / 129 degrees F
                FPC 5 QX 0 Chip                 OK          59 degrees C / 138 degrees F
                FPC 5 LU 0 TCAM TSen            OK          54 degrees C / 129 degrees F
                FPC 5 LU 0 TCAM Chip            OK          59 degrees C / 138 degrees F
                FPC 5 LU 0 TSen                 OK          54 degrees C / 129 degrees F
                FPC 5 LU 0 Chip                 OK          62 degrees C / 143 degrees F
                FPC 5 MQ 0 TSen                 OK          54 degrees C / 129 degrees F
                FPC 5 MQ 0 Chip                 OK          54 degrees C / 129 degrees F
                FPC 5 QX 1 TSen                 OK          48 degrees C / 118 degrees F
                FPC 5 QX 1 Chip                 OK          52 degrees C / 125 degrees F
                FPC 5 LU 1 TCAM TSen            OK          48 degrees C / 118 degrees F
                FPC 5 LU 1 TCAM Chip            OK          53 degrees C / 127 degrees F
                FPC 5 LU 1 TSen                 OK          48 degrees C / 118 degrees F
                FPC 5 LU 1 Chip                 OK          51 degrees C / 123 degrees F
                FPC 5 MQ 1 TSen                 OK          48 degrees C / 118 degrees F
                FPC 5 MQ 1 Chip                 OK          52 degrees C / 125 degrees F
Fans            Top Rear Fan                    OK          Spinning at intermediate-speed
                Bottom Rear Fan                 OK          Spinning at intermediate-speed
                Top Middle Fan                  OK          Spinning at intermediate-speed
                Bottom Middle Fan               OK          Spinning at intermediate-speed
```

```
Top Front Fan                 OK          Spinning at intermediate-speed

Bottom Front Fan              OK          Spinning at intermediate-speed
```

Related Documentation

- Routine Maintenance Procedures for the MX480 Router on page 131
- Installing the MX480 Fan Tray on page 177

Maintaining the MX480 Host Subsystem

Purpose For optimum router performance, verify the condition of the host subsystem. The host subsystem comprises an SCB and a Routing Engine installed directly into an SCB.

Action On a regular basis:

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

```
user@host> show chassis routing-engine
Routing Engine status:
  Slot 0:
    Current state                  Master
    Election priority              Master (default)
    Temperature                 45 degrees C / 113 degrees F
    CPU temperature             43 degrees C / 109 degrees F
    DRAM                      2048 MB
    Memory utilization          15 percent
    CPU utilization:
      User                       0 percent
      Background                 0 percent
      Kernel                     8 percent
      Interrupt                  0 percent
      Idle                      92 percent
    Model                          RE-S-1300
    Serial ID                      1000694968
    Start time                     2007-07-10 12:27:39 PDT
    Uptime                         1 hour, 40 minutes, 37 seconds
    Load averages:                 1 minute   5 minute  15 minute
                                       0.11       0.06       0.01
Routing Engine status:
  Slot 1:
    Current state                  Backup
    Election priority              Backup (default)
    Temperature                 46 degrees C / 114 degrees F
    CPU temperature             42 degrees C / 107 degrees F
    DRAM                      2048 MB
    Memory utilization          13 percent
    CPU utilization:
      User                       0 percent
      Background                 0 percent
```

```
    Kernel                    0 percent
    Interrupt                 0 percent
    Idle                    100 percent
  Model                       RE-S-1300
  Serial ID                   1000694976
  Start time                  2007-06-19 14:17:00 PDT
  Uptime                      20 days, 23 hours, 51 minutes, 4 seconds
```

- To check the status of the SCBs, issue the **show chassis environment cb** command. The output is similar to the following:

```
user@host> show chassis environment cb
CB 0 status:
  State                     Online Master
  Temperature               40 degrees C / 104 degrees F
  Power 1
    1.2 V                    1208 mV
    1.5 V                    1521 mV
    1.8 V                    1807 mV
    2.5 V                    2507 mV
    3.3 V                    3319 mV
    5.0 V                    5033 mV
    12.0 V                  12142 mV
    1.25 V                   1243 mV
    3.3 V SM3                3312 mV
    5 V RE                   5059 mV
    12 V RE                 11968 mV
  Power 2
    11.3 V bias PEM         11253 mV
    4.6 V bias MidPlane      4814 mV
    11.3 V bias FPD         11234 mV
    11.3 V bias POE 0       11176 mV
    11.3 V bias POE 1       11292 mV
  Bus Revision              42
  FPGA Revision             1
CB 1 status:
  State                     Online Standby
  Temperature               40 degrees C / 104 degrees F
  Power 1
    1.2 V                    1202 mV
    1.5 V                    1514 mV
    1.8 V                    1807 mV
    2.5 V                    2500 mV
    3.3 V                    3293 mV
    5.0 V                    5053 mV
    12.0 V                  12200 mV
    1.25 V                   1260 mV
    3.3 V SM3                3319 mV
    5 V RE                   5059 mV
    12 V RE                 12007 mV
  Power 2
    11.3 V bias PEM         11311 mV
    4.6 V bias MidPlane      4827 mV
    11.3 V bias FPD         11330 mV
    11.3 V bias POE 0       11292 mV
    11.3 V bias POE 1       11311 mV
  Bus Revision              42
  FPGA Revision             1
```

To check the status of a specific SCB, issue the **show chassis environment cb** command and include the slot number of the SCB. The output is similar to the following:

```
user@host> show chassis environment cb 0
CB 0 status:
  State                       Online
  Temperature Intake          66 degrees C / 150 degrees F
  Temperature Exhaust A       67 degrees C / 152 degrees F
  Temperature Exhaust B       73 degrees C / 163 degrees F
  Power
    1.2 V                      1153 mV
    1.5 V                      1417 mV
    1.8 V                      1704 mV
    2.5 V                      2375 mV
    3.3 V                      3138 mV
    5.0 V                      4763 mV
    1.2 V Rocket IO            1160 mV
    1.5 V Rocket IO            1408 mV
    1.8 V RLDRAM               1717 mV
  I2C Slave Revision          15
```

For more information about using the CLI, see the Junos OS manuals.

Related Documentation

- MX480 Craft Interface Description on page 44
- MX480 Routing Engine Description on page 40

Maintaining MX480 Packet Forwarding Engine Components

Maintaining MX480 DPCs

Purpose The router can have up to six Dense Port Concentrators (DPCs) mounted horizontally in the DPC card cage at the front of the chassis. For optimum router performance, verify the condition of the DPCs.

Action On a regular basis:

- Check the LEDs on the craft interface directly above each DPC slot. The green LED labeled **OK** lights steadily when a DPC is functioning normally.
- Check the **OK/FAIL** LED on the DPC. For more information, see *MX Series Interface Module Reference* . If the DPC detects a failure, the DPC sends an alarm message to the Routing Engine.
- Check the status of installed DPCs by issuing the CLI **show chassis fpc** command to check the status of installed DPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the DPC is functioning normally:

```
user@host> show chassis fpc
                    Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State            (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online            41      9          0       1024       15         57
  1  Online            43      5          0       1024       16         57
  2  Online            43     11          0       1024       16         57
  3  Empty
  4  Empty
  5  Online            42      6          0       1024       16         57
```

For more detailed output, add the **detail** option. The following example does not specify a slot number, which is optional:

```
user@host> show chassis fpc detail
Slot 0 information:
  State                               Online
  Temperature                      41 degrees C / 105 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2007-07-10 12:28:33 PDT
  Uptime:                             1 hour, 33 minutes, 52 seconds
  Max Power Consumption           368 Watts
Slot 1 information:
  State                               Online
  Temperature                      43 degrees C / 109 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2007-07-10 12:28:38 PDT
  Uptime:                             1 hour, 33 minutes, 47 seconds
  Max Power Consumption           249 Watts
Slot 2 information:
  State                               Online
  Temperature                      43 degrees C / 109 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2007-07-10 12:28:40 PDT
  Uptime:                             1 hour, 33 minutes, 45 seconds
  Max Power Consumption           335 Watts
Slot 5 information:
  State                               Online
  Temperature                      42 degrees C / 107 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
```

```
  Start time:                              2007-07-10 12:28:42 PDT
  Uptime:                                  1 hour, 33 minutes, 43 seconds
  Max Power Consumption                 333 Watts
```

- Issue the CLI **show chassis fpc pic-status** command. The DPC slots are numbered **0** through **5**, bottom to top:

```
user@host> show chassis fpc pic-status
Slot 0   Online       DPCE 4x 10GE R
  PIC 0  Online       1x 10GE(LAN/WAN)
  PIC 1  Online       1x 10GE(LAN/WAN)
  PIC 2  Online       1x 10GE(LAN/WAN)
  PIC 3  Online       1x 10GE(LAN/WAN)
Slot 1   Online       DPCE 40x 1GE R
  PIC 0  Online       10x 1GE(LAN)
  PIC 1  Online       10x 1GE(LAN)
  PIC 2  Online       10x 1GE(LAN)
  PIC 3  Online       10x 1GE(LAN)
Slot 2   Online       DPCE 40x 1GE R
  PIC 0  Online       10x 1GE(LAN)
  PIC 1  Online       10x 1GE(LAN)
  PIC 2  Online       10x 1GE(LAN)
  PIC 3  Online       10x 1GE(LAN)
Slot 5   Online       DPC 4x 10GE R
  PIC 0  Online       1x 10GE(LAN/WAN)
  PIC 1  Online       1x 10GE(LAN/WAN)
  PIC 2  Online       1x 10GE(LAN/WAN)
  PIC 3  Online       1x 10GE(LAN/WAN)
```

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

Related Documentation

- MX480 Chassis Description on page 9
- DPC and MPC LEDs on the MX480 Craft Interface on page 47

Maintaining MX480 FPCs

Purpose The MX480 router can have up to three Flexible PIC Concentrators (FPCs) installed horizontally in the front of the chassis. For optimum router performance, verify the condition of the FPC.

Action On a regular basis:

- Check the LEDs on the craft interface directly above the FPC. The green LED labeled **OK** lights steadily when an FPC is functioning normally.
- Check the **OK/FAIL** LED on the FPC. If the FPC detects a failure, the FPC sends an alarm message to the Routing Engine.
- Issue the CLI **show chassis fpc** command to check the status of the installed FPC. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the FPC is functioning normally:

```
user@host> show chassis fpc
                    Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State          (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online         24       3          0       1024       13         21
```

```
  1  Empty
  2  Online   41      9          0       1024       15         57
  3  Online   43      5          0       1024       16         57
  4  Online   24      3          0       1024       13         21
  5  Empty
```

For more detailed output, add the **detail** option. The following example does not specify a slot number, which is optional:

```
user@host> show chassis fpc detail
Slot 0 information:
  State                               Online
  Temperature                      24 degrees C / 75 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    128 MB
  Total DDR DRAM                 2048 MB
  Start time:                         2008-12-11 16:53:24 PST
  Uptime:                             15 hours, 2 minutes, 47 seconds
  Max Power Consumption           368 Watts
Slot 2 information:
  State                               Online
  Temperature                      29 degrees C / 84 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2008-12-11 16:53:18 PST
  Uptime:                             15 hours, 2 minutes, 53 seconds
  Max Power Consumption           294 Watts
Slot 3 information:
  State                               Online
  Temperature                      29 degrees C / 84 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2008-12-11 16:53:18 PST
  Uptime:                             15 hours, 2 minutes, 53 seconds
  Max Power Consumption           335 Watts
Slot 4 information:
  State                               Online
  Temperature                      29 degrees C / 84 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2008-12-11 16:53:18 PST
  Uptime:                             15 hours, 2 minutes, 53 seconds
  Max Power Consumption           333 Watts
```

- Issue the CLI **show chassis fpc pic-status** command. The following example shows an FPC installed in DPC slots **0**, and **1**:

```
user@host> show chassis fpc pic-status
Slot 0   Online       MX FPC Type 3
  PIC 0  Online       1x OC-192 SONET
  PIC 1  Online       1x OC-192 SONET
Slot 2   Online       DPC 40x 1GE R
  PIC 0  Online       10x 1GE(LAN)
  PIC 1  Online       10x 1GE(LAN)
  PIC 2  Online       10x 1GE(LAN)
  PIC 3  Online       10x 1GE(LAN)
Slot 3   Online       MPC Type 2 3D EQ
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
```

```
Slot 4   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
```

NOTE: An FPC takes up two DPC slots when installed on an MX Series router. The slot number corresponds to the lowest numbered DPC slot.

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

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) LEDs on page 26
- Replacing an MX480 FPC on page 206
- Holding an MX480 FPC on page 151
- Storing an MX480 FPC on page 154
- Troubleshooting the MX480 FPCs on page 162

Maintaining MX480 PICs

Purpose For optimum router performance, verify the condition of the PICs.

Action On a regular basis:

- Check the LEDs on PIC faceplates. The meaning of the LED states differs for various PICs. For more information, see the *MX Series Interface Module Reference*. If the FPC that houses the PIC detects a PIC failure, the FPC generates an alarm message to be sent to the Routing Engine.
- Issue the CLI **show chassis fpc pic-status** command. The PIC slots in an FPC are numbered from **0** through **1**, left to right:

```
user@host> show chassis fpc pic-status
Slot 0   Online       DPC 40x 1GE R
  PIC 0  Online       10x 1GE(LAN)
  PIC 1  Online       10x 1GE(LAN)
  PIC 2  Online       10x 1GE(LAN)
  PIC 3  Online       10x 1GE(LAN)
Slot 1   Online       MX FPC Type 3
  PIC 0  Online       1x OC-192 SONET
  PIC 1  Online       1x OC-192 SONET
Slot 2   Online       MS-DPC
  PIC 0  Online       MS-DPC PIC
  PIC 1  Online       MS-DPC PIC
Slot 3   Online       MPC Type 2 3D EQ
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
Slot 4   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
```

```
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
```

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

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) Description on page 24
- Replacing an MX480 PIC on page 211
- Troubleshooting the MX480 PICs on page 163
- MX480 PIC Serial Number Label on page 321

Maintaining MX480 MPCs

Purpose The router can have up to six MPCs mounted horizontally in the card cage at the front of the chassis. For optimum router performance, verify the condition of the MPCs.

Action On a regular basis:

- Check the LEDs on the craft interface directly above each MPC slot. The green LED labeled **OK** lights steadily when an MPC is functioning normally.
- Check the **OK/FAIL** LED on the MPC. If the MPC detects a failure, the MPC sends an alarm message to the Routing Engine.
- Issue the CLI **show chassis fpc** command to check the status of installed MPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the MPC is functioning normally:

```
user@host> show chassis fpc
                    Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State          (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online         36       3          0       2048       14         13
  1  Online         40       5          0       2048       26         13
  2  Online         41       6          0       1024        7         43
  3  Online         43       5          0       1024       16         57
  4  Online         24       3          0       1024       13         21
  5  Empty
```

For more detailed output, add the **detail** option. The following example does not specify a slot number, which is optional:

```
user@host> show chassis fpc detail
Slot 0 information:
  State                                 Online
  Temperature                        33 degrees C / 91 degrees F
  Total CPU DRAM                   1024 MB
  Total RLDRAM                      256 MB
  Total DDR DRAM                   4096 MB
  Start time:                           2009-12-22 12:26:54 PST
  Uptime:                               6 days, 3 hours, 8 minutes, 51 seconds

  Max Power Consumption             330 Watts
Slot 1 information:
  State                                 Online
  Temperature                        32 degrees C / 89 degrees F
  Total CPU DRAM                   1024 MB
```

```
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2009-12-22 12:26:54 PST
  Uptime:                             6 days, 3 hours, 8 minutes, 51 seconds

  Max Power Consumption           365 Watts
Slot 2 information:
  State                               Online
  Temperature                      41 degrees C / 105 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    128 MB
  Total DDR DRAM                 2048 MB
  Start time:                         2009-12-22 12:26:46 PST
  Uptime:                             6 days, 3 hours, 8 minutes, 59 seconds

  Max Power Consumption           265 Watts
Slot 3 information:
  State                               Online
  Temperature                      36 degrees C / 96 degrees F
  Total CPU DRAM                 2048 MB
  Total RLDRAM                    806 MB
  Total DDR DRAM                 2632 MB
  Start time:                         2009-12-22 12:27:04 PST
  Uptime:                             6 days, 3 hours, 8 minutes, 41 seconds

  Max Power Consumption           450 Watts
Slot 4 information:
  State                               Online
  Temperature                      40 degrees C / 104 degrees F
  Total CPU DRAM                 2048 MB
  Total RLDRAM                   1324 MB
  Total DDR DRAM                 5120 MB
  Start time:                         2009-12-22 12:27:02 PST
  Uptime:                             6 days, 3 hours, 8 minutes, 43 seconds

  Max Power Consumption           440 Watts
```

- Issue the CLI **show chassis fpc pic-status** command. The MPC slots are numbered **0** through **5**, bottom to top:

```
user@host> show chassis fpc pic-status
Slot 0   Online       DPCE 4x 10GE R EQ
  PIC 0  Online       1x 10GE(LAN/WAN) EQ
  PIC 1  Online       1x 10GE(LAN/WAN) EQ
  PIC 2  Online       1x 10GE(LAN/WAN) EQ
  PIC 3  Online       1x 10GE(LAN/WAN) EQ
Slot 1   Online       DPCE 40x 1GE R EQ
  PIC 0  Online       10x 1GE(LAN) EQ
  PIC 1  Online       10x 1GE(LAN) EQ
  PIC 2  Online       10x 1GE(LAN) EQ
  PIC 3  Online       10x 1GE(LAN) EQ
Slot 2   Online       MS-DPC
  PIC 0  Online       MS-DPC PIC
  PIC 1  Online       MS-DPC PIC
Slot 3   Online       MPC Type 2 3D EQ
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
Slot 4   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
```

```
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
```

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

Related Documentation

- MX480 Modular Port Concentrator (MPC) Description on page 18
- MX480 Modular Port Concentrator (MPC) LEDs on page 20
- Troubleshooting the MX480 MPCs on page 164
- Replacing an MX480 MPC on page 215

Maintaining MX480 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 MPC that houses the MIC detects a MIC failure, the MPC generates an alarm message to be sent to the Routing Engine.
- Issue the CLI **show chassis fpc pic-status** command. The MIC slots in an MPC are numbered **PIC 0/1** and **PIC 2/3**, left to right:

```
user@host> show chassis fpc pic-status
Slot 0   Online       DPCE 4x 10GE R EQ
  PIC 0  Online       1x 10GE(LAN/WAN) EQ
  PIC 1  Online       1x 10GE(LAN/WAN) EQ
  PIC 2  Online       1x 10GE(LAN/WAN) EQ
  PIC 3  Online       1x 10GE(LAN/WAN) EQ
Slot 1   Online       DPCE 40x 1GE R EQ
  PIC 0  Online       10x 1GE(LAN) EQ
  PIC 1  Online       10x 1GE(LAN) EQ
  PIC 2  Online       10x 1GE(LAN) EQ
  PIC 3  Online       10x 1GE(LAN) EQ
Slot 2   Online       MS-DPC
  PIC 0  Online       MS-DPC PIC
  PIC 1  Online       MS-DPC PIC
Slot 3   Online       MPC Type 2 3D EQ
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
Slot 4   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
```

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

Related Documentation

- MX480 Modular Interface Card (MIC) Description on page 20
- MX480 Modular Interface Card (MIC) LEDs on page 21
- Troubleshooting the MX480 MICs on page 166

- Replacing an MX480 MIC on page 220

Maintaining Cables That Connect to MX480 DPCs, MPCs, MICs, or PICs

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

Action On a regular basis:

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

- Maintaining MX480 DPCs on page 138
- Maintaining MX480 MPCs on page 143
- Maintaining MX480 MICs on page 145
- Maintaining MX480 PICs on page 142

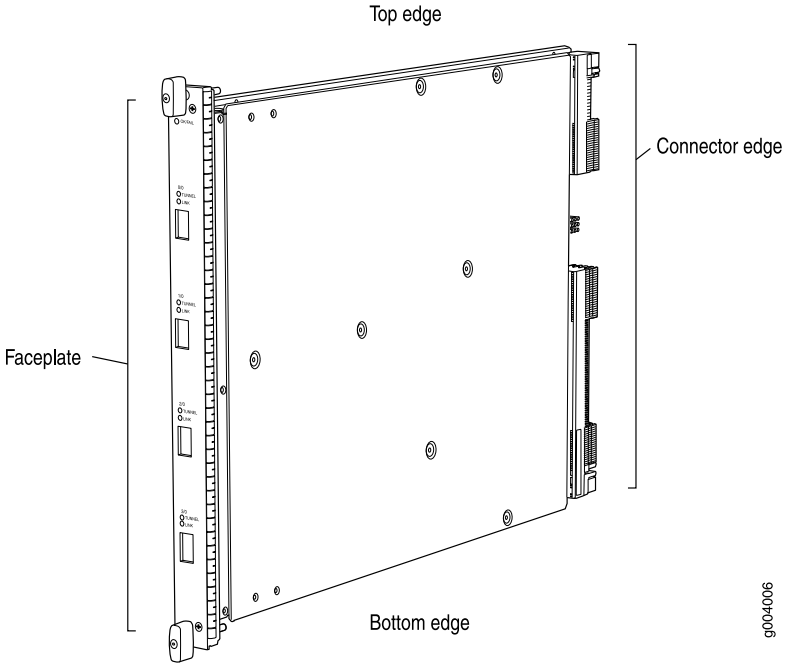
Holding and Storing MX Series DPCs

MX480 DPC Terminology

Regardless of whether you are holding a DPC vertically or horizontally, this information uses the same terms for all four edges of the DPC (see Figure 72 on page 147):

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

Figure 72: DPC Edges



Related Documentation

- Holding an MX480 DPC on page 148
- Installing a Cable on an MX480 DPC, MPC, MIC, or PIC on page 227
- Maintaining MX480 DPCs on page 138

Holding an MX480 DPC

When carrying a DPC, you can hold it either vertically or horizontally.

NOTE: **A DPC weighs 14.5 lb (6.6 kg). Be prepared to accept the full weight of the DPC as you lift it.**

To hold a DPC vertically:

1. Orient the DPC so that the faceplate faces you. To verify orientation, confirm that the text on the DPC is right-side up and the electromagnetic interference (EMI) strip is on the right-hand side.
2. Place one hand around the DPC faceplate about a quarter of the way down from the top edge. To avoid deforming the EMI shielding strip, do not press hard on it.
3. Place your other hand at the bottom edge of the DPC.

If the DPC is horizontal before you grasp it, place your left hand around the faceplate and your right hand along the bottom edge.

To hold a DPC horizontally:

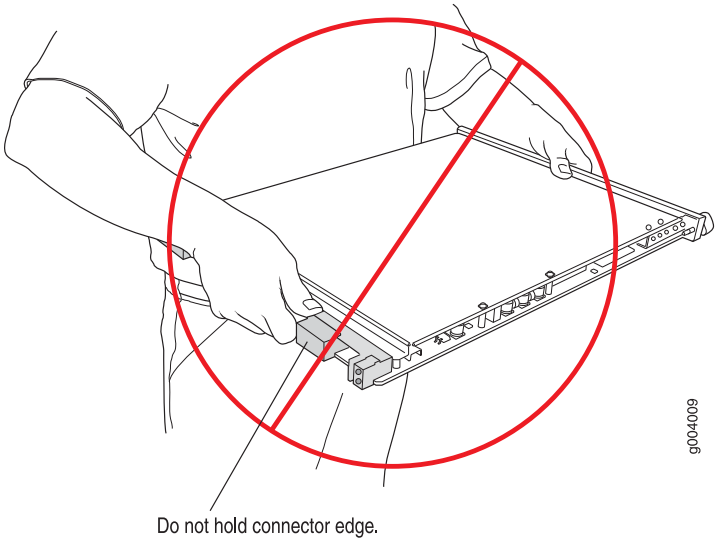
1. Orient the DPC so that the faceplate faces you.
2. Grasp the top edge with your left hand and the bottom edge with your right hand.

You can rest the faceplate of the DPC against your body as you carry it.

As you carry the DPC, do not bump it against anything. DPC components are fragile.

Never hold or grasp the DPC anywhere except places that this document indicates. In particular, never grasp the connector edge, especially at the power connector in the corner where the connector and bottom edges meet.

Figure 73: Do Not Grasp the Connector Edge

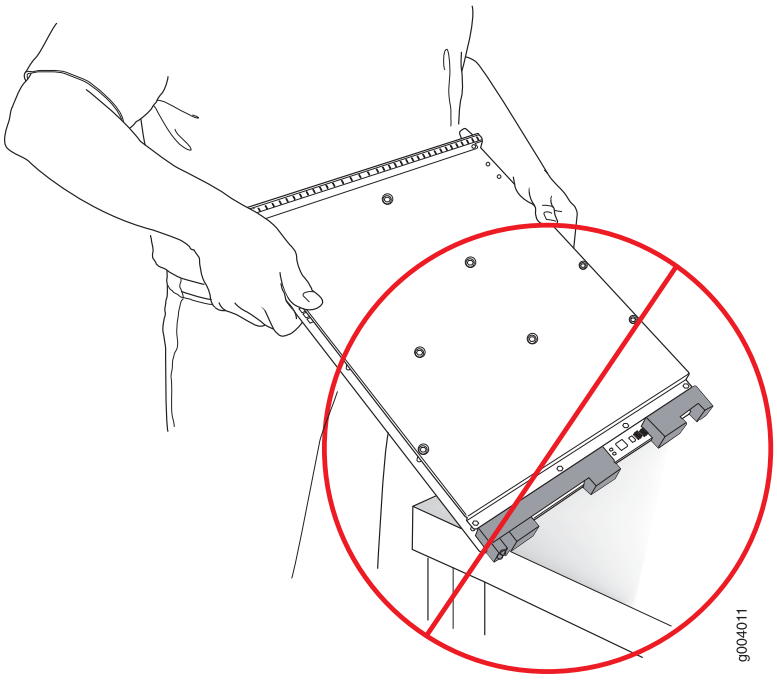


Never carry the DPC by the faceplate with only one hand.

Do not rest any edge of a DPC directly against a hard surface (see Figure 74 on page 149).

Do not stack DPCs.

Figure 74: Do Not Rest the DPC on an Edge



If you must rest the DPC temporarily on an edge while changing its orientation between vertical and horizontal, use your hand as a cushion between the edge and the surface.

Related Documentation
- MX480 DPC Terminology on page 147
- Storing an MX480 DPC on page 150

Storing an MX480 DPC

You must store a DPC as follows:

- In the router
- In the container in which a spare DPC is shipped
- Horizontally and sheet metal side down

When you store a DPC on a horizontal surface or in the shipping container, always place it inside an antistatic bag. Because the DPC is heavy, and because antistatic bags are fragile, inserting the DPC into the bag is easier with two people. To do this, one person holds the DPC in the horizontal position with the faceplate facing the body, and the other person slides the opening of the bag over the DPC connector edge.

If you must insert the DPC into a bag by yourself, first lay the DPC horizontally on a flat, stable surface, sheet metal side down. Orient the DPC with the faceplate facing you. Carefully insert the DPC connector edge into the opening of the bag, and pull the bag toward you to cover the DPC.

Never stack a DPC under or on top of any other component.

Related Documentation
- MX480 DPC Terminology on page 147
- Holding an MX480 DPC on page 148

Holding and Storing MX Series FPCs

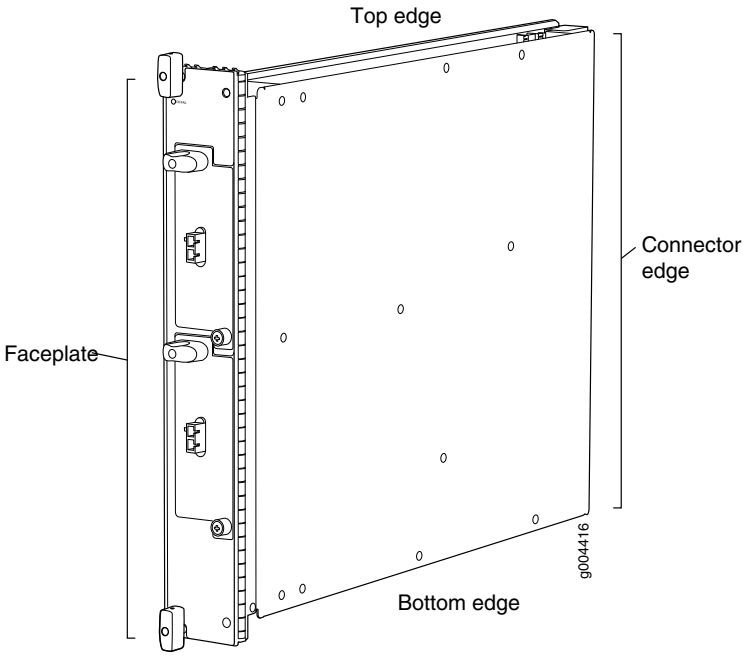
- MX480 FPC Terminology on page 150
- Holding an MX480 FPC on page 151
- Storing an MX480 FPC on page 154

MX480 FPC Terminology

Regardless of whether you are holding an FPC vertically or horizontally, this document uses the same terms for all four edges of the FPC (see Figure 75 on page 151):

- Faceplate—Edge of the FPC that has slots into which you insert the PICs
- Connector edge—Edge opposite the faceplate; this edge has the connectors that attach to the midplane
- Top edge—Edge at the top of the FPC when it is vertical
- Bottom edge—Edge at the bottom of the FPC when it is vertical

Figure 75: FPC Edges



Related Documentation

- MX480 Flexible PIC Concentrator (FPC) Description on page 24
- Holding an MX480 FPC on page 151
- Storing an MX480 FPC on page 154

Holding an MX480 FPC

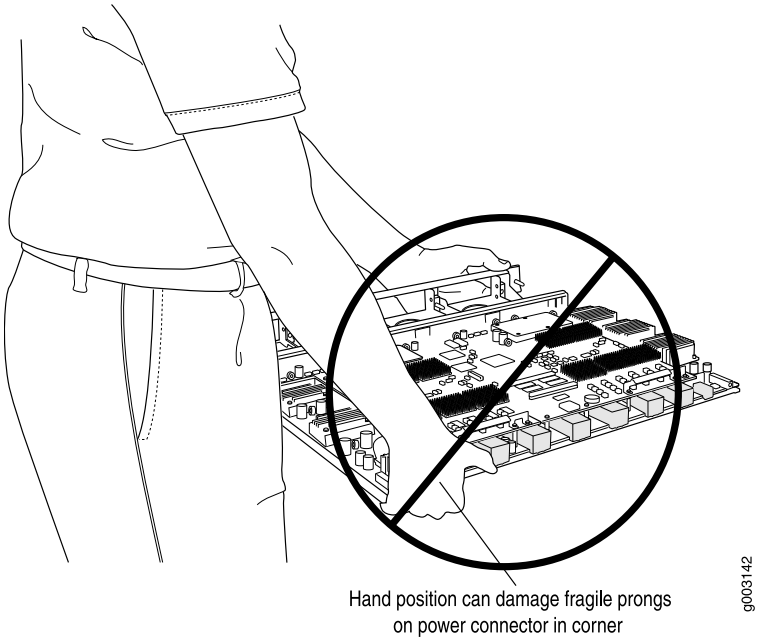
CAUTION: Many components on the FPC are fragile. Failure to handle FPCs as specified in this document can cause irreparable damage.

NOTE: An FPC configured with PICs installed can weigh as much as 18 lb (8.2 kg). Be prepared to accept the full weight of the FPC as you lift it.

CAUTION: To prevent damage when handling or carrying FPCs:

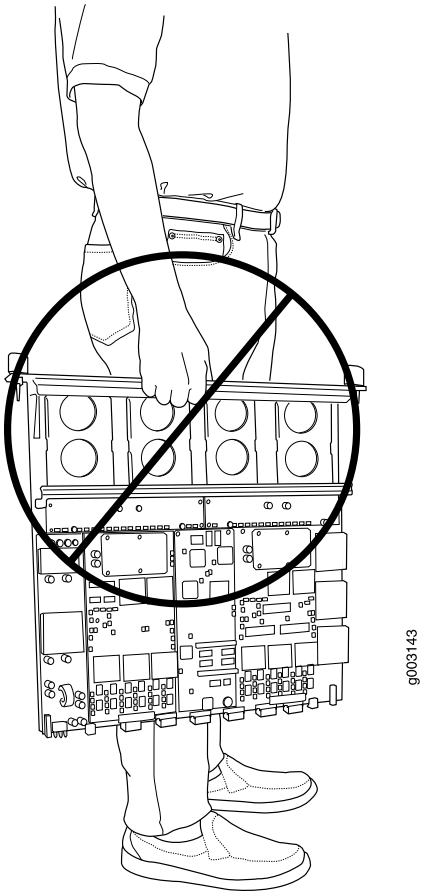
- As you carry the FPC, do not bump it against anything. FPC components are fragile.
- Do not grasp the FPC anywhere except places that this document indicates. In particular, never grasp the connector edge, especially at the power connector in the corner where the connector and bottom edges meet (see Figure 76 on page 152).

Figure 76: Do Not Grasp the Connector Edge



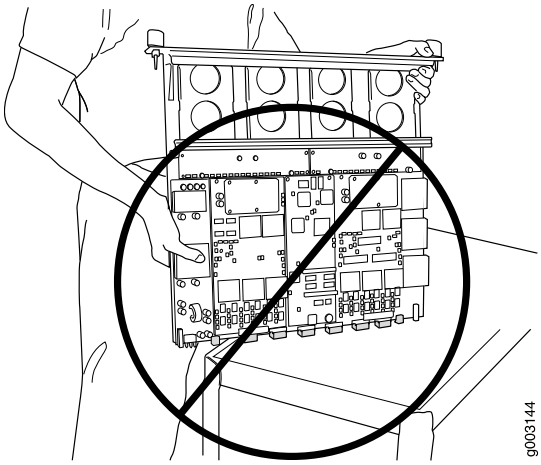
- Do not carry the FPC by the faceplate with only one hand (see Figure 77 on page 153).

Figure 77: Do Not Carry an FPC with Only One Hand



- Do not rest any edge of an FPC directly against a hard surface (see Figure 78 on page 154). If you must rest the FPC temporarily on an edge while changing its orientation between vertical and horizontal, use your hand as a cushion between the edge and the surface.

Figure 78: Do Not Rest the FPC on an Edge



You hold an FPC horizontally when installing it into the chassis or an equipment rack.

If the FPC is horizontal before you grasp it, place your left hand around the faceplate and your right hand along the bottom edge.

To hold an FPC horizontally:

1. Orient the FPC so that the faceplate faces you.
2. Grasp the top edge with your left hand and the bottom edge with your right hand.

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) Description on page 24
- MX480 FPC Terminology on page 150
- Storing an MX480 FPC on page 154

Storing an MX480 FPC

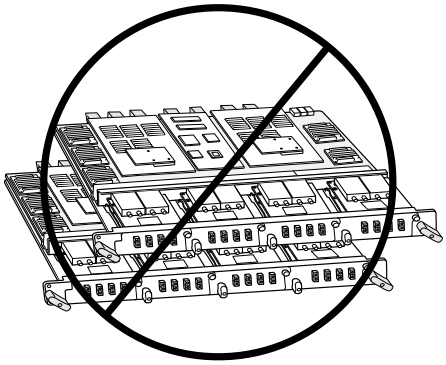
When not installed in the routing platforms, FPCs must be either stored in the container in which a spare FPC is shipped or stored horizontally with the component-side up on a flat, stable surface. When you store an FPC on a horizontal surface or in the shipping container, always place it inside an antistatic bag. Because the FPC is heavy and because antistatic bags are fragile, inserting the FPC into the bag is easier with two people. The storage guidelines are as follows:

- When storing an FPC with two people, one person holds the FPC in the horizontal position with the faceplate facing their body, the other person slides the opening of the bag over the FPC connector edge.
- When storing an FPC with one person, you must insert the FPC into a bag by yourself. First lay the FPC horizontally on a flat, stable surface, component-side up. Orient the FPC with the faceplate facing you. Carefully insert the FPC connector edge into the opening of the bag, and pull the bag toward you to cover the FPC.

CAUTION: To prevent damage when storing FPCs:

- Never lay an FPC component-side down.

Figure 79: Do Not Stack FPCs



- Never stack an FPC under or on top of any other component (see Figure 79 on page 155).

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) Description on page 24
- MX480 FPC Terminology on page 150
- Holding an MX480 FPC on page 151

Maintaining the MX480 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
  AC Input:                   OK
  DC Output          Voltage(V) Current(A)  Power(W)  Load(%)
                         59        0             0        0
PEM 1 status:
  State                       Online
  Temperature                 OK
  AC Input:                   OK
  DC Output          Voltage(V) Current(A)  Power(W)  Load(%)
                         59        18            1062     42
```

- 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 craft interface to determine if the power supplies are functioning normally.
- Check the red and yellow alarm LEDs on the craft interface. 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 following command:

  ```
  user@host> show chassis alarms
  ```
- Periodically inspect the site to ensure that the grounding and power cables connected to the router are securely in place and that there is no moisture accumulating near the router.

Related Documentation

- Power Supply LEDs on the MX480 Craft Interface on page 47
- MX480 AC Power Supply Description on page 50
- MX480 DC Power Supply Description on page 52
- Troubleshooting Resources for MX480 Routers on page 157
- MX480 Site Preparation Checklist on page 61

CHAPTER 13

Troubleshooting MX480 Hardware Components

Troubleshooting Resources for MX480 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 Routing Engine.

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 craft interface 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.

Alarm Relay Contacts

The craft interface has two alarm relay contacts for connecting the router to external alarm devices. Whenever a system condition triggers either the red or yellow alarm on the craft interface, the alarm relay contacts are also activated. The alarm relay contacts are located on the upper right of the craft interface.

Craft Interface LEDs

The craft interface is the panel on the front of the router located above the DPC cards that contains LEDs and buttons that allow you to troubleshoot the router.

LEDs on the craft interface include the following:

- Alarm LEDs—One large red circular LED and one large yellow triangular LED, located on the upper right of the craft interface, indicate two levels of alarm conditions. The circular red LED lights to indicate a critical condition that can result in a system shutdown. The triangular yellow LED lights to indicate a less severe condition that requires monitoring or maintenance. Both LEDs can be lit simultaneously. A condition that causes an alarm LED to light also activates the corresponding alarm relay contact on the craft interface.
- Host subsystem LEDs—Three LEDs, **MASTER**, **ONLINE**, and **OFFLINE**, indicate the status of the host subsystem. A green **MASTER** LED indicates that the host is functioning as the master. The **ONLINE** LED indicates that the host is online. The **OFFLINE** LED indicates that the host is installed but the routing engine is offline. The host subsystem LEDs are located on the left of the craft interface and are labeled **RE0** and **RE1**.
- Power supply LEDs—Two LEDs (**PEM**) indicate the status of each power supply. Green indicates that the power supply is functioning normally. Red indicates that the power supply is not functioning normally. The power supply LEDs are located in the center craft interface, and are labeled **0** through **3**.
- Line card LEDs—Two LEDs, **OK** and **FAIL**, indicate the status of each DPC, FPC, or MPC. Green indicates OK and red indicates a failure. The LEDs are located along the bottom of the craft interface.

- SCB LEDs—Two LEDs, **OK** and **FAIL**, indicate the status of each SCB. Green indicates OK and red indicates a failure. The SCB LEDs are located on the left of the craft interface along the bottom.
- Fan LEDs—Two LEDs indicate the status of the fans. Green indicates the fans are functioning normally and red indicates a fan has failed. The fan LEDs are located on the upper left of the craft interface.

Component LEDs

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

- DPC LED—One LED labeled **OK/FAIL** on each DPC faceplate indicates the DPC's status. For more information, see the *MX Series Interface Module Reference*.
- FPC LED—One LED labeled **OK/FAIL** on each FPC faceplate indicates the FPC's status.
- MPC LED—One LED labeled **OK/FAIL** on each FPC faceplate indicates the FPC's status.
- MIC LED—One LED labeled **OK/FAIL** on each MIC faceplate indicates the MIC's status. For more information, see the *MX Series Interface Module Reference*.
- PIC LED—One LED labeled **OK/FAIL** on each PIC faceplate indicates the PIC's status. For more information, see the *MX Series Interface Module Reference*.
- SCB LEDs—Three LEDs, labeled **FABRIC ACTIVE**, **FABRIC ONLY**, and **OK/FAIL**, on each SCB faceplate indicate the status of the SCB. If no LEDs are lit, the master RE might still be booting or the SCB is not receiving power.
- Routing Engine LEDs—Four LEDs, labeled **MASTER**, **HDD**, **ONLINE**, and **FAIL** on each Routing Engine faceplate indicate the status of the Routing Engine and hard disk drive.
- Power supply LEDs—Two LEDs on each power supply faceplate indicate the status of that power supply.

Juniper Networks Technical Assistance Center

If you need assistance during troubleshooting, you can contact the Juniper Networks Technical Assistance Center (JTAC) by using the Web or by telephone.

Related Documentation

- Troubleshooting the MX480 Cooling System on page 160
- Troubleshooting the MX480 DPCs on page 160
- Troubleshooting the MX480 FPCs on page 162
- Troubleshooting the MX480 PICs on page 163
- Troubleshooting the MX480 MPCs on page 164
- Troubleshooting the MX480 MICs on page 166
- Troubleshooting the MX480 Power System on page 167

Troubleshooting the MX480 Cooling System

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

Solution Follow these guidelines to troubleshoot the fans:

- Check the fan LEDs and alarm LEDs on the craft interface.
- If the red alarm LED on the craft interface lights, use the CLI to get information about the source of an alarm condition: **user@host> show chassis alarms**.

  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).

Related Documentation

- Alarm LEDs and Alarm Cutoff/Lamp Test Button on the MX480 Craft Interface on page 45
- Replacing the MX480 Fan Tray on page 176
- Maintaining the MX480 Air Filter on page 132
- Maintaining the MX480 Fan Tray on page 132

Troubleshooting the MX480 DPCs

Problem The DPCs are not functioning normally.

Solution

- Monitor the green LED labeled **OK** above the DPC on the craft interface as soon as a DPC is seated in an operating router.

  The Routing Engine downloads the DPC software to it under two conditions: the DPC is present when the Routing Engine boots Junos OS, and the DPC is installed and requested online through the CLI or push button on the front panel. The DPC then runs diagnostics, during which the **OK** LED blinks. When the DPC is online and functioning normally, the **OK** LED lights green steadily.
- Make sure the DPC is properly seated in the midplane. Check that each ejector handle has been turned clockwise and is tight.

- Check the **OK/FAIL** LED on the DPC and **OK** and **FAIL** DPC LEDs on the craft interface. When the DPC is online and functioning normally, the **OK** LED lights green steadily.
- Issue the **show chassis fpc** command to check the status of installed DPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the DPC is functioning normally:

```
user@host> show chassis fpc
                    Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State            (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online            41      9          0       1024       15         57
  1  Online            43      5          0       1024       16         57
  2  Online            43     11          0       1024       16         57
  3  Empty
  4  Empty
  5  Online            42      6          0       1024       16         57
```

NOTE: The show chassis fpc command displays the status of the DPCs.

For more detailed output, add the **detail** option. The following example does not specify a slot number, which is optional:

```
user@host> show chassis fpc detail
Slot 0 information:
  State                               Online
  Temperature                      41 degrees C / 105 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2007-07-10 12:28:33 PDT
  Uptime:                             1 hour, 33 minutes, 52 seconds
  Max Power Consumption           368 Watts
Slot 1 information:
  State                               Online
  Temperature                      43 degrees C / 109 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2007-07-10 12:28:38 PDT
  Uptime:                             1 hour, 33 minutes, 47 seconds
  Max Power Consumption           249 Watts
Slot 2 information:
  State                               Online
  Temperature                      43 degrees C / 109 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2007-07-10 12:28:40 PDT
  Uptime:                             1 hour, 33 minutes, 45 seconds
  Max Power Consumption           335 Watts
Slot 5 information:
  State                               Online
  Temperature                      42 degrees C / 107 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2007-07-10 12:28:42 PDT
```

```
  Uptime:                                 1 hour, 33 minutes, 43 seconds
  Max Power Consumption                333 Watts
```

For further description of the output from the commands, see the *Junos OS Administration Library for Routing Devices*.

Related Documentation

- Installing an MX480 DPC on page 204
- MX480 DPC Terminology on page 147
- Maintaining MX480 DPCs on page 138

Troubleshooting the MX480 FPCs

Problem The FPCs are not functioning normally.

Solution

- Monitor the green LED labeled **OK** above the FPC on the craft interface as soon as an FPC is seated in an operating router.

  The Routing Engine downloads the FPC software to it under two conditions: the FPC is present when the Routing Engine boots Junos OS, and the FPC is installed and requested online through the CLI or push button on the front panel. The FPC then runs diagnostics, during which the **OK** LED blinks. When the FPC is online and functioning normally, the **OK** LED lights green steadily.

- Make sure the FPC is properly seated in the midplane. Check that each ejector handle has been turned clockwise and is tight.
- Check the **OK/FAIL** LED on the FPC and **OK** and **FAIL** FPC LEDs on the craft interface. When the FPC is online and functioning normally, the **OK** LED lights green steadily.
- Issue the **show chassis fpc** command to check the status of installed FPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the FPC is functioning normally:

```
user@host> show chassis fpc
                    Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State          (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online         24       3          0       1024       13         21
  1  Empty
  2  Online         41       9          0       1024       15         57
  3  Online         43       5          0       1024       16         57
  4  Online         24       3          0       1024       13         21
  5  Empty
```

NOTE: **The show chassis fpc command displays the status of the FPCs.**

For more detailed output, add the **detail** option. The following example does not specify a slot number, which is optional:

```
user@host> show chassis fpc detail
Slot 0 information:
  State                                 Online
```

```
  Temperature                      24 degrees C / 75 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    128 MB
  Total DDR DRAM                 2048 MB
  Start time:                         2008-12-11 16:53:24 PST
  Uptime:                             15 hours, 2 minutes, 47 seconds
  Max Power Consumption           368 Watts
Slot 2 information:
  State                               Online
  Temperature                      29 degrees C / 84 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2008-12-11 16:53:18 PST
  Uptime:                             15 hours, 2 minutes, 53 seconds
  Max Power Consumption           294 Watts
Slot 3 information:
  State                               Online
  Temperature                      29 degrees C / 84 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2008-12-11 16:53:18 PST
  Uptime:                             15 hours, 2 minutes, 53 seconds
  Max Power Consumption           335 Watts
Slot 4 information:
  State                               Online
  Temperature                      29 degrees C / 84 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2008-12-11 16:53:18 PST
  Uptime:                             15 hours, 2 minutes, 53 seconds
  Max Power Consumption           333 Watts
```

For further description of the output from the commands, see the *Junos OS Administration Library for Routing Devices*.

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) LEDs on page 26
- Replacing an MX480 FPC on page 206
- Holding an MX480 FPC on page 151
- Storing an MX480 FPC on page 154
- Maintaining MX480 FPCs on page 140

Troubleshooting the MX480 PICs

Problem The PICs are not functioning normally.

Solution

- Check the status of each port on a PIC by looking at the LED located on the PIC faceplate. For information about the meaning of LED states on different PICs, see the *MX Series Interface Module Reference*.
- Check the status of a PIC by issuing the **show chassis fpc pic-status** CLI command. The PIC slots in the FPC are numbered from **0** through **1**, left to right:

```
user@host> show chassis fpc pic-status
Slot 0   Online       DPC 40x 1GE R
  PIC 0  Online       10x 1GE(LAN)
  PIC 1  Online       10x 1GE(LAN)
  PIC 2  Online       10x 1GE(LAN)
  PIC 3  Online       10x 1GE(LAN)
Slot 1   Online       MX FPC Type 3
  PIC 0  Online       1x OC-192 SONET
  PIC 1  Online       1x OC-192 SONET
Slot 2   Online       MS-DPC
  PIC 0  Online       MS-DPC PIC
  PIC 1  Online       MS-DPC PIC
Slot 3   Online       MPC Type 2 3D EQ
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
Slot 4   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
```

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

Related Documentation

- MX480 Flexible PIC Concentrator (FPC) Description on page 24
- Replacing an MX480 PIC on page 211
- Maintaining MX480 PICs on page 142
- MX480 PIC Serial Number Label on page 321

Troubleshooting the MX480 MPCs

Problem The MPCs are not functioning normally.

Solution

- Monitor the green LED labeled **OK** above the MPC on the craft interface as soon as an MPC is seated in an operating router.

  The Routing Engine downloads the MPC software to it under two conditions: The MPC is present when the Routing Engine boots Junos OS, and the MPC is installed and requested online through the CLI or push button on the front panel. The MPC then runs diagnostics, during which the **OK** LED blinks. When the MPC is online and functioning normally, the **OK** LED lights green steadily.

- Make sure the MPC is properly seated in the midplane. Check that each ejector handle has been turned clockwise and is tight.
- Check the **OK/FAIL** LED on the MPC and **OK** and **FAIL** line card LEDs on the craft interface. When the MPC is online and functioning normally, the **OK** LED lights green steadily.
- Issue the **show chassis fpc** command to check the status of installed MPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the MPC is functioning normally:

  ```
  user@host> show chassis fpc
  ```

```
                Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State       (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online       36      3          0       2048       14         13
  1  Online       40      5          0       2048       26         13
  2  Online       41      6          0       1024        7         43
  3  Online       43      5          0       1024       16         57
  4  Online       24      3          0       1024       13         21
  5  Empty
```

NOTE: The show chassis fpc command displays the status of the MPCs.

For more detailed output, add the **detail** option. The following example does not specify a slot number, which is optional:

```
user@host> show chassis fpc detail
Slot 0 information:
  State                               Online
  Temperature                      33 degrees C / 91 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2009-12-22 12:26:54 PST
  Uptime:                             6 days, 3 hours, 8 minutes, 51 seconds

  Max Power Consumption           330 Watts
Slot 1 information:
  State                               Online
  Temperature                      32 degrees C / 89 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    256 MB
  Total DDR DRAM                 4096 MB
  Start time:                         2009-12-22 12:26:54 PST
  Uptime:                             6 days, 3 hours, 8 minutes, 51 seconds

  Max Power Consumption           365 Watts
Slot 2 information:
  State                               Online
  Temperature                      41 degrees C / 105 degrees F
  Total CPU DRAM                 1024 MB
  Total RLDRAM                    128 MB
  Total DDR DRAM                 2048 MB
  Start time:                         2009-12-22 12:26:46 PST
  Uptime:                             6 days, 3 hours, 8 minutes, 59 seconds

  Max Power Consumption           265 Watts
Slot 3 information:
  State                               Online
  Temperature                      36 degrees C / 96 degrees F
  Total CPU DRAM                 2048 MB
  Total RLDRAM                    806 MB
  Total DDR DRAM                 2632 MB
  Start time:                         2009-12-22 12:27:04 PST
  Uptime:                             6 days, 3 hours, 8 minutes, 41 seconds

  Max Power Consumption           450 Watts
Slot 4 information:
  State                               Online
  Temperature                      40 degrees C / 104 degrees F
```

```
Total CPU DRAM                  2048 MB
Total RLDRAM                    1324 MB
Total DDR DRAM                  5120 MB
Start time:                          2009-12-22 12:27:02 PST
Uptime:                              6 days, 3 hours, 8 minutes, 43 seconds

Max Power Consumption            440 Watts
```

For further description of the output from the commands, see the *Junos OS Administration Library for Routing Devices*.

Related Documentation

- MX480 Modular Port Concentrator (MPC) Description on page 18
- Maintaining MX480 MPCs on page 143
- Replacing an MX480 MPC on page 215

Troubleshooting the MX480 MICs

Problem 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 MPC are labeled **PIC 0/1** and **PIC 2/3**, left to right:

```
user@host> show chassis fpc pic-status
Slot 0   Online       DPCE 4x 10GE R EQ
  PIC 0  Online       1x 10GE(LAN/WAN) EQ
  PIC 1  Online       1x 10GE(LAN/WAN) EQ
  PIC 2  Online       1x 10GE(LAN/WAN) EQ
  PIC 3  Online       1x 10GE(LAN/WAN) EQ
Slot 1   Online       DPCE 40x 1GE R EQ
  PIC 0  Online       10x 1GE(LAN) EQ
  PIC 1  Online       10x 1GE(LAN) EQ
  PIC 2  Online       10x 1GE(LAN) EQ
  PIC 3  Online       10x 1GE(LAN) EQ
Slot 2   Online       MS-DPC
  PIC 0  Online       MS-DPC PIC
  PIC 1  Online       MS-DPC PIC
Slot 3   Online       MPC Type 2 3D EQ
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
Slot 4   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
```

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

Related Documentation

- MX480 Modular Interface Card (MIC) Description on page 20
- Maintaining MX480 MICs on page 145

- Replacing an MX480 MIC on page 220

Troubleshooting the MX480 Power System

Problem The power system is not functioning normally.

Solution

- Check the LEDs on each power supply faceplate.
  - If an AC power supply is correctly installed and functioning normally, the **AC OK** and **DC OK** LEDs light steadily, and the **PS FAIL** LED is not lit.
  - If a DC power supply is correctly installed and functioning normally, the **PWR OK**, **BRKR ON**, and **INPUT OK** LEDs light 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
  AC Input:                   OK
  DC Output           Voltage(V) Current(A)  Power(W)  Load(%)
                          59        0             0        0
PEM 1 status:
  State                       Online
  Temperature                 OK
  AC Input:                   OK
  DC Output           Voltage(V) Current(A)  Power(W)  Load(%)
                          59        18            1062     42
```

If a power supply is not functioning normally, perform the following steps to diagnose and correct the problem:

- 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 DC circuit breaker (—) or AC input switch (|) is in the on position and that the power supply 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 LEDs indicate 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

- MX480 AC Power Supply Description on page 50
- MX480 DC Power Supply Description on page 52
- Replacing an MX480 AC Power Supply on page 231
- Troubleshooting Resources for MX480 Routers on page 157

CHAPTER 14

Replacing MX480 Hardware Components

MX480 Field-Replaceable Units (FRUs)

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

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

Table 24 on page 170 lists the FRUs for the MX480 router. Before you replace an SCB or a Routing Engine, you must take the host subsystem offline.

Table 24: Field-Replaceable Units

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs
• Air filter • Craft interface • Backup Switch Control Board (SCB) (if redundant) • Master Switch Control Board (SCB) (if nonstop active routing is configured) • Backup Routing Engine (if redundant) • Master Routing Engine (if nonstop active routing is configured) • Dense Port Concentrators (DPCs) • Flexible PIC Concentrators (FPCs) • Modular Port Concentrators (MPCs) • Modular Interface Cards (MICs) • PICs • AC and DC power supplies (if redundant) • Fan tray	• Master Switch Control Board (SCB) (if nonstop active routing is not configured) • Master Routing Engine (if nonstop active routing is not configured) • Switch Control Board (SCB) (nonredundant) • Routing Engine (nonredundant) • Solid-state drives (SSDs) of Routing Engines

Related Documentation

- MX480 Component Redundancy on page 6
- Tools and Parts Required to Replace MX480 Hardware Components on page 170

Tools and Parts Required to Replace MX480 Hardware Components

To replace hardware components, you need the tools and parts listed in Table 25 on page 170.

Table 25: Tools and Parts Required

Tool or Part	Components
2.5-mm flat-blade (–) screwdriver	• Alarm relay terminal block
7/16-in. (11 mm) nut driver or socket wrench	• DC power supply • Cables and connectors
Blank panels (if component is not reinstalled)	• DPC • FPC • PIC • MPC • MIC • Power supply • Routing Engine • SCB

Table 25: Tools and Parts Required *(continued)*

Tool or Part	Components
Electrostatic bag or antistatic mat	• Craft Interface • DPC • FPC • PIC • MPC • MIC • Routing Engine • SCB
Electrostatic discharge (ESD) grounding wrist strap	• All
Flat-blade (–) screwdriver	• DPC • Cables and connectors
Phillips (+) screwdrivers, numbers 1 and 2	• Air filter • Craft interface • Fan tray • SCB • Routing Engine • Cables and connectors
Rubber safety cap	• DPC • MPC • MIC • PIC
Wire cutters	• Cables and connectors • DC power supply

Related Documentation

- MX480 Component Redundancy on page 6
- MX480 Field-Replaceable Units (FRUs) on page 169

Replacing the MX480 Air Filter

1. Removing the MX480 Air Filter on page 171
2. Installing the MX480 Air Filter on page 172

Removing the MX480 Air Filter

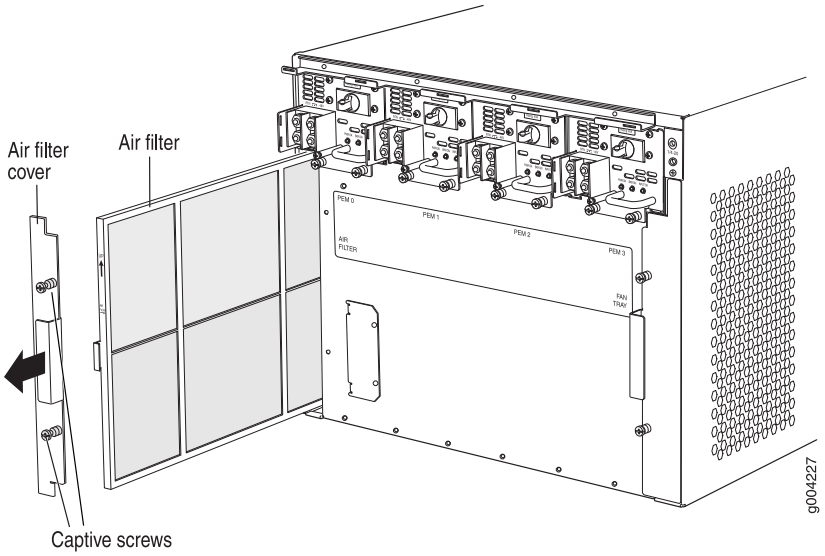
CAUTION: Do not run the router for more than a few minutes without the air filter in place.

CAUTION: Always keep the air filter in place while the router is operating, except during replacement. Because the fans are very powerful, they could pull small bits of wire or other materials into the router through the unfiltered air intake. This could damage the router components.

To remove the air filter (see Figure 80 on page 172):

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 screws on the air filter cover.
3. Remove the air filter cover.
4. Slide the air filter out of the chassis.

Figure 80: Removing the Air Filter

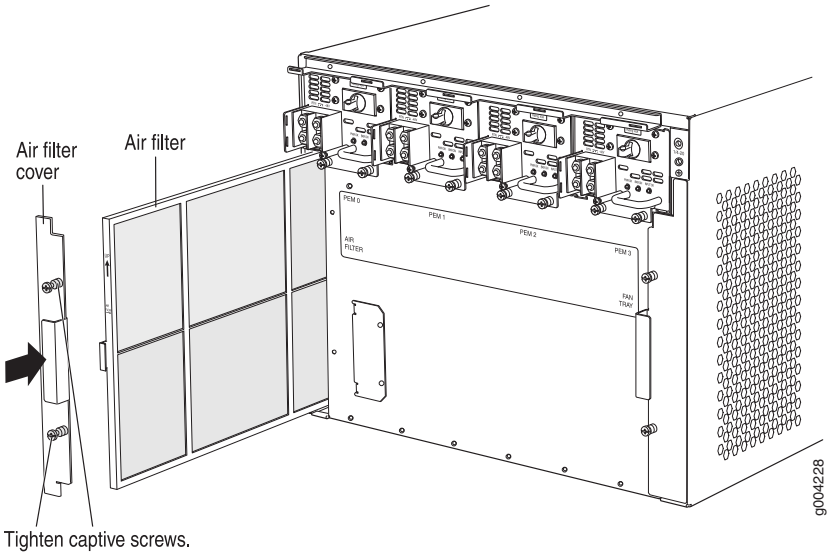


Installing the MX480 Air Filter

To install the air filter (see Figure 81 on page 173):

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 up arrow and ensure that the air filter is right side up.
3. Slide the air filter straight into the chassis until it stops.
4. Align the captive screws of the air filter cover with the mounting holes on the chassis.
5. Tighten the captive screws on the air filter cover.

Figure 81: Installing the Air Filter



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Maintaining the MX480 Air Filter on page 132
- MX480 Cooling System Description on page 55
- Troubleshooting the MX480 Cooling System on page 160

Replacing the MX480 Craft Interface

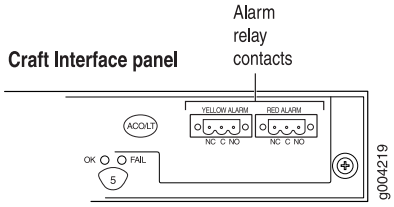
1. Disconnecting the Alarm Relay Wires from the MX480 Craft Interface on page 173
2. Removing the MX480 Craft Interface on page 174
3. Installing the MX480 Craft Interface on page 174
4. Connecting the Alarm Relay Wires to the MX480 Craft Interface on page 175

Disconnecting the Alarm Relay Wires from the MX480 Craft Interface

To disconnect the alarm relay wires from the router and an alarm-reporting device (see Figure 82 on page 174):

1. Disconnect the existing wire at the external device.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Using a 2.5-mm flat-blade screwdriver, loosen the small screws on the face of the terminal block and remove the block from the relay contact.
4. Using the 2.5-mm flat-blade screwdriver, loosen the small screws on the side of the terminal block. Remove existing wires from the slots in the front of the block.

Figure 82: Alarm Relay Contacts

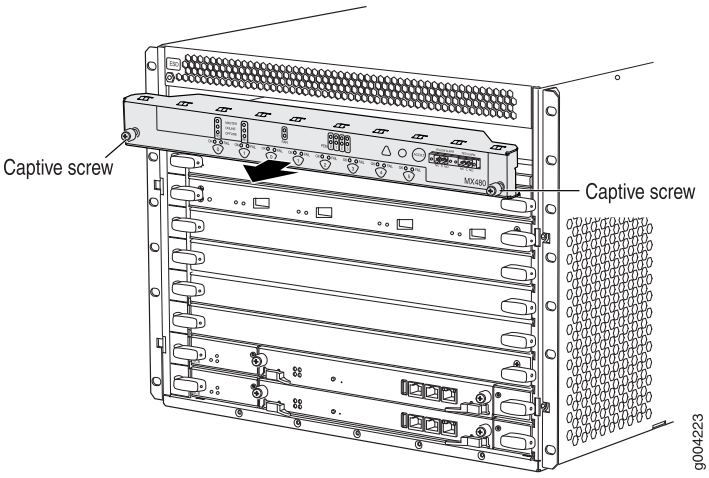


Removing the MX480 Craft Interface

To remove the craft interface (see Figure 83 on page 174):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Detach any external devices connected to the craft interface.
3. Loosen the captive screws at the left and right corners of the craft interface faceplate.
4. Grasp the craft interface faceplate and carefully tilt it toward you until it is horizontal.
5. Disconnect the ribbon cable from the back of the faceplate by gently pressing on both sides of the latch with your thumb and forefinger. Remove the craft interface from the chassis.

Figure 83: Removing the Craft Interface



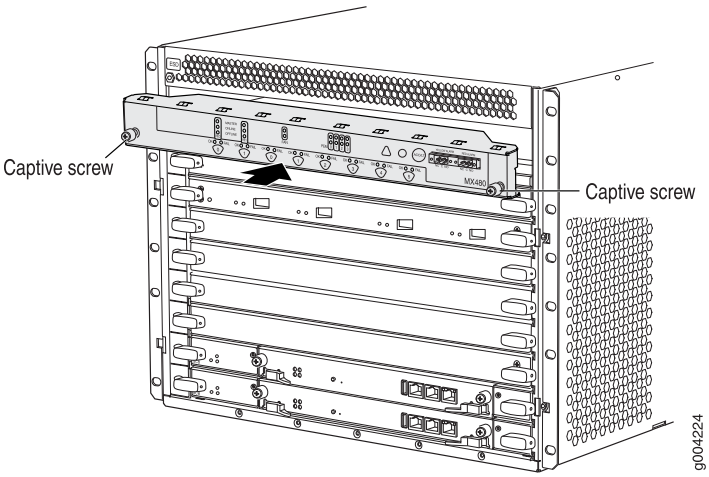
Installing the MX480 Craft Interface

To install the craft interface (see Figure 84 on page 175):

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 craft interface with one hand, and hold the bottom edge of the craft interface with the other hand to support its weight.
3. Orient the ribbon cable so that it plugs into the connector socket. The connector is keyed and can be inserted only one way.

4. Align the bottom of the craft interface with the sheet metal above the card cage and press it into place.
5. Tighten the screws on the left and right corners of the craft interface faceplate.
6. Reattach any external devices connected to the craft interface.

Figure 84: Installing the Craft Interface

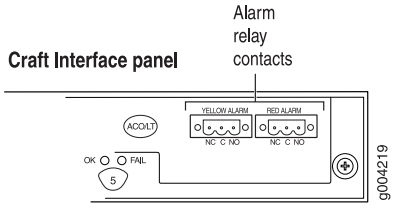


Connecting the Alarm Relay Wires to the MX480 Craft Interface

To connect the alarm relay wires between a router and an alarm-reporting device (see Figure 85 on page 175):

1. Prepare the required length of replacement wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2).
2. Insert the replacement wires into the slots in the front of the block. Use a 2.5-mm flat-blade screwdriver to tighten the screws and secure the wire.
3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Plug the terminal block into the relay contact, and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.
5. Attach the other end of the wires to the external device.

Figure 85: Alarm Relay Contacts



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

- MX480 Craft Interface Description on page 44
- Alarm LEDs and Alarm Cutoff/Lamp Test Button on the MX480 Craft Interface on page 45

Replacing the MX480 Fan Tray

1. Removing the MX480 Fan Tray on page 176
2. Installing the MX480 Fan Tray on page 177

Removing the MX480 Fan Tray

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

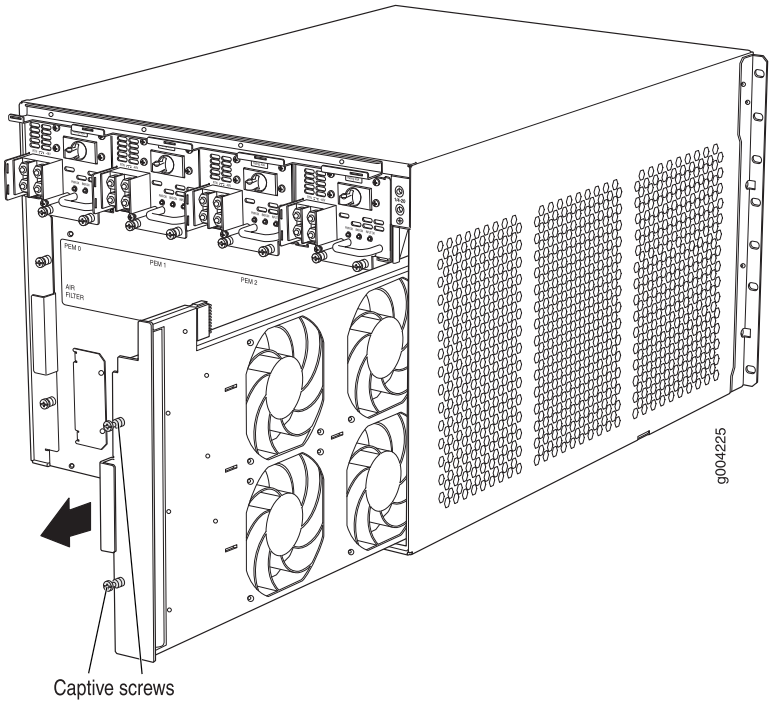
To remove the fan tray (see Figure 86 on page 177):

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 screws 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 86: Removing the Fan Tray

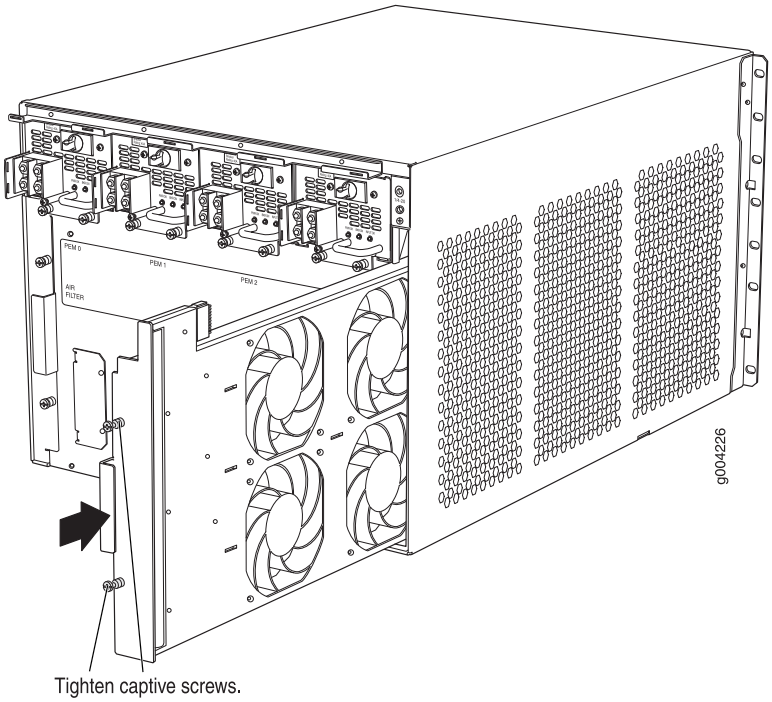


Installing the MX480 Fan Tray

To install the fan tray (see Figure 87 on page 178):

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. Note the correct orientation by the **this side up** label on the top surface of the fan tray.
3. Tighten the captive screws on the fan tray faceplate to secure it in the chassis.

Figure 87: Installing the Fan Tray



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

Replacing MX480 Host Subsystem Components

- Effect of Taking the MX480 Host Subsystem Offline on page 178
- Taking an MX480 Host Subsystem Offline on page 180
- Operating and Positioning the MX480 SCB Ejectors on page 181
- Replacing an MX480 SCB on page 182
- Replacing an MX480 Routing Engine on page 197
- Replacing an SSD Drive on an RE-A-1800 or RE-S-1800 on page 199
- Replacing Connections to MX480 Routing Engine Interface Ports on page 200

Effect of Taking the MX480 Host Subsystem Offline

The host subsystem is taken offline and brought online as a unit. Before you replace an SCB or a Routing Engine, you must take the host subsystem offline. The host subsystem is hot-pluggable.

Normally, if two host subsystems are installed in the router, Routing Engine 0 (**RE0**) functions as the master and Routing Engine 1 (**RE1**) functions as the backup. You can remove the backup host subsystem (or either of its components) without interrupting the functioning of the router. If you take the master host subsystem offline, the backup host subsystem becomes the master (the router might reboot, depending on your configuration). If the router has only one host subsystem, taking the host subsystem

offline causes the router to shut down. The effect of taking the master host subsystem offline varies depending on your configuration of high availability features.

Table 26 on page 179 explains the effect of taking the host subsystem offline.

Table 26: Effect of Taking the Host Subsystem Offline

Type of Host Subsystem	Effect of Taking the Host Subsystem Offline
Nonredundant host subsystem	The router shuts down.
Backup host subsystem	The functioning of the router is not interrupted. The backup host subsystem is hot-removable and hot-insertable.
Master host subsystem	The backup host subsystem becomes the master. The backup Routing Engine assumes Routing Engine functions. The master host subsystem is hot-pluggable. Removal or failure of the master Routing Engine affects forwarding and routing based on the high availability configuration: • Dual Routing Engines without any high availability features enabled—Traffic is interrupted while the Packet Forwarding Engine is reinitialized. All kernel and forwarding processes are restarted. When the switchover to the new master Routing Engine is complete, routing convergence takes place and traffic is resumed. • Graceful Routing Engine switchover (GRES) is enabled—Graceful Routing Engine switchover preserves interface and kernel information. Traffic is not interrupted. However, graceful Routing Engine switchover does not preserve the control plane. Neighboring routers detect that the router has restarted and react to the event in a manner prescribed by individual routing protocol specifications. To preserve routing without interruption during a switchover, graceful Routing Engine switchover must be combined with nonstop active routing. • Nonstop active routing is enabled (graceful Routing Engine switchover must be configured for nonstop active routing to be enabled)—Nonstop active routing supports Routing Engine switchover without alerting peer nodes that a change has occurred. Nonstop active routing uses the same infrastructure as graceful Routing Engine switchover to preserve interface and kernel information. However, nonstop active routing also preserves routing information and protocol sessions by running the routing protocol process (rpd) on both Routing Engines. In addition, nonstop active routing preserves TCP connections maintained in the kernel. • Graceful restart is configured—Graceful restart provides extensions to routing protocols so that neighboring helper routers restore routing information to a restarting router. These extensions signal neighboring routers about the graceful restart and prevent the neighbors from reacting to the router restart and from propagating the change in state to the network during the graceful restart period. Neighbors provide the routing information that enables the restarting router to stop and restart routing protocols without causing network reconvergence. Neighbors are required to support graceful restart. The routing protocol process (rpd) restarts. A graceful restart interval is required. For certain protocols, a significant change in the network can cause graceful restart to stop.

NOTE: Router performance might change if the backup Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to each Routing Engine.

To configure Routing Engine-specific parameters and still use the same configuration on both Routing Engines, include the appropriate configuration statements under the **re0** and **re1** statements at the [**edit groups**] hierarchy level and use the **apply-groups** staement. For instructions, see the *Junos OS Administration Library for Routing Devices*.

To configure Routing Engine-specific parameters and still use the same configuration on both Routing Engines, include the appropriate configuration statements under the **re0** and **re1** statements at the [**edit groups**] hierarchy level and use the **apply-groups** staement. For instructions, see the *Junos OS Administration Library for Routing Devices*.

NOTE: For information about configuring graceful Routing Engine switchover, graceful restart, and nonstop active routing, see the *Junos OS High Availability Library for Routing Devices*.

NOTE: The first supported release for both graceful Routing Engine switchover and nonstop active routing on the router is Junos OS Release 9.0. Graceful restart software requirements depend on the routing protocols configured on the router. For the minimum software requirements for graceful restart, see the *Junos OS High Availability Library for Routing Devices*.

Related Documentation

- Taking an MX480 Host Subsystem Offline on page 180
- MX480 Host Subsystem Description on page 30
- MX480 Host Subsystem LEDs on page 30
- Maintaining the MX480 Host Subsystem on page 136

Taking an MX480 Host Subsystem Offline

Before you take a host subsystem offline, see "Effect of Taking the MX480 Host Subsystem Offline" on page 178.

To take a host subsystem offline:

1. Determine whether the host subsystem is functioning as the master or as the backup, using one of the two following methods:
   - Check the Routing Engine LEDs on the craft interface. If the green **RE MASTER** LED is lit, the corresponding host subsystem is functioning as the master.

- Issue the following command. The master Routing Engine is designated **Master** in the **Current state** field:

  ```
  user@host> show chassis routing-engine
  Routing Engine status:      Slot 0:     Current state                Master
   ...
  ```

2. If the host subsystem is functioning as the master, switch it to backup using the command:

   ```
   user@host> request chassis routing-engine master switch
   ```

3. On the console or other management device connected to the Routing Engine that is paired with the SCB you are removing, enter CLI operational mode and issue the following command. The command shuts down the Routing Engine cleanly, so its state information is preserved:

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

   Wait until a message appears on the console confirming that the operating system has halted.

   For more information about the command, see the CLI Explorer.

   NOTE: **The SCB might continue forwarding traffic for approximately 5 minutes after the request system halt command has been issued.**

Related Documentation

- Effect of Taking the MX480 Host Subsystem Offline on page 178
- MX480 Host Subsystem Description on page 30
- MX480 Host Subsystem LEDs on page 30
- Maintaining the MX480 Host Subsystem on page 136

Operating and Positioning the MX480 SCB Ejectors

- When removing or inserting an SCB, ensure that the SCBs or blank panels in adjacent slots are fully inserted to avoid hitting them with the ejector handles. The ejector handles require that all adjacent components be completely inserted so the ejector handles do not hit them, which could result in damage.
- The ejector handles rotate. After you install an SCB, ensure that the ejectors are positioned horizontally and do not block any other components or the LEDs. To avoid blocking the visibility of the LEDs, position the ejectors over the PARK icon.
- To insert or remove the SCB, slide the ejector across the SCB horizontally, rotate it, and slide it again another quarter of a turn. Turn the ejector again and repeat as necessary. Utilize the indexing feature to maximize leverage and to avoid hitting any adjacent components.
- Operate both ejector handles simultaneously. The insertion force on an SCB is too great for one ejector.

Related Documentation

- MX480 SCB Description on page 31
- MX480 SCB LEDs on page 33
- Replacing an MX480 SCB on page 182
- MX480 SCB LEDs on page 33

Replacing an MX480 SCB

Before replacing an SCB, read the guidelines in "Operating and Positioning the MX480 SCB Ejectors" on page 181.

1. Removing an MX480 SCB on page 182
2. Installing an MX480 SCB on page 183
3. Upgrading an MX480 SCB on page 185
4. Upgrading an MX480 SCB or SCBE to SCBE2 on page 192

Removing an MX480 SCB

To remove an SCB (see Figure 88 on page 183):

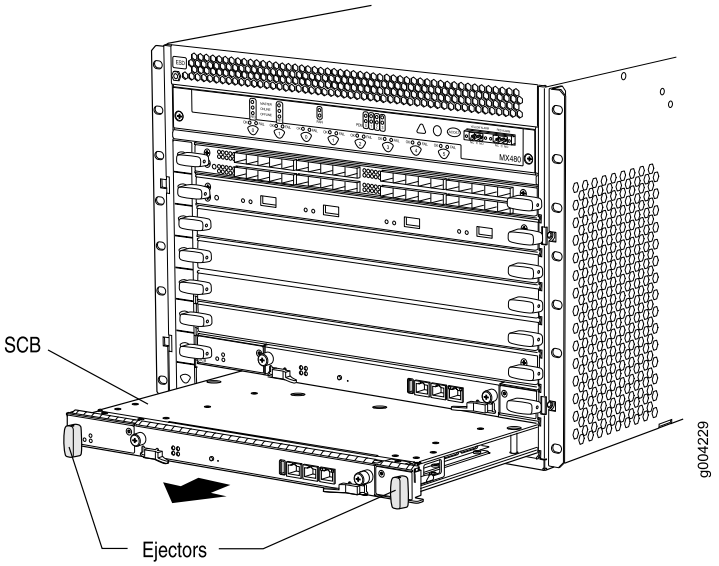
NOTE: You can remove the SCB and Routing Engine as a unit, or remove the Routing Engine separately.

CAUTION: Before removing an SCB, ensure that you know how to operate the ejector handles properly to avoid damage to the equipment.

CAUTION: Before you replace an SCB, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router.

1. Take the host subsystem offline.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Rotate the ejector handles simultaneously counterclockwise to unseat the SCB.
5. Grasp the ejector handles, and slide the SCB about halfway out of the chassis.
6. Place one hand underneath the SCB to support it, and slide it completely out of the chassis.
7. Place the SCB on the antistatic mat.
8. If you are not replacing the SCB now, install a blank panel over the empty slot.

Figure 88: Removing an SCB



Installing an MX480 SCB

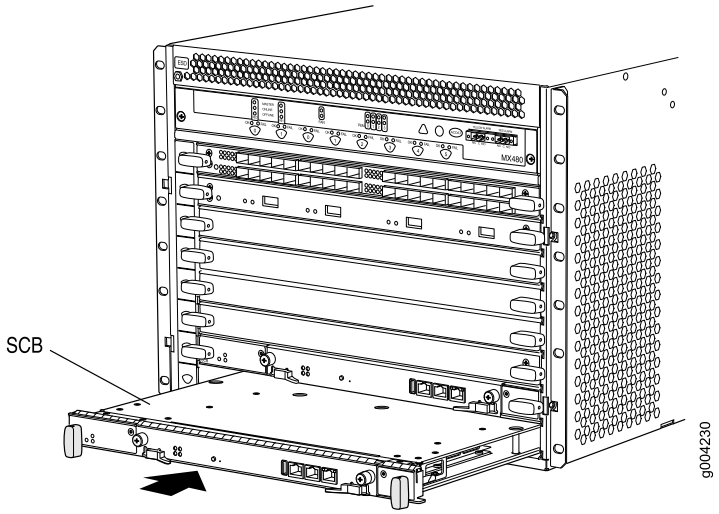
To install an SCB (see Figure 89 on page 184):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Carefully align the sides of the SCB with the guides inside the chassis.
3. Slide the SCB into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
4. Grasp both ejector handles, and rotate them simultaneously clockwise until the SCB is fully seated.
5. Place the ejector handles in the proper position, horizontally and toward the center of the board.
6. Check the LEDs on the SCB faceplate to verify that it is functioning normally.
   - The green **OK/FAIL** LED should light steadily a few minutes after the SCB is installed.
   - If the **OK/FAIL** LED is red, remove and install the SCB again. If the **OK/FAIL** LED still lights steadily, the SCB is not functioning properly. Contact your customer support representative.
7. Check the status of the SCB using the **show chassis environment cb** command:

```
user@host> show chassis environment cb
CB 0 status:
  State                       Online Master
  Temperature                 25 degrees C / 77 degrees F
  Power 1
    1.2 V                      1198 mV
    1.5 V                      1508 mV
    1.8 V                      1830 mV
    2.5 V                      5059 mV
```

```
    3.3 V                      6593 mV
    5.0 V                      5111 mV
    12.0 V                    12181 mV
    1.25 V                     1250 mV
    3.3 V SM3                  6587 mV
    5 V RE                     5078 mV
    12 V RE                   12026 mV
  Power 2
    11.3 V bias PEM           11253 mV
    4.6 V bias MidPlane        4827 mV
    11.3 V bias FPD           11408 mV
    11.3 V bias POE 0         11446 mV
    11.3 V bias POE 1         11408 mV
  Bus Revision                6
  FPGA Revision               0
CB 1 status:
  State                       Online Standby
  Temperature                 26 degrees C / 78 degrees F
  Power 1
    1.2 V                      1211 mV
    1.5 V                      1517 mV
    1.8 V                      1817 mV
    2.5 V                      2507 mV
    3.3 V                      3312 mV
    5.0 V                      5136 mV
    12.0 V                    12142 mV
    1.25 V                     1260 mV
    3.3 V SM3                  3306 mV
    5 V RE                     5085 mV
    12 V RE                   11968 mV
  Power 2
    11.3 V bias PEM           11369 mV
    4.6 V bias MidPlane        4814 mV
    11.3 V bias FPD           11427 mV
    11.3 V bias POE 0         11350 mV
    11.3 V bias POE 1         11330 mV
  Bus Revision                39
  FPGA Revision               1
```

Figure 89: Installing an SCB



Upgrading an MX480 SCB

Preparing for the Upgrade

NOTE: Do not make other changes to the CLI during the entire upgrade process. You can ensure that you will not make such changes by opening a telnet session to the master RE CLI operational mode and issuing the **configure exclusive** command. This command locks the configuration procedure.

TIP: To prevent traffic loss during the upgrade process, we recommend that you operate the line cards at 50% line rate. This 50% limit must be maintained per PFE on each line card.

To prepare the MX480 router for the Enhanced MX Switch Control Board (MX SCBE) upgrade:

1. Verify that the system runs Junos OS Release 11.4 or later by issuing the **show version** command on the master router.

   ```
   user@host> show version
   Model: mx480
   Junos Base OS Software Suite [11.4-20110530];
   ```

   NOTE: The MX SCBE is supported only in Junos OS Release 11.4 or later.

   The latest software ensures a healthy system—that is, Routing Engines, control boards, and FPCs—before the upgrade.

2. Verify that MX SCB boards are installed by issuing the **show chassis hardware** command.

   ```
   user@host> show chassis hardware
   Item  Version   Part Number Serial Number  Description
   CB0  REV 07   710-021523   ABBC8281   MX SCB
   CB1  REV 07   710-021523   ABBC8323   MX SCB
   ```

   SCB details are displayed as above, along with other hardware components. The MX480 router has only two SCBs and each SCB has four fabric planes.

3. Establish console connections to both Routing Engines. You can use a telnet session to connect to the router console by issuing the **<router name>-con** command. For example, if the router name is juniper, you can connect to RE0 and RE1 consoles by issuing the **telnet juniper-con** and **telnet juniper1-con** commands.

4. Ensure that graceful switchover (GRES), commit synchronize (required for nonstop routing), and nonstop routing (NSR) are enabled or configured by running the **set chassis redundancy graceful-switchover, set system commit synchronize, set routing-options nonstop-routing** commands.

   NOTE: These commands are mandatory for this upgrade and may be removed, if desired, after the upgrade.

5. Set the upgrade flag on, and start the SCB upgrade by issuing the **set chassis state cb-upgrade on** command.

   ```
   user@host# configure
   user@host# set chassis state cb-upgrade on
   user@host# commit
   ```

6. Determine the order to replace the existing SCBs with upgraded ones. SCB0 is associated with RE0 and SCB1 is associated with RE1.

   NOTE: Do not add or remove any router hardware during the upgrade procedure.

Upgrading the SCB in the Backup Routing Engine

TIP: MX480 has two slots for SCB—that is, SCB0 and SCB1—and these correspond to RE0 and RE1 respectively, where SCB1 is the first SCB.

To upgrade the SCB in the backup Routing Engine:

1. Power down the backup Routing Engine from the master Routing Engine by issuing the **request system power-off other-routing-engine** command.
2. Verify that the Routing Engine is powered down by issuing the **show chassis routing-engine 1** command. The slot of the Routing Engine may be 0 or 1, and is shown as 1 in this example:

   ```
   user@host> show chassis routing-engine 1
   Routing Engine Status:
   Slot 1:
   Current State  Present
   ```

   Ensure that the Current State is Present, which indicates that the Routing Engine is offline.

3. Take the fabric plane offline by issuing the **request chassis fabric plane 4 offline** command. SCB1 has four fabric planes numbered, 4, 5, 6, and 7.
4. Verify that the fabric plane is offline by issuing the **show chassis fabric summary** command.

   ```
   user@host> show chassis fabric summary

   Plane  State  Uptime
   ```

```
4  Offline
5  Online  1 hour, 15 minutes, 35 seconds
```

Verify that the State of Plane 4 is Offline.

5. Take the remaining fabric planes offline by issuing the **request chassis fabric plane 5/6/7 offline** command—that is, by changing the fabric plane number each time. Verify that the fabric planes are offline by issuing the command given in Step 2.
6. Take the SCB in slot 1 offline by issuing the **request chassis cb offline slot 1** command.
7. Verify that the control board is offline by issuing the **show chassis environment cb 1** command:

```
user@host> show chassis environment cb 1
CB 1 status:
State  Offline
Power 1  Disabled
Power 2  Disabled
```

8. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
9. Remove and replace SCB1 on the router with the SCBE. Use the replacement procedure described in "Removing an MX480 SCB" on page 182
10. Verify that the installation is successful and the SCB is online by issuing the **show chassis environment cb 1** command:

```
user@host> show chassis environment cb 1
CB 1 status
State  Online
Temperature 30 degrees C / 86 degrees F
```

Other details, such as power, are also displayed along with the state.

11. Verify that the fabric planes come online correctly by issuing the **show chassis fabric summary** command:

```
user@host> show chassis fabric summary
Plane  State Uptime
4 Online 2 minutes, 25 seconds
5 Online 2 minutes, 15 seconds
6 Online 2 minutes, 3 seconds
7 Online 1 minute, 49 seconds
```

12. Verify that the backup Routing Engine is back online by issuing the **show chassis routing-engine 0** command:

```
user@host> show chassis routing-engine 0
Routing Engine Status:
Slot 0:
Current State  Backup
```

13. Verify the alarms by issuing the **show chassis alarms** command:

```
user@host> show chassis alarms
Alarm Time   Class Description
2011-06-01 13:26:56 EDT Major CB fabrics are of mixed types
```

As only one SCB has been upgraded, the alarm indicates that the SCBs are of mixed type. This alarm is cleared after all the control boards are upgraded.

Upgrading the SCB in the Master Routing Engine

To upgrade the SCB in the master Routing Engine:

1. Ensure a Graceful RE Switchover (GRES) to gracefully switch between the master and backup Routing Engines, so that the backup RE becomes the master RE, by issuing the **request chassis routing-engine master switch** command.
2. Log in to the new master Routing Engine after the switchover.
3. Switch the configuration mode to ensure that you are still in configure exclusive mode by issuing the **exit** command and then the **configure exclusive** command, from the old master Routing Engine.
4. Log in to the current master Routing Engine again and issue the **configure exclusive** command.
5. Power down the backup Routing Engine from the master Routing Engine by issuing the **request system power-off other-routing-engine** command.
6. Ensure that the Routing Engine is powered down by issuing the **show chassis routing-engine 0** command.

   ```
   user@host> show chassis routing-engine 0
   Routing Engine Status:
   Slot 0:
   Current State  Present
   ```

   Verify that the Current State is Present, which indicates that the Routing Engine is offline.
7. Take the first fabric plane of the backup Routing Engine offline by issuing the **request chassis fabric plane 0 offline** command. SCB0 has four fabric planes numbered, 0, 1, 2, and 3.
8. Verify that the fabric plane is offline by issuing the **show chassis fabric summary** command.

   ```
   user@host> show chassis fabric summary
   Plane State Uptime
   0 Offline
   1  Online 3 minutes, 45 seconds
   ```

   Verify that the State of Plane 0 is Offline.
9. Take the remaining fabric planes offline by issuing the **request chassis fabric plane 1/2/3 offline** command—that is, by changing the fabric plane number each time. Verify that the fabric planes are offline by issuing the command given in Step 4.
10. Take the SCB in slot 0 offline by issuing the **request chassis cb offline slot 0** command.
11. Verify that the control board is offline by issuing the **show chassis environment cb 0** command:

    ```
    user@host> show chassis environment cb 0
    CB 0 status:
    State  Offline
    Power 1  Disabled
    Power 2  Disabled
    ```

12. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
13. Remove and replace the offline SCB on the router with the SCBE. Use the replacement procedure described in "Removing an MX480 SCB" on page 182.
14. Verify that the installation is successful and SCB0 is online by issuing the **show chassis environment cb 0** command:

    ```
    user@host> show chassis environment cb 0
    CB 0 status
    State  Online
    Temperature 30 degrees C / 86 degrees F
    ```

    Other details, such as power, are also displayed along with the state.
15. Verify that the fabric planes come online correctly by issuing the **show chassis fabric summary** command:

    ```
    user@host> show chassis fabric summary
    Plane State Uptime
    0 Online 2 minutes, 5 seconds
    1 Online 1 minute, 55 seconds
    2 Online 1 minute, 43 seconds
    3 Online 1 minute, 33 seconds
    ```
16. Verify that the backup Routing Engine is back online by issuing the **show chassis routing-engine 0** command:

    ```
    user@host> show chassis routing-engine 0
    Routing Engine Status:
    Slot 0:
    Current State  Backup
    ```
17. Verify the alarms by issuing the **show chassis alarms** command:

    ```
    user@host> show chassis alarms
    Alarm Time  Class Description
    2011-06-01 13:26:56 EDT Major CB fabric links require upgrade/training
    2011-06-01 12:10:41 EDT Major Require a fan tray upgrade
    ```

    The major alarm has changed from **CB fabrics are of mixed types** to **CB fabric links require upgrade/training**, as a switch control board requires training to change links from 3G speed to 6G speed of the SCBE. This alarm is displayed until the 3G to 6G link transition is completed.

Completing the SCB Upgrade

To complete the procedure after upgrading the SCBs:

1. Verify that any Modular Port Concentrator (MPC) is running at 3G instead of 6G by issuing the **request chassis fabric upgrade-bandwidth info** command:

   ```
   user@host> request chassis fabric upgrade-bandwidth info
   Slot State
   0 Upgrade not supported
   1 Needs upgrade
   2 Empty
   3 Empty
   4 Empty
   5 Empty
   ```

   The results indicate that slot 0 does not support the upgrade and slot 1 needs to be upgraded.

2. Upgrade the bandwidth of all MPCs by issuing the **request chassis fabric upgrade-bandwidth fpc all** command. If you want to control the MPC line card upgrade, go to Step 3.

   CAUTION: Use this command only if you are not concerned with the slot upgrade order or if only one old MPC is present in the chassis. Running this command may result in a loss of traffic across that MPC. Using this method may increase that loss, because it does not consider any redundancy or graceful switchover strategies that you may have configured on the system.

3. Upgrade the MPC in slot 1 by running the **request chassis fabric upgrade-bandwidth fpc slot 1** command.

4. Verify that the MPC is upgraded by issuing the **request chassis fabric upgrade-bandwidth info** command:

   ```
   user@host> request chassis fabric upgrade-bandwidth info
   Slot State
   0  Upgrade not supported
   1  Upgraded
   2  Empty
   ```

5. Verify the state of the fabric planes for all MPCs by issuing the **show chassis fabric summary** command.

   ```
   user@host> show chassis fabric summary
   Plane State  Uptime
   0  Spare  21 seconds
   1  Spare  12 seconds
   2  Online   12 minutes
   3  Online   12 minutes
   4  Online   30 minutes
   5  Online   30 minutes
   ```

6. Verify the state of the MPCs by issuing the **show chassis fabric fpcs** command.

   ```
   user@host> show chassis fabric fpcs
   ```

```
FPC 1
PFE #0
 Plane 0: Links ok
 Plane 1: Links ok
 Plane 2: Plane enabled
 Plane 3: Plane enabled
 Plane 4: Plane enabled
 Plane 5: Plane enabled
PFE #1
 Plane 0: Links ok
 Plane 1: Links ok
 Plane 2: Plane enabled
 Plane 3: Plane enabled
 Plane 4: Plane enabled
 Plane 5: Plane enabled
PFE #2
 Plane 0: Links ok
 Plane 1: Links ok
 Plane 2: Plane enabled
 Plane 3: Plane enabled
 Plane 4: Plane enabled
 Plane 5: Plane enabled
PFE #3
 Plane 0: Links ok
 Plane 1: Links ok
 Plane 2: Plane enabled
 Plane 3: Plane enabled
 Plane 4: Plane enabled
 Plane 5: Plane enabled
```

Fabric plane details of all MPCs are similarly displayed.

7. Verify if any output of the **show chassis fabric summary** command shows fabric planes in 'check' state, as it indicates that the fabric plane has an error. You can try to recover the fabric plane to normal operation by issuing the **request chassis fabric plane <#> offline** command, followed by the **request chassis fabric plane <#> online** command, where <#> equals the fabric plane in error.

   NOTE: After you issue the **request chassis fabric plane <#> offline** and **request chassis fabric plane <#> online** commands, issue the **show chassis fabric summary** command to verify that the fabric plane errors are rectified and to verify the current state of the fabric planes.

8. Verify that the major alarms are displayed by issuing the **show chassis alarms** command:

   ```
   user@host> show chassis alarms
   Alarm Time   Class Description
   2011-06-01 13:37:43 EDT Minor Require a fan tray upgrade
   2011-06-01 13:37:26 EDT Minor Backup RE Active
   ```

   The major alarms are not displayed anymore, and the upgrade is successfully completed.

9. Disable the upgrade configuration by issuing the **set chassis state cb-upgrade off** command and then the **commit** command.

10. You can delete that command by issuing the **delete chassis state cb-upgrade** command and then the **commit** command.

11. Verify the SCBs before you finish by issuing the **show chassis hardware** command:

```
user@host> show chassis hardware
Item  Version  Part Number Serial Number Description
CB0  REV 02 750-031391 YE8505  Enhanced MX SCB
CB1  REV 07 710-031391 YL6769  Enhanced MX SCB
```

    You can see that the MX480 now has the MX SCBEs.

Upgrading an MX480 SCB or SCBE to SCBE2

To upgrade the SCB or SCBE to SCBE2, follow these steps:

NOTE: SCBE2 does not support smooth upgrade.

1. Preparing the MX480 Router for the SCBE2 Upgrade on page 192
2. Powering Off the MX480 Router on page 193
3. Removing an MX480 Routing Engine from an SCB or SCBE on page 193
4. Replacing the SCB or SCBE with SCBE2 on page 194
5. Installing an MX480 Routing Engine into an SCBE2 on page 194
6. Powering On the MX480 Router on page 194
7. Completing the SCBE2 Upgrade on page 196

Preparing the MX480 Router for the SCBE2 Upgrade

To prepare the MX480 router for the SCBE2 upgrade:

1. Verify that the system runs Junos OS Release 13.3 or later by issuing the **show version** command on the master router.

```
user@host> show version
Model: mx480
Junos Base OS Software Suite [13.3-yyyymmdd];
...
```

NOTE: The SCBE2 is supported only on:

- Junos OS Release 13.3 or later
- Network Services Mode: Enhanced-IP
- MPC/MIC modules

The latest software ensures a healthy system—that is, a system that comprises Routing Engines, control boards, and FPCs—before the upgrade.

For information about how to verify and upgrade the Junos OS, see the *Junos OS Installation and Upgrade Guide*.

Powering Off the MX480 Router

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

To power off the MX480 router:

1. On the external management device connected to the Routing Engine, issue the **request system halt both-routing-engines** operational mode command. The command shuts down the Routing Engines cleanly, so that their state information is preserved. (If the router contains only one Routing Engine, issue the **request system halt** command.)

```
user@host> request system halt both-routing-engines
```

2. Wait until a message appears on the console confirming that the operating system has halted.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Move the AC input switch on the chassis above the AC power supply or the DC circuit breaker on each DC power supply faceplate to the off **(O)** position.

Removing an MX480 Routing Engine from an SCB or SCBE

To remove an MX480 Routing Engine from an SCB or SCBE:

1. Remove the cables connected to the Routing Engine.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.

3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Loosen the captive screws on the top and bottom of the Routing Engine.
5. Flip the ejector handles outward to unseat the Routing Engine.
6. Grasp the Routing Engine by the ejector handles, and slide it about halfway out of the chassis.
7. Place one hand underneath the Routing Engine to support it, and slide it completely out of the chassis.
8. Place the Routing Engine on the antistatic mat.

Replacing the SCB or SCBE with SCBE2

To replace the existing SCB or SCBE with SCBE2:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Remove and replace the offline SCB or SCBE on the router with SCBE2.

Installing an MX480 Routing Engine into an SCBE2

To install an MX480 Routing Engine into an SCBE2:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the ejector handles are not in the locked position. If necessary, flip the ejector handles outward.
3. Place one hand underneath the Routing Engine to support it.
4. Carefully align the sides of the Routing Engine with the guides inside the opening on the SCBE2.
5. Slide the Routing Engine into the SCBE2 until you feel resistance and then press the faceplate of the Routing Engine until it engages the connectors.
6. Press both of the ejector handles inward to seat the Routing Engine.
7. Tighten the captive screws on the top and bottom of the Routing Engine.
8. Connect the management device cables to the Routing Engine.

Powering On the MX480 Router

To power on the MX480 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. Follow the ESD and safety 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. Move the AC input switch on the chassis above the AC power supply or the DC circuit breaker on each DC power-supply faceplate to the off **(—)** position.
8. Check that the AC or the DC power supply is correctly installed and functioning normally. Verify that the **AC OK** and **DC OK** LEDs light steadily, and the **PS FAIL** LED is not lit.

   NOTE: 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.

   If any of the status LEDs indicates that the power supply is not functioning normally, repeat the installation and cabling procedures.
9. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.

   NOTE: If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. Normally, the router boots from the Junos OS on the CompactFlash card.

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

Completing the SCBE2 Upgrade

To complete the SCBE2 upgrade procedure:

1. Verify that the installation is successful and the SCBE2 is online by issuing the **show chassis environment cb** command:

```
user@host> show chassis environment cb 0
CB 0 status
State  Online
Temperature 30 degrees C / 86 degrees F
...

user@host> show chassis environment cb 1
CB 1 status
State  Online
Temperature 30 degrees C / 86 degrees F
...
```

   Other details, such as, temperature, power, etc are also displayed along with the state.

2. Verify that the fabric planes come online correctly by issuing the **show chassis fabric summary** command:

```
user@host> show chassis fabric summary
Plane   State    Uptime
 0      Online   2 days, 19 hours, 10 minutes, 9 seconds
 1      Online   2 days, 19 hours, 10 minutes, 9 seconds
...
```

3. Verify that the backup Routing Engine is back online by issuing the **show chassis routing-engine 1** command:

```
user@host> show chassis routing-engine 1
Routing Engine Status:
Slot 1:
Current State  Backup
...
```

4. Verify the SCBE2s before you finish by issuing the **show chassis hardware** command:

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
CB 0             REV 08   750-048307   CABC9829          Enhanced MX SCB 2
CB 1             REV 08   750-048307   CABC9828          Enhanced MX SCB 2
...
```

   You see that the MX480 now has SCBE2s.

Related Documentation

- Operating and Positioning the MX480 SCB Ejectors on page 181
- Effect of Taking the MX480 Host Subsystem Offline on page 178
- Taking an MX480 Host Subsystem Offline on page 180
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

Replacing an MX480 Routing Engine

Removing an MX480 Routing Engine

Before you remove a Routing Engine, remove the cables that connect to it.

CAUTION: Before you replace a Routing Engine, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router.

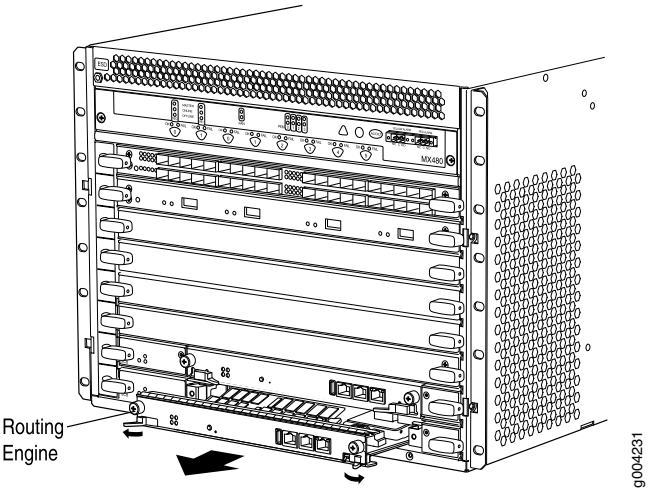
CAUTION: If the Routing Engine to be replaced is currently functioning as the master Routing engine, switch it to be the backup before removing it.

To remove a Routing Engine from an SCB (see Figure 90 on page 198):

1. Take the Routing Engine offline gracefully.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Verify that the Routing Engine LEDs are off.
5. Loosen the captive screws on the left and right of the Routing Engine.
6. Flip the ejector handles outward to unseat the Routing Engine.
7. Grasp the Routing Engine by the ejector handles, and slide it about halfway out of the chassis.
8. Place one hand underneath the Routing Engine to support it, and slide it completely out of the chassis.
9. Place the Routing Engine on the antistatic mat.

NOTE: To maintain proper airflow through the chassis, do not leave an SCB installed in the chassis without a Routing Engine for extended periods of time. If a Routing Engine is removed, a replacement Routing Engine should be installed as soon as possible.

Figure 90: Removing a Routing Engine



Installing an MX480 Routing Engine

To install a Routing Engine into an SCB (see Figure 91 on page 199):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Ensure that the ejector handles are not in the locked position. If necessary, flip the ejector handles outward.
3. Place one hand underneath the Routing Engine to support it.
4. Carefully align the sides of the Routing Engine with the guides inside the opening on the SCB.
5. Slide the Routing Engine into the SCB until you feel resistance, and then press the Routing Engine's faceplate until it engages the connectors.
6. Press both of the ejector handles inward to seat the Routing Engine.
7. Tighten the captive screws on the left and right of the Routing Engine.
8. Connect the management device cables to the Routing Engine.

The Routing Engine might require several minutes to boot.

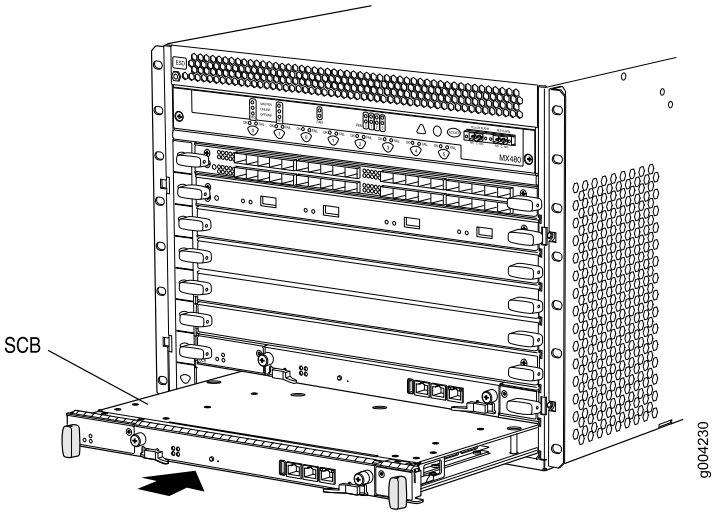
After the Routing Engine boots, verify that it is installed correctly by checking the **RE0** and **RE1** LEDs on the craft interface. If the router is operational and the Routing Engine is functioning properly, the green **ONLINE** LED lights steadily. If the red **FAIL** LED lights steadily instead, remove and install the Routing Engine again. If the red **FAIL** LED still lights steadily, the Routing Engine is not functioning properly. Contact your customer support representative.

To check the status of the Routing Engine, use the CLI command:

```
user@host> show chassis routing-engine
Routing Engine status:      Slot 0:     Current state                  Master ...
```

For more information about using the CLI, see the Junos OS documentation.

Figure 91: Installing a Routing Engine



Related Documentation

- Replacing Connections to MX480 Routing Engine Interface Ports on page 200
- Effect of Taking the MX480 Host Subsystem Offline on page 178
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Replacing Connections to MX480 Routing Engine Interface Ports on page 200
- *Synchronizing Routing Engines*

Replacing an SSD Drive on an RE-A-1800 or RE-S-1800

Each RE-1800 Routing Engine supports two solid-state drives (SSD) specified by Juniper Networks. The RE-1800 ships with one SSD installed. The spare SSD is Juniper part number RE-SSD-32G-UPG.Figure 92 on page 199 and Figure 93 on page 200show the arrangement of storage drive slots on a RE-1800 Routing Engine.

Figure 92: RE-A-1800 Storage Drive Slots

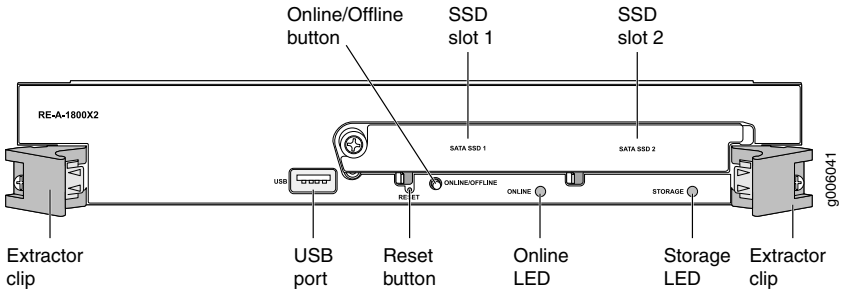
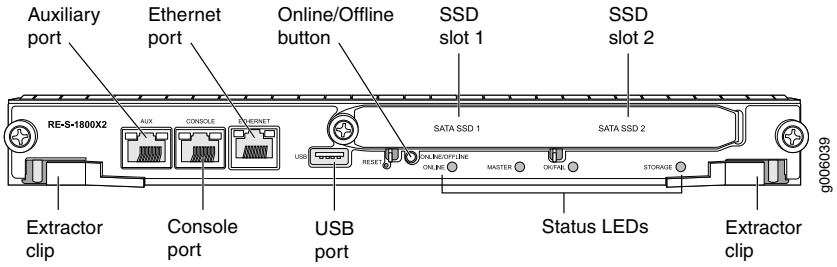


Figure 93: RE-S-1800 Storage Drive Slots



The following drive has been verified to work in the RE-1800 Routing Engines:

- SSD SLC 32 GB

To replace a storage drive:

1. Disable and deactivate the storage drive.
2. Remove the storage drive.
   a. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an ESD point on the appliance.

      For more information about ESD, see *Prevention of Electrostatic Discharge Damage on VXA Series Content Engines*.

   b. Unfasten the thumbscrew that secures the access door in front of the storage drive slots, and open the door.
   c. Slide the lock on the ejector to the unlocked position.
   d. Carefully slide the drive out of the slot.
3. Reinstall a storage drive.
   a. Carefully align the sides of the drive with the guides in the slot.
   b. Slide the drive into the slot until you feel resistance, carefully ensuring that it is correctly aligned.
   c. Close the access door and tighten the thumbscrew to secure the door.
4. Mount the new storage drive.

Related Documentation

- Returning a Hardware Component to Juniper Networks, Inc. on page 327

Replacing Connections to MX480 Routing Engine Interface Ports

- Replacing the Management Ethernet Cable on an MX Series Router on page 201
- Replacing the Console or Auxiliary Cable on an MX480 Router on page 201

Replacing the Management Ethernet Cable on an MX Series Router

One Ethernet cable with RJ-45 connectors is provided with the router. To replace the cable connected to the **ETHERNET** port:

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Press the tab on the connector, and pull the connector straight out of the port. Figure 94 on page 201 shows the connector.
3. Disconnect the cable from the network device.
4. Plug one end of the replacement cable into the **ETHERNET** port. Figure 95 on page 201 shows the port.
5. Plug the other end of the cable into the network device.

Figure 94: Cable Connector

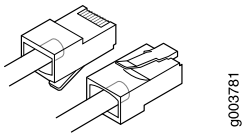
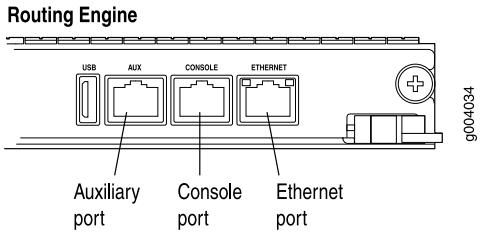


Figure 95: Ethernet Port



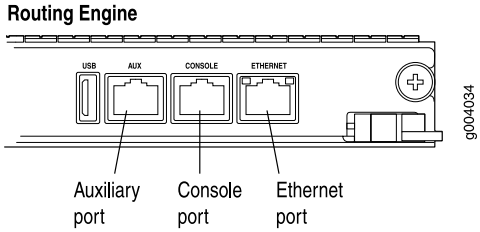
Replacing the Console or Auxiliary Cable on an MX480 Router

To use a system console to configure and manage the Routing Engine, connect it to the **CONSOLE** port on the Routing Engine. To use a laptop, modem, or other auxiliary device, connect it to the **AUX** port on the Routing Engine. Both ports accept a cable with an RJ-45 connector. One RJ-45/DB-9 cable is provided with the router. If you want to connect a device to both ports, you must supply another cable.

To replace a cable connected to a management console or auxiliary device:

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Press the tab on the connector, and pull the connector straight out of the port.
3. Disconnect the cable from the console or auxiliary device.
4. Plug the RJ-45 end of the replacement serial cable into the **CONSOLE** or **AUX** port. Figure 96 on page 202 shows the external device ports on the Routing Engine.
5. Plug the female DB-9 end into the console or auxiliary device's serial port.

Figure 96: Auxiliary and Console Ports



Related Documentation

- Routing Engine Interface Cable and Wire Specifications for MX Series Routers on page 310
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Replacing an MX480 Routing Engine on page 197

Replacing an MX480 DPC

1. Removing an MX480 DPC on page 202
2. Installing an MX480 DPC on page 204

Removing an MX480 DPC

A DPC weighs up to 13.1 lb (5.9 kg). Be prepared to accept its full weight.

To remove a DPC (see Figure 97 on page 204):

1. Have ready a replacement DPC or DPC blank panel and an antistatic mat for the DPC. Also have ready rubber safety caps for each DPC you are removing that uses an optical interface.
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 each port on the DPC so that you can later reconnect the cables to the correct ports.
4. Use one of the following methods to take the DPC offline:
   - Press and hold the corresponding DPC online button on the craft interface. The green **OK** LED next to the button begins to blink. Hold the button down until the LED goes off.
   - Issue the following CLI command:

     `user@host>` **request chassis fpc slot *slot-number* offline**

     For more information about the command, see the CLI Explorer.
5. Disconnect the cables from the DPC.

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.

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

6. Immediately cover each optical transceiver and the end of each fiber-optic cable with a rubber safety cap.
7. Arrange the disconnected cables in the cable management brackets to prevent the cables from developing stress points.
8. Simultaneously turn both of the ejector handles counterclockwise to unseat the DPC.
9. Grasp the handles, and slide the DPC straight out of the card cage halfway.
10. Place one hand around the front of the DPC and the other hand under it to support it. Slide the DPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the DPC is concentrated in the back end. Be prepared to accept the full weight—up to 13.1 lb (5.9 kg)—as you slide the DPC out of the chassis.

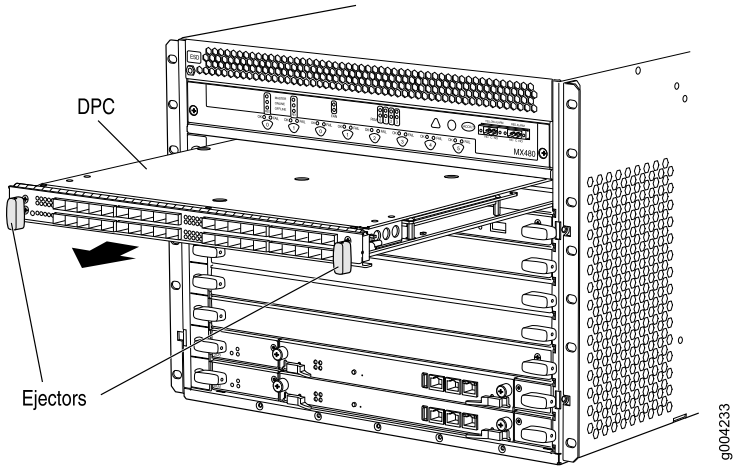
When the DPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Do not stack DPCs on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

11. If you are not reinstalling a DPC into the emptied DPC slot within a short time, install a blank DPC panel over the slot to maintain proper airflow in the DPC card cage.

CAUTION: After removing a DPC from the chassis, wait at least 30 seconds before reinserting it, removing a DPC from a different slot, or inserting a DPC into a different slot.

Figure 97: Removing a DPC



Installing an MX480 DPC

A DPC weighs up to 14.5 lb (6.6 kg). Be prepared to accept its full weight.

To install a DPC (see Figure 98 on page 205):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Place the DPC on an antistatic mat, or remove it from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Verify that each fiber-optic transceiver is covered with a rubber safety cap. If it does not, cover the transceiver with a safety cap.
5. Orient the DPC so that the faceplate faces you.
6. Lift the DPC into place, and carefully align the sides of the DPC with the guides inside the card cage.
7. Slide the DPC all the way into the card cage until you feel resistance.
8. Grasp both ejector handles, and rotate them clockwise simultaneously until the DPC is fully seated.
9. Remove the rubber safety cap from each fiber-optic transceiver and cable.

WARNING: **Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.**

10. Insert the cables into the cable connector ports on each DPC (see Figure 99 on page 206).
11. Arrange the cable in the cable management brackets to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight

as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

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

12. Use one of the following methods to bring the DPC online:

- Press and hold the corresponding DPC online button on the craft interface until the green **OK** LED next to the button lights steadily, in about 5 seconds.
- Issue the following CLI command:

  `user@host>` **request chassis fpc slot *slot-number* online**

  For more information about the command, see the CLI Explorer.

CAUTION: After the OK LED turns green, wait at least 30 seconds before removing the DPC again, removing a DPC from a different slot, or inserting a DPC in a different slot.

You can also verify that the DPC is functioning correctly by issuing the **show chassis fpc** and **show chassis fpc pic-status** commands.

Figure 98: Installing a DPC

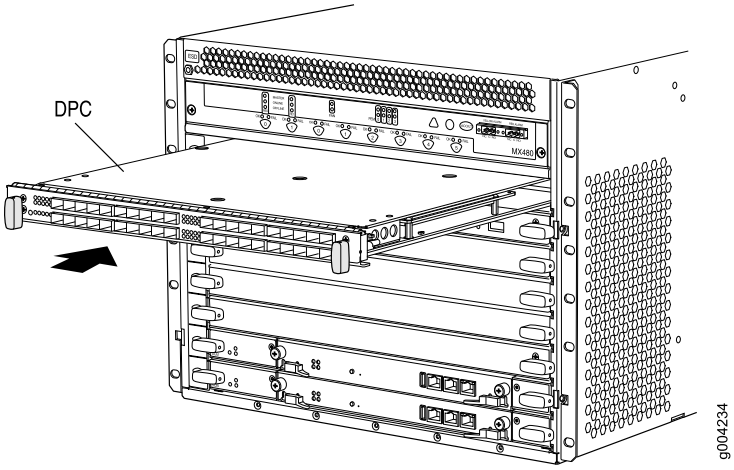
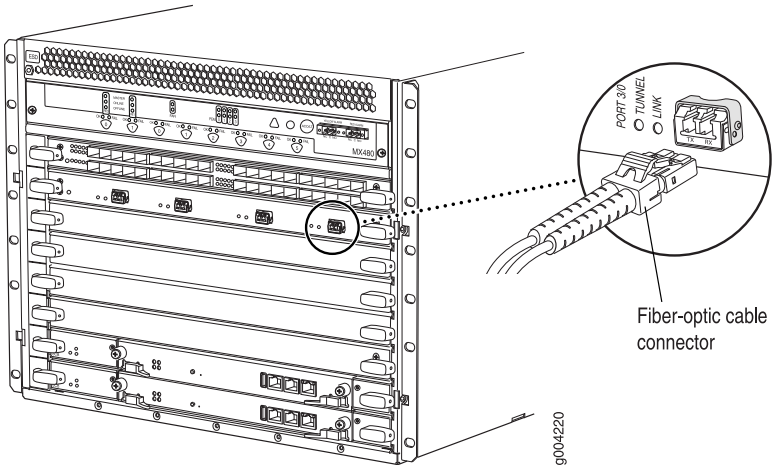


Figure 99: Attaching a Cable to a DPC



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- MX480 Dense Port Concentrator (DPC) Description on page 12
- MX480 Dense Port Concentrator (DPC) LEDs on page 14
- Troubleshooting the MX480 DPCs on page 160
- Maintaining MX480 DPCs on page 138

Replacing an MX480 FPC

1. Removing an MX480 FPC on page 206
2. Installing an MX480 FPC on page 209

Removing an MX480 FPC

When you remove an FPC, the router continues to function, although the PIC interfaces installed on the FPC being removed no longer function.

An FPC takes up two DPC slots on the MX480 router. Up to three FPCs can be installed horizontally in the front of the MX480 router. The FPCs are hot-insertable and hot-removable. An empty FPC3 weighs 14 lb (6.5 kg). A fully configured FPC can weigh up to 18 lb (8.2 kg). Be prepared to accept its full weight.

To remove an FPC (see Figure 100 on page 208):

1. Have ready a replacement FPC or FPC blank panel and an antistatic mat for the FPC. Also have ready rubber safety caps for each PIC using an optical interface on the FPC that you are removing.
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 each PIC on the FPC so that you can later reconnect the cables to the correct PICs.

4. Use one of the following methods to take the FPC offline:

   - Press and hold the FPC online/offline button. The green **OK** LED next to the button begins to blink. Hold the button down until the LED goes off. The LEDs and online/offline button for each FPC are located directly above it on the craft interface.
   - Issue the following CLI command:

     `user@host>` **request chassis fpc slot** *`slot-number`* **offline**

     For more information about the command, see the CLI Explorer.

     NOTE: **The slot number corresponds to the lowest numbered slot for which the FPC is installed.**

5. Disconnect the cables from the PICs installed in the FPC.
6. Immediately cover each fiber-optic transceiver and the end of each fiber-optic 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.**

7. Arrange the cable in the cable management brackets to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

   CAUTION: **Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.**

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

8. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.
9. Grasp the handles, and slide the FPC straight out of the card cage halfway.
10. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 18 lb (8.2 kg)—as you slide the FPC out of the chassis.

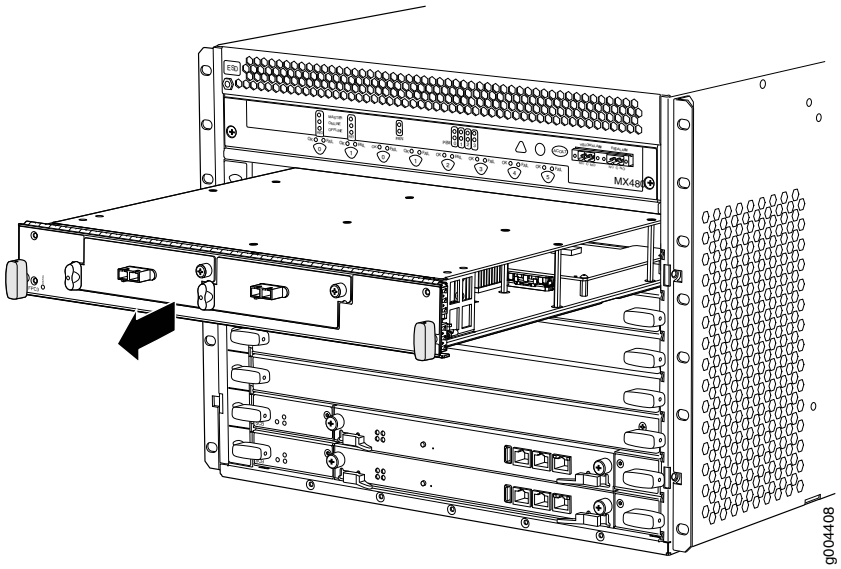
When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Do not stack FPCs on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

11. If necessary, remove each installed PIC from the FPC.
12. After you remove each PIC, immediately place it on an antistatic mat or in an electrostatic bag.
13. If you are not reinstalling an FPC into the emptied DPC slots within a short time, install a blank DPC panel over each slot to maintain proper airflow in the card cage.

CAUTION: After removing an FPC from the chassis, wait at least 30 seconds before reinserting it or inserting an FPC into a different slot.

Figure 100: Removing an FPC



Installing an MX480 FPC

An FPC takes up two DPC slots on the MX480 router. Up to three FPCs can be installed horizontally in the front of the router. The FPCs are hot-insertable and hot-removable. An empty FPC3 weighs 14 lb (6.5 kg). A fully configured FPC can weigh up to 18 lb (8.2 kg). Be prepared to accept its full weight.

To install an FPC (see Figure 101 on page 210):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Place the FPC on an antistatic mat.
3. Take each PIC to be installed in the replacement FPC out of its electrostatic bag, and identify the slot on the FPC where it will be connected.
4. Verify that each fiber-optic PIC has a rubber safety cap covering the PIC transceiver. If it does not, cover the transceiver with a safety cap.
5. Install each PIC into the appropriate slot on the FPC.
6. Locate the slots in the card cage in which you plan to install the FPC.
7. Orient the FPC so that the faceplate faces you.
8. Lift the FPC into place, and carefully align the sides of the FPC with the guides inside the card cage.

CAUTION: **When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.**

9. Slide the FPC all the way into the card cage until you feel resistance.
10. Grasp both ejector handles, and rotate them clockwise simultaneously until the FPC is fully seated.
11. If any of the PICs on the FPC connect to fiber-optic cable, remove the rubber safety cap from each transceiver and cable.

WARNING: **Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.**

12. Insert the appropriate cable into the cable connector ports on each PIC on the FPC.
13. Arrange the cable in the cable management brackets to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

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

14. Use one of the following methods to bring the FPC online:

- Press and hold the FPC online/offline button until the green **OK** LED next to the button lights steadily, in about 5 seconds. The LEDs and online/offline button for each FPC are located directly above it on the craft interface.
- Issue the following CLI command:

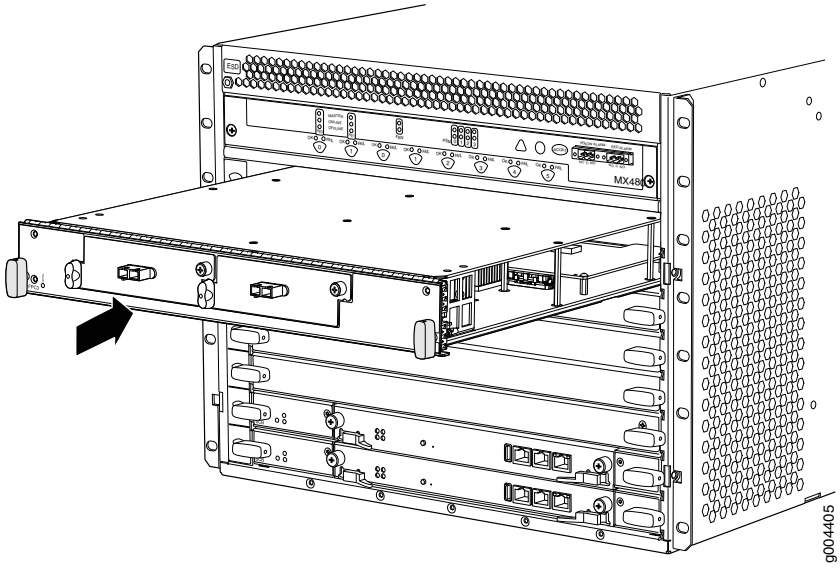
  `user@host>` **request chassis fpc slot** *`slot-number`* **online**

  For more information about the command, see the CLI Explorer.

CAUTION: After the OK LED lights steadily, wait at least 30 seconds before removing the FPC again, removing an FPC from a different slot, or inserting an FPC in a different slot.

You can also verify correct FPC and PIC functioning by issuing the **show chassis fpc** and **show chassis fpc pic-status** commands described in "Maintaining MX480 FPCs" on page 140 and "Maintaining MX480 PICs" on page 142.

Figure 101: Installing an FPC



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Replacing an MX480 PIC on page 211
- Holding an MX480 FPC on page 151
- Storing an MX480 FPC on page 154
- Maintaining MX480 FPCs on page 140

Replacing an MX480 PIC

1. Removing an MX480 PIC on page 211
2. Installing an MX480 PIC on page 213

Removing an MX480 PIC

PICs are hot-insertable and hot-removable. When you remove a PIC, the router continues to function, although the PIC interfaces being removed no longer function.

The PICs are located in the FPCs installed in the front of the router. A PIC weighs less than 2 lb (0.9 kg).

To remove a PIC (see Figure 102 on page 213):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the PIC. If the PIC connects to fiber-optic cable, have ready a rubber safety cap for each transceiver and cable.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Use one of the following methods to take the PIC offline:
   - Press its online/offline button. For a PIC installed in FPC3, use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the PIC LED goes off (about 5 seconds).
   - Issue the following CLI command:

     `user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline`

     For more information about the command, see the CLI Explorer.
4. Label the cables connected to the PIC so that you can later reconnect each cable to the correct PIC.
5. Disconnect the cables from the PIC. If the PIC 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.

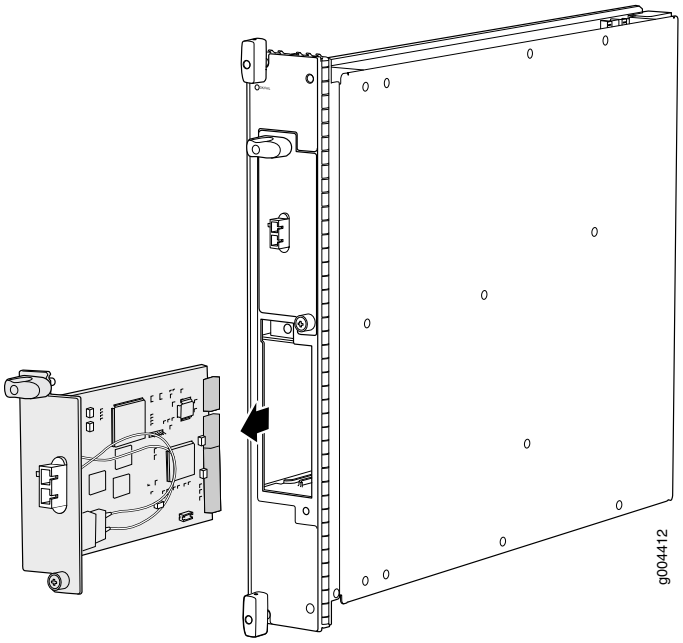
6. Arrange the cable in the cable management brackets to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

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

7. For an FPC3 PIC, loosen the captive screw at the bottom of the PIC faceplate, then twist the ejector handle at the top of the faceplate counterclockwise to unseat the PIC.
8. Slide the PIC out of the FPC card carrier and place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a PIC into the emptied PIC slot within a short time, install a blank PIC panel over the slot to maintain proper airflow in the FPC card cage.

Figure 102: Removing a PIC



Installing an MX480 PIC

To install a PIC (see Figure 103 on page 215):

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 PIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.
3. Align the notches in the connector at the rear of the PIC with the notches in the PIC slot in the FPC and then slide the PIC in until it lodges firmly in the FPC.

   CAUTION: Slide the PIC straight into the slot to avoid damaging the components on the bottom of the PIC.

4. For an FPC3 PIC, turn the ejector handle at the top of the PIC faceplate clockwise, then tighten the captive screw at the bottom of the faceplate to secure the PIC in the FPC.
5. If the PIC 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.

6. Insert the appropriate cables into the cable connectors on the PIC.
7. Arrange the cable in the cable management brackets to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

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

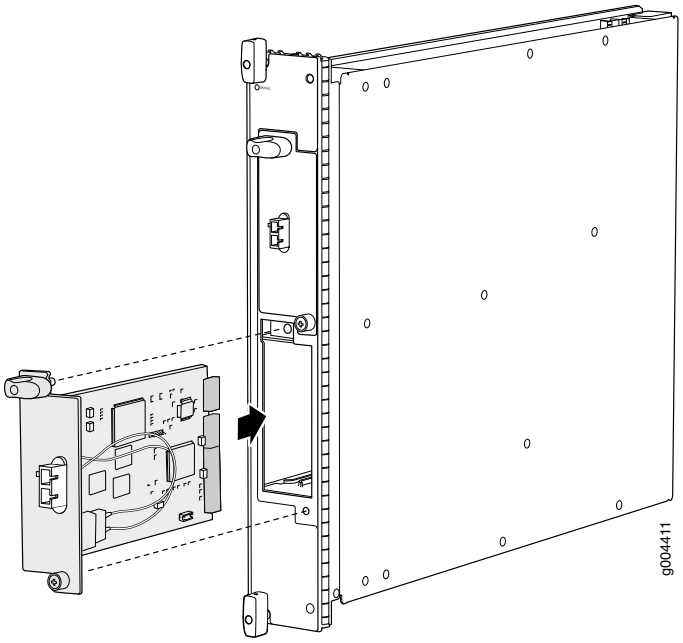
8. Use one of the following methods to bring the PIC online:
   - Press the PIC offline/online button until the PIC LED lights green. For a PIC installed in an FPC2 or FPC3, use a narrow-ended tool that fits inside the opening that leads to the button.
   - Issue the following CLI command:

     `user@host>` **request chassis pic fpc-slot** *`fpc-slot`* **pic-slot** *`pic-slot`* **online**

     For more information about the command, see the CLI Explorer.

   The normal functioning status LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the **show chassis fpc pic-status** command described in "Maintaining MX480 PICs" on page 142.

Figure 103: Installing a PIC



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Troubleshooting the MX480 PICs on page 163
- Maintaining MX480 PICs on page 142
- MX480 PIC Serial Number Label on page 321
- MX480 PIC Description on page 27
- Replacing an MX480 FPC on page 206

Replacing an MX480 MPC

1. Removing an MX480 MPC on page 216
2. Installing an MX480 MPC on page 218

Removing an MX480 MPC

When you remove an MPC, the router continues to function, although the MIC interfaces installed on the MPC being removed no longer function.

An MPC installs horizontally in the front of the router. The MPCs are hot-insertable and hot-removable. A fully configured MPC can weigh up to 18.35 lb (8.3 kg). Be prepared to accept its full weight.

To remove an MPC (see Figure 104 on page 217):

1. Have ready a replacement MPC or DPC blank panel and an antistatic mat for the MPC. Also have ready rubber safety caps for each MIC using an optical interface on the MPC that you are removing.
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 each MIC on the MPC so that you can later reconnect the cables to the correct MICs.
4. Use one of the following methods to take the MPC offline:
   - Press and hold the corresponding online button on the craft interface. The green **OK/FAIL** LED next to the button begins to blink. Hold the button down until the LED goes off.
   - Issue the following CLI command:

     `user@host>` **request chassis fpc slot** *slot-number* **offline**

     For more information about the command, see the CLI Explorer.
5. Disconnect the cables from the MICs installed in the MPC.

WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

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

6. If a MIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.

7. Arrange the disconnected cables in the cable management brackets to prevent the cables from developing stress points.
8. Simultaneously turn both the ejector handles counterclockwise to unseat the MPC.
9. Grasp the handles, and slide the MPC straight out of the card cage halfway.
10. Place one hand around the front of the MPC (the MIC housing) and the other hand under it to support it. Slide the MPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the MPC is concentrated in the back end. Be prepared to accept the full weight—up to 18.35 lb (8.3 kg)—as you slide the MPC out of the chassis.

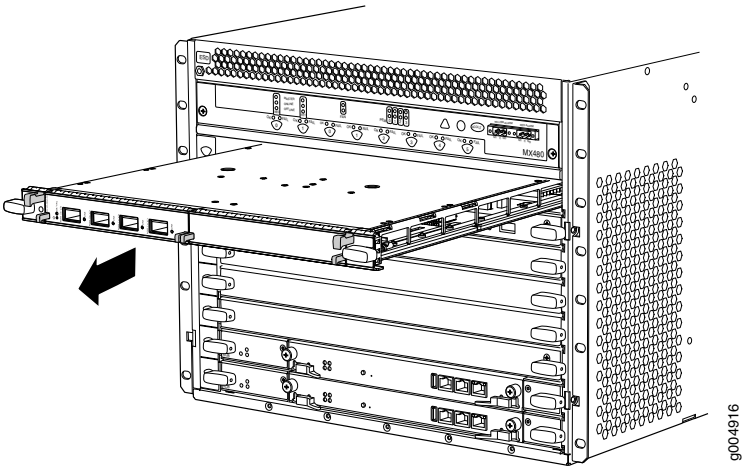
When the MPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Do not stack MPCs on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

11. If necessary, remove each installed MIC from the MPC.
12. After you remove each MIC, immediately place it on an antistatic mat or in an electrostatic bag.
13. If you are not reinstalling an MPC into the emptied line card slots within a short time, install a blank DPC panel over each slot to maintain proper airflow in the card cage.

CAUTION: After removing an MPC from the chassis, wait at least 30 seconds before reinserting it or inserting an MPC into a different slot.

Figure 104: Removing an MPC



Installing an MX480 MPC

An MPC installs horizontally in the front of the router. The MPCs are hot-insertable and hot-removable. A fully configured MPC can weigh up to 18.35 lb (8.3 kg). Be prepared to accept its full weight.

To install an MPC (see Figure 105 on page 219):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Place the MPC on an antistatic mat.
3. Take each MIC to be installed in the replacement MPC out of its electrostatic bag, and identify the slot on the MPC where it will be connected.
4. Verify that each fiber-optic MIC has a rubber safety cap covering the MIC transceiver. If it does not, cover the transceiver with a safety cap.
5. Install each MIC into the appropriate slot on the MPC.
6. Locate the slot in the card cage in which you plan to install the MPC.
7. Orient the MPC so that the faceplate faces you.
8. Lift the MPC into place, and carefully align the sides of the MPC with the guides inside the card cage.

   CAUTION: **When the MPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.**
9. Slide the MPC all the way into the card cage until you feel resistance.
10. Grasp both ejector handles, and rotate them clockwise simultaneously until the MPC is fully seated.
11. If any of the MICs on the MPC connect to fiber-optic cable, remove the rubber safety cap from each transceiver and cable.

    WARNING: **Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.**
12. Insert the appropriate cable into the cable connector ports on each MIC on the MPC. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.

    CAUTION: **Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.**

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

13. Use one of the following methods to bring the MPC online:

    - Press and hold the corresponding MPC online button on the craft interface until the green **OK/FAIL** LED next to the button lights steadily, in about 5 seconds.
    - Issue the following CLI command:

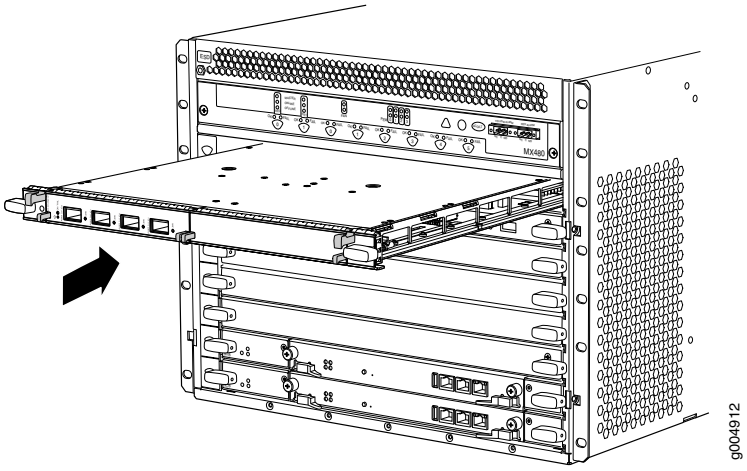
      `user@host>` **request chassis fpc slot** *slot-number* **online**

      For more information about the command, see the CLI Explorer.

CAUTION: After the OK/FAIL LED lights steadily, wait at least 30 seconds before removing the MPC again, removing an MPC from a different slot, or inserting an MPC in a different slot.

You can also verify correct MPC and MIC functioning by issuing the **show chassis fpc** and **show chassis fpc pic-status** commands described in"Maintaining MX480 MPCs" on page 143 and "Maintaining MX480 MICs" on page 145.

Figure 105: Installing an MPC



Related Documentation

- MX480 Modular Port Concentrator (MPC) Description on page 18
- Maintaining MX480 MPCs on page 143
- Tools and Parts Required to Replace MX480 Hardware Components on page 170
- Replacing an MX480 MIC on page 220
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- MX480 MPC Serial Number Label on page 322

Replacing an MX480 MIC

Removing an MX480 MIC

MICs are hot-insertable and hot-removable. When you remove a MIC, the router continues to function, although the MIC interfaces being removed no longer function.

The MICs are located in the MPCs installed in the front of the router. A MIC weighs less than 2 lb (0.9 kg).

To remove a MIC (see Figure 106 on page 221 and Figure 107 on page 221):

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 *mpc-slot* mic-slot *mic-slot* offline**

     For more information about the command, see the CLI Explorer.
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. On the MPC, pull the ejector lever that is adjacent to the MIC you are removing away from the MPC faceplate. Pulling the ejector lever disconnects the MIC from the MPC.

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

8. Grasp the handles on the MIC faceplate, and slide the MIC out of the MPC card carrier. Place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a MIC into the emptied MIC slot within a short time, install a blank MIC panel over the slot to maintain proper airflow in the MPC card cage.

Figure 106: Removing a MIC

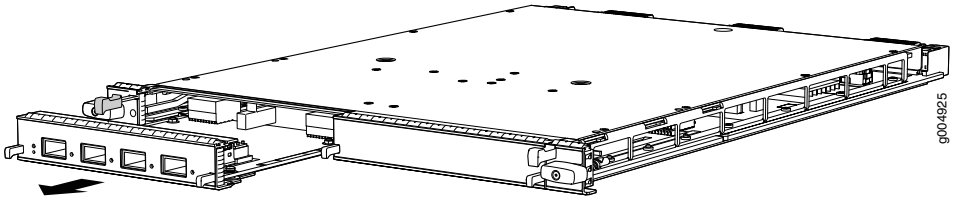
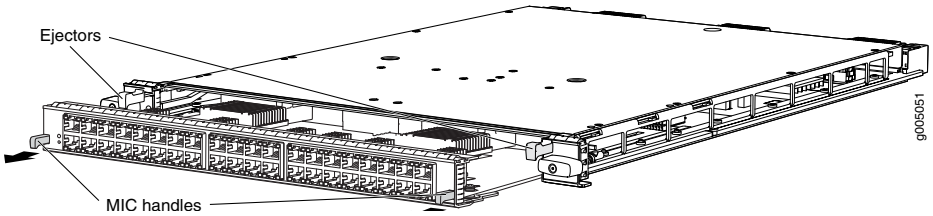


Figure 107: Removing a Dual-Wide MIC

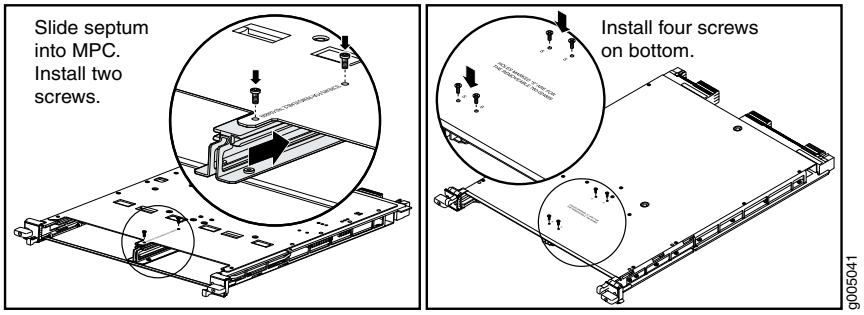


Installing an MX480 MIC

To install a MIC (see Figure 109 on page 223):

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 you have used a dual-wide MIC and are now replacing it with two "single" MICs, install the septum (see Figure 108 on page 222):
   a. Place the MPC on a flat surface (If necessary, remove the MPC from the router as described in "Removing an MX480 MPC" on page 216).
   b. Position the septum in the center of the MPC so that it lines up with holes labeled **S** on the top of the MPC.
   c. Insert a screw into each of the two holes labeled **S**, and then tighten completely.
   d. On the bottom of the MPC, insert a screw into each of the four holes labeled **S**, and then tighten completely.
   e. Install the MPC as described in "Installing an MX480 MPC" on page 218.

Figure 108: Installing the Septum



3. If the MIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.
4. On the MPC, pull the ejector lever that is adjacent to the MIC you are installing away from the MPC faceplate.
5. Align the rear of the MIC with the guides located at the corners of the MIC slot.
6. Slide the MIC into the MPC until it is firmly seated in the MPC.

CAUTION: **Slide the MIC straight into the slot to avoid damaging the components on the MIC.**

7. Verify that the ejector lever is engaged by pushing it toward the MPC faceplate.
8. If the MIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.

WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

CAUTION: Do not leave a fiber-optic transceiver uncovered except when 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.

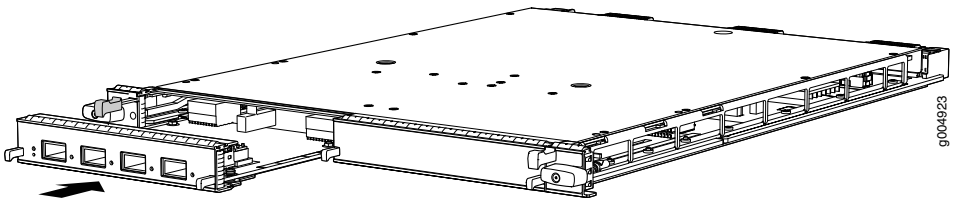
11. Use one of the following methods to bring the MIC online:
    - Press the MIC offline/online button until the MIC **OK/FAIL** LED lights green.
    - Issue the following CLI command:

      `user@host>` **request chassis mic fpc-slot *mpc-slot* mic-slot *mic-slot* online**

      For more information about the command, see the CLI Explorer.

    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 MX480 MICs" on page 145.

Figure 109: Installing a MIC

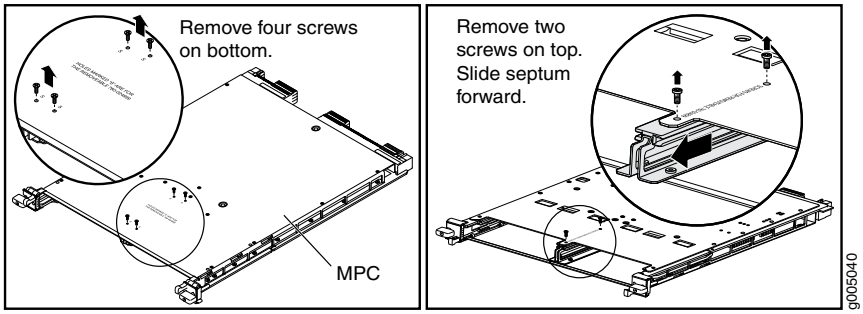


Installing an MX480 Dual-Wide MIC

To install a dual-wide MIC (see Figure 111 on page 225):

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 septum, if necessary (see Figure 110 on page 224):
   a. Place the MPC on a flat surface (if necessary, remove the MPC from the router as described in "Removing an MX480 MPC" on page 216).
   b. Remove the four screws labeled **S** on the bottom of the MPC.
   c. Remove the two screws labeled **S** on the top of the MPC.
   d. Slide the septum towards you and out of the MPC.
   e. Store the septum and screws for later use.
   f. Install the MPC as described in "Installing an MX480 MPC" on page 218.

Figure 110: Removing the Septum



3. If the MIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.
4. Pull the ejector lever above both MIC slots away from the router.
5. Align the rear of the MIC with the guides located at the corners of the MIC slot.
6. Slide the MIC into the MIC slot until it is firmly seated in the chassis.

CAUTION: **Slide the MIC straight into the slot to avoid damaging the components on the MIC.**

7. Verify that the ejector levers are engaged by pushing them toward the router.
8. If the MIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.

WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

CAUTION: Do not leave a fiber-optic transceiver uncovered except when 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.

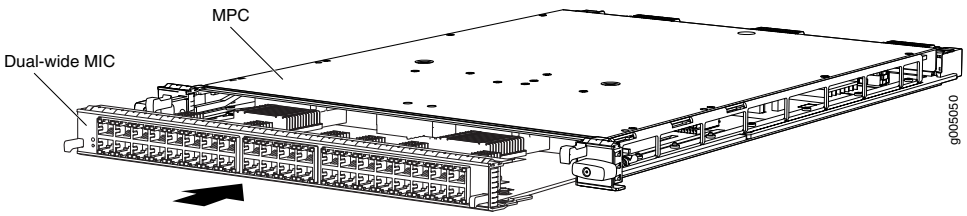
CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

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** ***mpc-slot*** **mic-slot** ***mic-slot*** **online**

    The normal functioning status LED confirms that the MIC is online. You can also verify correct MIC functioning by issuing the **show chassis fpc pic-status** command described in "Maintaining MX480 MICs" on page 145.

Figure 111: Installing a Dual-Wide MIC



Related Documentation

- MX480 Modular Interface Card (MIC) Description on page 20
- Maintaining MX480 MICs on page 145

- Troubleshooting the MX480 MICs on page 166
- Replacing an MX480 MPC on page 215
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- MX480 MIC Serial Number Label on page 323

Replacing a Cable on an MX480 DPC, MPC, MIC, or PIC

1. Removing a Cable on an MX480 DPC, MPC, MIC, or PIC on page 226
2. Installing a Cable on an MX480 DPC, MPC, MIC, or PIC on page 227

Removing a Cable on an MX480 DPC, MPC, MIC, or PIC

Removing and installing cables on a DPC, MPC, MIC, or PIC does not affect router function.

To remove a cable:

1. Have ready a rubber safety cap for each fiber-optic cable and transceiver.
2. If removing all cables connected to the component, use one of the following methods to take the component offline:
   - To take a DPC or an MPC offline:
     - Press and hold the corresponding online button on the craft interface. The green **OK** LED next to the button begins to blink. Hold the button down until the LED goes off.
     - Issue the following CLI command:

       `user@host>` **request chassis fpc slot** ***slot-number*** **offline**

       For more information about the command, see the CLI Explorer.
   - To take a PIC offline:
     - Press the online/offline button on the PIC. For a PIC installed in an FPC3, use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the PIC LED goes off (about 5 seconds).
     - Issue the following CLI command:

       `user@host>` **request chassis pic fpc-slot** *`fpc-slot`* **pic-slot** *`pic-slot`* **offline**

       For more information about the command, see the CLI Explorer.
   - To take a MIC offline:
     - Press the online/offline button on the MIC. Use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the MIC LED goes off (about 5 seconds).
     - Issue the following CLI command:

       `user@host>` **request chassis mic fpc-slot** *`mpc-slot`* **pic-slot** *`mic-slot`* **offline**

       For more information about the command, see the CLI Explorer.

3. Disconnect the cable from the cable connector port. If the component 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 brackets.
5. Disconnect the cable from the destination port.

Installing a Cable on an MX480 DPC, MPC, MIC, or PIC

To install a cable:

1. Have ready a length of the type of cable used by the DPC, MPC, MIC, or PIC. For cable specifications, see the *MX Series Interface Module Reference*.
2. If the cable connector port is covered by a rubber safety plug, remove the plug.

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 component faceplate.
4. Arrange the cable in the cable management brackets to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

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

5. Insert the other end of the cable into the destination port.
6. Repeat the previous steps for any additional cables.
7. If the component is offline (its failure indicator LED is lit), use one of the following methods to bring the it online:
   - To bring a DPC or an MPC online:
     - Press and hold the corresponding online button on the craft interface until the green **OK** LED next to the button lights steadily, in about 5 seconds.
     - Issue the following CLI command:

       `user@host>` **request chassis fpc slot** ***slot-number*** **online**

       For more information about the command, see the CLI Explorer.
   - To bring a PIC online:
     - Press the PIC offline/online button until the PIC LED lights green. For a PIC installed in an FPC2 or FPC3, use a narrow-ended tool that fits inside the opening that leads to the button.
     - Issue the following CLI command:

       `user@host>` **request chassis pic fpc-slot** *`fpc-slot`* **pic-slot** *`pic-slot`* **online**

       For more information about the command, see the CLI Explorer.
   - To bring a MIC online:
     - Press the MIC offline/online button until the MIC LED lights green.
     - Issue the following CLI command:

       `user@host>` **request chassis mic fpc-slot** *`mpc-slot`* **pic-slot** *`mic-slot`* **online**

       For more information about the command, see the CLI Explorer.

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

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Maintaining Cables That Connect to MX480 DPCs, MPCs, MICs, or PICs on page 146

Replacing an SFP or XFP Transceiver on an MX480 DPC, MPC, MIC, or PIC

Removing an SFP or XFP Transceiver from an MX480 DPC, MPC, MIC, or PIC

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

To remove an SFP or XFP transceiver (see Figure 112 on page 230):

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. Carefully arrange the disconnected cable in the cable management brackets to prevent the cable from developing stress points.

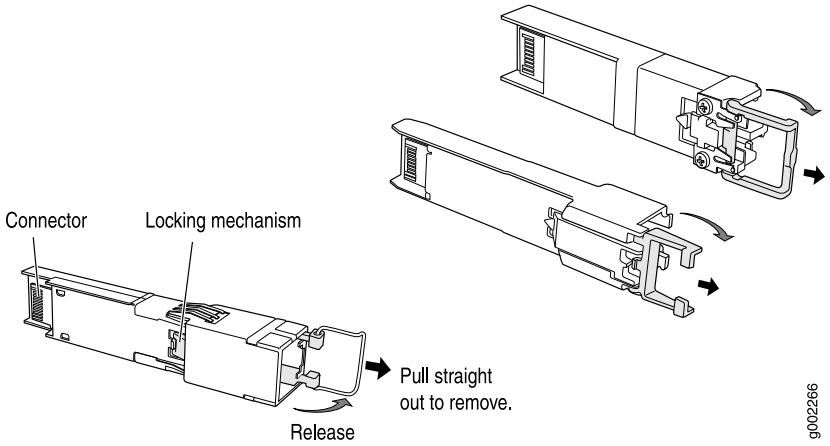
   CAUTION: **Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.**

6. Pull the ejector handle out from the transceiver to unlock the transceiver.

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

   Use needlenose pliers to pull the ejector handle out from the transceiver.
7. Grasp the transceiver ejector handle, and pull the transceiver approximately 0.5 in. (1.3 cm) out of the DPC, MPC, MIC, or PIC.
8. Using your fingers, grasp the body of the transceiver, and pull it the rest of the way out of the DPC, MPC, MIC, or PIC.

Figure 112: Removing SFPs or XFPs



9. Place a rubber safety cap over the transceiver.
10. Place the removed transceiver on an antistatic mat or in an electrostatic bag.

CAUTION: After removing a transceiver from the chassis, wait at least 30 seconds before reinserting it or inserting a transceiver into a different slot.

Installing an SFP or XFP Transceiver into an MX480 DPC, MPC, MIC, or PIC

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

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Replacing a Cable on an MX480 DPC, MPC, MIC, or PIC on page 226

Replacing MX480 Power System Components

- Replacing an MX480 AC Power Supply on page 231
- Replacing an MX480 DC Power Supply on page 233
- Replacing an MX480 AC Power Supply Cord on page 238
- Replacing an MX480 DC Power Supply Cable on page 239

Replacing an MX480 AC Power Supply

1. Removing an MX480 AC Power Supply on page 231
2. Installing an MX480 AC Power Supply on page 232

Removing an MX480 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.

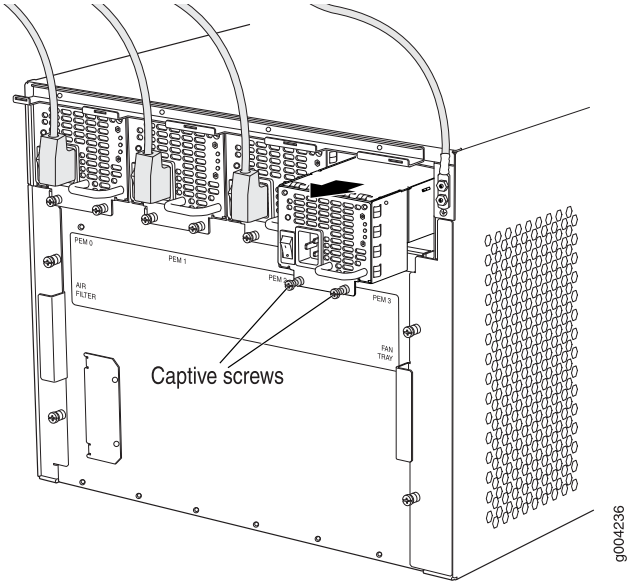
CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

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 113 on page 232):

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. Unscrew the captive screws on the bottom edge of the power supply.
6. Pull the power supply straight out of the chassis.

Figure 113: Removing an AC Power Supply



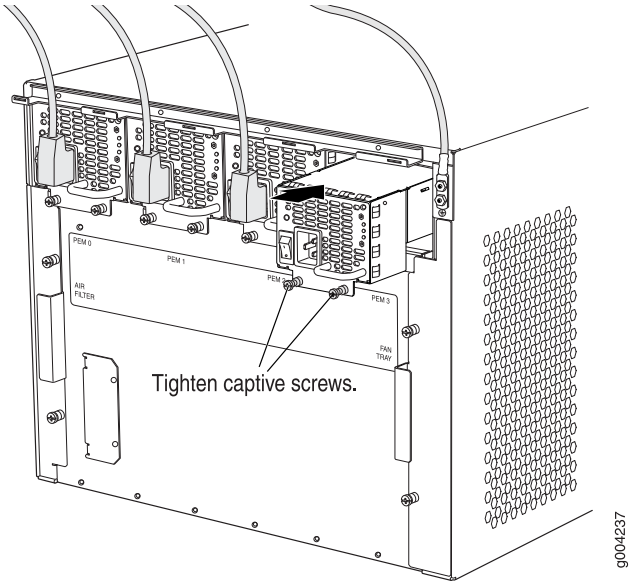
Installing an MX480 AC Power Supply

To install an AC power supply (see Figure 114 on page 233):

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. Tighten both captive screws at the bottom of the power supply.

5. Attach the power cord to the power supply.
6. Route the power cord along the cable restraint toward the left or right corner of the chassis. If needed to hold the power cord in place, thread plastic cable ties, which you must provide, through the openings on the cable restraint.
7. Attach the power cord to the AC power source, and switch on the dedicated customer site circuit breaker for the power supply. Follow the ESD and connection instructions for your site.
8. Move the AC input switch next to the appliance inlet on the power supply to the on (|) position and observe the status LEDs on the power supply faceplate. If the power supply is correctly installed and functioning normally, the **AC OK** and **DC OK** LEDs light steadily, and the **PS FAIL** LED is not lit.

Figure 114: Installing an AC Power Supply in an MX480 Router



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- MX480 AC Power Supply Description on page 50

Replacing an MX480 DC Power Supply

1. Removing an MX480 DC Power Supply on page 233
2. Installing an MX480 DC Power Supply on page 235

Removing an MX480 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.

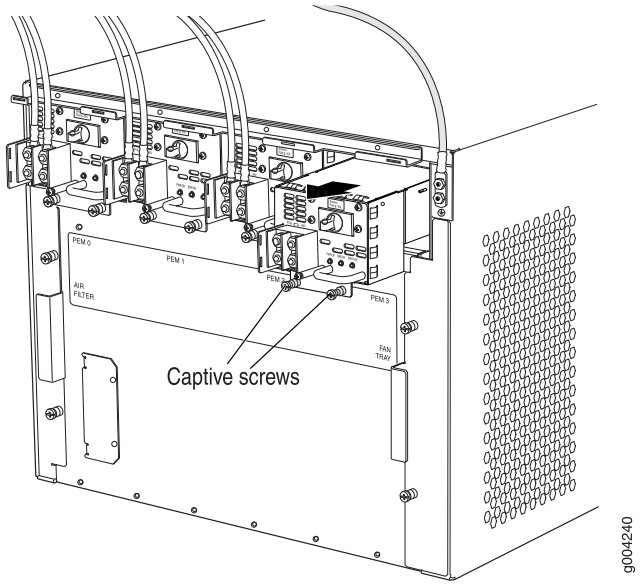
CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

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 115 on page 235):

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. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Move the DC circuit breaker on the DC power supply faceplate to the off (**O**) position.
5. Remove the clear plastic cover protecting the terminal studs on the faceplate.
6. Remove the nut and washer from each of the terminal studs. (Use a 7/16-in. [11 mm] nut driver or socket wrench.)
7. Remove the cable lugs from the terminal studs.
8. Loosen the captive screws on the bottom edge of the power supply faceplate.
9. Carefully move the power cables out of the way.
10. Pull the power supply straight out of the chassis.

Figure 115: Removing a DC Power Supply from the Router



Installing an MX480 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 116 on page 237):

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. Move the DC circuit breaker on the 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. Tighten the captive screws on the lower edge of the power supply faceplate.
6. Remove the clear plastic cover protecting the terminal studs on the faceplate.
7. Remove the nut and washer from each of the terminal studs.
8. Secure each power cable lug to the terminal studs, first with the flat washer, then with the split washer, and then with the nut (see Figure 117 on page 238). Apply between

23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut. Do not overtighten the nut. (Use a 7/16-in. [11 mm] torque-controlled driver or socket wrench.)

a. Secure 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 nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when improperly threaded may result in damage to the terminal stud.

CAUTION: The maximum torque rating of the terminal studs on the DC power supply is 36 lb-in. (4.0 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC power supply terminal studs.

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

NOTE: The DC power supplies in **PEM0** and **PEM1** must be powered by dedicated power feeds derived from feed **A**, and the DC power supplies in **PEM2** and **PEM3** must be powered by dedicated power feeds derived from feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system.

NOTE: For information about connecting to DC power sources, see "DC Power Supply Electrical Specifications for the MX480 Router" on page 302.

9. Replace the clear plastic cover over the terminal studs on the faceplate.

10. Route the power cables along the cable restraint toward the left or right corner of the chassis. If needed to hold the power cables in place, thread plastic cable ties, which you must provide, through the openings on the cable restraint.

11. 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.
12. Switch on the dedicated customer site circuit breakers. Follow your site's procedures for safety and ESD.

    Verify that the **INPUT OK** LED on the power supply is lit green.
13. 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 LEDs on the power supply faceplate. If the power supply is correctly installed and functioning normally, the **PWR OK**, **BRKR ON**, and **INPUT OK** LEDs light green steadily.

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

NOTE: An SCB must be present for the PWR OK LED to go on.

Figure 116: Installing a DC Power Supply in the Router

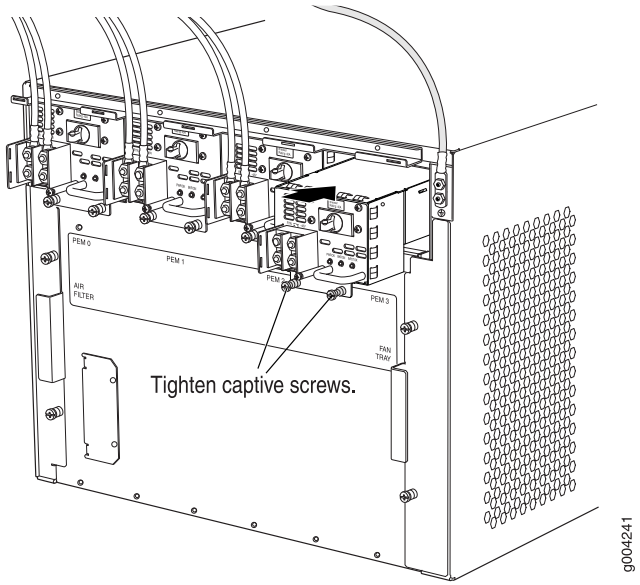
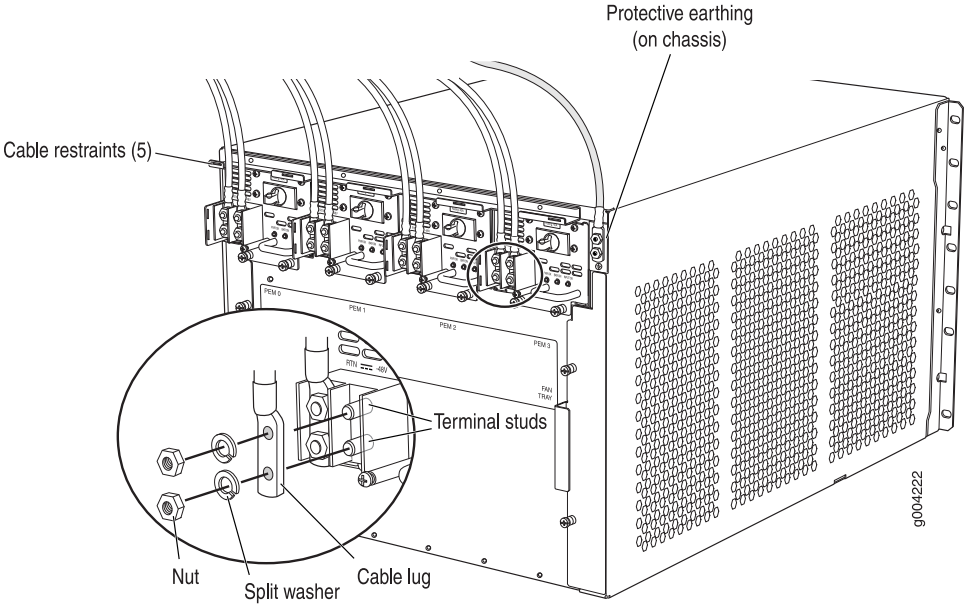


Figure 117: Connecting DC Power to the Router



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- MX480 DC Power Supply Description on page 52

Replacing an MX480 AC Power Supply Cord

1. Disconnecting an MX480 AC Power Supply Cord on page 238
2. Connecting an MX480 AC Power Supply Cord on page 239

Disconnecting an MX480 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 MX480 AC Power Supply Cord

To connect the AC power cord:

1. Locate a replacement power cord with the type of plug appropriate for your geographical location (see "AC Power Cord Specifications for the MX480 Router" on page 300).
2. Connect the power cord to the power supply.
3. Route the power cord along the cable restraint toward the left or right corner of the chassis. If needed to hold the power cord in place, thread plastic cable ties, which you must provide, through the openings on the cable restraint.
4. 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. Attach the power cord to the AC power source, and switch on the dedicated customer site circuit breaker for the power supply. Follow the ESD and connection instructions for your site.
6. Switch the AC input switch on the each power supply to the on (—) position and observe the status LEDs on the power supply faceplate. If the power supply is correctly installed and functioning normally, the **AC OK** and **DC OK** LEDs light steadily, and the **PS FAIL** LED is not lit.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Replacing an MX480 AC Power Supply on page 231
- AC Electrical Specifications for the MX480 Router on page 298

Replacing an MX480 DC Power Supply Cable

1. Disconnecting an MX480 DC Power Supply Cable on page 239
2. Connecting an MX480 DC Power Supply Cable on page 240

Disconnecting an MX480 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 **INPUT OK** 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 power supply faceplate to the off (**O**)position.
7. Remove the clear plastic cover protecting the terminal studs on the faceplate.
8. Remove the nut and washer from each of the terminal studs. (Use a 7/16-in. [11 mm] nut driver or socket wrench.)
9. Remove the cable lug from the terminal studs.
10. Remove the power cable from the cable restraint, and then carefully move the cable out of the way.

Connecting an MX480 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.**

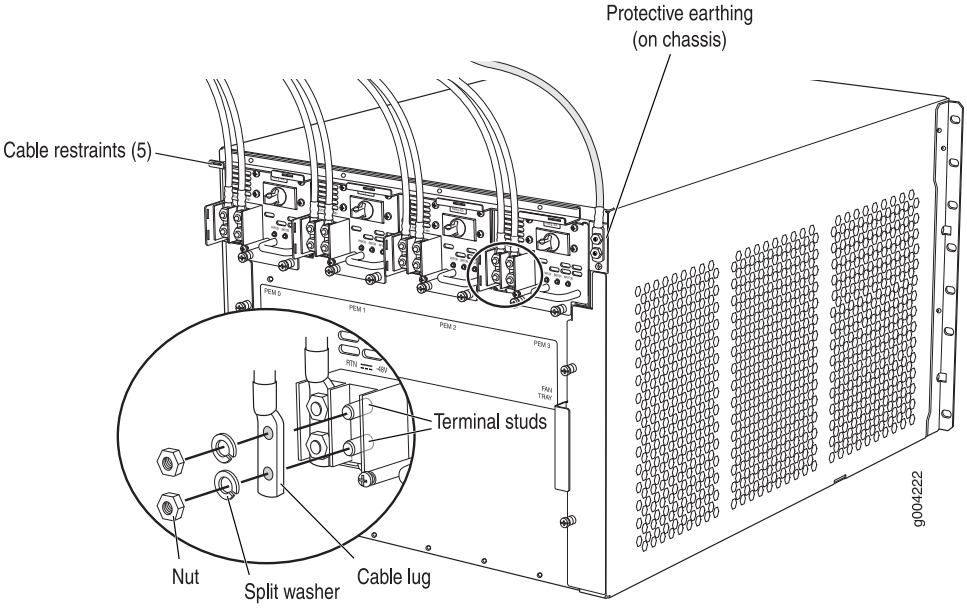
To connect a power cable for a DC power supply:

1. Locate a replacement power cable that meets the specifications defined in "DC Power Cable Specifications for the MX480 Router" on page 305.
2. Verify that a licensed electrician has attached a cable lug to the replacement power cable.
3. Verify that the **INPUT OK** LED is off.
4. Secure the power cable lug to the terminal studs, first with the flat washer, then with the nut. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut (see Figure 118 on page 241). Do not overtighten the nut. (Use a 7/16-in. [11 mm] torque-controlled driver or socket wrench.)

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

CAUTION: The maximum torque rating of the terminal studs on the DC power supply is 36 lb-in. (4.0 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC power supply terminal studs.

Figure 118: Connecting Power Cables to the DC Power Supply



5. Route the power cable along the cable restraint toward the left or right corner of the chassis. If needed, thread plastic cable ties, which you must provide, through the openings on the cable restraint to hold the power cable in place.
6. Verify that the DC power cable is connected correctly, that it does not touch or block access to router components, and that it does not drape where people could trip on it.
7. Replace the clear plastic cover over the terminal studs on the faceplate.
8. Attach the power cable to the DC power source.
9. Turn on the dedicated customer site circuit breaker to the power supply.
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 LEDs on the power supply faceplate. If the power supply is correctly installed and functioning normally, the **PWR OK**, **BRKR ON**, and **INPUT OK** LEDs light green steadily.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- MX480 DC Power Supply Description on page 52
- Replacing an MX480 DC Power Supply on page 233

Replacing the MX480 Cable Management Brackets

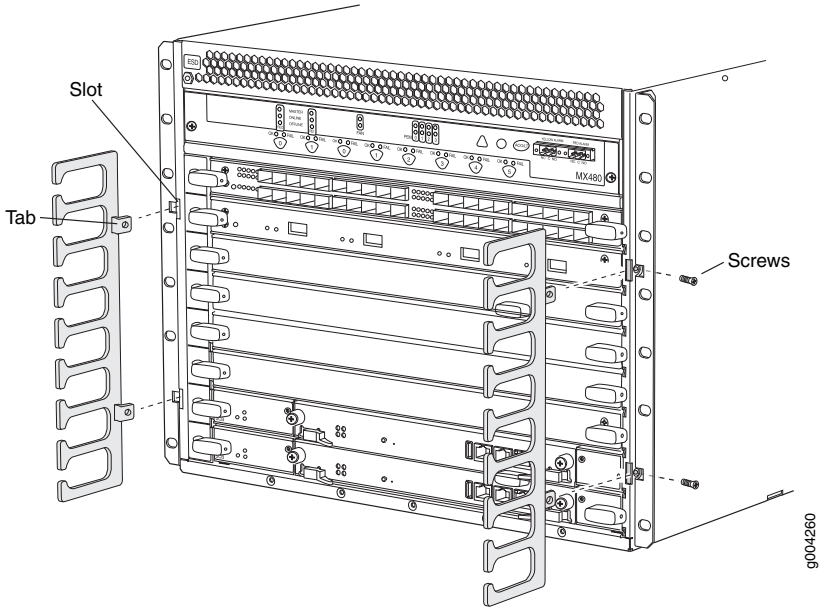
To remove the cable management brackets (see Figure 119 on page 242):

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 screws on either side of the chassis.
3. Remove the cable management brackets.

To install the cable management brackets (see Figure 119 on page 242):

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 on the front sides of the chassis.
3. Insert the tabs into the slots.
4. Tighten the screws completely.

Figure 119: Removing the Cable Management Brackets



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- MX480 Cable Management Brackets on page 57
- Installing the MX480 Router Cable Management Bracket on page 89

PART 4

Appendixes

APPENDIX A

Safety and Regulatory Compliance Information for the MX480 Router

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 248
- Installation Safety Warnings for Juniper Networks Devices on page 252
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 262
- General Electrical Safety Warnings for Juniper Networks Devices on page 267
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 273

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.

Related Documentation

- General Safety Warnings for Juniper Networks Devices on page 248

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 252
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 262
- General Electrical Safety Warnings for Juniper Networks Devices on page 267
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 273

Preventing Electrostatic Discharge Damage to an MX480 Router

Many router hardware components are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

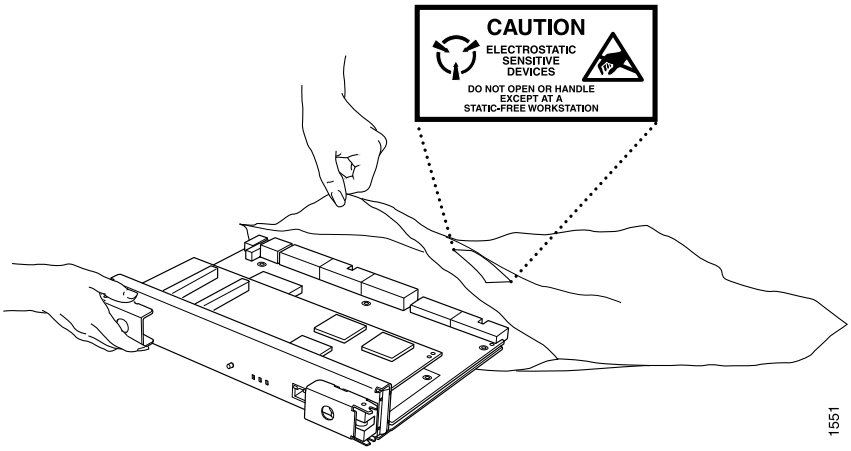
- Always use an ESD wrist strap or ankle strap, and make sure that it is in direct contact with your skin.

  CAUTION: For safety, periodically check the resistance value of the ESD strap. The measurement should be in the range of 1 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.
- 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 Figure 120 on page 251 . If you are returning a component, place it in an electrostatic bag before packing it.

Figure 120: Placing a Component into an Electrostatic Bag



Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 247
- General Safety Warnings for Juniper Networks Devices on page 248
- Fire Safety Requirements for Juniper Networks Devices on page 251
- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 271

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 247
- General Safety Warnings for Juniper Networks Devices on page 248
- General Electrical Safety Warnings for Juniper Networks Devices on page 267
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 273

Installation Safety Warnings for Juniper Networks Devices

Observe the following warnings before and during hardware equipment installation:

- Intra-Building Ports Warning on page 253
- Installation Instructions Warning on page 253
- Rack-Mounting Requirements and Warnings on page 253
- Ramp Warning on page 257

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 247
- General Safety Warnings for Juniper Networks Devices on page 248
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 262

MX480 Chassis Lifting Guidelines

The weight of a fully configured chassis is about 163.5 lb (74.2 kg). Observe the following guidelines for lifting and moving the router:

- Before moving the router, verify that the intended site meets the specified power, environmental, and clearance requirements.
- Do not attempt to lift a fully configured router by yourself. Using a mechanical lift to maneuver the router into a rack is recommended. If a lift cannot be used, a minimum of two people must lift the router, and you must remove components from the chassis before lifting.

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

  - Up to 39.7 lbs (18 kg) 1 person lift.
  - 39.7 lbs (18 kg) to 70.5 lbs (32 kg) 2 or more person lift.
  - 70.5 lbs (32 kg) to 121.2 lbs (55 kg) 3 or more person lift.
  - 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).
- Before lifting or moving the router, disconnect all external cables.
- 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

- MX480 Site Preparation Checklist on page 61
- Removing Components from the MX480 Router Before Installing It Without a Lift on page 91
- Installing the MX480 Chassis in the Rack Manually on page 97
- Installation Safety Warnings for Juniper Networks Devices on page 252

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 259
- General Safety Warnings for Juniper Networks Devices on page 248

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 247
- General Safety Warnings for Juniper Networks Devices on page 248
- Installation Safety Warnings for Juniper Networks Devices on page 252

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 40º C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

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

Product Disposal Warning

WARNING: **Disposal of this product must be handled according to all national laws and regulations.**

Waarschuwing Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

Varoitus Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

Attention La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

Warnung Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

Avvertenza L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

Advarsel Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

Aviso A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

¡Atención! El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

Varning! Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 247
- General Safety Warnings for Juniper Networks Devices on page 248

Electrical Safety Guidelines and Warnings for the MX480 Router

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 273

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 247
- General Safety Warnings for Juniper Networks Devices on page 248

General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers

- 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

- MX480 Field-Replaceable Units (FRUs) on page 169
- General Electrical Safety Warnings for Juniper Networks Devices on page 267

MX480 AC Power Electrical Safety Guidelines and Warnings

- MX480 AC Power Electrical Safety Guidelines and Warnings on page 271

MX480 AC Power Electrical Safety Guidelines and Warnings

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.
- Each AC power supply has one AC appliance inlet. Each inlet requires a dedicated AC power feed and a dedicated customer site circuit breaker. We recommend that you

use a dedicated circuit breaker rated at 15 A (250 VAC) minimum, or as required by local code.

WARNING: The router is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for UNC 1/4-20 ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal must be permanently connected to earth.

- The cores in the main lead are colored in accordance with the following code:
  - Green and yellow—Earth
  - Blue—Neutral
  - Brown—Live

Related Documentation

- AC Electrical Specifications for the MX480 Router on page 298
- Calculating Power Requirements for MX480 Routers on page 285
- AC Power Circuit Breaker Requirements for the MX480 Router on page 299
- AC Power Cord Specifications for the MX480 Router on page 300
- Connecting Power to an AC-Powered MX480 Router with Normal-Capacity Power Supplies on page 113

MX480 DC Power Electrical Safety Guidelines and Warnings

- MX480 DC Power Electrical Safety Guidelines on page 272
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 273

MX480 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 58 A (32 A per feed) @ –48 VDC for the system. The 48 VDC facility DC source should be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum. 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 40 A (–48 VDC) or a minimum of 125% of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada. Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 50 A.

- A DC-powered router that is equipped with a DC terminal block is intended for installation only in a restricted access location. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

NOTE: **Primary overcurrent protection is provided by the building circuit breaker. This breaker should protect against excess currents, short circuits, and earth faults in accordance with NEC ANSI/NFPA70.**

- 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 **RETURN**, the negative lead to the terminal labeled **–48V**, and the earth ground to the chassis grounding points.

Related Documentation

- DC Power Supply Electrical Specifications for the MX480 Router on page 302
- Calculating Power Requirements for MX480 Routers on page 285
- DC Power Circuit Breaker Requirements for the MX480 Router on page 303
- DC Power Cable Specifications for the MX480 Router on page 305
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 273

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 273
- DC Power Disconnection Warning on page 274
- DC Power Wiring Terminations Warning on page 275

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 248
- General Electrical Safety Warnings for Juniper Networks Devices on page 267

Agency Approvals and Compliance Statements for the MX480 Router

- Agency Approvals for MX480 Routers on page 277
- Compliance Statements for NEBS for MX480 Routers on page 278
- Compliance Statements for EMC Requirements for the MX480 Router on page 278

- Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 280
- Compliance Statements for Acoustic Noise for the MX480 Router on page 280

Agency Approvals for MX480 Routers

The routers comply with the following standards:

- Safety
  - CAN/CSA-22.2 No. 60950-00/UL 1950 Third Edition, Safety of Information Technology Equipment
  - EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
  - EN 60950 Safety of Information Technology Equipment
- EMC
  - AS/NZS CISPR22:2009 (Australia/New Zealand)
  - EN55022 Class A (Europe)
  - FCC Part 15 Class A (USA)
  - VCCI Class A (Japan)
- Immunity
  - EN-61000-3-2 Power Line Harmonics
  - EN-61000-3-3 Voltage Fluctuations and Flicker
  - EN-61000-4-2 ESD
  - EN-61000-4-3 Radiated Immunity
  - EN-61000-4-4 EFT
  - EN-61000-4-5 Surge
  - EN-61000-4-6 Low Frequency Common Immunity
  - EN-61000-4-11 Voltage Dips and Sags
- ETSI
  - ETSI EN-300386-2 Telecommunication Network Equipment. Electromagnetic Compatibility Requirements

The router is designed to comply with the following standards:

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

- GR-63-Core: NEBS, Physical Protection

Related Documentation

- Compliance Statements for NEBS for MX480 Routers on page 278
- Compliance Statements for EMC Requirements for the MX480 Router on page 278
- Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 280
- Compliance Statements for Acoustic Noise for the MX480 Router on page 280

Compliance Statements for NEBS for MX480 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.

Related Documentation

- Agency Approvals for MX480 Routers on page 277
- Compliance Statements for EMC Requirements for the MX480 Router on page 278
- Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 280
- Compliance Statements for Acoustic Noise for the MX480 Router on page 280

Compliance Statements for EMC Requirements for the MX480 Router

Canada

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

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

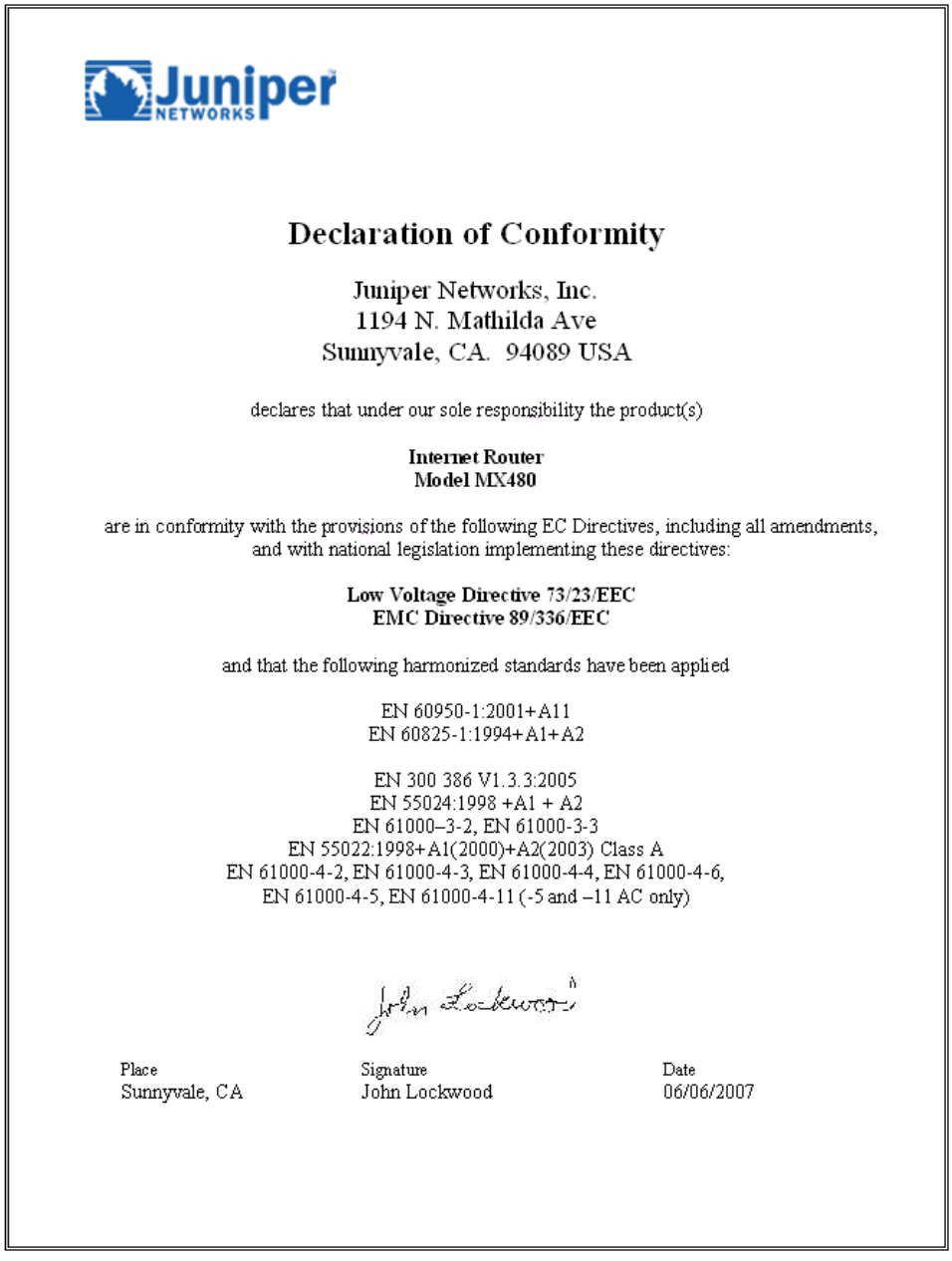
European Community

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Declaration of Conformity

This topic shows the Declaration of Conformity for the router.

Figure 121: MX480 Declaration of Conformity



Juniper NETWORKS

Declaration of Conformity

Juniper Networks, Inc.
1194 N. Mathilda Ave
Sunnyvale, CA. 94089 USA

declares that under our sole responsibility the product(s)

Internet Router
Model MX480

are in conformity with the provisions of the following EC Directives, including all amendments, and with national legislation implementing these directives:

Low Voltage Directive 73/23/EEC
EMC Directive 89/336/EEC

and that the following harmonized standards have been applied

EN 60950-1:2001+A11
EN 60825-1:1994+A1+A2

EN 300 386 V1.3.3:2005
EN 55024:1998 +A1 + A2
EN 61000–3-2, EN 61000-3-3
EN 55022:1998+A1(2000)+A2(2003) Class A
EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-6,
EN 61000-4-5, EN 61000-4-11 (-5 and –11 AC only)

Place	Signature	Date
Sunnyvale, CA	John Lockwood	06/06/2007

Japan

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

Translation from Japanese—This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. VCCI-A

United States

The router has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Related Documentation

- Agency Approvals for MX480 Routers on page 277
- Compliance Statements for NEBS for MX480 Routers on page 278
- Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 280
- Compliance Statements for Acoustic Noise for the MX480 Router on page 280

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

- General Safety Guidelines for Juniper Networks Devices on page 247
- General Safety Warnings for Juniper Networks Devices on page 248

Compliance Statements for Acoustic Noise for the MX480 Router

- 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

Related Documentation

- Agency Approvals for MX480 Routers on page 277
- Compliance Statements for NEBS for MX480 Routers on page 278
- Compliance Statements for EMC Requirements for the MX480 Router on page 278
- Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 280

APPENDIX B

MX480 Router Physical Specifications

MX480 Router Physical Specifications

Table 27 on page 281 summarizes the physical specifications for the router chassis.

Table 27: Physical Specifications

Description	Weight	Width	Depth	Height
Chassis dimensions	Chassis with midplane, fan tray, air filter, and cable management brackets: 65.5 lb (29.7 kg) Maximum configuration: 163.5 lb (74.2 kg)	17.45 in. (44.3 cm)	24.5 in. (62.2 cm) (from front to chassis rear) Total depth (including cable management brackets) 27.75 in. (70.5 cm)	14.0 in. (35.6 cm)
Routing Engine	2.4 lb (1.1 kg)	11 in (27.9 cm)	7.75 in (19.7 cm)	1.25 in (3.2 cm)
SCB	9.6 lb (4.4 kg) (with Routing Engine installed)	17 in (43.2 cm)	22 in (55.9 cm)	1.25 in (3.2 cm)
SCBE	9.6 lb (4.4 kg) (with Routing Engine installed)	17 in (43.2 cm)	22 in (55.9 cm)	1.25 in (3.2 cm)
SCBE2	9.6 lb (4.4 kg) (with Routing Engine installed)	17 in (43.2 cm)	22 in (55.9 cm)	1.25 in (3.2 cm)
DPC	Maximum up to 14.5 lb (6.6 kg) Blank panel in DPC slot: 9 lb	17 in (43.2 cm)	22 in (55.9 cm)	1.25 in (3.2 cm)

Table 27: Physical Specifications *(continued)*

Description	Weight	Width	Depth	Height
FPC	FPC2: 13 lb (5.9 kg) FPC3: 14 lb (6.5 kg)	17 in (43.2 cm)	22 in (55.9 cm)	2.5 in (6.4 cm)
PIC	2 lb (0.9 kg)	7.75 in (28.3 cm)	11.125 in (19.7 cm)	4.125 in (10.5 cm)
MPC (fixed configuration)	18.35 lb (8.3 kg)	17 in (43.2 cm)	22 in (55.9 cm)	1.25 in (3.2 cm)
MPC (without MICs)	14 lb (6.4 kg)	17 in (43.2 cm)	22 in (55.9 cm)	1.25 in (3.2 cm)
MIC	Maximum up to 1.2 lb (0.54 kg)	6.25 in (15.9 cm)	6.8 in (17.3 cm)	1.25 in (3.2 cm)
Craft interface	1.1 lb (0.5 kg)	21.25 in (54 cm)	8.5 in (21.6 cm)	6.25 in (15.9 cm)
Fan tray	6.8 lb (3.08 kg)	17 in (43.2 cm)	22 in (55.9 cm)	1.5 in (3.8 cm)
Air filter	1.0 lb (0.5 kg)	0.31 in (0.8 cm)	22.23 in (56.5 cm)	10.1 in (25.6 cm)
Cable management brackets	0.3 lb (0.14 kg)	0.25 in (0.6 cm)	4.5 in (11.4 cm)	9.9 in (25.0 cm)
DC power supply	3.8 lb (1.7 kg)	14.5 in (36.8 cm)	4 in (10.2 cm)	1.75 in (4.4 cm)
High-capacity DC power supply	6.2 lb (2.81 kg)	14.5 in (36.8 cm)	4 in (10.2 cm)	1.75 in (4.4 cm)
AC power supply	5.0 lb (2.3 kg)	14.5 in (36.8 cm)	4 in (10.2 cm)	1.75 in (4.4 cm)
High-capacity AC power supply	6.6 lb (2.99 kg)	14.5 in (36.8 cm)	4 in (10.2 cm)	1.75 in (4.4 cm)

Related Documentation

- MX480 Chassis Lifting Guidelines on page 258
- MX480 Router Description on page 3
- MX480 Chassis Description on page 9

APPENDIX C

MX480 Router Environmental Specifications

MX480 Router Environmental Specifications

Table 28 on page 283 specifies the environmental specifications required for normal router operation. In addition, the site should be as dust-free as possible.

Table 28: 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	AC power: 11,322 BTU/hour (3,318 W) DC power: 9,632 BTU/hour (2,823 W) NOTE: These specifications are estimates and subject to change.

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

Related Documentation

- Tools and Parts Required to Maintain the MX480 Router on page 131
- In Case of an Electrical Accident on page 270

APPENDIX D

Power Guidelines, Requirements, and Specifications for the MX480 Router

Calculating Power Requirements for MX480 Routers

The information in this topic helps you determine which power supplies are suitable for various configurations, as well as which power supplies are not suitable because output power is exceeded. You determine suitability by subtracting the total power draw from the maximum output of the power supplies. Afterward, the required input power is calculated. Finally, you calculate the thermal output. A sample configuration is provided in Table 30 on page 287.

We recommend that you provision power according to the maximum input current listed in the power supply electrical specifications (see "AC Electrical Specifications for the MX480 Router" on page 298and "DC Power Supply Electrical Specifications for the MX480 Router" on page 302).

Use the following procedures to calculate the power requirement:

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

Both normal-capacity and high-capacity MX480 chassis with DC power supplies are zoned, meaning that certain components are powered by specific power supplies (see Table 29 on page 286 for information on zoning). When calculating power requirements, be sure that there is adequate power for each zone.

For an AC-powered chassis, there is one overall zone. Two AC power supplies are mandatory for high-line, and three AC power supplies are mandatory for low-line power.

Table 29: MX480 DC Zoning

Zone	Power Supply (PEM)	Components Receiving Power
Zone 0	PEM 0 or 2	• Fan Tray • DPC/MPC slots 0 and 1 • SCB slots 0 and 1
Zone 1	PEM 1 or 3	• Fan Tray • DPC slots 2 through 5

The following sample configuration shows a DC-powered MX480 with:

- Two 16-port 10-Gigabit Ethernet MPCs with SFP+ (slots 0 and 1)
- Two SCBs with two (redundant) RE-1800x2 routing engines (SCB slot 0 and SCB slot 1)
- One DPCE-R-4XGE-XFP (slot 3)
- High-capacity cooling system

NOTE: **The high-capacity cooling system satisfies cooling requirements of MPCs, and must be used for proper cooling.**

1. Calculate the power requirements (usage) using the values in "Power Requirements for an MX480 Router" on page 289 as shown in Table 30 on page 287.

Table 30: Sample Power Requirements for an MX480 Router

Chassis Component	Part Number	Power Requirement	Zone
Base system	MX480BASE-DC-HIGH	40 W	—
High-capacity cooling system	FFANTRAY-MX480-HC	160 W	Zone 0 and Zone 1
MPC - Slot 2	MPC-3D-16XGE-SFPP-R-B	440 W	Zone 0
MPC - Slot 1	MPC-3D-16XGE-SFPP-R-B	440 W	Zone 0
SCB 1	SCBE2-MX with RE-S-1800X2-8G	185 W 90 W	Zone 0
SCB 0	SCBE2 with RE-S-1800X2-8G	185 W 90 W	Zone 0
DPC - Slot 3	DPCE-R-4XGE-XFP	310 W	Zone 1
Zone 0 total output power Zone 1 total output power		1530 W 410 W	
Zone 0 total output power (excluding cooling system) Zone 1 total output power (excluding cooling system)		1450 W 330 W	

2. Evaluate the power budget. In the case of a DC-powered chassis, evaluate the budget for each zone. In this step, we check the required power against the maximum output power of available power supply options.

NOTE: **The power for the cooling system comes from a different tap on the power supply, reserved for the cooling system only. The cooling system power requirement does not need to be deducted from the output power budget of the power supply.**

Table 31 on page 288 lists the power supplies, their maximum output power, and unused power (or a power deficit) for MX480 AC chassis. Table 32 on page 288 lists the power supplies, their maximum output power, and unused power (or a power deficit) for MX480 DC chassis. See "AC Electrical Specifications for the MX480 Router" on page 298 and "DC Power Supply Electrical Specifications for the MX480 Router" on page 302 for more information about the MX480 power supply electrical specifications.

Table 31: Calculating Power Budget for a MX480 AC Chassis

Power Supply	Maximum System Output Power	Unused Power[1]
MX480 AC Normal-capacity (low-line)	3081 W	1721 W
MX480 AC Normal-capacity (high-line)	3200 W	1840 W
MX480 AC High-capacity (low-line)	3501 W	2141 W
MX480 AC High-capacity (high-line)	4100 W	2740 W

[1] For this configuration, output power excluding the cooling system is 1360 W.

Table 32: Calculating Power Budget for a MX480 DC Chassis

Power Supply	Maximum System Output Power	Zone 0 Unused Power[1]	Zone 1 Unused Power[2]
MX480 DC Normal-capacity	3200 W	240 W	1290 W
MX480 DC High-capacity (DIP=0) NOTE: The DIP switch position is expected input current; the correct feeds must be present to obtain the desired output power.	4800 W	1040 W	2090 W
MX480 DC High-capacity (DIP=1) NOTE: The DIP switch position is expected input current; the correct feeds must be present to obtain the desired output power.	5200 W	1240 W	2290 W

[1] For this configuration, output power excluding the cooling system is 1360 W.

[2] For this configuration, output power excluding the cooling system is 310 W.

3. Calculate input power. In this step, the input power requirements for the example configuration are calculated. To do this, divide the total output requirement by the efficiency of the power supply as shown in Table 33 on page 288.

Table 33: Calculating Input Power Examples

Power Supply	Power Supply Efficiency[1]	Input Power Requirement[2]
MX480 AC Normal-capacity (high-line)	85 %	1694 W
MX480 AC High-capacity (high-line)	89 %	1618 W
MX480 DC Normal-capacity	~98 %	1469 W[3]
MX480 DC High-capacity	~98 %	1469 W[3]

[1] These values are at full load and nominal voltage.

[2] For this configuration, total power is 1440 W.

[3] Zone 0 requirement.

4. Calculate thermal output (BTUs). To calculate this, multiply the input power requirement (in watts) by 3.41.

Table 34: Calculating Thermal Output

Power Supply	Thermal Output (BTUs per hour)
MX480 AC Normal-capacity (high-line)	1694 * 3.41 = 5777 BTU/hr
MX480 AC High-capacity (high-line)	1618 * 3.41 = 5517 BTU/hr
MX480 DC Normal-capacity	1469 * 3.41 = 4879 BTU/hr[1]
MX480 DC High-capacity	1469 * 3.41 = 5009 BTU/hr[1]

[1] Zone 0 output.

Related Documentation

- Power Requirements for an MX480 Router on page 289
- AC Electrical Specifications for the MX480 Router on page 298
- DC Power Supply Electrical Specifications for the MX480 Router on page 302

Power Requirements for an MX480 Router

The following tables list the MX480 component power requirements. Table 35 on page 289 lists the MX480 base system power requirement. Table 36 on page 290 lists the FRU power requirements for Switch Control Boards (SCBs), Routing Engines, Modular Port Concentrators (MPCs), Modular Interface Cards (MICs), and Dense Port Concentrators (DPCs). In addition, Table 36 on page 290 lists the MPC power requirements with MICs and optics at various operating temperatures.

Table 35: MX480 Router Common Component Power Requirements

Component	Power Requirement (Watts)
Base system	40 W
Normal-capacity cooling system	110 W
High-capacity cooling system	160 W

NOTE: The power for the cooling system comes from a different tap on the power supply, reserved for the cooling system only. The cooling system power requirement does not need to be deducted from the output power budget of the power supply.

Table 36: FRU Power Requirements

Component	Part Number	Maximum Power Requirement
Switch Control Boards (SCBs)		
SCB	SCB-MX960 (applies to MX240, MX480, and MX960)	150 W
SCBE	SCBE-MX (applies to MX240, MX480, and MX960)	160 W at 55 degrees C 130 W at 40 degrees C 120 W at 25 degrees C
SCBE2	SCBE2-MX (applies to MX240, MX480, and MX960)	185 W at 55 degrees C 160 W at 40 degrees C 155 W at 25 degrees C
Routing Engines		
Routing Engines	RE-S-1300-2048 RE-S-1800X2-8G RE-S-1800X4-8G RE-S-1800X2-16G RE-S-1800X4-16G RE-S-2000-4096	90 W
MPCs		
16x10GE MPC	MPC-3D-16XGE-SFPP	440 W at 55 degrees C ambient
	MPC-3D-16XGE-SFPP-R-B	423 W at 25 degrees C ambient
MPC1	MX-MPC1-3D	165 W
	MX-MPC1E-3D	**With MICs and optics:** 239 W at 55 degrees C 227 W at 40 degrees C 219 W at 25 degrees C

Table 36: FRU Power Requirements *(continued)*

Component	Part Number	Maximum Power Requirement
MPC1 Q	MX-MPC1-3D-Q MX-MPC1E-3D-Q	175 W **With MICs and optics:** 249 W at 55 degrees C 237 W at 40 degrees C 228 W at 25 degrees C
MPC2	MX-MPC2-3D MX-MPC2E-3D	274 W **With MICs and optics:** 348 W at 55 degrees C 329 W at 40 degrees C 315 W at 25 degrees C
MPC2 Q *MPC2 EQ*	MX-MPC2-3D-Q MX-MPC2-3D-EQ MX-MPC2E-3D-Q MX-MPC2E-3D-EQ	294 W **With MICs and optics:** 368 W at 55 degrees C 347 W at 40 degrees C 333 W at 25 degrees C
MPC2E P	MX-MPC2E-3D-P	294 W **With MICs and optics:** 368 W at 55 degrees C 347 W at 40 degrees C 333 W at 25 degrees C
MPC3E	MX-MPC3E-3D	440 W **With MICs and optics:** 408 W at 25 degrees C, two CFP MICs with LR4 optics 420 W at 40 degrees C, two CFP MICs with LR4 optics 520 W at 55 degrees C, two 40W MICs
32x10GE MPC4E	MPC4E-3D-32XGE-SFPP	610 W **With optics:** 607 W at 55 degrees C, with SFPP ZR optics 560 W at 40 degrees C, with SFPP ZR optics 550 W at 25 degrees C, with SFPP ZR optics

Table 36: FRU Power Requirements *(continued)*

Component	Part Number	Maximum Power Requirement
2x100GE + 8x10GE MPC4E	MPC4E-3D-2CGE-8XGE	610 W **With optics:** 607 W at 55 degrees C, with SFPP ZR and CFP LR4 optics 550 W at 40 degrees C, with SFPP ZR and CFP LR4 optics 530 W at 25 degrees C, with SFPP ZR and CFP LR4 optics
6x40GE + 24x10GE MPC5E *6x40GE + 24x10GE MPC5EQ*	MPC5E-40G10G MPC5EQ-40G10G	645 W **With optics:** 511 W at 55 degrees C, with SFPP ZR and CFP LR4 optics 541 W at 40 degrees C, with SFPP ZR and CFP LR4 optics 604 W at 25 degrees C, with SFPP ZR and CFP LR4 optics
MPC6E	MX2K-MPC6E	1100 W **With optics:** 734 W at 55 degrees C, with SFPP ZR and CFP LR4 optics 748 W at 40 degrees C, with SFPP ZR and CFP LR4 optics 786 W at 25 degrees C, with SFPP ZR and CFP LR4 optics
MICs		
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	35 W
Gigabit Ethernet MIC with SFP	MIC-3D-20-GE-SFP	37 W
10-Gigabit Ethernet MIC with XFP	2-Port: MIC-3D-2XGE-XFP 4-Port: MIC-3D-4XGE-XFP	2-Port: 29 W 4-Port: 37 W
10-Gigabit Ethernet MIC with SFP+	MIC3-3D-10XGE-SFPP	24.2 W at 55 degrees C with SR and LR optics 29.8W at 55 degrees C with ER optics 29.8 W at 40 degrees C with ZR optics
10-Gigabit Ethernet MIC with SFP+	MIC6-10G	24 W 42 W at 55 degrees C with 10G BASE-SR optics 42 W at 40 degrees C with 10G BASE-SR optics 42 W at 25 degrees C with 10G BASE-SR optics

Table 36: FRU Power Requirements *(continued)*

Component	Part Number	Maximum Power Requirement
40-Gigabit Ethernet MIC with QSFP+	MIC3-3D-2X40GE-QSFPP	18 W
100-Gigabit Ethernet MIC with CFP	MIC3-3D-1X100GE-CFP	40 W
100-Gigabit Ethernet MIC with CXP	MIC3-3D-1X100GE-CXP	20 W
100-Gigabit Ethernet MIC with CXP	MIC6-100G-CXP	39 W 49 W at 55 degrees C with CXP SR10 optics 49 W at 40 degrees C with CXP SR10 optics 49 W at 25 degrees C with CXP SR10 optics
Multi-Services MIC	MS-MIC-16G	60 W
SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4OC3OC12-1OC48	4-Port: 24 W at 55 degrees C 22.75 W at 40 degrees C 21.5 W at 25 degrees C
	8-Port: MIC-3D-8OC3OC12-4OC48	8-Port: 29 W at 55 degrees C 27.75 W at 40 degrees C 26.5 W at 25 degrees C
SONET/SDH OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	41 W at 55 degrees C 38.5 W at 40 degrees C 36 W at 25 degrees C

Table 36: FRU Power Requirements *(continued)*

Component	Part Number	Maximum Power Requirement
Channelized SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4CHOC3-2CHOC12	4-Port: 41 W at 55 degrees C 40 W at 40 degrees C 39 W at 25 degrees C
	8-Port: MIC-3D-8CHOC3-4CHOC12	8-Port: 52 W at 55 degrees C 50.5 W at 40 degrees C 49 W at 25 degrees C
Tri-Rate MIC	MIC-3D-40GE-TX	41 W
DS3/E3 MIC	MIC-3D-8DS3-E3 MIC-3D-8CHDS3-E3-B	36 W at 55 degrees C 35 W at 40 degrees C 34 W at 25 degrees C
Channelized E1/T1 Circuit Emulation MIC	MIC-3D-16CHE1-T1-CE	29.08 W at 55 degrees C 27.84 W at 40 degrees C 26.55 W at 25 degrees C
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	36.48 W at 55 degrees C 35.04 W at 40 degrees C 33.96 W at 25 degrees C
DPCs		
Gigabit Ethernet DPC with SFP	DPC-R-40GE-SFP	335 W
Gigabit Ethernet Enhanced DPC with SFP	DPCE-R-40GE-SFP DPCE-X-40GE-SFP	335 W
Gigabit Ethernet Enhanced Queuing Ethernet Services DPC with SFP (40-Port)	DPCE-R-Q-40GE-SFP DPCE-X-Q-40GE-SFP	365 W

Table 36: FRU Power Requirements *(continued)*

Component	Part Number	Maximum Power Requirement
Gigabit Ethernet Enhanced Queuing IP Services DPCs with SFP (20-Port)	DPCE-R-Q-20GE-SFP	200 W
10-Gigabit Ethernet DPC with XFP	DPC-R-4XGE-XFP	310 W
10-Gigabit Ethernet Enhanced DPC with XFP (2-Port)	DPCE-R-2XGE-XFP	175 W
10-Gigabit Ethernet Enhanced DPC with XFP (4-Port)	DPCE-R-4XGE-XFP DPCE-X-4XGE-XFP	310 W
10-Gigabit Ethernet Enhanced Queuing Ethernet Services DPC with XFP or Enhanced Queuing IP Services DPC with XFP	DPCE-R-Q-4XGE-XFP DPCE-X-Q-4XGE-XFP	330 W
Multi-Rate Ethernet Enhanced DPC with SFP and XFP or Multi-Rate Ethernet Enhanced Ethernet Services DPC with SFP and XFP	DPCE-R-20GE-2XGE DPCE-X-20GE-2XGE	333 W
Multi-Rate Ethernet Enhanced Queuing IP Services DPC with SFP and XFP	DPCE-R-Q-20GE-2XGE	335 W
Tri-Rate Enhanced DPC or Tri-Rate Enhanced Ethernet Services DPC	DPCE-R-40GE-TX DPCE-X-40GE-TX	320 W
Multiservices DPC	MS-DPC	265 W
FPCs		
FPC Type 2	MX-FPC2	190 W (with PICs and optics)
FPC Type 3	MX-FPC3	265 W (with PICs and optics)

Related Documentation

- DC Power Supply Electrical Specifications for the MX480 Router on page 302
- AC Electrical Specifications for the MX480 Router on page 298
- Calculating Power Requirements for MX480 Routers on page 285

MX480 Chassis Grounding Specifications

MX480 Chassis Grounding Points Specifications

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

Two threaded inserts (PEM nuts) are provided on the upper rear of the chassis for connecting the router to earth ground. The grounding points fit UNC 1/4–20 screws (American). The grounding points are spaced at 0.625-in. (15.86-mm) centers (see Figure 122 on page 296 or Figure 123 on page 297).

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

Figure 122: Connecting AC Power to the Router

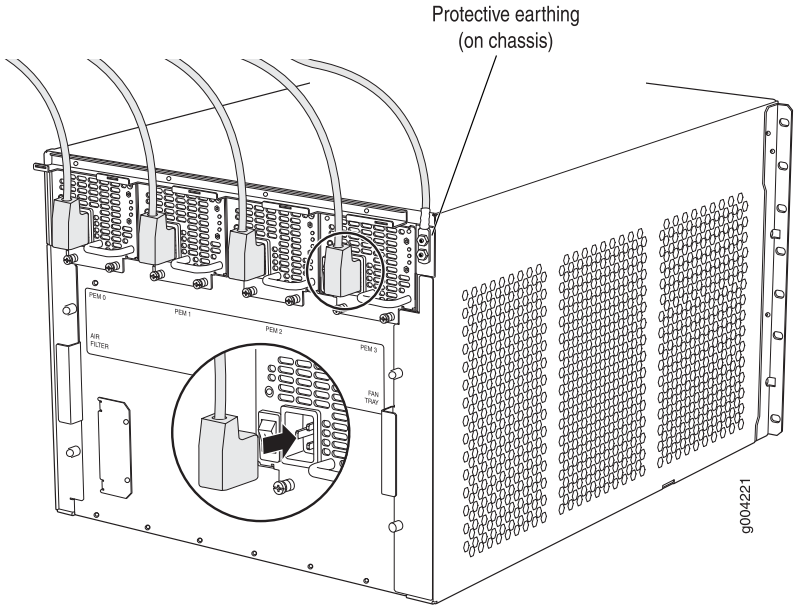
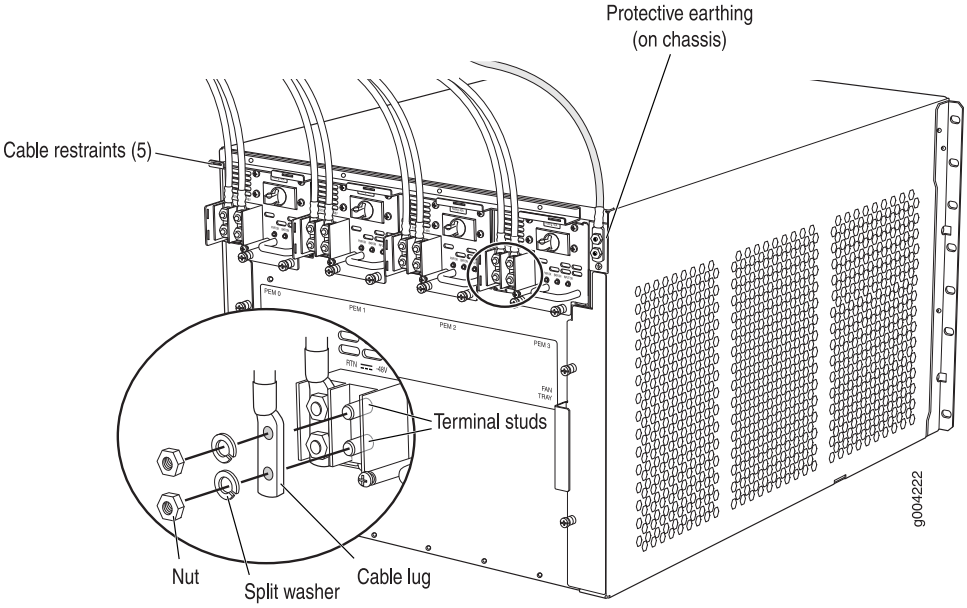


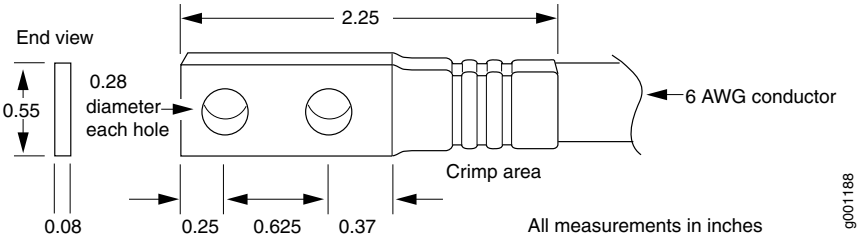
Figure 123: Connecting DC Power to the Router



MX480 Router Grounding Cable Lug Specifications

The accessory box shipped with the router includes one cable lug that attaches to the grounding cable (see Figure 124 on page 297) and two UNC 1/4–20 screws used to secure the grounding cable to the grounding points.

Figure 124: 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.

NOTE: The same cable lug is used for the DC power cables.

MX480 Router Grounding Cable Specifications

The grounding cable that you provide must meet the specifications in Table 37 on page 298.

Table 37: Grounding Cable Specifications

Cable Type	Quantity and Specification
Grounding	One 6-AWG (13.3 mm^2), minimum 60°C wire, or as required by the local code

WARNING: The router is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for UNC 1/4-20 ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal must be permanently connected to earth.

Related Documentation

- Tools and Parts Required for MX480 Router Grounding and Power Connections on page 111
- Grounding the MX480 Router on page 112
- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250

MX480 AC Power Specifications and Requirements

- AC Electrical Specifications for the MX480 Router on page 298
- AC Power Circuit Breaker Requirements for the MX480 Router on page 299
- AC Power Cord Specifications for the MX480 Router on page 300

AC Electrical Specifications for the MX480 Router

Table 38 on page 298 lists the AC power supply electrical specifications; Table 39 on page 299 lists the AC power system specifications.

Table 38: AC Power Supply Electrical Specifications

Item	Specification
Normal-Capacity Power Supplies	
Maximum output power	1027 W (low line) 1590 W (high line)
AC input voltage	Operating range: 100 – 240 VAC (nominal)
AC input line frequency	50 to 60 Hz (nominal)
AC input current rating	11.0 A @ 200 VAC or 14.5 A @ 110 VAC maximum
Efficiency NOTE: This value is at full load and nominal voltage.	85% (low line and high line)

Table 38: AC Power Supply Electrical Specifications *(continued)*

Item	Specification
High-Capacity Power Supplies	
Maximum output power	1167 W (low line) 2050 W (high line)
AC input voltage	Operating range: 100 – 240 VAC (nominal)
AC input line frequency	50 to 60 Hz (nominal)
AC input current rating	16 A @ 110 VAC maximum 15.1 A @ 200 VAC maximum
Efficiency NOTE: This value is at full load and nominal voltage.	84% (low line) 89% (high line)

Table 39: AC Power System Specifications

Item	Normal Capacity–Low Line	Normal-Capacity–High Line	High-Capacity–Low Line	High-Capacity–High Line
Redundancy	3+1	2+2	3+1	2+2
Output power (maximum) per power supply	1027 W	3200 W	1167 W	2050 W
Output power (maximum) per system	3081 W	3200 W	3501 W	4100 W

Related Documentation

- Calculating Power Requirements for MX480 Routers on page 285
- AC Power Circuit Breaker Requirements for the MX480 Router on page 299
- AC Power Cord Specifications for the MX480 Router on page 300

AC Power Circuit Breaker Requirements for the MX480 Router

Each AC power supply has a single AC appliance inlet located on the power supply that requires a dedicated AC power feed. We recommend that you use a customer site circuit breaker rated for 15 A (250 VAC) minimum for each AC power supply, or as required by local code. Doing so enables you to operate the router in any configuration without upgrading the power infrastructure.

Related Documentation

- AC Electrical Specifications for the MX480 Router on page 298
- Calculating Power Requirements for MX480 Routers on page 285

AC Power Cord Specifications for the MX480 Router

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.

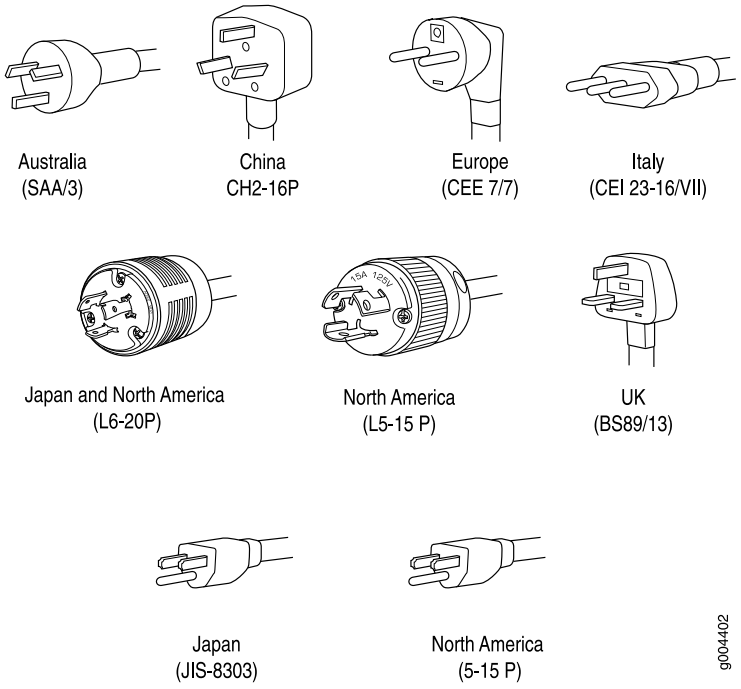
You can order detachable AC power cords, each approximately 8 ft (2.5 m) long that supply AC power to the router. The C19 appliance coupler at the female end of the cord inserts into the AC appliance inlet coupler, type C20 (right angle) as described by International Electrotechnical Commission (IEC) standard 60320. The plug at the male end of the power cord fits into the power source receptacle that is standard for your geographical location.

Table 40 on page 300 provides specifications and Figure 125 on page 301 depicts the plug on the AC power cord provided for each country or region.

Table 40: AC Power Cord Specifications

Country	Model Number	Electrical Specification	Plug Type
Australia	CBL-M-PWR-RA-AU	240 VAC, 50 Hz AC	SAA/3/15
China	CBL-M-PWR-RA-CH	220 VAC, 50 Hz AC	CH2-16P
Europe (except Denmark, Italy, Switzerland, and United Kingdom)	CBL-M-PWR-RA-EU	220 or 230 VAC, 50 Hz AC	CEE 7/7
Italy	CBL-M-PWR-RA-IT	230 VAC, 50 Hz AC	CEI 23-16/VII
Japan	CBL-PWR-RA-JP15	125 VAC, 50 or 60 Hz AC	JIS 8303
	CBL-M-PWR-RA-JP	220 VAC, 50 or 60 Hz AC	NEMA L6-20P
North America	CBL-PWR-RA-US15	125 VAC, 60 Hz AC	NEMA 5-15P
	CBL-PWR-RA-TWLK-US15	125 VAC, 60 Hz AC	NEMA L5-15P
	CBL-M-PWR-RA-US	250 VAC, 60 Hz AC	NEMA 6-20
	CBL-M-PWR-RA-TWLK-US	250 VAC, 60 Hz AC	NEMA L6-20P
United Kingdom	CBL-M-PWR-RA-UK	240 VAC, 50 Hz AC	BS89/13

Figure 125: AC Plug Types



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

WARNING:

注意

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

g017253

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

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

WARNING: The router is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for UNC 1/4-20 ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal must be permanently connected to earth.

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

Related Documentation

- Connecting Power to an AC-Powered MX480 Router with Normal-Capacity Power Supplies on page 113
- Replacing an MX480 AC Power Supply Cord on page 238
- AC Electrical Specifications for the MX480 Router on page 298
- Calculating Power Requirements for MX480 Routers on page 285
- AC Power Circuit Breaker Requirements for the MX480 Router on page 299

MX480 DC Power Specifications and Requirements

- DC Power Supply Electrical Specifications for the MX480 Router on page 302
- DC Power Circuit Breaker Requirements for the MX480 Router on page 303
- DC Power Source Cabling and Cable Specifications for the MX480 Router on page 304

DC Power Supply Electrical Specifications for the MX480 Router

Table 41 on page 302 lists the DC power supply electrical specifications.
Table 42 on page 303 lists the DC power system specifications.

Table 41: Power Supply Electrical Specifications

Item	Specification
Normal-Capacity Power Supplies	
Maximum output power	1600 W
DC input current rating	33.3 A @ –48 V nominal operating voltage
Maximum Input Current	40 A
DC input voltage	Operating Range: –40.5 VDC to –72 VDC Nominal: –48 VDC

Table 41: Power Supply Electrical Specifications *(continued)*

Item	Specification	
Efficiency NOTE: This value is at full load and nominal voltage.	~98%	
Internal Circuit Breaker	40 A	
High-Capacity Power Supplies		
Maximum Input Current	60 A (DIP=0)	70 A (DIP=1)
Maximum output power	2400 W	2600 W
DC input current rating	50 A @ -48 VDC normal operating voltage	54.2 A @ -48 VDC normal operating voltage
DC input voltage	Operating Range: –40.5 VDC to –72 VDC Nominal: –48 VDC	
Efficiency NOTE: This value is at full load and nominal voltage.	~98%	

Table 42: Power System Specifications

Item	Normal-Capacity	High-Capacity	
Redundancy	2+2	2+2	
Output power (maximum) per supply	1600 W	60 A (DIP=0)	70 A (DIP=1)
		2400 W	2600 W
Output power (maximum) per system	3200 W	4800 W	5200 W

Related Documentation

- Calculating Power Requirements for MX480 Routers on page 285
- DC Power Circuit Breaker Requirements for the MX480 Router on page 303

DC Power Circuit Breaker Requirements for the MX480 Router

Each DC power supply has a single DC input (–48 VDC and return) that requires a dedicated circuit breaker. If you plan to operate a maximally configured DC-powered router with normal-capacity power supplies, we recommend that you use a dedicated

customer site circuit breaker rated for 40 A (–48 VDC) minimum, or as required by local code. If you plan to operate a maximally configured DC-powered router with high-capacity power supplies, we recommend that you use a circuit breaker rated for 70 A (–48 VDC), or as required by local code.

If you plan to operate a DC-powered router at less than the maximum configuration, we recommend that you provision a circuit breaker according to respective National Electrical Code and customer site internal standards to maintain proper level of protection for the current specified above or each DC power supply rated for at least 125% of the continuous current that the system draws at –48 VDC.

Related Documentation

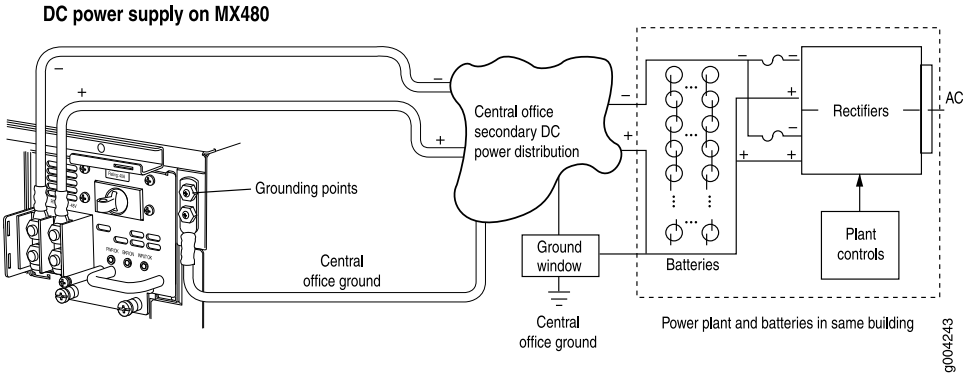
- DC Power Supply Electrical Specifications for the MX480 Router on page 302
- Calculating Power Requirements for MX480 Routers on page 285

DC Power Source Cabling and Cable Specifications for the MX480 Router

DC Power Source Cabling for the MX480 Router

Figure 126 on page 304 shows a typical DC source cabling arrangement.

Figure 126: Typical DC Source Cabling to the Router



The DC power supplies in **PEM0** and **PEM1** must be powered by dedicated power feeds derived from feed **A**, and the DC power supplies in **PEM2** and **PEM3** must be powered by dedicated power feeds 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.

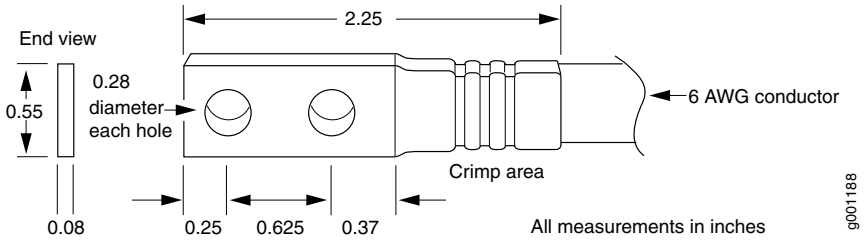
Related Documentation

- In Case of an Electrical Accident on page 270
- MX480 DC Power Supply Description on page 52
- Connecting Power to a DC-Powered MX480 Router with Normal Capacity Power Supplies on page 116
- Replacing an MX480 DC Power Supply Cable on page 239

DC Power Cable Specifications for the MX480 Router

DC Power Cable Lug Specifications—The accessory box shipped with the router includes the cable lugs that attach to the terminal studs of each power supply (see Figure 127 on page 305).

Figure 127: 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.

NOTE: The same cable lug is used for the grounding cable.

DC Power Cable Specifications—Table 43 on page 305 summarizes the specifications for the power cables, which you must supply.

Table 43: DC Power Cable Specifications

Cable Type	Quantity and Specification
Power	Eight 6-AWG (13.3 mm^2), minimum 60°C wire, or as required by the local code

Related Documentation

- DC Power Source Cabling for the MX480 Router on page 304
- MX480 DC Power Supply Description on page 52

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 247
- General Safety Warnings for Juniper Networks Devices on page 248

APPENDIX E

Cable and Wire Guidelines and Specifications for the MX480 Router

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

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 on page 308

Calculating Power Budget and Power Margin for Fiber-Optic Cables

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 dBm – (–28 dBm)

P_B = 13 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 44 on page 309 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 44: 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 44 on page 309 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 44 on page 309 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

- *Supported Network Interface Standards by Transceiver*
- Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 307

Routing Engine Interface Cable and Wire Specifications for MX Series Routers

Table 45 on page 310 lists the specifications for the cables that connect to management ports and the wires that connect to the alarm relay contacts.

Table 45: Cable and Wire Specifications for Routing Engine Management and Alarm Interfaces

Port	Cable Specification	Cable/Wire Supplied	Maximum Length	Router Receptacle
Routing Engine console or auxiliary interface	RS-232 (EIA-232) serial cable	One 6-ft (1.83-m) length with RJ-45/DB-9 connectors	6 ft (1.83 m)	RJ-45 female
Routing Engine Ethernet interface	Category 5 cable or equivalent suitable for 100Base-T operation	One 15-ft (4.57-m) length with RJ-45/RJ-45 connectors	328 ft (100 m)	RJ-45 autosensing

Table 45: Cable and Wire Specifications for Routing Engine Management and Alarm Interfaces *(continued)*

Port	Cable Specification	Cable/Wire Supplied	Maximum Length	Router Receptacle
Alarm relay contacts	Wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2)	No	None	—

Related Documentation

- Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 307
- Calculating Power Budget and Power Margin for Fiber-Optic Cables on page 308

APPENDIX F

MX480 Cable Connector Pinouts

RJ-45 Connector Pinouts for an MX Series Routing Engine ETHERNET Port

The port on the Routing Engine 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 46 on page 313 describes the RJ-45 connector pinout.

Table 46: 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

- MX480 Routing Engine Description on page 40
- RJ-45 Connector Pinouts for MX Series Routing Engine AUX and CONSOLE Ports on page 314

RJ-45 Connector Pinouts for MX Series Routing Engine AUX and CONSOLE Ports

The ports on the Routing Engine labeled **AUX** and **CONSOLE** are asynchronous serial interfaces that accept an RJ-45 connector. The ports connect the Routing Engine to an auxiliary or console management device. Table 47 on page 314 describes the RJ-45 connector pinout.

Table 47: 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

- MX480 Routing Engine Description on page 40
- RJ-45 Connector Pinouts for an MX Series Routing Engine ETHERNET Port on page 313

APPENDIX G

Contacting Customer Support and Returning MX480 Hardware

Locating MX480 Component Serial Numbers

Displaying MX480 Router Components and Serial Numbers

Before contacting Juniper Networks, Inc. to request a Return Materials Authorization (RMA), you must find the serial number on the router or component. To display all 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                                JN10B6596AFB      MX480
```

```
Midplane         REV 01   710-017414                    MX480
FPM Board
PEM 0            Rev 1E   740-017330   000083           PS 2.0kW; 90-264V AC
PEM 1            Rev 1E   740-017330   000089           PS 2.0kW; 90-264V AC
PEM 2            Rev 1E   740-017330   000109           PS 2.0kW; 90-264V AC
Routing Engine 0 REV 06   740-015113   1000694968       RE-S-1300
Routing Engine 1 REV 06   740-015113   1000694976       RE-S-1300
CB 0             REV 07   710-013385   KA5867           MX SCB
CB 1             REV 07   710-013385   KA5863           MX SCB
FPC 0            REV 01   750-018124   KA5710           DPCE 4x 10GE R
  CPU            REV 06   710-013713   KB4077           DPC PMB
  PIC 0                   BUILTIN      BUILTIN          1x 10GE(LAN/WAN)
    Xcvr 0       REV 01   740-014289   C712XU01J        XFP-10G-SR
  PIC 1                   BUILTIN      BUILTIN          1x 10GE(LAN/WAN)
    Xcvr 0       REV 01   740-014289   C712XU01E        XFP-10G-SR
  PIC 2                   BUILTIN      BUILTIN          1x 10GE(LAN/WAN)
  PIC 3                   BUILTIN      BUILTIN          1x 10GE(LAN/WAN)
FPC 1            REV 01   750-018122   JZ8183           DPCE 40x 1GE R
  CPU            REV 06   710-013713   KA0454           DPC PMB
  PIC 0                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0       REV 01   740-011613   PAJ4SNB          SFP-SX
    Xcvr 9       REV 01   740-011782   P9M0TYY          SFP-SX
  PIC 1                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 3       REV 01   740-011613   PAJ4SQ9          SFP-SX
    Xcvr 4       REV 01   740-011613   PAJ4SQR          SFP-SX
    Xcvr 9       REV 01   740-011782   PAR1L2P          SFP-SX
  PIC 2                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0                NON-JNPR     MTC009778        SFP-T
    Xcvr 9       REV 01   740-011782   PAR1L2N          SFP-SX
  PIC 3                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 3       REV 01   740-011613   PAJ4SQD          SFP-SX
    Xcvr 9       REV 01   740-011782   PAR1L27          SFP-SX
FPC 2            REV 01   750-018122   KA5576           DPCE 40x 1GE R
  CPU            REV 06   710-013713   KB3961           DPC PMB
  PIC 0                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0       REV 01   740-011782   PB83DK1          SFP-SX
    Xcvr 1       REV 01   740-011782   PB82174          SFP-SX
    Xcvr 2       REV 01   740-011782   PB81U9C          SFP-SX
    Xcvr 3       REV 01   740-011782   PB8329N          SFP-SX
    Xcvr 4       REV 01   740-011782   PB832A0          SFP-SX
    Xcvr 5       REV 01   740-011782   PB82A3T          SFP-SX
    Xcvr 6       REV 01   740-011782   PB835F7          SFP-SX
    Xcvr 7       REV 01   740-011782   PB81NBR          SFP-SX
    Xcvr 8       REV 01   740-011782   PB82CGR          SFP-SX
    Xcvr 9       REV 01   740-011782   PB81NC4          SFP-SX
  PIC 1                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0       REV 01   740-011782   PB81NBS          SFP-SX
    Xcvr 1       REV 01   740-011782   PB8390V          SFP-SX
    Xcvr 2       REV 01   740-011782   PB75EFU          SFP-SX
    Xcvr 3       REV 01   740-011782   PB82VHH          SFP-SX
    Xcvr 4       REV 01   740-011782   PB832DA          SFP-SX
    Xcvr 5       REV 01   740-011782   P9M0U35          SFP-SX
    Xcvr 6       REV 01   740-011782   P9M0U37          SFP-SX
    Xcvr 7       REV 01   740-011782   P9M0U74          SFP-SX
    Xcvr 8       REV 01   740-011782   P9M0U3C          SFP-SX
    Xcvr 9       REV 01   740-011782   P9M0U3B          SFP-SX
  PIC 2                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0       REV 01   740-011782   PAR1YWF          SFP-SX
    Xcvr 1       REV 01   740-011782   PAR1Z55          SFP-SX
    Xcvr 2       REV 01   740-011782   PAR1YXD          SFP-SX
    Xcvr 3       REV 01   740-011785   P6N0TQ1          SFP-LX
```

```
    Xcvr 4       REV 01   740-011782   PAR1Z4Q          SFP-SX
    Xcvr 5       REV 01   740-011782   PAR1XDZ          SFP-SX
    Xcvr 6       REV 01   740-011613   PAJ4SQQ          SFP-SX
    Xcvr 7       REV 01   740-011782   P8N1Y6L          SFP-SX
    Xcvr 8       REV 01   740-011613   PAJ4SYW          SFP-SX
    Xcvr 9       0        NON-JNPR     AM06211TK7       SFP-SX
  PIC 3                   BUILTIN      BUILTIN          10x 1GE(LAN)
    Xcvr 0       REV 01   740-011782   PAR1XB3          SFP-SX
    Xcvr 1       REV 01   740-011782   PAR1YHY          SFP-SX
    Xcvr 2       REV 01   740-011782   PAR1XDV          SFP-SX
    Xcvr 3       REV 01   740-011782   PAR1Z7B          SFP-SX
    Xcvr 4       REV 01   740-011782   PAR1YWE          SFP-SX
    Xcvr 5       REV 01   740-011782   PAR1X5W          SFP-SX
    Xcvr 6       REV 01   740-011782   PAR1Z5E          SFP-SX
    Xcvr 7       REV 01   740-011782   PAR1XB6          SFP-SX
    Xcvr 8       REV 01   740-011785   PAQ0ZAS          SFP-LX
    Xcvr 9       REV 01   740-011785   PAQ0ZA8          SFP-LX
FPC 5            REV 08   710-014219   KB0710           DPC 4x 10GE R
  CPU            REV 06   710-013713   KB1015           DPC PMB
  PIC 0                   BUILTIN      BUILTIN          1x 10GE(LAN/WAN)
    Xcvr 0       REV 01   740-014279   733019A00156     XFP-10G-LR
  PIC 1                   BUILTIN      BUILTIN          1x 10GE(LAN/WAN)
    Xcvr 0       REV 01   740-014279   733019A00192     XFP-10G-LR
  PIC 2                   BUILTIN      BUILTIN          1x 10GE(LAN/WAN)
  PIC 3                   BUILTIN      BUILTIN          1x 10GE(LAN/WAN)
Fan Tray                                               Left Fan Tray
```

Most components also have a small rectangular serial number ID label (see Figure 128 on page 317) attached to the component body.

Figure 128: Serial Number ID Label

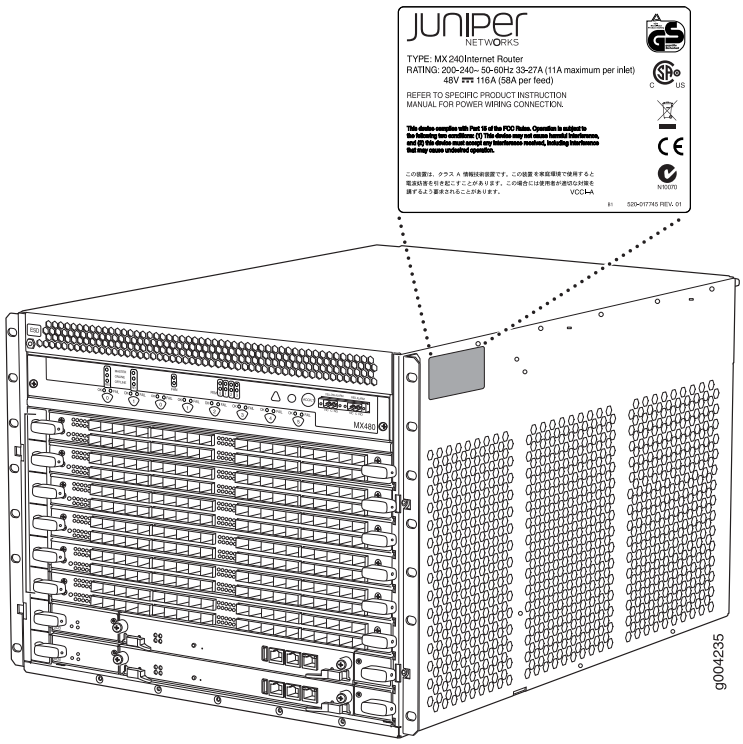
Related Documentation

- MX480 Chassis Serial Number Label on page 317
- MX480 SCB Serial Number Label on page 318
- MX480 DPC Serial Number Label on page 319
- MX480 FPC Serial Number Label on page 320
- MX480 PIC Serial Number Label on page 321
- MX480 MPC Serial Number Label on page 322
- MX480 MIC Serial Number Label on page 323
- MX480 Power Supply Serial Number Label on page 325
- MX480 Routing Engine Serial Number Label on page 326

MX480 Chassis Serial Number Label

The chassis serial number is located on the side of the chassis (see Figure 129 on page 318).

Figure 129: MX480 Chassis Serial Number Label



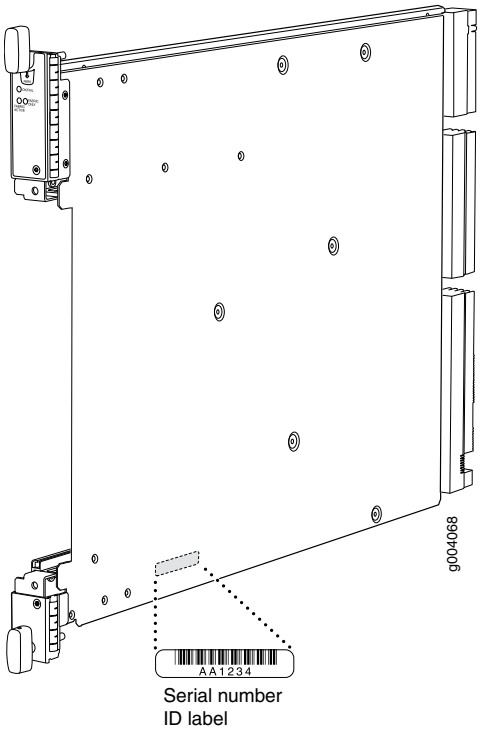
Related Documentation

- Displaying MX480 Router Components and Serial Numbers on page 315
- MX480 SCB Serial Number Label on page 318
- MX480 DPC Serial Number Label on page 319
- MX480 FPC Serial Number Label on page 320
- MX480 PIC Serial Number Label on page 321
- MX480 MPC Serial Number Label on page 322
- MX480 MIC Serial Number Label on page 323
- MX480 Power Supply Serial Number Label on page 325
- MX480 Routing Engine Serial Number Label on page 326

MX480 SCB Serial Number Label

The serial number is located on the right side of the top of the SCB (see Figure 130 on page 319).

Figure 130: SCB Serial Number Label



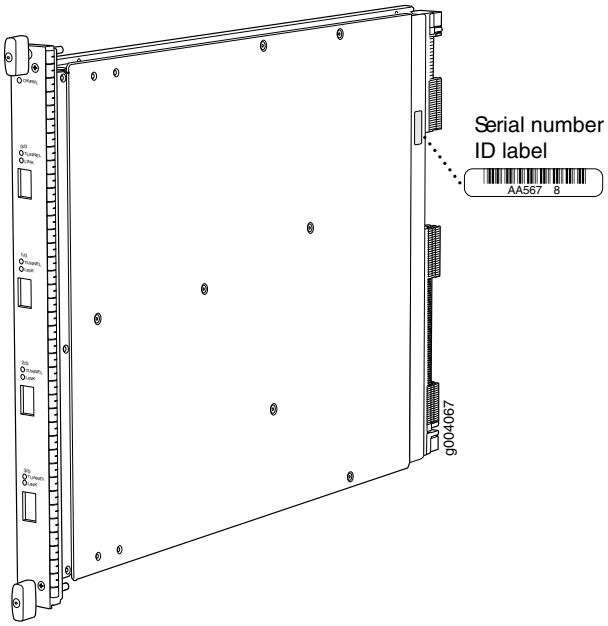
Related Documentation

- Replacing an MX480 SCB on page 182
- Displaying MX480 Router Components and Serial Numbers on page 315
- Contacting Customer Support on page 327
- Returning a Hardware Component to Juniper Networks, Inc. on page 327
- Guidelines for Packing Router Components for Shipment on page 330

MX480 DPC Serial Number Label

The serial number label is located on the center of the right side of the DPC (see Figure 131 on page 320).

Figure 131: DPC Serial Number Label



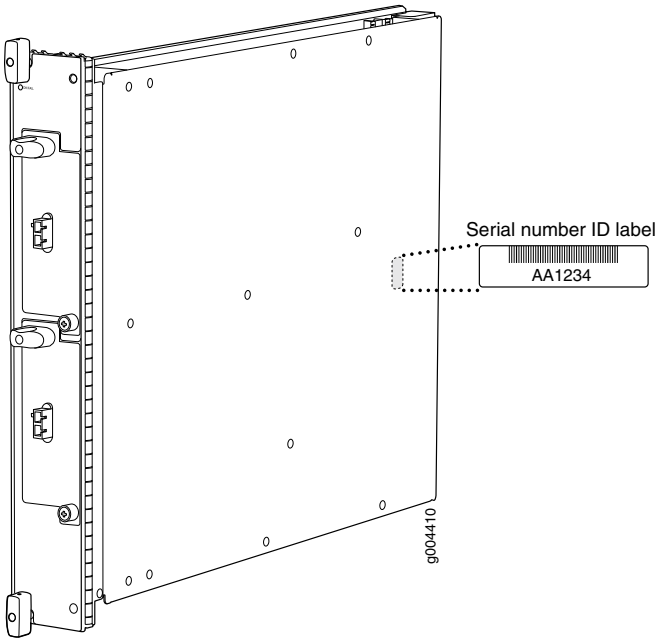
Related Documentation

- Replacing an MX480 DPC on page 202
- Displaying MX480 Router Components and Serial Numbers on page 315
- Contacting Customer Support on page 327
- Returning a Hardware Component to Juniper Networks, Inc. on page 327
- Guidelines for Packing Router Components for Shipment on page 330

MX480 FPC Serial Number Label

The serial number label is located on the center of the right side of the FPC (see Figure 132 on page 321).

Figure 132: FPC Serial Number Label



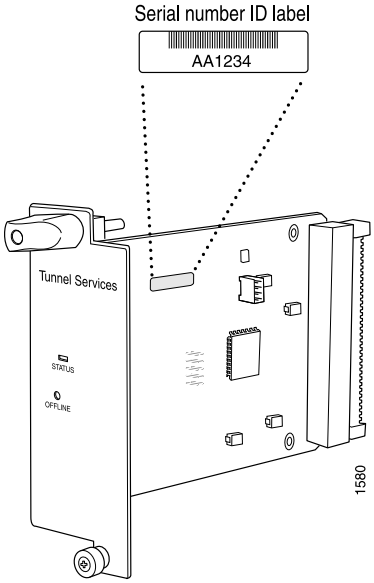
Related Documentation

- Replacing an MX480 FPC on page 206
- Displaying MX480 Router Components and Serial Numbers on page 315
- Contacting Customer Support on page 327
- Returning a Hardware Component to Juniper Networks, Inc. on page 327
- Guidelines for Packing Router Components for Shipment on page 330

MX480 PIC Serial Number Label

The serial number label is located on the right side of the PIC (see Figure 133 on page 322), when the PIC is vertically oriented (as it would be installed in the router). The exact location may be slightly different on different PICs, depending on the placement of components on the PIC board.

Figure 133: PIC Serial Number Label



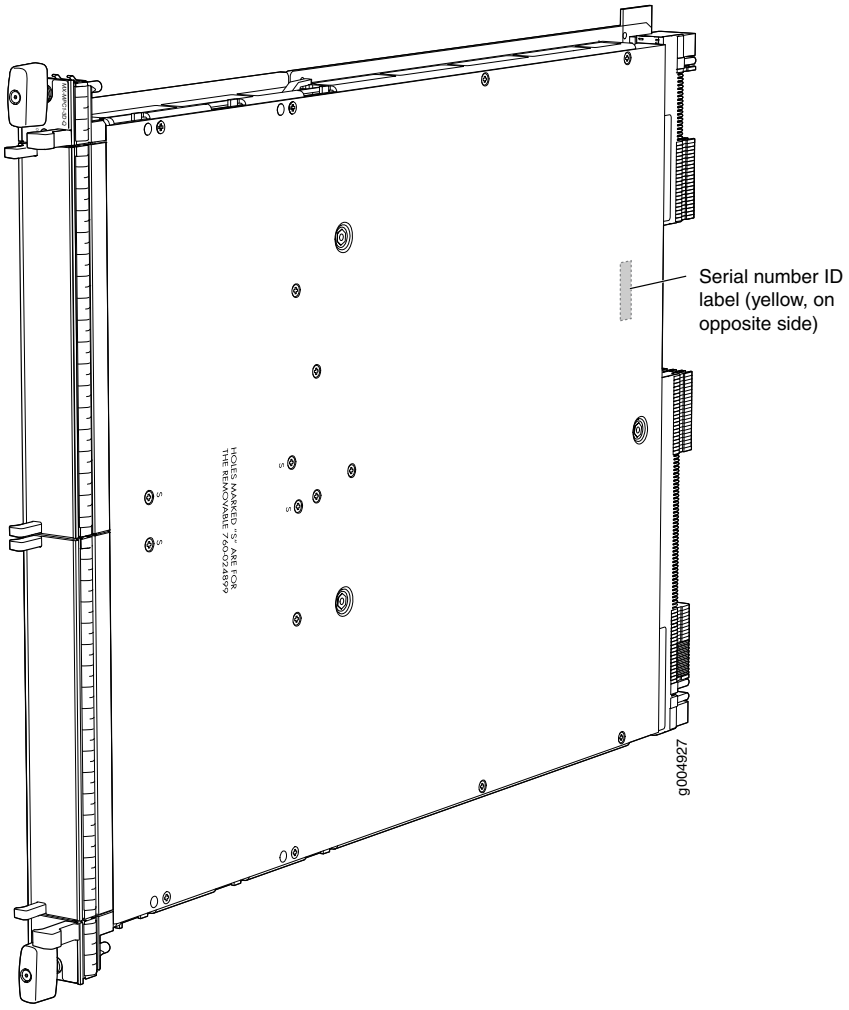
Related Documentation

- Replacing an MX480 PIC on page 211
- Displaying MX480 Router Components and Serial Numbers on page 315
- Contacting Customer Support on page 327
- Returning a Hardware Component to Juniper Networks, Inc. on page 327
- Guidelines for Packing Router Components for Shipment on page 330

MX480 MPC Serial Number Label

The serial number label is near the connectors located on the left side of the MPC when it is oriented vertically (see Figure 134 on page 323).

Figure 134: MPC Serial Number Label



Related Documentation

- Replacing an MX480 MPC on page 215
- Displaying MX480 Router Components and Serial Numbers on page 315
- Contacting Customer Support on page 327
- Returning a Hardware Component to Juniper Networks, Inc. on page 327
- Guidelines for Packing Router Components for Shipment on page 330

MX480 MIC Serial Number Label

The serial number label location varies per MIC (see Figure 136 on page 324 and Figure 137 on page 324). The exact location may be slightly different on different MICs,

depending on the placement of components on the MIC board (see Figure 135 on page 324, Figure 136 on page 324, Figure 137 on page 324, and Figure 138 on page 324).

Figure 135: 2-Port MIC Serial Number Label

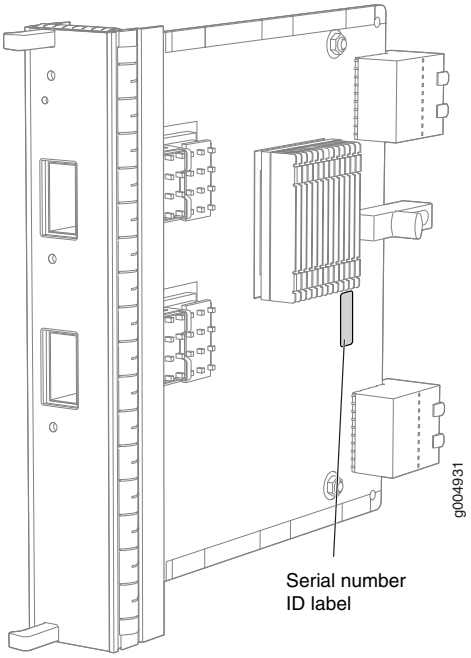


Figure 136: 4-Port MIC Serial Number Label

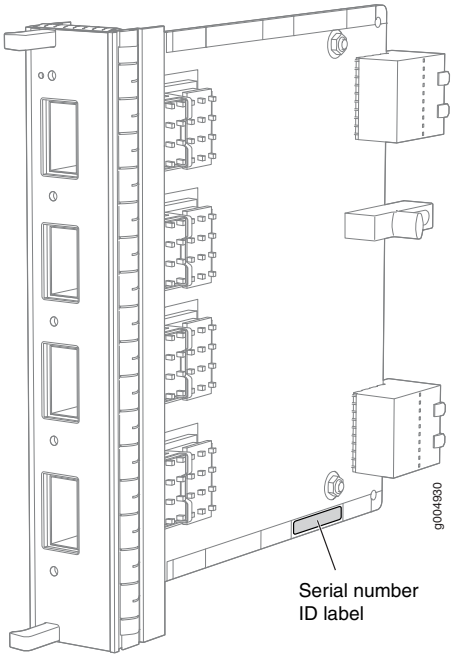


Figure 137: 20-Port MIC Serial Number Label

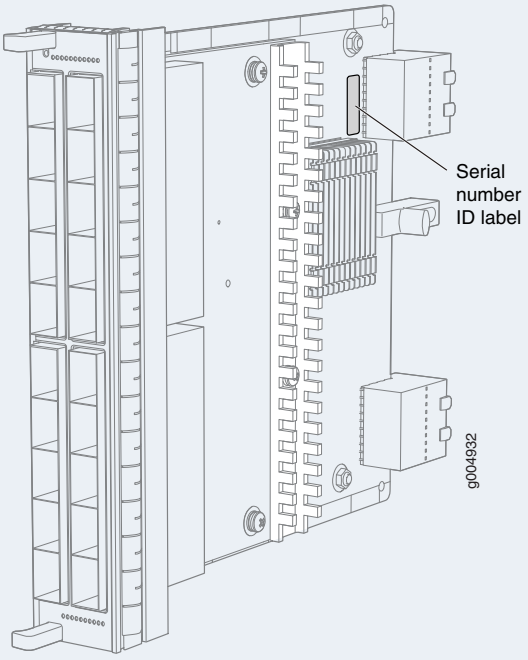
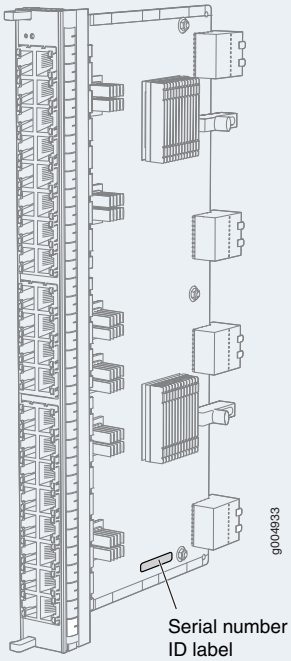


Figure 138: 40-Port MIC Serial Number Label



Related Documentation

- Replacing an MX480 MIC on page 220
- Displaying MX480 Router Components and Serial Numbers on page 315
- Contacting Customer Support on page 327
- Returning a Hardware Component to Juniper Networks, Inc. on page 327
- Guidelines for Packing Router Components for Shipment on page 330

MX480 Power Supply Serial Number Label

The serial number label is located on the top of the AC power supply (see Figure 139 on page 325).

The serial number label is located on the top of the DC power supply faceplate (see Figure 140 on page 326).

Figure 139: AC Power Supply Serial Number Label

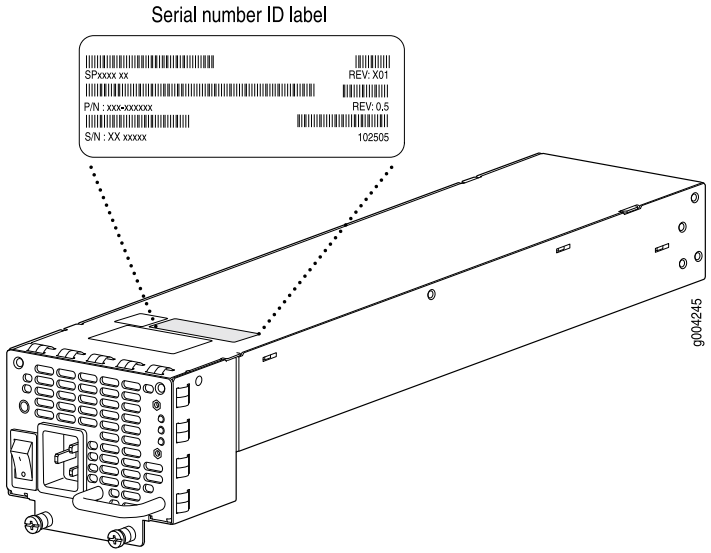
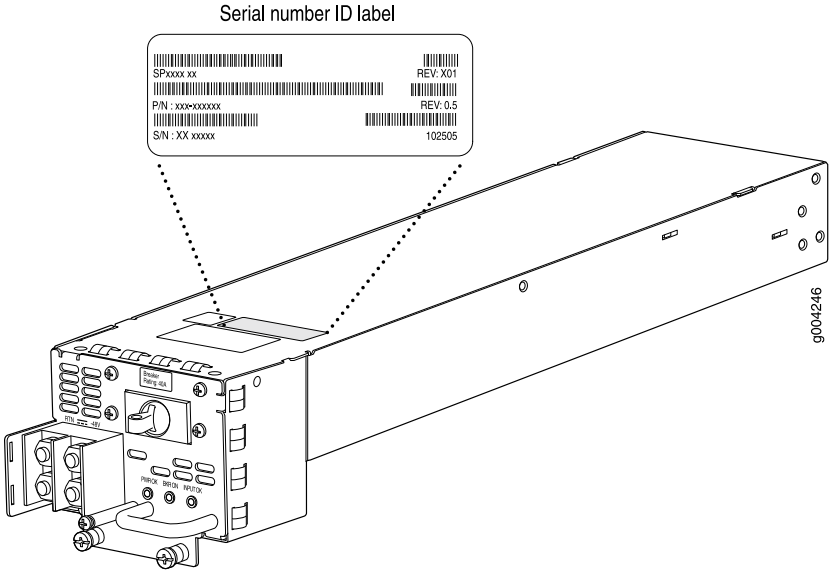


Figure 140: DC Power Supply Serial Number Label



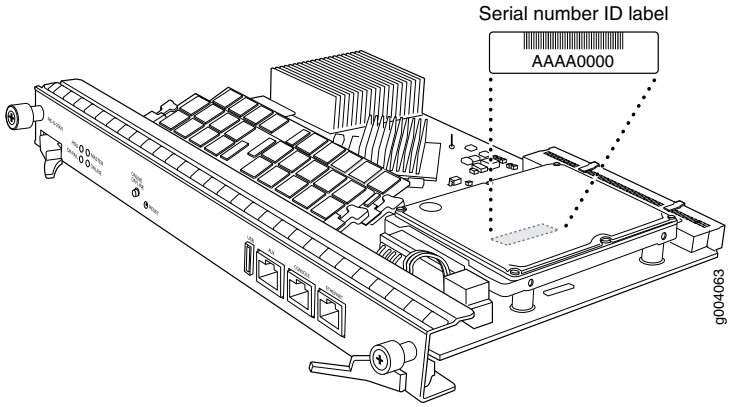
Related Documentation

- Replacing an MX480 AC Power Supply on page 231
- Replacing an MX480 DC Power Supply on page 233
- Displaying MX480 Router Components and Serial Numbers on page 315
- Contacting Customer Support on page 327
- Returning a Hardware Component to Juniper Networks, Inc. on page 327
- Guidelines for Packing Router Components for Shipment on page 330

MX480 Routing Engine Serial Number Label

The serial number label is located on the left side of the top of the Routing Engine (see Figure 141 on page 326).

Figure 141: Routing Engine Serial Number Label



Related Documentation

- Replacing an MX480 Routing Engine on page 197
- Displaying MX480 Router Components and Serial Numbers on page 315
- Contacting Customer Support on page 327
- Returning a Hardware Component to Juniper Networks, Inc. on page 327
- Guidelines for Packing Router Components for Shipment on page 330

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 327

Returning a Hardware Component to Juniper Networks, Inc.

If a problem cannot be resolved by the JTAC technician, a Return Materials Authorization M01i (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 327
- Guidelines for Packing Router Components for Shipment on page 330

Tools and Parts Required to Replace Components from an M Series, MX Series, or T Series Router

To remove components from the router or the router from a rack, you need the following tools and parts:

- 2.5-mm flat-blade (–) screwdriver, for detaching alarm relay terminal block
- 7/16-in. (11 mm) nut driver
- Blank panels to cover empty slots
- Electrostatic bag or antistatic mat, for each component
- Electrostatic discharge (ESD) grounding wrist strap
- Flat-blade (–) screwdriver
- Mechanical lift, if available
- Phillips (+) screwdrivers, numbers 1 and 2
- Rubber safety cap for fiber-optic interfaces or cable
- Wire cutters

Related Documentation

- Packing the MX480 Router for Shipment on page 329
- Guidelines for Packing Router Components for Shipment on page 330

Packing the MX480 Router for Shipment

To pack the router for shipment:

1. Retrieve the shipping crate and packing materials in which the router was originally shipped. If you do not have these materials, contact your Juniper Networks representative about approved packaging materials.
2. On the console or other management device connected to the master Routing Engine, enter CLI operational mode and issue the following command to shut down the router software. (If two Routing Engines are installed, also issue the command on the backup Routing Engine.)

   ```
   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 *request system halt*.
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:
   - If you are using a mechanical lift, place the lift platform under the router, unscrew and remove the mounting screws from the rack, and move the router to the shipping crate.
   - If you are not using a mechanical lift and the router weight is fully supported by a shelf or another router, unscrew and remove the mounting screws from the rack. Three people can then lift the router and move it to the shipping crate.
   - If you are not using a mechanical lift and the router weight is not fully supported by a shelf or another router, three people should grasp the router while a fourth person unscrews and removes the mounting screws from the rack. The three lifters can then move the router to the shipping container.
9. Place the router in the shipping crate or onto the pallet. If on a pallet, bolt the router to the pallet.
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 or place the crate cover over the router.
13. Write the RMA number on the exterior of the box to ensure proper tracking.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX480 Router on page 250
- Powering Off the MX480 Router on page 123
- Disconnecting an MX480 AC Power Supply Cord on page 238
- Disconnecting an MX480 DC Power Supply Cable on page 239
- Replacing Connections to MX480 Routing Engine Interface Ports on page 200
- Guidelines for Packing Router Components for Shipment on page 330

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 327
- Contacting Customer Support on page 327

PART 5

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