# M7i Multiservice Edge Router Hardware Guide

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*M7i Multiservice Edge Router Hardware Guide*


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

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# About the Documentation



## Documentation and Release Notes

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## Documentation Conventions

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

*Table 1: Notice Icons*

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

Table 2 on page 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:<br><br>user@host> **configure** |
| `Fixed-width text like this` | Represents output that appears on the terminal screen. | `user@host>` **show chassis alarms**<br><br>`No alarms currently active` |
| *Italic text like this* | • Introduces or emphasizes important new terms.<br>• Identifies guide names.<br>• Identifies RFC and Internet draft titles. | • A policy *term* is a named structure that defines match conditions and actions.<br>• *Junos OS CLI User Guide*<br>• 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:<br><br>[edit]<br>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.<br>• 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**<br><br>**(*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]<br>routing-options {<br>  static {<br>  route default {<br>  nexthop *address*;<br>  retain;<br>  }<br>  }<br>} |
| ; (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**.<br>• 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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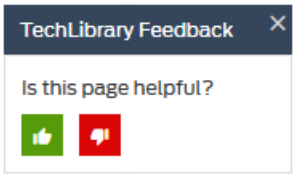
- Online feedback system—Click TechLibrary Feedback, on the lower right of any page on the Juniper Networks TechLibrary site, and do one of the following:




  - Click the thumbs-up icon if the information on the page was helpful to you.
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- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at https://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
- Product warranties—For product warranty information, visit https://www.juniper.net/support/warranty/.
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- Download the latest versions of software and review release notes: https://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: https://kb.juniper.net/InfoCenter/

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

PART 1

# Overview

CHAPTER 1

# System Overview and Architecture



## M7i Router Description

The M7i Multiservice Edge Router is a complete routing system that provides ATM, channelized, Ethernet, IP services, and SONET/SDH interfaces for large networks and network applications, such as those supported by Internet service providers (ISPs).

The router accommodates up to four Physical Interface Cards (PICs). In addition to the PICs, the Fixed Interface Card (FIC) provides two Fast Ethernet ports or one Gigabit Ethernet port, depending on your configuration. The built-in tunnel interface on the Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) provides tunneling services. The optional Adaptive Services Module (ASM) on the CFEB and CFEB-E, and the optional MultiServices Module (MSM) on the CFEB-E allow one or more services to be configured on this interface.

The router architecture cleanly separates control operations from packet forwarding operations, which helps to eliminate processing and traffic bottlenecks. Control operations in the router are performed by the Routing Engine, which runs Junos OS to handle routing protocols, traffic engineering, policy, policing, monitoring, and configuration management.

Application-specific integrated circuits (ASICs), a definitive part of the router design, enable the router to forward data at the high speeds demanded by current network media. Forwarding operations in the router are performed by the Packet Forwarding Engine, which consists of hardware, including ASICs, designed by Juniper Networks. The Packet Forwarding Engine can forward up to 16 million packets per second (Mpps) for all packet sizes. The aggregate throughput is 4 gigabits per second (Gbps), full duplex, for the FPC with 4 PIC slots. The fixed interface card (FIC) has a maximum throughput of 1 Gbps full duplex. Inserting a combination of PICs with an aggregate higher than the maximum throughput of the FPC is supported, but constitutes oversubscription of the FPC.

**Related Documentation**

- M7i Component Redundancy on page 4
- M7i Chassis Description on page 11
- M7i Router Physical Specifications on page 74
- Overview of M7i Router Installation on page 103

## M7i Component Redundancy

The router can be configured with two load-sharing, fully redundant power supplies to distribute power to the other components. If one power supply fails, the second power supply can provide full power to the router's components indefinitely.

**Related Documentation**

- M7i Router Description on page 3
- M7i Chassis Description on page 11
- Overview of M7i Router Installation on page 103
- M7i Router Physical Specifications on page 74

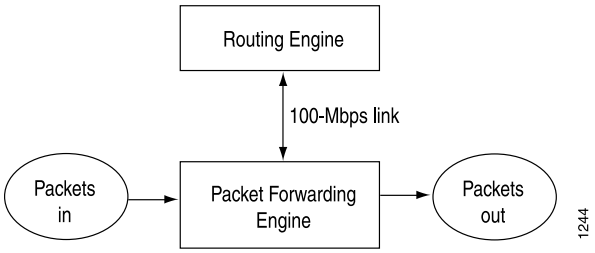
## System Architecture Overview

The router architecture consists of two major components:

- Packet Forwarding Engine—Performs Layer 2 and Layer 3 packet switching, route lookups, and packet forwarding.
- Routing Engine—Provides Layer 3 routing services and network management.

The Packet Forwarding Engine and the Routing Engine perform independently but communicate constantly through a 100-Mbps internal link. This arrangement provides streamlined forwarding and routing control and the ability to run Internet-scale networks at high speeds. Figure 1 on page 4 illustrates the relationship between the Packet Forwarding Engine and the Routing Engine.

*Figure 1: System Architecture*




**Related Documentation**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- M7i Power System Description on page 59

## M7i and M10i Packet Forwarding Engine Architecture

The Packet Forwarding Engine performs Layer 2 and Layer 3 packet switching. The Packet Forwarding Engine is implemented in application-specific integrated circuits (ASICs). It uses a centralized route lookup engine and shared memory.



### Packet Forwarding Engine Components

The Packet Forwarding Engine architecture includes the following components:

- Midplane—Transports packets, notifications, and other signals between the FPCs and the Packet Forwarding Engine (as well as other system components).
- Physical Interface Card (PIC)—Physically connects the router to fiber-optic or digital network media. A controller ASIC in each PIC performs control functions specific to the PIC media type.
- Compact Forwarding Engine Board (CFEB) or Enhanced Compact Forwarding Engine Board (CFEB-E)—Hosts an integrated ASIC, which makes forwarding decisions, distributes data cells to the shared memory, and directs data packets when they are ready for transmission.

### Data Flow Through the Packet Forwarding Engine

Use of ASICs promotes efficient movement of data packets through the system. Packets flow through the Packet Forwarding Engine in the following sequence (see Figure 2 on page 6):

1. Packets arrive at an incoming networking interface.
2. The networking interface passes the packets to the CFEB or CFEB-E, where the integrated ASIC processes the packet headers, divides the packets into 64-byte data cells, and distributes the data cells throughout the memory buffer.
3. The integrated ASIC on the CFEB or CFEB-E performs a route lookup for each packet and decides how to forward it.
    a. If services are configured for the packet, the integrated ASIC reassembles the packet and passes them to the services interface.
    b. The services interface passes the packet to the CFEB or CFEB-E, where the integrated ASIC processes the packet, divides the packet into 64-byte cells, and distributes the data cells throughout the memory buffer.

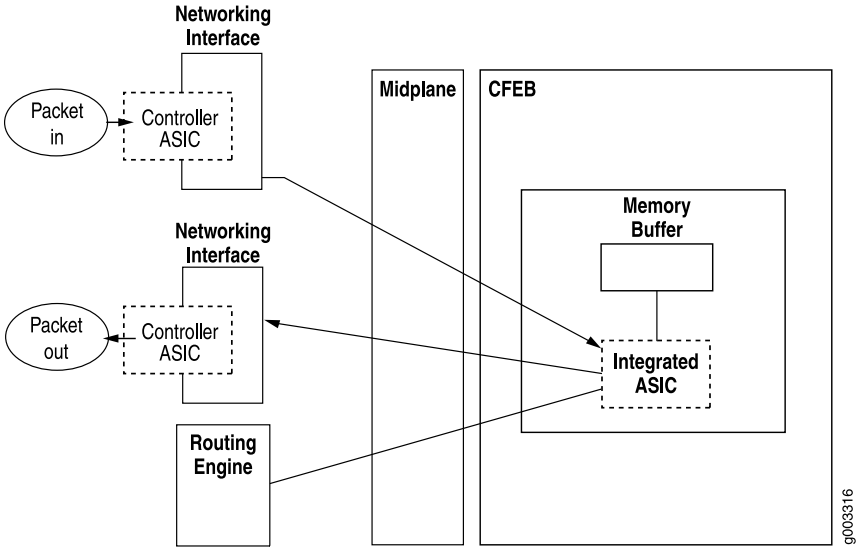
c. The integrated ASIC performs a second route lookup for each packet and decides how to forward it.

4. The integrated ASIC notifies the outbound networking interface.

5. The integrated ASIC reassembles data cells stored in shared memory into data packets as they are ready for transmission and passes them to the outbound networking interface.

6. The outbound networking interface transmits the data packets.

*Figure 2: Packet Forwarding Engine Components and Data Flow*




**Related Documentation**

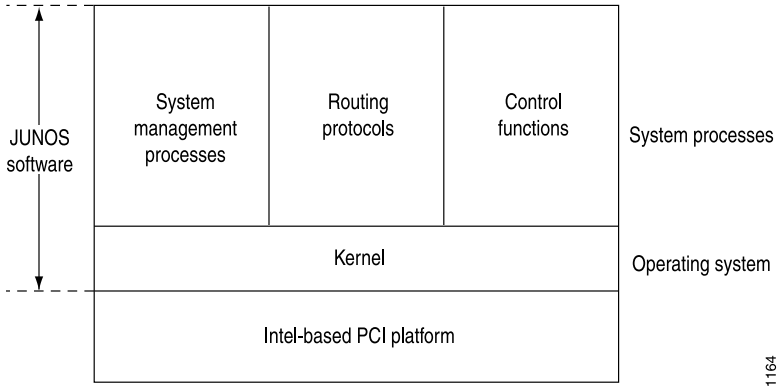
- M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description on page 63
- M7i Router Description on page 3

## Routing Engine Architecture

The Routing Engine runs the Junos OS, which Juniper Networks has developed and optimized to handle large numbers of network interfaces and routes. The software consists of a set of system processes running in protected memory modules on top of an independent operating system. The Junos kernel supports Junos system processes, which handle system management processes, routing protocols, and control functions (see Figure 3 on page 7).

The Routing Engine has a dedicated 100-Mbps internal connection to the Packet Forwarding Engine.

*Figure 3: Routing Engine Architecture*




## Routing Engine Functions

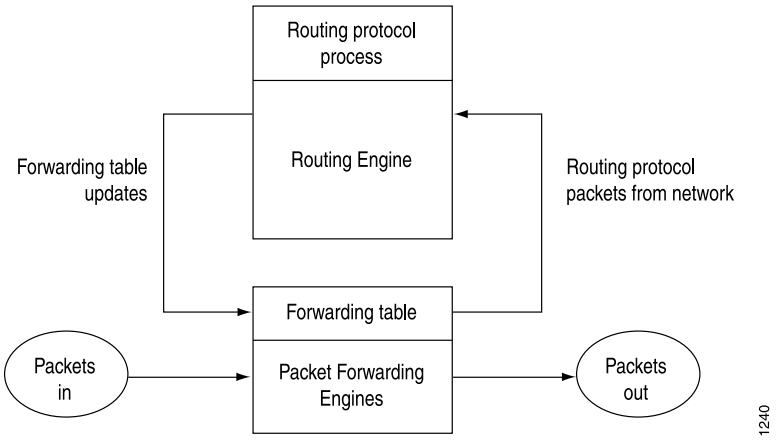
The Routing Engine handles all routing protocol processes, as well as the software processes that control the router's interfaces, the chassis components, system management, and user access to the router. These routing and software processes run on top of a kernel that interacts with the Packet Forwarding Engine. For more information about the processes, see the CLI Explorer.

The Routing Engine includes the following functions and features:

- Processing of routing protocol packets—The Routing Engine handles all packets that concern routing protocols, freeing the Packet Forwarding Engine to handle only packets that represent Internet traffic.
- Software modularity—Because each software process is devoted to a different function and uses a separate process space, the failure of one process has little or no effect on the others.
- In-depth Internet functionality—Each routing protocol is implemented with a complete set of Internet features and provides full flexibility for advertising, filtering, and modifying routes. Routing policies are set according to route parameters (for example, prefix, prefix lengths, and Border Gateway Protocol [BGP] attributes).
- Scalability—The Junos routing tables have been designed to hold all the routes in current networks with ample capacity for expansion. Additionally, the Junos OS can efficiently support large numbers of interfaces and virtual circuits.
- Management interface—Different levels of system management tools are provided, including the Junos OS command-line interface (CLI), the Junos XML management protocol, the craft interface, and SNMP.
- Storage and change management—Configuration files, system images, and microcode can be held and maintained in primary and secondary storage systems, permitting local or remote upgrades.
- Monitoring efficiency and flexibility—The router supports functions such as alarm handling and packet counting on every port, without degrading packet-forwarding performance.

The Routing Engine constructs and maintains one or more routing tables (see Figure 4 on page 8). From the routing tables, the Routing Engine derives a table of active routes, called the forwarding table, which is then copied into the Packet Forwarding Engine. The design of the ASICs allow the forwarding table in the Packet Forwarding Engine to be updated without interrupting forwarding performance.

*Figure 4: Control Packet Handling for Routing and Forwarding Table Updates*




**Related Documentation**

- M7i Routing Engine Description on page 17
- Maintaining the M7i Routing Engine on page 192
- Replacing the M7i Routing Engine on page 141

CHAPTER 2

# M7i Router Release Notes



## Outstanding Issues with the M7i Router

This section lists outstanding issues with the M7i router. For information about software issues, see the *Junos OS Release Notes*.

- The default hardware configuration of the Routing Engine does not include an internal CompactFlash card, which affects which media are available to the Routing Engine as it accesses the Junos OS at boot time. For more information about the Routing Engine's use of boot media, see "Installation Overview" in the *Junos OS Administration Library*.
- There are two versions of the Compact Forwarding Engine Board (CFEB) for M7i routers:
  - CFEB with 4 megabytes (MB) of I/O Manager SSRAM—When this CFEB is installed on an M7i router, Junos OS Release 6.0R1 or later is required. The part number for this CFEB is 750-009489 or 750-009490.
  - CFEB with 8 MB of I/O Manager SSRAM—When this CFEB is installed on an M7i router, Junos OS Release 6.0R2 or later is required. The part number for this CFEB is 750-010111 or 750-010112.

  To determine the part number of your CFEB if it is not installed in a router, locate the label on the circuit board. To determine the part number of your CFEB when it is installed in a router, use the **show chassis hardware** command:

  ```
  user@host> show chassis hardware
  .. CFEB            REV 01   750-009489   CA0187           Internet Processor
   ...
  ```

- If you install Junos OS Release 6.1R1 or later, a warning message might be logged if the CFEB field-programmable gate array (FPGA) firmware is not revision 15 or later. Contact the Juniper Networks Technical Assistance Center (JTAC) for assistance upgrading the FPGA firmware.
- The long haul (LH) small form-factor pluggable transceiver (SFP) conforms to Class A emissions standards on the M7i router when it is installed in the 1-port Gigabit Ethernet SFP Physical Interface Card (PIC).

**Related Documentation**

- Errata with the M7i Router Documentation on page 10
- M7i Routing Engine Description on page 17

## Errata with the M7i Router Documentation

This section lists outstanding issues with the documentation.

- The M7i router now supports the RE-850-1536 Routing Engine.

**Related Documentation**

- Outstanding Issues with the M7i Router on page 9
- M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description on page 63

CHAPTER 3

# Chassis Components and Descriptions



## M7i Chassis Description

The router chassis is a rigid sheet metal structure that houses the other hardware components. The chassis is 17.5 in. (44.5 cm) wide and 18 in. (45.7 cm) deep. The chassis height of 3.5 in. (8.9 cm) enables stacked installation of 21 M7i routers in a single floor-to-ceiling rack. For more information, see "M7i Router Rack Requirements" on page 75.

The two mounting brackets (one on each side) extend the chassis width to 19 in. (48.2 cm).

*Figure 5: Front of Chassis*

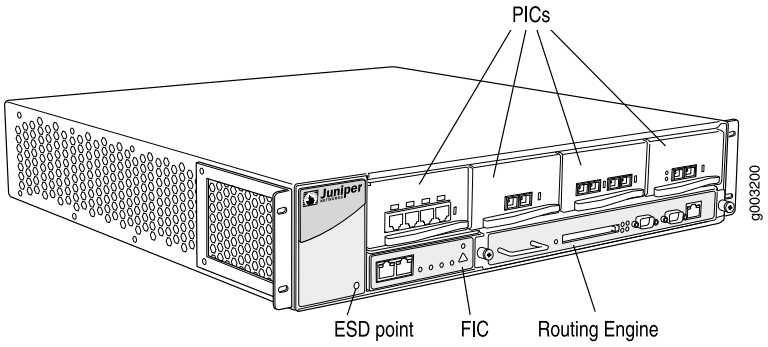
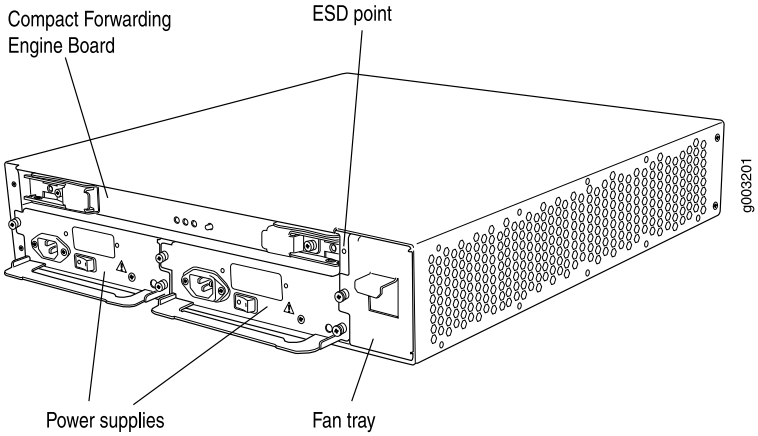


*Figure 6: Rear of Chassis*




The chassis includes the following electrical safety components:

- One electrostatic discharge (ESD) points (banana plug receptacles), at the front of the chassis, as shown in Figure 5 on page 11.
- Two internally threaded inserts providing grounding points for the router.

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

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

For further safety information, see "General Safety Guidelines for Juniper Networks Devices" on page 225 and "General Safety Warnings for Juniper Networks Devices" on page 226.

For chassis serial number information , see "Displaying M7i Router Components and Serial Numbers" on page 213.

**Related Documentation**

- M7i Router Physical Specifications on page 74
- Overview of M7i Router Installation on page 103
- M7i Router Description on page 3

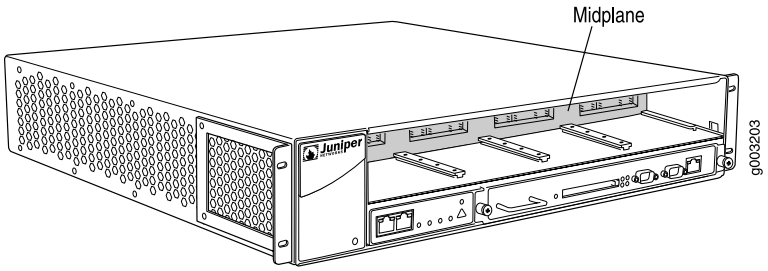
## M7i Midplane Description

The midplane is a panel located in the center of the chassis, running from side to side and forming the rear of the PIC card cage (see Figure 7 on page 13). All router components plug directly into the midplane. The midplane contains an EEPROM that stores the serial number and revision level of the midplane.

The midplane performs the following functions:

- Transfer of packets—An incoming data packet crosses the midplane to a CFEB or CFEB-E. The CFEB or CFEB-E performs switching and forwarding functions and transfers outgoing packets back across the midplane to the FIC or PICs for transmission to the network.
- Power distribution—The midplane distributes power to all router components from the power supplies attached to it.
- Signal connectivity—The midplane transports the signals exchanged by system components for monitoring and control purposes.

*Figure 7: Midplane*




For midplane serial number information, see "Displaying M7i Router Components and Serial Numbers" on page 213.

**Related Documentation**

- M7i Router Description on page 3
- M7i Chassis Description on page 11

## M7i Cable Management System

The cable management system consists of racks that attach vertically to each side of the chassis at the front. Pass PIC cables through the slots in the racks to keep the cables organized and securely in place, and to avoid bending optical cables beyond the proper bend radius. The cable management system evenly distributes the weight of a cable, so that it is not subjected to undue stress at the connector.

**Related Documentation**

- Installing the M7i Cable Management System on page 109
- M7i Router Description on page 3
- Overview of M7i Router Installation on page 103

CHAPTER 4

# Cooling System Components and Descriptions

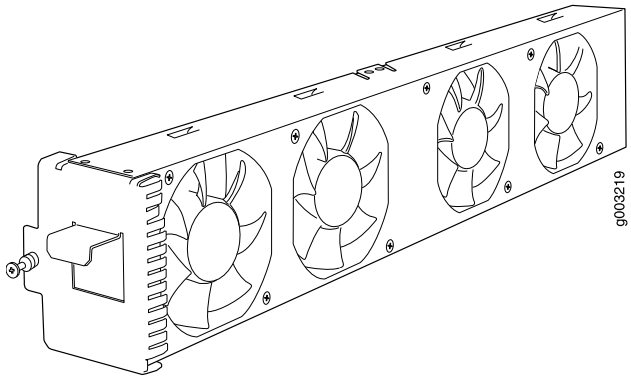


## M7i Cooling System Overview

The router cooling system consists of a fan tray, located along the left side of the chassis, that provides side-to-side cooling (see Figure 9 on page 16). It connects directly to the router midplane. The fan tray is a single unit containing four individually fault-tolerant fans. If a single fan fails, the remaining fans continue to function indefinitely.

The fan tray is hot-removable and hot-insertable.

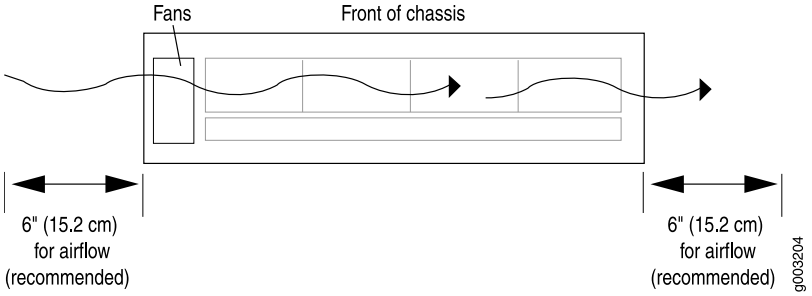
*Figure 8: Fan Tray*




### M7i Airflow Through the Chassis

Figure 9 on page 16 shows airflow through the chassis and the location of the fan tray.

*Figure 9: Airflow Through the Chassis*




**Related Documentation**

- Maintaining the M7i Cooling System on page 191
- M7i Router Clearance Requirements for Airflow and Hardware Maintenance on page 77
- M7i Router Description on page 3

CHAPTER 5

# Host Subsystem Components and Description



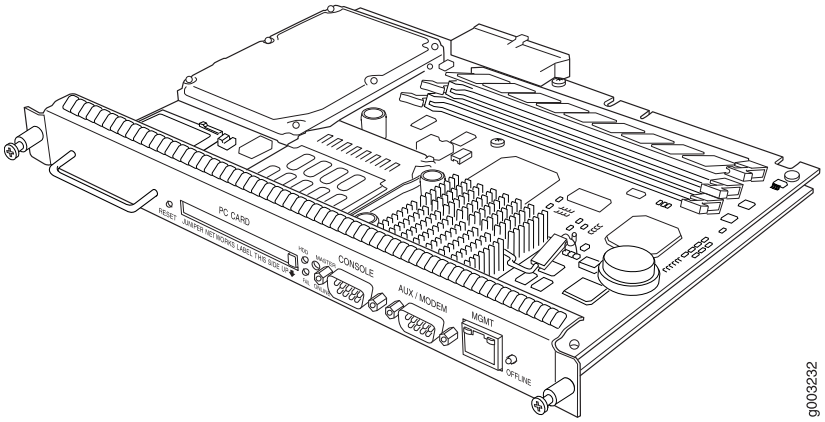
## M7i Routing Engine Description

The Routing Engine runs Junos OS. The software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router's interfaces, control some chassis components, and provide the interface for system management and user access to the router.

The Routing Engine is installed into the midplane from the front of the chassis, as shown in Figure 5 on page 11. For a more detailed description of the Routing Engine's role in router architecture, see "Routing Engine Architecture" on page 6.

The Routing Engine is hot-pluggable; you can remove and replace the Routing Engine without powering down the router, but the routing functions of the system are interrupted when it is removed.

*Figure 10: Routing Engine*




The Routing Engine (shown in Figure 10 on page 18) is a two-board system with the following components:

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols. It has a Pentium-class processor.
- SDRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- CompactFlash card—This disk is optional. If installed, it provides primary storage. It can accommodate software images, configuration files, and microcode.
- Hard disk—If no CompactFlash card is installed, provides primary storage for software images, configuration files, and microcode. If an CompactFlash card is installed, the hard disk provides secondary storage for log files and memory dumps, and can reboot the system if the CompactFlash card fails.
- PC card slot—Accepts a removable PC card, which stores software images for system upgrades.
- Four LEDs—A green LED labeled **HDD**, a blue LED labeled **MASTER**, a red LED labeled **FAIL**, and a green LED labeled **ONLINE** indicate Routing Engine status.
- Interfaces for out-of-band management access—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the Routing Engine.
- I2C/EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.
- Offline button—Powers down the Routing Engine when pressed.
- Thumbscrews—Secure the Routing Engine in the chassis.

## Boot Sequence

The disk from which the router boots is called the *primary boot device*, and the other disk is the *alternate boot device*.

The router attempts to boot from three devices in this order:

- PC Card
- CompactFlash card
- Hard disk

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

## M7i Routing Engine Management Ports

On the right half of the Routing Engine are ports for connecting 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.

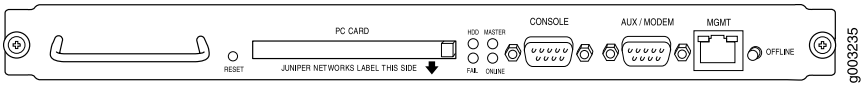
The ports are labeled and function as follows:

- **CONSOLE**—Connects the Routing Engine to a system console through an RS-232 (EIA-232) serial cable.
- **AUX/MODEM**— Connects the Routing Engine to a laptop, modem, or other auxiliary device through an RS-232 (EIA-232) serial cable.
- **MGMT**—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 both 10- and 100-Mbps connections. Two small LEDs on the left edge of the port indicate the connection in use: the yellow LED lights for a 10-Mbps connection and the green LED lights for a 100-Mbps connection.

For information about the pinouts for the connectors, see "RJ-45 Connector Pinouts for the M7i Routing Engine MGMT Port" on page 98.

Figure 11 on page 19 shows the ports that connect to the Routing Engine.

*Figure 11: Routing Engine Interface Ports*




**Related Documentation**

- M7i Routing Engine LEDs on page 20
- M7i Router Description on page 3
- M7i Router Physical Specifications on page 74
- M7i Router Power Requirements on page 79

## M7i Routing Engine LEDs

Four LEDs—A green LED labeled **HDD**, a blue LED labeled **MASTER**, a red LED labeled **FAIL**, and a green LED labeled **ONLINE** indicate Routing Engine status. Table 3 on page 20 describes the LED states.

*Table 3: States for Routing Engine LEDs*

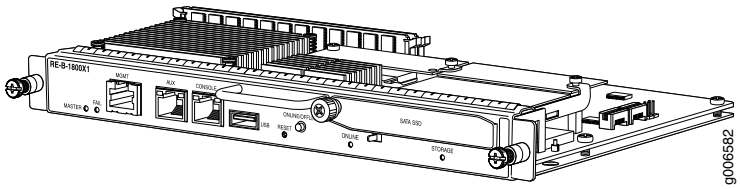
| Label | Color | State | Description |
|---|---|---|---|
| **HDD** | Green | Blinking | There is read/write activity on the PC card. |
| **MASTER** | Blue | On steadily | Routing Engine is functioning as master. On an M7i router, this LED is always lit. |
| **FAIL** | Red | On steadily | Routing Engine is not operational. |
| **ONLINE** | Green | On steadily | Routing Engine is running normally. |

**Related Documentation**

- M7i Routing Engine Description on page 17
- M7i Router Description on page 3
- M7i Router Physical Specifications on page 74
- M7i Router Power Requirements on page 79

## M7i Routing Engine RE-B-1800 Description

*Figure 12: Routing Engine RE-B-1800*




The Routing Engine RE-B-1800 has the following major components:

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols. It has Intel's single core Jasper Forest processor.
- USB port—Provides a removable media interface through which you can install the Junos OS manually. Junos OS supports USB version 2.0.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- CompactFlash card—Provides primary storage for software images, configuration files, and microcode. The CompactFlash card is field-replaceable.

- Solid-state Disk (SSD)—Provides secondary storage for log files and memory dumps, and can reboot the system if the CompactFlash card fails. SSD is front-pluggable and hot-swappable.
- Interface ports—The **AUX**, **CONSOLE**, and **MGMT** ports 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.
- Real-time clock—Provides real-time integrated clock with batter backup for data retention.
- Extractor handle—Used for inserting and extracting the Routing Engine.
- Captive screws—Secure the Routing Engine in place.
- Four LEDs—A green LED labeled **STORAGE**, a blue LED labeled **MASTER**, a red LED labeled **FAIL**, and a green LED labeled **ONLINE** indicate Routing Engine status.

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

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 SSD 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 SSD, then the LAN. Normally, the router boots from the copy of the software on the CompactFlash card.

**Related Documentation**

- M7i Routing Engine 1800 LEDs on page 22
- Replacing the M7i Routing Engine on page 141
- Replacing the SSD on an RE-B-1800 Routing Engine on page 143

## M7i Routing Engine 1800 LEDs

Four LEDs—a blue LED labeled **MASTER**, a red LED labeled **FAIL**, a green LED labeled **STORAGE**, and a green LED labeled **ONLINE**—located on the faceplate, indicate Routing Engine status. Table 4 on page 22 describes the Routing Engine 1800 LED states.

*Table 4: States for RE-B-1800 Routing Engine LEDs*

| Label | Color | State | Description |
|---|---|---|---|
| **MASTER** | Blue | On steadily | Routing Engine is functioning as master. |
| **FAIL** | Red | On steadily | Routing Engine is not operational. |
| **STORAGE** | Green | Blinking | Indicates activity on the SSD or Compact Flash. |
| **ONLINE** | Green | On steadily | Routing Engine is running normally. |

**Related Documentation**

- Displaying M7i Router Components and Serial Numbers on page 213
- M7i Router Physical Specifications on page 74

## Routing Engine Specifications

Table 5 on page 22 lists the current specifications for Routing Engines supported on M Series, MX Series, and T Series routers. Table 6 on page 25 lists the specifications for end-of-life Routing Engines.

NOTE: For a list of the routing engines that are supported on the M Series, MX Series, T Series, and PTX routers, see "Supported Routing Engines by Router" on page 27.

NOTE: For information about PTX Series Routing Engine specifications, see *Routing Engines Supported on PTX Series Routers*. For information about

*Table 5: Routing Engine Specifications*

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | Switch Control Board |
|---|---|---|---|---|---|---|---|
| RE-400-768 | 400-MHz Celeron | 768 MB | Fast Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 9.0 | – |

*Table 5: Routing Engine Specifications (continued)*

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | Switch Control Board |
|---|---|---|---|---|---|---|---|
| RE-A-1000-2048 | 1.0-GHz Pentium | 2048 MB | Gigabit Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 8.1 | – |
| RE-A-2000-4096 | 2.0-GHz Pentium | 4096 MB | Gigabit Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 8.1 | – |
| RE-S-1300-2048 | 1.3-GHz Pentium | 2048 MB | Gigabit Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 8.2 | SCB, SCBE |
| RE-S-2000-4096 | 2.0-GHz Pentium | 4096 MB | Gigabit Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 8.2 | SCB, SCBE |
| RE-C1800 | 1.8-GHz | 8 GB | Gigabit Ethernet | SSD | 4 GB CompactFlash card | T1600 router in a routing matrix: 9.6R2<br><br>Standalone T640 or T1600 router:11.2 | CB-T for a standalone router.<br><br>CB-LCC for a router in a routing matrix. |
| | 1.8 Ghz | 16 GB | Gigabit Ethernet | SSD | 4 GB CompactFlash card | 32-bit Junos OS on a standalone T1600 router: 11.4R2 32-bit Junos OS on a T1600 router in a routing matrix: 11.4R2<br><br>64-bit Junos OS on a standalone T1600 router: 11.4R2 64-bit Junos OS on a T1600 router in a routing matrix: 11.4R2 | CB-T for a standalone router.<br><br>CB-LCC for a router in a routing matrix. |
| RE-C2600 | 2.6-GHz | 16 GB | Gigabit Ethernet | SSD | 4 GB CompactFlash card | TX Matrix Plus router: 9.6R2 | – |
| RE-A-1800x2 | 1800-MHz | 8 GB or 16 GB | Gigabit Ethernet | 32 GB SSD | 4 GB CompactFlash card | 10.4 | – |

*Table 5: Routing Engine Specifications (continued)*

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | Switch Control Board |
|---|---|---|---|---|---|---|---|
| RE-S-1800x2 | 1800-MHz | 8 GB or 16 GB | Gigabit Ethernet | 32 GB SSD | 4 GB CompactFlash card | 10.4 | SCB, SCBE |
| RE-S-1800x4 | 1800-MHz | 8GB or 16 GB | Gigabit Ethernet | 32 GB SSD | 4 GB CompactFlash card | 10.4 | SCB, SCBE, SCBE2 |
| RE-S-MX104 | 1.8-GHz | 4 GB | Gigabit Ethernet | – | 8 GB NAND Flash | 13.2 | – |
| RE-B-1800x1-4G | 1.73-GHz | 4 GB | Gigabit Ethernet | 64 GB SSD | 4 GB CompactFlash card | 12.1R2, 11.4R4, and 12.2R1 | – |
| REMX2000-1800x4 | 1.8- GHz | 16 GB | Gigabit Ethernet | 32 GB SSD | 4 GB Fixed Internal CompactFlash card | 12.3R2 | SCB, SCBE |
| RE-S-1800X4-32G-S | 1.8- Ghz | 32 GB | Gigabit Ethernet | 32 GB SSD | 4 GB Fixed Internal CompactFlash card | • 12.3R4<br>• 13.2R1 | SCB, SCBE<br><br>SCBE2 |
| REMX2K-1800-32G-S | 1.8- Ghz | 32 GB | Gigabit Ethernet | 32 GB SSD | 4GB Fixed Internal CompactFlash card | • 12.3R4<br>• 13.2R1 | – |
| RE-S-X6-64G, RE-S-X6-64G-LT | 2 Ghz | 64 GB | Gigabit Ethernet | Two 50-GB SSDs | - | 15.1F4, 16.1 | SCBE2 |
| REMX2K-X8-64G | 2.3 Ghz | 64 GB | Gigabit Ethernet | Two 100-GB SSDs | - | 15.1F5-S1, 16.1R2, and 16.2R1 | – |
| REMX2K-X8-64G-LT | 2.3 Ghz | 64 GB | Gigabit Ethernet | Two 100-GB SSDs | - | 17.2R1 | – |
| REMX2008-X8-64G | 2.3 Ghz | 64 GB | Gigabit Ethernet | Two 50-GB SSDs | – | 15.1F7 | – |
| RE-S-1600x8 | 1.6 Ghz | 64 GB | Gigabit Ethernet | Two 50-GB SSDs | – | 17.3R1 | – |
| REMX008-X8-64G-LT | 2.1 Ghz | 64 GB | Gigabit Ethernet | Two 100-GB SSDs | - | 17.2R1 | - |

*Table 5: Routing Engine Specifications (continued)*

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | Switch Control Board |
|---|---|---|---|---|---|---|---|
| REMX2008X8128G | 2.3 Ghz | 128 GB | Gigabit Ethernet | Two 200-GB SSDs | - | 18.2R1 | - |
| RE-S-X6-128G | 2.1 Ghz | 128 GB | Gigabit Ethernet | Two 200-GB SSDs | - | 18.1R1 | - |
| REMX2K-X8-128G | 2.1 Ghz | 128 GB | Gigabit Ethernet | Two 200-GB SSDs | - | 18.1R1 | - |
| JNP10003-RE1 | 1.6-GHz | 64 GB | Gigabit Ethernet | Two 100 GB SSDs | - | 17.3R1 | - |
| JNP10003-RE1-LT | 1.6-GHz | 64 GB | Gigabit Ethernet | Two 100 GB SSDs | - | 18.1R1 | - |
| JNP10K-RE0 | 2.5 GhZ | 32 GB | Gigabit Ethernet | Two 50 GB SSDs | - | 17.2R1 | - |
| JNP10K-RE1 | 2.3 GhZ | 64 GB | Gigabit Ethernet | Two 200 GB SSDs | - | 18.2R1 | - |
| JNP10K-RE1-LT | 2.3 GhZ | 64 GB | Gigabit Ethernet | Two 200 GB SSDs | - | 18.3R1 | - |
| JNP10K-RE1-128 | 2.3 GhZ | 128 GB | Gigabit Ethernet | Two 200 GB SSDs | - | 18.3R1 | - |

NOTE: Use shielded CAT5e cable for connecting the AUX, CONSOLE, and MGMT ports in RE-S-X6-64G, REMX2K-X8-64G, and REMX2008-X8-64G Routing Engines.

*Table 6: End-of-Life Routing Engine Specifications*

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | EOL Details |
|---|---|---|---|---|---|---|---|
| RE-333-256 | 333-MHz Pentium II | 256 MB | Fast Ethernet | 6.4 GB hard disk | 80 MB CompactFlash card | 3.4 | PSN-2003-01-063 |
| RE-333-768 | 333-MHz Pentium II | 768 MB | Fast Ethernet | 6.4 GB hard disk | 80 MB CompactFlash card | 3.4 | PSN-2003-01-063 |

*Table 6: End-of-Life Routing Engine Specifications (continued)*

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | EOL Details |
|---|---|---|---|---|---|---|---|
| RE-600-512 | 600-MHz Pentium III | 512 MB | Fast Ethernet | 30 GB hard disk | 256 MB CompactFlash card | 5.4 | PSN-2004-07-019 |
| RE-600-2048 | 600-MHz Pentium III | 2048 MB | Fast Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 5.3 | PSN-2008-02-018 |
| RE-850-1536 | 850-MHz Pentium III | 1536 MB | Fast Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 7.2 | PSN-2011-04-226 |
| RE-M40 | 200-MHz Pentium | 256 MB | Fast Ethernet | 6.4 GB hard disk | 80 MB CompactFlash card | 3.2 | FA-HW-0101-001 |
| RE-M40-333-768 | 333-MHz Pentium II | 768 MB | Fast Ethernet | 10 GB hard disk | 80 MB CompactFlash card | 4.2 | PSN-2003-01-063 |
| RE-M40-600-2048 | 600-MHz Pentium III | 2048 MB | Fast Ethernet | 30 GB hard disk | 128 MB CompactFlash card | 5.4 | PSN-2004-11-020 |
| RE-1600-2048 | 1.6-GHz Pentium M | 2048 MB | Gigabit Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 6.2 | PSN-2008-02-019 |

NOTE: The memory in Table 5 on page 22 indicates the amount of total memory. To determine the amount of available memory, issue the **show chassis routing-engine** CLI command.

On routers that accept two Routing Engines, you cannot mix Routing Engine types except for a brief period (one minute or so) during an upgrade or downgrade to two Routing Engines of the same type.

**Related Documentation**

- Supported Routing Engines by Router on page 27

## Supported Routing Engines by Router

The following tables list the Routing Engines that each router supports, the first supported release for the Routing Engine in the specified router, the management Ethernet interface, and the internal Ethernet interfaces for each Routing Engine.



### M7i Routing Engines

Table 7 on page 28 lists the Routing Engines supported by the M7i router. The M7i router supports 32-bit Junos OS only.

*Table 7: M7i Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-400-768 (EOL details: TSB16445) | **RE-5.0** | 9.0 | fxp0 | fxp1 |
| RE-850-1536 (EOL details: TSB15553) | **RE-850** | 7.2 | fxp0 | fxp1 |
| RE-B-1800X1-4G | **RE-B-1800x1** | 11.4R4<br>12.1R2 | fxp0 | em0 |

## M10i Routing Engines

Table 8 on page 28 lists the Routing Engines supported by the M10i router. The M10i router supports 32-bit Junos OS only.

*Table 8: M10i Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-400-768 (EOL details: TSB16445) | **RE-5.0** | 9.0 | fxp0 | fxp1<br>fxp2 |
| RE-850-1536 (EOL details: TSB15553) | **RE-850** | 7.2 | fxp0 | fxp1<br>fxp2 |
| RE-B-1800X1-4G | **RE-B-1800x1** | 11.4R4<br>12.1R2 | fxp0 | em0 |

## M40e Routing Engines

Table 9 on page 28 lists the Routing Engines supported by the M40e router.

*Table 9: M40e Routing Engines*

| Model Number | Name in CLI Output | First Supported Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-600-2048 (EOL details: TSB14373) | **RE-3.0** or **RE-3.0 (RE-600)** | 5.3 | fxp0 | fxp1<br>fxp2 |
| RE-A-1000-2048 | **RE-A-1000** | 8.1 | fxp0 | fxp1<br>fxp2 |

## M120 Routing Engines

Table 10 on page 29 lists the Routing Engines supported by the M120 router.

*Table 10: M120 Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-A-1000-2048 | **RE-A-1000** | 8.0R2 | – | fxp0 | fxp1<br>fxp2 |
| RE-A-2000-4096 | **RE-A-2000** | 8.0R2 | – | fxp0 | em0<br>bcm0 |
| RE-A-1800X2-8G | **RE-A-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | fxp1<br>fxp2 |
| RE-A-1800X2-16G | **RE-A-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | fxp1<br>fxp2 |
| RE-A-1800X4-16G | **RE-A-1800x4** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |

## M320 Routing Engines

Table 11 on page 29 lists the Routing Engines supported by the M320 router.

*Table 11: M320 Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-1600-2048 (EOL details: TSB14374) | **RE-4.0** | 6.2 | – | fxp0 | fxp1<br>fxp2 |
| RE-A-2000-4096 | **RE-A-2000** | 8.1 | – | fxp0 | em0<br>bcm0 |
| RE-A-1800X2-8G | **RE-A-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>bcm0 |

*Table 11: M320 Routing Engines (continued)*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-A-1800X2-16G | **RE-A-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>bcm0 |
| RE-A-1800X4-8G | **RE-A-1800X4** | • 11.4R5<br>• 12.1R3<br>• 12.2 | 10.4 | fxp0 | em0<br>em1 |

## MX5, MX10, MX40, and MX80 Routing Engine

Table 12 on page 30 lists the Routing Engines supported by the MX5, MX10, MX40, and MX80 routers.

*Table 12: MX5, MX10, MX40, and MX80 Routing Engine*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| Built-in Routing Engine | **Routing Engine RE-MX80** | 12.3 | - | fxp0 | em0<br>em1<br>NOTE: em1 is used to communicate with the MS-MIC when it is inserted. |

## MX104 Routing Engines

Table 13 on page 30 lists the Routing Engines supported by MX104 routers.

*Table 13: MX104 Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-S-MX104 | **Routing Engine** | 13.2 | – | fxp0 | fxp1<br>fxp2 |

## MX240 Routing Engines

Table 14 on page 31 lists the Routing Engines supported by MX240 routers.

*Table 14: MX240 Supported Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-S-1300-2048 (EOL details: TSB16556 | **RE-S-1300** | 9.0 | – | fxp0 | fxp1<br>fxp2 |
| RE-S-2000-4096 (EOL details: TSB16735 | **RE-S-2000** | 9.0 | – | fxp0 | fxp1<br>fxp2 |
| RE-S-1800X2-8G (EOL details: TSB16556 | **RE-S-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800x2-16G (EOL details: TSB16556 | **RE-S-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-8G | **RE-S-1800X4** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-16G | **RE-S-1800x4** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-32G-S | **RE-S-1800X4** | • 12.3R4<br>• 13.2R1 | • 12.3R4<br>• 13.2R1 | fxp0 | em0,<br>em1 |
| RE-S-X6-64G | **RE-S-2X00x6** | – | 15.1F4<br>16.1R1 | fxp0 | ixlv0, igb0 |
| RE-S-X6-64G-LT | **RE-S-2X00x6 -LT** | – | 17.2R1 | fxp0 | ixlv0, igb0<br>em0 |
| RE-S-X6-128G | **RE-S-2X00x6-128** | – | 18.1R1 | fxp0 | ixlv0, igb0<br>em0 |

## MX480 Routing Engines

Table 15 on page 32 lists the Routing Engines supported by MX480 routers.

*Table 15: MX480 Supported Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-S-1300-2048 (EOL details: TSB16556 | **RE-S-1300** | 8.4 | – | fxp0 | fxp1<br>fxp2 |
| RE-S-2000-4096 (EOL details: TSB16735 | **RE-S-2000** | 8.4 | – | fxp0 | fxp1<br>fxp2 |
| RE-S-1800X2-8G (EOL details: TSB16556 | **RE-S-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X2-16G (EOL details: TSB16556 | **RE-S-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-8G | **RE-S-1800X4** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-16G | **RE-S-1800x4** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-32G-S | **RE-S-1800X4** | • 12.3R4<br>• 13.2R1 | • 12.3R4<br>• 13.2R1 | fxp0 | em0<br>em1 |
| RE-S-X6-64G | **RE-S-2X00x6** | – | 15.1F4<br>16.1R1 | fxp0 | ixlv0, igb0 |
| RE-S-X6-64G-LT | **RE-S-2X00x6 -LT** | – | 17.2R1 | fxp0 | ixlv0, igb0<br>em0 |
| RE-S-X6-128G | **RE-S-2X00x6-128** | – | 18.1R1 | fxp0 | ixlv0, igb0<br>em0 |

## MX960 Routing Engines

Table 16 on page 33 lists the Routing Engines supported by MX960 routers.

*Table 16: MX960 Supported Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-S-1300-2048 (EOL details: TSB16556 | **RE-S-1300** | 8.2 | – | fxp0 | fxp1<br>fxp2 |
| RE-S-2000-4096 (EOL details: TSB16735 | **RE-S-2000** | 8.2 | – | fxp0 | fxp1<br>fxp2 |
| RE-S-1800X2-8G (EOL details: TSB16556 | **RE-S-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X2-16G (EOL details: TSB16556 | **RE-S-1800x2** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-8G | **RE-S-1800x4** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-16G | **RE-S-1800x4** | • 11.4R5<br>• 12.1R3 | 10.4 | fxp0 | em0<br>em1 |
| RE-S-1800X4-32G-S | **RE-S-1800x4** | • 12.3R4<br>• 13.2R1 | • 12.3R4<br>• 13.2R1 | fxp0 | em0<br>em1 |
| RE-S-X6-64G | **RE-S-2X00x6** | – | 15.1F4<br>16.1R1 | fxp0 | ixlv0, igb0 |
| RE-S-X6-64G (For MX960-VC) | **RE-S-2X00x6** | – | 17.1R2 | fxp0 | ixlv0, igb0 |
| RE-S-X6-64G-LT | **RE-S-2X00x6 -LT** | – | 17.2R1 | fxp0 | ixlv0, igb0<br>em0 |
| RE-S-X6-128G | **RE-S-2X00x6-128** | – | 18.1R1 | fxp0 | ixlv0, igb0<br>em0 |

## MX2008 Routing Engines

Table 17 on page 34 lists the Routing Engines supported by MX2008 routers.

*Table 17: MX2008 Supported Routing Engines*

| Model Number | Name in CLI Output | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| REMX2008-X8-64G | **RE-MX2008-X8-64G** | 15.1F7 | fxp0 | ixlv0<br>ixlv1 |
| REMX2008-X8-64G-LT | **REMX2008-X8-64G-LT** | 17.2R1 | fxp0 | ixlv0<br>ixlv1 |
| REMX2008-X8-128G | **RE-MX2008-X8-128G** | 18.2R1 | fxp0 | ixlv0<br>ixlv1 |

## MX2010 Routing Engines

Table 18 on page 34 lists the Routing Engines supported by MX2010 routers.

*Table 18: MX2010 Supported Routing Engines*

| Model Number | Name in CLI Output | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-MX2000-1800X4 | **RE-S-1800x4** | 12.3R2 | fxp0 | em0<br>em1 |
| REMX2K-1800-32G-S | **RE-S-1800x4** | • 12.3R4<br>• 13.2R1 | fxp0 | em0<br>em1 |
| REMX2K-X8-64G | **RE-S-2X00x8** | • 15.1F5-S1<br>• 16.1R2<br>• 16.2R1 | fxp0 | ixlv0<br>ixlv1<br>em0 |
| REMX2K-X8-64G-LT | **RE-S-2X00x8** | 17.2R1 | fxp0 | ixlv0<br>ixlv1<br>em0 |
| REMX2K-X8-128G | **RE-MX200X8-128G** | 18.1R1 | fxp0 | ixlv0<br>ixlv1 |

## MX2020 Supported Routing Engines

Table 19 on page 35 lists the Routing Engines supported by MX2020 routers.

*Table 19: MX2020 Supported Routing Engines*

| Model Number | Name in CLI Output | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-MX2000-1800X4 | **RE-S-1800x4** | 12.3R2 | fxp0 | em0<br>em1 |
| REMX2K-1800-32G-S | **RE-S-1800x4** | • 12.3R4<br>• 13.2R1 | fxp0 | em0<br>em1 |
| REMX2K-X8-64G | **RE-S-2X00x8** | • 15.1F5-S1<br>• 16.1R2<br>• 16.2R1 | fxp0 | ixlv0<br>ixlv1<br>em0 |
| REMX2K-X8-64G-LT | **RE-S-2X00x8** | 17.2R1 | fxp0 | ixlv0<br>ixlv1<br>em0 |
| REMX2K-X8-128G | **RE-MX200X8-128G** | 18.1R1 | fxp0 | ixlv0<br>ixlv1<br>em0 |

## MX10003 Routing Engines

Table 20 on page 35 lists the Routing Engines supported by MX10003 routers.

*Table 20: MX10003 Supported Routing Engines*

| Model Number | Name in CLI Output | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| JNP10003-RE1 | **RE-S-2X00x6** | 17.3R1 | fxp0 | em3<br>em4 |
| JNP10003-RE1-LT | RE-S-1600x8 | 18.1R1 | fxp0 | em3<br>em4 |

## MX10008 Routing Engines

Table 21 on page 36 lists the Routing Engines supported on the MX10008 router.

*Table 21: MX10008 Routing Engines*

| Model Number | Name in CLI Output | First Supported Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| JNP10K-RE1 | **RE X10** | 18.2R1 | em0 | bme0<br>bme1 |
| JNP10K-RE1-LT | **RE X10 LT** | 18.3R1 | em0 | bme0<br>bme1 |
| JNP10K-RE1-128 | **RE X10 128G** | 18.3R1 | em0 | bme0<br>bme1 |

## PTX1000 Routing Engines

Table 22 on page 36 lists the Routing Engine supported on the PTX1000.

NOTE: The PTX1000 supports 64-bit Junos OS only.

*Table 22: PTX1000 Routing Engines*

| Model Number | Name in CLI Output | First Supported Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| Built-in Routing Engine | **RE-PTX1000** | • 16.1X65-D30<br>• 17.2R1 | em0 | bme0<br>em1 |

## PTX3000 Routing Engines

Table 23 on page 36 lists the Routing Engines supported on the PTX3000.

NOTE: The PTX3000 supports 64-bit Junos OS only.

*Table 23: PTX3000 Routing Engines*

| Model Number | Name in CLI Output | First Supported Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-DUO-C2600-16G | **RE-DUO-2600** | 13.2R2 | em0 | ixgbe0<br>ixgbe1 |

*Table 23: PTX3000 Routing Engines (continued)*

| Model Number | Name in CLI Output | First Supported Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RCB-PTX-X6-32G | **RE-PTX-2X00x6** | 16.1R4<br>17.1R1<br>This Routing Engine does not support Junos OS Release 16.2. | em0 | ixlv0<br>ixlv1 |

## PTX5000 Routing Engines

Table 24 on page 37 lists the Routing Engines supported on the PTX5000.

NOTE:

- PTX5000 supports 64-bit Junos OS only.
- The PTX5000 router supports two midplanes. The midplane identified as **Midplane-8S** in the CLI output is supported in Junos OS releases, 12.1X48, 12.3, and 13.2. The enhanced midplane, identified as **Midplane-8SeP** is supported from Junos OS release 14.1 onwards.

  The RE-DUO-2600 routing engine with Junos OS 13.2 or earlier is not supported on the PTX5000BASE2 midplane.

*Table 24: PTX5000 Routing Engines*

| Model Number | Name in CLI Output | First Supported Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-DUO-C2600-16G | **RE-DUO-2600** | 12.1X48<br>12.3<br>13.2<br>NOTE: The PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1. | em0 | ixgbe0<br>ixgbe1 |
| RE-PTX-X8-64G | **RE-PTX-2X00x8** | 15.1F4<br>16.1R1 | em0 | ixlv0<br>ixlv1<br>em1 |
| RE-PTX-X8-128G | **RE-PTX-2X00x8-128G** | 18.1R1 | em0 | ixlv0<br>ixlv1<br>em1 |

## PTX10008 and PTX10016 Routing Engines

Table 25 on page 38 lists the Routing Engines supported on the PTX10008 and PTX10016 routers.

*Table 25: PTX10008 and PTX10016 Routing Engines*

| Model Number | Name in CLI Output | First Supported Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| JNP10K-RE0 | **RE-PTX-2X00x4** | 17.2R1 | em0, em1 | bme0<br>bme1 |
| JNP10K-RE1 | **RE X10** | 18.2R1 | em0 | bme0<br>bme1 |
| JNP10K-RE1-LT | **RE X10 LT** | 18.3R1 | em0 | bme0<br>bme1 |
| JNP10K-RE1-128 | **RE X10 128G** | 18.3R1 | em0 | bme0<br>bme1 |

## T320 Routing Engines

Table 26 on page 38 lists the Routing Engines supported by the T320 router.

*Table 26: T320 Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-600-2048 (EOL details: TSB14373) | **RE-3.0** or **RE-3.0 (RE-600)** | 5.3 | fxp0 | fxp1<br>fxp2 |
| RE-1600-2048 (EOL details: TSB14374 | **RE-4.0** | 6.2 | fxp0 | fxp1<br>fxp2 |
| RE-A-2000-4096 | **RE-A-2000** | 8.1 | fxp0 | fxp1<br>fxp2 |

The T320 router supports the CB-T control board.

## T640 Routing Engines

Table 27 on page 39 lists the Routing Engines supported by the T640 router.

*Table 27: T640 Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-600-2048 (EOL details: TSB14373) | **RE-3.0** or **RE-3.0 (RE-600)** | 5.3 | – | fxp0 | fxp1<br>fxp2 |
| RE-1600-2048 (EOL details: TSB14374 | **RE-4.0** | 6.2 | – | fxp0 | fxp1<br>fxp2 |
| RE-A-2000-4096 | **RE-A-2000** | 8.1 | – | fxp0 | em0<br>bcm0 |
| RE-DUO-C1800-8G | **RE-DUO-1800** | 32-bit Junos OS on a standalone T640 router: 11.2<br>32-bit Junos OS on a T640 router in a routing matrix: 11.4R9 | 64-bit Junos OS on a standalone T640 router: 11.3<br>64-bit Junos OS on a T640 router in a routing matrix: 11.4R9 | em0 | bcm0<br>em1 |
| RE-DUO-C1800-16G | **RE-DUO-1800** | 32-bit Junos OS on a standalone T640 router: 11.4R2<br>32-bit Junos OS on a T640 router in a routing matrix: 11.4R9 | 64-bit Junos OS on a standalone T640 router: 11.4R2<br>64-bit Junos OS on a T640 router in a routing matrix: 11.4R9 | em0 | bcm0<br>em1 |

The T640 standalone router supports CB-T control board and CB-LCC in a T640 routing matrix.

## T1600 Routing Engines

Table 28 on page 39 lists the Routing Engines supported by the T1600 router.

NOTE: (Two RE-DUO-C1800-8G or two RE-DUO-C1800-16G are required to connect to a Routing Matrix)

*Table 28: T1600 Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-600-2048 (EOL details: TSB14373) | **RE-3.0** or **RE-3.0 (RE-600)** | 8.5 | – | fxp0 | fxp1<br>fxp2 |

*Table 28: T1600 Routing Engines (continued)*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-1600-2048 (EOL details: TSB14374 | **RE-4.0 (RE-1600)** | 8.5 | – | fxp0 | fxp1<br>fxp2 |
| RE-A-2000-4096 | **RE-A-2000** | 8.5 | – | fxp0 | em0<br>bcm0 |
| RE-DUO-C1800-8G | **RE-TXP-LCC** or **RE-DUO-1800** | 32-bit Junos OS on a T1600 router in a routing matrix: 9.6<br>NOTE: Junos OS Releases 9.6 through 10.4 support RE-DUO-C1800-8G only during upgrade to a line-card chassis (LCC) in a routing matrix.<br>32-bit Junos OS on a standalone T1600 router: 11.1 | 64-bit Junos OS on a T1600 router in a routing matrix: 9.6<br>64-bit Junos OS on a standalone T1600 router: 11.1 | em0 | bcm0<br>em1 |
| RE-DUO-C1800-16G | **RE-DUO-1800** | 32-bit Junos OS on a standalone T1600 router: 11.4R2<br>32-bit Junos OS on a T1600 router in a routing matrix: 11.4R2 | 64-bit Junos OS on a standalone T1600 router: 11.4R2<br>64-bit Junos OS on a T1600 router in a routing matrix: 11.4R2 | em0 | bcm0<br>em1 |

## T4000 Routing Engines

Table 29 on page 40 lists the Routing Engines supported by the T4000 router.

NOTE: The T4000 router supports 64-bit Junos OS only.

*Table 29: T4000 Routing Engines*

| Model Number | Name in CLI Output | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|
| RE-DUO-C1800-8G | **RE-DUO-1800** | Standalone T4000 router: 12.1<br>T4000 router in a routing matrix: 13.1 | em0 | bcm0<br>em1 |
| RE-DUO-C1800-16G | **RE-DUO-1800** | Standalone T4000 router: 12.1R2<br>T4000 router in a routing matrix: 13.1 | em0 | bcm0<br>em1 |

The T4000 router supports the CB-LCC control board.

## TX Matrix Routing Engines

Table 30 on page 41 lists the Routing Engines supported by the TX Matrix router.

*Table 30: TX Matrix Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-600-2048 (EOL details: TSB14373) | **RE-3.0** or **RE-3.0 (RE-600)** | 7.0 | – | fxp0 | fxp1<br>fxp2 |
| RE-1600-2048 (EOL details: TSB14374 | **RE-4.0 (RE-1600)** | 7.0 | – | fxp0 | fxp1<br>fxp2 |
| RE-A-2000-4096 | **RE-A-2000** | 8.5 | – | fxp0 | em0<br>bcm0 |
| RE-DUO-C1800-8G | **RE-DUO-1800** | 11.4R9 | 11.4R9 | em0 | bcm0<br>em1 |
| RE-DUO-C1800-16G | **RE-DUO-1800** | 11.4R9 | 11.4R9 | em0 | bcm0<br>em1 |

The TXP router supports two control boards, CB-TX and CB-LCC. The CB-LCC is required for both RE-DUO-C1800-8G and RE-DUO-C1800-16G Routing Engines.

## TX Matrix Plus Routing Engines

Table 31 on page 41 lists the Routing Engines supported by the TX Matrix Plus router.

*Table 31: TX Matrix Plus Routing Engines*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-DUO-C2600-16G | **RE-TXP-SFC** or **RE-DUO-2600** | 32-bit Junos OS: 9.6 | 64-bit Junos OS: 11.4 | em0 | ixgbe0<br>ixgbe1 |

The TX Matrix Plus router supports the CB-TXP control board.

## TX Matrix Plus (with 3D SIBs) Routing Engines

Table 32 on page 42 lists the Routing Engines supported by the TX Matrix Plus router with 3D SIBs.

*Table 32: Routing Engines on TX Matrix Plus with 3D SIBs*

| Model Number | Name in CLI Output | First Supported 32-bit Junos OS Release | First Supported 64-bit Junos OS Release | Management Ethernet Interface | Internal Ethernet Interface |
|---|---|---|---|---|---|
| RE-DUO-C2600-16G | **RE-TXP-SFC** or **RE-DUO-2600** | - | 64-bit Junos OS: 11.4 | em0 | ixgbe0<br>ixgbe1 |

**Related Documentation**

- Routing Engine Specifications on page 22
- *Understanding Internal Ethernet Interfaces*
- *Understanding Management Ethernet Interfaces*

CHAPTER 6

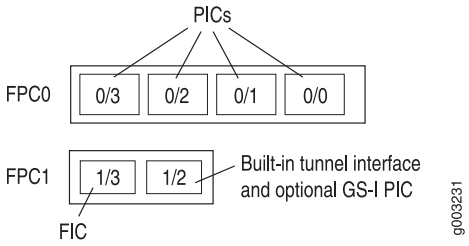
# Line Card Components and Descriptions



## M7i Flexible PIC Concentrators (FPCs) Description

Flexible PIC Concentrators (FPCs) house the PICs that connect the router to network media (for information about PICs, see "M7i PICs Description" on page 46). On the M7i router, each FPC is built in (it cannot be removed from the chassis as on other M Series routers). The networking and services interfaces in the M7i router are grouped onto two logical FPCs by the router, (see Figure 13 on page 43). PICs are located on **FPC 0**. On **FPC 1** the FIC is located in slot **3** and the built-in tunnel interface is located in slot **2**. If the ASM is installed on the CFEB or CFEB-E, it is located on slot **2** with the built-in tunnel interface.

*Figure 13: FPC Slot Numbering*




**Related Documentation**

- M7i Router Description on page 3
- M7i Router Physical Specifications on page 74

- Overview of M7i Router Installation on page 103

## M7i Fixed Interface Card (FIC) Description

The Fixed Interface Card (FIC) is built into the router chassis.

The FIC receives incoming packets from the network and transmits outgoing packets to the network, providing support for Fast Ethernet ports or Gigabit Internet interfaces, depending on which version of the FIC is installed in the router.

The FIC also allows you to view alarm status at a glance and to perform some system control functions, such as taking PICs online and offline.

The FIC is located on the front of the chassis to the left of the Routing Engine and is not a field-replaceable unit (FRU).

Each FIC consists of the following components:

- The FIC has either two 100Base-TX Fast Ethernet ports or one Gigabit Ethernet port, depending on which type of FIC is installed in the router. Table 33 on page 45 describes the interface connectors. See Figure 14 on page 44 and Figure 15 on page 44.

  For more information about Fast Ethernet and Gigabit Ethernet interfaces, see the *M7i Multiservice Edge Router Interface Module Reference*. The networking interface on the FIC is configured the same way as a PIC. For more information about configuring interfaces see the *Junos OS Network Interfaces Library for Routing Devices*.
- Buttons on the FIC labeled **PICS ON/OFF** to take a Physical Interface Card (PIC) offline when it needs to be removed, or bring it online when it is replaced.
- Alarm LEDs and interface LEDs.

*Figure 14: FIC with Fast Ethernet Ports*

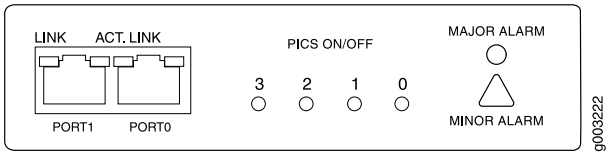
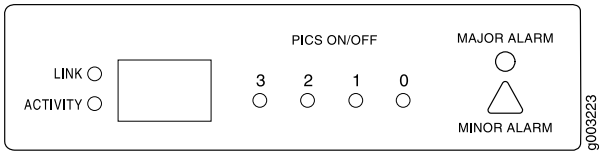



*Figure 15: FIC with Gigabit Ethernet Port*




**Related Documentation**

- M7i FIC LEDs on page 45
- Connecting FIC and PIC Cables to the M7i Router on page 120
- M7i Chassis Description on page 11
- M7i Midplane Description on page 12

## FIC Specifications for the M7i Router

Table 33 on page 45 lists the specifications for the type of network cable accepted by the FIC. For information about the network cables for the PICs in your router, refer to the *M7i Multiservice Edge Router Interface Module Reference*.

*Table 33: FIC Specifications*

| Interface Type | Cable Specification | Cable Supplied | Maximum Length | Router Receptacle |
|---|---|---|---|---|
| 2-port Fast Ethernet FIC | RJ-45 connectors (one for each port); MDI noncrossover | No | 328 ft (100 m) | RJ-45 |
| 1-port Gigabit Ethernet FIC with SX SFP | Duplex LC | No | 656 ft/200 m reach on 62.5/125 micrometer multimode fiber (MMF) 1640 ft/500 m reach on 50/125 micrometer MMF | LC |
| 1-port Gigabit Ethernet FIC with LX SFP | Duplex LC | No | 6.2 mile/10 km reach on 9/125 micrometer single-mode fiber (SMF) | LC |
| 1-port Gigabit Ethernet FIC with LH SFP | Duplex LC | No | 43.5 mile/70 km reach on 8.2 micrometer SMF | LC |

**Related Documentation**

- M7i PICs Description on page 46
- M7i Fixed Interface Card (FIC) Description on page 44
- Connecting FIC and PIC Cables to the M7i Router on page 120

## M7i FIC LEDs

Two large alarm LEDs are located on the right of the FIC (see Figure 14 on page 44 and Figure 15 on page 44). 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.

To deactivate red and yellow alarms, you must clear the condition that caused the alarm.

Table 34 on page 46 describes the alarm LEDs in more detail.

*Table 34: Alarm LEDs*

| Shape | Color | State | Description |
|---|---|---|---|
|  | Red | On steadily | Critical alarm LED—Indicates a critical condition that can cause the router to stop functioning, such as 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. |

Table 35 on page 46 describes the FIC interface LEDs in more detail.

*Table 35: FIC Interface LEDs*

| Label | Color | State | Description |
|---|---|---|---|
| LINK | Green | On steadily | The port is online. |
| ACTIVITY | Green | Blinking | The port is receiving data. |
| | | Off | The port might be on, but is not receiving data. |

**Related Documentation**

- M7i Fixed Interface Card (FIC) Description on page 44
- Connecting FIC and PIC Cables to the M7i Router on page 120

## M7i PICs Description

PICs physically connect the router to network media. PICs receive incoming packets from the network and transmit outgoing packets to the network, performing framing and line-speed signaling for their media type as required. PICs also encapsulate outgoing packets received from the Compact Forwarding Engine Board (CFEB) or Enhanced CFEB (CFEB-E) before transmitting them. The controller ASIC on each PIC performs additional control functions specific to the PIC media type.

The router supports various PICs, including ATM, Channelized, Gigabit Ethernet, Services, and SONET/SDH interfaces. You can install PICs of different media types on the same router as long as the router supports those PICs.

Blank PICs resemble other PICs but do not provide any physical connection or activity. When a slot is not occupied by a PIC, you must insert a blank PIC to fill the empty slot and ensure proper cooling of the system.

Four PIC slots are located in one Flexible PIC Concentrator (FPC), **FPC0**, which is built in to the chassis. The PIC slots are numbered from **0** (zero) through **3**, right to left. The number of ports on a PIC depends on the type of PIC.

The M7i router has a maximum throughput of 3.2 Gbps full duplex for the FPC with 4 PIC slots. Inserting a combination of PICs with an aggregate higher than the maximum

throughput is supported, but constitutes oversubscription of the FPC. The fixed interface card (FIC) has a maximum throughput of 1 Gbps full duplex.

PICs are hot-removable and hot-insertable.

Most PICs supported on the M7i router have the following components.

- One or more cable connector ports—Accept a network media connector.
- LEDs—Indicate PIC and port status. Most PICs have an LED labeled **STATUS** on the PIC faceplate. Some PICs have additional LEDs, often one per port. The meaning of the LED states differs for various PICs.
- Ejector lever—Controls the locking system that secures the PIC in the card cage.

**Related Documentation**

- M7i PICs Supported on page 47
- M7i PIC LEDs on page 47
- M7i Field-Replaceable Units (FRUs) on page 135
- M7i Flexible PIC Concentrators (FPCs) Description on page 43
- PIC Serial Number ID Label on page 214
- Replacing an M7i PIC on page 159
- Troubleshooting the M7i FIC or PICs on page 205

## M7i PIC LEDs

LEDs indicate PIC and port status. Most PICs have an LED labeled **STATUS** on the PIC faceplate. Some PICs have additional LEDs, often one per port. The meaning of the LED states differs for various PICs. For more information, see the *M7i Multiservice Edge Router Interface Module Reference*.

**Related Documentation**

- M7i PICs Description on page 46
- Installing an M7i PIC on page 161
- PIC Serial Number ID Label on page 214
- Replacing an M7i PIC on page 159
- Troubleshooting the M7i FIC or PICs on page 205

## M7i PICs Supported

Table 36 on page 48 lists the PICs supported by the M7i router. The PICs are listed alphabetically by PIC family.

NOTE: The M7i router is now end-of-life. See the JTAC support bulletin TSB16809 for additional information about the PICs and other associated FRUs that moved to end-of-life with the router. The "M7i End-of-Life PICs Supported" on page 50 topic lists PICs that moved to end-of-life before the M7i router itself moved to end-of-life.

*Table 36: PICs Supported in the M7i Router*

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|---|---|---|---|
| **ATM2 IQ** | | | | |
| *ATM2 DS3 IQ PIC (M7i Router)* | 4 | PE-4DS3-ATM2 | Coaxial:<br>• 10 ft (3.05 m) posilock SMB to BNC (provided)<br>• Four pairs of Rx and Tx coaxial cables | 6.1 |
| *ATM2 OC3/STM1 IQ PIC (M7i Router)* | 2 | PE-2OC3-ATM2-MM<br>PE-2OC3-ATM2-SMIR | • Optical: SC/PC | 6.0 |
| *ATM2 OC12/STM4 IQ PIC (M7i Router)* | 1 | PE-1OC12-ATM2-MM<br>PE-1OC12-ATM2-SMIR | • Optical: SC/PC | 6.0 |
| **Channelized IQE** | | | | |
| *Channelized DS3 and E3 Enhanced IQ (IQE) PIC (M7i Router)* | 4 | PE-4CHDS3-E3-IQE-BNC | • Standard DS3 BNC coaxial cable interfaces | 10.2 |
| *Channelized E1/T1 Enhanced IQ (IQE) PIC (M7i Router)* | 10 | PE-10CHE1-T1-IQE-RJ48 | • 120-ohm RJ-48C connector (female) | 10.2 |
| *Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M7i Router)* | 2 | PE-2CHOC3-STM1-IQE-SFP | • Optical: LC/PC | 10.2 |
| *Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M7i Router)* | 1 | PE-1CHOC12STM4-IQE-SFP | • Optical: LC/PC | 10.2 |
| **Circuit Emulation** | | | | |
| *Channelized OC3/STM1 Circuit Emulation PIC with SFP (M7i Router)* | 4 | PE-4CHOC3-CE-SFP | • Optical: LC/PC | 9.3 |
| *E1/T1 Circuit Emulation PIC (M7i Router)* | 12 | PE-12T1E1-CE-TELCO | • RJ-21 connector<br>• Cables are rated for intra-building connections only. | 9.3 |

*Table 36: PICs Supported in the M7i Router (continued)*

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|---|---|---|---|
| **DS3, E1, E3, and T1** | | | | |
| *DS3/E3 Enhanced IQ (IQE) PIC (M7i Router)* | 4 | PE-4DS3-E3-IQE-BNC | • Standard DS3 BNC coaxial cable interfaces | 10.2 |
| *E1 PIC (M7i Router)* | 4 | PE-4E1-RJ48 | • Four RJ-48 connectors (one per port) | 6.0 |
| *E3 IQ PIC (M7i Router)* | 4 | PE-4E3-QPP | • Standard DS3 BNC coaxial cable interfaces | 6.1 |
| **Ethernet** | | | | |
| *Fast Ethernet PICs (M7i Router)* | 4 | PE-4FE-TX | • Two-pair, Category 5 unshielded twisted-pair connectivity through an RJ-45 connector<br>• Pinout: MDI noncrossover | 6.0 |
| *Gigabit Ethernet PIC with SFP (M7i Router)* | 1 | PE-1GE-SFP | • Optical: LC/PC<br>• Copper: RJ-45<br>  ◦ Four-pair, Category 5 shielded twisted-pair connectivity<br>  ◦ Pinout: MDI crossover | 6.3 |
| **Ethernet Enhanced IQ2 (IQ2E)** | | | | |
| *Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP (M7i Router)* | 4 | PE-4GE-TYPE1-SFP-IQ2E | • Optical: LC/PC<br>• Copper: RJ-45<br>  ◦ Four-pair, Category 5 shielded twisted-pair connectivity<br>  ◦ Pinout: MDI crossover | 9.4 |
| **Services** | | | | |
| *Multiservices 100 PIC (M7i Router)* | 0 | PE-MS-100-1 | • None | 8.1 |
| *Tunnel Services PIC (M7i Router)* | 0 | PE-TUNNEL | • None | 6.0 |
| **Serial** | | | | |
| *EIA-530 PIC (M7i Router)* | 2 | PE-2EIA530 | • Two DB-25 male connectors (one per port, included with PIC)<br>• V.35 requires an EIA-530 to V.35 cable and connects to a V.35 DTE 34-pin Winchester type male cable (one per port)<br>• X.21 requires an EIA-530 to X.21 cable and connects to a X.21 DTE DB-15 male cable | 6.0 |

*Table 36: PICs Supported in the M7i Router (continued)*

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|---|---|---|---|
| SONET/SDH | | | | |
| *SONET/SDH OC3c/STM1 PIC with SFP (M7i Router)* | 2 | PE-2OC3-SON-SFP | • Optical: LC/PC | 8.4 |
| *SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M7i Router)* | 4 | PE-4OC3-STM1-IQE-SFP | • Optical: LC/PC | 10.2 |
| *SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP (M7i Router)* | 4 | PE-4OC3-1OC12-SON-SFP | • Optical: LC/PC | 8.4 |
| *SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP (M7i Router)* | 1 | PE-1OC12-SON-SFP | • Optical: LC/PC | 8.4 |

**Related Documentation**

- M7i PICs Description on page 46
- M7i End-of-Life PICs Supported on page 50
- M7i PIC/CFEB Compatibility on page 53

## M7i End-of-Life PICs Supported

Table 37 on page 50 lists the end-of-life PICs supported by the M7i router. The PICs are listed alphabetically by PIC family.

NOTE: The M7i router is now end-of-life. See the JTAC support bulletin TSB16809 for additional information about the PICs and other associated FRUs that moved to end-of-life with the router. The "M7i PICs Supported" on page 47 topic lists PICs that had not moved to end-of-life before the M7i router itself moved to end-of-life.

*Table 37: End-of-Life PICs Supported in the M7i Router*

| PIC Family and Type | Ports | Model Number | First Junos OS Release Support |
|---|---|---|---|
| ATM | | | |
| *ATM DS3 EOL PIC (M7i Router)* | 4 | PE-4DS3-ATM | 6.0 |
| *ATM E3 EOL PIC (M7i Router)* | 4 | PE-4E3-ATM | 6.1 |

*Table 37: End-of-Life PICs Supported in the M7i Router (continued)*

| PIC Family and Type | Ports | Model Number | First Junos OS Release Support |
|---|---|---|---|
| **ATM2 IQ** | | | |
| *ATM2 E3 IQ EOL PIC (M7i Router)* | 2 | PE-2E3-ATM2 | 6.1 |
| **Channelized** | | | |
| *Multichannel DS3 EOL PIC (M7i Router)* | 2 | PE-2CHDS3 | 6.1 |
| **Channelized IQ** | | | |
| *Channelized DS3 IQ EOL PIC (M7i Router)* | 4 | PE-4CHDS3-QPP | 6.0 |
| *Channelized E1 IQ EOL PIC (M7i Router)* | 10 | PE-10CHE1-RJ48-QPP | 6.0 |
| | 10 | PE-10CHE1-RJ48-QPP-N | 9.1R4<br>9.2R3<br>9.3R1 |
| *Channelized OC3 IQ EOL PIC (M7i Router)* | 1 | PE-1CHOC3-SMIR-QPP | 7.6 |
| *Channelized OC12 IQ EOL PIC (M7i Router)* | 1 | PE-1CHOC12SMIR-QPP | 6.1 |
| *Channelized STM1 IQ EOL PIC (M7i Router)* | 1 | PE-1CHSTM1-SMIR-QPP | 6.0 |
| *Channelized T1 IQ EOL PIC (M7i Router)* | 10 | PE-10CHT1-RJ48-QPP | 7.4 |
| **E1, E3, T1** | | | |
| *DS3 EOL PIC (M7i Router)* | 2 | PE-2DS3 | 6.0 |
| | 4 | PE-4DS3 | 6.0 |
| *E1 PIC (M7i Router)* | 4 | PE-4E1-COAX | 6.0 |
| *E3 EOL PIC (M7i Router)* | 2 | PE-2E3 | 6.0 |
| | 4 | PE-4E3 | 6.0 |
| *T1 EOL PIC (M7i Router)* | 4 | PE-4T1-RJ48 | 6.0 |
| **Ethernet** | | | |
| *Fast Ethernet PICs (M7i Router)* | 8 | PE-8FE-FX | 6.1 |
| | 12 | PE-12FE-TX-MDI<br>PE-12FE-TX-MDIX | 6.0 |

*Table 37: End-of-Life PICs Supported in the M7i Router (continued)*

| PIC Family and Type | Ports | Model Number | First Junos OS Release Support |
|---|---|---|---|
| *Gigabit Ethernet EOL PIC (M7i Router)* | 1 | PE-1GE-LH<br>PE-1GE-LX<br>PE-1GE-SX | 6.0 |
| Ethernet IQ | | | |
| *Gigabit Ethernet IQ EOL PIC with SFP (M7i Router)* | 1 | PE-1GE-SFP-QPP | 6.0 |
| Ethernet IQ2 | | | |
| *Gigabit Ethernet IQ2 EOL PIC with SFP (M7i Router)* | 4 | PE-4GE-TYPE1-SFP-IQ2 | 7.6R3 |
| Services | | | |
| *Adaptive Services EOL PIC (M7i Router)* | 0 | PE-AS | 6.0 |
| *Adaptive Services II EOL PIC (M7i Router)* | 0 | PE-AS2 | 6.4 |
| *Adaptive Services II FIPS EOL PIC (M7i Router)* | 0 | PE-AS2-FIPS | 7.2 |
| *Adaptive Services II Layer 2 Services EOL PIC (M7i Router)* | 0 | PE-AS2-LAYER2SERVICES | 8.0R2 |
| *ES EOL PIC (M7i Router)* | 0 | PE-ES-800 | 6.0 |
| *Link Services EOL PIC (M7i Router)* | 0 | PE-LS-4<br>PE-LS-32<br>PE-LS-128 | 6.0 |
| *Monitoring Services EOL PIC (M7i Router)* | 0 | PE-PM | 6.1 |
| SONET/SDH | | | |
| *SONET/SDH OC3c/STM1 EOL PIC (M7i Router)* | 2 | PE-2OC3-SON-MM<br>PE-2OC3-SON-SMIR | 6.0 |
| | 4 | PE-4OC3-SON-MM<br>PE-4OC3-SON-SMIR | 6.0 |
| *SONET/SDH OC12c/STM4 EOL PIC (M7i Router)* | 1 | PE-1OC12-SON-MM<br>PE-1OC12-SON-SMIR | 6.0 |
| *SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M7i Router)* | 1 | PE-1OC12-STM4-IQE-SFP | 10.2 |

**Related Documentation**

- M7i PICs Description on page 46
- M7i PICs Supported on page 47

- M7i PIC/CFEB Compatibility on page 53

## M7i PIC Combination Limitations

In most cases, you can install PICs of different media types in the M7i router. However, configuration rules might limit certain combinations of PICs. Some PICs of different PIC families cannot be installed in PIC slots 0 and 1, or in slots 2 and 3. If you have different PIC families in the M7i router and are running Junos OS Release 10.2 or later, review the configuration rules to plan which PICs to install in your router. Consult technical bulletin PSN-2007-01-023 on the Juniper Networks Support site at https://www.juniper.net/support/ for information about configuration rules for PIC combinations.

Newer Junos OS services for some PICs can require significant Internet Processor ASIC memory. Ethernet and SONET PICs typically do not use large amounts of memory. Gigabit Ethernet, ATM2, IQ serial PICs, IQE PICs, and Multiservices PICs use more. To conserve memory, you can group PICs in the same family together on the same router.

As a workaround, you can:

- Install one PIC in a different PIC slot.
- Remove one of the PICs from the router

**Related Documentation**

- M7i PICs Description on page 46
- M7i PIC/CFEB Compatibility on page 53

## M7i PIC/CFEB Compatibility

The PIC/CFEB compatibility matrixes list the current PICs for the M7i router. For example, Junos OS Release 9.4 is the first release in which the CFEB-E supports the ATM2 DS3 IQ PIC.

*Table 38: CFEB/PIC Compatibility in the M7i Router*

| PIC Family and Type | Ports | PIC Model Number | CFEB | CFEB-E |
|---|---|---|---|---|
| ATM (EOL) | | | | |
| *ATM DS3 EOL PIC (M7i Router)* | 4 | PE-4DS3-ATM<br>EOL (see notification PSN-2003-10-018) | 6.0 | 9.4 |
| *ATM E3 EOL PIC (M7i Router)* | 4 | PE-4E3-ATM<br>EOL (see notification PSN-2003-10-018) | 6.1 | 9.4 |
| ATM2 IQ | | | | |
| *ATM2 DS3 IQ PIC (M7i Router)* | 4 | PE-4DS3-ATM2 | 6.1 | 9.4 |

*Table 38: CFEB/PIC Compatibility in the M7i Router (continued)*

| PIC Family and Type | Ports | PIC Model Number | CFEB | CFEB-E |
|---|---|---|---|---|
| *ATM2 E3 IQ EOL PIC (M7i Router)* | 2 | PE-2E3-ATM2 | 6.1 | 9.4 |
| *ATM2 OC3/STM1 IQ PIC (M7i Router)* | 2 | PE-2OC3-ATM2-MM<br>PE-2OC3-ATM2-SMIR | 6.0 | 9.4 |
| *ATM2 OC12/STM4 IQ PIC (M7i Router)* | 1 | PE-1OC12-ATM2-MM<br>PE-1OC12-ATM2-SMIR | 6.0 | 9.4 |
| Channelized (EOL) | | | | |
| *Multichannel DS3 EOL PIC (M7i Router)* | 2 | PE-2CHDS3<br>EOL (see notification PSN-2004-10-026) | 6.1 | 9.4 |
| Channelized IQ | | | | |
| *Channelized DS3 IQ EOL PIC (M7i Router)* | 4 | PE-4CHDS3-QPP | 6.0 | 9.4 |
| *Channelized E1 IQ EOL PIC (M7i Router)* | 10 | PE-10CHE1-RJ48-QPP-N<br><br>PE-10CHE1-RJ48-QPP<br>EOL (see notification PSN-2008-10-038) | 9.1R4<br>9.2R3<br>9.3R1 | 9.4 |
| *Channelized OC3 IQ EOL PIC (M7i Router)* | 1 | PE-1CHOC3-SMIR-QPP | 7.1 | 9.4 |
| *Channelized OC12 IQ EOL PIC (M7i Router)* | 1 | PE-1CHOC12SMIR-QPP | 6.0 | 9.4 |
| *Channelized STM1 IQ EOL PIC (M7i Router)* | 1 | PE-1CHSTM1-SMIR-QPP | 6.0 | 9.4 |
| *Channelized T1 IQ EOL PIC (M7i Router)* | 10 | PE-10CHT1-RJ48-QPP | 7.4 | 9.4 |
| Channelized IQE | | | | |
| *Channelized DS3 and E3 Enhanced IQ (IQE) PIC (M7i Router)* | 4 | PE-4CHDS3-E3–IQE-BNC | – | 10.2 |
| *Channelized E1/T1 Enhanced IQ (IQE) PIC (M7i Router)* | 10 | PE-10CHE-T1-IQE-RJ48 | – | 10.2 |
| *Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M7i Router)* | 2 | PE-2CHOC3-STM1-IQE-SFP | – | 10.2 |
| *Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M7i Router)* | 1 | PE-1CHOC12STM4–IQE-SFP | – | 10.2 |
| Circuit Emulation | | | | |
| *Channelized OC3/STM1 Circuit Emulation PIC with SFP (M7i Router)* | 4 | PE-4CHOC3-CE-SFP | 9.3 | 9.5 |
| *E1/T1 Circuit Emulation PIC (M7i Router)* | 12 | PE-12T1E1-CE-TELCO | 9.3 | 9.5 |

*Table 38: CFEB/PIC Compatibility in the M7i Router (continued)*

| PIC Family and Type | Ports | PIC Model Number | CFEB | CFEB-E |
|---|---|---|---|---|
| **DS3, E1, E3, and T1** | | | | |
| *DS3 EOL PIC (M7i Router)* | 2 | PE-2DS3 | 6.0 | 9.4 |
| *DS3 EOL PIC (M7i Router)* | 4 | PE-4DS3 | 6.0 | 9.4 |
| *DS3/E3 Enhanced IQ (IQE) PIC (M7i Router)* | 4 | PE-4DS3–E3-IQE-BNC | – | 10.2 |
| *E1 PIC (M7i Router)* | 4 | PE-4E1-COAX<br>PE-4E1-RJ48 | 6.0 | 9.4 |
| *E3 EOL PIC (M7i Router)* | | | | |
| • E3 PIC | 2 | PE-2E3 | 6.0 | 9.4 |
| • E3 EOL PIC | 4 | PE-4E3<br>EOL (see notification PSN-2003-10-018) | 6.0 | 9.4 |
| *E3 IQ PIC (M7i Router)* | 4 | PE-4E3-QPP | 6.1 | 9.4 |
| *T1 EOL PIC (M7i Router)* | 4 | PE-4T1-RJ48 | 6.0 | 9.4 |
| **Ethernet** | | | | |
| Fast Ethernet PICs | 4 | PE-4FE-TX | 6.0 | 9.4 |
| | 8 | PE-8FE-FX | | |
| | 12 | PE-12FE-TX-MDI | | |
| | | PE-12FE-TX-MDIX | | |
| *Gigabit Ethernet EOL PIC (M7i Router)* | 1 | PE-1GE-LH<br>EOL (see notification PSN-2004-06-014)<br>PE-1GE-LX<br>EOL (see notification PF-HW-0103-001)<br>PE-1GE-SX<br>EOL (see notification PF-HW-0103-001) | 6.0 | 9.4 |
| *Gigabit Ethernet PIC with SFP (M7i Router)* | 1 | PE-1GE-SFP | 6.3 | 9.4 |
| **Ethernet IQ** | | | | |
| *Gigabit Ethernet IQ EOL PIC with SFP (M7i Router)* | 1 | PE-1GE-SFP-QPP | 6.0 | 9.4 |
| **Ethernet IQ2** | | | | |

*Table 38: CFEB/PIC Compatibility in the M7i Router (continued)*

| PIC Family and Type | Ports | PIC Model Number | CFEB | CFEB-E |
|---|---|---|---|---|
| *Gigabit Ethernet IQ2 EOL PIC with SFP (M7i Router)* | 4 | PE-4GE-TYPE1-SFP-IQ2 | 7.6R3 | 9.4 |
| **Ethernet Enhanced IQ2 (IQ2E)** | | | | |
| *Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP (M7i Router)* | 4 | PE-4GE-TYPE1-SFP-IQ2E | 9.4 | 9.5R2 |
| **Services** | | | | |
| *Adaptive Services EOL PIC (M7i Router)* | 0 | PE-AS<br>EOL (see notification PSN-2005-06-007) | 6.0 | 9.4 |
| *Adaptive Services II EOL PIC (M7i Router)* | 0 | PE-AS2<br>EOL (see notification PSN-2007-12-036) | 6.4 | 9.4 |
| *Adaptive Services II FIPS EOL PIC (M7i Router)* | 0 | PE-AS2-FIPS<br>EOL (see notification PSN-20011-09-381) | 7.2 | 9.4 |
| *Adaptive Services II Layer 2 Services EOL PIC (M7i Router)* | 0 | PB-AS2-LAYER2SERVICES<br>EOL (see notification PSN-2008-11-080) | 8.0R2 | 9.4 |
| *ES EOL PIC (M7i Router)* | 0 | PE-ES-800<br>EOL (see notification PSN-2010-04-734) | 6.0 | 9.4 |
| *Link Services EOL PIC (M7i Router)* | 0 | PE-LS-4<br>EOL (see notification PSN-2008-11-080)<br>PE-LS-32<br>EOL (see notification PSN-2008-11-080)<br>PE-LS-128<br>EOL (see notification PSN-2008-11-080) | 6.0 | 9.4 |
| *Monitoring Services EOL PIC (M7i Router)* | 0 | PE-PM<br>EOL (see notification PSN-2005-06-007) | 6.1 | 9.4 |
| *Multiservices 100 PIC (M7i Router)* | 0 | PE-MS-100-1 | 8.1 | 9.4 |
| *Tunnel Services PIC (M7i Router)* | 0 | PE-TUNNEL | 6.0 | 9.4 |
| **Serial** | | | | |
| *EIA-530 PIC (M7i Router)* | 2 | PE-2EIA530 | 6.0 | 9.4 |

*Table 38: CFEB/PIC Compatibility in the M7i Router (continued)*

| PIC Family and Type | Ports | PIC Model Number | CFEB | CFEB-E |
|---|---|---|---|---|
| SONET/SDH | | | | |
| *SONET/SDH OC3c/STM1 EOL PIC (M7i Router)* | 2 | PE-2OC3-SON<br>EOL (see notification PSN-2007-12-037)<br><br>PE-2OC3-SON-MM<br>EOL (see notification PSN-2007-12-037)<br><br>PE-2OC3-SON-SMIR<br>EOL (see notification PSN-2007-12-037) | 6.0 | 9.4 |
| • SONET/SDH OC3c/STM1 EOL PIC | 4 | PE-4OC3-SON-MM<br>EOL (see notification PSN-2007-12-037)<br>PE-4OC3-SON-SMIR<br>EOL (see notification PSN-2007-12-037) | 6.0 | 9.4 |
| *SONET/SDH OC3c/STM1 PIC with SFP (M7i Router)* | 2 | PE-2OC3-SON-SFP | 8.4 | 9.6 |
| *SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M7i Router)* | 4 | PE-4OC3–STM1-IQE-SFP | – | 10.2 |
| *SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP (M7i Router)* | 4 | PE-4OC3-1OC12-SON-SFP | 8.4 | 9.4 |
| *SONET/SDH OC12c/STM4 EOL PIC (M7i Router)* | 1 | PE-1OC12-SON-MM<br>EOL (see notification PSN-2007-12-037)<br>PE-1OC12-SON-SMIR<br>EOL (see notification PSN-2007-12-037) | 6.0 | 9.4 |
| *SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M7i Router)* | 1 | PE-1OC12–STM4-IQE-SFP | – | 10.2 |
| *SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP (M7i Router)* | 1 | PE-1OC12-SON-SFP | 8.4 | 9.4 |

**Related Documentation**

- M7i PICs Description on page 46
- M7i PICs Supported on page 47

CHAPTER 7

# Power System Components and Descriptions



## M7i Power System Description

The router uses either AC or DC power. You can install one or two load-sharing power supplies at the bottom rear of the chassis, as shown in Figure 6 on page 12. The power supplies connect to the midplane, which distributes power to router components according to their individual voltage requirements.

For full redundancy, two power supplies are required. When the power supplies are installed and operational, they automatically share the electrical load. If a power supply stops functioning for any reason, the second power supply instantly begins providing all the power the router needs for normal functioning. It can provide full power indefinitely.

An enable control signal on the output connector of each power supply ensures that the supply is fully seated into the router midplane before the supply can be turned on. The enable pin prevents a user-accessible energy hazard, so there is no interlocking mechanism. The enable pin disables the voltage at the output connector if the power supply is not turned off before removal.

Power supplies are hot-removable and hot-insertable, as described in "M7i Field-Replaceable Units (FRUs)" on page 135. To avoid electrical injury, carefully follow the instructions in "Replacing an M7i AC Power Supply" on page 177 and "Replacing a DC Power Supply" on page 171.

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 router 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 router again, first issue the CLI **request system halt** command. For more information, see .

After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the output status LED on the power supply, the command display output, and messages on the LED display on the craft interface—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

**Related Documentation**

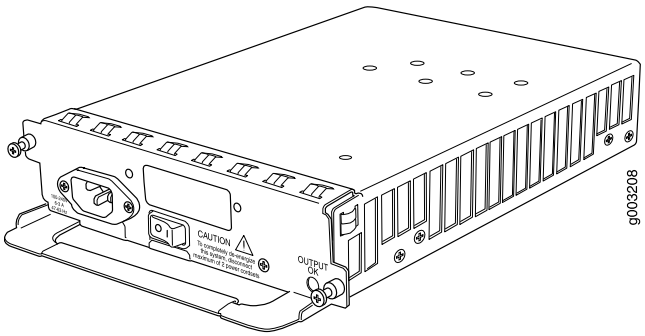
- M7i AC Power Supply on page 60
- M7i DC Power Supply on page 61
- Removing an M7i AC Power Supply on page 177
- Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 206

## M7i AC Power Supply

An AC-powered router has one or two load-sharing AC power supplies, located at the bottom rear of the chassis, as shown in Figure 6 on page 12. For information about power supply redundancy and replaceability, see "M7i Power System Description" on page 59.

Figure 16 on page 60 shows the power supply.

*Figure 16: AC Power Supply*




**Related Documentation**

- Table 48 on page 85
- M7i Power Supply LEDs on page 61

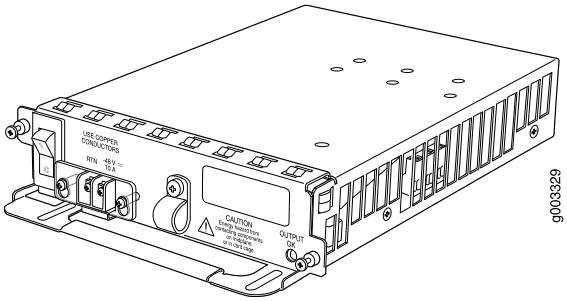
- Installing an M7i AC Power Cord on page 181
- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- Removing an M7i AC Power Cord on page 181
- Replacing an M7i AC Power Supply on page 177

## M7i DC Power Supply

A DC-powered router has one or two load-sharing DC power supplies, located at the bottom rear of the chassis, as shown in Figure 6 on page 12. For information about power supply redundancy and replaceability, see "M7i Power System Description" on page 59.

Figure 17 on page 61 shows the power supply.

*Figure 17: DC Power Supply*




NOTE: The DC power supplies are marked –48 VDC. This is the nominal voltage associated with the battery circuit. Any higher voltages are associated only with float voltages for the charging function.

**Related Documentation**

- Table 49 on page 87
- M7i Power Supply LEDs on page 61
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256
- M7i DC Power Electrical Safety Guidelines on page 255
- Replacing a DC Power Supply on page 171

## M7i Power Supply LEDs

Table 39 on page 62 describes the LED on both AC and DC power supplies.

*Table 39: States for the M7i Power Supply LED*

| Label | Color | State | Description |
|---|---|---|---|
| **OUTPUT OK** | Green | On steadily | Power supply is functioning normally, input is occurring, outputs are within range, and the temperature is within range. |
| | | Blinking | Power supply is not functioning, is starting up, or is not properly inserted, or airflow is not sufficient. |

**Related Documentation**

- Installing an M7i AC Power Supply on page 179
- M7i Power System Description on page 59
- Replacing an M7i AC Power Supply on page 177
- Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 206

CHAPTER 8

# Switch Fabric Components and Descriptions



## M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description

The M7i Multiservice Edge Router houses either a Compact Forwarding Engine Board (CFEB) or an Enhanced Compact Forwarding Engine Board (CFEB-E), which is located on the rear of the router above the power supplies, as shown in Figure 6 on page 12. It provides route lookup, filtering, and switching on incoming data packets, then directs outbound packets to the appropriate interface for transmission to the network. It can process 16 million packets per second (Mpps). The CFEB or CFEB-E communicates with the Routing Engine using a dedicated 100-Mbps link that transfers routing table data from the Routing Engine to the forwarding table. The link is also used to transfer routing link-state updates and other packets destined for the router from the CFEB or CFEB-E to the Routing Engine.

The CFEB or CFEB-E provides the following functions:

- Route lookups—Performs route lookups using the forwarding table stored in the synchronous SRAM (SSRAM) on CFEBs or stored in the RLDRAM on CFEB-Es.
- Management of shared memory —Uniformly allocates incoming data packets throughout the router's shared memory.
- Transfer of outgoing data packets—Passes data packets to the destination FIC or PIC when the data is ready to be transmitted.
- Transfer of exception and control packets—Passes exception packets to the microprocessor on the CFEB or CFEB-E, which processes almost all of them. The remainder are sent to the Routing Engine for further processing. Any errors originating in the Packet Forwarding Engine and detected by the CFEB or CFEB-E are sent to the Routing Engine using system log messages.
- Built-in tunnel interface—Encapsulates arbitrary packets inside a transport protocol, providing a private, secure path through an otherwise public network.

The built-in tunnel interface on the CFEB or CFEB-E is configured the same way as a PIC. For information about configuring the built-in tunnel interface, see the *Junos OS Services Interfaces Library for Routing Devices*.

- Optional Adaptive Services Module (ASM)—Provides one or more services on one PIC. See "M7i Adaptive Services Module" on page 67 for more information.

The CFEB and CFEB-E are hot-pluggable when you replace a CFEB with a CFEB or a CFEB-E with a CFEB-E. Upgrading or downgrading a CFEB device requires a system reboot, as described in "Upgrading and Downgrading the CFEB and CFEB-E" on page 185. You can remove and replace the CFEB or CFEB-E without powering down the router, but the routing functions of the system are interrupted when it is removed.

## CFEB

The CFEB has the following major components:

- Processing components:
  - 266-MHz CPU and supporting circuitry
  - Integrated ASIC
  - 33-MHz PCI bus
- Storage components:
  - 128-MB SDRAM for packet memory
  - 128-MB SDRAM for the microkernel
  - 8-MB SSRAM for route lookup
  - 4-MB SSRAM for control memory
- Services interfaces:
  - Built-in tunnel interface
  - Optional Adaptive Services Module
- System interfaces:
  - 100-Mbps link for internal interface to the Routing Engine
  - 19.44-MHz reference clock—Generates clock signal for SONET/SDH PICs.
  - I2C controller to read the I2C/EEPROMs in the PICs and temperature sensors
  - I2C/EEPROM containing the serial number and revision level
  - Two 512-KB boot flash EPROMs (programmable on the board)
- One PowerPC 8245 integrated processor
- Three LEDs—A green LED labeled **OK**, a red LED labeled **FAIL**, and a blue LED labeled **MASTER** indicate CFEB status.

- Online/Offline button—Prepares the CFEB for removal from the router when pressed.
- Ejector levers—Control the locking system that secures the CFEB in the chassis.

*Figure 18: CFEB*

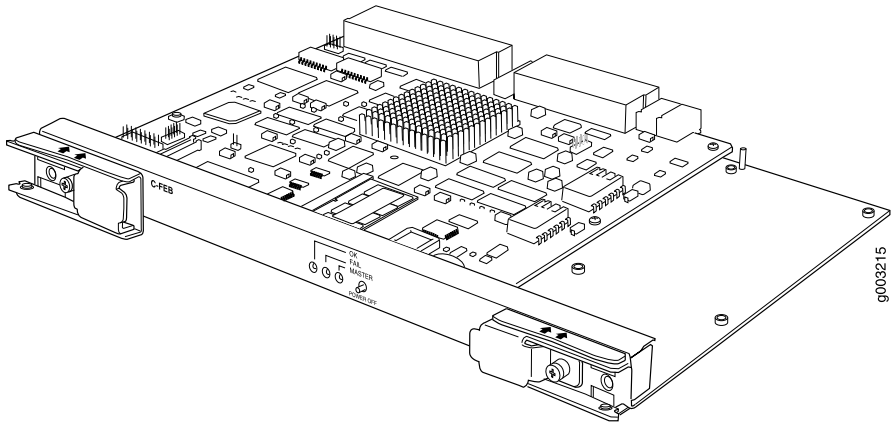
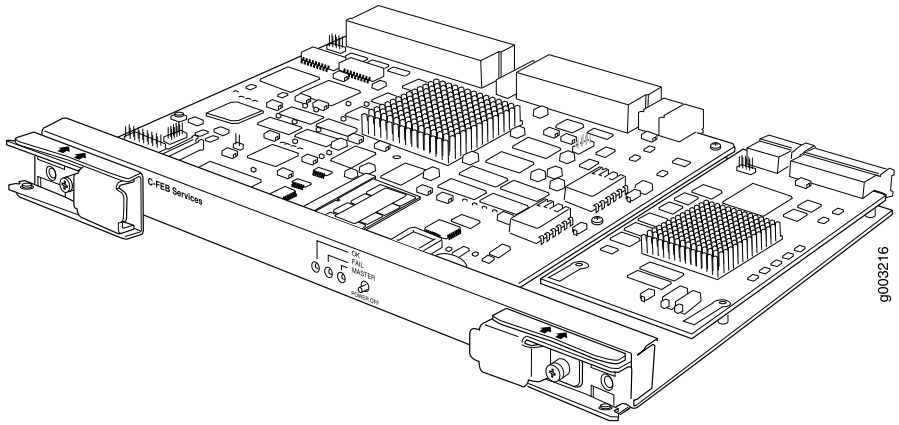



*Figure 19: CFEB with Adaptive Services Module*




## CFEB-E

The CFEB-E provides the following additional and enhanced functions:

- Optional MultiServices Module (MSM)—Provides one or more services on one PIC. See "M7i MultiServices Module" on page 68 for more information.
- Increased number of logical interfaces.
- Increased route, nexthop, and interface lookup memory.
- Increased FPC throughput.
- Enhanced class of service features, including:
  - More queues and priority levels
  - Increased drop precedence per queue
  - Excess bandwidth allocation in proportion to weights

- Hierarchical policing
- Increased number of WRED profiles
- Independent EXP and DSCP rewrite
- Independent Layer 2 and Layer 3 classification on same port

The CFEB-E has the following major components:

- Processing components:
  - 1-GHz CPU and supporting circuitry
  - Integrated ASIC
  - 33-MHz PCI bus
- Storage components:
  - Three 256-MB SDRAMs for packet memory
  - 1-GB SDRAM for the microkernel
  - Two 64-MB RLDRAMs for route lookup
  - Two 64-MB RLDRAMs for control memory
- Services interfaces:
  - Built-in tunnel interface
  - Optional Adaptive Services Module
  - Optional MultiServices Module
- System interfaces:
  - 100-Mbps link for internal interface to the Routing Engine
  - 19.44-MHz reference clock—Generates clock signal for SONET/SDH PICs
  - I2C controller to read the I2C/EEPROMs in the PICs and temperature sensors
  - I2C/EEPROM containing the serial number and revision level
  - Two 512-KB boot flash EPROMs (programmable on the board)
- One MPC8545 integrated processor with 1-GB DDR2 SDRAM
- Three LEDs—A green LED labeled **OK**, a red LED labeled **FAIL**, and a blue LED labeled **MASTER** indicate CFEB-E status.
- Offline button—Prepares the CFEB-E for removal from the router when pressed.
- Ejector levers—Control the locking system that secures the CFEB-E in the chassis.

*Figure 20: CFEB-E*

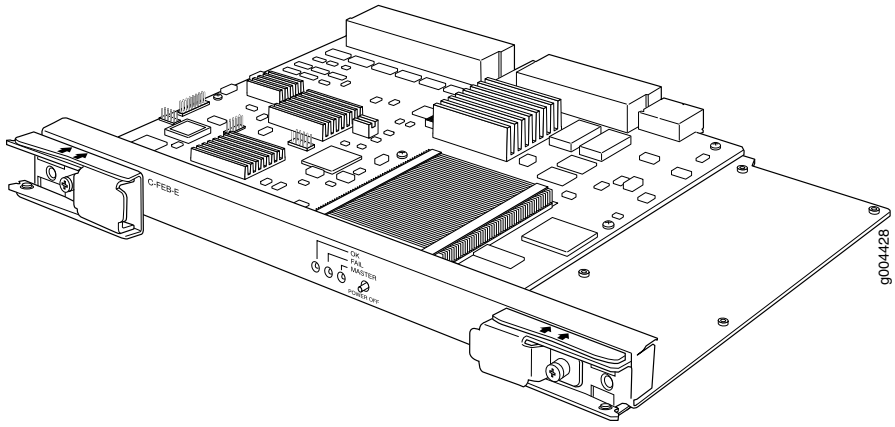



*Figure 21: CFEB-E with Adaptive Services Module*

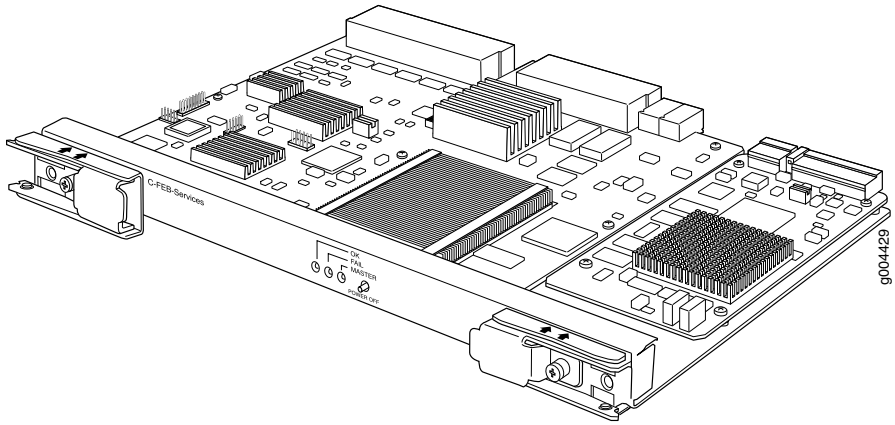
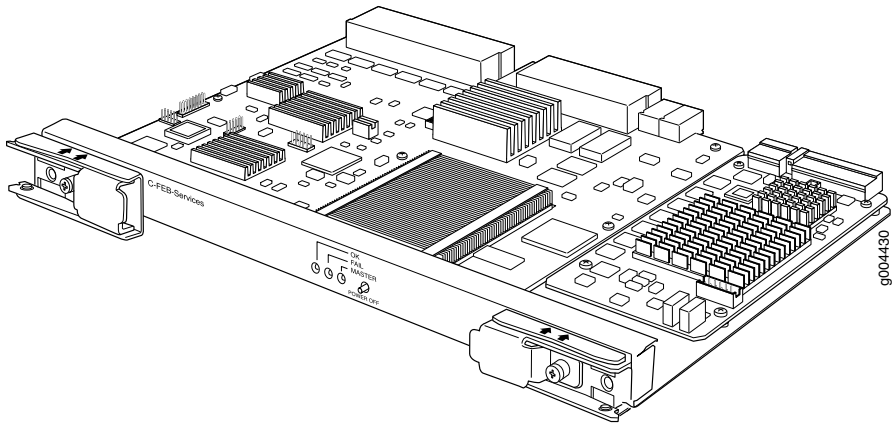



*Figure 22: CFEB-E with MultiServices Module*




## M7i Adaptive Services Module

The Adaptive Services Module is an optional component of the CFEB and CFEB-E. The Adaptive Services Module is similar to the standalone Adaptive Services PIC, but operates

at a reduced bandwidth. The Adaptive Services Module enables you to perform one or more services on the same PIC by configuring a set of services and applications.

The Adaptive Services Module provides the following services:

- Stateful firewall—A type of firewall filter that considers state information derived from previous communications and other applications when evaluating traffic.
- Network Address Translation (NAT)—A security procedure for concealing host addresses on a private network behind a pool of public addresses.
- Intrusion detection services (IDS)—A set of tools for detecting, redirecting, and preventing certain kinds of network attack and intrusion.

The configuration for these three services comprises a series of rules that you can arrange in order of precedence as a rule set. Each rule follows the structure of a firewall filter, with a **from** statement containing input or match conditions and a **then** statement containing actions to be taken if the match conditions are met.

For information about configuring interfaces on the ASM, see the *Junos OS Services Interfaces Library for Routing Devices*.

## M7i MultiServices Module

The MultiServices Module is an optional component of the CFEB-E. The CFEB does not support the MultiServices Module. The MultiServices Module enables you to perform one or more services on the same PIC by configuring a set of services and applications. Like the standalone MultiServices 100 PIC, the MultiServices Module supports the following services:

- Layer 3 Services:
  - Stateful firewall—A type of firewall filter that considers state information derived from previous communications and other applications when evaluating traffic.
  - Network Address Translation (NAT)—A security procedure for concealing host addresses on a private network behind a pool of public addresses.
  - Intrusion detection services (IDS)—A set of tools for detecting, redirecting, and preventing certain kinds of network attack and intrusion.
  - IPsec
  - Layer 2 Tunneling Protocol (L2TP)
  - Active monitoring (cflowd)
  - Tunnel services
  - GRE prefragmentation
  - GRE key stamping
  - RPM
- Layer 2 Services:

- MLPPP
- MLFR
- cRTP
- Multiclass MLPPP
- RPM

NOTE: You can enable either Layer 2 or Layer 3 services on the MultiServices Module, but you cannot enable both Layer 2 and Layer 3 services concurrently.

The configuration for these services comprises a series of rules that you can arrange in order of precedence as a rule set. Each rule follows the structure of a firewall filter, with a **from** statement containing input or match conditions and a **then** statement containing actions to be taken if the match conditions are met.

For information about configuring interfaces on the MSM, see the *Junos OS Services Interfaces Library for Routing Devices*.

**Related Documentation**

- M7i CFEB and CFEB-E LEDs on page 69
- M7i and M10i Packet Forwarding Engine Architecture on page 5
- M7i Router Description on page 3
- M7i Router Physical Specifications on page 74

## M7i CFEB and CFEB-E LEDs

*Table 40: States for CFEB or CFEB-E LEDs*

| Label | Color | State | Description |
|---|---|---|---|
| **OK** | Green | On steadily | CFEB/CFEB-E is running normally. |
| | | Blinking | CFEB-E is starting up |
| | | Off | CFEB/CFEB-E is offline. |
| **FAIL** | Red | On steadily | CFEB/CFEB-E is not operational or is in reset mode. |
| | | Off | CFEB/CFEB-E is functioning properly. |
| **MASTER** | Blue | On steadily | CFEB/CFEB-E is functioning as master. On an M7i router, this LED is always lit. |

**Related Documentation**

- M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description on page 63

PART 2

# Site Planning, Preparation, and Specifications

CHAPTER 9

# Preparation Overview



## M7i Router Site Preparation Checklist

The checklist in Table 41 on page 73 summarizes the tasks you need to perform when preparing a site for router installation.

*Table 41: Site Preparation Checklist*

| Item or Task | Performed By | Date | Notes |
|---|---|---|---|
| Verify that environmental factors such as temperature and humidity do not exceed router tolerances. | | | |
| Measure distance between external power sources and router installation site. | | | |
| Select the type of rack. | | | |
| Plan rack location, including required space clearances. | | | |
| Secure rack to floor and building structure. | | | |
| Acquire cables and connectors. | | | |
| Locate sites for connection of system grounding. | | | |
| Calculate power budget and power margin. | | | |

**Related Documentation**

- M7i Router Description on page 3
- M7i Router Physical Specifications on page 74
- M7i Router Clearance Requirements for Airflow and Hardware Maintenance on page 77

## M7i Router Physical Specifications

Table 42 on page 74 summarizes the physical specifications for the router chassis.

*Table 42: Chassis Physical Specifications*

| Description | Weight | Width | Depth | Height |
|---|---|---|---|---|
| Chassis dimension | 36.5 lb (16.6 kg) maximum configuration<br><br>28.2 lb (12.8 kg) minimum configuration | 17.5 in. (44.5 cm) for sides of chassis<br><br>19 in. (48.2 cm) with mounting brackets | 18 in. (45.7 cm) | 3.5 in. (8.9 cm) |
| Routing Engine | | | | |
| CFEB and CFEB-E | | | | |
| FIC | | | | |
| FPC | | | | |
| PIC | | | | |
| Craft Interface | | | | |
| Fan tray | 1.6 lb (0.7 kg) | | | |
| Air filter | | | | |
| Cable Management Brackets | | | | |
| DC power supply | | | | |
| AC power supply | 15 lb (6.8 kg) | | | |

**Related Documentation**

- M7i Router Environmental Specifications on page 78
- M7i Router Power Requirements on page 79
- M7i Router Description on page 3

## M7i Router Rack Requirements

The router can be installed in many types of racks, including four-post (telco) racks and open-frame racks. An example of an open-frame rack appears in Figure 23 on page 76.Table 43 on page 75 summarizes rack requirements and specifications for an M7i router.

*Table 43: Rack Requirements and Specifications for an M7i Router*

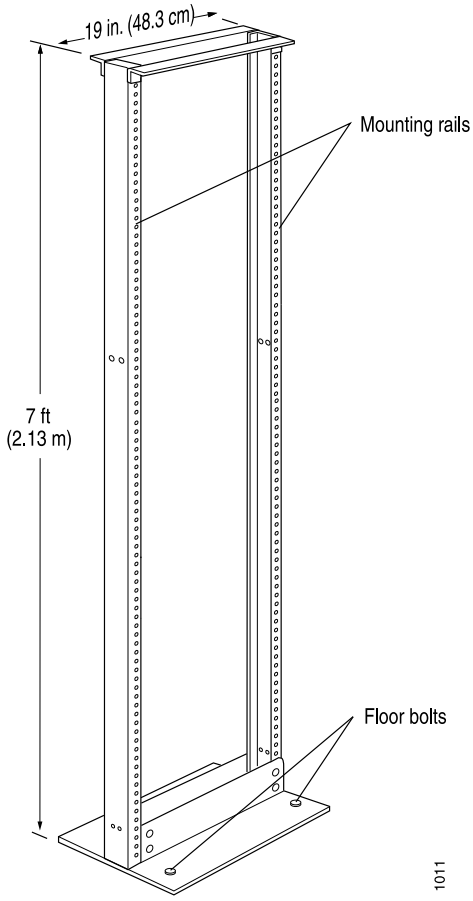
| Rack Requirement | Guidelines |
|---|---|
| Rack type and mounting bracket hole spacing | Use a four-post rack or a two-post rack. You can mount the router on any four-post or two-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75-in./4.44-cm) increments and that meets the size and strength requirements specified in this table.<br><br>A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Components Industry Association (http://www.ecianow.org/). |
| Rack size and strength | • Ensure that the rack is a 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Components Industry Association (http://www.ecianow.org/).<br>• Ensure that the rack is one of the following standard lengths:<br>  ◦ 23.62 in. (600 mm)<br>  With the use of adaptors, the router can fit into a rack that is 600 mm wide and 600 mm deep as defined in the four-part *Equipment Engineering (EE); European telecommunications standard for equipment practice* (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute (**http://www.etsi.org**). Use approved wing devices to narrow the opening between the rails as required.<br>  ◦ 30.0 in. (762 mm)<br>  ◦ 21.5 in. (800 mm)<br>• The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions: 3.5 in. (8.9 cm) high, 18 in. (45.7 cm) deep, and 17.5 in. (44.5 cm) wide. The outer edges of the mounting brackets extend the width to 19 in. (48.2 cm). The spacing of rails and adjacent racks must also allow for the clearances around the router and rack that are specified in "M7i Router Clearance Requirements for Airflow and Hardware Maintenance" on page 77.<br>• The chassis height of 3.5 in. (8.9 cm) is approximately 2 U. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Components Industry Association. You can stack 21 M7i routers in a rack that has at least 42 U (73.5 in. or 1.87 m) of usable vertical space.<br>• The rack must be strong enough to support the weight of the fully configured router, up to 36.5 lb (16.6 kg). If you stack multiple fully configured routers in one rack, it must be capable of supporting the combined weight of the routers.<br>• Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the switch and rack as specified in "M7i Router Clearance Requirements for Airflow and Hardware Maintenance" on page 77. |

*Table 43: Rack Requirements and Specifications for an M7i Router (continued)*

| Rack Requirement | Guidelines |
|---|---|
| Rack connection to the building structure | • Secure the rack to the building structure.<br>• If earthquakes are a possibility in your geographical area, secure the rack to the floor.<br>• Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability. |

CAUTION: If you are front-mounting the chassis, we recommend supporting the back of the router with a shelf or other structure.

*Figure 23: Typical Open-Frame Rack*




**Related Documentation**

- Installation Safety Warnings for Juniper Networks Devices on page 233
- M7i Router Clearance Requirements for Airflow and Hardware Maintenance on page 77
- M7i Router Physical Specifications on page 74
- M7i Router Site Preparation Checklist on page 73

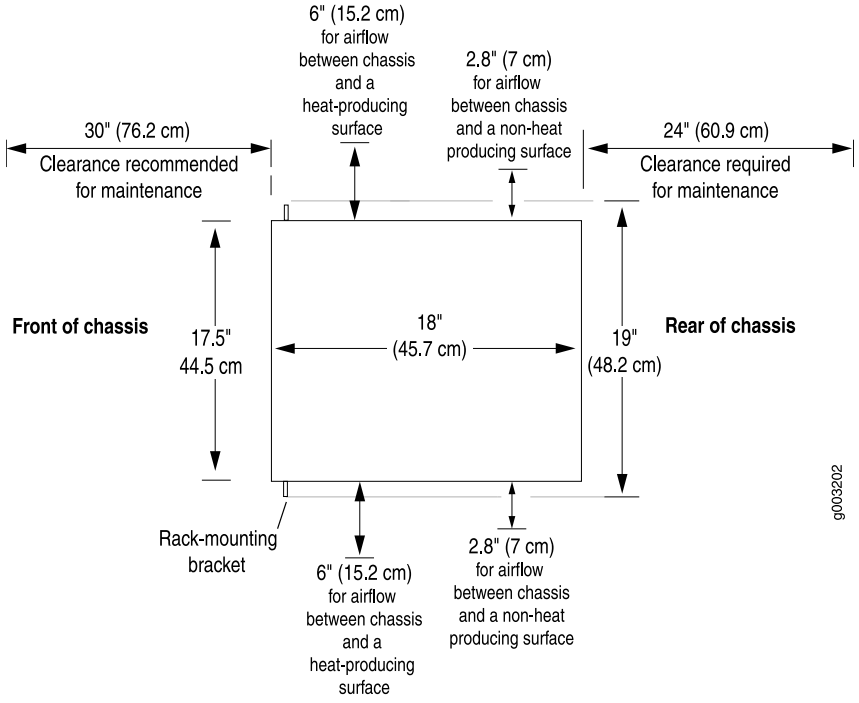
## M7i Router Clearance Requirements for Airflow and Hardware Maintenance

When planning the installation site, you need to allow sufficient clearance around the rack (see Figure 24 on page 77):

- For the cooling system of side-cooled routers 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. Allow at least 24 in. (61 cm) both in front of and behind the chassis. NEBS GR-63 recommends at least 30 in. (76.2 cm) clearance in front of the chassis.

NOTE: We recommend that you do not install the router in a cabinet. If mounting the router in a cabinet, you must be sure that ventilation is sufficient to prevent overheating.

*Figure 24: Chassis Dimensions and Clearance Requirements*




**Related Documentation**

- M7i Router Description on page 3
- M7i Router Physical Specifications on page 74

## M7i Router Environmental Specifications

Table 44 on page 78 specifies the environmental conditions required for normal router operation. In addition, the site should be as dust-free as possible. Dust can clog air intake vents and filters, reducing cooling system efficiency. Check the filters and vents frequently, cleaning them as necessary. For more information, see "Routine Maintenance Procedures for the M7i Router" on page 189.

*Table 44: Router Environmental Tolerances*

| Description | Tolerance |
|---|---|
| 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 to 104°F (0°C to 40°C) |
| Seismic | Tested to meet Telcordia Technologies Zone 4 earthquake requirements |
| Thermal output | • AC: 1400 BTU<br>• DC: 1600 BTU |

NOTE: Install the router only in restricted or service 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.

For additional safety guidelines and requirements, see "General Safety Guidelines for Juniper Networks Devices" on page 225.

**Related Documentation**

- M7i Router Physical Specifications on page 74
- M7i Router Power Requirements on page 79
- M7i Router Description on page 3

## M7i Chassis Grounding, Connection, and Cable Specifications

To ground a router, connect a grounding cable to earth ground and then attach it to the chassis grounding point on the rear of the chassis.

Table 45 on page 79 summarizes the specifications for the groundingcable, which you must supply.

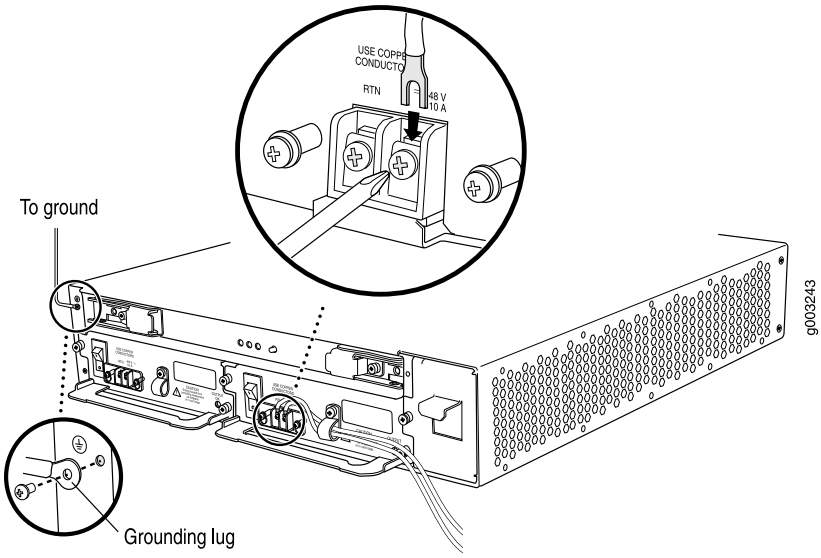
*Table 45: Grounding Cable Specifications*

| Quantity and Specification | Maximum Equal Length |
|---|---|
| One 14-AWG (2.08 $mm^2$) single-strand-count wire cable | None |

Figure 25 on page 79 shows the location of the grounding point on the upper left side of the M7i router above the power supplies.

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

*Figure 25: Grounding Cable Connection*




**Related Documentation**

- M7i Chassis Description on page 11
- Connecting the Grounding Cable to the M7i Router on page 113

## M7i Router Power Requirements

Table 46 on page 80 lists the power requirements for various hardware components when the router is operating under typical voltage conditions. For PIC power requirements, see the *M7i Multiservice Edge Router Interface Module Reference*.

*Table 46: M7i Component Power Requirements*

| Component | Power Requirement (Amps)@ 48 V |
|---|---|
| Base system (cooling system, power supplies, and FIC) | 0.6 A |
| CFEB/CFEB-E | 1.4 A |
| CFEB/CFEB-E with Adaptive Services Module | 1.9 A |
| CFEB-E with MultiServices Module | 1.9 A |
| Routing Engine | 0.7 A |

You can use the information in Table 46 on page 80 and the *M7i Multiservice Edge Router Interface Module Reference* to calculate power consumption for various hardware configurations, input current from a different source voltage, and thermal output, as shown in the following examples. (For an added safety margin, the examples use a generalized value for PICs of 0.625 A @ 48 V each.)

- Power consumption for minimum configuration:

  Base system + 1 CFEB + 1 RE + 1 PIC =
  0.6 A + 1.4 A + 0.7 A + 0.625 A = 3.3 A @ 48 V = 159 W DC

- Power consumption for maximum configuration:

  Base system + 1 CFEB with ASM + 1 RE + 4 PICs =
  0.6 A + 1.9 A + 0.7 A + 4(0.625 A) =
  0.6 A + 1.9 A + 0.7 A + 2.5 A = 5.7 A @ 48 V = 274 W DC

- Input current from a DC source other than –48 VDC (based on maximum configuration):

  (–54 VDC input) x (input current X) = (–48 VDC) x (input current Y)
  54 x X = 48 x 48.2
  X = 48 x 48.2/54 = 42.8 A

- System thermal output for maximally configured AC-powered router:

  Watts DC/85% AC PEM efficiency/0.293 = BTU/hr
  274/0.85/0.293 = 1100 BTU/hr

- System thermal output for maximally configured DC-powered router:

  Watts DC/0.293 = BTU/hr
  274/0.293 = 935 BTU/hr

NOTE: We recommend that you provision at least 13.5 A @ 48 VDC and use a facility circuit breaker rated for 15 A minimum. Doing so enables you to operate the router in any configuration without upgrading the power infrastructure, and allows the router to function at full capacity using multiple power supplies.

**Related Documentation**

- M7i Router AC Power Supply Specifications on page 85
- M7i Router DC Power Supply Specifications on page 87
- General Electrical Safety Warnings for Juniper Networks Devices on page 250

CHAPTER 10

# AC Power Requirements and Specifications



## M7i Router AC Power, Connection, and Power Cord Specifications

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

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


WARNING:

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.

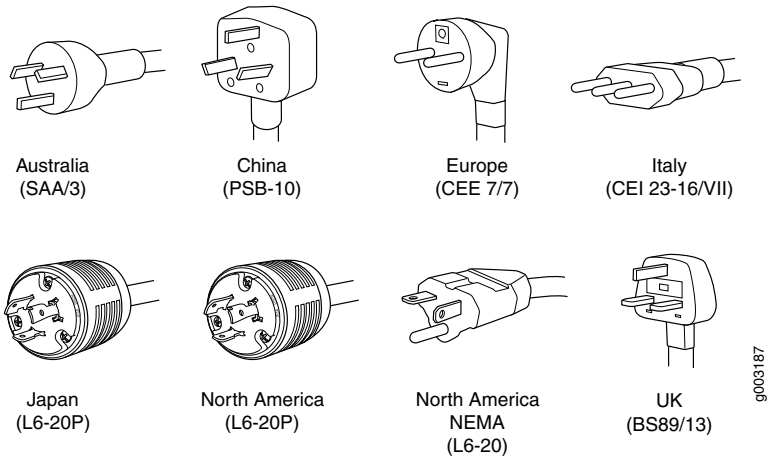
NOTE: In North America, AC power cords must not exceed 4.5 m (approximately 14.75 ft) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52, and Canadian Electrical Code (CEC) Section 4-010(3). The cords supplied with the router are in compliance.

Table 47 on page 84 provides specifications and Figure 26 on page 84 depicts the plug on the AC power cord provided for each country or region.

*Table 47: AC Power Cord Specifications*

| Country | Electrical Specification | Plug Type |
|---|---|---|
| Australia | 240 VAC, 50 Hz AC | SAA/3 |
| Europe (except Italy and United Kingdom) | 220 or 230 VAC, 50 Hz AC | CEE 7/7 |
| Italy | 230 VAC, 50 Hz AC | CEI 23-16 |
| North America | 120 VAC, 60 Hz AC | NEMA 5-15P |
| United Kingdom | 240 VAC, 50 Hz AC | BS89/13 |

*Figure 26: AC Plug Types*




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

**Related Documentation**

- M7i AC Power Supply on page 60
- Connecting Power to an AC-Powered M7i Router on page 123

- Replacing an M7i AC Power Supply on page 177
- Replacing an M7i AC Power Cord on page 181
- M7i Router Power Requirements on page 79
- M7i Router AC Power Supply Specifications on page 85

## M7i Router AC Power Supply Specifications

Table 48 on page 85 lists electrical specifications for the AC Power Supply.

*Table 48: Electrical Specifications for AC Power Supply*

| Description | Specification |
|---|---|
| Maximum power output | 293 WDC |
| AC input voltage | Nominal: 100, 120, 200, 208, 220, 240 VAC<br>Operating range: 90–264 VAC |
| AC input line frequency | 47–63 Hz |
| AC input current rating | 6–3 A |
| Output voltages | +3.3 V @ 40 A, +2.5 V @ 20 A, +5.0 V @ 15 A, +12 V@ 3 A |

**Related Documentation**

- M7i AC Power Supply on page 60
- Connecting Power to an AC-Powered M7i Router on page 123
- Replacing an M7i AC Power Supply on page 177
- Replacing an M7i AC Power Cord on page 181
- M7i Router Power Requirements on page 79
- M7i Router AC Power, Connection, and Power Cord Specifications on page 83

CHAPTER 11

# DC Power Requirements and Specifications



## M7i Router DC Power Supply Specifications

Table 49 on page 87 lists electrical specifications for the DC power supply.

*Table 49: Electrical Specifications for DC Power Supply*

| Description | Specification |
|---|---|
| Maximum power output | 293 W |
| DC input voltage | Nominal: –48, –60 VDC<br>Operating range: –40.5 to –72 VDC |
| Input DC current rating | 10 A @ –48 V |
| Output voltages | +3.3 V @ 40 A, +2.5 V @ 20 A, +5.0 V @ 15 A, +12 V@ 3 A |

NOTE: The DC power supplies are marked –48 VDC. This is the nominal voltage associated with the battery circuit. Any higher voltages are associated only with float voltages for the charging function.

**Related Documentation**

- M7i DC Power Supply on page 61
- Replacing a DC Power Supply on page 171
- Replacing an M7i DC Power Cable on page 175
- M7i Router Power Requirements on page 79
- M7i Chassis Grounding, Connection, and Cable Specifications on page 78
- M7i Power Supply LEDs on page 61

# M7i DC Power Cable and Cable Lug Specifications



## DC Power Cables

To supply power to the router, connect power cables to a separate, dedicated DC power source for each power supply and attach the cables to the field-wiring terminals on each power supply. Most sites distribute DC power through a main conduit that leads to frame-mounted DC power distribution panels, one of which might be located at the top of the rack that houses the router. A pair of cables (one input and one return) connects the field-wiring terminals to the power distribution panel.

Table 50 on page 88 summarizes the specifications for the DC power cables, which you must supply.

*Table 50: DC Power Cable Specifications*

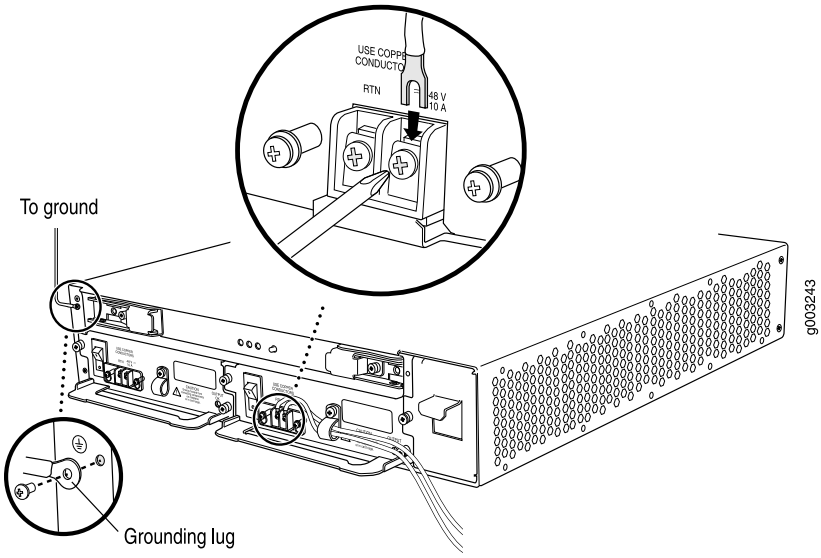
| Quantity and Specification | Maximum Equal Length |
|---|---|
| Two 14-AWG (2.08 $mm^2$) single-strand-count wire cables for each power supply | None |

WARNING: For field-wiring connections, use copper conductors only.

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

Figure 27 on page 89 shows how to attach the DC power cables. The power cables insert into the field-wiring terminals located on each power supply— the input terminal is labeled **-48V** and the return terminal is labeled **RTN**.

*Figure 27: DC Power Cable Connections*




## DC Power Lugs

CAUTION: Before router installation begins, a licensed electrician must attach a cable lug to the power cables that you supply. A cable with an incorrectly attached lug can damage the router (for example, by causing a short circuit).

**Related Documentation**

- M7i DC Power Supply on page 61
- Replacing a DC Power Supply on page 171
- Replacing an M7i DC Power Cable on page 175
- M7i Router Power Requirements on page 79
- M7i Router DC Power Supply Specifications on page 87
- General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers on page 254

CHAPTER 12

# Network Cable and Transceiver Planning



## Fiber-Optic and Network Cable Specifications for the M7i Router

The router supports PICs that use various kinds of network cable, including multimode and single-mode fiber-optic cable. For information about the type of cable used by each PIC, see the *M7i Multiservice Edge Router Interface Module Reference*.

**Related Documentation**

- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 91
- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 92
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 93
- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 94

## Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers

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. While 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**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 92
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 93
- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 94

## Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router

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. LEDs are not coherent sources, however. 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 to 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. It is consequently more expensive.

The router uses optical lasers for SONET/SDH PIC single-mode interfaces. These optics comply with IR-1 of Bellcore GR-253-CORE Issue 2, December 1995 and ANSI TI.105.06.

For information about the maximum transmission distances and wavelength ranges supported by multimode and single-mode (ATM and SONET/SDH) PIC interfaces, see the interface module reference for your device. Exceeding the maximum transmission distances can result in significant signal loss, which causes unreliable transmission.

**Related Documentation**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 91
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 93
- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 94

## Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers

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

$$P_B = P_T - P_R$$

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

$$P_B = P_T - P_R$$

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

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

**Related Documentation**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 92
- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 91

- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 94

## Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers

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 51 on page 94 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 51: Estimated Values for Factors Causing Link Loss*

| Link-Loss Factor | Estimated Link-Loss Value |
|---|---|
| Higher-order mode losses | Single-mode—None<br>Multimode—0.5 dB |
| Modal and chromatic dispersion | Single-mode—None<br>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<br>Multimode—1 dB/km |

The following example uses the estimated values in Table 51 on page 94 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 51 on page 94 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**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 92
- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 91
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 93

CHAPTER 13

# Management Cable and Transceiver Specifications and Pinouts



## Routing Engine Interface Cable and Wire Specifications for the M7i Router

For management and service operations, you connect the Routing Engine to an external console or management network. (For more information, see "M7i Routing Engine Description" on page 17.)

Table 52 on page 97 lists the specifications for the cables that connect to management ports.

*Table 52: Cable Specifications for Routing Engine Management Ports*

| Port | Cable Specification | Cable/Wire Supplied | Maximum Length | Router Receptacle |
|---|---|---|---|---|
| Routing Engine console or auxiliary interface | RS-232 (EIA-232) serial | One 6-ft (1.83-m) length with DB-9/DB-9 connectors | 6 ft (1.83 m) | DB-9 male |
| Routing Engine Ethernet interface | Category 5 cable or equivalent suitable for 100Base-T operation | One 15-ft (4.92-m) length with RJ-45/RJ-45 connectors | 328 ft (100 m) | RJ-45 autosensing |

**Related Documentation**

- Replacing the Routing Engine Interface Port Cables on page 144
- Maintaining the M7i Routing Engine on page 192
- Replacing the M7i Routing Engine on page 141

## RJ-45 Connector Pinouts for the M7i Routing Engine MGMT Port

The port on the Routing Engine labeled **MGMT** is an autosensing 10/100-Mbps Ethernet RJ-45 receptacle that accepts an Ethernet cable for connecting the Routing Engine to a management LAN (or another device that supports out-of-band management). Table 53 on page 98 describes the RJ-45 connector pinout.

*Table 53: RJ-45 Connector Pinout*

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

**Related Documentation**

- M7i Routing Engine Description on page 17
- Maintaining the M7i Routing Engine on page 192
- Replacing the M7i Routing Engine on page 141
- Replacing the Routing Engine Interface Port Cables on page 144
- DB-9 Connector Pinouts for the M7i Routing Engine AUX/MODEM and CONSOLE Ports on page 98

## DB-9 Connector Pinouts for the M7i Routing Engine AUX/MODEM and CONSOLE Ports

The ports on the CIP labeled **AUX/MODEM** and **CONSOLE** are DB-9 receptacles that accept RS-232 (EIA-232) cable. The **AUX/MODEM** port connects the Routing Engine to a laptop, modem, or other auxiliary unit, and the **CONSOLE** port connects it to a management console. The ports are configured as data terminal equipment (DTE). Table 54 on page 99 describes the DB-9 connector pinouts.

*Table 54: DB-9 Connector Pinout*

| Pin | Signal | Direction | Description |
|---|---|---|---|
| 1 | DCD | <– | Carrier Detect |
| 2 | RxD | <– | Receive Data |
| 3 | TxD | –> | Transmit Data |
| 4 | DTR | –> | Data Terminal Ready |
| 5 | Ground | — | Signal Ground |
| 6 | DSR | <– | Data Set Ready |
| 7 | RTS | –> | Request To Send |
| 8 | CTS | <– | Clear To Send |
| 9 | RING | <– | Ring Indicator |

**Related Documentation**

- M7i Routing Engine Description on page 17
- Maintaining the M7i Routing Engine on page 192
- Replacing the M7i Routing Engine on page 141
- Replacing the Routing Engine Interface Port Cables on page 144
- RJ-45 Connector Pinouts for the M7i Routing Engine MGMT Port on page 98

PART 3

# Initial Installation and Configuration

CHAPTER 14

# Installation Overview



## Overview of M7i Router Installation

After you have prepared your installation site as described in "M7i Router Site Preparation Checklist" on page 73, you are ready to unpack and install the router. It is important to proceed through the installation process in the following order:

1. Review the safety guidelines explained in "General Safety Guidelines for Juniper Networks Devices" on page 225 and "General Safety Warnings for Juniper Networks Devices" on page 226.
2. Follow the instructions in "Unpacking the M7i Router" on page 105 and "Verifying the M7i Router Parts Received" on page 107.
3. Install the cable management system as described in "Installing the M7i Cable Management System" on page 109.
4. If you are center-mounting the router, move the mounting brackets as described in "Moving the Mounting Brackets" on page 110.
5. Install the router as described in "Installing the M7i Router Into the Rack" on page 110.
6. Connect the grounding cable as described in "Connecting the Grounding Cable to the M7i Router" on page 113.
7. Connect cables to external devices as described in "Connecting the M7i Router to Management and Alarm Devices" on page 115.
8. Connect the AC power cords as described in "Connecting Power to an AC-Powered M7i Router" on page 123 or DC power cables "Connecting Power to a DC-Powered Router" on page 124.

9. Power on the router as described in "Powering On the M7i Router" on page 125.

10. Perform the initial system startup as described in "Initially Configuring the M7i Router" on page 129.

**Related Documentation**

- Connecting the M7i Router to a Management Console or Auxiliary Device on page 116
- Connecting the M7i Router to a Network for Out-of-Band Management on page 116
- M7i Chassis Description on page 11
- M7i Chassis Lifting Guidelines on page 233

CHAPTER 15

# Unpacking the M7i



## Tools and Parts Required to Unpack the M7i 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**

- M7i Router Description on page 3
- M7i Chassis Description on page 11
- M7i Chassis Lifting Guidelines on page 233

## Unpacking the M7i Router

The router is shipped in a cardboard carton, secured with foam packing material. The carton also contains an accessory box and the M7i Internet Router Installation Quick Start.

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

To unpack the router, perform these steps (see Figure 28 on page 106):

1. Move the shipping carton to a staging area as close to the installation site as possible, but where you have enough room to remove the system components.

2. Position the carton so that the arrows are pointing up.

3. Open the top flaps on the shipping carton.

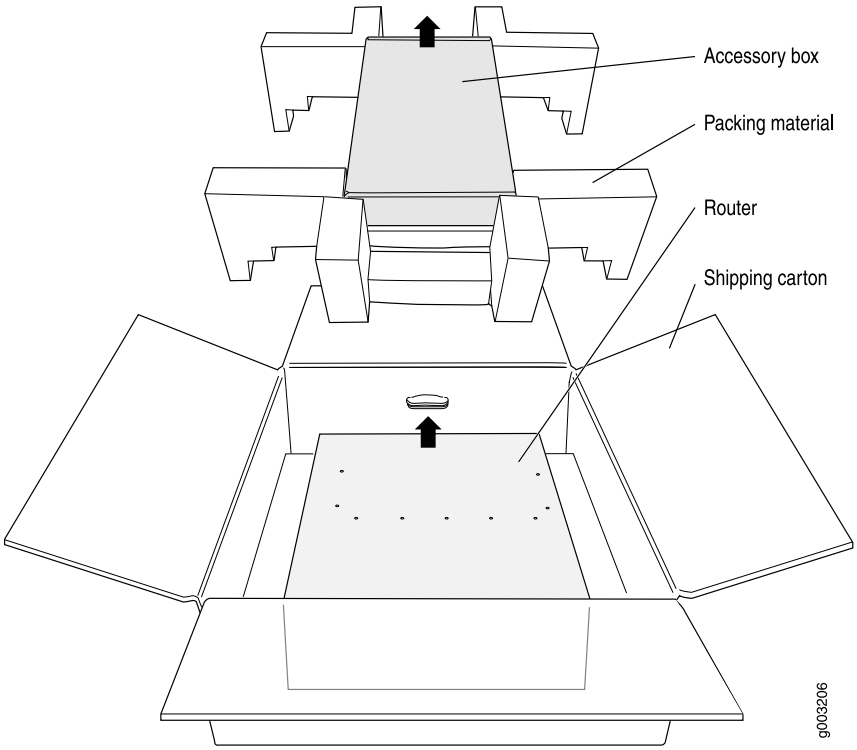
4. Remove the accessory box and verify the contents against the parts inventory on the label attached to the carton.

5. Pull out the packing material holding the router in place.

6. Verify the chassis components received against the packing list included with the router. A generic parts inventory appears in Table 55 on page 107.

7. Save the shipping crate, packing materials, and pallet in case you later need to move or ship the router.

*Figure 28: Unpacking the Router*




**Related Documentation**

- M7i Router Description on page 3
- M7i Router Physical Specifications on page 74
- M7i Router Rack Requirements on page 75

## Verifying the M7i 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 55 on page 107, and an accessory box, which contains the parts listed in Table 56 on page 107. The parts shipped with your router can vary depending on the configuration you ordered.

*Table 55: Generic Inventory of Router Components Installed in the M7i Chassis*

| Component | Quantity |
|---|---|
| PIC | Up to 4 |
| FIC | 1 (2-port Fast Ethernet or 1-port Gigabit Ethernet) |
| Routing Engine | 1 |
| Midplane | 1 |
| CFEB or CFEB-E | 1 |
| Fan tray | 1 |
| Power supply | 1 or 2 |
| Mounting brackets | 2 |
| Blank panels for slots without components | Depends on router configuration |

*Table 56: Accessory Box Parts List*

| Part | Quantity |
|---|---|
| Screws, Screw, Pan hd, Phil, 12-24 x 1/2", self-tapping | 4 |
| Screws, Flat Hd, Phil, 5 x 10.5mm Long, 1.6mm Pitch, self-tapping | 4 |
| Terminal lugs, 16-AWG to 14-AWG, #6 stud, ring terminal, vinyl insulated | 2 |
| Terminal fork lugs, 14-AWG, #6, 0.25 Wide, insulation strain relieved, for DC power cables | 9 (2 per power supply) |

*Table 56: Accessory Box Parts List (continued)*

| Part | Quantity |
|---|---|
| Terminal lugs, 14-AWG, #8 stud, ring tongue, insulated | 2 |
| Terminal lugs, 14-AWG, two hole for grounding | 1 |
| DB-9 (male) to DB-25 (female) serial adapter | 1 |
| Serial cable, Console, DB9F/DB9F | 1 |
| Label, contents, 3-1/3" x 4", M7i/M10i | 1 |
| Label, Accessory Kit Label, Green "Small Parts Enclosed" | 1 |
| Read me first document | 1 |
| JNPR Compliance Form Letter, RoHS Worldwide | 1 |
| Affidavit for T1 connection | 1 |
| Juniper Networks Product Warranty | 1 |
| End User License Agreement | 1 |
| Addendum, Documentation Card for Routing Platforms | 1 |
| Document sleeve | 1 |
| 3" x 5" pink bag | 2 |
| 9" x 12" pink bag, ESD | 2 |
| Accessory box, 19 x 12 x 3" | 1 |
| Ethernet cable, RJ-45/RJ-45, 4-pair stranded UTP, Category 5E, 15' | 1 |
| ESD wrist strap with cable | 1 |

**Related Documentation**

- M7i Router Description on page 3
- M7i Router Physical Specifications on page 74
- M7i Chassis Description on page 11

CHAPTER 16

# Installing the M7i into a Rack



## Tools and Parts Required to Install the M7i Router Into a Rack

To install the chassis into a rack, you need the following tools and parts:

- Phillips (+) screwdriver, number 2

**Related Documentation**

- Initially Configuring the M7i Router on page 129
- M7i Chassis Description on page 11
- M7i Chassis Lifting Guidelines on page 233

## Installing the M7i Cable Management System

The cable management system organizes and supports the PIC cables to prevent damage.

To install the cable management system (see Figure 29 on page 110):

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. Verify that the router is attached to a proper earth ground.

2. Use a number 2 Phillips screwdriver to loosen the screws that secure the mounting brackets to the chassis, and remove the mounting brackets.

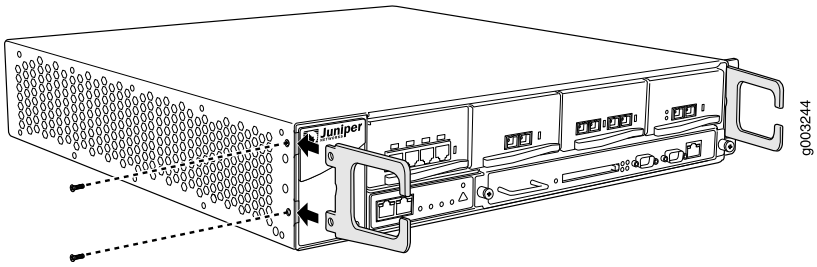
3. Locate the cable management racks and appropriate screws in the accessory box.

4. Slide the cable management rack into the slots at the front of the chassis.

5. Use a number 2 Phillips screwdriver to tighten the screws that secure the cable management system to the chassis.

6. Reinstall the mounting brackets.

*Figure 29: Installing the Cable Management System*




**Related Documentation**

- M7i Cable Management System on page 13
- M7i Chassis Description on page 11

## Moving the Mounting Brackets

For an open-frame rack, center-mounting is preferable, because the more even distribution of weight provides greater stability. The router is shipped with the mounting brackets already installed for front-mounting, as shown in Figure 5 on page 11.

To move the mounting brackets before center-mounting the router:

1. Move the mounting brackets to the center of the chassis.

2. Secure the mounting brackets to the chassis by installing screws along both the front and rear of the brackets.

**Related Documentation**

- Installation Safety Warnings for Juniper Networks Devices on page 233
- Installing the M7i Router Into the Rack on page 110

## Installing the M7i Router Into the Rack

CAUTION: Depending on configuration, the chassis weighs between 28.2 lb (12.8 kg) and 36.5 lb (16.6 kg). Installing it into the rack requires at least one person to lift and another person to secure the mounting screws.

First, perform the following prerequisite procedures:

- Verify that the router site meets the requirements described in "M7i Router Site Preparation Checklist" on page 73.
- Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure. For details, see "M7i Router Rack Requirements" on page 75.
- Read the information in "General Safety Guidelines for Juniper Networks Devices" on page 225 and "General Safety Warnings for Juniper Networks Devices" on page 226.
- Review the guidelines in "M7i Chassis Lifting Guidelines" on page 233.
- Remove the router from the shipping carton, as described in "Unpacking the M7i Router" on page 105.

Then, perform the following procedures to install the router:

NOTE: **If you are installing multiple routers in one rack, install the lowest one first and proceed upward in the rack.**

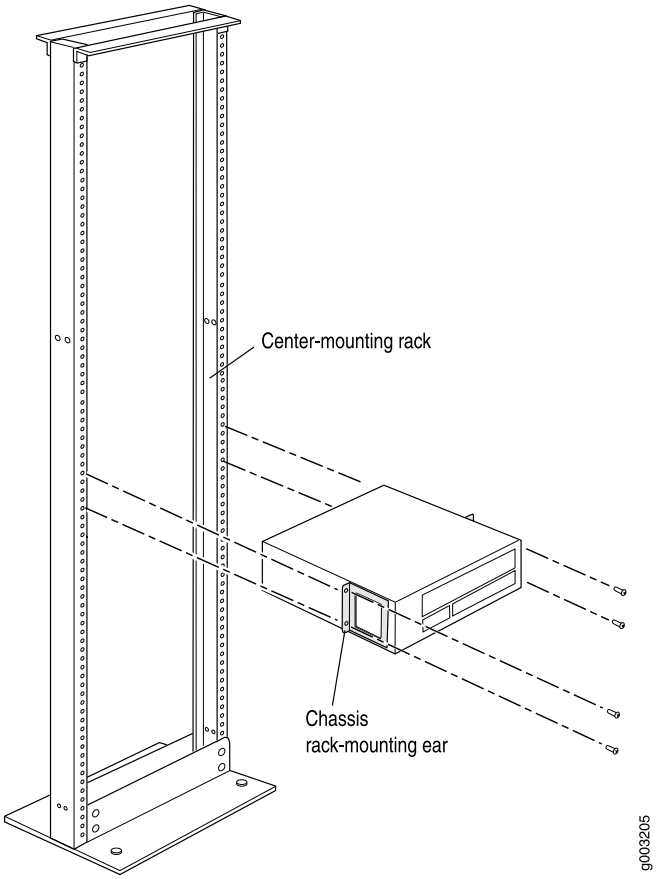
1. If you are center-mounting the router, move the mounting brackets on the chassis as described in "Moving the Mounting Brackets" on page 110.

2. Have one person grasp each side of the router, lift the router, and position it in the rack.

3. Align the bottom hole in both mounting brackets with a hole in each rack rail, making sure the chassis is level.

4. Install one of the mounting screws provided (in the accessory box shipped with the router) into each of the two aligned holes. Use a Phillips screwdriver to tighten the screws.

*Figure 30: Installing the Router*




5. Install the second screw in each mounting ear.

6. Verify that all the mounting screws on one side of the rack are aligned with the mounting screws on the opposite side and that the router is level.

7. To continue the installation, proceed to "Connecting the M7i Router to Management and Alarm Devices" on page 115.

**Related Documentation**

- Overview of M7i Router Installation on page 103
- Initially Configuring the M7i Router on page 129
- M7i Chassis Lifting Guidelines on page 233
- M7i Router Physical Specifications on page 74

CHAPTER 17

# Connecting the M7i to Ground



## Connecting the Grounding Cable to the M7i Router

To connect the grounding cable:

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. Connect the grounding cable to a proper earth ground.
3. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
4. Make sure that grounding surfaces are clean and brought to a bright finish before grounding connections are made.
5. Using a number 2 Phillips screwdriver, remove the screws next to the grounding symbol above the power supplies on the chassis rear. Secure the grounding cable lug to the chosen grounding point by reinstalling and tightening the screws.
6. Verify that the grounding cabling is correct, that the grounding cable does not touch or block access to router components, and that it does not drape where people could trip on it.

**Related Documentation**

- M7i Chassis Description on page 11
- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- M7i Chassis Grounding, Connection, and Cable Specifications on page 78

CHAPTER 18

# Connecting the M7i to External Devices



## Tools and Parts Required for M7i Router Connections

To connect the router to management devices and PICs and to power on the router, you need the following tools and parts:

- Electrostatic discharge (ESD) grounding wrist strap

**Related Documentation**

- M7i Router Power Requirements on page 79
- M7i Router Site Preparation Checklist on page 73

## Connecting the M7i Router to Management and Alarm Devices

After you have installed the router into the rack, connect the router to one or more external devices for management and service operations.

To connect external devices, perform the procedures described in the following topics:

- Connecting the M7i Router to a Network for Out-of-Band Management on page 116
- Connecting the M7i Router to a Management Console or Auxiliary Device on page 116

## Connecting the M7i Router to a Network for Out-of-Band Management

To connect the Routing Engine to a network for out-of-band management, insert an Ethernet cable with RJ-45/RJ-45 connectors into the **MGMT** port on the Routing Engine. One such cable is provided with the router (see "Routing Engine Interface Cable and Wire Specifications for the M7i Router" on page 97). Follow this procedure:

1. Plug one end of the Ethernet cable (Figure 31 on page 116 shows the connector) into the **MGMT** port on the Routing Engine Figure 32 on page 116 shows the layout of the ports on the Routing Engine.

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

*Figure 31: Routing Engine Ethernet Cable Connector*

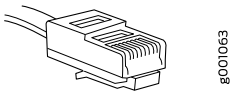
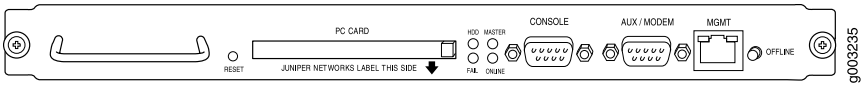



*Figure 32: Routing Engine Interface Ports*




**See Also**

- M7i Power System Description on page 59
- M7i Router Power Requirements on page 79
- M7i Router Site Preparation Checklist on page 73

## Connecting the M7i Router to a Management Console or Auxiliary Device

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/MODEM** port on the Routing Engine. Both ports accept an RS-232 (EIA-232) serial cable with DB-9/DB-9 connectors. One such cable is provided with the router. If you want to connect a device to both ports, you must supply another cable. See "Routing Engine Interface Cable and Wire Specifications for the M7i Router" on page 97. To connect a management console or auxiliary device:

1. Turn off the power to the console or auxiliary device.

2. Plug the female end (shown in Figure 33 on page 117) of the provided console cable into the **CONSOLE** or **AUX/MODEM** port. "Routing Engine Interface Ports" on page 116 shows the layout of the ports on the Routing Engine.

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

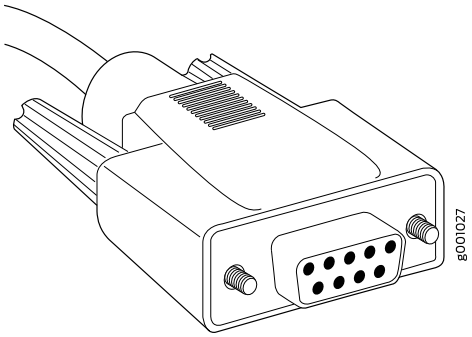
3. Tighten the screws on the connector.

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 33: Console and Auxiliary Serial Port Connector*




**See Also**

- Initially Configuring the M7i Router on page 129
- Connecting Power to an AC-Powered M7i Router on page 123
- Connecting Power to a DC-Powered Router on page 124

**Related Documentation**

- Routing Engine Interface Cable and Wire Specifications for the M7i Router on page 97.
- M7i Power System Description on page 59

- M7i Router Power Requirements on page 79
- M7i Router Site Preparation Checklist on page 73
- Initially Configuring the M7i Router on page 129
- Connecting Power to an AC-Powered M7i Router on page 123
- Connecting Power to a DC-Powered Router on page 124

## Connecting the M7i Router to a Network for Out-of-Band Management

To connect the Routing Engine to a network for out-of-band management, insert an Ethernet cable with RJ-45/RJ-45 connectors into the **MGMT** port on the Routing Engine. One such cable is provided with the router (see "Routing Engine Interface Cable and Wire Specifications for the M7i Router" on page 97). Follow this procedure:

1. Plug one end of the Ethernet cable (Figure 31 on page 116 shows the connector) into the **MGMT** port on the Routing Engine Figure 32 on page 116 shows the layout of the ports on the Routing Engine.

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

*Figure 34: Routing Engine Ethernet Cable Connector*

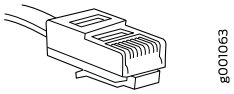
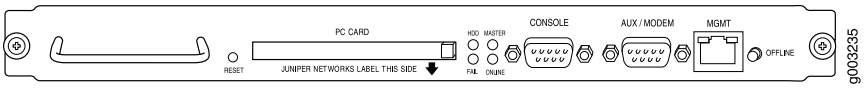



*Figure 35: Routing Engine Interface Ports*




**Related Documentation**

- M7i Power System Description on page 59
- M7i Router Power Requirements on page 79
- M7i Router Site Preparation Checklist on page 73

## Connecting the M7i Router to a Management Console or Auxiliary Device

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/MODEM** port on the Routing Engine. Both ports accept an RS-232 (EIA-232) serial cable with DB-9/DB-9 connectors. One such cable is provided with the router. If you want to connect a device to both ports, you must supply another cable. See "Routing Engine Interface Cable and Wire Specifications for the M7i Router" on page 97. To connect a management console or auxiliary device:

1. Turn off the power to the console or auxiliary device.

2. Plug the female end (shown in Figure 33 on page 117) of the provided console cable into the **CONSOLE** or **AUX/MODEM** port. "Routing Engine Interface Ports" on page 116 shows the layout of the ports on the Routing Engine.

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

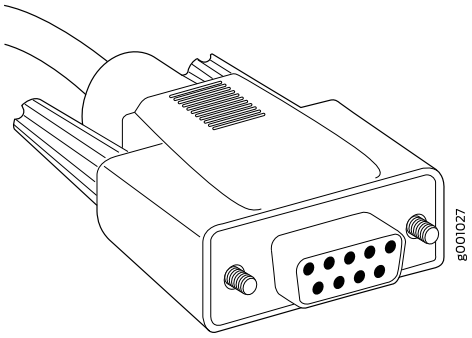
   - Baud rate—9600
   - Parity—N
   - Data bits—8
   - Stop bits—1
   - Flow control—none

3. Tighten the screws on the connector.

   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 36: Console and Auxiliary Serial Port Connector*




**Related Documentation**

- Initially Configuring the M7i Router on page 129
- Connecting Power to an AC-Powered M7i Router on page 123
- Connecting Power to a DC-Powered Router on page 124

## Connecting FIC and PIC Cables to the M7i Router

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

CAUTION: When handling fiber-optic transceivers and fiber-optic cable, observe the following precautions:

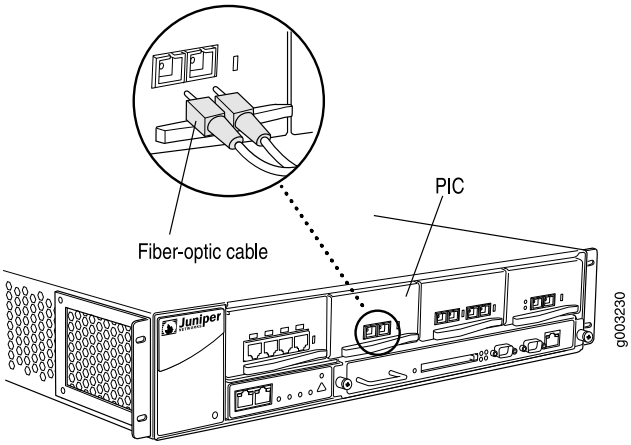
- Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.
- Do not bend fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.
- 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.

Plug network cables into the FIC and the PICs housed in the router.

To connect cables into the cable connector ports in the FIC or a PIC faceplate (see Figure 37 on page 121, which shows a fiber-optic PIC):

1. Have ready a length of the type of cable used by the FIC or PIC, as specified in "FIC Specifications for the M7i Router" on page 45 or the *M7i Multiservice Edge Router Interface Module Reference*.
2. If the cable connector port is covered by a rubber safety plug, remove the plug.
3. Insert the cable connector into the cable connector port on the FIC or PIC faceplate.
4. Arrange the cable to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

*Figure 37: Attaching the Cable to a PIC*




**Related Documentation**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- M7i Fixed Interface Card (FIC) Description on page 44
- M7i Flexible PIC Concentrators (FPCs) Description on page 43

CHAPTER 19

# Providing Power to the M7i



## Connecting Power to an AC-Powered M7i Router

To connect power to an AC-powered router:

1. Locate the power cords shipped with the router, which should have a plug appropriate for your geographical location (see "M7i Router AC Power, Connection, and Power Cord Specifications" on page 83).

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Verify that the switch on each power supply faceplate is in the **OFF** (**O**) position.

4. For each power supply, insert the appliance coupler end of a power cord into the appliance inlet on a power supply faceplate and insert the plug into an AC power source receptacle. Verify that the power cord does not block access to router components or drape where people could trip on it.

**Related Documentation**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- Removing an M7i AC Power Cord on page 181
- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- M7i AC Power Supply on page 60
- M7i Router AC Power Supply Specifications on page 85

## Connecting Power to a DC-Powered Router

Connect DC power to the router by inserting power cables into the field-wiring terminals on the faceplate of each power supply. Power cables are not supplied with the router. For information about the required cable type, see .

NOTE: **The router must be connected to at least two separate external DC power sources.**

CAUTION: **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. You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity.**

To connect DC power to the router (see Figure 38 on page 125):

1. Verify that there is no power flowing from either external power source, so that the voltage across the leads of the power cables is 0 V. Ensure that there is no chance that the cable leads might become active during the procedure.

2. Verify that a licensed electrician has attached a listed power cable lug to each power source cable.

3. Loop the power cables through the hook located on the faceplate to the right of the field-wiring terminals.

4. Depending on the type of power cable lugs used, loosen or remove the screws on the field-wiring terminals.

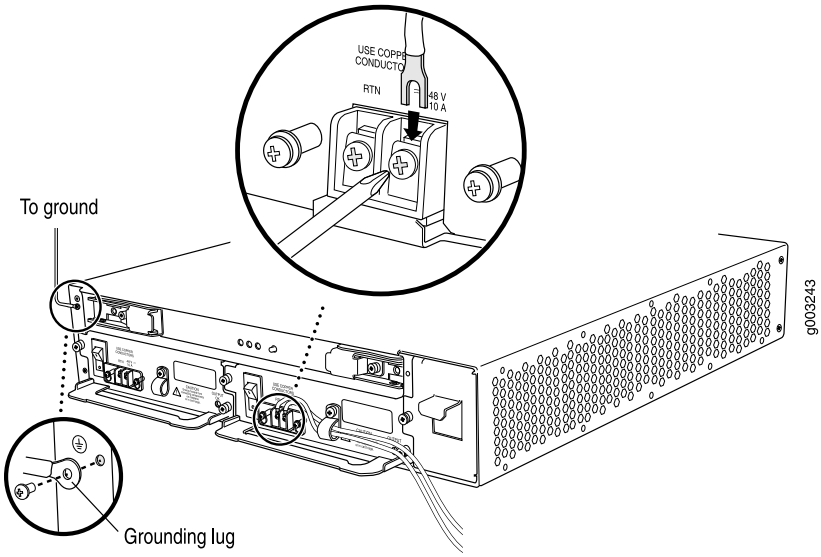
5. Insert the power cable lugs into the appropriate field-wiring terminals. Using a number 1 Phillips screwdriver, turn the screw on each field-wiring terminal clockwise to secure the power cable lug. Apply between 8 lb-in. (.9 Nm) and 9 lb-in. (1.02 Nm) of torque to each screw.

   a. Insert the positive (+) source cable into the return terminal, which is labeled **RTN**.

   b. Insert the negative (–) source cable into the input terminal, which is labeled **–48V**.

6. Verify that the DC source power cabling and the grounding cabling are correct, that they are not touching or blocking access to router components, and that they do not drape where people could trip on them.

*Figure 38: Connecting DC PowerCables*




**Related Documentation**

- Removing an M7I DC Power Cable on page 175
- M7i DC Power Electrical Safety Guidelines on page 255
- M7i DC Power Supply on page 61
- M7i Router DC Power Supply Specifications on page 87

## Powering On the M7i Router

To power on the router:

1. Verify that the power supplies are fully inserted in the chassis and the thumbscrews on their faceplates are tightened.

2. For each power supply on an AC-powered router, verify that the ends of the power cord are firmly plugged into the appliance inlet on the power supply faceplate and the external power source receptacle.

   For each power supply on a DC-powered router, verify that the source DC power cables are connected to the appropriate terminal on the power supply faceplate: the positive (+) source cable to the return terminal (labeled **RTN**) and the negative (–) source cable to the input terminal (labeled **–48V**).

3. Verify that an external management device is connected to one of the Routing Engine ports on the Routing Engine (**AUX/MODEM**, **CONSOLE**, or **MGMT**). For more information on connecting management devices, see "Connecting the M7i Router to Management and Alarm Devices" on page 115.

4. Turn on the power to the external management device.

5. Press the power switch for one power supply to the **ON** ( **|** ) position. On both AC and DC power supplies, the switch is located on the power supply faceplate.

6. Verify that the **OUTPUT OK** LED lights steadily.

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 router 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 router again, see "Powering Off the M7i Router" on page 126.

After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the output status LED on the power supply, the command display output, and messages on the LED display on the craft interface—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

7. Press the power switch for the second power supply to the **ON** ( **|** ) position and verify that the **OUTPUT OK** LED lights steadily. If the LED does not light after 60 seconds, verify that the power supply is properly inserted into the chassis and repeat the cable installation procedures described in "Connecting Power to an AC-Powered M7i Router" on page 123 or "Connecting Power to a DC-Powered Router" on page 124.

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**

- Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 206
- Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off on page 206
- General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers on page 254

## Powering Off the M7i Router

To power off the router:

1. 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
```

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

2. Press the power switch on each power supply faceplate to the **OFF** (**O**) position.

3. Shut down power to the router by pressing the power switch for all power supplies to the off (**O**) position. On both AC and DC power supplies, the switch is located on the power supply faceplate.

CHAPTER 20

# Configuring the Junos Software



## Initially Configuring the M7i Router

The router is shipped with the Junos OS preinstalled and ready to be configured when the router is powered on.

The default boot order for the M7i Multiservice Edge Router is different from other Juniper Networks routers, because the default configuration of the Routing Engine on the M7i router does not include an CompactFlash card.

If the Routing Engine does not have an CompactFlash card, two copies of the Junos OS are preinstalled on the router: one on a PC card that can be inserted into the slot in the Routing Engine faceplate, and one on a rotating hard disk in the Routing Engine. When the router boots, it first attempts to access the software image on the PC card. If a PC card is not inserted into the Routing Engine or the attempt otherwise fails, the router tries the hard disk.

If the Routing Engine has an CompactFlash card, three copies of the Junos OS are preinstalled on the router and the boot order is as follows. The router first attempts to access the image on the PC card. If a PC card is not inserted into the Routing Engine or the attempt otherwise fails, the router next tries the CompactFlash card, 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 **MGMT** 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 as described in "Powering On the M7i Router" on page 125.

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. Configure the router's domain name.

```
[edit]
root@# set system domain-name domain-name
```

7. 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
```

8. Configure the IP address of a DNS server.

```
[edit]
root@# set system name-server address
```

9. 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
```

10. Optionally, 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;
         }
      }
   }
}
```

11. Commit the configuration to activate it on the router.

```
[edit]
root@# commit
```

12. Optionally, configure additional properties by adding the necessary configuration statements. Then commit the changes to activate them on the router.

```
[edit]
root@host# commit
```

13. 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, internal 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**

- M7i Router Description on page 3
- Overview of M7i Router Installation on page 103

PART 4

# Installing and Replacing Components

CHAPTER 21

# Overview of Installing and Replacing Components



## M7i 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 down the router or disrupting the routing functions.
- Hot-pluggable FRUs—You can remove and replace these components without powering down the router, but the routing functions of the system are interrupted when the component is removed.

Table 57 on page 135 lists the FRUs for the M7i router.

*Table 57: Field-Replaceable Units*

| Hot-Removable and Hot-Insertable FRUs | Hot-Pluggable FRUs |
|---|---|
| • Fan tray<br>• Physical Interface Card (PIC)<br>• Power supply | • Compact Forwarding Engine Board (CFEB) (when swapping for an existing CFEB)<br>• Enhanced Compact Forwarding Engine Board (CFEB-E) (when swapping for an existing CFEB-E)<br>• Routing Engine |

**Related Documentation**

- Replacing the M7i Fan Tray on page 137
- Replacing an M7i PIC on page 159
- Replacing an M7i AC Power Supply on page 177
- Replacing a DC Power Supply on page 171
- Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E on page 183

- Replacing the M7i Routing Engine on page 141

## Tools and Parts Required to Replace M Series Hardware Components

To replace hardware components, you need the tools and parts listed in Table 58 on page 136.

*Table 58: Tools and Parts Required*

| Tool or part | Components |
|---|---|
| Electrostatic bag or antistatic mat | • CFEB/CFEB-E<br>• Routing Engine |
| Electrostatic discharge (ESD) grounding wrist strap | All |
| Phillips (+) screwdriver, number 2 | • CFEB/CFEB-E<br>• Fan tray<br>• Power supply<br>• Routing Engine |
| Flat-blade screwdriver, 2.5-mm | Routing Engine console port cable |
| Needlenose pliers | CompactFlash card |
| Rubber safety cap | Fiber-optic PIC or PIC cable |

**Related Documentation**

- Displaying M7i Router Components and Serial Numbers on page 213
- M7i Chassis Description on page 11
- M7i Component Redundancy on page 4

CHAPTER 22

# Replacing Cooling System Components



## Replacing the M7i Fan Tray



### Removing the M7i Fan Tray

The fan tray is located on the back of the chassis. It weighs approximately 1.6 lb (0.7 kg).

To remove the fan tray (see Figure 39 on page 138):

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. Verify that the router is attached to a proper earth ground.

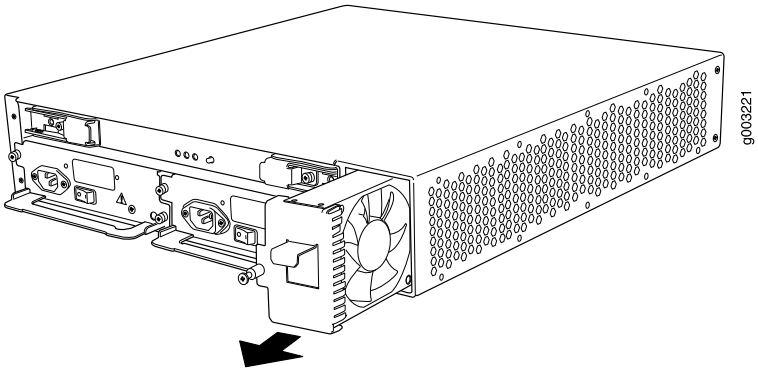
2. Loosen the thumbscrew securing the fan tray, using a Phillips screwdriver if necessary.

3. Grasp the handle on the fan tray and pull firmly to slide it halfway out of the chassis.

CAUTION: To avoid injury, do not touch the fans with your fingers or any tool as you slide the fan tray out of the chassis—they might still be spinning.

4. When the fans are no longer spinning, slide the fan tray completely out of the chassis.

*Figure 39: Removing the Fan Tray*




**See Also**

- M7i Cooling System Overview on page 15
- M7i Chassis Description on page 11
- Troubleshooting the M7i Fan Tray on page 204
- Installing the M7i Fan Tray on page 138

## Installing the M7i Fan Tray

To install the fan tray (see Figure 40 on page 139):

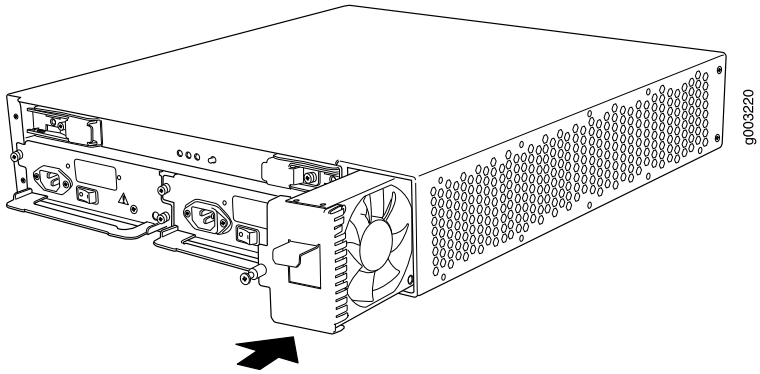
CAUTION: When sliding the fan tray into the chassis, make sure your fingers are not near the fans, which start spinning as soon as the fan tray contacts the midplane.

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. Verify that the router is attached to a proper earth ground.
2. Grasp the sides of the fan tray and align the rear of the tray with the guides inside the chassis.
3. Slide the fan tray all the way into the chassis.

   NOTE: Use the fan tray handle to slide the fan tray into the chassis. Do not push on the fan tray faceplate.

4. Tighten the thumbscrew on the fan tray.

*Figure 40: Installing the Fan Tray*




**See Also**

- M7i Cooling System Overview on page 15
- M7i Chassis Description on page 11
- Troubleshooting the M7i Fan Tray on page 204
- Removing the M7i Fan Tray on page 137

**Related Documentation**

- M7i Cooling System Overview on page 15
- M7i Chassis Description on page 11
- Troubleshooting the M7i Fan Tray on page 204

CHAPTER 23

# Replacing Host Subsystem Components



## Replacing the M7i Routing Engine

The Routing Engine is hot-pluggable, as described in "M7i Field-Replaceable Units (FRUs)" on page 135. To replace a Routing Engine, perform the following procedures:



### Removing an M7i Routing Engine

To remove a Routing Engine (see Figure 41 on page 142):

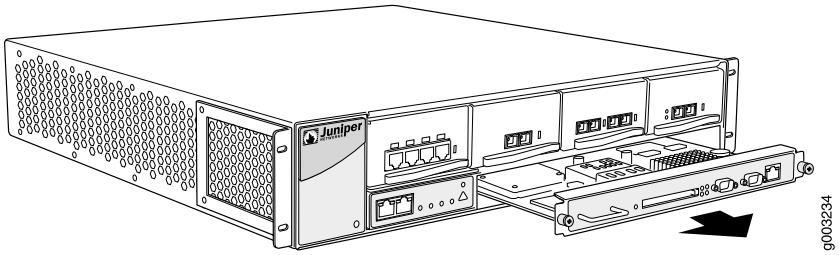
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Press and hold the offline button on the faceplate of the Routing Engine until the green **ONLINE** LED turns off, which takes about 5 seconds.
4. Loosen the thumbscrews securing the Routing Engine, using a Phillips screwdriver if necessary.

5. Grasp the handle and slide the unit about halfway out of the chassis.

CAUTION: Be careful to slide the Routing Engine straight out of the chassis. Damage can result if it gets lodged because of uneven movement.

6. Place one hand under the Routing Engine to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

*Figure 41: Removing the Routing Engine*




**See Also**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- M7i Chassis Description on page 11
- M7i Routing Engine Description on page 17
- Installing the Routing Engine in a M7i Router on page 142
- Maintaining the M7i Routing Engine on page 192

## Installing the Routing Engine in a M7i Router

To install the Routing Engine (see Figure 42 on page 143):

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. Verify that the router is attached to a proper earth ground.

2. Place one hand under the Routing Engine to support it and grasp the handle on the faceplate with the other hand.

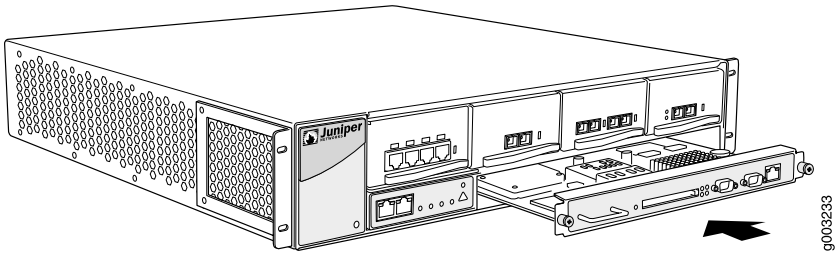
3. Align the rear of the Routing Engine with the guide rails inside the chassis and slide it in completely.

CAUTION: Be careful to align the Routing Engine correctly with the guide rails and push it in evenly. Damage can result if it gets lodged in the rails because of uneven movement.

4. Tighten the thumbscrews at each end of the Routing Engine.

5. You can verify correct Routing Engine functioning by issuing the **show chassis routing-engine** command, described in "Maintaining the M7i Routing Engine" on page 192.

*Figure 42: Installing the Routing Engine*




**See Also**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- M7i Chassis Description on page 11
- M7i Routing Engine Description on page 17
- Removing an M7i Routing Engine on page 141

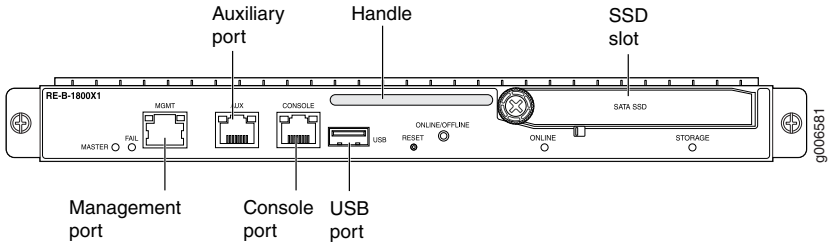
**Related Documentation**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- M7i Chassis Description on page 11
- M7i Routing Engine Description on page 17
- Maintaining the M7i Routing Engine on page 192

## Replacing the SSD on an RE-B-1800 Routing Engine

The RE-B-1800 Routing Engine supports a solid-state drive (SSD) specified by Juniper Networks and ships with one SSD installed. Figure 43 on page 143 shows the arrangement of storage drive slots on an RE-B-1800 Routing Engine.

*Figure 43: RE-B-1800 Storage Drive Slots*



The following drive has been verified to work in the RE-B-1800 Routing Engines:

- SSD SLC 64 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.
   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 the 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 217

## Replacing the Routing Engine Interface Port Cables

The Routing Engine is located on the front of the router, as shown in Figure 5 on page 11. It houses the Routing Engine interface ports, which accept connections to external management devices.

To replace the cables connecting to the Routing Engine interface ports, perform the following procedures:

- Replacing the Management Ethernet Cable on page 145
- Replacing the Console or Auxiliary Cable on page 145

## Replacing the Management Ethernet Cable

To replace the management Ethernet cable:

1. Press the tab on the connector on the management Ethernet cable and pull the connector straight out of the port. Figure 44 on page 145 shows the connector.
2. Disconnect the cable from the network device.
3. Plug one end of the replacement Ethernet cable into the **MGMT** port (see Figure 45 on page 145).
4. Plug the other end of the cable into the network device.

*Figure 44: Routing Engine Ethernet Cable Connector*

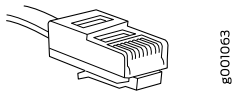
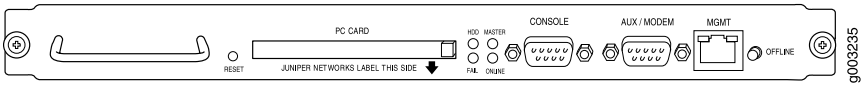



*Figure 45: Routing Engine Interface Ports*




**See Also**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- M7i Chassis Description on page 11
- FIC Specifications for the M7i Router on page 45
- Replacing the Console or Auxiliary Cable on page 145

## Replacing the Console or Auxiliary Cable

If a cable is already connected to the **CONSOLE** or **AUX/MODEM** port, follow these steps to remove it:

1. Turn off the power to the console or auxiliary device.
2. Unscrew the screws that secure the cable connector to the port, using a 2.5-mm flat-blade screwdriver if necessary.
3. Pull the cable connector straight out of the port.
4. Disconnect the cable from the console or auxiliary device.

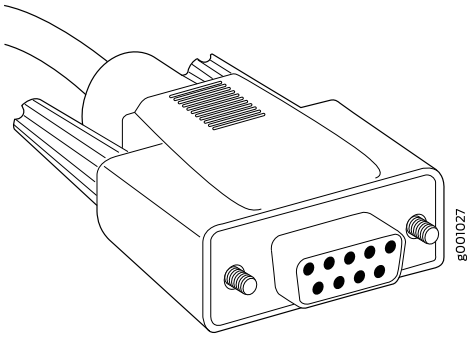
To connect the new cable, follow these steps:

1. Plug the female end of the replacement serial cable into the **CONSOLE** or **AUX/MODEM** port (see "Routing Engine Interface Ports" on page 145).

2. Tighten the screws on the connector.

3. Power on the auxiliary or console device.

*Figure 46: Console and Auxiliary Serial Port Connector*




**See Also**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- M7i Chassis Description on page 11
- FIC Specifications for the M7i Router on page 45
- Replacing the Management Ethernet Cable on page 145

**Related Documentation**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- M7i Chassis Description on page 11
- FIC Specifications for the M7i Router on page 45

## Replacing the Management Ethernet Cable

To replace the management Ethernet cable:

1. Press the tab on the connector on the management Ethernet cable and pull the connector straight out of the port. Figure 44 on page 145 shows the connector.

2. Disconnect the cable from the network device.

3. Plug one end of the replacement Ethernet cable into the **MGMT** port (see Figure 45 on page 145).

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

*Figure 47: Routing Engine Ethernet Cable Connector*

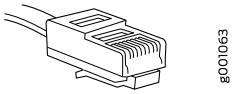
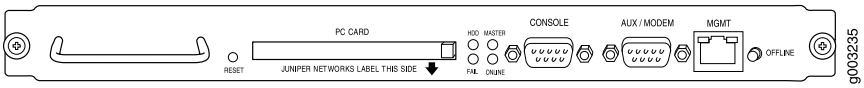



*Figure 48: Routing Engine Interface Ports*




**Related Documentation**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- M7i Chassis Description on page 11
- FIC Specifications for the M7i Router on page 45
- Replacing the Console or Auxiliary Cable on page 145

## Replacing the PC Card Adapter Flash Disk

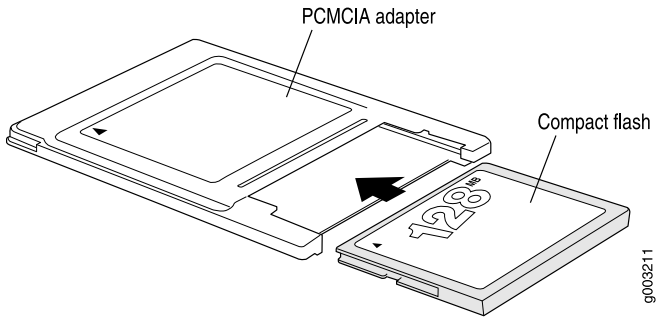
The PC card is an adapter that holds a flash disk. To replace the flash disk (see Figure 49 on page 147):

1. If a flash disk is already inserted in the PC card adapter, slide the flash disk out of the adapter.

2. Align the replacement flash disk with the adapter.

3. Press the flash disk firmly all the way into the adapter.

*Figure 49: Inserting the PC Card Flash Disk*



**Related Documentation**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192
- Removing the PC Card on page 156
- Inserting the PC Card on page 157

## Replacing the Console or Auxiliary Cable

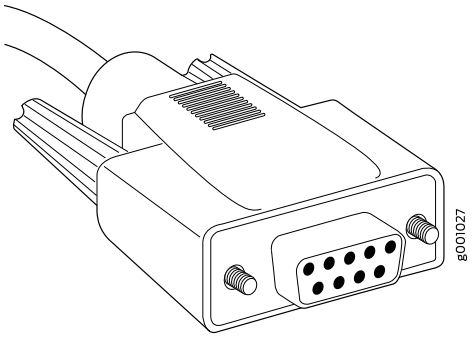
If a cable is already connected to the **CONSOLE** or **AUX/MODEM** port, follow these steps to remove it:

1. Turn off the power to the console or auxiliary device.
2. Unscrew the screws that secure the cable connector to the port, using a 2.5-mm flat-blade screwdriver if necessary.
3. Pull the cable connector straight out of the port.
4. Disconnect the cable from the console or auxiliary device.

To connect the new cable, follow these steps:

1. Plug the female end of the replacement serial cable into the **CONSOLE** or **AUX/MODEM** port (see "Routing Engine Interface Ports" on page 145).
2. Tighten the screws on the connector.
3. Power on the auxiliary or console device.

*Figure 50: Console and Auxiliary Serial Port Connector*




**Related Documentation**

- Fiber-Optic and Network Cable Specifications for the M7i Router on page 91
- M7i Chassis Description on page 11

- FIC Specifications for the M7i Router on page 45
- Replacing the Management Ethernet Cable on page 145

## Removing and Inserting the CompactFlash Card

The CompactFlash card is an optional component of the M7i router. If installed, it provides primary storage for the router. It can accommodate software images, configuration files, and microcode.

To remove, insert and configure an CompactFlash card, perform the following procedures:

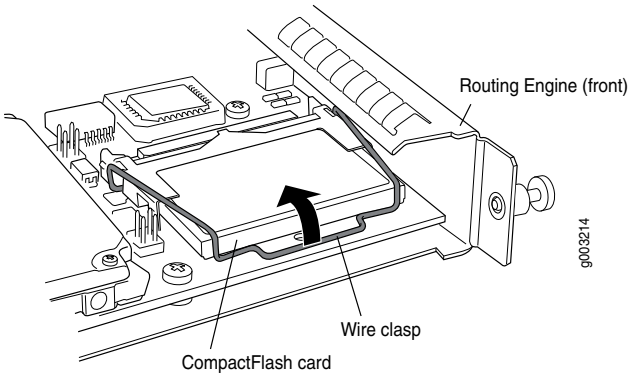
- Removing the CompactFlash Card from a Routing Engine on page 149
- Inserting the CompactFlash Card on page 150
- Configuring the CompactFlash Card on page 151

### Removing the CompactFlash Card from a Routing Engine

The CompactFlash card is located inside the Routing Engine. To remove the CompactFlash card (see Figure 51 on page 150):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Remove the Routing Engine as described in "Removing an M7i Routing Engine" on page 141.
4. Use needlenose pliers with grooved jaws to pull the wire clasp out from under the CompactFlash card and lift it up (see Figure 51 on page 150).
5. Use the needlenose pliers to gently grasp the CompactFlash card and slide it out of the connector. Place the CompactFlash card on the antistatic mat or in the electrostatic bag.

*Figure 51: Removing the CompactFlash Card*




**See Also**

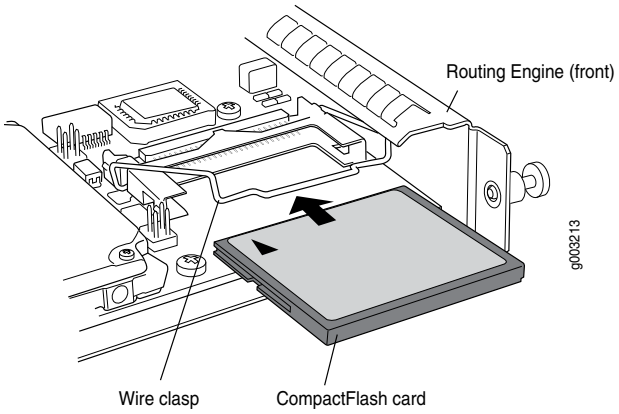
- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192
- Inserting the CompactFlash Card on page 150
- Configuring the CompactFlash Card on page 151

## Inserting the CompactFlash Card

To install the CompactFlash card (see Figure 52 on page 151):

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. Verify that the router is attached to a proper earth ground.
2. If the CompactFlash card is in a PCMCIA card adapter, slide it out of the adapter.
3. Slide the CompactFlash card into the connector on the Routing Engine (see Figure 52 on page 151).
4. Use needlenose pliers with grooved jaws to lower and secure the wire clasp.
5. Install the Routing Engine as described in "Installing the Routing Engine in a M7i Router" on page 142.

*Figure 52: Inserting the CompactFlash Card*




**See Also**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192
- Removing the CompactFlash Card from a Routing Engine on page 149
- Configuring the CompactFlash Card on page 151

## Configuring the CompactFlash Card

After installing the CompactFlash card for the first time, you must copy the software from the Routing Engine's hard disk to the CompactFlash card.

To copy software to the CompactFlash card:

1. Install the CompactFlash card and replace the Routing Engine as described in "Inserting the CompactFlash Card" on page 150 and "Installing the Routing Engine in a M7i Router" on page 142.

2. On the console or other management device connected to the Routing Engine, enter CLI operational mode and issue the following command to copy the currently running and active file system partitions on the router to standby partitions on the CompactFlash card.

   ```
   user@host> request system snapshot partition
   ```

   Wait until a message appears on the console confirming that the procedure is complete.

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

3. Issue the following command to reboot the router's software:

   ```
   user@host> request system reboot
   ```

The CompactFlash card will now be the primary boot device.

4. You can verify correct boot order by issuing the **show system boot-messages** command. The output lists the devices mounted. The CompactFlash card is located at **ad0**.

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

**See Also**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192

**Related Documentation**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192

## Configuring the CompactFlash Card

After installing the CompactFlash card for the first time, you must copy the software from the Routing Engine's hard disk to the CompactFlash card.

To copy software to the CompactFlash card:

1. Install the CompactFlash card and replace the Routing Engine as described in "Inserting the CompactFlash Card" on page 150 and "Installing the Routing Engine in a M7i Router" on page 142.

2. On the console or other management device connected to the Routing Engine, enter CLI operational mode and issue the following command to copy the currently running and active file system partitions on the router to standby partitions on the CompactFlash card.

   ```
   user@host> request system snapshot partition
   ```

   Wait until a message appears on the console confirming that the procedure is complete.

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

3. Issue the following command to reboot the router's software:

   ```
   user@host> request system reboot
   ```

The CompactFlash card will now be the primary boot device.

4. You can verify correct boot order by issuing the **show system boot-messages** command. The output lists the devices mounted. The CompactFlash card is located at **ad0**.

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

**Related Documentation**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192

## Removing and Inserting SDRAM Modules

The SDRAM installed on the Routing Engine provides storage for the routing and forwarding tables and for other Routing Engine processes. The design of the Routing Engine allows you to modify the SDRAM configuration by adding DIMM memory modules to or removing modules from the Routing Engine board. The Routing Engine contains from one to three 168-pin DIMMs.

To modify the SDRAM configuration, use the following procedures:

- Removing an SDRAM Module on page 153
- Inserting an SDRAM Module on page 154

### Removing an SDRAM Module

The SDRAM modules are located on the top of the Routing Engine. To remove a SDRAM module:

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Remove the Routing Engine as described in "Removing an M7i Routing Engine" on page 141.
4. To release the SDRAM module, press the plastic ejectors on both sides of the module.
5. Grasp the SDRAM module, being careful not to touch any electrical components on the module, and firmly pull it out of the slot on the Routing Engine.
6. Place the SDRAM module on the antistatic mat or in the electrostatic bag.
7. Push the plastic ejectors to close the empty SDRAM module slot.

**See Also**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192
- Inserting an SDRAM Module on page 154

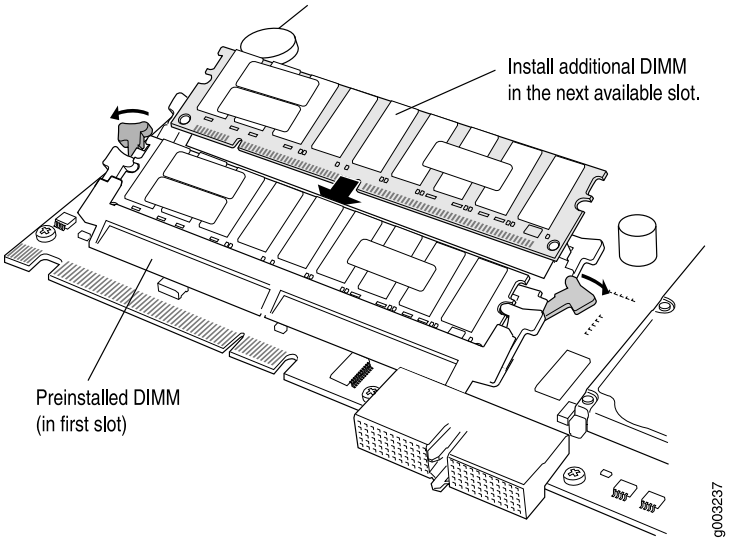
## Inserting an SDRAM Module

To insert a SDRAM module onto the Routing Engine (see Figure 53 on page 155):

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. Verify that the router is attached to a proper earth ground.
2. Remove the SDRAM module from its electrostatic bag.
3. To open the empty SDRAM slot, press the plastic ejectors on both sides.
4. Grasp the SDRAM module by the edges, being careful not to touch any electrical components.
5. Pressing firmly on both ends, push the module into the slot until the ejectors return completely to the closed position.
6. Install the Routing Engine as described in "Installing the Routing Engine in a M7i Router" on page 142.

   You can view the SDRAM configuration and verify it was installed correctly by issuing the **show chassis routing-engine** command, described in "Maintaining the M7i Routing Engine" on page 192.

*Figure 53: Installing the SDRAM Module*




**See Also**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Removing an SDRAM Module on page 153

**Related Documentation**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192

## Removing and Inserting the PC Card

The slot labeled **PC CARD** on the Routing Engine faceplate accepts a Type I PC card, as defined in the *PC Card Standard* published by the Personal Computer Memory Card International Association (PCMCIA). You can also copy Junos OS from the Routing Engine onto a PC card, for example, to create a backup copy of upgrade software that you have obtained from Juniper Networks. Instructions for copying software to a PC card are available at the Juniper Networks Customer Support Center Web site (**https://www.juniper.net/support**); after logging in, navigate to the download page for Junos OS.

The following Compact Flash are supported on the M7i Router:

- Sandisk (SDCFJ-1024-388)
- Unigen (UGB30SHS1000C3JN)
- Western Digital (SSD-C01G-3502)

To remove and insert a PC card, perform the following procedures:

- Removing the PC Card on page 156
- Replacing the PC Card Adapter Flash Disk on page 157
- Inserting the PC Card on page 157

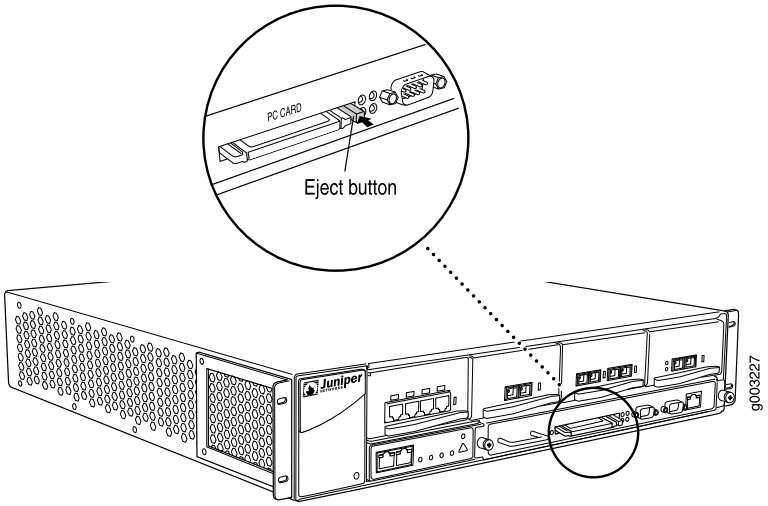
## Removing the PC Card

The PC card is inserted in the slot labeled **PC CARD** in the Routing Engine faceplate. To remove the PC card (see Figure 54 on page 156):

1. Press the eject button located to the right of the PC card slot in the Routing Engine faceplate.

2. When the PC card pops partially out of the slot, grasp the card and pull it straight out of the slot.

*Figure 54: Removing the PC Card*




**See Also**

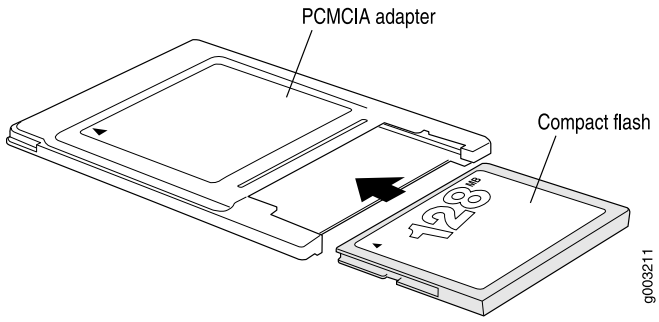
- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192
- Replacing the PC Card Adapter Flash Disk on page 147
- Inserting the PC Card on page 157

## Replacing the PC Card Adapter Flash Disk

The PC card is an adapter that holds a flash disk. To replace the flash disk (see Figure 49 on page 147):

1. If a flash disk is already inserted in the PC card adapter, slide the flash disk out of the adapter.
2. Align the replacement flash disk with the adapter.
3. Press the flash disk firmly all the way into the adapter.

*Figure 55: Inserting the PC Card Flash Disk*




**See Also**

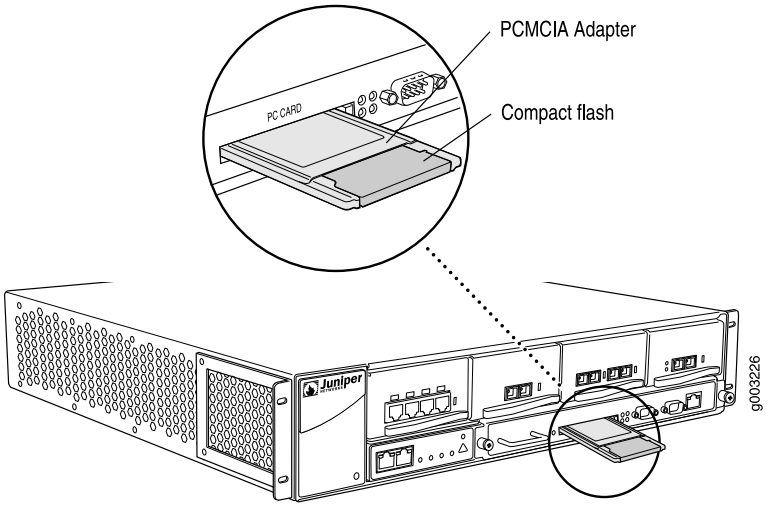
- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192
- Removing the PC Card on page 156
- Inserting the PC Card on page 157

## Inserting the PC Card

To insert the PC card (see Figure 56 on page 158):

1. Orient the PC card with the Juniper Networks logo facing in the direction specified on the Routing Engine faceplate. Insert the card into the slot.
2. Press the card firmly all the way into the slot.

*Figure 56: Inserting the PC Card*




**See Also**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192
- Removing the PC Card on page 156
- Replacing the PC Card Adapter Flash Disk on page 147

**Related Documentation**

- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Maintaining the M7i Routing Engine on page 192

CHAPTER 24

# Replacing Line Card Components



## Replacing an M7i PIC

PICs are housed in the front of the router, as shown in Figure 5 on page 11. PICs are hot-insertable and hot-removable, as described in "M7i Field-Replaceable Units (FRUs)" on page 135. Removing a PIC does not affect router function, except that the PIC no longer receives or transmits data.

To replace a PIC, perform the following procedures:

- Removing an M7i PIC on page 159
- Installing an M7i PIC on page 161

### Removing an M7i PIC

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

CAUTION: When handling fiber-optic transceivers and fiber-optic cable, observe the following precautions:

- 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.
- Do not bend 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.

- 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.

To remove a PIC (see Figure 57 on page 161):

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 electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.

3. If the PIC has multiple cable connector ports, label the cable connected to each port so that you can later reconnect the cables correctly.

4. Press and hold the PIC offline button on the FIC until its failure indicator LED lights, which usually takes about 5 seconds. The failure LED is usually red; for more information, see the *M7i Multiservice Edge Router Interface Module Reference*.

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.

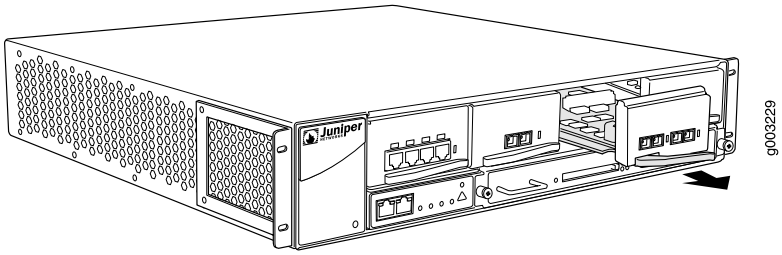
6. Arrange the cable to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

7. Pull the right end of the PIC ejector lever away from the PIC faceplate. This disconnects the PIC from the midplane.

8. Slide the PIC out of the chassis and place it in the electrostatic bag or on the antistatic mat.

9. If you are not reinstalling a PIC into the empty PIC slot within a short time, install a blank PIC panel over the slot to maintain proper airflow in the chassis.

*Figure 57: Removing a PIC*




**See Also**

- M7i PICs Description on page 46
- M7i Chassis Description on page 11
- M7i Midplane Description on page 12
- Installing an M7i PIC on page 161

## Installing an M7i PIC

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

CAUTION: When handling fiber-optic transceivers and fiber-optic cable, observe the following precautions:

- 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.
- Do not bend 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.
- 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.

To install a PIC (see Figure 58 on page 162):

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. Verify that the router is attached to a proper earth ground.

2. If the PIC uses fiber-optic cable, verify that there is a rubber safety cap over each transceiver on the faceplate. Install a cap if necessary.

3. Pull the ejector lever away from the PIC faceplate and hold it while you insert the PIC.

4. Align the rear of the PIC with the guides located at the bottom corners of the PIC slot.

5. Slide the PIC into the card cage until about 0.5 in. (1 cm) of the PIC remains outside the slot and you feel some resistance. Release the ejector lever.

CAUTION: **Be careful to insert the PIC straight into the chassis to avoid damaging the components on the bottom of the PIC.**

6. Continue pushing the PIC until it contacts the midplane and you hear a click. The ejector lever engages and closes automatically.

7. If the PIC uses fiber-optic cable, remove the rubber safety cap from each transceiver.

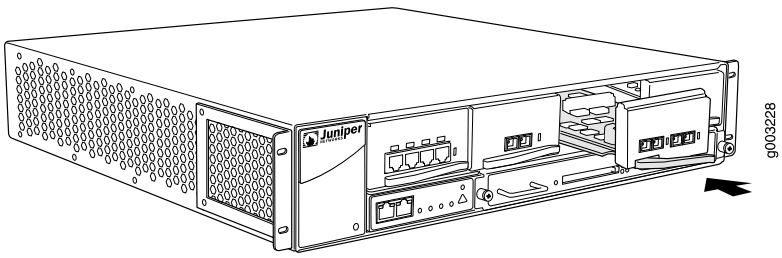
8. Insert the appropriate cable into the cable connector ports on the PIC.

9. 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. Placing fasteners on the loop helps to maintain its shape.

10. Press and hold the PIC offline button on the FIC until the normal function indicator LED lights, which usually takes about 5 seconds. The normal function indicator LED is usually green; for more information, see the *M7i Multiservice Edge Router Interface Module Reference*.

You can verify correct PIC functioning by issuing the **show chassis fpc pic-status** command, described in "Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables" on page 192.

*Figure 58: Installing a PIC*




**See Also**

- M7i PICs Description on page 46
- M7i Chassis Description on page 11
- M7i Midplane Description on page 12

- Removing an M7i PIC on page 159

**Related Documentation**

- M7i PICs Description on page 46
- M7i Chassis Description on page 11
- M7i Midplane Description on page 12

## Replacing an M7i FIC or PIC Cable

Removing and installing FIC or PIC cables does not affect router function, except that a PIC does not receive or transmit data while its cable is disconnected. To replace a PIC cable, perform the following procedures:

- Removing an M7i FIC or PIC Cable on page 163
- Installing an M7i FIC or PIC Cable on page 164

### Removing an M7i FIC or PIC Cable

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

CAUTION:

When handling fiber-optic transceivers and fiber-optic cable, observe the following precautions:

- 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.
- Do not bend 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.
- 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.

To remove a FIC or PIC cable:

1. If the interface connects to fiber-optic cable, have ready a rubber safety cap for each cable you are removing.

2. If removing all cables connected to the interface, press and hold the PIC offline button on the FIC until its failure indicator LED lights, which usually takes about 5 seconds.

The failure LED is usually red; for more information, see the *M7i Multiservice Edge Router Interface Module Reference*.

3. Unplug the cable from the cable connector port. If the interface uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.

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

**See Also**

- M7i Flexible PIC Concentrators (FPCs) Description on page 43
- M7i PICs Description on page 46
- Installing an M7i FIC or PIC Cable on page 164
- Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 192
- Troubleshooting the M7i FIC or PICs on page 205

## Installing an M7i FIC or PIC Cable

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

CAUTION:

When handling fiber-optic transceivers and fiber-optic cable, observe the following precautions:

- 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.
- Do not bend 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.
- 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.

To install a PIC cable (see Figure 59 on page 165):

1. Have ready a length of the type of cable used by the interface, as specified in "FIC Specifications for the M7i Router" on page 45.

2. If the interface cable connector port is covered by a rubber safety plug, remove the plug.

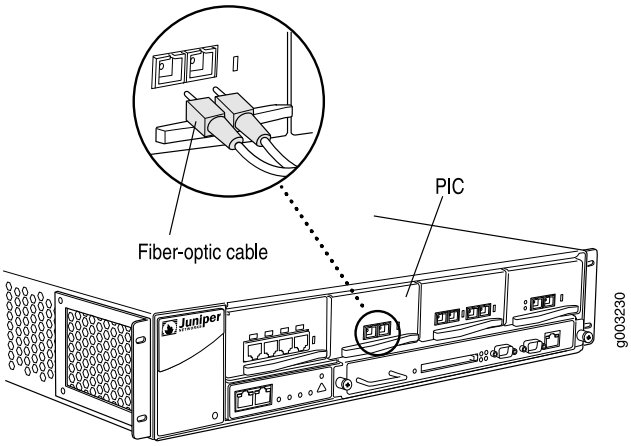
3. Insert the cable connector into the cable connector port on the interface faceplate.

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

6. Verify that the FIC or PIC is functioning correctly by noting whether the normal function indicator LED is lit. The normal function indicator LED is usually green; for more information, see the *M7i Multiservice Edge Router Interface Module Reference*.

   You can also verify correct PIC functioning by issuing the **show chassis fpc pic-status** command, described in "Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables" on page 192.

*Figure 59: Connecting Fiber-Optic Cable to a PIC*




**See Also**

- M7i Flexible PIC Concentrators (FPCs) Description on page 43
- M7i PICs Description on page 46
- Removing an M7i FIC or PIC Cable on page 163
- Troubleshooting the M7i FIC or PICs on page 205

**Related Documentation**

- M7i Flexible PIC Concentrators (FPCs) Description on page 43

- M7i PICs Description on page 46
- Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 192
- Troubleshooting the M7i FIC or PICs on page 205

## Replacing an SFP on an M7i Router

Small form-factor pluggables (SFPs) are optical transceivers that can be removed from a PIC (for more information, see "M7i PICs Description" on page 46).

SFPs are hot-insertable and hot-removable. Removing an SFP does not interrupt PIC functioning, but the removed SFP no longer receives or transmits data. To replace an SFP, perform the following procedures:

- Removing an SFP from an M7i Router on page 166
- Installing an SFP into an M7i Router on page 167

### Removing an SFP from an M7i Router

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

CAUTION:
When handling fiber-optic transceivers and fiber-optic cable, observe the following precautions:

- 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.
- Do not bend 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.
- 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.

To remove an SFP (see Figure 60 on page 167):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the SFP. Have ready a rubber safety cap for the SFP transceiver and the 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. Label the cable connected to the SFP so that you can later reconnect it to the correct SFP.

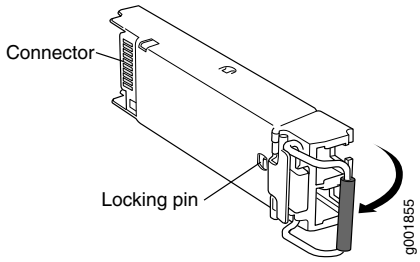
4. Disconnect the cable from the SFP. Immediately cover the transceiver and the end of the cable with a rubber safety cap.

5. 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. Placing fasteners on the loop helps to maintain its shape.

6. Pull the ejector handle away from the SFP faceplate to unseat the SFP from the PIC. Pull the SFP out of the PIC and place it on the antistatic mat or in the 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.

*Figure 60: Small Form-Factor Pluggable (SFP)*




**See Also**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- M7i Chassis Description on page 11
- M7i Router Physical Specifications on page 74
- Installing an SFP into an M7i Router on page 167

## Installing an SFP into an M7i Router

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

CAUTION:

When handling fiber-optic transceivers and fiber-optic cable, observe the following precautions:

- 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.
- Do not bend 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.
- 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.

To install a replacement SFP (see Figure 61 on page 169):

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 a rubber safety cap covers the SFP transceiver, installing one if necessary.

3. Orient the SFP over the port in the PIC so that the connector end will enter the slot first and the SFP connector faces the appropriate direction:
   - If the PIC has ten SFP ports, the ports are arranged in two columns. The SFP connector faces to the right for ports in the left column, and to the left for ports in the right column.
   - If the PIC has one or two SFP ports, the SFP connector faces to the left on platforms in which FPCs install vertically in the chassis, and faces upward on platforms in which FPCs install horizontally in the chassis.
4. Slide the SFP into the slot. If there is resistance, remove the SFP and flip it so that the connector faces the other direction.

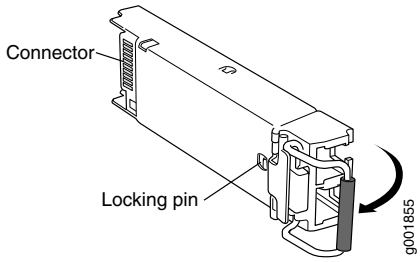
5. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

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

7. Verify that the status LEDs on the PIC faceplate indicate that the SFP is functioning correctly (there is an LED for each SFP port). For more information about the PIC LEDs, see the *M7i Multiservice Edge Router Interface Module Reference*. You can also

verify PIC functioning by issuing the **show chassis fpc pic-status** command described in "Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables" on page 192.

*Figure 61: Small Form-Factor Pluggable (SFP)*




**See Also**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- M7i Chassis Description on page 11
- M7i Router Physical Specifications on page 74
- Removing an SFP from an M7i Router on page 166

**Related Documentation**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- M7i Chassis Description on page 11
- M7i Router Physical Specifications on page 74

CHAPTER 25

# Replacing Power System Components



## Replacing a DC Power Supply

A DC-powered router has one or two load-sharing, redundant DC power supplies that install into the rear of the router as shown in Figure 6 on page 12. Each power supply is hot-removable and hot-insertable, as described in "M7i Field-Replaceable Units (FRUs)" on page 135. When one power supply fails or is powered down, the remaining power supplies automatically assume the entire electrical load for the router. For more information about DC power supplies, see "M7i DC Power Supply" on page 61.

To replace a DC power supply, perform the following procedures:



### Removing a DC Power Supply

Before removing a DC power supply from an M7i router with only one power supply, you must power off the router. See "Powering Off the M7i Router" on page 126. The DC power supplies are located at the bottom rear of the chassis, as shown in Figure 6 on page 12. Each DC power supply weighs approximately 7 lb (3.2 kg).

CAUTION: **Do not leave a power supply slot empty for more than a short time while the router is operational. The power supply must remain in the chassis for proper airflow.**

To remove a DC power supply (see Figure 62 on page 172):

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. Verify that the router is attached to a proper earth ground.

2. Press the power switch for the power supply (located on the power supply faceplate) to the **OFF** (**O**) position.

   NOTE: If you are power cycling the power supply rather than shutting it off for a time, wait at least 60 seconds after turning it off before turning it back on. If you need to power it off again, wait for at least 60 seconds after powering it on.

3. Shut off the power flowing to the power supply from the external power source, so that the voltage across the leads of the power cables is 0 V. Ensure that there is no chance that the cable leads might become active during the procedure.

4. Using a number 1 Phillips screwdriver, turn the screw on each field-wiring terminal counter-clockwise to loosen the terminal connector from around the cable lug.

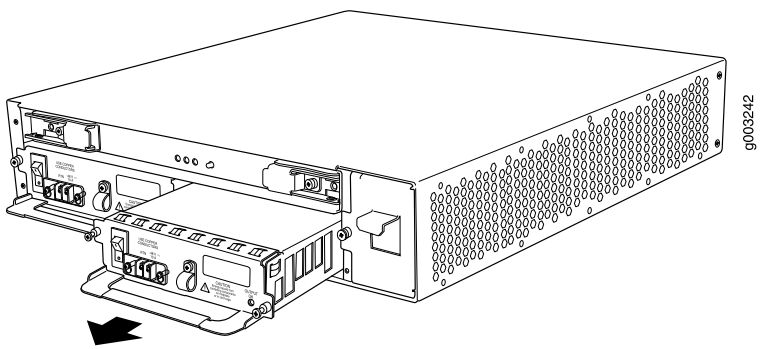
5. Remove the cables from the terminal connectors and from the hook located on the faceplate to the right of the field-wiring terminals.

6. Loosen the thumbscrew at each corner of the power supply faceplate, using a Phillips screwdriver if necessary.

7. Grasp the handle on the power supply faceplate and pull firmly to slide the unit about halfway out of the chassis.

8. Place one hand under the power supply to support it, then slide it completely out of the chassis.

*Figure 62: Removing a DC Power Supply*



**See Also**

- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256
- M7i DC Power Electrical Safety Guidelines on page 255
- M7i Router DC Power Supply Specifications on page 87
- Installing a DC Power Supply on page 173

## Installing a DC Power Supply

To install a DC power supply (see Figure 63 on page 174):

1. Verify that there is no power flowing to the power supply from the external power source, so that the voltage across the leads of the power cables is 0 V. Ensure that there is no chance that the cable leads might become active during the procedure.
2. Verify that the power switch for the power supply (located on the power supply faceplate) is in the **OFF** (**O**) position.
3. Verify that the grounding cable is attached to the chassis and properly connected to an earth ground.
4. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
5. Place one hand under the power supply and grasp the handle on the faceplate with the other hand. Slide the power supply into the chassis until it contacts the midplane.
6. Starting with the bottom screw, tighten (but do not overtighten) the thumbscrews at each corner of the power supply faceplate.
7. Verify that a licensed electrician has attached a listed power cable lug to each power source cable.
8. Loop the power cables through the hook located on the faceplate to the right of the field-wiring terminals.
9. Depending on the type of power cable lugs used, loosen or remove the screws on the field-wiring terminals.
10. Insert the power cable lugs into the appropriate field-wiring terminals. Using a number 1 Phillips screwdriver, turn the screw on each field-wiring terminal clockwise to secure the power cable lug. Apply between 8 lb-in. (.9 Nm) and 9 lb-in. (1.02 Nm) of torque to each screw.
    a. Insert the positive (+) source cable into the return terminal, which is labeled **RTN**.

b. Insert the negative (–) source cable into the input terminal, which is labeled **–48V**.

11. Verify that the DC source power cabling cabling is correct, that the DC power cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.

12. Turn on the DC power source so that voltage flows to the power supply.

13. Press the switch on the power supply faceplate to the **ON** ( **|** ) position.

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

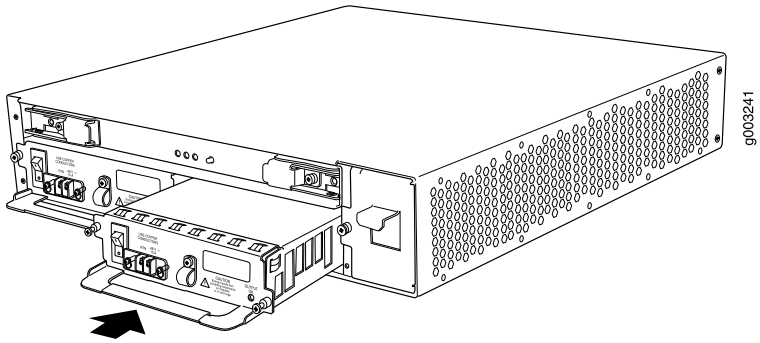
14. If the M7I has only one power supply or the router is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the router again, see "Powering Off the M7i Router" on page 126.

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

15. Check the LEDs on the power supply faceplate. When the power supply has powered on successfully, the green **OUTPUT OK** LED lights steadily.

    After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the output status LED on the power supply, the command display output, and messages on the LED display on the craft interface—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

*Figure 63: Installing a DC Power Supply*




**See Also**
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256

- M7i Router DC Power Supply Specifications on page 87
- M7i DC Power Electrical Safety Guidelines on page 255
- Removing a DC Power Supply on page 171

**Related Documentation**

- M7i Router DC Power Supply Specifications on page 87
- M7i DC Power Electrical Safety Guidelines on page 255
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256

## Replacing an M7i DC Power Cable

On a DC-powered router, the power cables from the external DC power sources connect to field-wiring terminals on each power supply.

- Removing an M7I DC Power Cable on page 175
- Installing an M7i DC Power Cable on page 176

### Removing an M7I DC Power Cable

Before removing a DC power cable from an M7i router with only one power supply, you must power off the router. To remove a DC power cable from the router:

1. Shut off the power flowing from the external power sources, so that the voltage across the leads of the power cables is 0 V. Ensure that there is no chance that the cable leads might become active during the procedure.
2. Press the power switch on the power supply faceplate to the **OFF** (**O**) position.

NOTE: If you are power cycling the power supply rather than shutting it off for a time, wait at least 60 seconds after turning it off before turning it back on. If you need to power it off again, wait for at least 60 seconds after powering it on.

3. Using a number 1 Phillips screwdriver, turn the screw on each field-wiring terminal counter-clockwise to loosen the terminal connector from around the cable lug.
4. Remove the DC cables from the terminal connectors and from the hook located on the faceplate to the right of the field-wiring terminals.
5. Verify that the removed DC cables are not touching or blocking access to any router components.

**See Also**

- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256

- Connecting Power to a DC-Powered Router on page 124

## Installing an M7i DC Power Cable

For information about the required DC power cables, see "M7i DC Power Cable and Cable Lug Specifications" on page 88.

CAUTION: 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. You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity.

To install a DC power cable (see Figure 64 on page 177):

1. Verify that there is no power flowing from either external power source, so that the voltage across the leads of the power cables is 0 V. Ensure that there is no chance that the cable leads might become active during the procedure.

2. Verify that a licensed electrician has attached a listed power cable lug to each power source cable.

3. Loop the power cables through the hook located on the faceplate to the right of the field-wiring terminals.

4. Depending on the type of power cable lugs used, loosen or remove the screws on the field-wiring terminals.

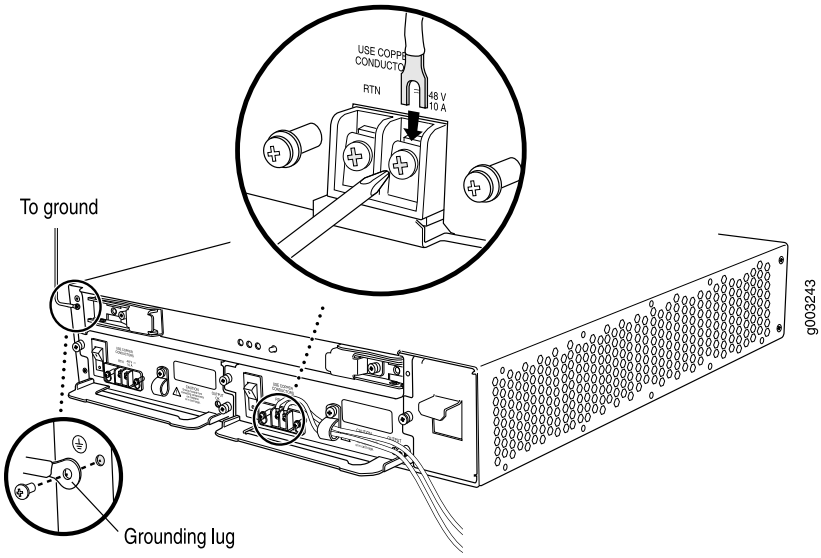
5. Insert the power cable lugs into the appropriate field-wiring terminals. Using a number 1 Phillips screwdriver, turn the screw on each field-wiring terminal clockwise to secure the power cable lug. Apply between 8 lb-in. (.9 Nm) and 9 lb-in. (1.02 Nm) of torque to each screw.

   a. Insert the positive (+) source cable into the return terminal, which is labeled **RTN**.

   b. Insert the negative (–) source cable into the input terminal, which is labeled **–48V**.

6. Verify that the DC source power cabling is correct, that the DC power cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.

*Figure 64: Connecting DC Power Cables*




**Related Documentation**

- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256
- M7i Router DC Power Supply Specifications on page 87
- M7i DC Power Electrical Safety Guidelines on page 255

## Replacing an M7i AC Power Supply

An AC-powered router has one or two load-sharing, redundant AC power supplies. Each power supply is hot-removable and hot-insertable, as described in "M7i Field-Replaceable Units (FRUs)" on page 135. For full redundancy, two power supplies are required. If a power supply stops functioning for any reason, the remaining power supply instantly begins providing all the power the router needs for normal functioning, and can provide full power indefinitely. For more information about AC power supplies, see "M7i AC Power Supply" on page 60.

To replace an AC power supply, perform the following procedures:

- Removing an M7i AC Power Supply on page 177
- Installing an M7i AC Power Supply on page 179

### Removing an M7i AC Power Supply

Before removing the AC power supply from an M7i router with only one power supply, you must power off the router. See "Powering Off the M7i Router" on page 126. The AC power supplies are located at the bottom rear of the chassis, as shown in Figure 6 on page 12. Each AC power supply weighs approximately 12 lb (5.5 kg).

CAUTION: Do not leave a power supply slot empty for more than a short time while the router is operational. The power supply must remain in the chassis for proper airflow.

To remove an AC power supply (see Figure 65 on page 178):

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. Verify that the router is attached to a proper earth ground.

2. Press the power switch on the power supply faceplate to the **OFF** (**O**) position.

   NOTE: If you are not removing the power supply, but simply powering it off, wait at least 60 seconds before turning it back on. If you need to power it off again, wait for at least 60 seconds after powering it on.

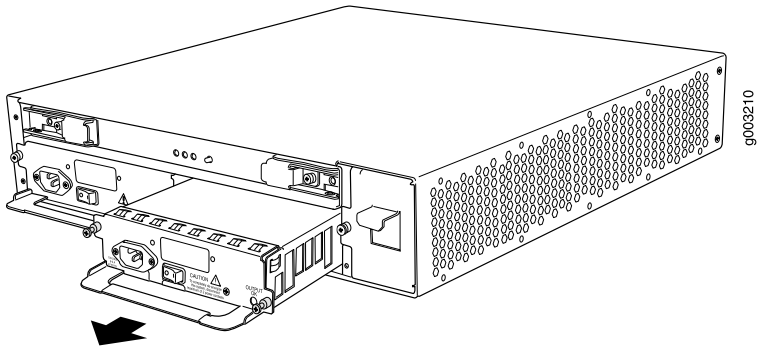
3. Unplug the power cord from the appliance inlet on the faceplate.

4. Loosen the thumbscrew at each corner of the power supply faceplate, using a Phillips screwdriver if necessary.

5. Grasp the handle on the power supply faceplate and pull firmly to slide the unit about halfway out of the chassis.

6. Place one hand under the power supply to support it, then slide it completely out of the chassis.

*Figure 65: Removing an AC Power Supply*




**See Also**

- Connecting Power to an AC-Powered M7i Router on page 123
- Removing an M7i AC Power Cord on page 181
- M7i AC Power Electrical Safety Guidelines and Warnings on page 254

- M7i AC Power Supply on page 60
- M7i Router AC Power Supply Specifications on page 85
- Installing an M7i AC Power Supply on page 179

## Installing an M7i AC Power Supply

To install an AC power supply (see Figure 66 on page 180):

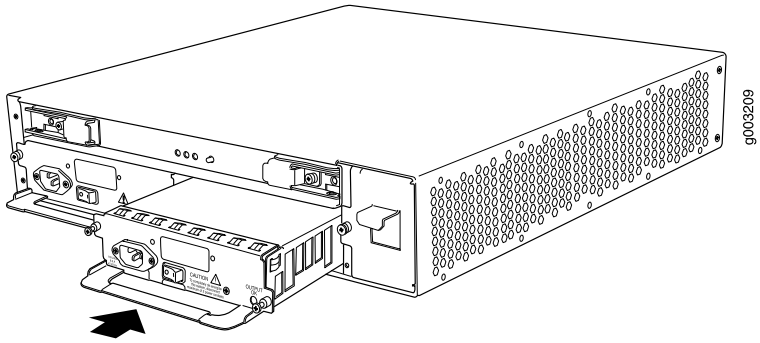
1. Verify that the switch on the power supply faceplate is in the **OFF** (**O**) position.
2. Locate the power cord shipped with the router, which should be appropriate for your geographical location (see "M7i Router AC Power, Connection, and Power Cord Specifications" on page 83).
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
4. Place one hand under the power supply and grasp the handle on the faceplate with the other hand. Slide the power supply into the chassis until it contacts the midplane.
5. Starting with the bottom screw, tighten (but do not overtighten) the thumbscrews at each corner of the power supply faceplate.
6. Insert the appliance coupler end of the power cord into the appliance inlet on the power supply faceplate and insert the plug into an AC power source receptacle. Verify that the power cord does not block access to router components or drape where people could trip on it.
7. Press the power switch on the faceplate to the **ON** ( **|** ) position. When the power supply has powered on successfully, the green **OUTPUT OK** LED lights steadily.

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 router 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 router again, see "Powering Off the M7i Router" on page 126.

After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the output status LED on the power supply, the command display output, and messages on the LED display on the craft interface—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

*Figure 66: Installing an AC Power Supply*




**See Also**

- Connecting Power to an AC-Powered M7i Router on page 123
- Removing an M7i AC Power Cord on page 181
- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- M7i AC Power Supply on page 60
- Removing an M7i AC Power Supply on page 177

**Related Documentation**

- Connecting Power to an AC-Powered M7i Router on page 123
- Removing an M7i AC Power Cord on page 181
- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- M7i AC Power Supply on page 60
- M7i Router AC Power Supply Specifications on page 85

## Replacing an M7i AC Power Cord

The AC power cord that plugs into the appliance inlet on the faceplate of each AC power supply provides direct connection to the external power source.



### Removing an M7i AC Power Cord

Before removing the AC power cord from an M7i router with only one power supply, you must power off the router. See "Powering Off the M7i Router" on page 126. To remove the AC power cord:

1. Press the power switch on each power supply faceplate to the **OFF** (**O**) position.
2. Unplug the power cord from the appliance inlet on the faceplate and from the power source receptacle.

**See Also**

- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- M7i Router AC Power Supply Specifications on page 85
- Replacing an M7i AC Power Supply on page 177
- Installing an M7i AC Power Cord on page 181

### Installing an M7i AC Power Cord

To install an AC power cord:

1. Locate a replacement power cord with the type of plug appropriate for your geographical location (see "M7i Router AC Power, Connection, and Power Cord Specifications" on page 83).
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Press the power switch on the power supply faceplate to the **OFF** (**O**) position.
4. Insert the appliance coupler end of the replacement power cord into the appliance inlet on the power supply faceplate and insert the plug into an AC power source receptacle.
5. Verify that the power cord does not block access to router components or drape where people could trip on it.
6. Press the power switch on the power supply faceplate to the **ON** ( **|**) position.

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

7. If you have only one power supply or the router is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence.

   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 Routing Engine finishes booting and you need to power off the router again, see "Powering Off the M7i Router" on page 126. After powering off a power supply, wait at least 60 seconds before turning it back on.

8. Check the LEDs on the power supply faceplate. When the power supply has powered on successfully, the green **OUTPUT OK** LED lights steadily.

   After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the output status LED on the power supply, the command display output, and messages on the LED display on the craft interface—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

   If the LEDs are not lit in the appropriate pattern after 60 seconds, repeat the procedures to replace the AC power cord.

**See Also**

- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- M7i Router AC Power Supply Specifications on page 85
- Replacing an M7i AC Power Supply on page 177
- Removing an M7i AC Power Cord on page 181

**Related Documentation**

- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- M7i Router AC Power Supply Specifications on page 85
- Replacing an M7i AC Power Supply on page 177

CHAPTER 26

# Replacing Switch Fabric Components



## Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E

The CFEB and CFEB-E are hot-pluggable when you replace a CFEB with a CFEB or a CFEB-E with a CFEB-E, as described in "M7i Field-Replaceable Units (FRUs)" on page 135. Upgrading or downgrading a CFEB device requires a system reboot, as described in "Upgrading and Downgrading the CFEB and CFEB-E" on page 185. To replace the CFEB or CFEB-E, perform the following procedures:



### Removing the M7i CFEB and CFEB-E

To remove the CFEB or CFEB-E (see Figure 67 on page 184):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Press and hold the **ONLINE/OFFLINE** button on the faceplate of the CFEB or CFEB-E until the green **OK** LED turns off, which takes about 5 seconds.
4. Loosen the thumbscrew on each ejector locking tab (shown in Figure 18 on page 65), using a Phillips screwdriver if necessary.
5. Pull the ends of the ejector handles outward until they are nearly perpendicular to the faceplate of the CFEB or CFEB-E.

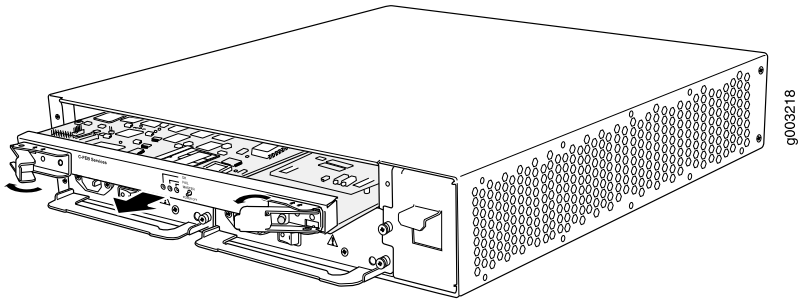
6. Grasp the ejector handles and pull firmly to slide the CFEB or CFEB-E about halfway out of the chassis.

7. Place one hand under the CFEB or CFEB-E to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: When a CFEB or CFEB-E is out of the chassis, do not hold it by the ejector handles. They cannot support its weight.

Do not stack CFEBs or CFEB-Es on top of or under other components. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

*Figure 67: Removing the CFEB or CFEB-E*




**See Also**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- Installing the M7i CFEB and CFEB-E on page 184
- Maintaining the M7i CFEB and CFEB-E on page 195
- Troubleshooting the M7i CFEB and CFEB-E on page 207
- Upgrading and Downgrading the CFEB and CFEB-E on page 185

## Installing the M7i CFEB and CFEB-E

To install the CFEB or CFEB-E (see Figure 68 on page 185):

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 ends of the ejector handles are pulled outward to a position nearly perpendicular to the faceplate of the CFEB or CFEB-E.

3. Place one hand under the CFEB or CFEB-E to support it and grasp one of the ejector handles at the front with the other hand.

4. Align the rear of the CFEB or CFEB-E with the guides inside the chassis and slide it in completely.

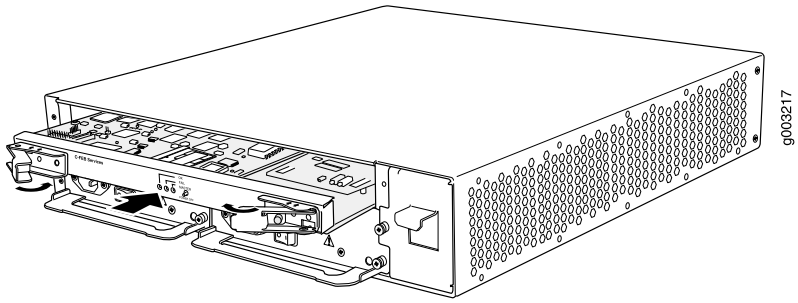
5. Press the ejector handle at each end of the CFEB or CFEB-E inward.

6. Tighten the thumbscrew on each ejector locking tab (shown in Figure 18 on page 65) to seat the CFEB or CFEB-E firmly in the chassis.

7. Press and hold the **ONLINE/OFFLINE** button on the CFEB or CFEB-E faceplate until the green **OK** LED lights steadily.

   You can verify correct CFEB or CFEB-E functioning by issuing the **show chassis cfeb** command described in "Maintaining the M7i CFEB and CFEB-E" on page 195.

*Figure 68: Installing a CFEB or CFEB-E*




**See Also**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- Troubleshooting the M7i CFEB and CFEB-E on page 207
- Removing the M7i CFEB and CFEB-E on page 183
- Upgrading and Downgrading the CFEB and CFEB-E on page 185

## Upgrading and Downgrading the CFEB and CFEB-E

To upgrade by replacing a CFEB with a CFEB-E or to downgrade by replacing a CFEB-E with a CFEB requires a system reboot after swapping the CFEB devices.

To upgrade from a CFEB to a CFEB-E or downgrade from a CFEB-E to a CFEB:

1. Remove the CFEB or CFEB-E as described in "Removing the M7i CFEB and CFEB-E" on page 183.

2. Install the upgrade CFEB-E or downgrade CFEB as described in "Installing the M7i CFEB and CFEB-E" on page 184.

3. Reboot the router by issuing the following CLI command:

   ```
   user@host> request system reboot
   ```

After the reboot, the router recognizes the new CFEB or CFEB-E.

**See Also**

- Maintaining the M7i CFEB and CFEB-E on page 195
- Troubleshooting the M7i CFEB and CFEB-E on page 207
- Installing the M7i CFEB and CFEB-E on page 184
- Removing the M7i CFEB and CFEB-E on page 183

**Related Documentation**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- Maintaining the M7i CFEB and CFEB-E on page 195
- Troubleshooting the M7i CFEB and CFEB-E on page 207

PART 5

# Maintaining the Chassis and Components

CHAPTER 27

# Routine Maintenance Procedures



## Routine Maintenance Procedures for the M7i 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.

**Related Documentation**

- M7i Router Environmental Specifications on page 78
- M7i Router Physical Specifications on page 74
- Packing the M7i Router for Shipment on page 218
- Overview of Troubleshooting Resources for the M7i Router on page 199

CHAPTER 28

# Maintaining Components



## Maintaining the M7i Cooling System

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

**Action** The router has a single fan tray that installs into the back of the chassis, as shown in Figure 6 on page 12.

To check the status of the fans in the fan tray, issue the **show chassis environment** command. The output includes an entry for each fan in the fan tray:

user@host> **show chassis environment**

```
Class Item                  Status     Measurement
Power Power Supply 0        OK
      Power Supply 1        OK
Temp  Intake                OK         24 degrees C / 75 degrees F
      PICs                  OK         27 degrees C / 80 degrees F
      Power Supplies        OK         27 degrees C / 80 degrees F
      CFEB Intake           OK         27 degrees C / 80 degrees F
      CFEB Exhaust          OK         33 degrees C / 91 degrees F
      Routing Engine        OK         26 degrees C / 78 degrees F
Fans  Left Fan Tray         Present
      Left Tray front fan   OK         Spinning at normal speed
      Left Tray second fan  OK         Spinning at normal speed
      Left Tray third fan   OK         Spinning at normal speed
      Left Tray fourth fan  OK         Spinning at normal speed
```

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

**Related Documentation**

- M7i Cooling System Overview on page 15
- Replacing the M7i Fan Tray on page 137

## Maintaining the M7i Routing Engine

**Purpose** For optimum performance, verify the condition of the Routing Engine.

**Action**

- Check the LEDs on the Routing Engine. The green LED labeled **ONLINE** lights steadily when it is functioning normally. For more information about the LEDs, see "M7i Routing Engine Description" on page 17.
- Issue the CLI **show chassis routing-engine** command to check the status of the Routing Engines:

```
user@host> show chassis routing-engine
Routing Engine status:

    Temperature                 26 degrees C / 78 degrees F
    DRAM                       256 MB
    Memory utilization          27 percent
    CPU utilization:
      User                       0 percent
      Background                 0 percent
      Kernel                     4 percent
      Interrupt                  0 percent
      Idle                      96 percent
    Model                          RE-5.0
    Serial ID                      1000392782
    Start time                     2003-06-11 11:39:32 PDT
    Uptime                         1 hour, 41 minutes, 51 seconds
    Load averages:                 1 minute   5 minute  15 minute
                                       0.00       0.03       0.05
```

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

**Related Documentation**

- Replacing the M7i Routing Engine on page 141
- Routing Engine Interface Cable and Wire Specifications for the M7i Router on page 97

## Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables

**Purpose** For optimum performance, verify the condition of the FIC and FIC cables and PICs and PIC cables.

**Action**

- Check the LEDs on the FIC faceplate. The Fast Ethernet and Gigabit Ethernet ports on the FIC have LEDs that display the status of the ports. For more information, see "M7i Fixed Interface Card (FIC) Description" on page 46.
- Check the LEDs on PIC faceplates. Most PIC faceplates have an LED labeled **STATUS**. Some PICs have additional LEDs, often one per port. The meaning of the LED states differs for various PICs. For more information, see the *M7i Multiservice Edge Router Interface Module Reference*.

- Issue the CLI **show chassis fpc pic-status** command. The following example specifies an FPC slot number (**0**), which is optional.

  ```
  user@host> show chassis fpc pic-status 0
  Slot 0 Online
    PIC 0    2x OC-3 ATM, MM
    PIC 1    2x CT3-NxDS0
    PIC 2    2x OC-3 ATM, MM
  ```

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

- Support cables to prevent them from dislodging or developing stress points.
- Place excess cable out of the way, using the cable management system on the rack. Do not allow fastened loops of cable to dangle from the ladder rack because this stresses the cable at the fastening point. Putting fasteners on the loops help 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 all interface cables to identify them, labeling each end of the cable the same.

The following guidelines apply specifically to fiber-optic cable:

- When you unplug a fiber-optic cable from a FIC or PIC, always place a rubber safety plug over the transceiver on the FIC or PIC faceplate and on the end of the cable.
- Anchor fiber-optic cable to avoid stress on the connectors. When attaching fiber to an interface, be sure to secure the fiber so it is not supporting its own weight as it hangs 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, such as ATM or SONET/SDH analyzers, 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 micro-deposits of oil and dust in the canal of the transceiver or cable connector can 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 945/946 Fiber Optic Connector Cleaning System. Follow the directions for the cleaning kit you use.

  After you have cleaned the transceiver on the fiber-optic interface, 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 Cletop - Cletop Reel-Type Cleaner – Part# CLETOP-RL. Follow the directions for the cleaning kit you use.

**Related Documentation**

- Replacing an M7i FIC or PIC Cable on page 163
- Troubleshooting the M7i FIC or PICs on page 205

## Maintaining the M7i Power Supplies

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

**Action**

- Check that the green **OUTPUT OK** LED is lit on the faceplate of both power supplies. For more information about the LED, see "M7i Power Supply LEDs" on page 61.
- Issue the following CLI command to check the status of the power supplies. As shown in the sample output, the value **OK** in the **Status** column indicates that the power supply is operating normally:

```
user@host> show chassis environment
Class Item                  Status     Measurement
Power Power Supply 0        OK
      Power Supply 1        OK
Temp  Intake                OK         24 degrees C / 75 degrees F
      PICs                  OK         27 degrees C / 80 degrees F
      Power Supplies        OK         27 degrees C / 80 degrees F
      CFEB Intake           OK         27 degrees C / 80 degrees F
      CFEB Exhaust          OK         33 degrees C / 91 degrees F
      Routing Engine        OK         26 degrees C / 78 degrees F
Fans  Left Fan Tray         Present
      Left Tray front fan   OK         Spinning at normal speed
      Left Tray second fan  OK         Spinning at normal speed
      Left Tray third fan   OK         Spinning at normal speed
      Left Tray fourth fan  OK         Spinning at normal speed
```

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

- Check the red and yellow alarm LEDs on the FIC. 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 CLI command:

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

  For a list of possible alarm messages, see "Hardware and Interface Alarm Messages" on page 200.

- Verify that the power source has the proper current rating and that each power supply is connected to a separate power source.
- Verify that the cable or cord connecting the power supply to the external power source is securely in place and that there is no moisture accumulating near the router.
- Verify that the cable or cord from the power source to the router is not damaged. If the insulation is cracked or broken, replace the cable or cord immediately.

- Verify that the power cables or cord do not touch or obstruct access to other router components, and that they do not drape where people could trip on them.
- Verify that the air flow in and out of cooling system components is not obstructed.

**Related Documentation**

- M7i Power System Description on page 59
- M7i Router Power Requirements on page 79
- Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 206
- Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off on page 206

## Maintaining the M7i CFEB and CFEB-E

**Purpose** For optimum cooling, verify the condition of the CFEB.

**Action**

- Check the LEDs on the CFEB or CFEB-E faceplate. The green LED labeled **OK** lights steadily on the CFEB or CFEB-E when it is functioning normally. For more information, see "M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description" on page 63.
- Issue the CLI **show chassis cfeb** command to check the status of the CFEB (first output example) or the CFEB-E (second output example):

```
user@host> show chassis cfeb
CFEB status:
  State                          Online
  Intake Temperature          27 degrees C / 80 degrees F
  Exhaust Temperature         33 degrees C / 91 degrees F
  CPU utilization              3 percent
  Interrupt utilization        0 percent
  Heap utilization             8 percent
  Buffer utilization          21 percent
  Total CPU DRAM             128 MB
  Internet Processor II          Version 1, Foundry IBM, Part number 164
  Start time:                    2003-06-11 11:41:22 PDT
  Uptime:                        1 hour, 39 minutes, 31 seconds
```

```
user@host> show chassis cfeb
CFEB-E status:
  State                          Online
  Intake Temperature          27 degrees C / 80 degrees F
  Exhaust Temperature         33 degrees C / 91 degrees F
  CPU utilization              3 percent
  Interrupt utilization        0 percent
  Heap utilization             8 percent
  Buffer utilization          21 percent
  Total CPU DRAM             128 MB
  Internet Processor II          Version 1, Foundry IBM, Part number 164
```

```
Start time:                    2003-06-11 11:41:22 PDT
Uptime:                        1 hour, 39 minutes, 31 seconds
```

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

**Related Documentation**

- Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E on page 183
- Installing the M7i CFEB and CFEB-E on page 184
- Troubleshooting the M7i CFEB and CFEB-E on page 207

PART 6

# Troubleshooting Hardware

CHAPTER 29

# Troubleshooting Components



## Overview of Troubleshooting Resources for the M7i Router



### LEDs on the FIC

The FIC provides status and troubleshooting information at a glance. It is located on the front of the chassis below the PICs, as shown in Figure 5 on page 11. The LEDs on the FIC include the following:

- Alarm—The circular red **MAJOR ALARM** LED indicates a critical condition that can result in a system shutdown. The triangular yellow **MINOR ALARM** LED next to it indicates a less severe condition that requires monitoring or maintenance. Both alarms can occur simultaneously. When an alarm LED is lit, issue the **show chassis alarms** command in the CLI to determine the cause of the alarm. For more information about the alarm LEDs, see "M7i Fixed Interface Card (FIC) Description" on page 44. For more information about the causes of alarms, see "Hardware and Interface Alarm Messages" on page 200.
- Interface—Each interface on a FIC has a **LINK** LED that indicates the port is online, and a **ACTIVITY** LED that indicates activity on the port.
- PIC—Each PIC has an LED on the FIC labeled **PICS ON/OFF** that shows whether the PIC is online.

## LEDs on Hardware Components

LEDs on the faceplates of many hardware components report component status:

- AC power supply—A green LED labeled **OUTPUT OK**. For more information, see "M7i AC Power Supply" on page 60.
- Routing Engine—Four LEDs on the Routing Engine faceplate indicate the status of the Routing Engine. Two upper LEDs—a green one labeled **HDD**, and a blue one labeled **MASTER**—and two lower LEDs—a red one labeled **FAIL**, and a green one labeled **ONLINE**. For more information, see "M7i Routing Engine Description" on page 20.
- PIC—Most PICs have an LED labeled **STATUS** on the PIC faceplate. Some PICs have additional LEDs, often one per port. The meaning of the LED states differs for various PICs. For more information, see the *M7i Multiservice Edge Router Interface Module Reference*.
- CFEB or CFEB-E—A green LED labeled **OK**, a red one labeled **FAIL**, and a blue one labeled **MASTER**. For more information, see "M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description" on page 69.

## Hardware and Interface Alarm Messages

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

There are two classes of alarm messages:

- Chassis alarms—Indicate a problem with a chassis component such as the cooling system or power supplies, as described in Table 59 on page 200.
- Interface alarms—Indicate a problem with a specific network interface, as described in Table 60 on page 203.

*Table 59: Chassis Alarm Messages*

| Chassis Component | Alarm Condition | Remedy | Alarm Severity |
|---|---|---|---|
| **Alternative Media** | The router has an CompactFlash card but boots from alternate boot device. If you configure your router to boot from the hard disk, ignore this alarm condition. | Contact technical support. See"Contacting Customer Support" on page 211 for more information. | Yellow |

*Table 59: Chassis Alarm Messages (continued)*

| Chassis Component | Alarm Condition | Remedy | Alarm Severity |
|---|---|---|---|
| CFEB/CFEB-E | CFEB/CFEB-E has failed. If this occurs, the board attempts to reboot. | Replace failed CFEB/CFEB-E. | Red |
| | Too many hard errors in CFEB/CFEB-E memory. | Replace failed CFEB/CFEB-E. | Red |
| | Too many soft errors in CFEB/CFEB-E memory. | Replace failed CFEB/CFEB-E. | Red |
| | A CFEB/CFEB-E microcode download has failed. | Replace failed CFEB/CFEB-E. | Red |
| Fan Trays | A fan has failed. | Replace failed fan tray. | Red |
| | The fan tray has been removed from the chassis. | Install missing fan tray. | Red |
| Hot swapping | Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's midplane from the front is broken. | Contact technical support. See "Contacting Customer Support" on page 211 for more information. | Red |
| Power supplies | A power supply has been removed. | Insert missing power supply. | Yellow |
| | A power supply has failed. | Replace failed power supply | Red |

*Table 59: Chassis Alarm Messages (continued)*

| Chassis Component | Alarm Condition | Remedy | Alarm Severity |
|---|---|---|---|
| Routing Engine | Error in reading or writing hard disk. | Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine. | Yellow |
| | Error in reading or writing CompactFlash card. | Reformat CompactFlash card and install bootable image. If this fails, replace failed Routing Engine. | Yellow |
| | System booted from hard disk. This alarm only applies if you have an optional CompactFlash card installed. | Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine. | Yellow |
| | CompactFlash card missing in boot list. | Replace failed Routing Engine. | Red |
| | Hard disk missing in boot list. | Replace failed Routing Engine. | Red |
| | Routing Engine failed to boot. | Replace failed Routing Engine. | Red |

*Table 59: Chassis Alarm Messages (continued)*

| Chassis Component | Alarm Condition | Remedy | Alarm Severity |
|---|---|---|---|
| Temperature | The chassis temperature has exceeded 55° C and the fans have been turned on to full speed and one or more fans have failed. | • Check room temperature.<br>• Check air flow.<br>• Check fan tray. | Yellow |
| | The chassis temperature has exceeded 65° C and the fans have been turned on to full speed. | • Check room temperature.<br>• Check air flow.<br>• Check fan tray. | Yellow |
| | The chassis temperature has exceeded 65° C and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down. | • Check room temperature.<br>• Check air flow.<br>• Check fan tray. | Red |
| | The chassis temperature has exceeded 75° C. If this condition persists for more than 4 minutes, the router shuts down. | • Check room temperature.<br>• Check air flow.<br>• Check fan tray. | Red |
| | The temperature sensor has failed. | Contact technical support. See "Contacting Customer Support" on page 211 for more information. | Red |

*Table 60: SONET/SDH Interface Alarm Messages*

| CLI Message |
|---|
| *interface-name* so-*x/x/x* - SONET bit error rate defect |
| *interface-name* so-*x/x/x* - SONET bit error rate fault |
| *interface-name* so-*x/x/x* - SONET line AIS |
| *interface-name* so-*x/x/x* - SONET line remote defect indicator |
| *interface-name* so-*x/x/x* - SONET loss of frame |
| *interface-name* so-*x/x/x* - SONET loss of light |
| *interface-name* so-*x/x/x* - SONET loss of pointer |
| *interface-name* so-*x/x/x* - SONET loss of signal |
| *interface-name* so-*x/x/x* - SONET path AIS |

*Table 60: SONET/SDH Interface Alarm Messages (continued)*

| CLI Message |
| --- |
| *interface-name* so-*x/x/x* - SONET path mismatch |
| *interface-name* so-*x/x/x* - SONET path remote defect indicator |
| *interface-name* so-*x/x/x* - SONET PLL lock |
| *interface-name* so-*x/x/x* - SONET remote error indicator |
| *interface-name* so-*x/x/x* - SONET severely errored frame |
| *interface-name* so-*x/x/x* - SONET unequipped |

**Related Documentation**

- Displaying M7i Router Components and Serial Numbers on page 213
- M7i Midplane Description on page 12
- M7i Router Description on page 3

## Troubleshooting the M7i Fan Tray

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

**Solution** The router's single fan tray provides cooling for the router, including the CFEB or CFEB-E, PICs, power supplies, and Routing Engine.

The cooling system draws in room air through the air intake vent on the left side of the chassis. After entering the chassis, the air stream separates into separate flows for the front and rear components. For a graphic depiction of the airflow, see Figure 9 on page 16.

For the cooling system to function properly, the clearance around the chassis must be sufficient for unobstructed airflow. See "M7i Router Clearance Requirements for Airflow and Hardware Maintenance" on page 77.

During normal operation, the fans in the fan tray function at less than full speed. The router constantly monitors the temperatures detected by sensors on the router components, adjusting the speed of the fans as necessary. If the router temperature exceeds the acceptable maximum, the router turns off the power supplies.

The following conditions automatically cause the fans to run at full speed and 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).

For more information about cooling-related alarms, see "Hardware and Interface Alarm Messages" on page 200.

To troubleshoot the fans:

- If the red alarm LED on the craft interface lights, use the **show chassis alarms** command to determine the source of the problem. The display reports the number of alarm conditions and the source of each alarm. For a list of messages, see "Hardware and Interface Alarm Messages" on page 200.
- Issue the **show chassis alarms** command for more information about the source of an alarm condition.
- If both power supplies have failed, the system temperature might have exceeded the threshold, causing the system to shut down. See "Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off" on page 206.
- If the fan tray has failed, it must be replaced for the router to operate normally. For replacement instructions, see "Replacing the M7i Fan Tray" on page 137. For instructions about returning a faulty component to Juniper Networks, see "Contacting Customer Support" on page 211.

**Related Documentation**

- M7i Power System Description on page 59
- M7i Router Power Requirements on page 79
- Maintaining the M7i Power Supplies on page 194
- Powering On the M7i Router on page 125

## Troubleshooting the M7i FIC or PICs

**Problem** **Description:** The FIC or PICs are not functioning normally.

**Solution** To troubleshoot the FIC or PICs:

- To check the status of each port on a FIC or PIC, look at the LED located on the faceplate. For information about the meaning of LED states on different PICs, see the *M7i Multiservice Edge Router Interface Module Reference*.
- To check the status of an interface, issue the **show chassis fpc pic-status** command.

  The following example specifies an FPC slot number (**0**), which is optional.

  ```
  user@host> show chassis fpc pic-status 0
  Slot 0 Online   PIC 0    2x OC-3 ATM, MM   PIC 1    2x CT3-NxDS0   PIC 2    2x
   OC-3 ATM, MM
  ```

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

**Related Documentation**

- Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 192
- Replacing an M7i FIC or PIC Cable on page 163

## Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off

**Problem**

**Description:** If the LED is off on all power supply faceplates, either someone has switched off power to the router or the system temperature has exceeded the acceptable maximum. In the latter case, the Routing Engine shuts down all power supplies. There is no power to the router, so no LED is lit, including the alarm LEDs on the craft interface.

**Solution**

Excessive system temperature is almost always caused by excessive environmental temperature. Correct the environmental temperature before repowering the router.

**Related Documentation**

- M7i Power System Description on page 59
- M7i Router Power Requirements on page 79
- Maintaining the M7i Power Supplies on page 194
- Powering On the M7i Router on page 125

## Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off

**Problem**

**Description:** The LED on one power supply is off, but the LED on the other supplies indicate that they are functioning properly.

**Solution**

Perform the following diagnostic procedure:

1. Check the red alarm LED on the craft interface:
   - If it is lit, issue the following CLI command for information about the cause of an alarm condition:

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

     For a list of messages that can appear in the output, see "Hardware and Interface Alarm Messages" on page 200.

     A common cause of power supply shutdown is that the temperature of the power supply or another router component has exceed the maximum limit.
   - If the red alarm LED is not lit, check that the power switch is in the **ON** position on the power supply faceplate.
2. Replace the faulty power supply with a spare. For instructions, see "Replacing an M7i AC Power Supply" on page 177 and "Replacing a DC Power Supply" on page 171. If the

LED lights correctly on the spare, the original power supply is faulty. Return it to Juniper Networks for replacement, as described in "Contacting Customer Support" on page 211.

3. If the spare power supply also does not work, connect the router to a different power source. You might also try replacing the AC power cord (on an AC-powered router) or DC power cables (on a DC-powered router). For instructions, see "Replacing an M7i AC Power Cord" on page 181 and "Replacing an M7i DC Power Cable" on page 175 (you do not need to disconnect and reconnect the grounding cable).

4. If you cannot determine the cause of the problem or need additional assistance, see "Contacting Customer Support" on page 211.

**Related Documentation**

- M7i Power System Description on page 59
- M7i Router Power Requirements on page 79
- Maintaining the M7i Power Supplies on page 194
- Powering On the M7i Router on page 125

## Troubleshooting the M7i CFEB and CFEB-E

**Problem** **Description:** The CFEB or CFEB-E is not functioning normally.

**Solution** To troubleshoot the CFEB or CFEB-E:

- Make sure the CFEB or CFEB-E is properly seated in the midplane. Use a Phillips screwdriver to ensure that the screws on the CFEB or CFEB-E handles are securely tightened.
- Check the alarm LEDs on the FIC. A CFEB or CFEB-E failure generates a red alarm.

**Related Documentation**

- Installing the M7i CFEB and CFEB-E on page 184
- M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description on page 63
- Maintaining the M7i CFEB and CFEB-E on page 195

PART 7

# Contacting Customer Support and Returning the Chassis or Components

CHAPTER 30

# Contacting Customer Support



## Contacting Customer Support

You can contact Juniper Networks Technical Assistance Center (JTAC) 24 hours a day, 7 days a week in one of the following ways:

- On the Web, using the Case Manager link at:

  https://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 12-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

CHAPTER 31

# Locating Component Serial Numbers



## Displaying M7i 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 list all the router components and their serial numbers, enter the following command-line interface (CLI) command (the first example output is for a CFEB, the second example output is for a CFEB-E):

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                12345             M7i
Midplane         REV 02   710-008761   CA0213
Power Supply 0   Rev 04   740-008537   PD10302           AC
Power Supply 1   Rev 04   740-008537   PD10290           AC
Routing Engine   REV 01   740-008846   1000392782        RE-5.0
CFEB             REV 01   750-009346   CA0189            Internet Processor II
FPC 0
  PIC 1          REV 05   750-005656   BE1873            2x EIA-530
FPC 1
  PIC 0          REV 01   750-009098   CA0148            2x F/E, 100 BASE-TX
```

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                J4479             M7i
Midplane         REV 05   710-008761   PP1018            M7i Midplane
Power Supply 0   Rev 08   740-008537   UE64425           AC Power Supply
Power Supply 1   Rev 08   740-008537   UE64436           AC Power Supply
Routing Engine   REV 08   740-011202   1000744799        RE-850
CFEB             REV 06   750-023594   PW7856            Enhanced CFEB
FPC 0                                                   E-FPC
```

```
  PIC 0          REV 11   750-002971   DC5173           4x OC-3 SONET, MM
  PIC 1         REV 12   750-005633   HN0432          1x CHOC12 IQ SONET, SMIR

  PIC 3          REV 14   750-014895   DE6782           MultiServices 100
FPC 1                                                  E-FPC
  PIC 2                   BUILTIN      BUILTIN          1x Tunnel
  PIC 3          REV 09   750-009099   PP8480           1x G/E, 1000 BASE
    Xcvr 0       REV 01   740-011782   PBE2BU8          SFP-SX
Fan Tray                                               Rear Fan Tray
```

Most components also have a small rectangular serial number ID label (see Figure 69 on page 214) attached to the component body.

*Figure 69: Serial Number ID Label*


**Related Documentation**

- CFEB and CFEB-E Serial Number ID Label on page 216
- PIC Serial Number ID Label on page 214
- Power Supply Serial Number ID Label on page 215
- Routing Engine Serial Number ID Label on page 214
- Contacting Customer Support on page 211

## Routing Engine Serial Number ID Label

The serial number ID label for a Routing Engine is located on the left side near the midplane connector. Some Routing Engines might have more than one serial number. Contact your Juniper Networks support representative if you need assistance in determining which serial number to provide.

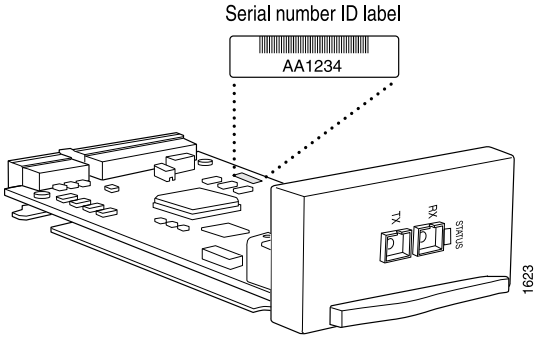
**Related Documentation**

- M7i Routing Engine Description on page 17
- Maintaining the M7i Routing Engine on page 192
- Replacing the M7i Routing Engine on page 141
- Contacting Customer Support on page 211

## PIC Serial Number ID Label

The serial number ID label for a PIC is located on the right side of the PIC, as shown in Figure 70 on page 215.

*Figure 70: PIC Serial Number ID Label*



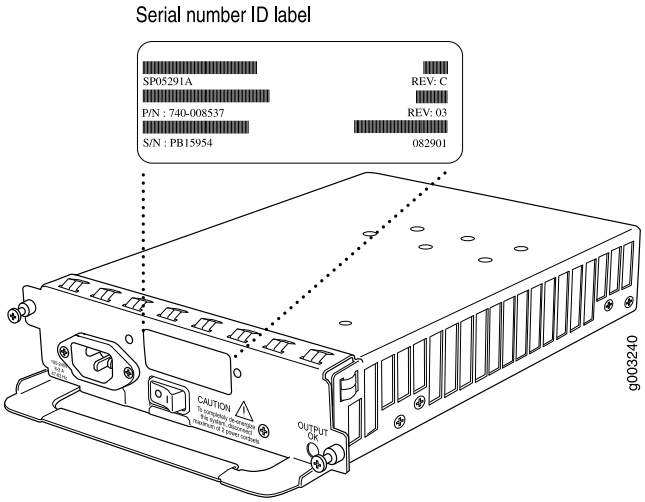

**Related Documentation**

- M7i PICs Description on page 46
- Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 192
- Troubleshooting the M7i FIC or PICs on page 205
- Replacing an M7i PIC on page 159
- Contacting Customer Support on page 211

## Power Supply Serial Number ID Label

The serial number ID label on a power supply is located on the faceplate, as shown in Figure 71 on page 215.

*Figure 71: Power Supply Serial Number ID Label*




**Related Documentation**

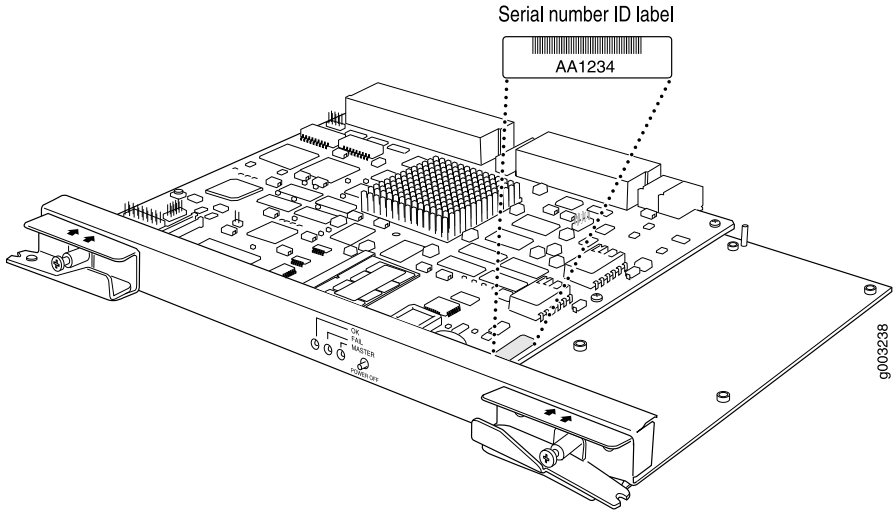
- M7i Power System Description on page 59
- Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 206
- Replacing an M7i AC Power Supply on page 177

- Replacing a DC Power Supply on page 171
- Contacting Customer Support on page 211

## CFEB and CFEB-E Serial Number ID Label

The serial number ID label on a CFEB or CFEB-E is located on the right side of the top panel, as shown in Figure 72 on page 216.

*Figure 72: CFEB or CBEF-E Serial Number ID Label*




**Related Documentation**

- M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description on page 63
- Maintaining the M7i CFEB and CFEB-E on page 195
- Troubleshooting the M7i CFEB and CFEB-E on page 207
- Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E on page 183
- Contacting Customer Support on page 211

CHAPTER 32

# Packing and Returning Components



## Returning a Hardware Component to Juniper Networks, Inc.

In the event of a hardware failure, please contact Juniper Networks, Inc. to obtain a Return Material Authorization (RMA) number. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.

NOTE: **Do not return any component to Juniper Networks, Inc. unless you have first obtained an RMA number. Juniper Networks, Inc. reserves the right to refuse shipments that do not have an RMA. Refused shipments are returned to the customer by collect freight.**

For more information about return and repair policies, see the customer support Web page at https://www.juniper.net/support/guidelines.html.

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Case Manager link at https://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 defective hardware component:

1. Determine the part number and serial number of the defective component.

2. Obtain an RMA number from the Juniper Networks Technical Assistance Center (JTAC). You can send e-mail or telephone as described above.

3. Provide the following information in your e-mail message or during the telephone call:
   - Part number and serial number of component
   - Your name, organization name, telephone number, and fax number

- Description of the failure

4. The support representative validates your request and issues an RMA number for return of the component.

5. Pack the component for shipment.

## Tools and Parts Required to Remove Components from an M7i 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**

- Contacting Customer Support on page 211
- Returning a Hardware Component to Juniper Networks, Inc. on page 217
- Packing the M7i Router for Shipment on page 218
- Guidelines for Packing M7i Components for Shipment on page 220

## Packing the M7i 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. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.

3. Power off the router. See "Powering Off the M7i Router" on page 126.

4. Disconnect power from the router: .
   - Unplug the power cord from each power supply. See "Removing an M7i AC Power Cord" on page 181

     NOTE: When multiple AC power supplies are installed in the chassis, each AC power cord (one for each power supply) must be unplugged to disconnect power completely from the router.

   - See "Removing an M7I DC Power Cable" on page 175.

     NOTE: All DC power cables must be disconnected to disconnect power completely from the router.

5. Remove the cables that connect to all external devices. For instructions, see "Replacing the Routing Engine Interface Port Cables" on page 144 and "Removing an M7i PIC" on page 159.
6. Remove all Field Replaceable Units (FRUs) from the router.
7. 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
     - If the router weight is fully supported by a shelf or another router, unscrew and remove the mounting screws from the rack. Then, move it to the shipping crate.
     - If the router weight is not fully supported by a shelf or another router, one person should grasp the router while another person unscrews and removes the mounting screws from the rack. You can then move the router to the shipping crate.
8. Place the router in the shipping crate or onto the pallet. If on a pallet, bolt the router to the pallet.
9. Cover the router with an ESD bag and place the packing foam on top of and around the router.
10. Replace the accessory box on top of the packing foam.
11. Securely tape the box closed or place the crate cover over the router.
12. Write the RMA number on the exterior of the box to ensure proper tracking.

**Related Documentation**

- Contacting Customer Support on page 211
- Returning a Hardware Component to Juniper Networks, Inc. on page 217
- Tools and Parts Required to Remove Components from an M7i Router on page 218
- Guidelines for Packing M7i Components for Shipment on page 220

## Guidelines for Packing M7i 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 antistatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.

CAUTION: **Do not stack any of the hardware components.**

**Related Documentation**

- Contacting Customer Support on page 211
- Returning a Hardware Component to Juniper Networks, Inc. on page 217
- Tools and Parts Required to Remove Components from an M7i Router on page 218
- Packing the M7i Router for Shipment on page 218

PART 8

# Safety and Compliance Information

CHAPTER 33

# General Safety Guidelines and Warnings



## Definition of Safety Warning Levels

The documentation uses the following levels of safety warnings:

NOTE: You might find this information helpful in a particular situation, or might otherwise overlook it.

CAUTION: You must observe the specified guidelines to avoid minor injury or discomfort to you, or severe damage to the hardware device.

WARNING: This symbol alerts you to the risk of personal injury from a laser.

WARNING: This symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

**Waarschuwing** Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

**Varoitus** Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista.

**Attention** Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents.

**Warnung** Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt.

**Avvertenza** Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti.

**Advarsel** Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.

**Aviso** Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes.

**¡Atención!** Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes.

**Varning!** Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador.

**Related Documentation**

- General Safety Warnings for Juniper Networks Devices on page 226
- Installation Safety Warnings for Juniper Networks Devices on page 233
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 243
- General Electrical Safety Warnings for Juniper Networks Devices on page 250

- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256

## 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, that could become caught in the chassis.
- Wear safety glasses if you are working under any conditions that could be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.
- Never install or manipulate wiring during electrical storms.
- Never install electrical jacks in wet locations unless the jacks are specifically designed for wet environments.
- Operate the hardware equipment only when the chassis is properly grounded.
- Do not open or remove chassis covers or sheet metal parts unless instructions are provided in this documentation. Such an action could cause severe electrical shock.
- Do not push or force any objects through any opening in the chassis frame. Such an action could result in electrical shock or fire.
- Avoid spilling liquid onto the chassis or onto any hardware component. Such an action could cause electrical shock or damage the hardware equipment.
- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Such an action could cause electrical shock.
- Some parts of the router might become hot. The following label provides the warning of the hot surfaces on the router:


**Related Documentation**

- General Safety Warnings for Juniper Networks Devices on page 226

## 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 233
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 243
- General Electrical Safety Warnings for Juniper Networks Devices on page 250
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256

## 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 225
- General Safety Warnings for Juniper Networks Devices on page 226

## Preventing Electrostatic Discharge Damage to an M7i Router

Many router hardware components are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

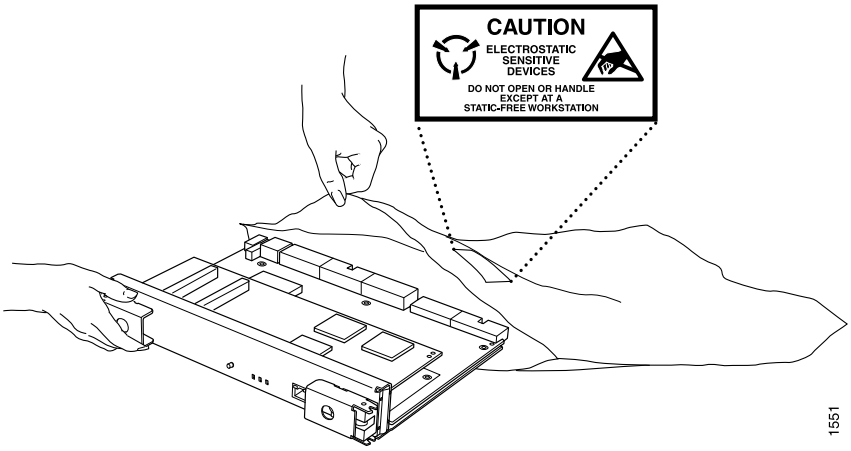
- Always use an ESD wrist strap or ankle strap, and make sure that it is in direct contact with your skin.

CAUTION: **For safety, periodically check the resistance value of the ESD strap. The measurement should be in the range of 1 through 10 Mohms.**

- When handling any component that is removed from the chassis, make sure the equipment end of your ESD strap is attached to one of the ESD points on the chassis.
- Avoid contact between the component and your clothing. ESD voltages emitted from clothing can still damage components.
- When removing or installing a component, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an electrostatic bag (see

Figure 73 on page 229) . If you are returning a component, place it in an electrostatic bag before packing it.

*Figure 73: Placing a Component into an Electrostatic Bag*




**Related Documentation**

- Definition of Safety Warning Levels on page 223
- General Safety Warnings for Juniper Networks Devices on page 226
- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- M7i DC Power Electrical Safety Guidelines on page 255

CHAPTER 34

# Fire Safety Requirements



## Fire Safety Requirements for Juniper Networks Devices



### General Fire Safety Requirements

In the event of a fire emergency involving network devices, the safety of people is the primary concern. Establish procedures for protecting people in a fire emergency, provide safety training, and properly provision fire-control equipment and fire extinguishers.

In addition, establish procedures to protect your equipment in a fire emergency. Juniper Networks products must 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 off power 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 225
- General Safety Warnings for Juniper Networks Devices on page 226
- General Electrical Safety Warnings for Juniper Networks Devices on page 250
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256

CHAPTER 35

# Installation Safety Guidelines and Warnings



## M7i Chassis Lifting Guidelines

The weight of a fully configured chassis is about 36.5 lb (16.6 kg). Observe the following guidelines for lifting and moving the router:

- Before moving the router, read the guidelines in "M7i Router Site Preparation Checklist" on page 73 to verify that the intended site meets the specified power, environmental, and clearance requirements.
- If a lift cannot be used, one person can lift the router. Another person is required install the mounting screws.
- 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**


- Installation Safety Warnings for Juniper Networks Devices on page 233


## Installation Safety Warnings for Juniper Networks Devices

Observe the following warnings before and during hardware equipment installation:

## Intrabuilding Ports Warning

WARNING: The intrabuilding ports of the equipment or subassembly are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

## Installation Instructions Warning

WARNING: Read the installation instructions before you connect the hardware equipment to a power source.

**Waarschuwing** Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.

**Varoitus** Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

**Attention** Avant de brancher le système sur la source d'alimentation, consulter les directives d'installation.

**Warnung** Lesen Sie die Installationsanweisungen, bevor Sie das System an die Stromquelle anschließen.

**Avvertenza** Consultare le istruzioni di installazione prima di collegare il sistema all'alimentatore.

**Advarsel** Les installasjonsinstruksjonene før systemet kobles til strømkilden.

**Aviso** Leia as instruções de instalação antes de ligar o sistema à sua fonte de energia.

**¡Atención!** Ver las instrucciones de instalación antes de conectar el sistema a la red de alimentación.

**Varning!** Läs installationsanvisningarna innan du kopplar systemet till dess strömförsörjningsenhet.

## Rack-Mounting Requirements and Warnings

Ensure that the equipment rack into which the chassis is installed is evenly and securely supported, to avoid the hazardous condition that could result from uneven mechanical loading.

WARNING: To prevent bodily injury when mounting or servicing the chassis in a rack, take the following precautions to ensure that the system remains stable. The following directives help maintain your safety:

- The chassis must be installed into a rack that is secured to the building structure.
- The chassis should be mounted at the bottom of the rack if it is the only unit in the rack.
- 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 225
- General Safety Warnings for Juniper Networks Devices on page 226
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 243

CHAPTER 36

# Laser and LED Safety Guidelines and Warnings



## General Laser Safety Guidelines for the M7i Router

Physical Interface Cards (PICs) 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 per EN 60825–1 +A11 +A2 requirements.

When working around PICs, 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**

- M7i Laser and LED Safety Warnings on page 239

## M7i Laser and LED Safety Warnings

## 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 may 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 Laser Safety Guidelines for the M7i Router on page 239

CHAPTER 37

# Maintenance and Operational Safety Guidelines and Warnings



## Maintenance and Operational Safety Warnings for Juniper Networks Devices

As you maintain the hardware equipment, observe the following warnings:



### Battery Handling Warning

WARNING: Replacing the battery incorrectly might result in an explosion. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

**Waarschuwing** Er is ontploffingsgevaar als de batterij verkeerd vervangen wordt. Vervang de batterij slechts met hetzelfde of een equivalent type dat door de fabrikant aanbevolen is. Gebruikte batterijen dienen overeenkomstig fabrieksvoorschriften weggeworpen te worden.

**Varoitus** Räjähdyksen vaara, jos akku on vaihdettu väärään akkuun. Käytä vaihtamiseen ainoastaan saman- tai vastaavantyyppistä akkua, joka on valmistajan suosittelema. Hävitä käytetyt akut valmistajan ohjeiden mukaan.

**Attention** Danger d'explosion si la pile n'est pas remplacée correctement. Ne la remplacer que par une pile de type semblable ou équivalent, recommandée par le fabricant. Jeter les piles usagées conformément aux instructions du fabricant.

**Warnung** Bei Einsetzen einer falschen Batterie besteht Explosionsgefahr. Ersetzen Sie die Batterie nur durch den gleichen oder vom Hersteller empfohlenen Batterietyp. Entsorgen Sie die benutzten Batterien nach den Anweisungen des Herstellers.

**Avvertenza** Pericolo di esplosione se la batteria non è installata correttamente. Sostituire solo con una di tipo uguale o equivalente, consigliata dal produttore. Eliminare le batterie usate secondo le istruzioni del produttore.

**Advarsel** Det kan være fare for eksplosjon hvis batteriet skiftes på feil måte. Skift kun med samme eller tilsvarende type som er anbefalt av produsenten. Kasser brukte batterier i henhold til produsentens instruksjoner.

**Aviso** Existe perigo de explosão se a bateria for substituída incorrectamente. Substitua a bateria por uma bateria igual ou de um tipo equivalente recomendado pelo fabricante. Destrua as baterias usadas conforme as instruções do fabricante.

**¡Atención!** Existe peligro de explosión si la batería se reemplaza de manera incorrecta. Reemplazar la batería exclusivamente con el mismo tipo o el equivalente recomendado por el fabricante. Desechar las baterías gastadas según las instrucciones del fabricante.

**Varning!** Explosionsfara vid felaktigt batteribyte. Ersätt endast batteriet med samma batterityp som rekommenderas av tillverkaren eller motsvarande. Följ tillverkarens anvisningar vid kassering av använda batterier.

## Jewelry Removal Warning

WARNING: Before working on equipment that is connected to power lines, remove jewelry, including rings, necklaces, and watches. Metal objects heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

**Waarschuwing** Alvorens aan apparatuur te werken die met elektrische leidingen is verbonden, sieraden (inclusief ringen, kettingen en horloges) verwijderen. Metalen voorwerpen worden warm wanneer ze met stroom en aarde zijn verbonden, en kunnen ernstige brandwonden veroorzaken of het metalen voorwerp aan de aansluitklemmen lassen.

**Varoitus** Ennen kuin työskentelet voimavirtajohtoihin kytkettyjen laitteiden parissa, ota pois kaikki korut (sormukset, kaulakorut ja kellot mukaan lukien). Metalliesineet kuumenevat, kun ne ovat yhteydessä sähkövirran ja maan kanssa, ja ne voivat aiheuttaa vakavia palovammoja tai hitsata metalliesineet kiinni liitäntänapoihin.

**Attention** Avant d'accéder à cet équipement connecté aux lignes électriques, ôter tout bijou (anneaux, colliers et montres compris). Lorsqu'ils sont branchés

à l'alimentation et reliés à la terre, les objets métalliques chauffent, ce qui peut provoquer des blessures graves ou souder l'objet métallique aux bornes.

**Warnung** Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzen sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.

**Avvertenza** Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

**Advarsel** Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.

**Aviso** Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

**¡Atención!** Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.

**Varning!** Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.

## Lightning Activity Warning

WARNING: Do not work on the system or connect or disconnect cables during periods of lightning activity.

**Waarschuwing** Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.

**Varoitus** Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.

**Attention** Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.

**Warnung** Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.

**Avvertenza** Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.

**Advarsel** Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.

**Aviso** Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).

**¡Atención!** No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

**Varning!** Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

## Operating Temperature Warning

WARNING: To prevent the hardware equipment from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of 104° F (40° C). To prevent airflow restriction, allow at least 6 inches (15.2 cm) of clearance around the ventilation openings.

**Waarschuwing** Om te voorkomen dat welke router van de router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

**Varoitus** Ettei router-sarjan reititin ylikuumentuisi, sitä ei saa käyttää tilassa, jonka lämpötila ylittää korkeimman suositellun ympäristölämpötilan 40° C. Ettei ilmanvaihto estyisi, tuuletusaukkojen ympärille on jätettävä ainakin 15,2 cm tilaa.

**Attention** Pour éviter toute surchauffe des routeurs de la gamme router, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40° C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

**Warnung** Um einen router der router vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene Maximum von 40° C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsöffnungen herum frei bleibt.

**Avvertenza** Per evitare il surriscaldamento dei router, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

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

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

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

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

## Product Disposal Warning

WARNING: Disposal of this product must be handled according to all national laws and regulations.

**Waarschuwing** Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

**Varoitus** Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

**Attention** La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

**Warnung** Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

**Avvertenza** L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

**Advarsel** Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

**Aviso** A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

**¡Atención!** El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

**Varning!** Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

**Related Documentation**

- General Safety Guidelines for Juniper Networks Devices on page 225
- General Safety Warnings for Juniper Networks Devices on page 226

CHAPTER 38

# Electrical Safety Guidelines and Warnings



## Preventing Electrostatic Discharge Damage to an M7i Router

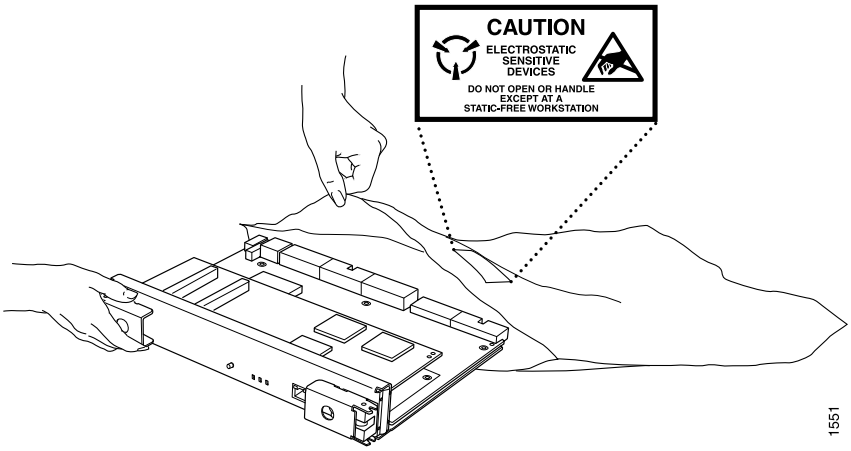
Many router hardware components are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

- Always use an ESD wrist strap or ankle strap, and make sure that it is in direct contact with your skin.

  CAUTION: **For safety, periodically check the resistance value of the ESD strap. The measurement should be in the range of 1 through 10 Mohms.**

- When handling any component that is removed from the chassis, make sure the equipment end of your ESD strap is attached to one of the ESD points on the chassis.
- Avoid contact between the component and your clothing. ESD voltages emitted from clothing can still damage components.
- When removing or installing a component, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an electrostatic bag (see Figure 73 on page 229) . If you are returning a component, place it in an electrostatic bag before packing it.

*Figure 74: Placing a Component into an Electrostatic Bag*




**Related Documentation**

- Definition of Safety Warning Levels on page 223
- General Safety Warnings for Juniper Networks Devices on page 226
- M7i AC Power Electrical Safety Guidelines and Warnings on page 254
- M7i DC Power Electrical Safety Guidelines on page 255

## General Electrical Safety Warnings for Juniper Networks Devices

- Grounded Equipment Warning on page 250
- Grounding Requirements and Warning on page 251
- Midplane Energy Hazard Warning on page 252
- Multiple Power Supplies Disconnection Warning on page 252
- Power Disconnection Warning on page 253

### 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 256

## General Electrical Safety Guidelines and 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**

- M7i Field-Replaceable Units (FRUs) on page 135

## M7i AC Power Electrical Safety Guidelines and Warnings

The following electrical safety guidelines apply to AC-powered routers:

- AC-powered routers are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding should comply with local and national electrical codes.
- You must provide an external circuit breaker rated minimum 15 A (250 VAC) in the building installation.
- The power cord serves as the main disconnecting device. The socket outlet must be near the router and be easily accessible.
- The cores in the mains lead are colored in accordance with the following code:

  - Green and yellow—Earth
  - Blue—Neutral
  - Brown—Live
- When a router is equipped with two AC power supplies, both power cords (one for each power supply) must be unplugged to completely disconnect power to the router.
- Note the following warnings printed on the AC power supply faceplate:
  - To completely de-energize the system disconnect maximum of 2 power cordsets.
  - Apparaten skall anslutas till jordat uttag när den ansluts till ett nätverk. [Swedish]

**Related Documentation**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 228
- General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers on page 254
- M7i DC Power Electrical Safety Guidelines on page 255

## M7i 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 31 A @ –48 VDC per input for each power supply.
- Incorporate an easily accessible disconnect device into the facility wiring. We recommend that the 48 VDC facility DC source should be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum, or as required by local code. In the United States and Canada, the 48 VDC facility should be equipped with a circuit breaker rated a minimum of 125% of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada.
- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 50 A.
- Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- A DC-powered router that is equipped with a DC terminal block is intended only for installation in a restricted access location. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

NOTE: **Primary overcurrent protection is provided by the building circuit breaker. This breaker should protect against excess currents, short circuits, and earth faults in accordance with NEC ANSI/NFPA70.**

- Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.
- For personal safety, connect the green and yellow wire to safety (earth) ground at both the router and the supply side of the DC wiring.
- The marked input voltage of –48 VDC for a DC-powered router is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.
- Because the router is a positive ground system, you must connect the positive lead to the terminal labeled **RTN**, the negative lead to the terminal labeled **–48V**, and the earth ground to the chassis grounding points.

**Related Documentation**

- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 256

## 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 256
- DC Power Disconnection Warning on page 257
- DC Power Wiring Terminations Warning on page 258

### DC Power Copper Conductors Warning

WARNING: **Use copper conductors only.**

**Waarschuwing** Gebruik alleen koperen geleiders.

**Varoitus** Käytä vain kuparijohtimia.

**Attention** Utilisez uniquement des conducteurs en cuivre.

**Warnung** Verwenden Sie ausschließlich Kupferleiter.

**Avvertenza** Usate unicamente dei conduttori di rame.

**Advarsel** Bruk bare kobberledninger.

**Aviso** Utilize apenas fios condutores de cobre.

**¡Atención!** Emplee sólo conductores de cobre.

**Varning!** Använd endast ledare av koppar.

## DC Power Disconnection Warning

WARNING: Before performing any procedures on power supplies, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

**Waarschuwing** Voordat u een van de onderstaande procedures uitvoert, dient u te controleren of de stroom naar het gelijkstroom circuit uitgeschakeld is. Om u ervan te verzekeren dat alle stroom UIT is geschakeld, kiest u op het schakelbord de stroomverbreker die het gelijkstroom circuit bedient, draait de stroomverbreker naar de UIT positie en plakt de schakelaarhendel van de stroomverbreker met plakband in de UIT positie vast.

**Varoitus** Varmista, että tasavirtapiirissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paikanna tasavirrasta huolehtivassa kojetaulussa sijaitseva suojakytkin, käännä suojakytkin KATKAISTU-asentoon ja teippaa suojakytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

**Attention** Avant de pratiquer l'une quelconque des procédures ci-dessous, vérifier que le circuit en courant continu n'est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le disjoncteur en position fermée (OFF) et, à l'aide d'un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

**Warnung** Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

**Avvertenza** Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

**Advarsel** Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.

**Aviso** Antes de executar um dos seguintes procedimentos, certifique-se que desligou a fonte de alimentação de energia do circuito de corrente contínua. Para se assegurar que toda a corrente foi DESLIGADA, localize o disjuntor no painel que serve o circuito de corrente contínua e coloque-o na posição OFF

(Desligado), segurando nessa posição a manivela do interruptor do disjuntor com fita isoladora.

**¡Atención!** Antes de proceder con los siguientes pasos, comprobar que la alimentación del circuito de corriente continua (CC) esté cortada (OFF). Para asegurarse de que toda la alimentación esté cortada (OFF), localizar el interruptor automático en el panel que alimenta al circuito de corriente continua, cambiar el interruptor automático a la posición de Apagado (OFF), y sujetar con cinta la palanca del interruptor automático en posición de Apagado (OFF).

**Varning!** Innan du utför någon av följande procedurer måste du kontrollera att strömförsörjningen till likströmskretsen är bruten. Kontrollera att all strömförsörjning är BRUTEN genom att slå AV det överspänningsskydd som skyddar likströmskretsen och tejpa fast överspänningsskyddets omkopplare i FRÅN-läget.

## DC Power Wiring Terminations Warning

WARNING: When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations must be the appropriate size for the wires and must clamp both the insulation and conductor.

**Waarschuwing** Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingspunten, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

**Varoitus** Jos säikeellinen johdin on tarpeen, käytä hyväksyttyä johdinliitäntää, esimerkiksi suljettua silmukkaa tai kourumaista liitäntää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitäntöjen tulee olla kooltaan johtimiin sopivia ja niiden tulee puristaa yhteen sekä eristeen että johdinosan.

**Attention** Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

**Warnung** Wenn Litzenverdrahtung erforderlich ist, sind zugelassene Verdrahtungsabschlüsse, z.B. Ringoesen oder gabelförmige Kabelschuhe mit nach oben gerichteten Enden zu verwenden. Diese Abschlüsse sollten die angemessene Größe für die Drähte haben und sowohl die Isolierung als auch den Leiter festklemmen.

**Avvertenza** Quando occorre usare trecce, usare connettori omologati, come quelli a occhiello o a forcella con linguette rivolte verso l'alto. I connettori devono avere la misura adatta per il cablaggio e devono serrare sia l'isolante che il conduttore.

**Advarsel** Hvis det er nødvendig med flertrådede ledninger, brukes godkjente ledningsavslutninger, som for eksempel lukket sløyfe eller spadetype med oppoverbøyde kabelsko. Disse avslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og lederen.

**Aviso** Quando forem requeridas montagens de instalação eléctrica de cabo torcido, use terminações de cabo aprovadas, tais como, terminações de cabo em circuito fechado e planas com terminais de orelha voltados para cima. Estas terminações de cabo deverão ser do tamanho apropriado para os respectivos cabos, e deverão prender simultaneamente o isolamento e o fio condutor.

**¡Atención!** Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

**Varning!** När flertrådiga ledningar krävs måste godkända ledningskontakter användas, t.ex. kabelsko av sluten eller öppen typ med uppåtvänd tapp. Storleken på dessa kontakter måste vara avpassad till ledningarna och måste kunna hålla både isoleringen och ledaren fastklämda.

**Related Documentation**

- General Safety Warnings for Juniper Networks Devices on page 226
- General Electrical Safety Warnings for Juniper Networks Devices on page 250

## Site Electrical Wiring Guidelines for Juniper Networks Devices



### 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 network device 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.

CAUTION: To comply with intrabuilding lightning and surge requirements, intrabuilding wiring must be shielded, and the shield for the wiring must be grounded at both ends.

WARNING: The intrabuilding ports of the equipment or subassembly are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the Outside Plant (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 in order to connect these interfaces metallically to OSP wiring.

**Related Documentation**

- *General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices*

CHAPTER 39

# Agency Approvals and Compliance Statements



## Agency Approvals for M7i Routers

The router complies 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 3548 Class A (Australia/New Zealand)
  - EN55022 Class A (Europe)

- FCC Part 15 Class A (USA)
- VCCI Class B (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 EN-300386-2 Telecommunication Network Equipment. Electromagnetic Compatibility Requirements
- 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 EMC Requirements for the M7i Router (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.

**Related Documentation**

## Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada)

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

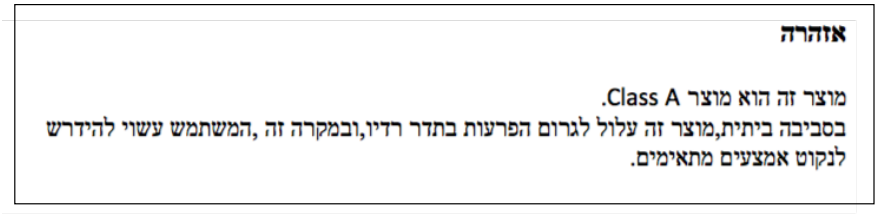
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

**Related Documentation**

- Compliance Statements for EMC Requirements for Juniper Networks Devices (Israel) on page 263

- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) on page 263
- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) on page 263

## Compliance Statements for EMC Requirements for Juniper Networks Devices (Israel)




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

**Related Documentation**

- Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada) on page 262
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) on page 263
- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) on page 263

## Compliance Statements for EMC Requirements for Juniper Networks Devices (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

**Related Documentation**

## Compliance Statements for EMC Requirements for Juniper Networks Devices (United States)

The hardware equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in

a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

**Related Documentation**

- 

## Compliance Statements for Environmental Requirements

Batteries in this product are not based on mercury, lead, or cadmium substances. The batteries used in this product are in compliance with EU Directives 91/157/EEC, 93/86/EEC, and 98/101/EEC. The product documentation includes instructional information about the proper method of reclamation and recycling.

## Compliance Statements for NEBS for the M7i Router

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (that is, DC-I), as defined in GR-1089-CORE.
- You must provision a readily accessible device outside of the equipment to disconnect power. The device must also be rated based on local electrical code practice.

**Related Documentation**

## Compliance Statements for Acoustic Noise for the M7i Router

The router complies with NEBS Level 3 requirements:

- GR-63-CORE: NEBS, Physical Protection
- GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment

**Related Documentation**

- Agency Approvals for M7i Routers on page 261
- Compliance Statements for NEBS for the M7i Router on page 264
- Compliance Statements for EMC Requirements for the M7i Router (European Community) on page 262
- Compliance Statements for Environmental Requirements on page 264

## Statements of Volatility for Juniper Network Devices

A *statement of volatility*—sometimes known as *letter of volatility*—identifies the volatile and non-volatile storage components in Juniper Networks devices, and describes how to remove non-volatile storage components from the device.

NOTE: **Statements of volatility are not available for all Juniper Networks devices.**

CTP series:

- CTP2000

EX series:

- EX2200 and EX2200-C
- EX2300-24P, EX2300-24T, and EX2300-24T-DC
- EX2300-48P and EX2300-48T
- EX2300-C
- EX3300
- EX3400-24P, EX3400-24T, EX3400-24T-DC
- EX3400-48P, EX3400-48T, EX3400-48T-AFI
- EX4200
- EX4300
- EX4500
- EX4550
- EX4600
- EX8200
- XRE200 External Routing Engine

LN Series:

- LN1000–CC

MX series:

- M7i
- M7i Compact Forwarding Engine Board (CFEB)
- M40e and M10i
- M320

- MX5, MX10, MX40, and MX80
- MX240, MX480, and MX960
- RE-A-2000 Route Engine
- RE-S-X6-64G Routing Engine

QFX series:

- QFX3008-I
- QFX3100
- QFX3500
- QFX3600
- QFX5100-24Q
- QFX5100-48S6Q
- QFX5100-48T
- QFX5200
- QFX5200-32C
- QFX10008 and QFX10016

SRX series:

- SRX100
- SRX110
- SRX210B
- SRX210H-POE
- SRX210H-P-MGW
- SRX220
- SRX240H
- SRX240H-POE
- SRX300
- SRX320
- SRX340 and SRX345
- SRX550
- SRX650
- SRX1400
- SRX1500
- SRX3400 and SRX3600

- SRX5400, SRX5600, and SRX5800
- SRX-MP-1SERIAL
- SSG-520M

T series:

- RE-A-2000 Route Engine