



M320 Multiservice Edge Router Hardware Guide



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M320 Multiservice Edge Router Hardware Guide
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- Documentation Conventions on page xxiii
- Documentation Feedback on page xxv
- Requesting Technical Support on page xxvi

Documentation and Release Notes

To obtain the most current version of all Juniper Networks[®] technical documentation, see the product documentation page on the Juniper Networks website at <https://www.juniper.net/documentation/>.

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

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

Documentation Conventions

Table 1 on page xxiv 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 xxiv defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

| Convention | Description | Examples |
|------------------------------|---|--|
| Bold text like this | Represents text that you type. | To enter configuration mode, type the configure command: user@host> configure |
| Fixed-width text like this | Represents output that appears on the terminal screen. | user@host> show chassis alarms No alarms currently active |
| <i>Italic text like this</i> | <ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies guide names. Identifies RFC and Internet draft titles. | <ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS CLI User Guide</i> RFC 1997, <i>BGP Communities Attribute</i> |
| <i>Italic text like this</i> | Represents variables (options for which you substitute a value) in commands or configuration statements. | Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i> |

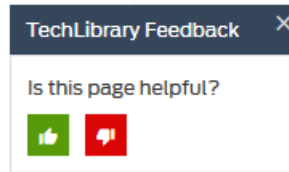
Table 2: Text and Syntax Conventions (continued)

| Convention | Description | Examples |
|--------------------------------|--|--|
| Text like this | Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components. | <ul style="list-style-type: none"> To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level. The console port is labeled CONSOLE. |
| < > (angle brackets) | Encloses optional keywords or variables. | stub <default-metric <i>metric</i> >; |
| (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 <i>(string1 string2 string3)</i> |
| # (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 [<i>community-ids</i>] |
| Indentation and braces ({ }) | Identifies a level in the configuration hierarchy. | [edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } } |
| ;(semicolon) | Identifies a leaf statement at a configuration hierarchy level. | |
| GUI Conventions | | |
| Bold text like this | Represents graphical user interface (GUI) items you click or select. | <ul style="list-style-type: none"> In the Logical Interfaces box, select All Interfaces. To cancel the configuration, click Cancel. |
| > (bold right angle bracket) | Separates levels in a hierarchy of menu selections. | In the configuration editor hierarchy, select Protocols>Ospf . |

Documentation Feedback

We encourage you to provide feedback so that we can improve our documentation. You can use either of the following methods:

- 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.
- Click the thumbs-down icon if the information on the page was not helpful to you or if you have suggestions for improvement, and use the pop-up form to provide feedback.
- E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

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

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <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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Self-Help Online Tools and Resources

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

- Find CSC offerings: <https://www.juniper.net/customers/support/>
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- Find product documentation: <https://www.juniper.net/documentation/>
- Find solutions and answer questions using our Knowledge Base: <https://kb.juniper.net/>
- 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/>

- Join and participate in the Juniper Networks Community Forum:
<https://www.juniper.net/company/communities/>
- Create a service request online: <https://myjuniper.juniper.net>

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

Creating a Service Request with JTAC

You can create a service request with JTAC on the Web or by telephone.

- Visit <https://myjuniper.juniper.net>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

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

PART 1

Overview

- [System Overview on page 3](#)
- [M320 Router Release Notes on page 5](#)
- [Chassis Components and Descriptions on page 7](#)
- [Cooling System Components and Descriptions on page 21](#)
- [Host Subsystem Components and Descriptions on page 23](#)
- [Line Card Components and Descriptions on page 55](#)
- [Power System Components and Descriptions on page 81](#)
- [Switch Fabric Components and Descriptions on page 87](#)

CHAPTER 1

System Overview

- [M320 Router Description on page 3](#)
- [M320 Component Redundancy on page 4](#)

M320 Router Description

The M320 Multiservice Edge Router is a high-density edge aggregation, routing, and service creation platform that builds on Juniper Networks service-built edge design. Constructed with separations between the control plane, forwarding plane, and services plane, the router supports multiple services on a single platform. The Junos OS runs on a control subsystem with dedicated hardware, ensuring that control functions are performed without affecting the forwarding subsystem. Forwarding and packet processing operations in the router are performed by dedicated programmable ASICs that enable the router to achieve data forwarding rates that match current fiber-optic capacity. This design eliminates processing and traffic bottlenecks, permitting the router to achieve high performance.

The router can be deployed in core, peering, and data center applications, but is optimized for dense edge aggregation and service creation. The M320 router can provide a single point of edge aggregation for thousands of customers over any access type, including ATM, Frame Relay, Ethernet, and TDM, at any speed from DS0 up to OC192/STM64 and 10-Gigabit Ethernet.

The router is a half-rack chassis that supports up to eight Flexible PIC Concentrators (FPCs) providing up to 64 SONET/SDH OC48/STM16, 16 SONET/SDH OC192/STM64, or 160 Gigabit Ethernet ports for the router. In a standalone configuration, the router's maximum aggregate throughput is 320 gigabits per second (Gbps), half duplex. The router supports up to eight of these FPCs:

- Type 1 FPCs—Rated at 4 Gbps full duplex, supports up to four PICs.
- Type 2 FPCs—Rated at 16 Gbps full duplex, supports up to four PICs.
- Type 3 FPCs—Rated at 20 Gbps full duplex, supports up to two PICs, including higher-speed PICs.

The router can operate with any FPC type in any slot. Type 1 FPCs and Type 2 FPCs each support four PICs, and Type 3 FPCs supports two PICs.

- Related Documentation**
- [M320 Chassis Description on page 7](#)
 - [M320 Router Physical Specifications on page 94](#)
 - [M320 Environmental Specifications on page 101](#)
 - [M320 Power Requirements on page 104](#)

M320 Component Redundancy

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

- **Switch Interface Boards (SIBs)**—A fully configured router has four SIBs. Each FPC has a dedicated ASIC with four high-speed links that connect to the SIBs (one link per SIB). In the event of a complete SIB failure, the traffic is forwarded across the remaining three planes with a slight degradation in performance. When the failed SIB is replaced, the router regains full forwarding capacity.
- **Host subsystem**—The host subsystem consists of a Routing Engine functioning together with a CB. To operate, each host subsystem requires a Routing Engine installed in an adjacent slot to the CB. The router can have one or two host subsystems. If two host subsystems are installed, one functions as the master and the other functions as the backup. If the master host subsystem (or either of its components) fails or is taken offline, the backup can take over as the master.

For information about the effect of taking the host subsystem offline, see [“Taking the M320 Host Subsystem Offline” on page 243](#). For more information about high availability features, see the *High Availability Feature Guide*.

- **Power supplies**—A router with a minimum of three AC power supplies or four DC power supplies is fully power redundant. In the AC configuration, all power supplies share the load evenly. In the DC configuration, two power supplies share the load to some of the components, and two other power supplies share the load to the remaining components. In both configurations, if one power supply fails, the remaining power supplies can provide full power to the router.
- **Cooling system**—The cooling system has redundant components, which are controlled by the host subsystem. If one of the fans fails, the host subsystem increases the speed of the remaining fans to provide sufficient cooling for the router indefinitely.

- Related Documentation**
- [M320 SIB Description on page 87](#)
 - [M320 Host Subsystem Description on page 23](#)
 - [M320 Cooling System Description on page 21](#)
 - [M320 Power System Description on page 81](#)

CHAPTER 2

M320 Router Release Notes

- [Outstanding Issues with the M320 Router on page 5](#)
- [Errata with the M320 Router Documentation on page 5](#)

Outstanding Issues with the M320 Router

This section lists outstanding hardware issues with the M320 Multiservice Edge Router. For information about software issues, see the *Junos OS Release Notes*.

- There are currently no outstanding issues for the M320 router.

**Related
Documentation**

- [Errata with the M320 Router Documentation on page 5](#)

Errata with the M320 Router Documentation

There are currently no outstanding documentation issues for the M320 router.

**Related
Documentation**

- [Outstanding Issues with the M320 Router on page 5](#)

CHAPTER 3

Chassis Components and Descriptions

- [M320 Chassis Description on page 7](#)
- [M320 Midplane Description on page 10](#)
- [M320 Fuses on page 12](#)
- [M320 Cable Management System Description on page 12](#)
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [M320 Craft Interface Description on page 15](#)
- [M320 Craft Interface Alarm LEDs and ACO/LT Button on page 16](#)
- [M320 Craft Interface LED Display and Navigation Buttons on page 17](#)
- [M320 Craft Interface Host Subsystem LEDs on page 18](#)
- [M320 Craft Interface FPC LEDs and Online/Offline Buttons on page 18](#)
- [M320 Craft Interface Power Supply LEDs on page 19](#)
- [M320 Craft Interface SIB LEDs on page 19](#)

M320 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components (see [Figure 1 on page 8](#)). The chassis measures 34.80 in. (88.4 cm) high, 17.43 in. (44.3 cm) wide, and 25.64 in. (65.1 cm) deep (from the front-mounting flanges to the rear of the chassis). The chassis can be installed in many types of racks or cabinets. For more information, see “[M320 Cabinet Size and Clearance Requirements](#)” on [page 96](#), and “[Rack Requirements for the M320 Router](#)” on [page 95](#).

The chassis includes the following features (see [Figure 1 on page 8](#), [Figure 2 on page 9](#), and [Figure 3 on page 10](#)):

- One pair of metal adjustable center-mounting brackets that can be attached to one of 11 positions on the side of the chassis. You can use the brackets for mounting the chassis in the rack or cabinet.
- Two installation handles on the top to facilitate positioning the router in the rack. Do not use the handles to lift the router.
- Two electrostatic discharge points (banana plug receptacles): one front and one rear.



CAUTION: Before removing or installing components of a 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.

Figure 1: Front View of a Fully Configured Router Chassis

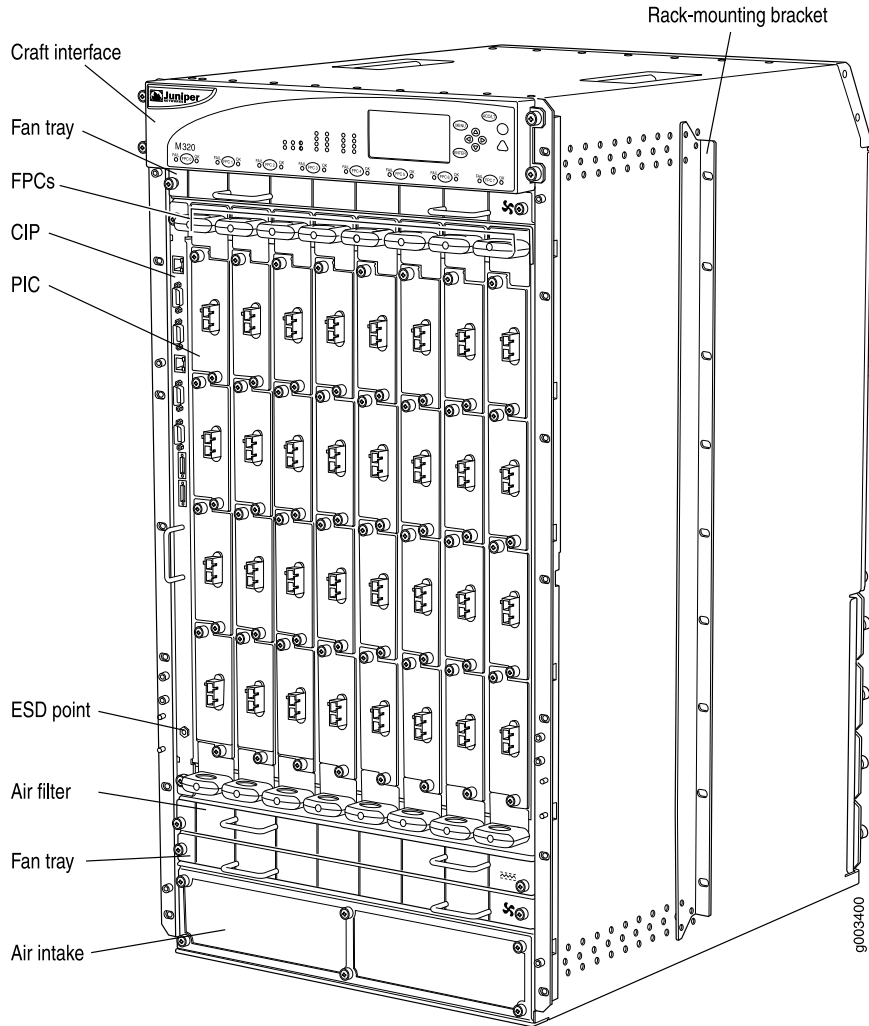


Figure 2: Rear View of a Fully Configured AC-Powered Router Chassis

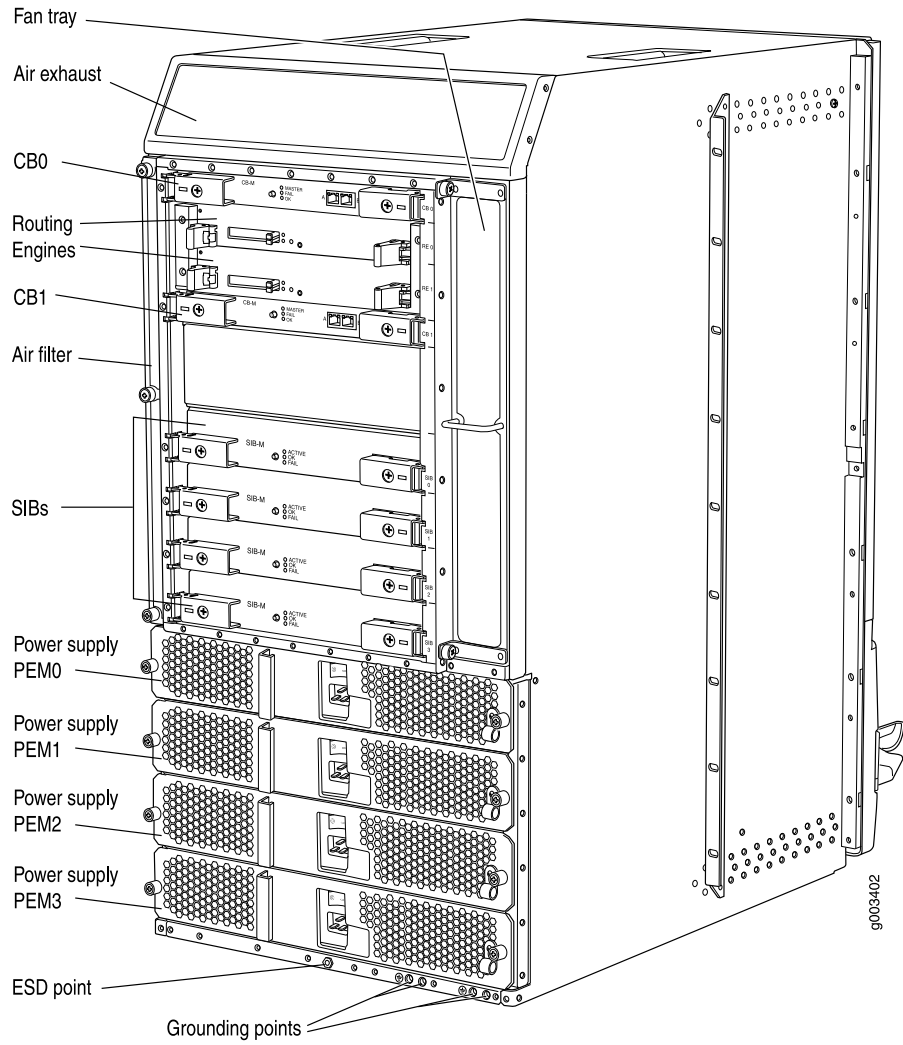
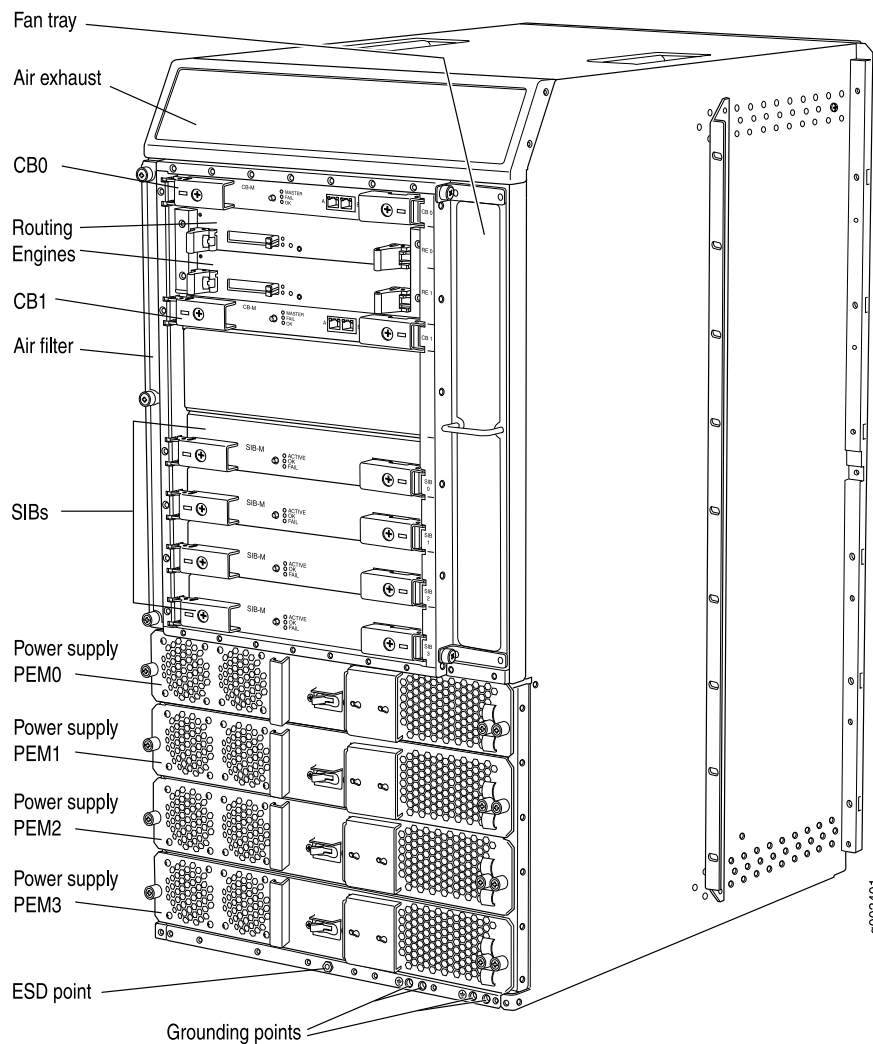


Figure 3: Rear View of a Fully Configured DC-Powered Router Chassis



For chassis serial number information, see [“Locating M320 Component Serial Numbers Using the CLI”](#) on page 339.

Related Documentation

- [M320 Router Description](#) on page 3
- [Installing the M320 Chassis Using a Mechanical Lift](#) on page 148
- [Installing the M320 Chassis in the Rack Manually](#) on page 167
- [M320 Installation Safety Guidelines](#) on page 363
- [M320 Router Physical Specifications](#) on page 94

M320 Midplane Description

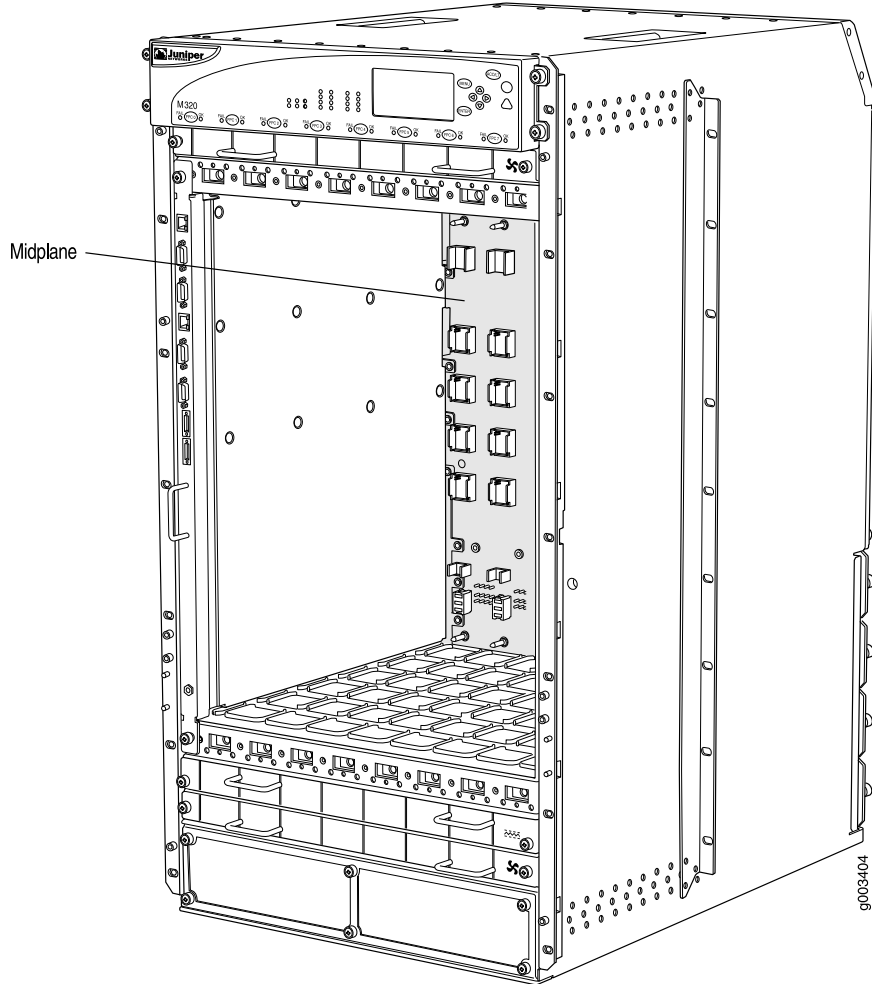
The midplane is located in the center of the chassis and forms the rear of the FPC card cage (see [Figure 4](#) on page 11). The FPCs install into the midplane from the front of the

chassis, and the SIBs, Routing Engines, and CBs install into the midplane from the rear of the chassis. The power supplies and cooling system components also connect to the midplane.

The midplane performs the following major functions:

- Data path—Data packets are transferred across the midplane from the Packet Forwarding Engine on the originating FPC to the SIBs, and from the SIBs across the midplane to the Packet Forwarding Engine on the destination FPC.
- Power distribution—The router power supplies are connected to the midplane, which distributes power to all the router components.
- Signal path—The midplane provides the signal path to the FPCs, SIBs, Routing Engines, CB, and other system components for monitoring and control of the system.

Figure 4: Midplane



For chassis serial number information, see [“Locating M320 Component Serial Numbers Using the CLI”](#) on page 339.

- Related Documentation**
- [M320 Router Description on page 3](#)
 - [M320 Host Subsystem Description on page 23](#)
 - [M320 Cabinet Size and Clearance Requirements on page 96](#)

M320 Fuses

The router uses fuses from the Cooper Bussman brand GMT series for the CB, SIBs, and FPCs. The fuses are located in the rear of the midplane behind the power supply in slot **PEMO**. When the fuse for a component blows, the component stops functioning even though it is installed correctly and the power supplies are providing power to the router. For more information, see [“Troubleshooting the M320 Fuses” on page 330](#). For fuse replacement instructions, see [“Replacing an M320 Fuse” on page 225](#).

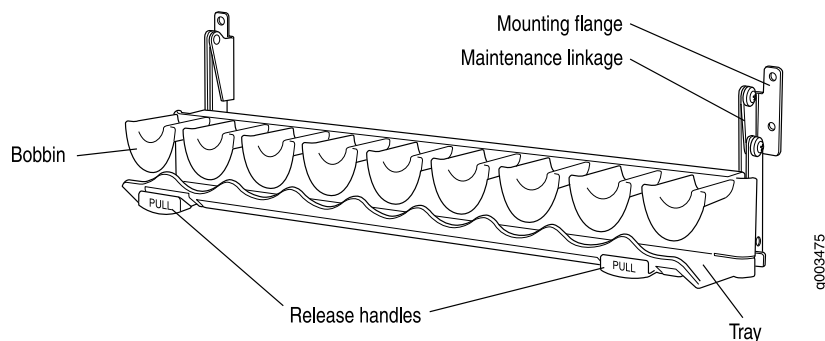
- Related Documentation**
- [M320 Fuse Specifications on page 107](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

M320 Cable Management System Description

The cable management system (see [Figure 5 on page 12](#)) consists of a row of nine semicircular plastic bobbins mounted on the front of the router below the FPC card cage. The PIC cables pass between the bobbins and into the tray, keeping the cables organized and securely in place. The curvature of the bobbins also helps maintain the proper bend radius for optical PIC cables.

You can pull the cable management system up and outward to lock it into the maintenance position. This allows you to access the lower fan tray and the front air filter.

Figure 5: Cable Management System



The router ships with an accessory box that contains four cable guards—two upper and two lower—that you can install on the front-mounting flanges of the chassis after you have mounted the chassis in a rack or cabinet. The cable guards protect the PIC and CIP cables from rubbing against the front edges of the chassis.

Included with your router shipment is a clear plastic cable cover that you can attach to slots in the cable guards without using tools. The cable cover prevents the PIC and CIP cables from being disturbed or snagged.

Related Documentation

- [M320 Chassis Description on page 7](#)

M320 Connector Interface Panel (CIP) Description

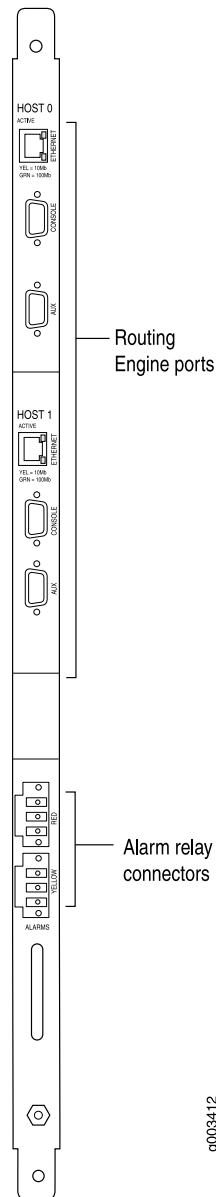
The CIP is located at the left side of the FPC card cage. The front electrostatic discharge point is located near the bottom of the CIP.

- [CIP Components on page 13](#)
- [Routing Engine Ports on page 14](#)
- [Alarm Relay Contacts on page 15](#)

CIP Components

The Connector Interface Panel (CIP) consists of Ethernet, console, and auxiliary connectors for the Routing Engines and alarm relay contacts (see [Figure 6 on page 14](#)).

Figure 6: CIP



Routing Engine Ports

The CIP has two sets of ports that you use to connect the Routing Engines to external management devices. From these management devices, you can use the CLI to configure the router.

The upper set of ports, labeled **HOST 0**, connects to the Routing Engine in slot **RE0**; and the lower set, labeled **HOST 1**, connects to the Routing Engine in slot **RE1**. Each set includes the following ports:

- **ETHERNET**—Connects the Routing Engine through an Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for

out-of-band management. The port uses an autosensing RJ-45 connector to support both 10- and 100-Mbps connections. Two small LEDs on the right edge of the port indicate the connection in use: the LED labeled **ETHERNET** lights yellow or green for a 10-Mbps or 100-Mbps connection, and the LED labeled **ACT** lights green when traffic is passing through the port.

- **CONSOLE**—Connects the Routing Engine to a system console through an RS-232 (EIA-232) serial cable.
- **AUX**— Connects the Routing Engine to a laptop, modem, or other auxiliary device through an RS-232 (EIA-232) serial cable.

Alarm Relay Contacts

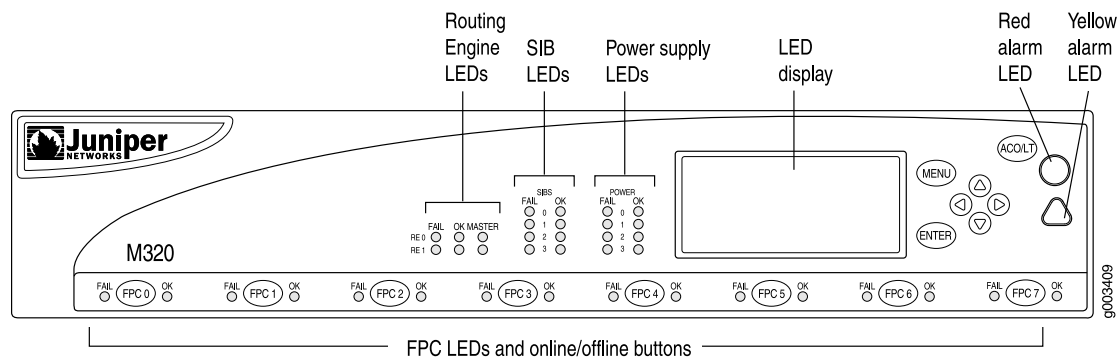
The CIP has two alarm relay contacts for connecting the router to external alarm devices. Whenever a system condition triggers either the red or yellow alarm on the craft interface, the alarm relay contacts are also activated. The alarm relay contacts are located below the Routing Engine ports. The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²), which is not provided. Use the gauge of wire appropriate for the external device you are connecting.

- Related Documentation**
- [M320 Craft Interface Description on page 15](#)
 - [Replacing the M320 CIP on page 213](#)

M320 Craft Interface Description

The craft interface allows you to view status and troubleshooting information at a glance and to perform many system control functions. It is hot-insertable and hot-removable. The craft interface is located on the front of the router above the FPCs. [Figure 7 on page 15](#) shows the front panel of the M320 craft interface.

Figure 7: Front Panel of the Craft Interface



- Related Documentation**
- [M320 Craft Interface Alarm LEDs and ACO/LT Button on page 16](#)
 - [M320 Craft Interface Host Subsystem LEDs on page 18](#)
 - [Replacing an M320 Craft Interface on page 223](#)

M320 Craft Interface Alarm LEDs and ACO/LT Button




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

A condition that causes an LED to light also activates the corresponding alarm relay contact on the connector interface panel (CIP). The LCD on the craft interface reports the cause of the alarm.

To deactivate red and yellow alarms, press the button labeled **ACO/LT** (for “alarm cutoff/lamp test”), which is located to the right of the alarm LEDs. Deactivating an alarm turns off both LEDs and deactivates the device attached to the corresponding alarm relay contact on the CIP. However, the LCD continues to report the alarm message until you clear the condition that caused the alarm.

[Table 3 on page 16](#) describes the alarm LEDs and alarm cutoff button in more detail.

Table 3: Alarm LEDs and Alarm Cutoff/Lamp Test Button

| Shape | Color | State | Description |
|---|--------|-------------|--|
|  | Red | On steadily | Critical alarm LED—Indicates a critical condition that can cause the router to stop functioning. Possible causes include component removal, failure, or overheating. |
|  | Yellow | On steadily | Warning alarm LED—Indicates a serious but nonfatal error condition, such as a maintenance alert or a significant increase in component temperature. |
|  | — | — | Alarm cutoff/lamp test button—Deactivates red and yellow alarms. Causes all LEDs on the craft interface to light (for testing purposes), when pressed and held. |

- Related Documentation**
- [M320 Craft Interface Description on page 15](#)
 - [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [M320 Craft Interface LED Display and Navigation Buttons on page 17](#)

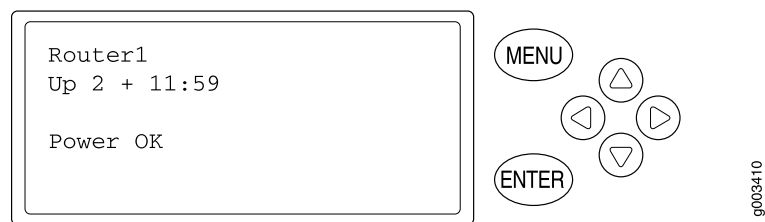
M320 Craft Interface LED Display and Navigation Buttons

A four-line LED display is located in the craft interface, along with six navigation buttons. The LED display operates in two modes:

- LED display idle mode
- LED display alarm mode

During normal operation, the LED display operates in idle mode and reports current status information, as shown in [Figure 8 on page 17](#).

Figure 8: LED Display in Idle Mode



The lines in the display report the following information:

- First line—Router name.
- Second line—Length of time the router has been running, reported in the following form:

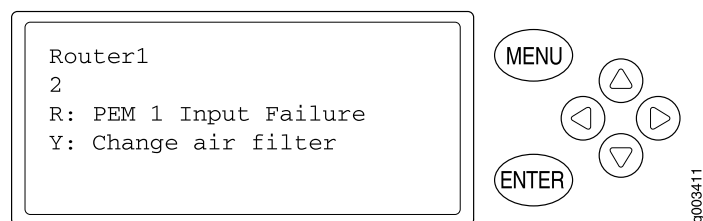
Up days + hours:minutes

- Third and fourth lines—Status messages, which rotate at 2-second intervals. Some conditions, such as removal or insertion of a system component, can interrupt the messages.

To add a message that alternates every 2 seconds with the default status messages, use the **set chassis display message** command. For more information, see the [CLI Explorer](#).

When a red or yellow alarm occurs, the LED display switches to alarm mode and reports about the alarm condition, as shown in [Figure 9 on page 17](#).

Figure 9: LED Display in Alarm Mode



The lines in the display report the following information:

- First line—Router name.

- Second line—Number of active alarms.
- Third and fourth lines—Individual alarm messages, with the most severe condition shown first. The prefix on each line indicates whether the alarm is a red (R) or yellow (Y) alarm.

For a list of alarm messages that can appear on the LED display, see “[M320 Chassis and Interface Alarm Messages](#)” on page 325.

Related Documentation

- [M320 Craft Interface Description on page 15](#)
- [M320 Craft Interface Alarm LEDs and ACO/LT Button on page 16](#)

M320 Craft Interface Host Subsystem LEDs

Each host subsystem has three LEDs, located in the middle of the craft interface, that indicate its status. The LEDs labeled **RE0** show the status of the Routing Engine in slot **RE0** and the CB in slot **CBO**. The LEDs labeled **RE1** show the status of the Routing Engine in slot **RE1** and the CB in slot **CBI**. [Table 4 on page 18](#) describes the functions of the host subsystem LEDs.

Table 4: M320 Host Subsystem LEDs

| Label | Color | State | Description |
|--------|-------|-------------|---|
| FAIL | Red | On steadily | Host is offline. |
| OK | Green | On steadily | Host is online and is functioning normally. |
| MASTER | Green | On steadily | Host is functioning as the master. |

Related Documentation

- [M320 Host Subsystem Description on page 23](#)
- [M320 Craft Interface Description on page 15](#)
- [M320 Craft Interface Alarm LEDs and ACO/LT Button on page 16](#)

M320 Craft Interface FPC LEDs and Online/Offline Buttons

Each FPC slot has two LEDs that indicate its status. The FPC LEDs, labeled **FPC0** through **FPC7**, are located along the bottom of the craft interface. [Table 5 on page 18](#) describes the functions of the FPC LEDs.

Table 5: FPC LEDs

| Label | Color | State | Description |
|-------|-------|-------------|-----------------|
| FAIL | Red | On steadily | FPC has failed. |

Table 5: FPC LEDs (continued)

| Label | Color | State | Description |
|-------|-------|-------------|------------------------------|
| OK | Green | On steadily | FPC is functioning normally. |
| | | Blinking | FPC is starting up. |

Related Documentation

- [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
- [M320 Craft Interface Description on page 15](#)
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [Troubleshooting the M320 FPCs on page 329](#)

M320 Craft Interface Power Supply LEDs

Each power supply has two LEDs on the craft interface that indicate its status. The LEDs, labeled **0** through **3**, are located in the middle of the craft interface under the **POWER** label. [Table 6 on page 19](#) describes the functions of the power supply LEDs.

Table 6: Power Supply LEDs on the Craft Interface

| Label | Color | State | Description |
|-------|-------|-------------|---------------------------------------|
| FAIL | Red | On steadily | Power supply has failed. |
| OK | Green | On steadily | Power supply is functioning normally. |

Related Documentation

- [M320 Craft Interface Description on page 15](#)
- [M320 AC Power Supplies Description on page 82](#)
- [M320 DC Power Supplies Description on page 82](#)

M320 Craft Interface SIB LEDs

Each SIB has two LEDs on the craft interface that indicate its status. The SIB LEDs, labeled **SIB0** through **SIB2**, are located on the upper right of the craft interface. The **ACTIVE** LED on the SIB faceplate is not replicated on the craft interface. [Table 7 on page 19](#) describes the functions of the SIB LEDs.

Table 7: SIB LEDs on the Craft Interface

| Label | Color | State | Description |
|-------|-------|-------------|------------------------------|
| FAIL | Red | On steadily | SIB has failed. |
| OK | Green | On steadily | SIB is functioning normally. |

**Related
Documentation**

- [M320 SIB Description on page 87](#)
- [M320 SIB LEDs on page 89](#)
- [M320 Craft Interface Description on page 15](#)
- [Maintaining the M320 SIBs on page 318](#)

CHAPTER 4

Cooling System Components and Descriptions

- [M320 Cooling System Description on page 21](#)

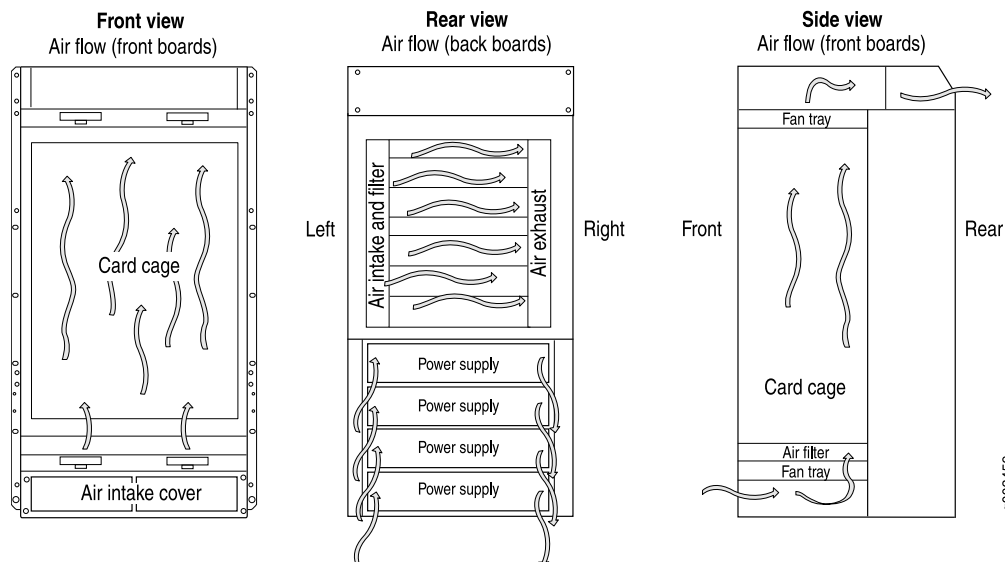
M320 Cooling System Description

The cooling system consists of the following components:

- Two front fan trays
- Front air filter
- Rear fan tray
- Rear air filter

The cooling system components work together to keep all router components within the acceptable temperature range (see [Figure 10 on page 21](#)). All fan trays and filters are hot-insertable and hot-removable. The two front fan trays are interchangeable. The front and rear fan trays are not interchangeable.

Figure 10: Airflow Through the Chassis



The host subsystem monitors the temperature of the router components. When the router is operating normally, the fans function at lower than full speed. If a fan fails or the ambient temperature rises above a threshold, the speed of the remaining fans is automatically adjusted to keep the temperature within the acceptable range. If the ambient maximum temperature specification is exceeded and the system cannot be adequately cooled, the Routing Engine shuts down some or all of the hardware components.

**Related
Documentation**

- [M320 Cabinet Airflow Requirements on page 98](#)
- [Maintaining the M320 Fan Trays on page 306](#)
- [Troubleshooting the M320 Cooling System on page 327](#)

Host Subsystem Components and Descriptions

- [M320 Host Subsystem Description on page 23](#)
- [M320 Routing Engine Description on page 24](#)
- [M320 Routing Engine 600 Description on page 25](#)
- [M320 Routing Engine 1600 Description on page 26](#)
- [M320 Routing Engine 2000 Description on page 27](#)
- [M320 RE-A-1800 Routing Engine Description on page 28](#)
- [RE-A-1800 Routing Engine LEDs on page 31](#)
- [Routing Engine Specifications on page 31](#)
- [Supported Routing Engines by Router on page 36](#)
- [M320 Control Board \(CB\) Description on page 51](#)
- [M320 Control Board \(CB\) LEDs on page 53](#)

M320 Host Subsystem Description

The host subsystem provides the routing and system management functions of the router. You can install one or two host subsystems on the router. To operate, each host subsystem functions as a unit; the Routing Engine requires the corresponding Control Board (CB) and vice versa.



NOTE: We recommend that you install two host subsystems for redundant protection. If you install only one host subsystem, we recommend that you install it in slot RE0.



NOTE: Each host subsystem has three LEDs that display its status. The LEDs that report host module status (including Routing Engine status) are located in the middle of the craft interface rather than the Routing Engine faceplate. For more information about the host subsystem LEDs, see [“M320 Craft Interface Host Subsystem LEDs” on page 18](#).



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



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

Related Documentation

- [Maintaining the M320 Host Subsystem on page 307](#)
- [Taking the M320 Host Subsystem Offline on page 243](#)

M320 Routing Engine Description

The Routing Engine runs the Junos operating system (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 interfaces, control some chassis components, and provide the interface for system management and user access to the router.

You can install one or two Routing Engines in the router. The Routing Engines install into the upper rear of the chassis in the slots labeled **RE0** and **RE1**. Each Routing Engine requires a CB to be installed in the adjacent slot. **RE0** installs below **CB0**, and **RE1** installs above **CB1**. A Routing Engine does not power up if a CB is not present in the adjacent slot.

If two Routing Engines are installed, one functions as the master, and the other acts as the backup. If the master Routing Engine fails or is removed, and the backup is configured appropriately, the backup can take over as the master. If the Routing Engines are configured for nonstop active routing, the backup Routing Engine automatically synchronizes its configuration and state with the master Routing Engine. Any update to the master Routing Engine state is replicated on the backup Routing Engine. If the backup Routing Engine assumes mastership, packet forwarding continues through the router without interruption. For more information about nonstop active routing, see the *High Availability Feature Guide*.

The master Routing Engine (if nonstop active routing is configured) and the backup Routing Engine are hot-removable and hot-insertable. A nonredundant Routing Engine or master Routing Engine (if nonstop active routing is not configured) is hot-pluggable.

The M320 router supports the following Routing Engines:

- RE-600-2048
- RE-1600-2048
- RE-A-2000-4096
- RE-A-1800x2 for Junos OS Release 10.4.

- Related Documentation**
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [Replacing an M320 Routing Engine on page 246](#)
 - [M320 Routing Engine 600 Description on page 25](#)
 - [M320 Routing Engine 1600 Description on page 26](#)
 - [M320 Routing Engine 2000 Description on page 27](#)
 - [M320 RE-A-1800 Routing Engine Description on page 28](#)

M320 Routing Engine 600 Description

Each M320 Routing Engine 600 consists of the following components:

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols. It has a Pentium-class processor.
- 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 inaccessible from outside the router.
- Hard disk—Provides secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.
- One PC card slot—Accepts a removable PC card, which stores software images for system upgrades.
- LED—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.
- 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 Connector Interface Panel (CIP).

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.

On the RE-600-2048 Routing Engine, the boot sequence for the storage media is as follows: the PC card (if present), then the CompactFlash card (if present), then the hard disk.

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

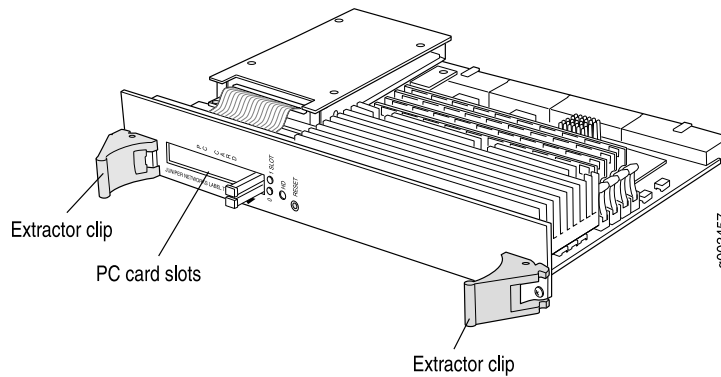


NOTE: If the router boots from an alternate boot device, a yellow alarm lights the LED on the router's craft interface.

- Related Documentation**
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [M320 Routing Engine Description on page 24](#)
 - [Replacing an M320 Routing Engine on page 246](#)

M320 Routing Engine 1600 Description

Figure 11: Routing Engine 1600



Each Routing Engine (shown in [Figure 11 on page 26](#)) consists of the following components:

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols. It has a Pentium-class processor.
- 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 inaccessible from outside the router.
- Hard disk—Provides secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.
- PC card slots—Accept removable PC cards, which store software images for system upgrades.
- LED—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.
- 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 Connector Interface Panel (CIP).

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.

On the RE-1600-2048 Routing Engine, the boot sequence for the storage media is as follows: the PC card in **SLOT 0** (if present), then the PC card in **SLOT 1** (if present), then the CompactFlash card (if present), then the hard disk.

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



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

Related Documentation

- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [M320 Routing Engine Description on page 24](#)
- [Replacing an M320 Routing Engine on page 246](#)

M320 Routing Engine 2000 Description

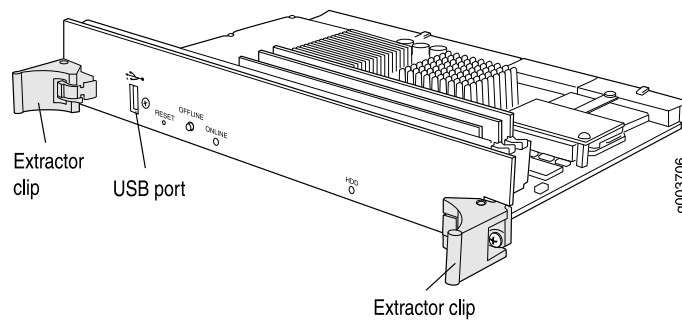
Each Routing Engine (shown in [Figure 12 on page 28](#)) consists of the following components:

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols. It has a Pentium-class processor.
- 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 inaccessible from outside the router.
- Hard disk—Provides secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.
- USB port—Provides a removable media interface through which you can install the Junos OS manually. The Junos OS supports USB version 1.0.
- LED—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.
- 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 Connector Interface Panel (CIP).

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.

Figure 12: Routing Engine 2000



On the RE-A-2000-4096 Routing Engine, the boot sequence for the storage media is as follows: USB device (if present), then the CompactFlash card (if present), then the hard disk.

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



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

Related Documentation

- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [M320 Routing Engine Description on page 24](#)
- [Replacing an M320 Routing Engine on page 246](#)

M320 RE-A-1800 Routing Engine Description

- [Routing Engine Components on page 28](#)
- [Routing Engine Boot Sequence on page 30](#)

Routing Engine Components

Each Routing Engine (shown in [Figure 13 on page 29](#) and [Figure 14 on page 29](#)) consists of the following components:

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- USB port—Provides a removable media interface through which you can install the Junos OS manually. See [Figure 15 on page 30](#). Junos supports USB version 1.0.
- CompactFlash card—Provides primary storage for software images, configuration files, and microcode. The disk is a fixed compact flash and is inaccessible from outside the router.

- SSD—Provides storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.
- LED—Indicates disk activity. It does not necessarily indicate routing-related activity.



NOTE: The LEDs that report host module status (including Routing Engine status) are on the craft interface rather than the Routing Engine faceplate.

- Storage LED—Indicates disk activity for the solid state disk drive.
- 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 craft interface.

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.
- Offline button—Takes the Routing Engine offline when pressed.
- Extractor clips—Control the locking system that secures the Routing Engine.

Figure 13: RE-A-1800 Routing Engine

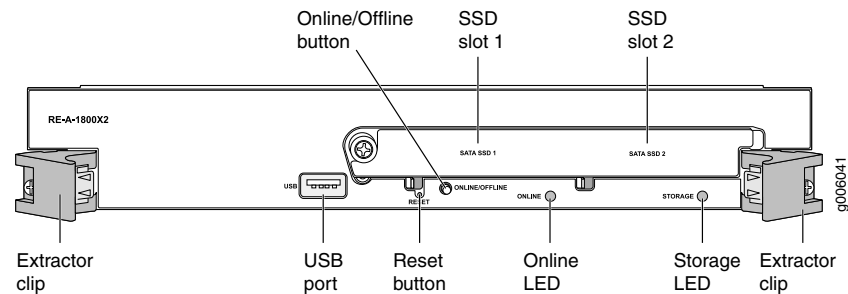
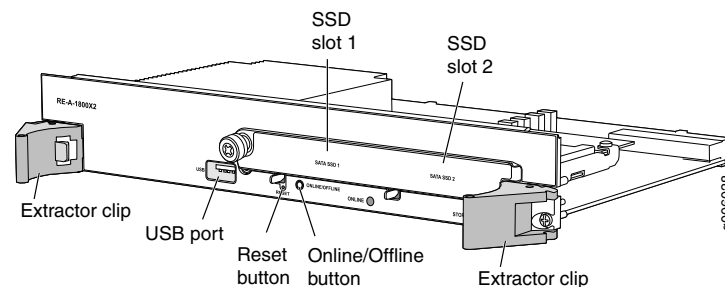


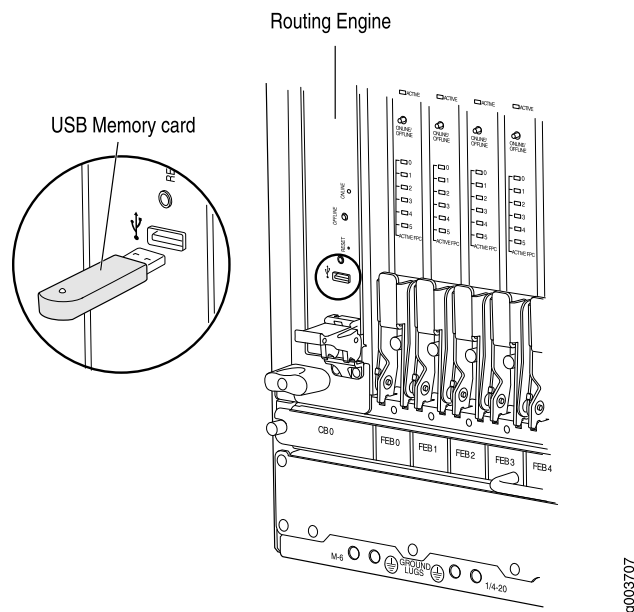
Figure 14: RE-A-1800x2 Routing Engine





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

Figure 15: USB Memory Device in an Routing Engine



Routing Engine Boot Sequence

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



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

Related Documentation

- [M320 Routing Engine Description on page 24](#)
- [M320 Host Subsystem Description on page 23](#)
- [RE-A-1800 Routing Engine LEDs on page 31](#)
- [Maintaining the M320 Host Subsystem on page 307](#)
- [Taking the M320 Host Subsystem Offline on page 243](#)

RE-A-1800 Routing Engine LEDs

Each Routing Engine has four LEDs that indicate its status. The LEDs, labeled **MASTER**, **STORAGE**, **ONLINE**, and **OK/FAIL**, are located directly on the faceplate of the Routing Engine. [Table 8 on page 31](#) describes the functions of the Routing Engine LEDs.

Table 8: Routing Engine LEDs

| Label | Color | State | Description |
|----------------|-------|-------------|---|
| MASTER | Blue | On steadily | Routing Engine is the Master. |
| STORAGE | Green | Blinking | Indicates activity on the SSD or Compact Flash. |
| ONLINE | Green | Blinking | Routing Engine is transitioning online. |
| | | On steadily | Routing Engine is functioning normally. |
| OK/FAIL | Red | On steadily | Routing Engine has failed. |

Related Documentation

- [M320 LED Overview on page 324](#)
- [M320 RE-A-1800 Routing Engine Description on page 28](#)
- [Maintaining the M320 Host Subsystem on page 307](#)

Routing Engine Specifications

[Table 9 on page 32](#) lists the current specifications for Routing Engines supported on M Series, MX Series, and T Series routers. [Table 10 on page 34](#) 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 36](#).



NOTE: For information about PTX Series Routing Engine specifications, see [Routing Engines Supported on PTX Series Routers](#). For information about

Table 9: 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 | – |
| RE-A1000-2048 | 1.0-GHz Pentium | 2048 MB | Gigabit Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 8.1 | – |
| RE-A2000-4096 | 2.0-GHz Pentium | 4096 MB | Gigabit Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 8.1 | – |
| RE-S300-2048 | 1.3-GHz Pentium | 2048 MB | Gigabit Ethernet | 40 GB hard disk | 1 GB CompactFlash card | 8.2 | SCB, SCBE |
| RE-S2000-4096 | 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 | CB-T for a standalone router. |
| | | | | | | Standalone T640 or T1600 router:11.2 | CB-LCC for a router in a routing matrix. |
| | | | | | | 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 | CB-T for a standalone router. CB-LCC for a router in a routing matrix. |
| RE-C1800 | 1.8 Ghz | 16 GB | Gigabit Ethernet | SSD | 4 GB CompactFlash card | 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. CB-LCC for a router in a routing matrix. |
| | | | | | | 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 | CB-T for a standalone router. CB-LCC for a router in a routing matrix. |
| | | | | | | 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. 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 | – |

Table 9: Routing Engine Specifications (continued)

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | Switch Control Board |
|-------------------------------|-----------|---------------|--------------------|-----------------|---------------------------------------|--|----------------------|
| RE-A-1800x2 | 1800-MHz | 8 GB or 16 GB | Gigabit Ethernet | 32 GB SSD | 4 GB CompactFlash card | 10.4 | – |
| 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-1800x4G | 1.73-GHz | 4 GB | Gigabit Ethernet | 64 GB SSD | 4 GB CompactFlash card | 12.1R2, 11.4R4, and 12.2R1 | – |
| RE-M-1800x4 | 1.8- GHz | 16 GB | Gigabit Ethernet | 32 GB SSD | 4 GB Fixed Internal CompactFlash card | 12.3R2 | SCB, SCBE |
| RE-S-1800x4GS | 1.8- Ghz | 32 GB | Gigabit Ethernet | 32 GB SSD | 4 GB Fixed Internal CompactFlash card | <ul style="list-style-type: none"> • 12.3R4 • 13.2R1 | SCB, SCBE SCBE2 |
| RE-M-1800x4GS | 1.8- Ghz | 32 GB | Gigabit Ethernet | 32 GB SSD | 4GB Fixed Internal CompactFlash card | <ul style="list-style-type: none"> • 12.3R4 • 13.2R1 | – |
| RE-S-X6-64G, RE-S-X6-64GLT | 2 Ghz | 64 GB | Gigabit Ethernet | Two 50-GB SSDs | – | 15.1F4, 16.1 | SCBE2 |
| RE-M-X6-64G | 2.3 Ghz | 64 GB | Gigabit Ethernet | Two 100-GB SSDs | – | 15.1F5-S1, 16.1R2, and 16.2R1 | – |
| RE-M-X6-64GLT | 2.3 Ghz | 64 GB | Gigabit Ethernet | Two 100-GB SSDs | – | 17.2R1 | – |
| RE-M-X6-86G | 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 | – |

Table 9: Routing Engine Specifications (continued)

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | Switch Control Board |
|----------------|-----------|--------|--------------------|-----------------|-------|------------------------|----------------------|
| RE-S-X6-64G | 2.1 Ghz | 64 GB | Gigabit Ethernet | Two 100-GB SSDs | - | 17.2R1 | - |
| RE-S-X6-128G | 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 | - |
| RE-S-X8-128G | 2.1 Ghz | 128 GB | Gigabit Ethernet | Two 200-GB SSDs | - | 18.1R1 | - |
| JNP10003-REI | 1.6-GHz | 64 GB | Gigabit Ethernet | Two 100 GB SSDs | - | 17.3R1 | - |
| JNP10003-RELT | 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-RE1LT | 2.3 GhZ | 64 GB | Gigabit Ethernet | Two 200 GB SSDs | - | 18.3R1 | - |
| JNP10K-RE128 | 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 10: 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 |

Table 10: End-of-Life Routing Engine Specifications (continued)

| Routing Engine | Processor | Memory | Connection to PFEs | Disk | Media | First Junos OS Support | EOL Details |
|----------------------------|---------------------|---------|--------------------|------------------|--------------------------|------------------------|---------------------------------|
| 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 |
| 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 9 on page 32](#) 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 36](#)

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 on page 36](#)
- [M10i Routing Engines on page 37](#)
- [M40e Routing Engines on page 37](#)
- [M120 Routing Engines on page 38](#)
- [M320 Routing Engines on page 38](#)
- [MX5, MX10, MX40, and MX80 Routing Engine on page 39](#)
- [MX104 Routing Engines on page 39](#)
- [MX240 Routing Engines on page 39](#)
- [MX480 Routing Engines on page 40](#)
- [MX960 Routing Engines on page 41](#)
- [MX2008 Routing Engines on page 42](#)
- [MX2010 Routing Engines on page 43](#)
- [MX2020 Supported Routing Engines on page 43](#)
- [MX10003 Routing Engines on page 44](#)
- [MX10008 Routing Engines on page 44](#)
- [PTX1000 Routing Engines on page 45](#)
- [PTX3000 Routing Engines on page 45](#)
- [PTX5000 Routing Engines on page 46](#)
- [PTX10008 and PTX10016 Routing Engines on page 47](#)
- [T320 Routing Engines on page 47](#)
- [T640 Routing Engines on page 47](#)
- [T1600 Routing Engines on page 48](#)
- [T4000 Routing Engines on page 49](#)
- [TX Matrix Routing Engines on page 50](#)
- [TX Matrix Plus Routing Engines on page 50](#)
- [TX Matrix Plus \(with 3D SIBs\) Routing Engines on page 51](#)

M7i Routing Engines

Table 11 on page 37 lists the Routing Engines supported by the M7i router. The M7i router supports 32-bit Junos OS only.

Table 11: 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 12.1R2 | fxp0 | em0 |

M10i Routing Engines

Table 12 on page 37 lists the Routing Engines supported by the M10i router. The M10i router supports 32-bit Junos OS only.

Table 12: 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 fxp2 |
| RE-850-1536 (EOL details: TSB15553) | RE-850 | 7.2 | fxp0 | fxp1 fxp2 |
| RE-B-1800X1-4G | RE-B-1800x1 | 11.4R4 12.1R2 | fxp0 | em0 |

M40e Routing Engines

Table 13 on page 37 lists the Routing Engines supported by the M40e router.

Table 13: 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 fxp2 |
| RE-A-1000-2048 | RE-A-1000 | 8.1 | fxp0 | fxp1 fxp2 |

M120 Routing Engines

Table 14 on page 38 lists the Routing Engines supported by the M120 router.

Table 14: 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 fxp2 |
| RE-A-2000-4096 | RE-A-2000 | 8.0R2 | – | fxp0 | em0 bcm0 |
| RE-A-1800X2-8G | RE-A-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | fxp1 fxp2 |
| RE-A-1800X2-16G | RE-A-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | fxp1 fxp2 |
| RE-A-1800X4-16G | RE-A-1800x4 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |

M320 Routing Engines

Table 15 on page 38 lists the Routing Engines supported by the M320 router.

Table 15: 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 fxp2 |
| RE-A-2000-4096 | RE-A-2000 | 8.1 | – | fxp0 | em0 bcm0 |
| RE-A-1800X2-8G | RE-A-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 bcm0 |

Table 15: 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 | <ul style="list-style-type: none"> • 11.4R5 • 12.1R3 | 10.4 | fxp0 | em0 bcm0 |
| RE-A-1800X4-8G | RE-A-1800X4 | <ul style="list-style-type: none"> • 11.4R5 • 12.1R3 • 12.2 | 10.4 | fxp0 | em0 em1 |

MX5, MX10, MX40, and MX80 Routing Engine

Table 16 on page 39 lists the Routing Engines supported by the MX5, MX10, MX40, and MX80 routers.

Table 16: 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 em1 |

NOTE: em1 is used to communicate with the MS-MIC when it is inserted.

MX104 Routing Engines

Table 17 on page 39 lists the Routing Engines supported by MX104 routers.

Table 17: 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 fxp2 |

MX240 Routing Engines

Table 18 on page 40 lists the Routing Engines supported by MX240 routers.

Table 18: 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 fxp2 |
| RE-S-2000-4096 (EOL details: TSB16735) | RE-S-2000 | 9.0 | – | fxp0 | fxp1 fxp2 |
| RE-S-1800X2-8G (EOL details: TSB16556) | RE-S-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800x2-16G (EOL details: TSB16556) | RE-S-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-8G | RE-S-1800X4 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-16G | RE-S-1800x4 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-32G-S | RE-S-1800X4 | <ul style="list-style-type: none"> 12.3R4 13.2R1 | <ul style="list-style-type: none"> 12.3R4 13.2R1 | fxp0 | em0, em1 |
| RE-S-X6-64G | RE-S-2X00x6 | – | 15.1F4 16.1R1 | fxp0 | ixlv0, igb0 |
| RE-S-X6-64G-LT | RE-S-2X00x6-LT | – | 17.2R1 | fxp0 | ixlv0, igb0 em0 |
| RE-S-X6-128G | RE-S-2X00x6-128 | – | 18.1R1 | fxp0 | ixlv0, igb0 em0 |

MX480 Routing Engines

Table 19 on page 41 lists the Routing Engines supported by MX480 routers.

Table 19: 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 fxp2 |
| RE-S-2000-4096 (EOL details: TSB16735) | RE-S-2000 | 8.4 | – | fxp0 | fxp1 fxp2 |
| RE-S-1800X2-8G (EOL details: TSB16556) | RE-S-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X2-16G (EOL details: TSB16556) | RE-S-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-8G | RE-S-1800X4 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-16G | RE-S-1800x4 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-32G-S | RE-S-1800X4 | <ul style="list-style-type: none"> 12.3R4 13.2R1 | <ul style="list-style-type: none"> 12.3R4 13.2R1 | fxp0 | em0 em1 |
| RE-S-X6-64G | RE-S-2X00x6 | – | 15.1F4 16.1R1 | fxp0 | ixlv0, igb0 |
| RE-S-X6-64G-LT | RE-S-2X00x6-LT | – | 17.2R1 | fxp0 | ixlv0, igb0 em0 |
| RE-S-X6-128G | RE-S-2X00x6-128 | – | 18.1R1 | fxp0 | ixlv0, igb0 em0 |

MX960 Routing Engines

Table 20 on page 42 lists the Routing Engines supported by MX960 routers.

Table 20: 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 fxp2 |
| RE-S-2000-4096 (EOL details: TSB16735) | RE-S-2000 | 8.2 | – | fxp0 | fxp1 fxp2 |
| RE-S-1800X2-8G (EOL details: TSB16556) | RE-S-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X2-16G (EOL details: TSB16556) | RE-S-1800x2 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-8G | RE-S-1800x4 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-16G | RE-S-1800x4 | <ul style="list-style-type: none"> 11.4R5 12.1R3 | 10.4 | fxp0 | em0 em1 |
| RE-S-1800X4-32G-S | RE-S-1800x4 | <ul style="list-style-type: none"> 12.3R4 13.2R1 | <ul style="list-style-type: none"> 12.3R4 13.2R1 | fxp0 | em0 em1 |
| RE-S-X6-64G | RE-S-2X00x6 | – | 15.1F4 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 em0 |
| RE-S-X6-128G | RE-S-2X00x6-128 | – | 18.1R1 | fxp0 | ixlv0, igb0 em0 |

MX2008 Routing Engines

Table 21 on page 43 lists the Routing Engines supported by MX2008 routers.

Table 21: 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 ixlv1 |
| REMX2008-X8-64G-LT | REMX2008-X8-64G-LT | 17.2R1 | fxp0 | ixlv0 ixlv1 |
| REMX2008-X8-128G | RE-MX2008-X8-128G | 18.2R1 | fxp0 | ixlv0 ixlv1 |

MX2010 Routing Engines

Table 22 on page 43 lists the Routing Engines supported by MX2010 routers.

Table 22: 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 em1 |
| REMX2K-1800-32G-S | RE-S-1800x4 | <ul style="list-style-type: none"> • 12.3R4 • 13.2R1 | fxp0 | em0 em1 |
| REMX2K-X8-64G | RE-S-2X00x8 | <ul style="list-style-type: none"> • 15.1F5-S1 • 16.1R2 • 16.2R1 | fxp0 | ixlv0 ixlv1 em0 |
| REMX2K-X8-64G-LT | RE-S-2X00x8 | 17.2R1 | fxp0 | ixlv0 ixlv1 em0 |
| REMX2K-X8-128G | RE-MX200X8-128G | 18.1R1 | fxp0 | ixlv0 ixlv1 |

MX2020 Supported Routing Engines

Table 23 on page 44 lists the Routing Engines supported by MX2020 routers.

Table 23: 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 em1 |
| REMX2K-1800-32G-S | RE-S-1800x4 | <ul style="list-style-type: none"> • 12.3R4 • 13.2R1 | fxp0 | em0 em1 |
| REMX2K-X8-64G | RE-S-2X00x8 | <ul style="list-style-type: none"> • 15.1F5-S1 • 16.1R2 • 16.2R1 | fxp0 | ixlv0 ixlv1 em0 |
| REMX2K-X8-64G-LT | RE-S-2X00x8 | 17.2R1 | fxp0 | ixlv0 ixlv1 em0 |
| REMX2K-X8-128G | RE-MX200X8-128G | 18.1R1 | fxp0 | ixlv0 ixlv1 em0 |

MX10003 Routing Engines

Table 24 on page 44 lists the Routing Engines supported by MX10003 routers.

Table 24: 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 em4 |
| JNP10003-RE1-LT | RE-S-1600x8 | 18.1R1 | fxp0 | em3 em4 |

MX10008 Routing Engines

Table 25 on page 45 lists the Routing Engines supported on the MX10008 router.

Table 25: 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 bme1 |
| JNP10K-RE1-LT | RE X10 LT | 18.3R1 | em0 | bme0 bme1 |
| JNP10K-RE1-128 | RE X10 128G | 18.3R1 | em0 | bme0 bme1 |

PTX1000 Routing Engines

Table 26 on page 45 lists the Routing Engine supported on the PTX1000.



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

Table 26: 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 | <ul style="list-style-type: none"> 16.1X65-D30 17.2R1 | em0 | bme0 em1 |

PTX3000 Routing Engines

Table 27 on page 45 lists the Routing Engines supported on the PTX3000.



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

Table 27: 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 ixgbe1 |

Table 27: 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 | em0 | ixlv0 |
| | | 17.1R1 | | ixlv1 |
| | | This Routing Engine does not support Junos OS Release 16.2. | | |

PTX5000 Routing Engines

Table 28 on page 46 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 28: 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 | em0 | ixgbe0 |
| | | 12.3 | | ixgbe1 |
| | | 13.2 | | |
| | | NOTE: The PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1. | | |
| RE-PTX-X8-64G | RE-PTX-2X00x8 | 15.1F4 | em0 | ixlv0 |
| | | 16.1R1 | | ixlv1 |
| | | | | em1 |
| RE-PTX-X8-128G | RE-PTX-2X00x8-128G | 18.1R1 | em0 | ixlv0 |
| | | | | ixlv1 |
| | | | | em1 |

PTX10008 and PTX10016 Routing Engines

Table 29 on page 47 lists the Routing Engines supported on the PTX10008 and PTX10016 routers.

Table 29: 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 bme1 |
| JNP10K-RE1 | RE X10 | 18.2R1 | em0 | bme0 bme1 |
| JNP10K-RE1-LT | RE X10 LT | 18.3R1 | em0 | bme0 bme1 |
| JNP10K-RE1-128 | RE X10 128G | 18.3R1 | em0 | bme0 bme1 |

T320 Routing Engines

Table 30 on page 47 lists the Routing Engines supported by the T320 router.

Table 30: 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 fxp2 |
| RE-1600-2048 (EOL details: TSB14374) | RE-4.0 | 6.2 | fxp0 | fxp1 fxp2 |
| RE-A-2000-4096 | RE-A-2000 | 8.1 | fxp0 | fxp1 fxp2 |

The T320 router supports the CB-T control board.

T640 Routing Engines

Table 31 on page 48 lists the Routing Engines supported by the T640 router.

Table 31: 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 fxp2 |
| RE-1600-2048 (EOL details: TSB14374) | RE-4.0 | 6.2 | – | fxp0 | fxp1 fxp2 |
| RE-A-2000-4096 | RE-A-2000 | 8.1 | – | fxp0 | em0 bcm0 |
| RE-DUO-C1800-8G | RE-DUO-1800 | 32-bit Junos OS on a standalone T640 router: 11.2 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 64-bit Junos OS on a T640 router in a routing matrix: 11.4R9 | em0 | bcm0 em1 |
| RE-DUO-C1800-16G | RE-DUO-1800 | 32-bit Junos OS on a standalone T640 router: 11.4R2 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 64-bit Junos OS on a T640 router in a routing matrix: 11.4R9 | em0 | bcm0 em1 |

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

T1600 Routing Engines

Table 32 on page 48 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 32: 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 fxp2 |

Table 32: 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 fxp2 |
| RE-A-2000-4096 | RE-A-2000 | 8.5 | – | fxp0 | em0 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 <i>NOTE:</i> 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. 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 64-bit Junos OS on a standalone T1600 router: 11.1 | em0 | bcm0 em1 |
| RE-DUO-C1800-16G | RE-DUO-1800 | 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 | 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 | em0 | bcm0 em1 |

T4000 Routing Engines

Table 33 on page 49 lists the Routing Engines supported by the T4000 router.



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

Table 33: 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 T4000 router in a routing matrix: 13.1 | em0 | bcm0 em1 |
| RE-DUO-C1800-16G | RE-DUO-1800 | Standalone T4000 router: 12.1R2 T4000 router in a routing matrix: 13.1 | em0 | bcm0 em1 |

The T4000 router supports the CB-LCC control board.

TX Matrix Routing Engines

Table 34 on page 50 lists the Routing Engines supported by the TX Matrix router.

Table 34: 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 fxp2 |
| RE-1600-2048 (EOL details: TSB14374) | RE-4.0 (RE-1600) | 7.0 | – | fxp0 | fxp1 fxp2 |
| RE-A-2000-4096 | RE-A-2000 | 8.5 | – | fxp0 | em0 bcm0 |
| RE-DUO-C1800-8G | RE-DUO-1800 | 11.4R9 | 11.4R9 | em0 | bcm0 em1 |
| RE-DUO-C1800-16G | RE-DUO-1800 | 11.4R9 | 11.4R9 | em0 | bcm0 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 35 on page 50 lists the Routing Engines supported by the TX Matrix Plus router.

Table 35: 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 ixgbe1 |

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

TX Matrix Plus (with 3D SIBs) Routing Engines

Table 36 on page 51 lists the Routing Engines supported by the TX Matrix Plus router with 3D SIBs.

Table 36: 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 ixgbe1 |

- Related Documentation**
- [Routing Engine Specifications on page 31](#)
 - [Understanding Internal Ethernet Interfaces](#)
 - [Understanding Management Ethernet Interfaces](#)

M320 Control Board (CB) Description

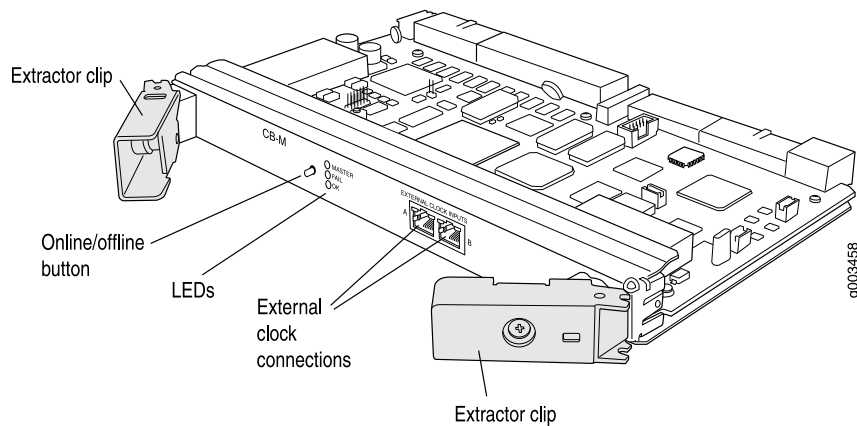
Each CB works with an adjacent Routing Engine to provide control and monitoring functions for the router (see [Figure 16 on page 52](#)). These functions include determining Routing Engine mastership, controlling power and reset for the other router components, monitoring and controlling fan speed, and monitoring system status.

You can install one or two CBs in the router. They install into the upper rear of the chassis in the slots labeled **CB0** and **CB1** (referred to as **CB-0** and **CB-1**, top to bottom) (referred to as **CB-0** and **CB-1**, top to bottom). If two CBs are installed, one functions as the master CB and the other as its backup. If the master fails or is removed, the backup restarts and becomes the master.

Each CB requires a Routing Engine to be installed in the adjacent slot. **CB0** installs above **RE0**, and **CB1** installs below **RE1**. A CB cannot function if a Routing Engine is not present in the adjacent slot.

CBs are hot-pluggable.

Figure 16: CB



Each CB consists of the following components:

- PCI bus—Provides the interface to the Routing Engine.
- 1000Base-T Ethernet controller—Provides a 1-Gbps link between the Routing Engine and the on-board Fast Ethernet switch.
- Fast Ethernet switch—Provides a 100-Mbps Ethernet link to each FPC for Routing Engine data transfers.
- Three LEDs, located on the CB faceplate, indicate the status of the CB. [“M320 Control Board \(CB\) LEDs” on page 53](#) describes the functions of the CB LEDs.
- CB online/offline button, located on the CB faceplate.



NOTE: When the adjacent Routing Engine is online, the online/offline button on the CB faceplate is nonfunctional. For more information, see [“Taking the M320 Host Subsystem Offline” on page 243](#).

- Circuits that control fans and other hardware components in the chassis.
- Internally-generated 19.44-MHz Stratum 3 reference clock for line timing.
- Two RJ-48 connectors for external clock inputs for 19.44-MHz Stratum 3 reference clocks.
- Power circuits for the Routing Engine.

Related Documentation

- [Replacing an M320 Control Board on page 256](#)
- [M320 Routing Engine Description on page 24](#)

M320 Control Board (CB) LEDs

Table 37: M320 CB LEDs

| Label | Color | State | Description |
|--------|--------|-------------|--|
| MASTER | Blue | On steadily | Control board is functioning as the master. |
| FAIL | Yellow | On steadily | Control board has failed. |
| OK | Green | On steadily | Control board is online and is functioning normally. |
| | | Blinking | Control board is powering up, but not online. |

Related Documentation

- [M320 Chassis Description on page 7](#)
- [M320 Control Board \(CB\) Description on page 51](#)
- [Replacing an M320 Control Board on page 256](#)

CHAPTER 6

Line Card Components and Descriptions

- [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
- [M320 FPC Terminology on page 59](#)
- [M320 FPCs Supported on page 59](#)
- [M320 PIC Description on page 60](#)
- [M320 PICs Supported on page 61](#)
- [M320 End-of-Life PICs Supported on page 70](#)
- [M320 PIC Combination Limitations on page 72](#)
- [M320 PIC/FPC Compatibility on page 73](#)

M320 Flexible PIC Concentrator (FPC) Description

Up to eight Flexible PIC Concentrators (FPCs) install vertically in the front of the router (see [Figure 17 on page 56](#)). The FPC slots are numbered left to right from **FPC0** to **FPC7**. Depending on the FPC type, an FPC has either two or four slots into which a PIC can be installed (see [“M320 FPCs Supported” on page 59](#) for more information). An FPC can be installed into any FPC slot on the router, regardless of which PICs it contains.

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

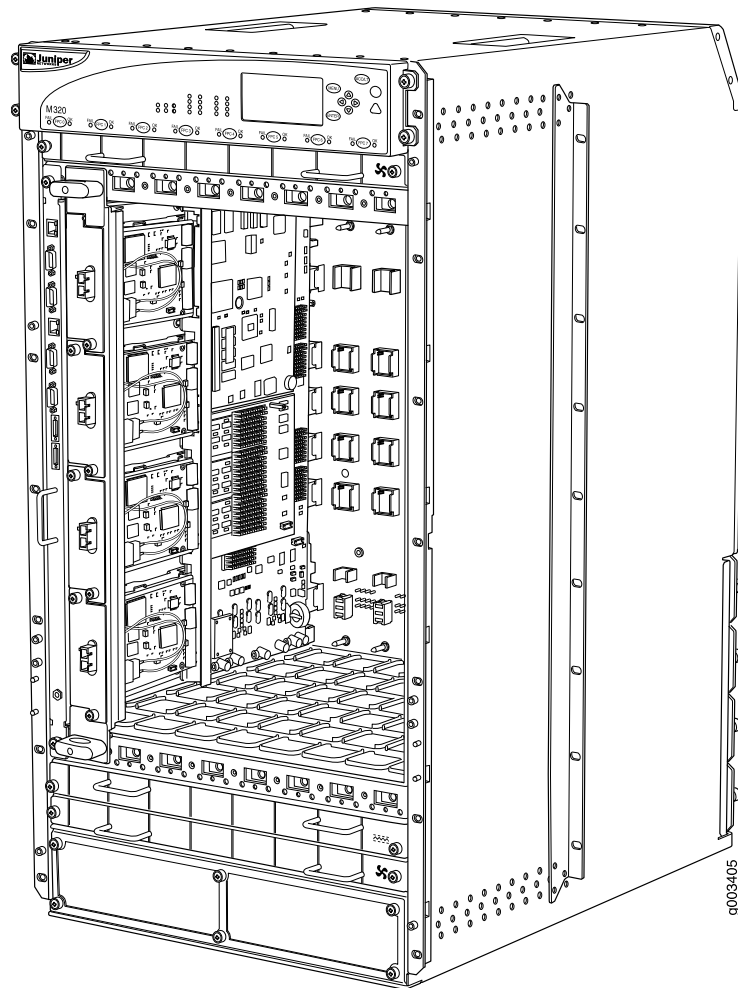
Each FPC consists of the following components:

- FPC card carrier, which includes the PIC slots.
- One Packet Forwarding Engine consisting of Layer 2/Layer 3 Packet Processing ASICs, Switch Interface ASICs, Internet Processor ASICs, and an MMB, which includes the Queuing and Memory Interface ASICs.
- Midplane connectors and power circuitry.
- Processor subsystem (PMB), which includes a 288-MHz CPU, system controller, 256 MB of SDRAM, and two Fast Ethernet interfaces.
- Two LEDs, located on the craft interface above the FPC, that display the status of the FPC. For more information about the FPC LEDs, see [“M320 Craft Interface FPC LEDs and Online/Offline Buttons” on page 18](#).
- FPC online/offline button, located on the craft interface above the FPC.

The Packet Forwarding Engine receives incoming packets from the PICs installed on the FPC and forwards them through the switch planes to the appropriate destination port. Each FPC contains a memory subsystem (MMB) that is managed by the Queuing and Memory Interface ASICs.

FPCs are hot-removable and hot-insertable, as described in “[M320 Field Replaceable Units](#)” on page 209. When you install an FPC into a functioning router, the Routing Engine downloads the FPC software, the FPC runs its diagnostics, and the PICs, housed on the FPC, are enabled. Forwarding continues uninterrupted during this process. When you remove or install an FPC, packet forwarding is not affected. For FPC replacement instructions, see “[Replacing an M320 FPC](#)” on page 259.

Figure 17: FPC Installed in Router Chassis



The M320 router supports the following types of FPCs (see [Figure 18](#) on page 57):

- FPC1, Enhanced II FPC1, and Enhanced III FPC1—Rated at 4 gigabits per second (Gbps) full duplex
- FPC2, Enhanced II FPC2, and Enhanced III FPC2—Rated at 16 Gbps full duplex

- FPC3, Enhanced II FPC3, and Enhanced III FPC3—Rated at 20 Gbps full duplex

Figure 18: FPC1, FPC2, and FPC3 for the M320 Router

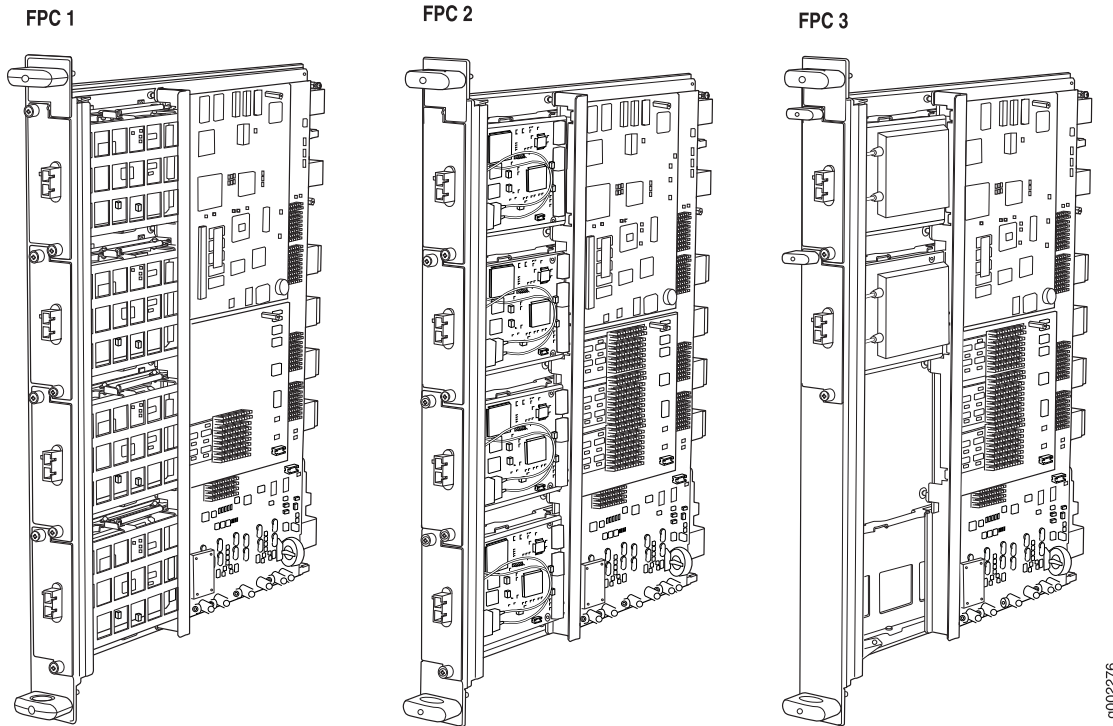


Figure 19 on page 58 shows the Enhanced II FPCs that the M320 router supports.

Figure 19: Enhanced II FPC1, FPC2, and FPC3 for the M320 Router

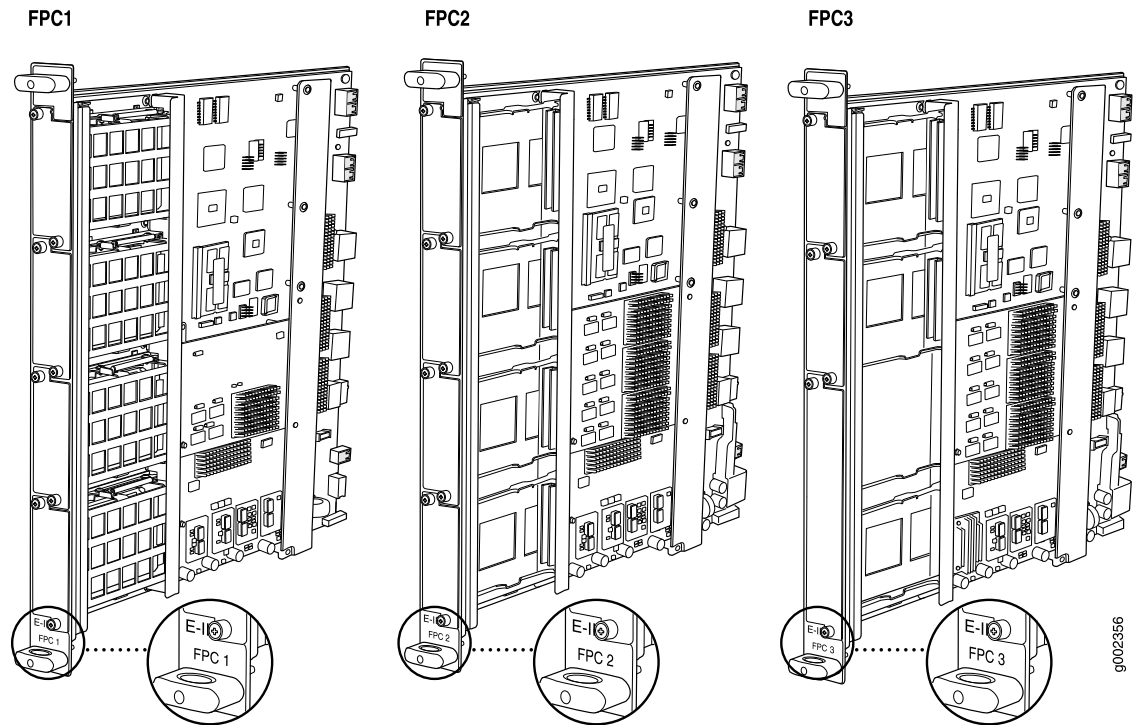
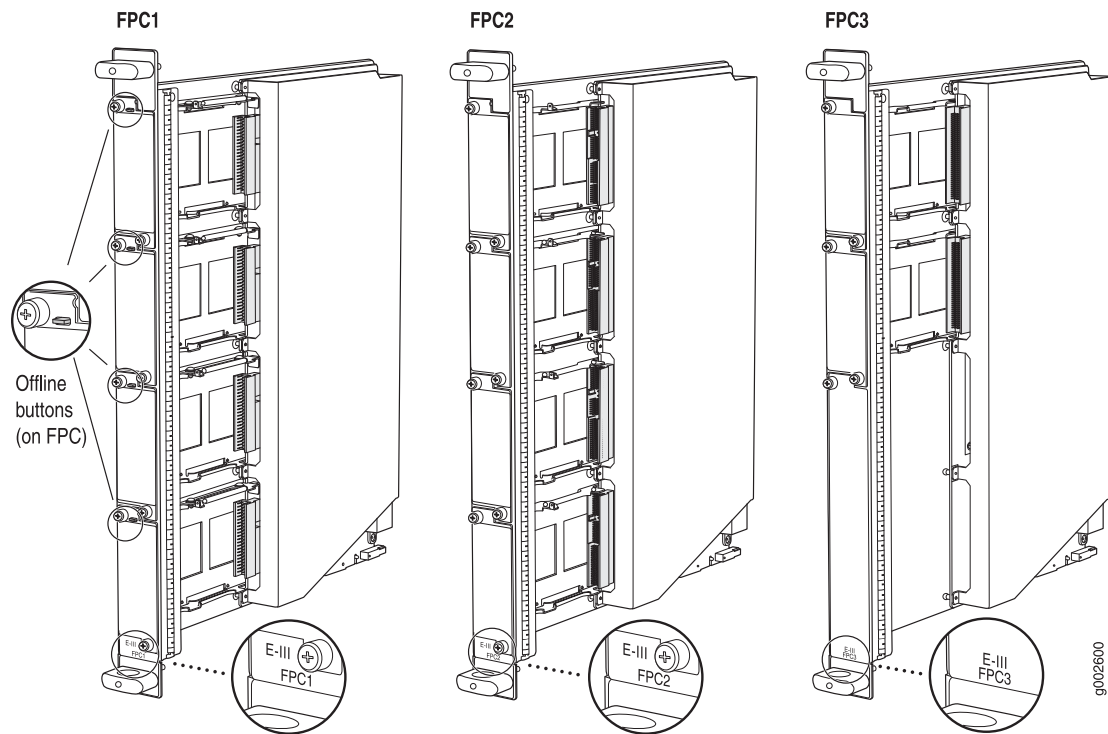


Figure 20 on page 58 shows the Enhanced III FPCs that the M320 router supports.

Figure 20: Enhanced III FPC1, FPC2, and FPC3 for the M320 Router



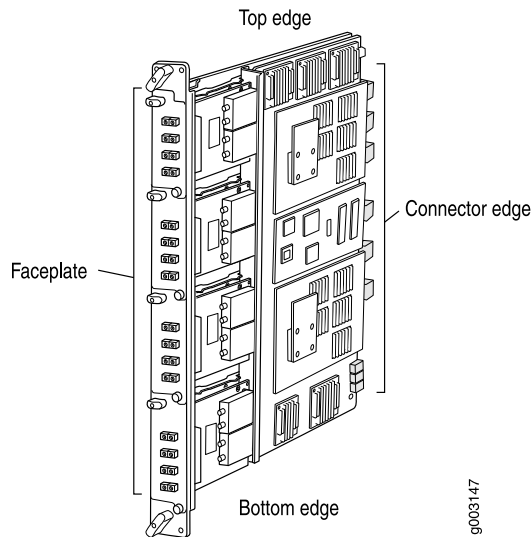
- Related Documentation**
- [Maintaining M320 FPCs on page 309](#)
 - [Storing M320 FPCs on page 313](#)
 - [Troubleshooting the M320 FPCs on page 329](#)

M320 FPC Terminology

Regardless of whether you are holding an FPC vertically or horizontally, this document uses the same terms for all four edges of the FPC (see [Figure 21 on page 59](#)):

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

Figure 21: FPC Edges



- Related Documentation**

M320 FPCs Supported

[Table 38 on page 60](#) lists the FPCs that the M320 router supports. You can install any combination of the following FPCs in the M320 router.

Table 38: FPCs Supported by the M320 Router

| FPC Type | FPC Name | FPC Model Number | Maximum Number of PICs Supported | Maximum Throughput per FPC (Full-Duplex) | First Junos OS Release |
|----------|-------------------|------------------|----------------------------------|--|------------------------|
| 1 | FPC1 | M320-FPC1 | 4 | 4 Gbps | 6.2 |
| 1 | Enhanced II FPC1 | M320-FPC1-E2 | 4 | 4 Gbps | 7.5 |
| 1 | Enhanced III FPC1 | M320-FPC1-E3 | 4 | 4 Gbps | 8.4 |
| 2 | FPC2 | M320-FPC2 | 4 | 16 Gbps | 6.2 |
| 2 | Enhanced II FPC2 | M320-FPC2-E2 | 4 | 16 Gbps | 7.5 |
| 2 | Enhanced III FPC2 | M320-FPC2-E3 | 4 | 16 Gbps | 8.4 |
| 3 | FPC3 | M320-FPC3 | 2 | 20 Gbps | 6.2 |
| 3 | Enhanced II FPC3 | M320-FPC3-E2 | 2 | 20 Gbps | 7.5 |
| 3 | Enhanced III FPC3 | M320-FPC3-E3 | 2 | 20 Gbps | 8.4 |

- Related Documentation**
- [Maintaining M320 FPCs on page 309](#)
 - [Replacing an M320 FPC on page 259](#)
 - [Troubleshooting the M320 FPCs on page 329](#)

M320 PIC Description

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

PICs are hot-removable and hot-insertable. You can install up to four PICs in the slots of each Type 1 and Type 2 FPC, and up to two PICs in the slots of each Type 3 FPC. Type 1 and Type 2 PICs have captive screws at their upper and lower corners. Type 3 PICs have an upper ejector handle and a lower captive screw.

The router supports various PICs, including ATM, Channelized, Gigabit Ethernet, IP Services, and SONET/SDH interfaces. 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.

- Related Documentation**
- [M320 PICs Supported on page 61](#)
 - [M320 End-of-Life PICs Supported on page 70](#)
 - [Maintaining M320 PICs and PIC Cables on page 314](#)
 - [Replacing an M320 PIC on page 266](#)
 - [Troubleshooting the M320 PICs on page 331](#)

M320 PICs Supported

The following tables list the PICs supported by the M320 router. The PICs are listed alphabetically by PIC family.



NOTE: The M320 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 [“M320 End-of-Life PICs Supported” on page 70](#) topic lists PICs that moved to end-of-life before the M320 router itself moved to end-of-life.

- [Table 39 on page 61](#) lists the ATM IQ PICs.
- [Table 40 on page 62](#) lists the ATM2 IQ PICs.
- [Table 41 on page 62](#) lists the Channelized PICs.
- [Table 42 on page 63](#) lists the Channelized IQ PICs.
- [Table 43 on page 63](#) lists the Channelized IQE PICs.
- [Table 44 on page 64](#) lists the Circuit Emulation PICs.
- [Table 45 on page 64](#) lists the DS3, E1, E3, and T1 PICs.
- [Table 46 on page 65](#) lists the EIA-530 PIC.
- [Table 47 on page 65](#) lists the Fast Ethernet PICs.
- [Table 48 on page 66](#) lists the Gigabit Ethernet PICs.
- [Table 49 on page 68](#) lists the 10-Gigabit Ethernet PICs.
- [Table 50 on page 68](#) lists the Services PICs.
- [Table 51 on page 69](#) lists the SONET/SDH PICs.

Table 39: ATM IQ PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--------------------------------------|-------|------------------------------------|--|--------------------------------|
| <i>ATM OC3 EOL PIC (M320 Router)</i> | 2 | PB-2OC3-ATM-MM PB-2OC3-ATM-SMIR | <ul style="list-style-type: none"> • Duplex SC/PC connector (RX and TX) | 6.3 |

Table 39: ATM IQ PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---------------------------------------|-------|--------------------------------------|--|--------------------------------|
| <i>ATM OC12 EOL PIC (M320 Router)</i> | 1 | PB-1OC12-ATM-MM PB-1OC12-ATM-SMIR | <ul style="list-style-type: none"> Duplex SC/PC connector (RX and TX) | 6.3 |

Table 40: ATM2 IQ PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|--|--|--------------------------------|
| <i>ATM2 DS3 IQ PIC (M320 Router)</i> | 4 | PB-4DS3-ATM2 | Coaxial: <ul style="list-style-type: none"> 10 ft (3.05 m) posilock SMB to BNC (provided) Four pairs of Rx and Tx coaxial cables | 6.4 |
| <i>ATM2 E3 IQ PIC (M320 Router)</i> | 4 | PB-4E3-ATM2 | Coaxial: <ul style="list-style-type: none"> 10 ft (3.05 m) posilock SMB to BNC cable (provided) Four pairs of Rx and Tx coaxial cables | 6.3 |
| <i>ATM2 OC3/STM1 IQ PIC (M320 Router)</i> | 2 | PB-2OC3-ATM2-MM PB-2OC3-ATM2-SMIR | <ul style="list-style-type: none"> Optical: SC/PC | 6.2 |
| <i>ATM2 OC12/STM4 IQ PICs (M320 Router)</i> | | | | |
| <ul style="list-style-type: none"> ATM2 OC12/STM4 IQ PIC | 1 | PB-1OC12-ATM2-MM PB-1OC12-ATM2-SMIR | <ul style="list-style-type: none"> Optical: SC/PC | 6.2 |
| <ul style="list-style-type: none"> ATM2 OC12/STM4 IQ PIC | 2 | PB-2OC12-ATM2-MM PB-2OC12-ATM2-SMIR | <ul style="list-style-type: none"> Optical: SC/PC | 6.2 |
| <i>ATM2 OC48/STM16 IQ PIC with SFP (M320 Router)</i> | 1 | PB-1OC48-ATM2-SFP | <ul style="list-style-type: none"> Optical: LC/PC | 7.3 |

Table 41: Channelized PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|--------------------|--|--------------------------------|
| <i>Channelized DS3 EOL PIC (M320 Router)</i> | 4 | PB-4CHDS3 | <ul style="list-style-type: none"> Custom 10-ft (3.05-m) posilock to BNC male cable, separate RX and TX | 6.3 |
| <i>Channelized OC12 EOL PIC (M320 Router)</i> | 1 | PB-1CHOC12DS3-SMIR | <ul style="list-style-type: none"> Duplex SC/PC connector (RX and TX) | 6.3 |

Table 41: Channelized PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|--------------|--|--------------------------------|
| <i>Multichannel DS3 EOL PIC (M320 Router)</i> | 2 | PB-2MCDS3 | <ul style="list-style-type: none"> Custom 10 ft/3.05 m posilock to BNC male cable, separate Rx and Tx | 6.2 |

Table 42: Channelized IQ PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|----------------------|---|--------------------------------|
| <i>Channelized DS3 IQ PIC (M320 Router)</i> | 4 | PB-4CHDS3-QPP | Coaxial <ul style="list-style-type: none"> Standard DS3 BNC coaxial cable interfaces | 6.2 |
| <i>Channelized E1 IQ PIC (M320 Router)</i> | 10 | PB-10CHE1-RJ48-QPP-N | <ul style="list-style-type: none"> 120-ohm RJ-48C | 9.1R4 9.2R3 9.3R1 |
| <i>Channelized OC3 IQ PIC (M320 Router)</i> | 1 | PB-1CHOC3-SMIR-QPP | <ul style="list-style-type: none"> Optical: SC/PC | 7.1 |
| <i>Channelized OC12 IQ EOL PIC (M320 Router)</i> | 1 | PB-1CHOC12SMIR-QPP | <ul style="list-style-type: none"> Duplex SC/PC connector (Rx and Tx); single-mode fiber | 6.2 |
| <i>Channelized STM1 IQ PIC (M320 Router)</i> | 1 | PB-1CHSTM1-SMIR-QPP | <ul style="list-style-type: none"> Optical: SC/PC | 6.2 |
| <i>Channelized T1 IQ PIC (M320 Router)</i> | 10 | PB-10CHT1-RJ48-QPP | <ul style="list-style-type: none"> 120-ohm RJ-48C connector (female) | 7.4 |

Table 43: Channelized IQE PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|------------------------|---|--------------------------------|
| <i>Channelized DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)</i> | 4 | PB-4CHDS3-E3-IQE-BNC | Coaxial <ul style="list-style-type: none"> Standard DS3 BNC coaxial cable interfaces | 9.3 |
| <i>Channelized E1/T1 Enhanced IQ (IQE) PIC (M320 Router)</i> | 10 | PB-10CHE1-T1-IQE-RJ48 | <ul style="list-style-type: none"> 120-ohm RJ-48C connector (female) | 9.5 |
| <i>Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router)</i> | 2 | PB-2CHOC3-STM1-IQE-SFP | <ul style="list-style-type: none"> Optical: LC/PC | 9.3 |

Table 43: Channelized IQE PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|--------------------------|------------------|--------------------------------|
| <i>Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router)</i> | | | | |
| • Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP | 1 | PB-1CHOC12-STM4-IQE-SFP | • Optical: LC/PC | 9.3 |
| • Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP | 4 | PB-4CHOC12-STM4-IQE-SFP | • Optical: LC/PC | 9.4 |
| <i>Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router)</i> | 1 | PB-1CHOC48-STM16-IQE-SFP | • Optical: LC/PC | 9.4 |

Table 44: Circuit Emulation PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|--------------------|--|--------------------------------|
| <i>Channelized OC3/STM1 Circuit Emulation PIC with SFP (M320 Router)</i> | 4 | PB-4CHOC3-CE-SFP | • Optical: LC/PC | 9.4 |
| <i>E1/T1 Circuit Emulation PIC (M320 Router)</i> | 12 | PB-12T1E1-CE-TELCO | <ul style="list-style-type: none"> • RJ-21 connector • Cables are rated for intra-building connections only. | 9.4 |

Table 45: DS3, E1, E3, and T1 PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|--------------------|---|--------------------------------|
| <i>DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)</i> | 4 | PB-4DS3-E3-IQE-BNC | Coaxial | 9.3R2 |
| | | | <ul style="list-style-type: none"> • Standard DS3 BNC coaxial cable interfaces | |
| <i>DS3 EOL PIC (M320 Router)</i> | 4 | PB-2DS3 | <ul style="list-style-type: none"> • Custom 10-ft (3.05-m) posilock SMB to BNC male cable, separate Rx and Tx (provided) | 6.2 |

Table 45: DS3, E1, E3, and T1 PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--------------------------------|-------|----------------------------|--|--------------------------------|
| <i>E1 PICs (M320 Router)</i> | 4 | PB-4E1-COAX PB-4E1-RJ48 | <ul style="list-style-type: none"> Four RJ-48 connectors (one per port) Four coaxial connectors Custom 10-ft (3.05-m) posilock to BNC male cable, separate Rx and Tx | 6.4 |
| <i>E3 PIC (M320 Router)</i> | 4 | PB-4E3-QPP | <ul style="list-style-type: none"> Custom 10 ft (3.05 m) posilock to BNC male cable, separate RX and TX | 6.3 |
| <i>E3 IQ PIC (M320 Router)</i> | 4 | PB-4E3-QPP | Coaxial <ul style="list-style-type: none"> Standard DS3 BNC coaxial cable interfaces | 6.2 |
| <i>T1 PIC (M320 Router)</i> | 4 | PB-4T1-RJ48 | <ul style="list-style-type: none"> 100-ohm RJ-48 connector | 6.4 |

Table 46: EIA-530 PIC Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|----------------------------------|-------|--------------|---|--------------------------------|
| <i>EIA-530 PIC (M320 Router)</i> | 2 | PB-2EIA530 | <ul style="list-style-type: none"> Two DB-25 male connectors (one per port, included with PIC) 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) X.21 requires an EIA-530 to X.21 cable and connects to a X.21 DTE DB-15 male cable | 6.2 |

Table 47: Fast Ethernet PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|--------------|---|--------------------------------|
| <i>Fast Ethernet PICs (M320 Router)</i> | | | | |
| <ul style="list-style-type: none"> Fast Ethernet PIC | 4 | PB-4FE-TX | <ul style="list-style-type: none"> RJ-45 Two-pair, Category 5 unshielded twisted-pair Pinout: MDI noncrossover | 6.2 |

Table 47: Fast Ethernet PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---------------------|-------|-----------------------------------|--|--------------------------------|
| • Fast Ethernet PIC | 8 | PB-8FE-FX | • MT-RJ female | 6.3 |
| • Fast Ethernet PIC | 12 | PB-12FE-TX-MDI PB-12FE-TX-MDIX | • One very high density connector interface (VHDCI) to RJ-21 cable that connects to an RJ-45 patch panel | 6.2 |
| • Fast Ethernet PIC | 48 | PB-48FE-TX | • Four VHDCI connectors VHDCI-to-RJ-21 cables that connect to an RJ-45 patch panel | 6.4 |

Table 48: Gigabit Ethernet PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|--------------|--|--------------------------------|
| Gigabit Ethernet | | | | |
| <i>Gigabit Ethernet PICs with SFP (M320 Router)</i> | | | | |
| • Gigabit Ethernet PIC with SFP | 1 | PB-1GE-SFP | • Optical: LC/PC • Copper: RJ-45 • Four-pair, Category 5 shielded twisted-pair connectivity • Pinout: MDI crossover | 6.4 |
| • Gigabit Ethernet PIC with SFP | 2 | PB-2GE-SFP | • Optical: LC/PC • Copper: RJ-45 • Four-pair, Category 5 shielded twisted-pair connectivity | 6.4 |
| • Gigabit Ethernet PIC with SFP | 4 | PB-4GE-SFP | • Optical: LC/PC • Copper: RJ-45 • Four-pair, Category 5 shielded twisted-pair connectivity | 7.0 |
| • Gigabit Ethernet PIC with SFP | 10 | PC-10GE-SFP | • Optical: LC/PC • Copper: RJ-45 • Four-pair, Category 5 shielded twisted-pair connectivity | 6.2 |

Table 48: Gigabit Ethernet PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|----------------------|--|--------------------------------|
| Gigabit Ethernet IQ | | | | |
| <i>Gigabit Ethernet IQ PICs with SFP (M320 Router)</i> | | | | |
| • Gigabit Ethernet IQ PIC with SFP | 1 | PB-1GE-SFP-QPP | <ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity Pinout: MDI crossover | 6.2 |
| • Gigabit Ethernet IQ PIC with SFP | 2 | PB-2GE-SFP-QPP | <ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity Pinout: MDI crossover | 6.2 |
| Gigabit Ethernet IQ2 | | | | |
| <i>Gigabit Ethernet IQ2 PICs with SFP (M320 Router)</i> | | | | |
| • Gigabit Ethernet IQ2 PIC with SFP | 4 | PB-4GE-TYPE1-SFP-IQ2 | <ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity | 7.6R3 |
| • Gigabit Ethernet IQ2 PIC with SFP | 8 | PB-8GE-TYPE2-SFP-IQ2 | <ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity | 7.6R2 |
| • Gigabit Ethernet IQ2 PIC with SFP | 8 | PC-8GE-TYPE3-SFP-IQ2 | <ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity | 8.2 |
| Gigabit Ethernet IQ2E | | | | |
| <i>Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router)</i> | | | | |

Table 48: Gigabit Ethernet PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|-----------------------|---|--------------------------------|
| <ul style="list-style-type: none"> Type 1 Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP | 4 | PB-4GE-TYPE1-SFP-IQ2E | <ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity | 9.4 |
| <ul style="list-style-type: none"> Type 2 Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP | 8 | PB-8GE-TYPE2-SFP-IQ2E | <ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity | 9.4 |
| <ul style="list-style-type: none"> Type 3 Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with SFP | 8 | PC-8GE-TYPE3-SFP-IQ2E | <ul style="list-style-type: none"> Optical: LC/PC Copper: RJ-45 <ul style="list-style-type: none"> Four-pair, Category 5 shielded twisted-pair connectivity | 9.4 |

Table 49: 10-Gigabit Ethernet PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|------------------------|--|--------------------------------|
| 10-Gigabit Ethernet PIC with XENPAK (M320 Router) | 1 | PC-1XGE-XENPAK | <ul style="list-style-type: none"> XENPAK | 6.2 |
| 10-Gigabit Ethernet DWDM PIC (M320 Router) | 1 | PC-1XGE-DWDM-CBAND | <ul style="list-style-type: none"> Optical: SC/PC | 7.5 |
| 10-Gigabit Ethernet IQ2 PIC with XFP (M320 Router) | 1 | PC-1XGE-TYPE3-XFP-IQ2 | <ul style="list-style-type: none"> Optical: LC/PC | 8.0R3 |
| 10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M320 Router) | 1 | PC-1XGE-TYPE3-XFP-IQ2E | <ul style="list-style-type: none"> Optical: LC/PC | 9.4 |

Table 50: Service PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|--------------|--|--------------------------------|
| <i>Multiservices PICs (M320 Router)</i> | | | | |
| <ul style="list-style-type: none"> 100 Multiservices PIC | 0 | PB-MS-100-1 | <ul style="list-style-type: none"> None | 8.1 |

Table 50: Service PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|--------------|-----------|--------------------------------|
| • 400 Multiservices PIC | 0 | PB-MS-400-2 | • None | 8.1R2 |
| • 500 Multiservices PIC | 0 | PB-MS-500-3 | • None | 8.3 |
| <i>Tunnel Services PIC (M320 Router)</i> | | | | |
| • Type 1 Tunnel Services PIC | 0 | PB-TUNNEL-1 | • None | 6.2 |
| • Type 2 Tunnel Services PIC | 0 | PB-TUNNEL | • None | 6.2 |
| • Type 3 Tunnel Services PIC | 0 | PC-TUNNEL | • None | 6.3 |

Table 51: SONET/SDH PICs Supported by the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|------------------------|------------------|--------------------------------|
| SONET/SDH | | | | |
| <i>SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router)</i> | 4 | PB-4OC3-STM1-IQE-SFP | • Optical: LC/PC | 9.3R2 |
| <i>SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M320 Router)</i> | | | | |
| • SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP | 4 | PB-4OC3-1OC12-SON-SFP | • Optical: LC/PC | 8.4 |
| • SONET/SDH OC3/STM1 (Multi-Rate) PIC with SFP | 4 | PB-4OC3-1OC12-SON2-SFP | • Optical: LC/PC | 8.3 |
| <i>SONET/SDH OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router)</i> | 1 | PB-1OC12-STM4-IQE-SFP | • Optical: LC/PC | 9.3 |
| <i>SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M320 Router)</i> | | | | |
| • SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP | 1 | PB-1OC12-SON-SFP | • Optical: LC/PC | 8.4 |
| • SONET/SDH OC12/STM4 (Multi-Rate) PIC with SFP | 4 | PB-4OC3-4OC12-SON-SFP | • Optical: LC/PC | 8.3 |
| <i>SONET/SDH OC48c/STM16 PICs with SFP (M320 Router)</i> | 4 | PC-4OC48-SON-SFP | • Optical: LC/PC | 6.2 |
| <i>SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router)</i> | 4 | PC-4OC48-STM16-IQE-SFP | • Optical: LC/PC | 10.4R2 |

Table 51: SONET/SDH PICs Supported by the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|--------------------|--|--------------------------------|
| SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M320 Router) | 1 | PB-1OC48-SON-B-SFP | • Optical: LC/PC | 8.3 |
| SONET/SDH OC192c/STM64 PIC (M320 Router) | 1 | PC-1OC192-SON-VSR | • 12-ribbon multimode fiber with MTP connector | 6.2 |
| SONET/SDH OC192/STM64 PIC with XFP (M320 Router) | 1 | PC-1OC192-SON-XFP | • Optical: LC/PC | 8.1 |

- Related Documentation**
- [M320 PIC Description on page 60](#)
 - [M320 PIC Combination Limitations on page 72](#)
 - [M320 FPCs Supported on page 59](#)
 - [M320 PIC/FPC Compatibility on page 73](#)

M320 End-of-Life PICs Supported

Table 52 on page 70 lists the end-of-life PICs supported by the M320 router. The PICs are listed alphabetically by PIC family.



NOTE: The M320 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 “M320 PICs Supported” on page 61 topic lists PICs that had not moved to end-of-life before the M320 router itself moved to end-of-life.

Table 52: End-of-Life PICs Supported in the M320 Router

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--------------------------------|-------|--------------------------------------|-----------|--------------------------------|
| ATM | | | | |
| ATM OC3 EOL PIC (M320 Router) | 2 | PB-2OC3-ATM-MM PB-2OC3-ATM-SMIR | | 6.3 |
| ATM OC12 EOL PIC (M320 Router) | 1 | PB-1OC12-ATM-MM PB-1OC12-ATM-SMIR | | 6.3 |

Channelized

Table 52: End-of-Life PICs Supported in the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|--|-------|-------------------------------------|-----------|--------------------------------|
| <i>Channelized DS3 EOL PIC (M320 Router)</i> | 4 | PB-4CHDS3 | | 6.3 |
| <i>Channelized OC12 EOL PIC (M320 Router)</i> | 1 | PB-1CHOC12DS3-SMIR | | 6.3 |
| <i>Multichannel DS3 EOL PIC (M320 Router)</i> | 2 | PB-2MCDS3 | | 6.2 |
| Channelized IQ | | | | |
| <i>Channelized E1 IQ EOL PIC (M320 Router)</i> | 10 | PB-10CHE1-RJ48-QPP | | 6.2 |
| <i>Channelized OC12 IQ EOL PIC (M320 Router)</i> | 1 | PB-1CHOC12SMIR-QPP | | 6.2 |
| DS3 | | | | |
| <i>DS3 EOL PIC (M320 Router)</i> | 4 | PB-2DS3 | | 6.2 |
| Ethernet | | | | |
| <i>Gigabit Ethernet EOL PICs (M320 Router)</i> | 1 | PB-1GE-LH PB-1GE-LX PB-1GE-SX | | 6.2 |
| <i>Gigabit Ethernet EOL PICs (M320 Router)</i> | | | | |
| • Gigabit Ethernet PIC | 2 | PB-2GE-LX PB-2GE-SX | | 6.2 |
| • Gigabit Ethernet PIC | 4 | PB-4GE-SX | | 6.2 |
| <i>10-Gigabit Ethernet EOL PIC (M320 Router)</i> | 1 | PC-1XGE-LR | | 6.2 |
| Services | | | | |
| <i>Adaptive Services II EOL PIC (M320 Router)</i> | 0 | PB-AS2 | • None | 6.4 |
| <i>Adaptive Services II Layer 2 Services EOL PIC (M320 Router)</i> | 0 | PB-AS2-LAYER2SERVICES | • None | 7.5 |
| <i>Adaptive Services II FIPS EOL PIC (M320 Router)</i> | 0 | PB-AS2-FIPS | • None | 7.2 |
| <i>ES EOL PIC (M320 Router)</i> | 0 | PB-ES-800 | • None | 6.2 |

Table 52: End-of-Life PICs Supported in the M320 Router (continued)

| PIC Family and Type | Ports | Model Number | Connector | First Junos OS Release Support |
|---|-------|--|-----------|--------------------------------|
| <i>Link Services EOL PIC (M320 Router)</i> | 0 | PB-LS-4 PB-LS-32 PB-LS-128 | • None | 6.2 |
| <i>Monitoring Services II EOL PIC (M320 Router)</i> | 0 | PB-PM2 | • None | 6.0 |
| <i>Monitoring Services III EOL PIC (M320 Router)</i> | 0 | PB-PM3 | • None | 7.4 |
| SONET/SDH | | | | |
| <i>SONET/SDH OC3c/STM1 EOL PICs (M320 Router)</i> | 4 | PB-4OC3-SON-MM PB-4OC3-SON-SMIR | | 6.2 |
| <i>SONET/SDH OC12c/STM4 EOL PICs (M320 Router)</i> | | | | |
| • SONET/SDH OC12c/STM4 PIC | 1 | PB-1OC12-SON-MM | | 6.2 |
| • SONET/SDH OC12c/STM4 PIC | 4 | PB-4OC12-SON-MM PB-4OC12-SON-SMIR | | 6.2 |
| <i>SONET/SDH OC48c/STM16 EOL PICs (M320 Router)</i> | | | | |
| • SONET/SDH OC48c/STM16 PIC | 1 | PB-1OC48-SON-SMLR PB-1OC48-SON-SMSR | | 6.2 |
| • SONET/SDH OC48c/STM16 PIC | 4 | PC-4OC48-SON-SMSR | | 6.2 |
| <i>SONET/SDH OC48c/STM16 EOL PIC with SFP (M320 Router)</i> | 1 | PB-1OC48-SON-SFP | | 6.2 |
| <i>SONET/SDH OC192c/STM64 EOL PICs (M320 Router)</i> | 1 | PC-1OC192-SON-LR PC-1OC192-SON-SR2 | | 5.4 |

Related Documentation • [M320 PIC Description on page 60](#)

M320 PIC Combination Limitations

In most cases, you can install PICs of different media types on the same FPC as long as the FPC and the router support those PICs. However, configuration rules might limit certain combinations of PICs on some platforms.

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, and Multiservices PICs use more. To conserve memory, you can group PICs in the same family together on the same FPC.

If you have different PIC families on a single FPC, review the configuration rules to plan which PICs to install on the FPCs for your router. Consult technical bulletin [PSN-2007-01-023](#) for information about configuration rules for PIC combinations on the Juniper Networks Support site at <https://www.juniper.net/alerts/>.

When you upgrade to Junos OS Release 7.5 or later, a warning appears if any configuration rules affect your PIC combinations. If you continue the installation, one or more PICs might appear to be online (the LEDs are on), but the Junos OS cannot enable them and they cannot pass traffic. As a workaround, you can:

- Install a Junos OS release that supports the combination.
- Install PICs on a different FPC.
- Remove PICs from the affected FPC.

Related Documentation

- [M320 PIC Description on page 60](#)
- [M320 PICs Supported on page 61](#)
- [M320 FPCs Supported on page 59](#)
- [M320 PIC/FPC Compatibility on page 73](#)

M320 PIC/FPC Compatibility

The PIC/FPC compatibility matrixes list the first Junos OS Release in which an FPC supports each PIC currently supported for the M320 router. For example, Junos OS Release 7.5 is the first release in which the E-II-FPC1 supports the ATM2 OC3/STM1 IQ, 2-port PIC.



NOTE: A – indicates that the PIC is not supported by the FPC.

- [PIC/FPC Compatibility \(Type 1 FPCs and Type 1 PICs\) on page 73](#)
- [PIC/FPC Compatibility \(Type 2 FPCs and Type 2 PICs\) on page 76](#)
- [PIC/FPC Compatibility \(Type 3 FPCs and Type 3 PICs\) on page 78](#)

PIC/FPC Compatibility (Type 1 FPCs and Type 1 PICs)

[Table 53 on page 74](#) provides a PIC/FPC compatibility matrix for the current Type 1 PICs for the M320 router and Type 1 FPCs. A link to the PIC description is included in the table.

Table 53: M320 PIC/FPC Compatibility Type 1

| PIC | PIC Model Number | FPC1 | E-II FPC1 | E-III FPC1 |
|--|-----------------------|-------|-----------|------------|
| ATM2 IQ PICs | | | | |
| <i>ATM2 DS3 IQ PIC (M320 Router)</i> 4-port | PB-4DS3-ATM2 | 6.4 | 7.5 | 8.4 |
| <i>ATM2 E3 IQ PIC (M320 Router)</i> 4-port | PB-4E3-ATM2 | 6.3 | 7.5 | 8.4 |
| <i>ATM2 OC3/STM1 IQ PIC (M320 Router)</i> 2-port | PB-2OC3-ATM2-MM | 6.2 | 7.5 | 8.4 |
| | PB-2OC3-ATM2-SMIR | 6.2 | 7.5 | 8.4 |
| <i>ATM2 OC12/STM4 IQ PICs (M320 Router)</i> 1-port | PB-1OC12-ATM2-MM | 6.2 | 7.5 | 8.4 |
| | PB-1OC12-ATM2-SMIR | 6.2 | 7.5 | 8.4 |
| | PB-1OC12-ATM2-MM | 6.2 | 7.5 | 8.4 |
| Channelized Circuit Emulation PICs | | | | |
| <i>Channelized OC3/STM1 Circuit Emulation PIC with SFP (M320 Router)</i> | PB-4CHOC3-CE-SFP | – | – | 9.4 |
| Channelized IQ PICs | | | | |
| <i>Channelized DS3 IQ PIC (M320 Router)</i> 4-port | PB-4CHDS3-QPP | 6.2 | 7.5 | 8.4 |
| <i>Channelized E1 IQ PIC (M320 Router)</i> 10-port | PB-1OCHE1-RJ48-QPP-N | 9.1R4 | 9.1R4 | 9.1R4 |
| | | 9.2R3 | 9.2R3 | 9.2R3 |
| | | 9.3R1 | 9.3R1 | 9.3R1 |
| <i>Channelized OC3 IQ PIC (M320 Router)</i> 1-port | PB-1CHOC3-SMIR-QPP | 7.1 | 7.5 | 8.4 |
| <i>Channelized STM1 IQ PIC (M320 Router)</i> 1-port | PB-1CHSTM1-SMIR-QPP | 6.2 | 7.5 | 8.4 |
| <i>Channelized T1 IQ PIC (M320 Router)</i> 10-port | PB-1OCHT1-RJ48-QPP | 7.4 | 7.5 | 8.4 |
| Channelized Enhanced IQ (IQE) PICs | | | | |
| <i>Channelized DS3/E3 Enhanced IQ (IQE) PIC (M320 Router)</i> 4-port | PB-4CHDS3-E3-IQE-BNC | – | 9.3 | 9.3 |
| <i>Channelized E1/T1 Enhanced IQ (IQE) PIC (M320 Router)</i> 10-port | PB-1OCHE1-T1-IQE-RJ48 | – | 9.5 | 9.5 |

Table 53: M320 PIC/FPC Compatibility Type 1 (continued)

| PIC | PIC Model Number | FPC1 | E-II FPC1 | E-III FPC1 |
|---|-------------------------|------|-----------|------------|
| <i>Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router) 2-port</i> | PB-2CHOC3-STM1-IQE-SFP | – | 9.3 | 9.3 |
| <i>Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router) IQE, 1-port</i> | PB-1CHOC12-STM4-IQE-SFP | – | 9.3 | 9.3 |
| T1, DS3, E1, E3 PICs | | | | |
| <i>DS3 EOL PIC (M320 Router), 4-port</i> | PB-4DS3 | – | 6.2 | – |
| <i>DS3/E3 Enhanced IQ (IQE) PIC (M320 Router) 4-port</i> | PB-4DS3-E3-IQE-BNC | – | 9.3R2 | 9.3R2 |
| <i>E1 PICs (M320 Router), 4-port</i> | PB-4E1-COAX | 6.4 | 7.5 | 8.4 |
| | PB-4E1-RJ48 | 6.4 | 7.5 | 8.4 |
| <i>E1/T1 Circuit Emulation PIC (M320 Router), 12-port</i> | PB-12T1E1-CE-TELCO | – | – | 9.4 |
| <i>E3 PIC (M320 Router), 4-port</i> | PB-4E3 | 6.3 | 7.5 | – |
| <i>T1 PIC (M320 Router), 4-port</i> | PB-4T1-RJ48 | 6.4 | 7.5 | 8.4 |
| E3 IQ PIC | | | | |
| <i>E3 IQ PIC (M320 Router), 4-port</i> | PB-4E3-QPP | 6.2 | 7.5 | 8.4 |
| EIA-530 PIC | | | | |
| <i>EIA-530 PIC (M320 Router), 2-port</i> | PB-2EIA530 | 6.2 | 7.5 | 8.4 |
| Ethernet PICs | | | | |
| <i>Fast Ethernet PICs (M320 Router), 4-port</i> | PB-4FE-TX | 6.2 | 7.5 | 8.4 |
| <i>Fast Ethernet PICs (M320 Router), 8-port</i> | PB-8FE-FX | 6.3 | 7.5 | 8.4 |
| <i>Fast Ethernet PICs (M320 Router), 12-port</i> | PB-12FE-TX | 6.2 | 7.5 | 8.4 |

Table 53: M320 PIC/FPC Compatibility Type 1 (continued)

| PIC | PIC Model Number | FPC1 | E-II FPC1 | E-III FPC1 |
|--|-----------------------|-------|-----------|------------|
| <i>Gigabit Ethernet PICs with SFP (M320 Router), 1-port SFP</i> | PB-1GE-SFP | 6.4 | 7.5 | 8.4 |
| Ethernet IQ PICs | | | | |
| <i>Gigabit Ethernet IQ PICs with SFP (M320 Router), 1-port SFP</i> | PB-1GE-SFP-QPP | 6.2 | 7.5 | 8.4 |
| Ethernet IQ2 PICs | | | | |
| <i>Gigabit Ethernet IQ2 PICs with SFP (M320 Router), 4-port SFP</i> | PB-4GE-TYPE1-SFP-IQ2 | 7.6R3 | 7.6R3 | 8.4 |
| Ethernet Enhanced IQ2 (IQ2E) PICs | | | | |
| <i>Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router), 4-port SFP</i> | PB-4GE-TYPE1-SFP-IQ2E | 9.4 | 9.4 | 9.4 |
| Services PICs | | | | |
| <i>Multiservices PICs (M320 Router) 100</i> | PB-MS-100-1 | 8.1 | 8.1 | 8.4 |
| <i>Tunnel Services PIC (M320 Router)</i> | PB-TUNNEL-1 | 6.2 | 7.5 | 8.4 |
| SONET/SDH PICs | | | | |
| <i>SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M320 Router) 4-port, SFP</i> | PB-4OC3-STM1-IQE-SFP | – | 9.3R2 | 9.3R2 |
| <i>SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M320 Router), 4-port, SFP (Type 1)</i> | PB-4OC3-1OC12-SON-SFP | 8.4 | 8.4 | 8.4 |
| <i>SONET/SDH OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router), 1-port, SFP</i> | PB-1OC12-STM4-IQE-SFP | – | 9.3 | 9.3 |
| <i>SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M320 Router), 1-port, SFP</i> | PB-1OC12-SON-SFP | 8.4 | 8.4 | 8.4 |

PIC/FPC Compatibility (Type 2 FPCs and Type 2 PICs)

Table 54 on page 77 provides a PIC/FPC compatibility matrix for the current Type 2 PICs for the M320 router and Type 2 FPCs. A link to the PIC description is included in the table.

Table 54: M320 PIC/FPC Compatibility Type 2

| PIC | Model Number | FPC2 | E-II FPC2 | E-III-FPC2 |
|---|-------------------------|-------|-----------|------------|
| ATM2 IQ PICs | | | | |
| <i>ATM2 OC12/STM4 IQ PICs (M320 Router) 2-port</i> | PB-2OC12-ATM2-MM | 6.2 | 7.5 | 8.4 |
| | PB-2OC12-ATM2-SMIR | 6.2 | 7.5 | 8.4 |
| <i>ATM2 OC12/STM4 IQ PICs (M320 Router)</i> | | | | |
| <i>ATM2 OC48/STM16 IQ PIC with SFP (M320 Router) 1-port</i> | PB-1OC48-ATM2-SFP | 7.3 | 7.5 | 8.4 |
| Channelized Enhanced IQ (IQE) PICs | | | | |
| <i>Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M320 Router) 4-port</i> | PB-4CHOC12-STM4-IQE-SFP | – | – | 9.4 |
| <i>Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router) 1-port</i> | PB-1CHOC48-STM16-IQE | – | – | 9.4 |
| Ethernet PICs | | | | |
| <i>Fast Ethernet PICs (M320 Router) 48-port</i> | PB-48FE-TX | 6.4 | 7.5 | 8.4 |
| <i>Gigabit Ethernet PICs with SFP (M320 Router) 2-port</i> | PB-2GE-SFP | 6.4 | 7.5 | 8.4 |
| <i>Gigabit Ethernet PICs with SFP (M320 Router) 4-port</i> | PB-4GE-SFP | 7.0 | 7.5 | 8.4 |
| Ethernet IQ PICs | | | | |
| <i>Gigabit Ethernet IQ PICs with SFP (M320 Router) 2-port</i> | PB-2GE-SFP-QPP | 6.2 | 7.5 | 8.4 |
| Ethernet IQ2 PICs | | | | |
| <i>Gigabit Ethernet IQ2 PICs with SFP (M320 Router) 8-port</i> | PB-8GE-TYPE2-SFP-IQ2 | 7.6R2 | 7.6R2 | 8.4 |
| Ethernet Enhanced IQ2 (IQ2E) PICs | | | | |
| <i>Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router) 8-port</i> | PB-8GE-TYPE2-SFP-IQ2E | 9.4 | 9.4 | 9.4 |
| Services PICs | | | | |
| <i>Multiservices PICs (M320 Router) 400</i> | PB-MS-400-2 | 8.1R2 | 8.1R2 | 8.4 |

Table 54: M320 PIC/FPC Compatibility Type 2 (continued)

| PIC | Model Number | FPC2 | E-II FPC2 | E-III-FPC2 |
|--|------------------------|------|-----------|------------|
| <i>Tunnel Services PIC (M320 Router)</i> | PB-TUNNEL | 6.3 | 7.5 | 8.4 |
| SONET/SDH PICs | | | | |
| <i>SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M320 Router) 4-port</i> | PB-4OC3-1OC12-SON2-SFP | 8.3 | 8.3 | 8.4 |
| <i>SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M320 Router) 4-port</i> | PB-4OC3-4OC12-SON-SFP | 8.3 | 8.3 | 8.4 |
| <i>SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M320 Router) 1-port</i> | PB-1OC48-SON-B-SFP | 8.3 | 8.3 | 8.4 |

PIC/FPC Compatibility (Type 3 FPCs and Type 3 PICs)

Table 55 on page 78 provides a PIC/FPC compatibility matrix for the current Type 3 PICs for the M320 router and Type 3 FPCs. A link to the PIC description is included in the table.

Table 55: M320 PIC/FPC Compatibility Type 3

| PIC | Model Number | FPC3 | E-II-FPC3 | E-III-FPC3 |
|--|-----------------------|-------|-----------|------------|
| Ethernet PICs | | | | |
| <i>Gigabit Ethernet PICs with SFP (M320 Router) 10-port</i> | PC-10GE-SFP | 6.2 | 7.5 | 8.4 |
| 10-Gigabit Ethernet PICs | | | | |
| <i>10-Gigabit Ethernet PIC with XENPAK (M320 Router) 1-port</i> | PC-1XGE-XENPAK | 6.2 | 7.5 | 8.4 |
| <i>10-Gigabit Ethernet DWDM PIC (M320 Router) 1-port</i> | PC-1XGE-DWDM-CBAND | 7.5 | 7.5 | 8.4 |
| Ethernet IQ2 PICs | | | | |
| <i>Gigabit Ethernet IQ2 PICs with SFP (M320 Router) 8-port</i> | PC-8GE-TYPE3-SFP-IQ2 | 8.2 | 8.2 | 8.4 |
| <i>Gigabit Ethernet IQ2 PICs with SFP (M320 Router) 1-port</i> | PC-1GE-TYPE3-XFP-IQ2 | 8.0R3 | 8.0R3 | 8.4 |
| Ethernet Enhanced IQ2 (IQ2E) PICs | | | | |
| <i>Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M320 Router) 8-port</i> | PC-8GE-TYPE3-SFP-IQ2E | 9.4 | 9.4 | 9.4 |

Table 55: M320 PIC/FPC Compatibility Type 3 (continued)

| PIC | Model Number | FPC3 | E-II-FPC3 | E-III-FPC3 |
|---|------------------------|------|-----------|------------|
| 10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M320 Router) 1-port | PC-1XGE-TYPE3-XFP-IQ2E | 9.4 | 9.4 | 9.4 |
| Services PICs | | | | |
| Multiservices PICs (M320 Router) 500 | PC-MS-500-3 | 8.3 | 8.3 | 8.4 |
| Tunnel Services PIC (M320 Router) | PC-TUNNEL | 6.3 | 7.5 | 8.4 |
| SONET/SDH PICs | | | | |
| SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M320 Router) 4-port | PC-4OC48-STM16-IQE-SFP | – | – | 10.4R2 |
| SONET/SDH OC48c/STM16 PICs with SFP (M320 Router) 4-port | PC-4OC48-SON-SFP | 6.2 | 7.5 | 8.4 |
| SONET/SDH OC192c/STM64 PIC (M320 Router) 1-port | PC-1OC192-SON-VSR | 6.2 | 7.5 | 8.4 |
| SONET/SDH OC192/STM64 PIC with XFP (M320 Router) 1-port | PC-1OC192-SON-SFP | 8.1 | 8.1 | 8.4 |

- Related Documentation**
- [M320 PIC Description on page 60](#)
 - [M320 PIC Combination Limitations on page 72](#)
 - [M320 PICs Supported on page 61](#)
 - [M320 FPCs Supported on page 59](#)

CHAPTER 7

Power System Components and Descriptions

- [M320 Power System Description on page 81](#)
- [M320 AC Power Supplies Description on page 82](#)
- [M320 DC Power Supplies Description on page 82](#)
- [M320 Power Supply LEDs on page 84](#)

M320 Power System Description

The M320 router uses either AC power supplies (see [“M320 AC Power Supplies Description” on page 82](#)), isolated DC power supplies, or nonisolated DC power supplies (see [“M320 DC Power Supplies Description” on page 82](#)). The power supplies connect to the midplane, which distributes the different output voltages produced by the power supplies to the router components, depending on their voltage requirements. All power supplies are hot-removable and hot-insertable. Each power supply is cooled by its own internal cooling system.

The M320 router is configurable with:

- Two, three, or four AC power supplies
- Two or four DC power supplies (either isolated or nonisolated)



CAUTION: Mixing AC and DC power supplies is not supported and prevents the router from powering on. You must ensure that all power supplies are the same model number.

Related Documentation

- [M320 Power Requirements on page 104](#)
- [Troubleshooting the M320 Power System on page 332](#)

M320 AC Power Supplies Description

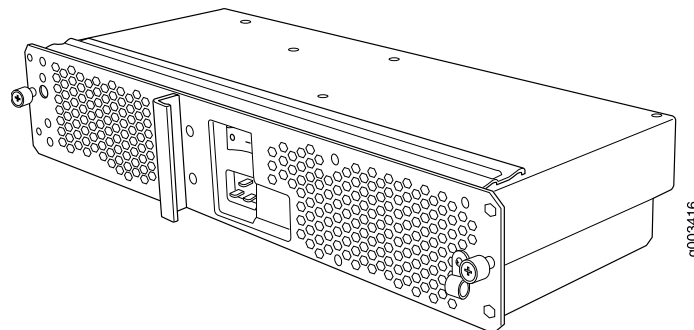
In the AC power configuration, the router contains two to four load-sharing AC power supplies (see [Figure 22 on page 82](#)), which are located at the lower rear of the chassis in slots **PEM0** through **PEM3** (top to bottom). The router requires a minimum of two fully functional power supplies to operate.

To provide power redundancy, you can upgrade the number of AC power supplies from two to three or from three to four. Each AC power supply provides power to all components in the router.. Three AC power supplies provide full power redundancy. If one power supply fails or is removed, the remaining power supplies instantly assume the entire electrical load.



NOTE: In a router with two power supplies (no power supply redundancy), if one power supply fails or is shut down, the other power supply goes into a “check” state and does not operate even though it has not failed (this is because the router requires two power supplies to operate).

Figure 22: AC Power Supply



Related Documentation

- [M320 Power System Description on page 81](#)
- [Connecting Power to an AC-Powered M320 Router on page 193](#)
- [M320 AC Power Electrical Specifications on page 109](#)
- [M320 AC Power Cord Specifications on page 110](#)

M320 DC Power Supplies Description

In the DC power configuration, the router contains either two or four DC power supplies, located at the lower rear of the chassis in slots **PEM0** through **PEM3** (top to bottom).

If only two DC power supplies are installed, the power supplies in either slots **PEM0** and **PEM1** or slots **PEM2** and **PEM3** can provide full power to the router. You can upgrade your DC power supply from two to four power supplies for full redundancy.



NOTE: Except during upgrade, all DC power supplies installed in the chassis must be the same model number, either all isolated or all nonisolated DC power supplies. Using both isolated and nonisolated DC power supplies during normal operations prevents load sharing.

- [Nonisolated DC Power Supply on page 83](#)
- [Isolated DC Power Supply on page 83](#)
- [Components Powered by Each Power Supply Slot on page 83](#)
- [DC Power Supply Load Sharing and Fault Tolerance on page 84](#)

Nonisolated DC Power Supply

Each nonisolated power supply consists of a single DC input (-48 VDC and return), a circuit breaker, a fan (each power supply is cooled by its own internal cooling system), and LEDs to monitor the status of the power supply. Each nonisolated power supply weighs approximately 10 lb (4.5 kg).

Isolated DC Power Supply

Each isolated power supply consists of a single DC input (-48 VDC and return), a circuit breaker, a fan (each power supply is cooled by its own internal cooling system), and LEDs to monitor the status of the power supply. Each isolated power supply weighs approximately 10 lb (4.5 kg).



NOTE: The Isolated DC power supply is designed to be more resilient to power irregularity such as noise or surge in power environment.

Components Powered by Each Power Supply Slot

The DC power supplies in the slots indicated provide power to the components listed in [Table 56 on page 83](#).

Table 56: Components Powered by Each DC Power Supply Slot

| Slot | Provide Power to These Components |
|---------------|--|
| PEM0 and PEM2 | FPCs in slots FPC3 through FPC7 |
| PEM1 and PEM3 | FPCs in slots FPC0 through FPC2 , SIBs, CBs, and Routing Engines, and fan trays. |

DC Power Supply Load Sharing and Fault Tolerance

When the router is fully configured with four DC power supplies:

- The DC power supplies provide full redundancy
- The DC power supply in **PEM2** serves as the backup to the DC power supply in slot **PEM0**.
- DC power supply in **PEM3** serves as the backup to the DC power supply in slot **PEM1**
- Load sharing occurs between the DC power supplies installed in slots **PEM0** and **PEM2**
- Load sharing occurs between the DC power supplies in slots **PEM1** and **PEM3**



NOTE: Isolated DC power supplies share current over the full input operating voltage range. The current sharing between nonisolated power supplies relies on equal voltages at the power supply input terminals.

Related Documentation

- [M320 Power System Description on page 81](#)
- [Connecting Power to a DC-Powered M320 Router on page 195](#)
- [Maintaining the M320 Power Supplies on page 316](#)
- [Replacing an M320 DC Power Supply on page 287](#)
- [M320 DC Power Electrical Specifications on page 113](#)
-

M320 Power Supply LEDs

The **OUTPUT OK** LED on each power supply faceplate indicates the status of the power supply (see [Table 57 on page 84](#), which applies to the AC and DC power supply). The power supply status is also reflected in two LEDs on the craft interface (see [“M320 Craft Interface Power Supply LEDs” on page 19](#)). In addition, a power supply failure triggers the red alarm LED on the craft interface.

Table 57: Power Supply LED

| Label | Color | State | Description |
|-----------|-------|-------------|--|
| OUTPUT OK | Blue | Off | No power applied to power supply. |
| | | Blinking | <ul style="list-style-type: none"> • Power supply blinks for 5 seconds after initial power on. • Power supply is installed, but not powered on, and is receiving bias power from a powered on power supply. • Input voltage is invalid. • Power supply has failed. |
| | | On steadily | Power supply is functioning normally. |

**Related
Documentation**

- [M320 Power System Description on page 81](#)
- [Maintaining the M320 Power Supplies on page 316](#)
- [Troubleshooting the M320 Power System on page 332](#)

CHAPTER 8

Switch Fabric Components and Descriptions

- M320 SIB Description on page 87
- M320 Performance for Different SIB Configurations on page 88
- M320 SIB LEDs on page 89

M320 SIB Description

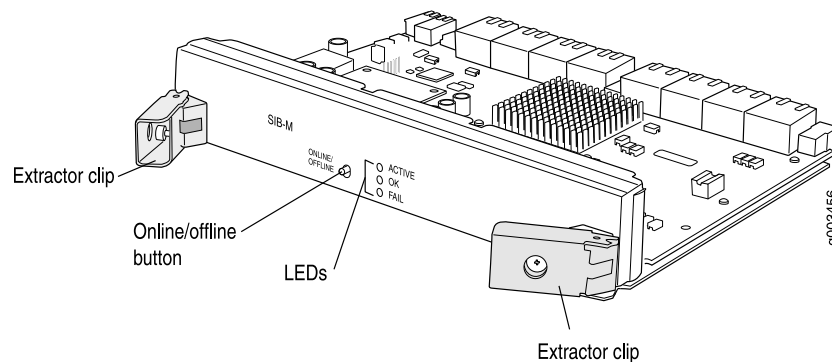
The Switch Interface Boards (SIBs) provide the switching function to the destination FPC. The SIBs (see [Figure 23 on page 87](#)) create the switch fabric for the router, providing up to a total of 385 million packets per second (Mpps) of forwarding with the maximum configuration.

SIBs are located at the center rear of the router chassis in the slots labeled **SIB0** through **SIB3** (top to bottom). The M320 router can be configured with two, three, or four SIBs. You can upgrade from two to three SIBs or from three to four SIBs without resetting or stopping Packet Forwarding Engines.

Each FPC has a dedicated ASIC with up to four high-speed links that connect to the SIBs (one link per SIB).

SIBs are hot-insertable and hot-removable.

Figure 23: SIB-M



Each SIB consists of the following components:

- Switch Fabric ASICs.
- High-speed links (HSLs) to each FPC.
- Three LEDs located on the SIB faceplate that display the status of the SIB. See [“M320 SIB LEDs” on page 89](#).
- SIB online/offline button, located on the SIB faceplate.

- Related Documentation**
- [Replacing an M320 SIB on page 297](#)
 - [Maintaining the M320 SIBs on page 318](#)

M320 Performance for Different SIB Configurations

[Table 58 on page 88](#) describes expected performance per total active SIBs for different FPC and PIC configurations. The packet forwarding rate of each FPC is independent of the number and configuration of other FPCs in the chassis. The packet forwarding rate depends on the total number of PICs in the FPC, the number of active SIBs in the chassis, and packet size.

Table 58: Performance per SIB/FPC Configuration

| Number of Active SIBs | FPC Type and Number of PICs per FPC | Performance |
|-----------------------|---|--------------------------|
| 1 | FPC1 with up to four PICs | Line rate |
| | FPC2 with up to two PICs (except when both PICs are 4-port GE PICs) | Line rate |
| | FPC2 with two 4-port GE PICs | Line rate not guaranteed |
| | FPC2 with three or four PICs | Line rate not guaranteed |
| | FPC3 with one or two PICs | Line rate not guaranteed |
| 2 | FPC1 with up to four PICs | Line rate |
| | FPC2 with up to four PICs (except when all PICs are 4-port GE PICs) | Line rate |
| | FPC2 with four 4-port GE PICs | Line rate not guaranteed |
| | FPC2 with three 4-port GE PICs | Line rate |
| | FPC3 with two PICs | Line rate not guaranteed |
| | FPC3 with one PIC | Line rate |

Table 58: Performance per SIB/FPC Configuration (continued)

| Number of Active SIBs | FPC Type and Number of PICs per FPC | Performance |
|-----------------------|-------------------------------------|--------------------------|
| 3 | FPC1 with up to four PICs | Line rate |
| | FPC2 with up to four PICs | Line rate |
| | FPC3 with two PICs | Line rate not guaranteed |
| 4 | FPC1 with up to four PICs | Line rate |
| | FPC2 with up to four PICs | Line rate |
| | FPC3 with up to two PICs | Line rate |

- Related Documentation**
- [Replacing an M320 SIB on page 297](#)
 - [Maintaining the M320 SIBs on page 318](#)

M320 SIB LEDs

Table 59 on page 89 describes the functions of the SIB LEDs. If all three LEDs are off, the SIB is not receiving power. The **OK** and **FAIL** LEDs are replicated on the craft interface.

Table 59: SIB LEDs

| Label | Color | State | Description |
|---------------|--------|-------------|------------------------------|
| ACTIVE | Green | On steadily | SIB is in active mode. |
| OK | Green | On steadily | SIB is functioning normally. |
| | | Blinking | SIB is starting up. |
| FAIL | Yellow | On steadily | SIB has failed. |

- Related Documentation**
- [M320 SIB Description on page 87](#)
 - [Replacing an M320 SIB on page 297](#)
 - [Maintaining the M320 SIBs on page 318](#)

PART 2

Site Planning, Preparation, and Specifications

- [Preparation Overview on page 93](#)
- [AC Power Specifications on page 109](#)
- [DC Power Specifications on page 113](#)
- [Network Cable and Transceiver Planning on page 119](#)
- [Management Cable and Transceiver Specifications and Pinouts on page 123](#)

CHAPTER 9

Preparation Overview

- M320 Site Preparation Checklist Requirements on page 93
- M320 Router Physical Specifications on page 94
- Rack Requirements for the M320 Router on page 95
- M320 Cabinet Size and Clearance Requirements on page 96
- M320 Cabinet Airflow Requirements on page 98
- M320 Clearance Requirements on page 99
- M320 Environmental Specifications on page 101
- M320 Chassis Grounding Cable and Lug Specifications on page 102
- Site Electrical Wiring Guidelines for Juniper Networks Devices on page 103
- M320 Power Requirements on page 104
- M320 RJ-48 Connector Pinouts for the Control Board External Clock Inputs on page 106
- M320 Fuse Specifications on page 107

M320 Site Preparation Checklist Requirements

The checklist in [Table 60 on page 93](#) summarizes the tasks you need to perform when preparing a site for router installation.

Table 60: Site Preparation Checklist

| Item or Task | For More Information | Performed By | Date |
|---|---|--------------|------|
| Environment | | | |
| Verify that environmental factors such as temperature and humidity do not exceed router tolerances. | "M320 Environmental Specifications" on page 101 | | |
| Power | | | |
| Locate sites for connection of system grounding. | "M320 Chassis Grounding Cable and Lug Specifications" on page 102 | | |
| Calculate the power consumption and requirements. | "M320 Power Requirements" on page 104 | | |

Table 60: Site Preparation Checklist (continued)

| Item or Task | For More Information | Performed By | Date |
|--|--|--------------|------|
| Hardware Configuration | | | |
| Choose the configuration. | "M320 Chassis Description" on page 7 | | |
| Rack | | | |
| Verify that your rack meets the minimum requirements for the installation of the router. | "Rack Requirements for the M320 Router" on page 95 | | |
| Plan rack location, including required space clearances. | "M320 Clearance Requirements" on page 99 | | |
| If a rack is used, secure rack to floor and building structure. | "Rack Requirements for the M320 Router" on page 95 | | |
| Cables | | | |
| Acquire cables and connectors: <ul style="list-style-type: none"> Determine the number of cables needed based on your planned configuration. Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected. | "Calculating Power Budget and Power Margin for Fiber-Optic Cables" on page 120 | | |
| Plan the cable routing and management. | "Maintaining M320 PICs and PIC Cables" on page 314 | | |

- Related Documentation**
- [M320 Installation Safety Guidelines on page 363](#)
 - [General Safety Guidelines for Juniper Networks Devices on page 355](#)
 - [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 375](#)

M320 Router Physical Specifications

Table 61 on page 95 summarizes the physical specifications for the router chassis.

Table 61: M320 Physical Specifications

| Description | Value |
|--------------------|--|
| Chassis dimensions | 34.80 in. (88.4 cm) high |
| | 17.43 in. (44.3 cm) wide |
| | 25.64 in. (65.1 cm) deep (from front-mounting flange to chassis rear) |
| | Total depth (including cable management system) 29.85 in. (75.8 cm) |
| Router weight | Chassis with midplane: 142 lb (64.7 kg) |
| | Maximum configuration: 439 lb (199.6 kg) |

Rack Requirements for the M320 Router

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 is shown in [Figure 24 on page 96](#).

For open-frame racks, center-mounting is preferable to front-mounting because the more even distribution of weight provides greater stability.

The router is designed for installation in a 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Components Industry Association (<http://www.ecianow.org/>).

With the use of adapters, the router can fit into a 600-mm-wide rack, as defined in the four-part *Equipment Engineering (EE); European Telecommunications Standard for Equipment Practice* (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute (<http://www.etsi.org>). Use approved wing devices to narrow the opening between the rails.

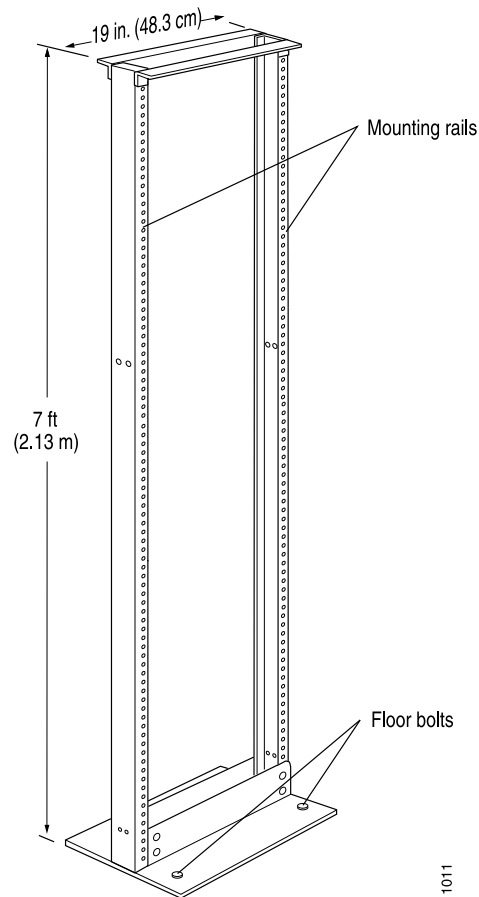
The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions: 37.45 in. (95.1 cm) high, 31 in. (78.7 cm) deep, and 17.43 in. (44.3 cm) wide, excluding the front and rear cable management systems. The outer edges of the mounting brackets extend the width to 19 in. (48.3 cm). The spacing of rails and adjacent racks must also allow for the clearances around the router and rack.

The mounting holes for connecting the mounting brackets to the chassis are spaced 0.984 in. (25 mm) apart.

The chassis height of 37.45 in. (95.1 cm) is approximately 21.4 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 two routers in a rack that has at least 42.8 U (74.9 in. or 1.90 m) of usable vertical space.

The rack must be strong enough to support the weight of the fully configured router, up to 606 lb (275 kg). If you stack two fully configured routers in one rack, it must be capable of supporting about 1212 lb (550 kg).

Figure 24: Typical Open-Frame Rack



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

- Related Documentation**
- [M320 Clearance Requirements on page 99](#)
 - [M320 Installation Safety Guidelines on page 363](#)

M320 Cabinet Size and Clearance Requirements

The minimum size enclosed cabinet that can accommodate the router is 600 mm wide and 800 mm deep. A cabinet larger than the minimum requirement provides better airflow and reduces the chance of overheating. To accommodate a single router, the cabinet must be at least 20 U (35 in. or 88.9 cm) high. If you provide adequate cooling air and airflow clearance, you can stack two routers in a cabinet that has at least 40 U (70 in. or 1.78 m) of usable vertical space.

The minimum front and rear clearance requirements depend on the mounting configuration you choose. The minimum total clearance inside the cabinet is 30.70 in. between the inside of the front door and the inside of the rear door. If you choose a

front-mount installation, you must maintain clearance of 4.80 in. (122 mm) between the front-mounting flanges and the inside of the cabinet front door, and 25.90 in. (658 mm) between the front-mounting flanges and the inside of the cabinet rear door. If you choose an adjustable-mount installation using the mounting brackets, the clearance requirements depend on where you install the mounting brackets.

[Table 62 on page 97](#) provides the clearance requirements for each of the 11 mounting bracket positions on the side of the chassis (position 1 represents the mounting brackets installed closest to the front of the chassis; position 11 represents the mounting brackets installed closest to the rear of the chassis). The front clearance is measured between the front of the front rack rail and the inside of the cabinet front door. The rear clearance is measured between the front of the front rack rail and the inside of the cabinet rear door.

Table 62: Cabinet Clearance Requirements

| Mounting Bracket Position | Front Clearance | Rear Clearance |
|---------------------------|--------------------|--------------------|
| 1 | 7.04 in. (179 mm) | 23.66 in. (601 mm) |
| 2 | 8.02 in. (204 mm) | 22.68 in. (576 mm) |
| 3 | 9.01 in. (229 mm) | 21.69 in. (551 mm) |
| 4 | 9.99 in. (254 mm) | 20.71 in. (526 mm) |
| 5 | 10.98 in. (279 mm) | 19.73 in. (501 mm) |
| 6 | 11.96 in. (304 mm) | 18.74 in. (476 mm) |
| 7 | 12.94 in. (329 mm) | 17.76 in. (451 mm) |
| 8 | 13.93 in. (354 mm) | 16.77 in. (426 mm) |
| 9 | 14.91 in. (379 mm) | 15.79 in. (401 mm) |
| 10 | 15.90 in. (404 mm) | 14.81 in. (376 mm) |
| 11 | 16.88 in. (429 mm) | 13.82 in. (351 mm) |

Related Documentation

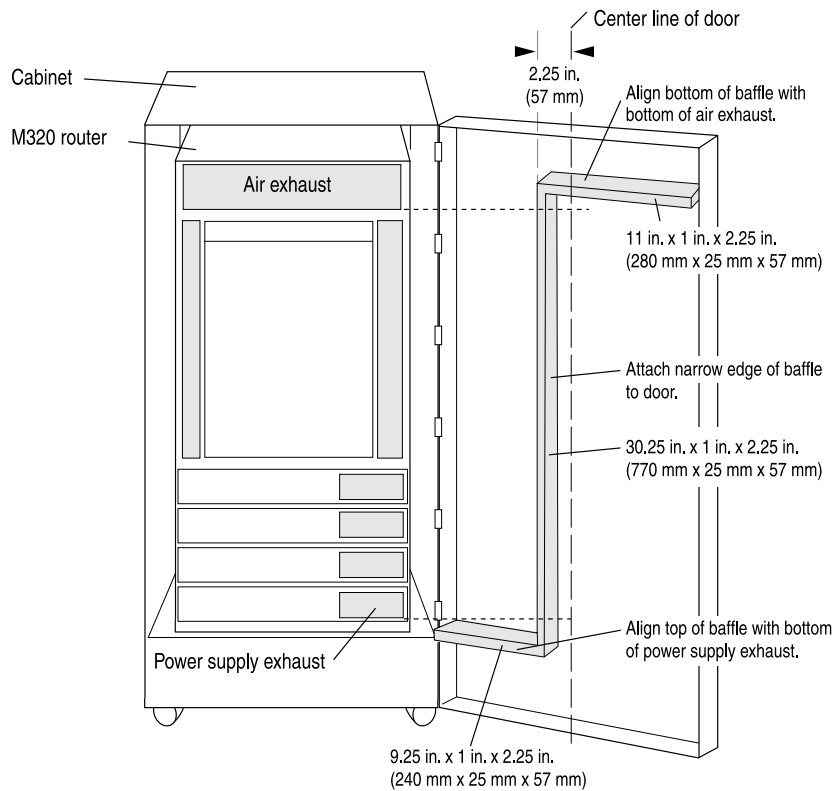
- [M320 Site Preparation Checklist Requirements on page 93](#)
- [M320 Installation Safety Guidelines on page 363](#)

M320 Cabinet Airflow Requirements

When you mount the router in a cabinet, you must ensure that ventilation through the cabinet is sufficient to prevent overheating. Following is a list of requirements to consider when planning for chassis cooling:

- Ensure that the cool air supply you provide through the cabinet can adequately dissipate the thermal output of the router. “[M320 Environmental Specifications](#)” on page 101 lists the router’s environmental specifications, including its operating temperature and thermal output.
- Ensure that the cabinet allows the chassis hot exhaust air to exit from the cabinet without recirculating into the router. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. For an illustration of chassis airflow, see “[M320 Cooling System Description](#)” on page 21.
- Install the router as close as possible to the front of the cabinet so that the cable management system just clears the inside of the front door. This maximizes the clearance in the rear of the cabinet for critical airflow.
- If you operate the router in an enclosed 800-mm cabinet, you must install a baffle on the inside of the rear door of the cabinet to prevent the router from overheating at elevated ambient temperatures. The baffle separates the cool air intake from the hot air exhaust in the rear of the cabinet (for baffle dimensions and location, see [Figure 25 on page 99](#)). We recommend that the baffle be made of soft foam with a depth of 2.25 in. (57 mm) so that it slightly touches the rear of the router when the rear cabinet door is closed.
- Route and dress all cables to minimize the blockage of airflow to and from the chassis.

Figure 25: Airflow Baffle Template



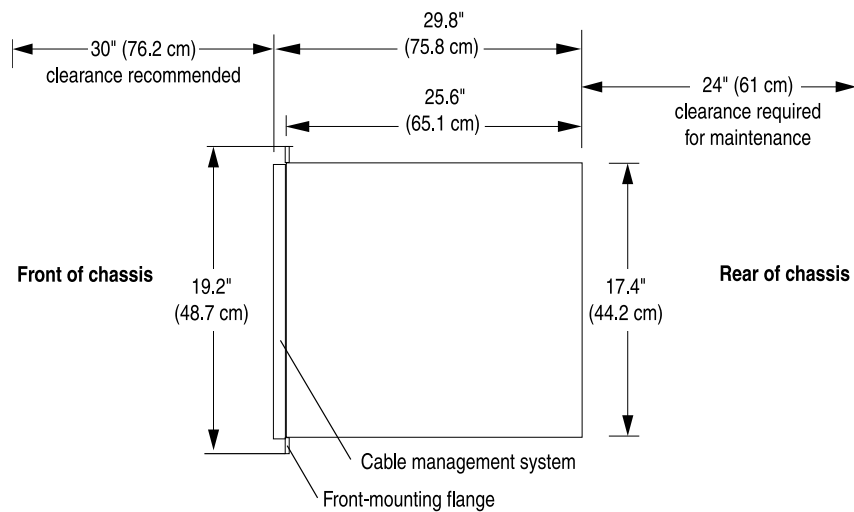
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- Related Documentation**
- [Maintaining the M320 Air Filters on page 305](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)

M320 Clearance Requirements

When planning the installation site, you need to allow sufficient clearance around the rack (see [Figure 26 on page 100](#)):

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. “[M320 Cooling System Description](#)” on [page 21](#) depicts the airflow in the router.
- For service personnel to remove and install hardware components, there must be adequate space at the front and back of the router. We recommend that you allow at least 30 in. (72.6 cm) in front of the rack and 24 in. (61.0 cm) behind the rack.

Figure 26: Chassis Dimensions and Clearance Requirements

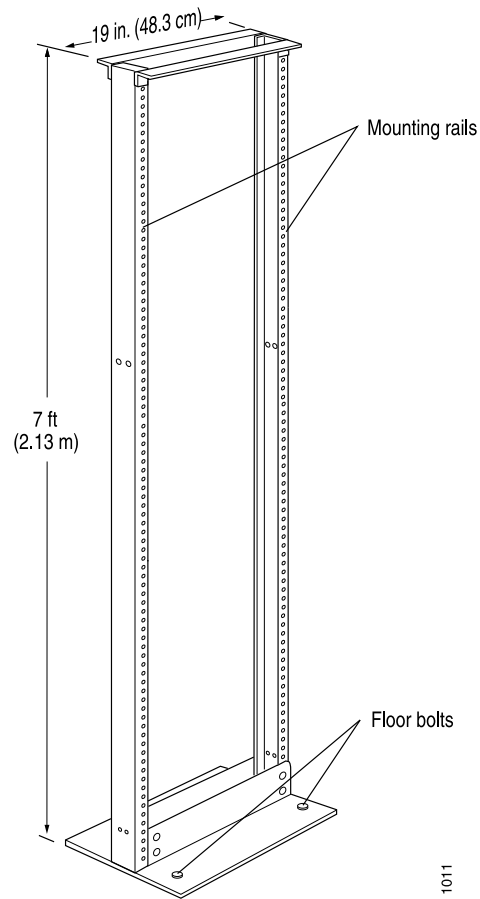
The router has two adjustable center-mounting brackets that are initially attached to the mounting holes closest to the rear of the chassis. You can move the pair of adjustable center-mounting brackets to one of 11 positions on the side of the chassis. The mounting holes for connecting the mounting brackets to the chassis are spaced 0.984 in. (25 mm) apart.

For instructions about installing the mounting hardware, see [“Installing the M320 Mounting Hardware for a Four-Post Rack or Cabinet”](#) on page 137.

The chassis height of 34.80 in. (88.4 cm) is approximately 20 U. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Industry Association. You can stack two M320 routers in a rack that has at least 40 U (70 in. or 1.78 m) of usable vertical space.

The rack must be strong enough to support the weight of the fully configured router, up to 439 lb (199.6 kg). If you stack two fully configured routers in one rack, it must be capable of supporting about 878 lb (399.1 kg).

Figure 27: Typical Open-Frame Rack



- Related Documentation**
- [M320 Site Preparation Checklist Requirements on page 93](#)
 - [M320 Installation Safety Guidelines on page 363](#)

M320 Environmental Specifications

Table 63 on page 101 specifies the environmental specifications required for normal router operation. In addition, the site should be as dust-free as possible.

Table 63: Router Environmental Specifications

| Description | Value |
|-------------------|---|
| Altitude | No performance degradation to 10,000 ft (3048 m) |
| Relative humidity | Normal operation ensured in relative humidity range of 5% to 90%, noncondensing |

Table 63: Router Environmental Specifications (continued)

| Description | Value |
|------------------------|--|
| Temperature | Normal operation ensured in temperature range of 32°F (0°C) to 104°F (40°C) Nonoperating storage temperature in shipping crate: -40°F (-40°C) to 158°F (70°C) |
| Seismic | Designed to meet Telcordia Technologies Zone 4 earthquake requirements |
| Maximum thermal output | DC power: 28,498 BTU/hour (8350 W) |



NOTE: Install the router only in restricted areas, such as dedicated equipment rooms and equipment closets, in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code, ANSI/NFPA 70.

Related Documentation

- [M320 Site Preparation Checklist Requirements on page 93](#)
- [Routine Maintenance Procedures for the M320 Router on page 303](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)

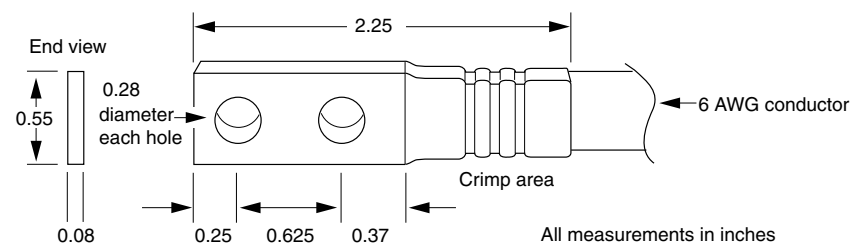
M320 Chassis Grounding Cable and Lug Specifications

The grounding cable must meet the following requirements:

- Ability to handle up to 82 A
- 6-AWG (13.3 mm²), minimum 75°C wire, or as permitted by the local code

The cable lug shown in [Figure 28 on page 102](#) is also used for the DC power cables.

Figure 28: DC Power and Grounding Cable Lug



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

- Related Documentation**
- [M320 Site Preparation Checklist Requirements on page 93](#)
 - [M320 Power System Description on page 81](#)
 - [Connecting the M320 Router Grounding Cable on page 179](#)

Site Electrical Wiring Guidelines for Juniper Networks Devices

- [Distance Limitations for Signaling on page 103](#)
- [Radio Frequency Interference on page 103](#)
- [Electromagnetic Compatibility on page 103](#)

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 metallicly 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 metallurgically to OSP wiring.

- Related Documentation**
- [General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices on page 385](#)

M320 Power Requirements



NOTE: To allow for future growth so that you can operate the router in any hardware configuration without upgrading the power infrastructure, we recommend that you provision at least 48 A @ –48 VDC (nominal) for each DC power supply. If you do not plan to provision at least 48 A @ –48 VDC (nominal) per input, you can use the information in [Table 64 on page 104](#) to calculate the typical power consumption @ –48 VDC and typical thermal output for your hardware configuration.

[Table 64 on page 104](#) lists the power requirements for various hardware components when the router is operating under typical voltage conditions. Generalized values are listed for PICs. For power requirements for specific PICs, see the *M320 Multiservice Edge Router Interface Module Reference*.

Table 64: Component Power Requirements

| Component | Power Requirement (Watts) | Current Requirement (Amps @ –48 VDC) |
|--|---------------------------|--------------------------------------|
| Base system, not including FPCs and PICs (includes four SIBs, one host subsystem, two power supplies, cooling system running at normal speed, and craft interface) | 450 W (approximate) | 9.4 A (approximate) |
| Type 1 FPC (without PICs) | 160 W | 3.3 A |
| Type 2 FPC (without PICs) | 160 W | 3.3 A |
| Type 3 FPC (without PICs) | 160 W | 3.3 A |
| Host subsystem (Routing Engine and CB) | 100 W | 2.1 A |
| SIB | 38 W | 0.8 A |
| AC power supply | 100 W | Not applicable. |
| DC power supply | 40 W | 0.8 A |

Table 64: Component Power Requirements (continued)

| Component | Power Requirement (Watts) | Current Requirement (Amps @ -48 VDC) |
|-------------------------------|---------------------------|--------------------------------------|
| Cooling system (normal speed) | 140 W | 2.9 A |
| Cooling system (full speed) | 200 W | 4.0 A |
| PIC—Generalized typical value | 30 W | 0.625 A |
| PIC—Generalized maximum value | 52.8 W | 1.1 A |

You can use the information in [Table 64 on page 104](#) and the *M320 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 a DC-powered router.

- Example of calculating power consumption for minimum configuration:

$$\begin{aligned} \text{Base system} + 1 \text{ FPC} + 1 \text{ PIC} &= \\ 9.4 \text{ A} + 3.3 \text{ A} + 0.625 \text{ A} &= 13.3 \text{ A @ } -48 \text{ VDC} = 638 \text{ W DC} \end{aligned}$$

- Example of calculating power consumption for maximum configuration:

$$\begin{aligned} \text{Base system} + 1 \text{ Host subsystem} + 2 \text{ redundant DC power supplies} + 8 \text{ FPCs} + 32 \text{ PICs} &= \\ 9.4 \text{ A} + 2.1 \text{ A} + 2(0.8 \text{ A}) + 8(3.3 \text{ A}) + 32(1.1 \text{ A}) &= \\ 9.4 \text{ A} + 2.1 \text{ A} + 1.6 \text{ A} + 26.4 \text{ A} + 35.2 \text{ A} &= 74.7 \text{ A @ } -48 \text{ VDC} = 3,586 \text{ W DC} \end{aligned}$$

- Current requirement adjustment for fans running at full speed (high temperature environment or cooling component failure):

$$\begin{aligned} \text{Calculated system current (X)} - \text{Cooling (normal)} + \text{Cooling (full speed)} &= \\ X \text{ A} - 2.9 \text{ A} + 4.0 \text{ A} &= \\ X \text{ A} + 1.1 \text{ A} & \end{aligned}$$

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

$$\begin{aligned} (-54 \text{ VDC input}) \times (\text{input current X}) &= (-48 \text{ VDC input}) \times (\text{input current Y}) \\ 54 \times X &= 48 \times 57.9 \text{ A} \\ X &= 48 \times 57.9 \text{ A} / 54 = 51.5 \text{ A} \end{aligned}$$

- Example of calculating system thermal output for a DC-powered router:

$$\begin{aligned} \text{Watts DC} / 0.293 &= \text{BTU/hr} \\ 3,586 / 0.293 &= 12,239 \text{ BTU/hr} \end{aligned}$$

- Example of calculating system thermal output for an AC-powered router:

Watts DC/85% AC PEM efficiency/0.293 = BTU/hr
 3,586/0.85/0.293 = 14,398 BTU/hr

- Related Documentation**
- [M320 Power System Description on page 81](#)
 - [M320 AC Power Supplies Description on page 82](#)
 - [M320 DC Power Supplies Description on page 82](#)
 - [M320 AC Power Electrical Specifications on page 109](#)
 - [M320 DC Power Electrical Specifications on page 113](#)

M320 RJ-48 Connector Pinouts for the Control Board External Clock Inputs

The two inputs on the CB labeled **EXTERNAL CLOCK INPUT** are RJ-48 receptacles that accept RJ-48 cables for connecting the CB to 19.44-MHz Stratum 3 reference clocks. . [Table 65 on page 106](#) describes the RJ-48 connector pinouts.

Table 65: RJ-48 Connector Pinouts

| Pin | Signal |
|-----|--|
| 1 | EXT_RRING (negative input clock) |
| 2 | EXT_RTIP (positive input clock) |
| 3 | Shield ground |
| 4 | EXT_TRING (negative output signal—not a clock) |
| 5 | EXT_TTIP (positive output signal—not a clock) |
| 6 | Shield ground |
| 7 | Not used |
| 8 | Not used |

Connecting an External Clock Device to the M320 Control Board

1.

- Related Documentation**
- [M320 Control Board \(CB\) Description on page 51](#)
 - [M320 Chassis Description on page 7](#)
 - [M320 Craft Interface Description on page 15](#)

M320 Fuse Specifications

Table 66: Fuse Specifications

| Component | Indicator Bulb Color | Fuse Rating | Quantity | Locations |
|-----------|----------------------|-------------|----------|--|
| CB | Red and blue | 15 A | 2 | J411 C J416 A |
| FPC | Red and blue | 15 A | 8 | J410 A and D J412 A and D J414 D J415 A and D J416 C |
| SIB | Red and blue | 15 A | 4 | J412 B and C J415 B J416 D |
| Spares | Red and blue | 15 A | 4 | J410 B and C J414 C J415 C |
| Spares | Red and blue | 15 A | 6 | J411 A, B, and D J414 A and B J416 B |

Related Documentation

- [M320 Fuses on page 12](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
- [Troubleshooting the M320 Fuses on page 330](#)

AC Power Specifications

- M320 AC Power Electrical Specifications on page 109
- M320 AC Power Cord Specifications on page 110

M320 AC Power Electrical Specifications

Table 67 on page 109 lists the AC power supply and power system electrical specifications. For information about AC power cord specifications, see “M320 AC Power Cord Specifications” on page 110. For information about connecting the router to power, see “Connecting Power to an AC-Powered M320 Router” on page 193.

Table 67: AC Power Electrical Specifications

| Item | Specification |
|--------------------------|-----------------------------------|
| Power Supply | |
| Maximum output power | 1750 W |
| AC input voltage | Operating range: 180 to 264 VAC |
| AC input line frequency | 47 to 63 Hz |
| AC input current rating | 10 A @ 200 VAC 8.5 A @ 240 VAC |
| Power System | |
| AC input voltage | Operating range: 200 to 240 VAC |
| AC input line frequency | 47 to 63 Hz |
| AC system current rating | 17 A @ 200 VAC 14 A @ 240 VAC |



NOTE: If you plan to operate a maximally configured AC-powered router, we recommend that you provision at least 14 A @ 240 VAC (or 17 A @ 200 VAC) for the system, or at least 10 A for each power supply.

Each AC power supply has a single AC appliance inlet that requires a dedicated AC power feed and a dedicated 15 A (250 VAC) circuit breaker. Use a facility circuit breaker rated for 15 A (250 VAC) minimum for each AC power supply. Doing so enables you to operate the router in any configuration without upgrading the power infrastructure.

Related Documentation

- [M320 AC Power Supplies Description on page 82](#)
- [Replacing an M320 AC Power Supply Cord on page 292](#)

M320 AC Power Cord Specifications

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

Detachable AC power cords, each 2.5 m (approximately 8 ft) long, are supplied with the router. The appliance coupler at the female end of the cord inserts into the appliance inlet on the faceplate of the AC power supply. The coupler is type C19 and C19W (right angle) as described by International Electrotechnical Commission (IEC) standard 60320. The plug at the male end of the power cord fits into the power source receptacle that is standard for your geographical location.



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



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

注意

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

g017253



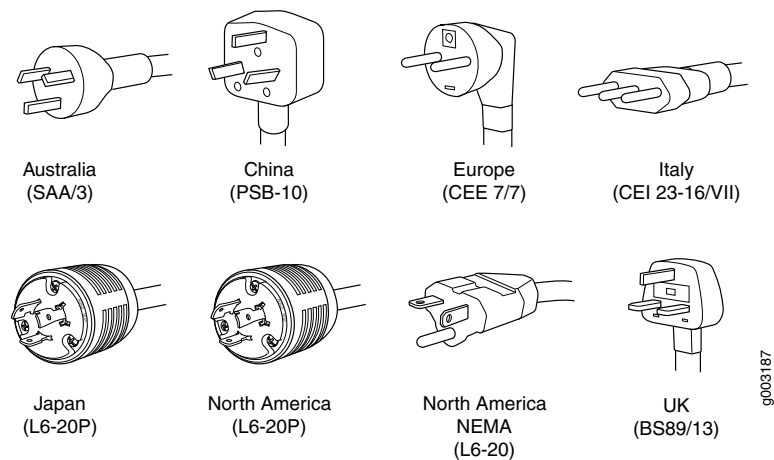
NOTE: In North America, AC power cords must not exceed 4.5 m (approximately 14.75 ft) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52, and Canadian Electrical Code (CEC) Section 4-010(3). The cords supplied with the router are in compliance.

Table 68 on page 111 provides AC power cord specifications and Figure 29 on page 111 depicts the plug on the AC power cord provided for each country or region.

Table 68: AC Power Cord Specifications

| Country | Model Number | Electrical Specification | Plug Type |
|---|----------------------|--------------------------|---------------|
| Australia | CBL-M-PWR-RA-AU | 240 VAC, 50 Hz AC | SAA/3 |
| China | CBL-M-PWR-RA-CH | 220 VAC, 50 Hz AC | PSB-10 |
| Europe (except Denmark, Italy, Switzerland, and United Kingdom) | CBL-M-PWR-RA-EU | 220 or 230 VAC, 50 Hz AC | CEE 7/7 |
| Italy | CBL-M-PWR-RA-IT | 230 VAC, 50 Hz AC | CEI 23-16/VII |
| Japan | CBL-M-PWR-RA-JP | 220 VAC, 50 or 60 Hz AC | NEMA L6-20P |
| North America | CBL-M-PWR-RA-US | 250 VAC, 60 Hz AC | NEMA L6-20 |
| | CBL-M-PWR-RA-TWLK-US | 250 VAC, 60 Hz AC | NEMA L6-20P |
| United Kingdom | CBL-M-PWR-RA-UK | 240 VAC, 50 Hz AC | BS89/13 |

Figure 29: AC Plug Types





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CAUTION: AC Power cords must not block access to router components or drape where people could trip on them.

.....

**Related
Documentation**

- [M320 AC Power Supplies Description on page 82](#)
- [M320 Power Requirements on page 104](#)
- [M320 AC Power Electrical Specifications on page 109](#)
- [Connecting Power to an AC-Powered M320 Router on page 193](#)
- [Replacing an M320 AC Power Supply Cord on page 292](#)
- [Site Electrical Wiring Guidelines for Juniper Networks Devices on page 103](#)

CHAPTER 11

DC Power Specifications

- M320 DC Power Electrical Specifications on page 113
- M320 DC Power Cable Specifications on page 115
- M320 DC Power Distribution on page 117
- DC Power Circuit Breaker for M320 Routers on page 117

M320 DC Power Electrical Specifications

- DC Power System Electrical Specifications on page 113
- Nonisolated DC Power Supply Electrical Specifications on page 114
- Isolated DC Power Supply Electrical Specifications on page 114

DC Power System Electrical Specifications

Table 69 on page 113 lists the DC power system electrical specifications.

Table 69: DC Power System Electrical Specifications

| Item | Specification |
|--------------------------|---|
| DC input voltage | Operating range: -40.0 to -72.0 VDC NOTE: If the input voltage from the DC power source drops between -37.5 and -39.5 VDC, the router automatically shuts down. During automatic shutdown, the circuit remains active. When the input voltage returns to -43 to -44 VDC, the router automatically starts up again and the system returns to normal operation within 30 minutes. No operator intervention is required. |
| DC system current rating | 65 A @ -48 VDC (nominal) (3120 W) |



NOTE: To allow for future growth so that you can operate the router in any hardware configuration without upgrading the power infrastructure, we recommend that you provision at least 48 A @ –48 VDC (nominal) for each power supply. To base the amount of power you provision on the typical power consumption @ –48 VDC (nominal) for your current hardware configuration, you can use the information in “M320 Power Requirements” on page 104.

Nonisolated DC Power Supply Electrical Specifications

Table 70 on page 114 list the electrical specifications for nonisolated DC power supplies.

Table 70: Nonisolated DC Power Supply Electrical Specifications

| Item | Specification |
|----------------------------------|--|
| Maximum output power | 2000 W |
| DC input voltage | Nominal: –48 VDC, –60 VDC Operating range: –40.5 to –72 VDC NOTE: If the input voltage from the DC power source drops below –40.5 VDC, the router automatically shuts down. During automatic shutdown, the circuit remains active. When the input voltage returns to –42.75 VDC, the router automatically starts up again and the system returns to normal operation within 30 minutes. No operator intervention is required. |
| DC input current rating | 42 A @ –48 VDC |
| Internal Supplementary Protector | 50 A |

Isolated DC Power Supply Electrical Specifications

Table 71 on page 114 list the electrical specifications for isolated DC power supplies.

Table 71: Isolated DC Power Supply Electrical Specifications

| Item | Specification |
|----------------------|---------------|
| Maximum output power | 2000 W |

Table 71: Isolated DC Power Supply Electrical Specifications (continued)

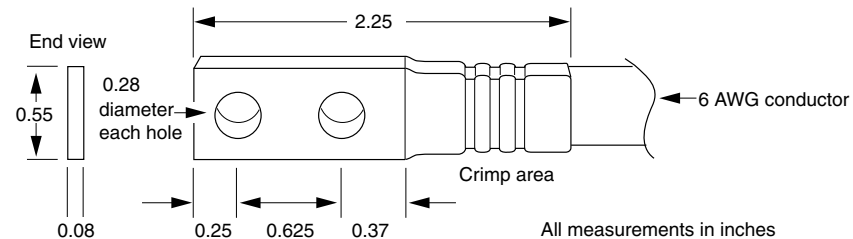
| Item | Specification |
|----------------------------------|--|
| DC input voltage | Nominal: -48 VDC, -60 VDC Operating range: -40.0 to -72.0 VDC NOTE: If the input voltage from the DC power source drops between -37.5 and -39.5 VDC, the router automatically shuts down. During automatic shutdown, the circuit remains active. When the input voltage returns to -43 to -44 VDC, the router automatically starts up again and the system returns to normal operation within 30 minutes. No operator intervention is required. |
| DC input current rating | 48 A @ -48 VDC |
| Internal Supplementary Protector | 60 A |

- Related Documentation**
- [M320 DC Power Supplies Description on page 82](#)
 - [Connecting Power to a DC-Powered M320 Router on page 195](#)

M320 DC Power Cable Specifications

The accessory box shipped with the router includes the cable lugs that attach to the terminal studs of each power supply (see [Figure 30 on page 115](#)). (The cable lug shown in is also used for the grounding the chassis.)

Figure 30: DC Power Cable Lug



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

[Table 72 on page 116](#) summarizes the specifications for the power cables, which you must supply.

Table 72: DC Power Cable Specifications

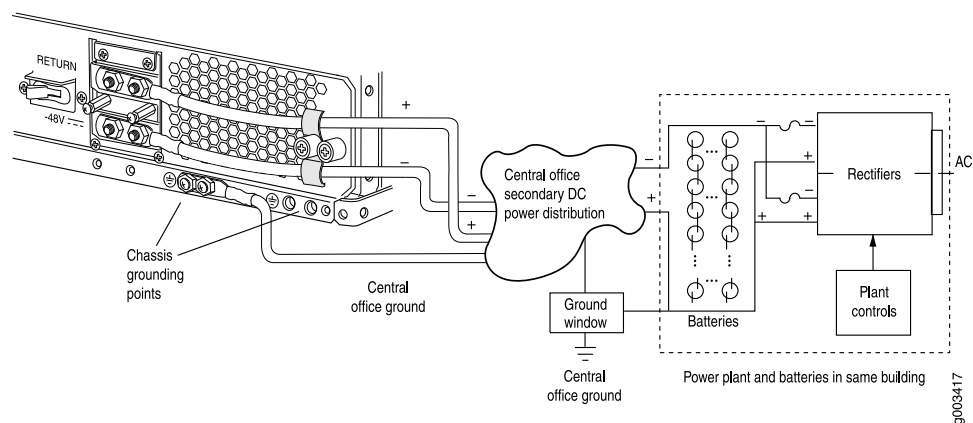
| Cable Type | Quantity and Specification | Connector Specification |
|------------|--|---|
| Power | Eight 4-AWG (21.2 mm ²) (minimum) copper conductor, or as permitted by the local code. | Cable lug; dual hole, sized to fit 1/4-20 UNC terminal studs at 15.86-mm (0.625-in.) center line. |



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

Figure 31 on page 116 shows a typical DC source cabling arrangement.

Figure 31: Typical DC Source Cabling to the Router



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

For other electrical safety information, see *M320 General Electrical Safety Guidelines and Electrical Codes*, “[M320 DC Power Electrical Safety Guidelines](#)” on page 386, and “[DC Power Electrical Safety Warnings for Juniper Networks Devices](#)” on page 387.



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

For a description of the DC power supply, see , as opposed to the DC power configuration (see “[M320 DC Power Supplies Description](#)” on page 82 for more information). For instructions on connecting the DC power and grounding cables during initial installation,

see “Connecting Power to a DC-Powered M320 Router” on page 195. For instructions on replacing a DC power cable, see “Replacing an M320 DC Power Supply Cable” on page 294.

- Related Documentation**
- [M320 Power System Description on page 81](#)
 - [M320 Power Supply LEDs on page 84](#)
 - [M320 Power Requirements on page 104](#)

M320 DC Power Distribution

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 each set of terminal studs to the power distribution panel.



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

- Related Documentation**
- [M320 DC Power Cable Specifications on page 115](#)

DC Power Circuit Breaker for M320 Routers

Each DC power supply has a single DC input (–48 VDC and return). To enable you to operate the router in any configuration without upgrading the power infrastructure, we recommend that you use a dedicated customer site circuit breaker rated for 60 A (–48 VDC) minimum for each power supply. If you do not provision a 60 A (–48 VDC) circuit breaker, provision a customer site circuit breaker for each DC power supply rated for at least 125% of the continuous current that the system draws at –48 VDC, or as required by local code.

- Related Documentation**
- [M320 DC Power Cable Specifications on page 115](#)
 - [M320 DC Power Distribution on page 117](#)
 - [M320 Power Requirements on page 104](#)

Network Cable and Transceiver Planning

- [Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 119](#)
- [Calculating Power Budget and Power Margin for Fiber-Optic Cables on page 120](#)

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

This topic describes signal loss, attenuation, and dispersion in fiber-optic cable.

- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cable on page 119](#)
- [Attenuation and Dispersion in Fiber-Optic Cable on page 119](#)

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

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

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

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

Attenuation and Dispersion in Fiber-Optic Cable

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

and single-mode transmission. An efficient optical data link must have enough light available to overcome attenuation.

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

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

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

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

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

Calculating Power Budget and Power Margin for Fiber-Optic Cables

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



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

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

1. [Calculating Power Budget for Fiber-Optic Cable on page 120](#)
2. [Calculating Power Margin for Fiber-Optic Cable on page 121](#)

Calculating Power Budget for Fiber-Optic Cable

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

$$P_B = P_T - P_R$$

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

$$P_B = P_T - P_R$$

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

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

Calculating Power Margin for Fiber-Optic Cable

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

$$P_M = P_B - LL$$

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

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. [Table 73 on page 121](#) 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 73: Estimated Values for Factors Causing Link Loss

| Link-Loss Factor | Estimated Link-Loss Value |
|--------------------------------|--|
| Higher-order mode losses | Single-mode—None Multimode—0.5 dB |
| Modal and chromatic dispersion | Single-mode—None Multimode—None, if product of bandwidth and distance is less than 500 MHz-km |
| Connector | 0.5 dB |
| Splice | 0.5 dB |
| Fiber attenuation | Single-mode—0.5 dB/km Multimode—1 dB/km |

The following sample calculation for a 2-km-long multimode link with a power budget (P_B) of 13 dB uses the estimated values from [Table 73 on page 121](#) to calculate link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The power margin (P_M) is calculated as follows:

$$P_M = P_B - LL$$

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

$$P_M = 13 \text{ dB} - 2 \text{ dB} - 2.5 \text{ dB} - 1 \text{ dB} - 0.5 \text{ dB}$$

$$P_M = 7 \text{ dB}$$

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 73 on page 121](#) 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:

$$P_M = P_B - LL$$

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

$$P_M = 13 \text{ dB} - 4 \text{ dB} - 3.5 \text{ dB}$$

$$P_M = 5.5 \text{ dB}$$

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.

Management Cable and Transceiver Specifications and Pinouts

- [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)
- [M320 RJ-45 Connector Pinouts for the Routing Engine ETHERNET Port on page 124](#)
- [M320 DB-9 Connector Pinouts for the Routing Engine AUX and CONSOLE Ports on page 124](#)

M320 Routing Engine Interface Cable and Wire Specifications

Table 74 on page 123 lists the specifications for the cables that connect to management ports and the wires that connect to the alarm relay contacts.

Table 74: Cable and Wire Specifications for Routing Engine Management and Alarm Interfaces

| Port | Cable Specification | Cable/Wire Supplied | Maximum Length | Router Receptacle |
|---|--|---|----------------|-------------------|
| Routing Engine console or auxiliary interface | RS-232 (EIA-232) serial cable | One 6-ft (1.83-m) length with 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 (4.57-m) length with RJ-45/RJ-45 connectors | 328 ft (100 m) | RJ-45 autosensing |
| Alarm relay contacts | Wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm ²) | NO | None | — |

Related Documentation

- [M320 Routing Engine Description on page 24](#)
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [M320 Site Preparation Checklist Requirements on page 93](#)

M320 RJ-45 Connector Pinouts for the Routing Engine ETHERNET Port

The port on the CIP labeled **ETHERNET** is an autosensing 10/100 millions of packets per second (Mbps) Ethernet RJ-45 receptacle that accepts an Ethernet cable for connecting the Routing Engine to a management LAN (or other device that supports out-of-band management). [Table 75 on page 124](#) describes the RJ-45 connector pinouts.

Table 75: RJ-45 Connector Pinouts

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

Related Documentation

- [M320 Chassis Description on page 7](#)
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [M320 Site Preparation Checklist Requirements on page 93](#)

M320 DB-9 Connector Pinouts for the Routing Engine AUX and CONSOLE Ports

The ports on the CIP labeled **AUXILIARY** and **CONSOLE** are DB-9 receptacles that accept RS-232 (EIA-232) cable. The **AUXILIARY** 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 76 on page 124](#) describes the DB-9 connector pinouts.

Table 76: DB-9 Connector Pinouts

| Pin | Signal | Direction | Description |
|-----|--------|-----------|----------------|
| 1 | DCD | <– | Carrier Detect |
| 2 | RxD | <– | Receive Data |

Table 76: DB-9 Connector Pinouts (continued)

| Pin | Signal | Direction | Description |
|-----|--------|-----------|---------------------|
| 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

- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [M320 Chassis Description on page 7](#)
- [M320 Craft Interface Description on page 15](#)
- [M320 Site Preparation Checklist Requirements on page 93](#)

PART 3

Initial Installation and Configuration

- [Installation Overview on page 129](#)
- [Unpacking the M320 on page 131](#)
- [Installing the Mounting Hardware on page 137](#)
- [Installing the M320 With a Mechanical Lift on page 147](#)
- [Installing the M320 Without a Mechanical Lift on page 157](#)
- [Connecting the M320 to Ground on page 179](#)
- [Connecting the M320 to External Devices on page 181](#)
- [Providing Power to the M320 on page 193](#)
- [Configuring the Junos OS Software on page 201](#)

CHAPTER 14

Installation Overview

- [M320 Router Installation Summary on page 129](#)

M320 Router Installation Summary

After you have prepared your installation site as described in “[M320 Site Preparation Checklist Requirements](#)” on page 93, 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 355.

2. Unpack the router and verify the parts received.

3. Install the mounting hardware.

See “[Installing the M320 Mounting Hardware for a Four-Post Rack or Cabinet](#)” on page 137 or “[Installing the M320 Mounting Hardware for Open-Frame Racks](#)” on page 141.

4. Install the chassis.

See “[Installing the M320 Chassis Using a Mechanical Lift](#)” on page 148 or “[Installing the M320 Chassis in the Rack Manually](#)” on page 167.

5. Perform the initial system startup as described in “[Initially Configuring the M320 Router](#)” on page 201.

Related Documentation

- [M320 Installation Safety Guidelines on page 363](#)

Unpacking the M320

- [Tools and Parts Required to Unpack the M320 Router on page 131](#)
- [Unpacking the M320 Router on page 131](#)
- [Verifying the M320 Router Parts Received on page 133](#)

Tools and Parts Required to Unpack the M320 Router

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

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

**Related
Documentation**

- [Unpacking the M320 Router on page 131](#)

Unpacking the M320 Router

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

The shipping crate measures 50 in. (127 cm) high, 30 in. (76.2 cm) wide, and 41 in. (104 cm) deep. The total weight of the crate containing the router and accessories can range from 582 lb (267 kg) to 650 lb (295 kg).

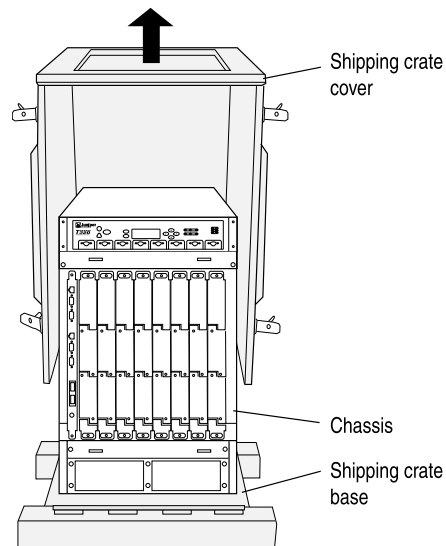


NOTE: The router is maximally protected inside the shipping crate. Do not unpack it until you are ready to begin installation.

To unpack:

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

Figure 32: Contents of the Shipping Crate



- Related Documentation**
- [Verifying the M320 Router Parts Received on page 133](#)
 - [Installing the M320 Chassis Using a Mechanical Lift on page 148](#)
 - [Installing the M320 Chassis in the Rack Manually on page 167](#)

Verifying the M320 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 77 on page 133](#), and an accessory box, which contains the parts listed in [Table 78 on page 134](#). The parts shipped with your router can vary.

Table 77: M320 Router Parts List for a Fully Configured Router

| Component | Quantity |
|--|------------------|
| Cable cover | 1 |
| Cable guards | 2 upper, 2 lower |
| Chassis, including midplane, craft interface, and rack-mounting brackets | 1 |
| FPCs | Up to 8 |

Table 77: M320 Router Parts List for a Fully Configured Router (continued)

| Component | Quantity |
|---|---|
| PICs | Up to 4 per FPC |
| SIBs | 4 |
| Routing Engines | 1 or 2 |
| CBs | 1 or 2 |
| Power supplies | 4 |
| CIP | 1 |
| Front fan tray | 1 |
| Rear fan tray | 1 |
| Front air filter | 1 |
| Rear air filter | 1 |
| Quick start installation instructions | 1 |
| Large mounting shelf | 1 |
| Small mounting shelf | 1 |
| Spacer bars | 2 |
| Blank panels for slots without components installed | One blank panel for each slot not occupied by a component |

Table 78: M320 Router Accessory Box Parts List

| Part | Quantity |
|--|----------|
| Affidavit for T1 connection | 1 |
| Connectors for alarm relay cables | 2 |
| DB-9 (male) to DB-25 (female) adapter | 1 |
| ESD wrist strap with cable | 1 |
| Ethernet cable, 15-ft length, to connect Routing Engine to management device | 1 |

Table 78: M320 Router Accessory Box Parts List (continued)

| Part | Quantity |
|--|-----------|
| PCMCIA card holder and hook-and-loop fasteners (male and female) | 1 of each |
| DC Power and grounding cable lugs | 9 |
| Read me first document | 1 |
| Screws to fasten grounding cable to chassis | 2 |
| Screws to mount chassis | Bag of 14 |
| Serial cable, 6-ft length, to connect Routing Engine to management console | 1 |
| Software license agreement | 1 |
| Washers for grounding cable lug | 2 |

- Related Documentation**
- [M320 Chassis Description on page 7](#)
 - [Unpacking the M320 Router on page 131](#)

Installing the Mounting Hardware

- [Installing the M320 Mounting Hardware for a Four-Post Rack or Cabinet on page 137](#)
- [Installing the M320 Mounting Hardware for Open-Frame Racks on page 141](#)

Installing the M320 Mounting Hardware for a Four-Post Rack or Cabinet

To prepare to install the M320 router in a four-post rack or cabinet, you install the large shelf and the spacer bars on the front rail, and the small mounting shelf on the rear rail (see [Figure 33 on page 139](#)). You also remove the adjustable center-mounting brackets from the chassis.

1. [Installing Cage Nuts \(If Needed\) for M320 Four-Post Racks or Cabinets on page 137](#)
2. [Installing the Large Mounting Shelf for M320 Four-Post Racks or Cabinets on page 138](#)
3. [Installing the Small Mounting Shelf for M320 Four-Post Racks or Cabinets on page 139](#)
4. [Removing the Adjustable Center-Mounting Brackets for M320 Four-Post Racks or Cabinets on page 140](#)

Installing Cage Nuts (If Needed) for M320 Four-Post Racks or Cabinets

For racks without threaded holes, you must install cage nuts in the locations specified in [Table 79 on page 137](#). To install the cage nuts:

1. On the front rack rails, install cage nuts in the holes specified for the large shelf and the spacer bars.
2. On the rear rack rails, install cage nuts in the holes specified for the small shelf.

[Table 79 on page 137](#) specifies the holes in which you insert mounting screws (an X indicates a mounting hole location), and cage nuts if needed. The hole distances are relative to one of the standard U divisions on the rack. The bottom of all mounting shelves is at 0.04 in. (0.02 U) above a U division.

Table 79: Four-Post or Cabinet Rack Mounting Hole Locations

| Hole | Distance Above U Division | Large Shelf | Spacer Bars | Small Shelf |
|------|---------------------------|-------------|-------------|-------------|
| 51 | 29.51 in. (74.9 cm) | 16.86 U | X | |

Table 79: Four-Post or Cabinet Rack Mounting Hole Locations (continued)

| Hole | Distance Above U Division | | Large Shelf | Spacer Bars | Small Shelf |
|------|---------------------------|---------|-------------|-------------|-------------|
| 42 | 24.26 in. (61.6 cm) | 13.86 U | | X | |
| 33 | 19.01 in. (48.3 cm) | 10.86 U | | X | |
| 30 | 17.26 in. (43.8 cm) | 9.86 U | X | | |
| 24 | 13.76 in. (34.9 cm) | 7.86 U | | X | |
| 15 | 8.51 in. (21.6 cm) | 4.86 U | | X | |
| 6 | 3.26 in. (8.3 cm) | 1.86 U | | X | |
| 3 | 1.51 in. (3.8 cm) | 0.86 U | | | X |
| 2 | 0.88 in. (2.2 cm) | 0.50 U | X | | X |
| 1 | 0.25 in. (0.6 cm) | 0.14 U | | | X |

See Also • [M320 Site Preparation Checklist Requirements on page 93](#)

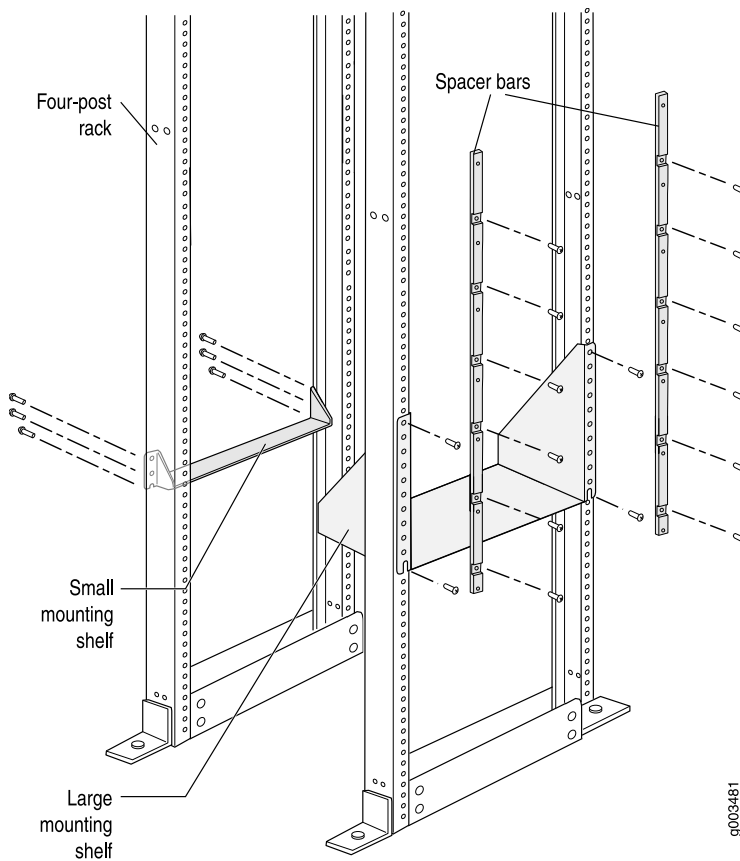
Installing the Large Mounting Shelf for M320 Four-Post Racks or Cabinets

To install the large mounting shelf:

1. On the front of each front rack rail, partially insert a mounting screw into the lowest hole.
2. Install the large shelf on the front rack rails. Rest the bottom slot of each flange on a mounting screw.
3. Partially insert a mounting screw into the top hole in each flange of the large shelf.
4. Tighten all the screws completely.
5. The router is shipped with each spacer bar attached to the rear of each front-mounting flange. Remove each spacer bar by removing the seven screws that fasten the spacer bar to the front-mounting flange.
6. Place one of the spacer bars over an flange of the installed large shelf. Position the notch in the rear of the spacer bar so the upper part of the bar is flush with the rack rail and the lower part is flush with the flange of the shelf.

7. Insert a mounting screw into each of the nonthreaded holes in the recesses of the spacer bar to secure the spacer bar.
8. Repeat Steps 6 and 7 for the other spacer bar.
9. Tighten all the screws completely.

Figure 33: Installing the Mounting Hardware for a Four-Post Rack or Cabinet



See Also • [M320 Site Preparation Checklist Requirements on page 93](#)

Installing the Small Mounting Shelf for M320 Four-Post Racks or Cabinets

1. On the back of each rear rack rail, partially insert a mounting screw into the lowest hole.
2. Install the small shelf on the back rack rails. Rest the bottom slot of each flange on a mounting screw. The small shelf installs on the back of the rear rails, extending toward the center of the rack. The bottom of the small shelf should align with the bottom of the large shelf.

3. Partially insert screws into the open holes in the flanges of the small shelf.
4. Tighten all the screws completely.

See Also • [M320 Site Preparation Checklist Requirements on page 93](#)

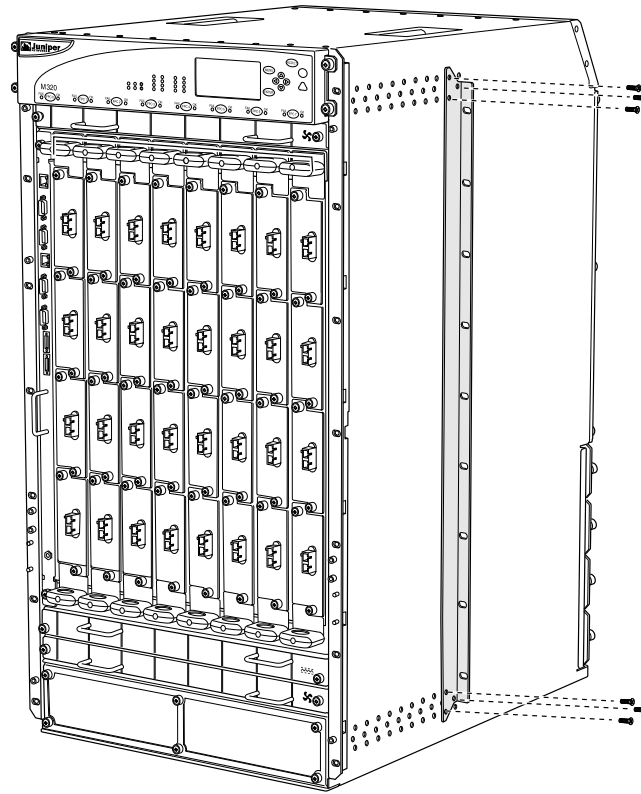
Removing the Adjustable Center-Mounting Brackets for M320 Four-Post Racks or Cabinets

Two adjustable center-mounting brackets attached to the center of the chassis (in the mounting holes closest to the rear of the chassis), but are needed only for center-mounting in an open-frame rack. Before installing the M320 router in a four-post rack or cabinet, you must remove the adjustable center-mounting brackets.

To remove the adjustable center-mounting brackets:

1. Loosen the three screws at the top and bottom of each bracket (see [Figure 34 on page 140](#)).
2. Remove the center-mounting bracket.

Figure 34: Center-Mounting Bracket Removal



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See Also • [M320 Site Preparation Checklist Requirements on page 93](#)

Related Documentation • [M320 Site Preparation Checklist Requirements on page 93](#)

Installing the M320 Mounting Hardware for Open-Frame Racks

To prepare to center-mount the router in an open-frame rack, you install both the large and small mounting shelves. The small mounting shelf and adjustable center-mounting brackets are needed only if you are center-mounting the router. To prepare to front-mount the router in an open-frame rack, install the large mounting shelf on the rack.

Two adjustable center-mounting brackets are attached to the center of the chassis (in the mounting holes closest to the rear of the chassis). Optionally, you can move the adjustable center-mounting brackets to any of 11 positions on the side of the chassis. The spacer bars are not needed to center-mount the chassis; however, you can leave them attached to the front-mounting flanges.

The mounting holes for the adjustable center-mounting brackets are spaced 0.984 in. (25 mm) apart. The adjustable center-mounting brackets have holes for rack-mounting screws, spaced at 3.5 in. (8.89 cm).

1. [Installing Cage Nuts \(If Needed\) for M320 Open Frame Racks on page 141](#)
2. [Installing the Large Mounting Shelf for the M320 Open-Frame Racks on page 142](#)
3. [Installing the Small Mounting Shelf for the M320 Open-Frame Racks on page 143](#)
4. [Moving the Adjustable Center-Mounting Brackets for M320 Open-Frame Racks on page 143](#)

Installing Cage Nuts (If Needed) for M320 Open Frame Racks

For racks without threaded holes, you must install cage nuts in the locations specified in [Table 80 on page 141](#). To install the cage nuts:

1. On the front rack rails, install cage nuts in the holes specified for the large shelf.
2. On the rear rack rails, install cage nuts in the holes specified for the small shelf.

For an open-frame rack, [Table 80 on page 141](#) specifies the holes in which you insert mounting screws (an X indicates a mounting hole location), and cage nuts if needed. The hole distances are relative to one of the standard “U” divisions on the rack. For reference, the bottom of all mounting shelves is at 0.04 in. (0.02 U) above a U division.

Table 80: Open-Frame Rack Mounting Hole Locations

| Hole | Distance Above “U” Division | | Large Shelf | Small Shelf |
|------|-----------------------------|--------|-------------|-------------|
| 30 | 17.26 in. (43.8 cm) | 9.86 U | X | |
| 27 | 15.51 in. (39.4 cm) | 8.86 U | X | |
| 24 | 13.76 in. (34.9 cm) | 7.86 U | X | |

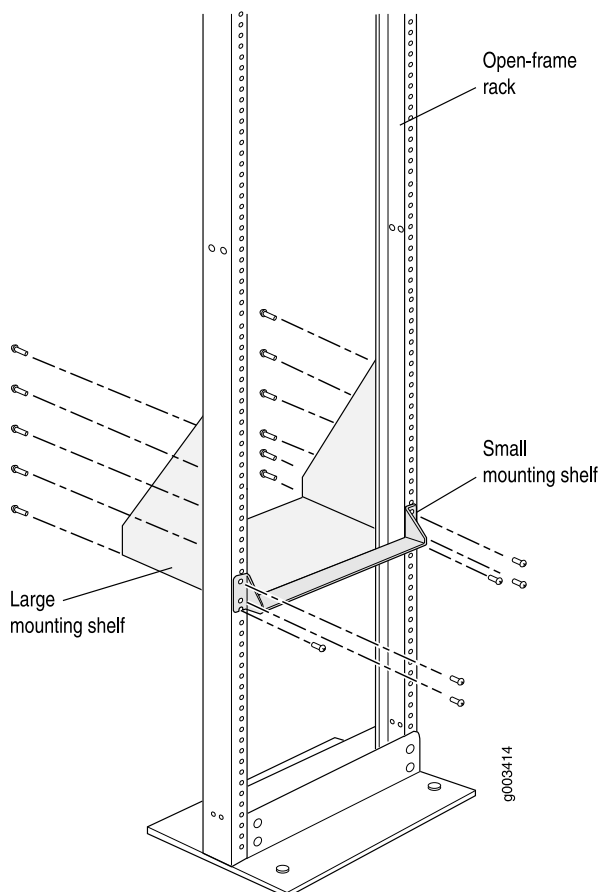
Table 80: Open-Frame Rack Mounting Hole Locations (continued)

| Hole | Distance Above "U" Division | | Large Shelf | Small Shelf |
|------|-----------------------------|--------|-------------|-------------|
| 21 | 12.01 in. (30.5 cm) | 6.86 U | X | |
| 18 | 10.26 in. (26.0 cm) | 5.86 U | X | |
| 15 | 8.51 in. (21.6 cm) | 4.86 U | X | |
| 12 | 6.76 in. (17.1 cm) | 3.86 U | X | |
| 9 | 5.01 in. (12.7 cm) | 2.86 U | X | |
| 6 | 3.26 in. (8.3 cm) | 1.86 U | X | |
| 3 | 1.51 in. (3.8 cm) | 0.86 U | X | X |
| 2 | 0.88 in. (2.2 cm) | 0.50 U | X | X |
| 1 | 0.25 in. (0.6 cm) | 0.14 U | | X |

Installing the Large Mounting Shelf for the M320 Open-Frame Racks

1. On the rear of each rack rail, partially insert a mounting screw into the lowest hole specified in [Table 80 on page 141](#) for the large shelf.
2. Install the large shelf on the rack. Rest the bottom slot of each flange on a mounting screw.
3. Partially insert screws into the open holes in the flanges of the large shelf.

Figure 35: Installing the Mounting Hardware for a Center-Mount Open-Frame Rack



Installing the Small Mounting Shelf for the M320 Open-Frame Racks

To install the small mounting shelf:

1. On the front of each rack rail, partially insert a mounting screw into the lowest hole specified in [Table 80 on page 141](#) for the small shelf.
2. Install the small shelf on the rack. Rest the bottom slot of each flange on a mounting screw. The small shelf installs on the front of the rails, extending away from the rack. The bottom of the small shelf should align with the bottom of the large shelf.
3. Partially insert screws into the open holes in the flanges of the small shelf.
4. Tighten all the screws completely.

Moving the Adjustable Center-Mounting Brackets for M320 Open-Frame Racks

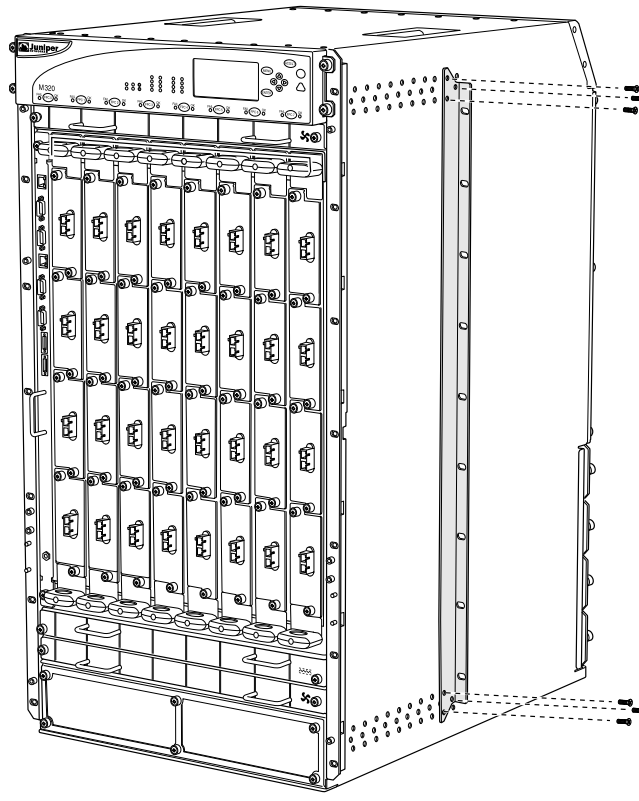
The router has two adjustable center-mounting brackets that are initially attached to the mounting holes closest to the rear of the chassis. You can move the pair of adjustable center-mounting brackets to one of 11 positions on the side of the chassis. The mounting

holes for connecting the mounting brackets to the chassis are spaced 0.984 in. (25 mm) apart.

To move the adjustable center-mounting brackets to a different location on the side of the chassis:

1. Loosen the three screws at the top and bottom of each bracket (see [Figure 36 on page 144](#)).
2. Align each mounting bracket with the mounting holes on the chassis that correspond to your rack mounting option.
3. Insert the three screws at the top and bottom of each mounting bracket, tightening each partway.
4. Tighten all the screws completely.

Figure 36: Center-Mounting Bracket Removal



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See Also • [M320 Site Preparation Checklist Requirements on page 93](#)

- Related Documentation**
- [M320 Site Preparation Checklist Requirements on page 93](#)

Installing the M320 With a Mechanical Lift

- [Overview of Installing the M320 Chassis Using a Mechanical Lift on page 147](#)
- [Tools Required to Install the M320 Chassis Using a Mechanical Lift on page 148](#)
- [Installing the M320 Chassis Using a Mechanical Lift on page 148](#)
- [Installing the M320 Cable Guards on page 154](#)

Overview of Installing the M320 Chassis Using a Mechanical Lift

Because of the M320 router's size and weight—up to 439 lb (199.6 kg) depending on the configuration—we strongly recommend that you install the router using a mechanical lift.

1. Verify that the following tasks have been completed:
 - [“Installing the M320 Mounting Hardware for Open-Frame Racks” on page 141 or Installing the M320 Mounting Hardware for a Four-Post Rack or Cabinet on page 137](#)
 - [Unpacking the M320 Router on page 131](#)
2. Gather the tools required to install the router.
[See “Tools Required to Install the M320 Chassis Using a Mechanical Lift” on page 148](#)
3. Remove the power supplies.
[See “Removing the M320 Power Supplies” on page 158.](#)
4. Attach the installation handle.
[See “Attaching the Installation Handle to the M320 Chassis” on page 148.](#)
5. Mount the chassis in the rack or cabinet.
[See “Mounting the M320 Chassis Using a Mechanical Lift” on page 150.](#)
6. Remove the installation handle, and reinstall the power supplies.

See [“Removing the M320 Installation Handle and Reinstalling the Power Supplies”](#) on page 152.

7. Optionally, install the M320 cable guards.

See [“Installing the M320 Cable Guards”](#) on page 154.

Tools Required to Install the M320 Chassis Using a Mechanical Lift

To install the T320 chassis using a mechanical lift, you need the following tools:

- Mechanical lift
- Phillips (+) screwdrivers, number 2

Related Documentation

- [M320 Installation Safety Guidelines on page 363](#)
- [M320 Cabinet Size and Clearance Requirements on page 96](#)
- [M320 Chassis Description on page 7](#)

Installing the M320 Chassis Using a Mechanical Lift

Because of the router's size and weight—up to 439 lb (199.6 kg) depending on the configuration—we strongly recommend that you install the router using a mechanical lift.



NOTE: To avoid harm to yourself or the router as you install and maintain it, follow the guidelines for working with and near electrical equipment, as well as the safety procedures for working with routers. However, providing an exhaustive set of guidelines for working with electrical equipment is beyond the scope of this documentation.

1. [Attaching the Installation Handle to the M320 Chassis on page 148](#)
2. [Mounting the M320 Chassis Using a Mechanical Lift on page 150](#)
3. [Removing the M320 Installation Handle and Reinstalling the Power Supplies on page 152](#)

Attaching the Installation Handle to the M320 Chassis

To assist you with the installation of the router, attach the installation handle over the three lowest power supply slots of the chassis. To remove the corresponding power supplies and attach the handle:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Switch the circuit breaker on the power supply faceplate to the off position (O). We recommend this even though the power supplies are not connected to power sources.
3. Loosen the captive screw on each side of the power supply faceplate completely.
4. Grasp the flange on each side of the power supply faceplate, placing your hand between the flange and the chassis.
5. Pull firmly to start removing the power supply. Slide it halfway out of the chassis (see [Figure 37 on page 149](#), which shows the removal of a DC power supply).
6. Place one hand underneath the power supply to support it, and slide it completely out of the chassis.



CAUTION: Each power supply weighs approximately 10 lb (4.5 kg). Be prepared to support the full weight of the power supply as you remove it from the router.

7. Repeat the procedure for the remaining power supplies.
8. Attach the installation handle by tightening the captive screws of the handle into the holes previously occupied by the captive screws of the power supplies in slots **PEM1** and **PEM3** (see [Figure 38 on page 150](#)).

Figure 37: Removing an M320 Power Supply Before Installing the Installation Handle

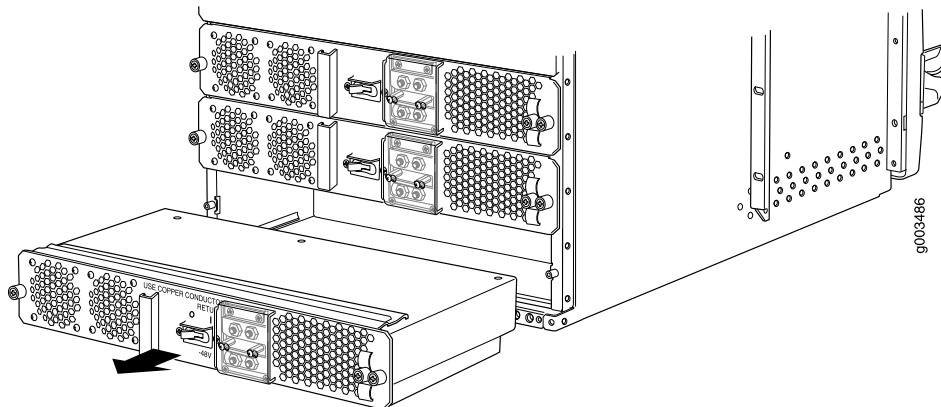
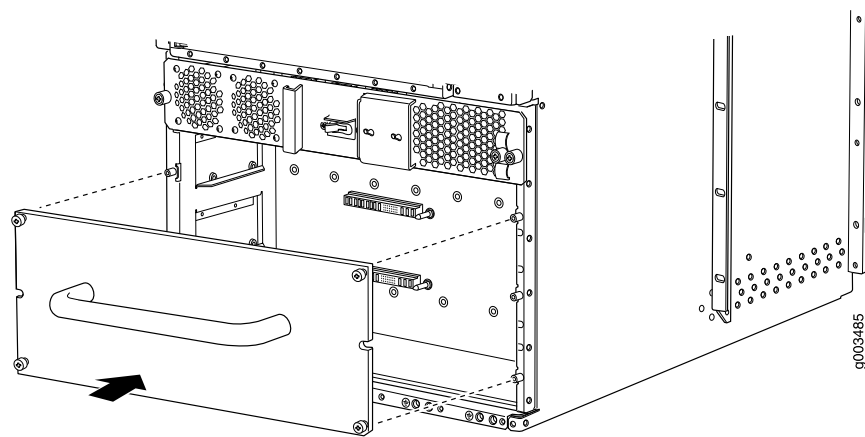


Figure 38: Attaching the M320 Installation Handle



- See Also**
- [M320 Installation Safety Guidelines on page 363](#)
 - [M320 Cabinet Size and Clearance Requirements on page 96](#)
 - [M320 Chassis Description on page 7](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Mounting the M320 Chassis Using a Mechanical Lift



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

To install the router using a lift (see [Figure 39 on page 152](#)):

1. Ensure that the rack is in its permanent location and is secured to the building. Ensure that the installation site allows adequate clearance for both airflow and maintenance. For details, see "[M320 Clearance Requirements](#)" on page 99.
2. Load the router onto the lift, making sure it rests securely on the lift platform.

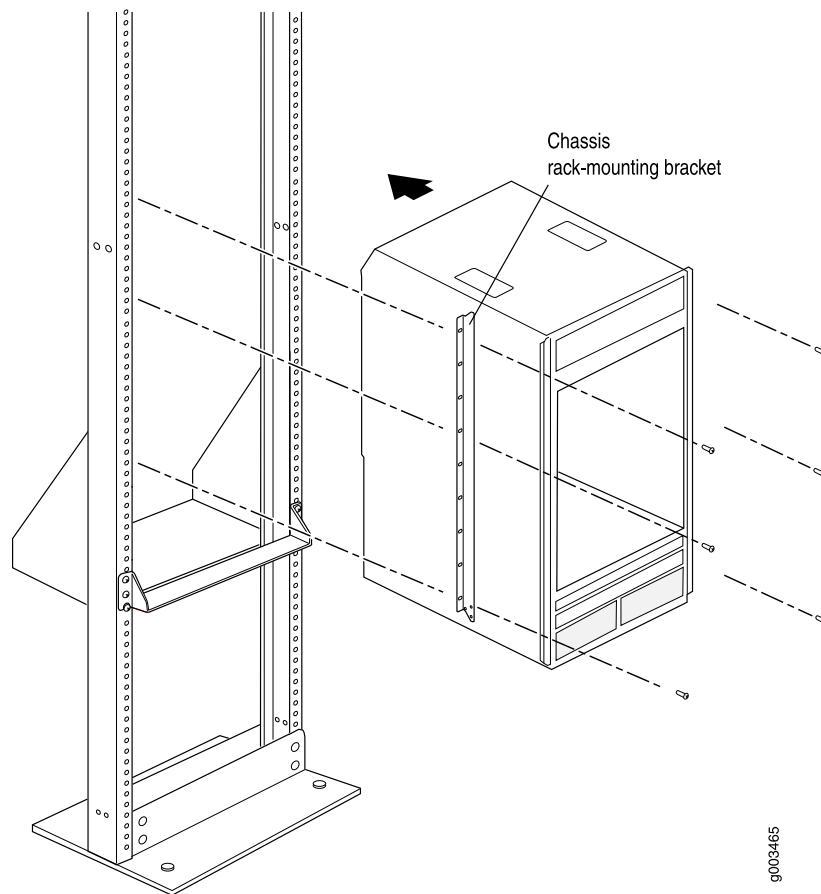


CAUTION: Do not lift the router using the craft interface, installation handle, or the handles on top of the chassis. Use these handles only to help position the router.

3. Using the lift, position the router in front of the rack or cabinet, centering it in front of the mounting shelves.

4. Lift the chassis approximately 0.75 in. above the surface of the mounting shelves and position it as close as possible to the shelves.
5. Carefully slide the router onto the mounting shelves so that the bottom of the chassis and the mounting shelves overlap by approximately 2 inches.
6. With one person pulling on the installation handle from the rear of the rack or cabinet while another person pushes on the front-mounting flanges, slide the router onto the mounting shelves until the mounting brackets or front-mounting flanges contact the rack rails or spacer bars (depending on your type of installation). The shelves ensure that the holes in the mounting brackets and the front-mounting flanges of the chassis align with the holes in the rack rails.
7. Move the lift away from the rack.
8. If you are installing the router in a four-post rack or cabinet, install a mounting screw and a cage nut into each of the holes aligned with the threaded holes in the spacer bars. If you are installing the router in an open-frame rack, install a mounting screw into each of the open mounting holes aligned with the rack, starting from the bottom.
9. Visually inspect the alignment of the router. If the router is installed properly in the rack, all the mounting screws on one side of the rack should be aligned with the mounting screws on the opposite side and the router should be level.

Figure 39: Installing the M320 Router in the Rack



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

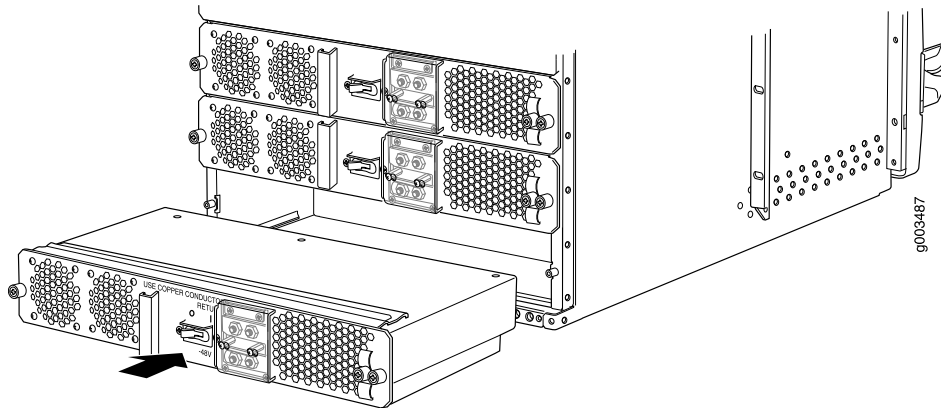
- See Also**
- [General Safety Guidelines for Juniper Networks Devices on page 355](#)
 - [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 375](#)
 - [M320 Cabinet Size and Clearance Requirements on page 96](#)
 - [M320 Chassis Description on page 7](#)

Removing the M320 Installation Handle and Reinstalling the Power Supplies

After you have installed the router, remove the installation handle and reinstall the power supplies in the chassis, starting from the bottom (see [Figure 40 on page 153](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws on the installation handle completely, and remove the handle from the chassis.
3. Switch the circuit breaker on the power supply faceplate to the off position (O).
4. Using both hands, slide the power supply into the chassis until you feel resistance.
5. Firmly push the power supply into the chassis until it comes to a stop. The power supply faceplate should be flush with any adjacent power supply faceplates.
6. Tighten the captive screws on each side of the power supply faceplate to secure the power supply in the chassis.
7. Repeat the procedure for the remaining power supplies.

Figure 40: Reinstalling an M320 Power Supply



- See Also**
- [M320 Cabinet Size and Clearance Requirements on page 96](#)
 - [M320 Chassis Description on page 7](#)

- Related Documentation**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Installation Safety Guidelines on page 363](#)
 - [M320 Chassis Description on page 7](#)
 - [M320 Cabinet Size and Clearance Requirements on page 96](#)
 - [M320 Site Preparation Checklist Requirements on page 93](#)
 - [General Safety Guidelines for Juniper Networks Devices on page 355](#)

- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 375](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)

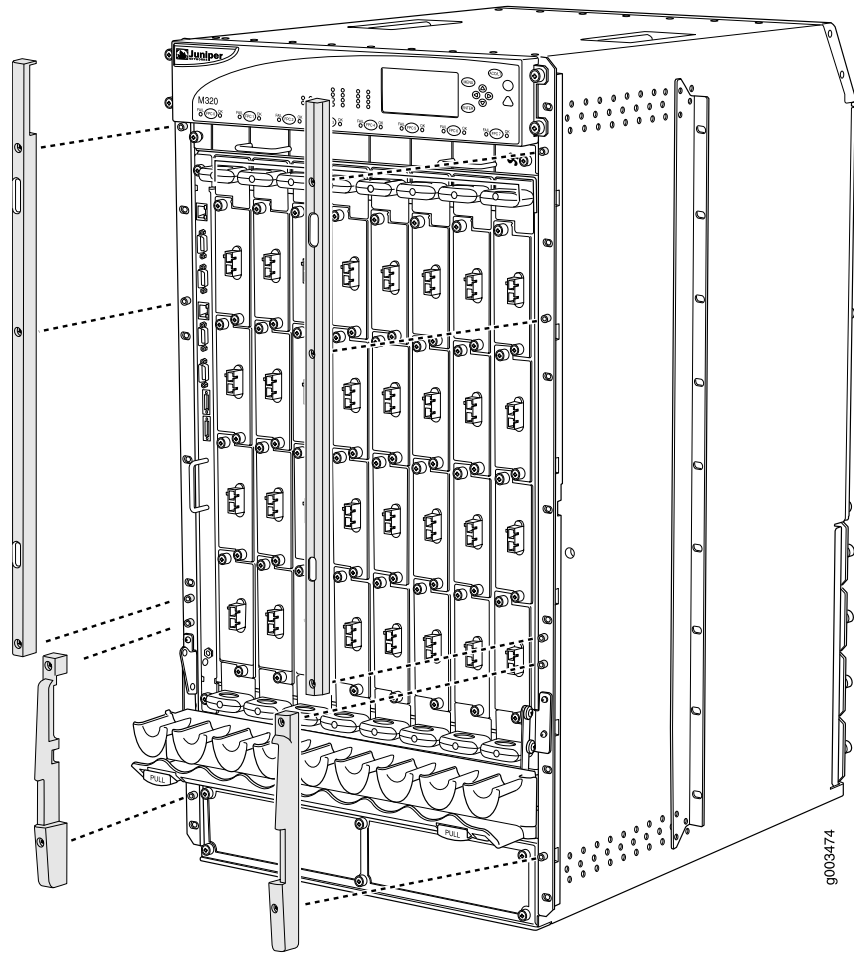
Installing the M320 Cable Guards

After the chassis is installed in the rack or cabinet, you can install the four cable guards. The cable guards protect the PIC and CIP cables from rubbing against the front edges of the chassis.

To install the cable guards (see [Figure 41 on page 155](#)):

1. Place one of the upper cable guards over one of the front-mounting flanges of the chassis, aligning the top of the cable guard with the top of the flange. Each of the three captive screws on the guard should be aligned with a corresponding standoff on the flange.
2. Tighten each of the three captive screws partway on the cable guard.
3. Tighten each of the three captive screws completely.
4. Repeat Steps 1 through 3 for the other upper cable guard.
5. Place one of the lower cable guards over one of the front-mounting flanges of the chassis, aligning the cable guard with the standoffs on the flange. Each of the two captive screws on the guard should be aligned with a corresponding hole in the flange.
6. Tighten each of the two captive screws partway on the cable guard.
7. Tighten each of the two captive screws completely.
8. Repeat Steps 5 through 7 for the other lower cable guard.

Figure 41: Installing the M320 Cable Guards

**Related Documentation**

- [M320 Cable Management System Description on page 12](#)
- [M320 Installation Safety Guidelines on page 363](#)
- [M320 Chassis Description on page 7](#)
- [M320 Cabinet Size and Clearance Requirements on page 96](#)

CHAPTER 18

Installing the M320 Without a Mechanical Lift

- [Tools and Parts Required to Install the M320 Chassis Without a Mechanical Lift on page 157](#)
- [Removing M320 Components from the Chassis on page 157](#)
- [Installing the M320 Chassis in the Rack Manually on page 167](#)
- [Reinstalling M320 Components in the Chassis on page 169](#)
- [Installing the M320 Cable Guards on page 177](#)

Tools and Parts Required to Install the M320 Chassis Without a Mechanical Lift

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

- Phillips (+) screwdrivers, numbers 1 and 2
- 7/16-in. (11 mm) socket wrench for the DC power supply
- 3/8-in. nut driver for the cable management system
- ESD grounding wrist strap

Related Documentation

- [M320 Site Preparation Checklist Requirements on page 93](#)
- [Removing M320 Components from the Chassis on page 157](#)

Removing M320 Components from the Chassis

- [Removing the M320 Power Supplies on page 158](#)
- [Removing the M320 SIBs on page 159](#)
- [Removing the M320 CBs on page 160](#)
- [Removing the M320 Rear Fan Tray on page 161](#)
- [Removing the M320 Cable Management System on page 163](#)
- [Removing the M320 Front Fan Trays on page 163](#)
- [Removing the M320 FPCs on page 164](#)

Removing the M320 Power Supplies

The power supplies are located at the rear of the chassis below the SIBs. Each power supply weighs approximately 10 lb (4.5 kg).

Remove the upper power supply first and finish with the lowest power supply. To remove the AC or DC power supplies:

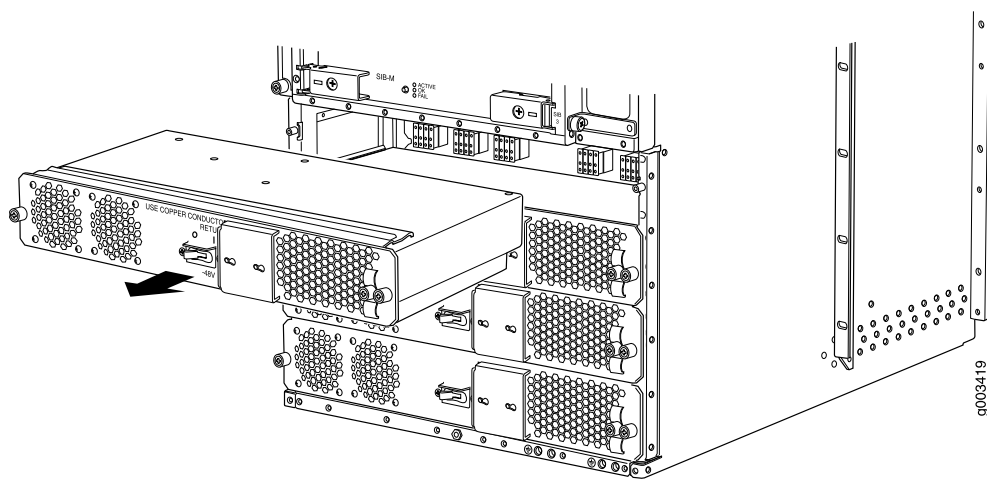
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Switch the circuit breaker on the power supply faceplate to the off position (O). We recommend this even though the power supplies are not connected to power sources.
3. Loosen the captive screw on each side of the power supply faceplate completely.
4. Grasp the flange on each side of the power supply faceplate, placing your hand between the flange and the chassis.
5. Pull firmly to start removing the power supply. Slide it halfway out of the chassis (see [Figure 42 on page 159](#), which shows the removal of DC power supplies).
6. Place one hand underneath the power supply to support it, and slide it completely out of the chassis.



CAUTION: Each power supply weighs approximately 10 lb (4.5 kg). Be prepared to support the full weight of the power supply as you remove it from the router.

7. Repeat the procedure for each of the remaining power supplies.

Figure 42: Removing a Power Supply Before Installing the Router



- See Also**
- [M320 General Electrical Safety Guidelines and Electrical Codes](#)
 - [M320 Power System Description on page 81](#)

Removing the M320 SIBs

Two to four SIBs are installed in the router. The SIBs are located in the rear of the chassis in the slots marked **SIB0** through **SIB3**. SIBs are hot-insertable and hot-removable. Each SIB weighs approximately 4 lb (1.8 kg).

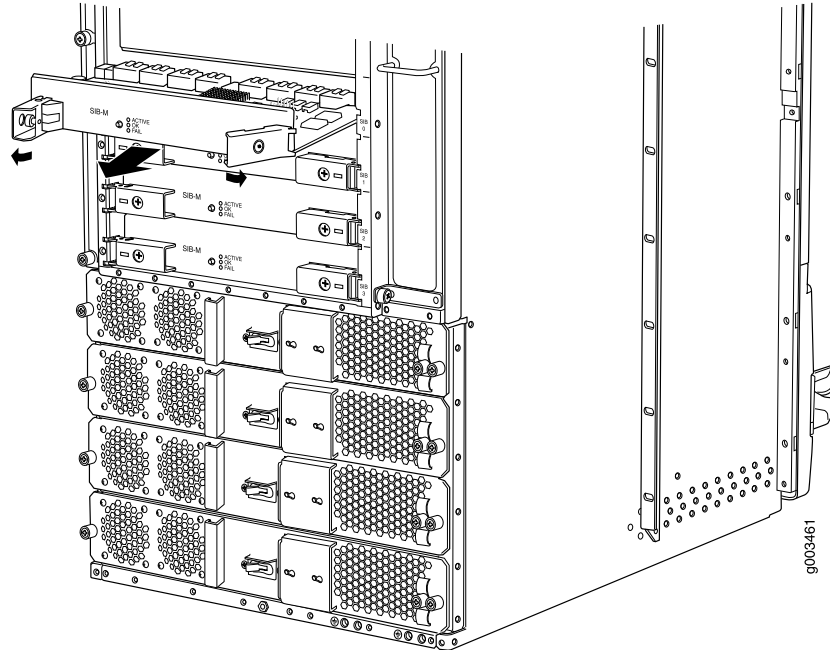
To remove a SIB (see [Figure 43 on page 160](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Loosen the captive screws (using a Phillips (+) screwdriver, number 2) on the ejector handles on each side of the SIB faceplate.
4. Flip the ejector handles outward to unseat the SIB.
5. Grasp both ejector handles, pull firmly, and slide the SIB about three-quarters of the way out of the chassis.
6. Place one hand underneath the SIB to support it, and slide it completely out of the chassis. Place it on the antistatic mat.



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

Figure 43: Removing a SIB



- See Also**
- [M320 SIB Description on page 87](#)
 - [Reinstalling the M320 SIBs on page 172](#)
 - [Maintaining the M320 SIBs on page 318](#)

Removing the M320 CBs

The router can have one or two CBs. They are located in the upper rear of the chassis in the slots marked **CB0** and **CB1**. Each CB weighs approximately 3.4 lb (1.5 kg).

To remove the CBs (see [Figure 44 on page 161](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Loosen the captive screws on the ejector handles on both sides of the CB faceplate.

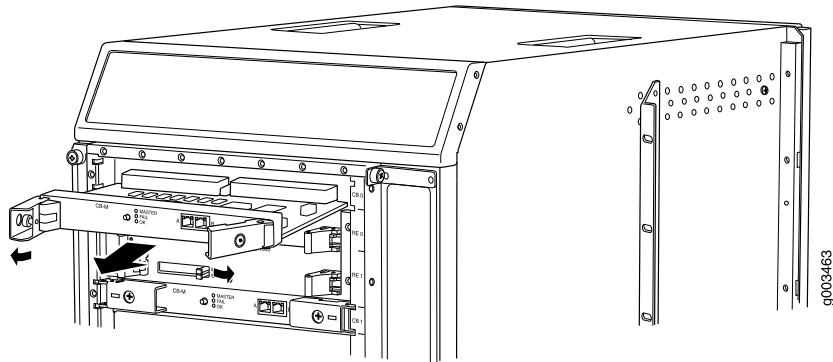
4. Flip the ejector handles outward to unseat the CB.
5. Grasp the ejector handles, and slide the CB about halfway out of the chassis.
6. Place one hand underneath the CB to support it, and slide it completely out of the chassis. Place it on the antistatic mat.



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

7. Repeat the procedure for the second CB.

Figure 44: Removing a CB



- See Also**
- [Taking the M320 Host Subsystem Offline on page 243](#)
 - [M320 Control Board \(CB\) Description on page 51](#)
 - [Reinstalling the M320 CBs on page 171](#)

Removing the M320 Rear Fan Tray

The rear fan tray is mounted vertically on the right side of the rear of the chassis. The rear fan tray contains seven fans. The fan tray weighs about 8.4 lb (3.8 kg).

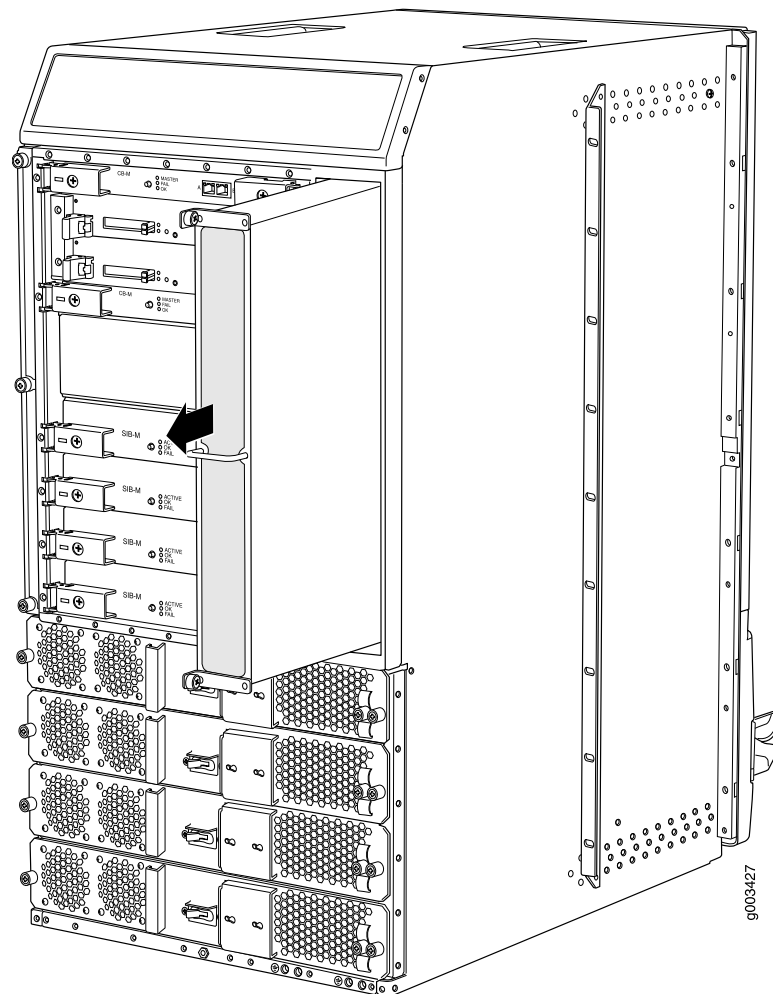


CAUTION: To maintain proper cooling, do not operate the router with the rear fan tray removed for more than 1 minute.

To remove the rear fan tray (see [Figure 45 on page 162](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Loosen the captive screws on the top and bottom of the fan tray faceplate, using a Phillips (+) screwdriver, number 2.
3. Grasp the handle and pull the fan tray halfway out of the chassis.
4. When the fans stop spinning, place one hand under the fan tray to support it, and pull the fan tray completely out of the chassis.

Figure 45: Removing the Rear Fan Tray



See Also • [M320 Cooling System Description on page 21](#)

- [Maintaining the M320 Fan Trays on page 306](#)
- [Troubleshooting the M320 Cooling System on page 327](#)

Removing the M320 Cable Management System

The cable management system is located below the FPC card cage. The cable management system weighs approximately 5 lb (2.3 kg).

To remove the cable management system:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Using a 3/8-in. nut driver, unscrew the nuts on the corners of the cable management system.
3. Grasp the bottom of the cable management system and pull it straight out from the studs on the front of the chassis.

- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)

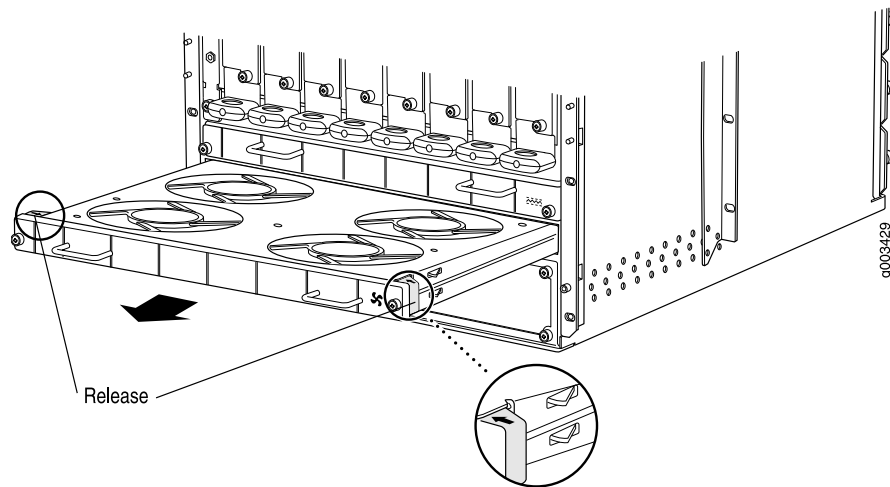
Removing the M320 Front Fan Trays

The upper front fan tray is located above the FPC card cage, and the lower front fan tray is located below the air filter. Each fan tray weighs about 11 lb (5.1 kg).

To remove the front fan trays (see [Figure 46 on page 164](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Loosen the captive screw on each side of the faceplate of one of the fan trays.
3. Grasp the handles and pull the fan tray until it stops.
4. Press the tabs on both sides of the fan tray and pull the fan tray halfway out of the chassis.
5. Place one hand under the fan tray to support it, and pull the fan tray completely out of the chassis.
6. Repeat the procedure to remove the remaining front fan tray.

Figure 46: Removing a Front Fan Tray



- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)

Removing the M320 FPCs

The router holds up to eight FPCs, which are installed vertically in the front of the router. The FPCs are hot-insertable and hot-removable. An empty FPC1 or FPC2 weighs 15 lb (6.8 kg), and an empty FPC3 weighs 16 lb (7.3 kg). A fully configured FPC can weigh up to 29 lb (13.2 kg)

Each FPC slot not occupied by an FPC must be covered by an FPC blank panel. An FPC blank panel weighs 7.7 lb (3.5 kg).

To remove an FPC (see [Figure 47 on page 166](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Before removing the FPCs, record their location in the chassis so that you can reinstall each FPC in the correct slot
4. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.
5. Grasp the handles and slide the FPC straight out of the card cage halfway.

6. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.



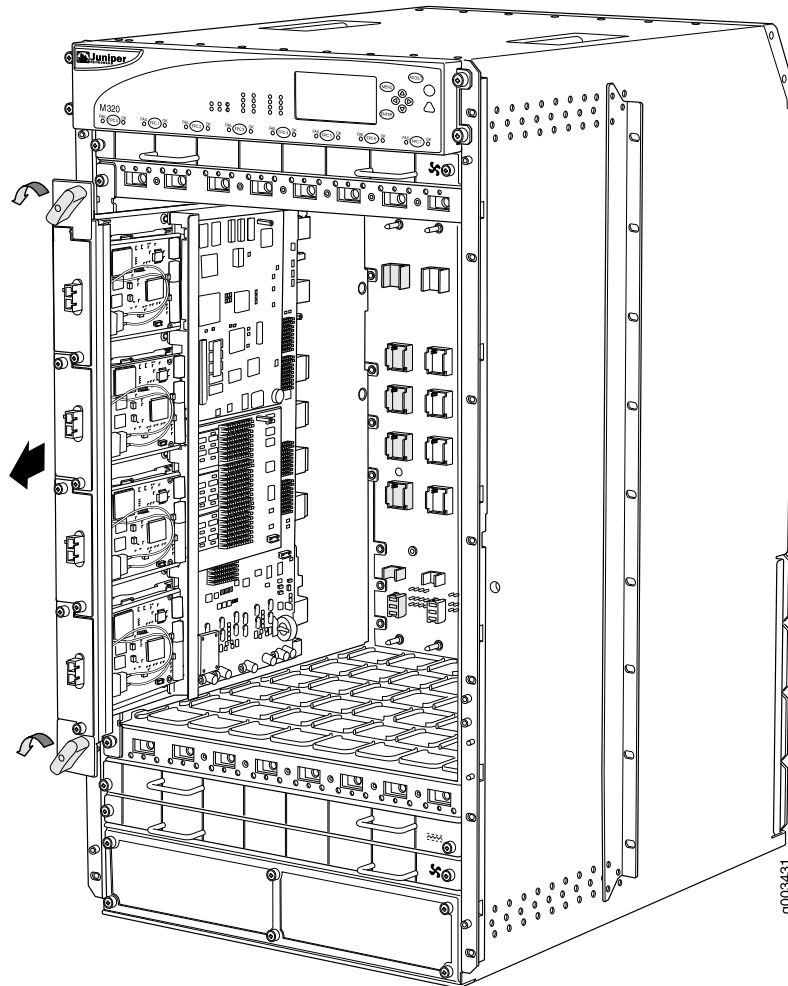
CAUTION: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 29 lb (13.2 kg)—as you slide the FPC out of the chassis.

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

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

7. Repeat the procedure for each remaining FPC.

Figure 47: Removing an FPC



- See Also**
- [M320 FPCs Supported on page 59](#)
 - [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Maintaining M320 FPCs on page 309](#)
 - [Reinstalling the M320 FPCs on page 174](#)

- Related Documentation**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Removing the M320 Power Supplies on page 158](#)
 - [Removing the M320 SIBs on page 159](#)
 - [Removing the M320 CBs on page 160](#)
 - [Removing the M320 FPCs on page 164](#)

- M320 Cooling System Description on page 21

Installing the M320 Chassis in the Rack Manually



CAUTION: If you are installing two routers in one rack, install the lower one first. Installing a router in the upper position in a rack or cabinet requires a lift.



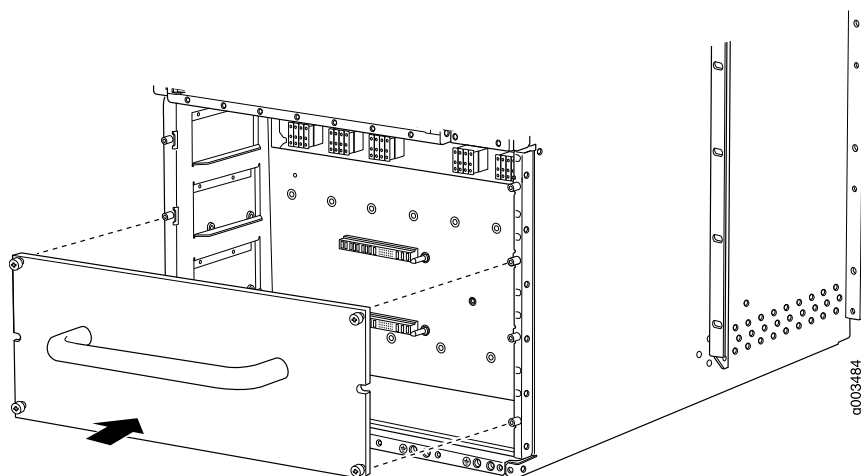
CAUTION: Before front-mounting the router in a rack, have a qualified technician verify that the rack is strong enough to support the router's weight and is adequately supported at the installation site.

Lifting the chassis and mounting it in a rack requires three people. The empty chassis weighs approximately 142 lb (64.7 kg).

To install the chassis in the rack (see [Figure 49 on page 169](#)):

1. Ensure that the rack is in its permanent location and is secured to the building. Ensure that the installation site allows adequate clearance for both airflow and maintenance. For details, see “[M320 Site Preparation Checklist Requirements](#)” on page 93.
2. Attach the installation handle by tightening the captive screws of the handle into the holes previously occupied by the captive screws of the power supplies in slots **PEM1** and **PEM3** (see [Figure 48 on page 167](#)). Tighten the screws, using a Phillips (+) screwdriver, number 2.

Figure 48: Attaching the Installation Handle



3. Position the router in front of the rack or cabinet, centering it in front of the mounting shelves. Use a pallet jack if one is available.

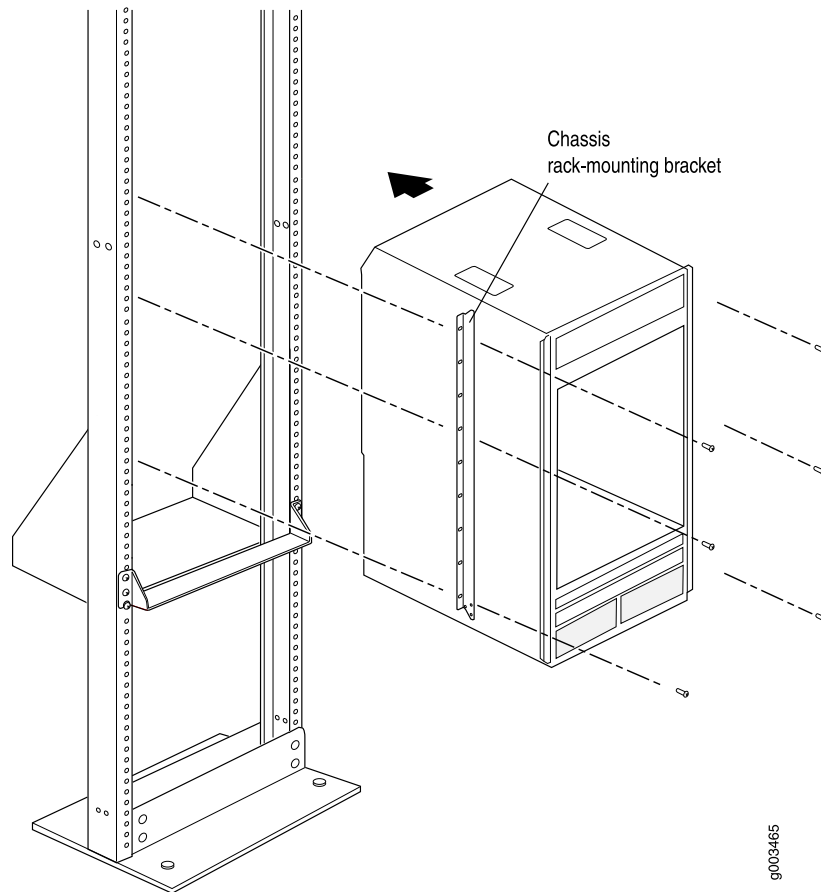
4. With one person on each side and one person in the front, hold onto the bottom of the chassis and carefully lift it onto the large and small (if installed) mounting shelves.



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

5. With one person pulling on the installation handle from the rear of the rack or cabinet while another person pushes on the front-mounting flanges, slide the router onto the mounting shelves until the mounting brackets or front-mounting flanges contact the rack rails or spacer bars (depending on your type of installation). The shelves ensure that the holes in the mounting brackets and the front-mounting flanges of the chassis align with the holes in the rack rails.
6. If you are installing the router in a four-post rack or cabinet, install a mounting screw and a cage nut into each of the holes aligned with the threaded holes in the spacer bars. If you are installing the router in an open-frame rack, install a mounting screw into each of the open mounting holes aligned with the rack, starting from the bottom.
7. Loosen the captive screws on the installation handle completely, and remove the handle from the chassis.
8. Visually inspect the alignment of the router. If the router is installed properly in the rack, all the mounting screws on one side of the rack should be aligned with the mounting screws on the opposite side and the router should be level.

Figure 49: Installing the Router in the Rack



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

Related Documentation

- [M320 Installation Safety Guidelines on page 363](#)
- [M320 Router Installation Summary on page 129](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Reinstalling M320 Components in the Chassis

- [Reinstalling an M320 Rear Fan Tray on page 170](#)
- [Reinstalling the M320 CBs on page 171](#)
- [Reinstalling the M320 SIBs on page 172](#)
- [Reinstalling the M320 Power Supplies on page 173](#)
- [Reinstalling the M320 FPCs on page 174](#)

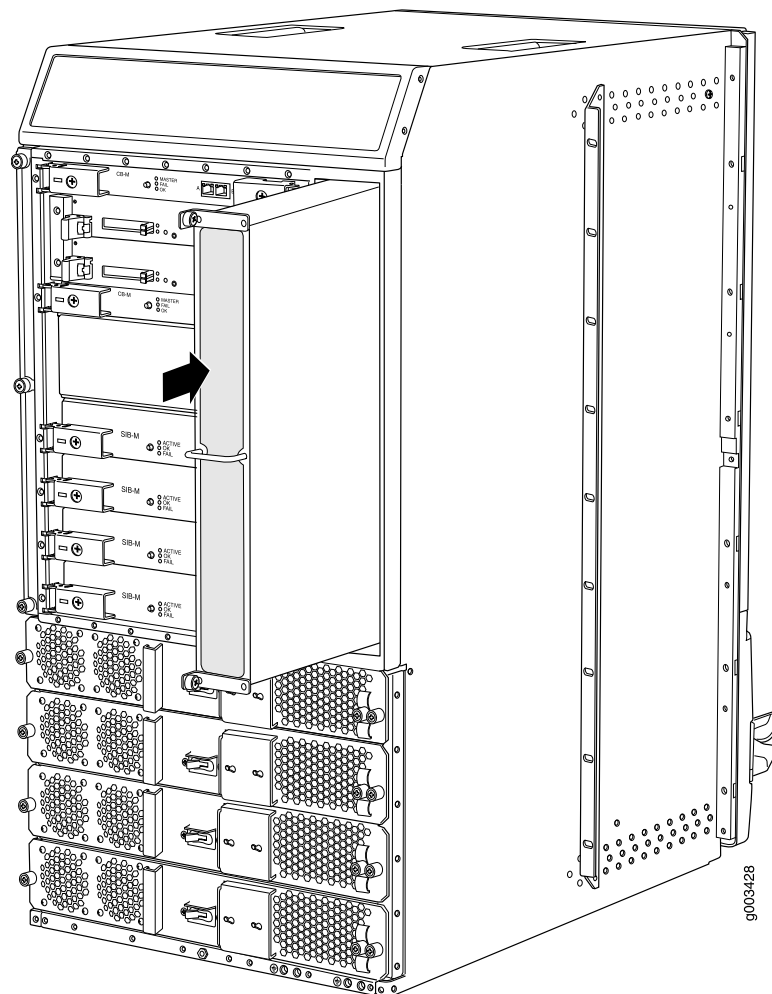
- [Reinstalling M320 Front Fan Trays on page 175](#)
- [Reinstalling the M320 Cable Management System on page 176](#)

Reinstalling an M320 Rear Fan Tray

To reinstall the rear fan tray (see [Figure 50 on page 170](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Grasp the handle with one hand and place the other hand under the fan tray. Insert the fan tray straight into the chassis.
3. Tighten the captive screws on the top and bottom of the fan tray faceplate to secure it in the chassis.

Figure 50: Reinstalling the Rear Fan Tray



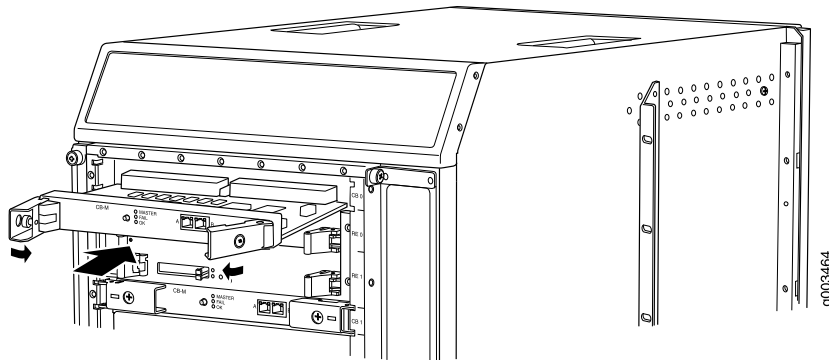
- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)

Reinstalling the M320 CBs

To reinstall CBs (see [Figure 51 on page 171](#)):

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. Carefully align the sides of the CB with the guides inside the chassis.
3. Slide the CB into the chassis, carefully ensuring that it is correctly aligned.
4. Grasp both ejector handles and press them inward to seat the CB.
5. Tighten the captive screws on the ejector handles, using a Phillips (+) screwdriver, number 2.
6. Repeat the procedure to reinstall the remaining CB.

Figure 51: Reinstalling a CB



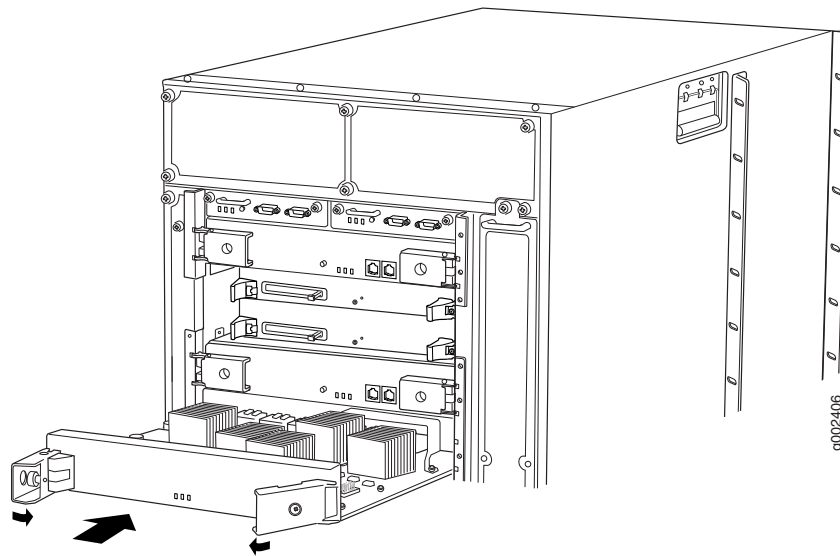
- See Also**
- [Taking the M320 Host Subsystem Offline on page 243](#)
 - [M320 Control Board \(CB\) Description on page 51](#)

Reinstalling the M320 SIBs

To reinstall the SIBs (see [Figure 52 on page 172](#)):

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. Place one hand underneath the SIB to support it. With the other hand, hold one of the ejector handles on the SIB faceplate.
3. Carefully align the sides of the SIB with the guides inside the chassis.
4. Slide the SIB into the chassis, carefully ensuring that it is correctly aligned.
5. Grasp both ejector handles and press them inward to seat the SIB.
6. Tighten the captive screws on the ejector handles.
7. Repeat the procedure for each of the remaining SIBs.

Figure 52: Reinstalling a SIB



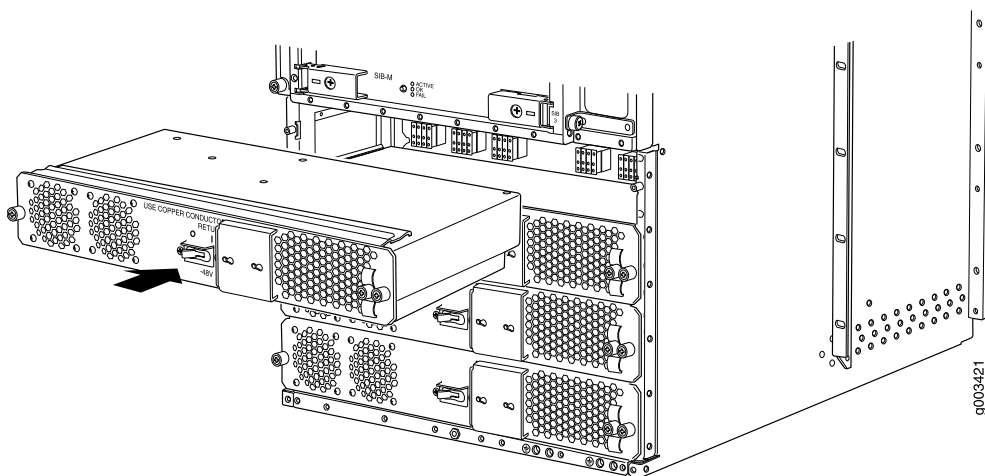
- See Also**
- [M320 SIB Description on page 87](#)
 - [Maintaining the M320 SIBs on page 318](#)

Reinstalling the M320 Power Supplies

Reinstall the lowest power supply first and finish with the upper power supply. To reinstall AC or DC power supplies (see [Figure 53 on page 173](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Loosen the captive screws on the installation handle completely, and remove the handle from the chassis.
3. Switch the circuit breaker on the DC power supply faceplate to the off position (O).
4. Using both hands, slide the power supply into the chassis until you feel resistance.
5. Firmly push the power supply into the chassis until it comes to a stop. The power supply faceplate should be flush with any adjacent power supply faceplates.
6. Tighten the captive screws on each side of the power supply faceplate to secure the power supply in the chassis.
7. Repeat the procedure for each of the remaining power supplies.

Figure 53: Reinstalling a Power Supply



- See Also**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Power System Description on page 81](#)

Reinstalling the M320 FPCs

To reinstall FPCs (see [Figure 54 on page 175](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Using the list you created when you removed the FPCs, locate the slot in the FPC card cage in which you plan to install the FPC.
3. Inspect the slots in the FPC card cage to verify that there are no missing or bent pins on the midplane.
4. Inspect each FPC to verify that the connectors are not misaligned or damaged.



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

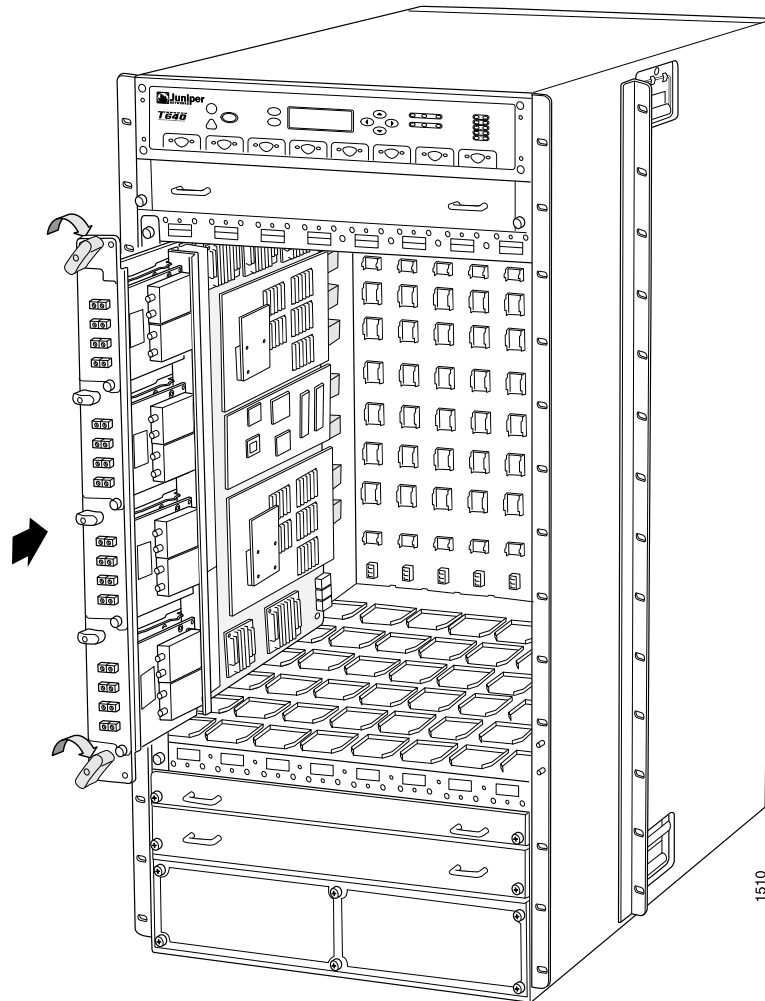
5. Lift the FPC into place and carefully align first the bottom and top of the FPC with the guides inside the card cage. Be sure the FPC is right-side up, with the components on the right of the FPC.
6. Gently rest the bottom edge of the FPC on the bottom edge of the slot opening, making contact a short distance forward of the power connector.



CAUTION: Take care not to bend or otherwise damage the power connector prongs.

7. Slide the FPC all the way into the card cage until you feel resistance.
8. Starting with the ejector handles on the FPC faceplate nearly horizontal, simultaneously turn both ejector handles clockwise to seat the FPC.
9. If you are installing a Type 2 FPC or Type 3 FPC, tighten the screws inside the ejector handles to secure the FPC. Do not overtighten them.
10. Repeat the procedure to reinstall each remaining FPC.

Figure 54: Reinstalling an FPC



- See Also**
- [M320 FPCs Supported on page 59](#)
 - [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Maintaining M320 FPCs on page 309](#)

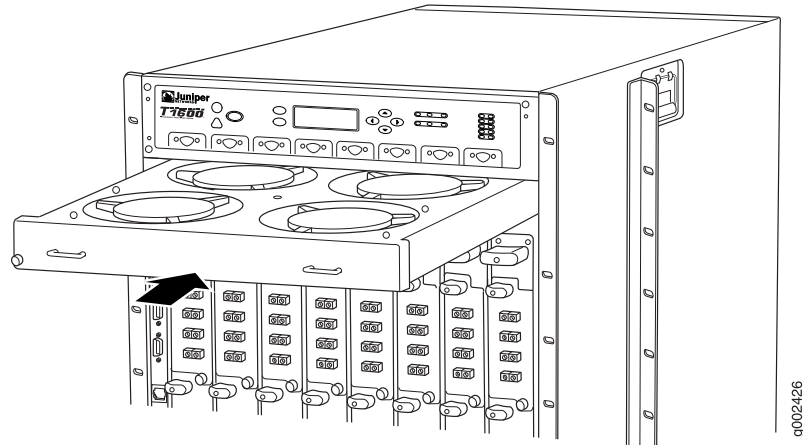
Reinstalling M320 Front Fan Trays

To reinstall the standard front fan trays (see [Figure 55 on page 176](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Grasp one of the fan trays by its handles and insert it straight into the chassis.

3. Tighten the captive screw on each side of the fan tray faceplate to secure it in the chassis.
4. Repeat the procedure to reinstall the remaining fan tray.

Figure 55: Reinstalling a Front Fan Tray



- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)

Reinstalling the M320 Cable Management System

To reinstall the cable management system:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Position the cable management system on the studs on the lower front of the chassis.
3. Insert the nuts through the holes in the cable management system onto the studs on the chassis.
4. Using a 3/8-in. nut driver, tighten the nuts securely.

- See Also**
- [M320 Cable Management System Description on page 12](#)
 - [M320 Site Preparation Checklist Requirements on page 93](#)

- Related Documentation**
- [Taking the M320 Host Subsystem Offline on page 243](#)

- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
- [Removing the M320 SIBs on page 159](#)
- [Removing the M320 CBs on page 160](#)
- [M320 Cooling System Description on page 21](#)

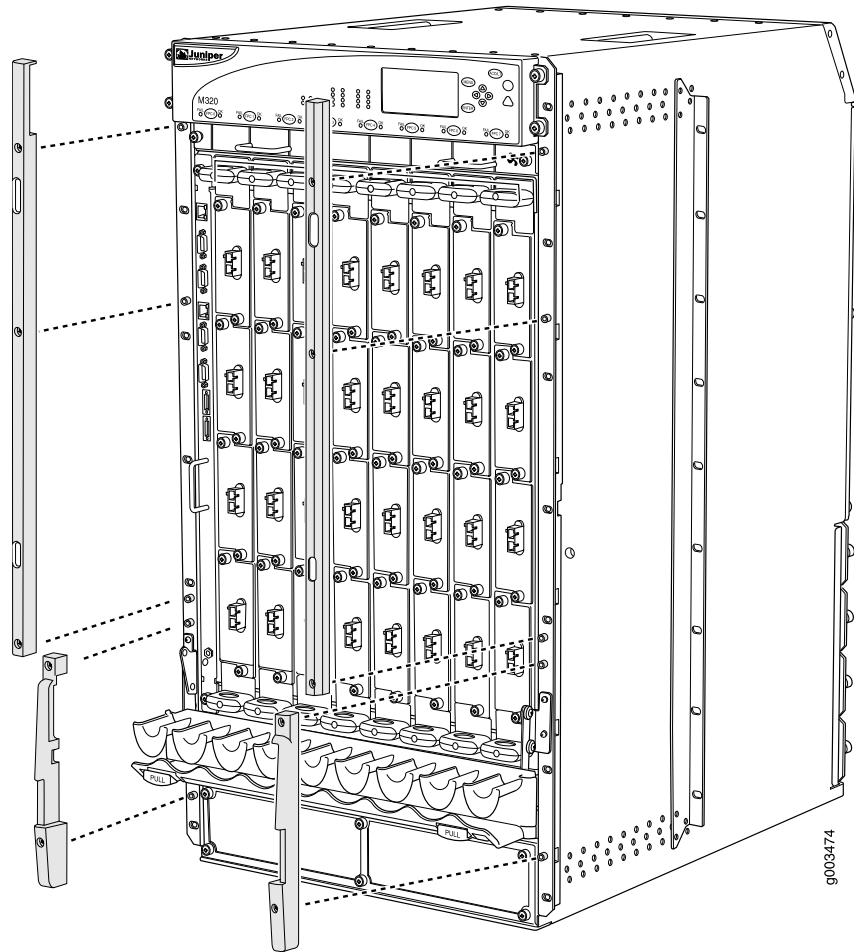
Installing the M320 Cable Guards

After the chassis is installed in the rack or cabinet, you can install the four cable guards. The cable guards protect the PIC and CIP cables from rubbing against the front edges of the chassis.

To install the cable guards (see [Figure 41 on page 155](#)):

1. Place one of the upper cable guards over one of the front-mounting flanges of the chassis, aligning the top of the cable guard with the top of the flange. Each of the three captive screws on the guard should be aligned with a corresponding standoff on the flange.
2. Tighten each of the three captive screws partway on the cable guard.
3. Tighten each of the three captive screws completely.
4. Repeat Steps 1 through 3 for the other upper cable guard.
5. Place one of the lower cable guards over one of the front-mounting flanges of the chassis, aligning the cable guard with the standoffs on the flange. Each of the two captive screws on the guard should be aligned with a corresponding hole in the flange.
6. Tighten each of the two captive screws partway on the cable guard.
7. Tighten each of the two captive screws completely.
8. Repeat Steps 5 through 7 for the other lower cable guard.

Figure 56: Installing the M320 Cable Guards



Related Documentation

- [M320 Cable Management System Description on page 12](#)
- [M320 Installation Safety Guidelines on page 363](#)
- [M320 Chassis Description on page 7](#)
- [M320 Cabinet Size and Clearance Requirements on page 96](#)

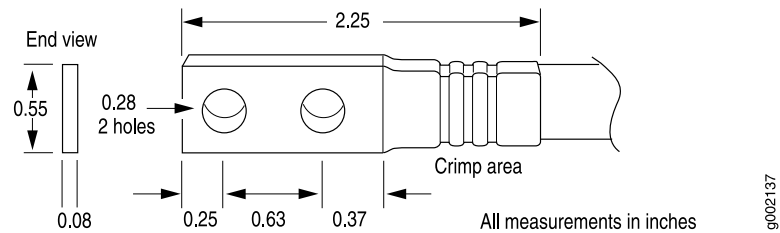
Connecting the M320 to Ground

- [Tools and Parts Required to Ground the M320 Router on page 179](#)
- [Connecting the M320 Router Grounding Cable on page 179](#)

Tools and Parts Required to Ground the M320 Router

- Grounding cable (which you must provide)
- Grounding lug (provided with the router)

Figure 57: Grounding Lug



- M6 screws or UNC 1/4-20 screws
- Electrostatic discharge (ESD) grounding wrist strap

Related Documentation

- [M320 Chassis Description on page 7](#)
- [M320 Chassis Grounding Cable and Lug Specifications on page 102](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Connecting the M320 Router Grounding Cable



CAUTION: Sub-optimal ground such as ground-loop or ground with high-impedance can result in unexpected FRU shut down. Engage a third party power consultant or certified electrician to ensure optimal grounding.

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the router must be adequately grounded before power is connected.

Two pairs of threaded inserts (PEM nuts) are provided on the right rear of the chassis for connecting the router to earth ground. The left pair of grounding points fits M6 screws (European), and the right pair fits UNC 1/4–20 screws (American). The grounding points are spaced at 0.625-in. (15.86-mm) centers. The accessory box shipped with the router includes the cable lug that attaches to the grounding cable (see “[M320 Chassis Grounding Cable and Lug Specifications](#)” on page 102) and two UNC 1/4–20 screws. For power cord and grounding cable specifications, see “[M320 AC Power Cord Specifications](#)” on page 110.



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

To ground AC and DC powered routers:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. 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. Place the grounding cable lug over the grounding points on the bottom rear of the chassis. The left pair is sized for M6 bolts, and the right pair is sized for UNC 1/4–20 bolts.
5. Secure the grounding cable lug to the grounding points, first with the washers, then with the screws.

- Related Documentation**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)

CHAPTER 20

Connecting the M320 to External Devices

- [Tools and Parts Required for M320 Router Connections on page 181](#)
- [Overview of Connecting the M320 Router to Management and Alarm Devices on page 182](#)
- [Connecting the M320 Router to a Management Console or Auxiliary Device on page 183](#)
- [Connecting the M320 Router to a Network for Out-of-Band Management on page 185](#)
- [Connecting the M320 Router to an External Alarm-Reporting Device on page 186](#)
- [Connecting the M320 Router to an External Clocking Device on page 187](#)
- [Connecting PIC Cables to the M320 Router on page 189](#)

Tools and Parts Required for M320 Router Connections

To connect the M320 router to management devices and PICs and to power on the router, you need the following tools and parts:

- Phillips (+) screwdrivers, numbers 1 and 2
- 2.5-mm flat-blade (-) screwdriver for the DB-9 connectors on the **CONSOLE** and **AUX** ports
- 2.5-mm Phillips (+) screwdriver
- 7/16-in. (11 mm) hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm), for tightening nuts to terminal studs on each power supply on a DC-powered router.
- Electrostatic discharge (ESD) grounding wrist strap

Related Documentation

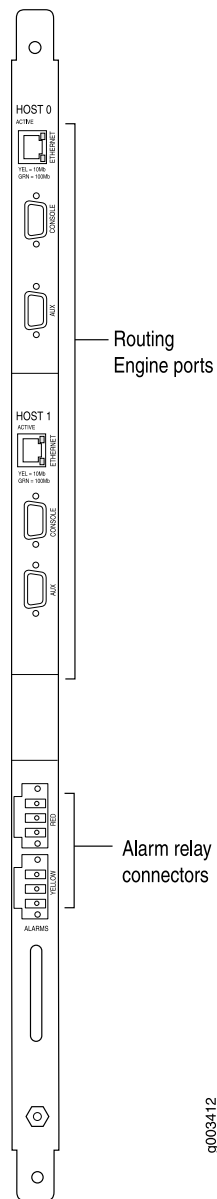
- [Connecting the M320 Router Grounding Cable on page 179](#)
- [Connecting Power to an AC-Powered M320 Router on page 193](#)
- [Connecting Power to a DC-Powered M320 Router on page 195](#)
- [M320 Power Requirements on page 104](#)
- [Powering On the M320 Router on page 197](#)

Overview of Connecting the M320 Router to Management and Alarm Devices

For management and service operations, you connect the Routing Engine to an external console or management network through ports on the Connector Interface Panel (CIP). You can also connect the router to external alarm-reporting devices through the alarm relay contacts on the CIP.

After you have installed the router into the rack, attach one or more external devices to the ports on the CIP that connect to the Routing Engines for management and service operations (see [Figure 58 on page 182](#)).

Figure 58: Routing Engine Management Ports and Alarm Relay Contacts



9003412

Related Documentation • [Initially Configuring the M320 Router on page 201](#)

Connecting the M320 Router to a Management Console or Auxiliary Device

To use a system console to configure and manage the Routing Engine, connect it to the appropriate **CONSOLE** port on the CIP. To use a laptop, modem, or other auxiliary device, connect it to the appropriate **AUXILIARY** port on the CIP. Both ports accept an RS-232 (EIA-232) serial cable with a DB-9 female connector. One DB-9/DB-9 cable is provided with the router. To connect a device to the **CONSOLE** port, and another device to the **AUXILIARY** port, you must supply another cable.

To connect a management console or auxiliary device:

1. Turn off the power to the console or auxiliary device.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Connect one end (shown in [Figure 59 on page 184](#)) of a serial cable with a DB-9 female connector to the appropriate **CONSOLE** or **AUXILIARY** port (see [Figure 60 on page 184](#)). The ports labeled **HOST 0** connect to the Routing Engine in the upper Routing Engine slot (**RE0**), and the ports labeled **HOST 1** connect to the Routing Engine in the lower Routing Engine slot (**RE1**).



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

4. Using a 2.5-mm flat-blade screwdriver, tighten the screws on the connector.
5. Attach the other end of the cable to the console or auxiliary device.

Figure 59: Console and Auxiliary Serial Port Connector

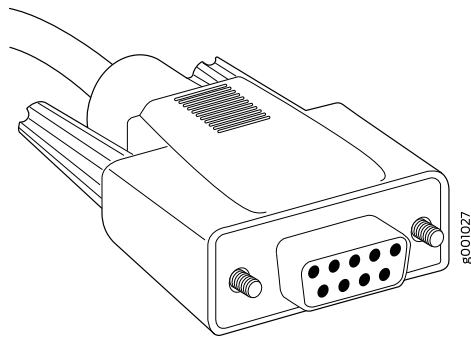
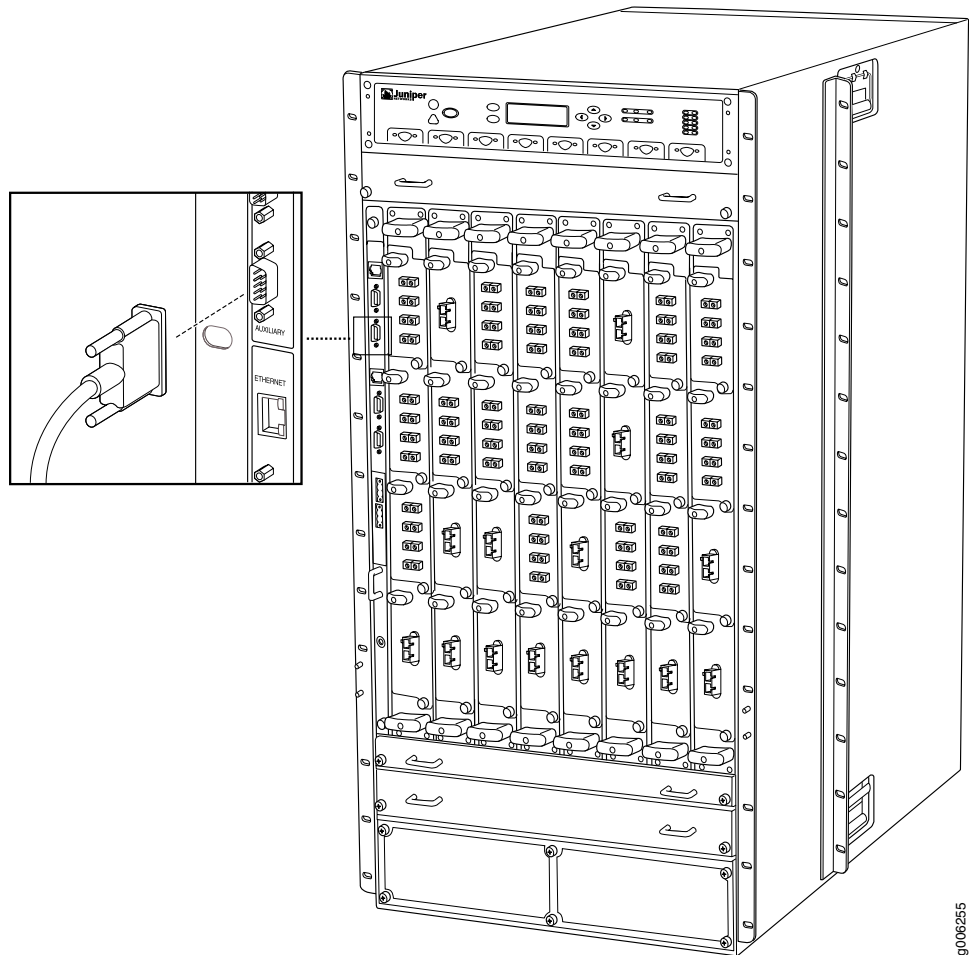


Figure 60: Console and Auxiliary Ports on the CIP



Related Documentation

- [Overview of Connecting the M320 Router to Management and Alarm Devices on page 182](#)
- [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)

Connecting the M320 Router to a Network for Out-of-Band Management

To connect the Routing Engine to a network for out-of-band management, connect an Ethernet with RJ-45 connectors to the **ETHERNET** port on the CIP. One cable is provided with the router.

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Turn off the power to the management device.
3. Plug one end of the Ethernet cable (Figure 61 on page 185 shows the connector) in to the appropriate **ETHERNET** port on the CIP (see Figure 62 on page 186). The ports labeled **HOST 0** connect to the Routing Engine in the upper Routing Engine slot (**RE0**), and the ports labeled **HOST 1** connect to the Routing Engine in the lower Routing Engine slot (**RE1**).
4. Plug the other end of the cable into the network device.

Figure 61: Routing Engine Ethernet Cable Connector

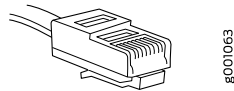
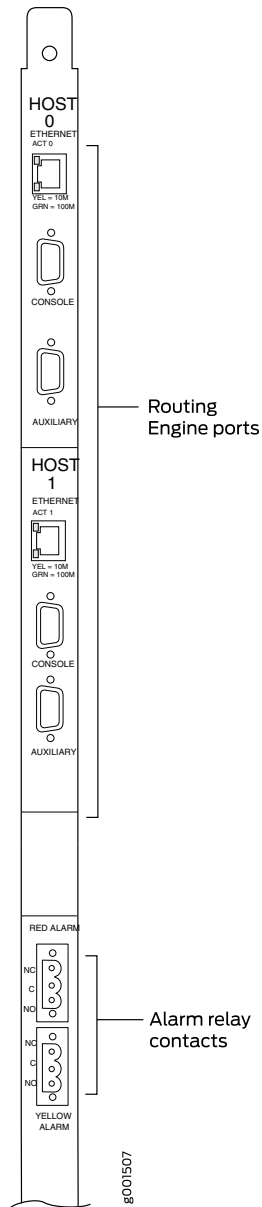


Figure 62: ETHERNET Port on the CIP



Related Documentation

- [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)
- [Overview of Connecting the M320 Router to Management and Alarm Devices on page 182](#)

Connecting the M320 Router to an External Alarm-Reporting Device

To connect the router to external alarm-reporting devices, attach wires to the **RED ALARM** and **YELLOW ALARM** relay contacts on the CIP. A system condition that triggers the red

or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²), which is not provided. Use the gauge of wire appropriate for the external device you are connecting.

To connect an external device to an alarm relay contact:

1. Prepare the required length of wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²).
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. While the terminal block is not plugged into the relay contact, use a 2.5-mm flat-blade screwdriver to loosen the small screws on its side. With the small screws on its side facing left, insert wires into the slots in the front of the block based on the wiring for the external device. Tighten the screws to secure the wire.
4. Orient the terminal block according to the labels to the left of the appropriate relay contact (**NC** means “normally closed, **C** means “common,” and (**NO** means “normally open”).
5. Plug the terminal block into the relay contact and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.
6. Attach the other end of the wires to the external device.

If attaching a reporting device for the other kind of alarm, repeat the procedure.

**Related
Documentation**

- [Overview of Connecting the M320 Router to Management and Alarm Devices on page 182](#)
- [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)

Connecting the M320 Router to an External Clocking Device

The M320 router contains two external clock input (**EXTERNAL CLOCK INPUTS**) ports on each control board (CB) labeled **A** or **B**.

To connect the router to external clocking devices, connect a cable with RJ-45 connectors to each external clock input port:

1. Attach an electrostatic discharge (ESD) grounding trap on your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Plug one end of the RJ-45 cable into the external clock input ports on the front of the CB.
3. Plug the other end of the RJ-45 cable into the E1 or T1 external clocking device.
4. Verify that the LEDs for the external clock inputs are lit steadily green.
5. Repeat the cabling procedures as needed for the other CB.
6. Configure the port. See the **synchronization** statement for M Series and T Series in the *Junos OS Administration Library*.
7. Issue the **show chassis synchronization** command to check the status of the port.

```
user@host> show chassis synchronization
```

```
Clock Synchronization Status :  
  Clock module on CB 0  
    Current state           : master  
    Current clock state     : internal  
    Selected for            : 4 days, 11 hours, 9 minutes, 26 seconds  
    Selected since          : 2012-11-08 02:37:37 PST  
    Deviation (in ppm)     : +0.00  
    Last deviation (in ppm): +0.01  
Clock Synchronization Status :  
  Clock module on CB 1  
    Current state           : backup  
    Current clock state     : locked to master CB  
    Selected for            : 10 days, 9 hours, 34 minutes, 28 seconds  
    Selected since          : 2012-11-02 05:12:35 PDT
```

**Related
Documentation**

- [M320 Control Board \(CB\) Description on page 51](#)
- [M320 RJ-48 Connector Pinouts for the Control Board External Clock Inputs on page 106](#)

Connecting PIC Cables to the M320 Router

Now connect PICs to the network by plugging in network cable. To connect cable to the PICs (see [Figure 63 on page 190](#), which shows a fiber-optic PIC):

1. Have ready a length of the type of cable used by the PIC. For cable specifications, see *Determining Transceiver Support and Specifications for M Series and T Series Routers*, *OBSOLETE: Network Cable and Transceiver Overview for M Series Routers*, and the *M320 Multiservice Edge Router Interface Module Reference*.

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



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



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

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



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



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

5. After you have draped the PIC cables, you can optionally install the cable cover (the cable cover prevents the PIC and CIP cables from being disturbed or snagged. To install the cable cover, insert the upper tabs of the cover into the slots of the upper

cable guards, then insert the lower tabs of the cover into the slots of the lower cable guards (see “Installing the M320 Cable Guards” on page 154).

Figure 63: Attaching Cable to a PIC

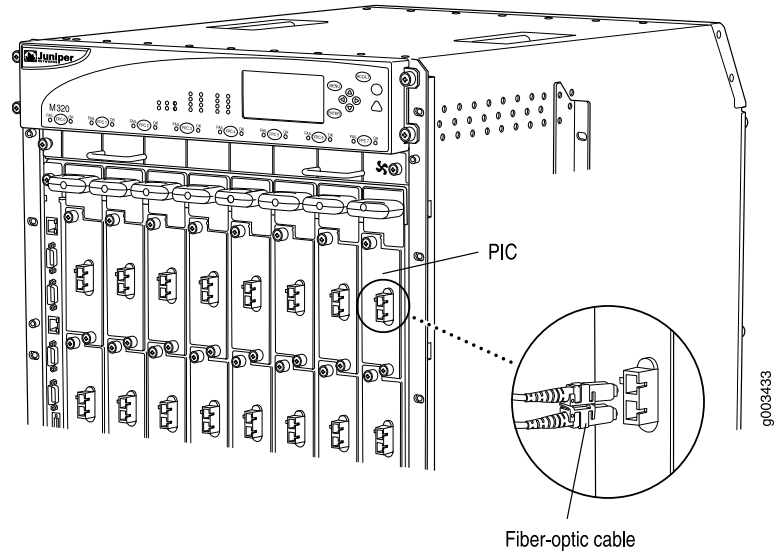
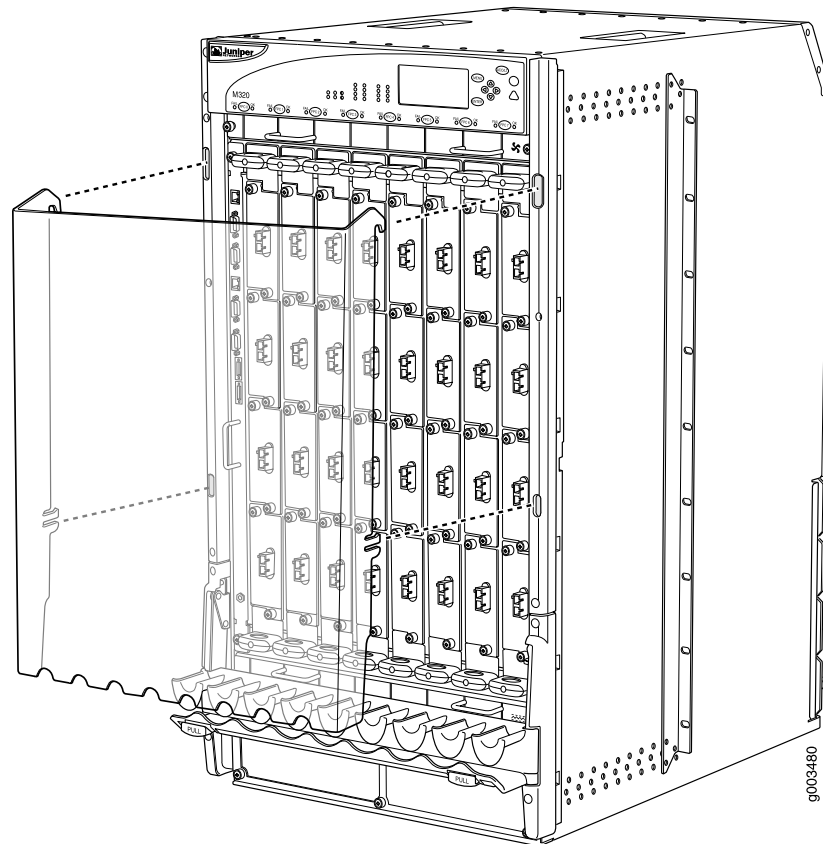


Figure 64: Installing the Cable Cover



- Related Documentation**
- [M320 Cable Management System Description on page 12](#)
 - [M320 PIC Description on page 60](#)

Providing Power to the M320

- [Connecting Power to an AC-Powered M320 Router on page 193](#)
- [Connecting Power to a DC-Powered M320 Router on page 195](#)
- [Powering On the M320 Router on page 197](#)
- [Powering Off the M320 Router on page 198](#)

Connecting Power to an AC-Powered M320 Router



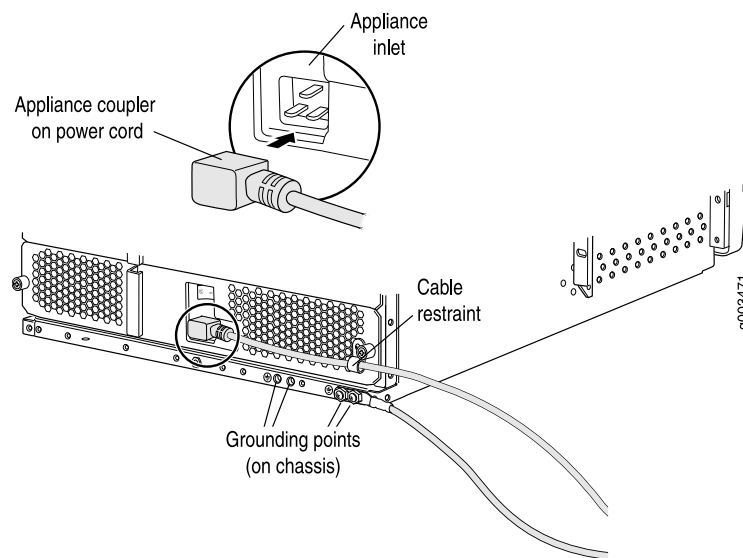
NOTE: Each power supply must be connected to a dedicated AC power feed and a dedicated 15 A (250 VAC) circuit breaker. For information about AC power specifications, see [“M320 AC Power Electrical Specifications” on page 109](#).

To connect the AC power cords to the router, attach the power cords from each AC power source to the AC appliance inlet on the faceplate of each power supply (see [Figure 65 on page 194](#)):

1. Locate the power cords shipped with the router, which should have a plug appropriate for your geographical location (see [“M320 AC Power Cord Specifications” on page 110](#)).
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. Verify that the 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.
4. Switch the power switch on the power supply faceplate to the off position (O).
5. Insert the appliance coupler end of a power cord into the appliance inlet on the power supply faceplate.
6. Remove the cable restraint from the right edge of the power supply faceplate by removing its retainer screw.

7. Wrap the cable restraint around the power cord, then slide it along the power cord to a position that enables you to reinstall it in the power supply faceplate.
8. Reinstall the cable restraint by tightening its retainer screw partway into the power supply faceplate.
9. Carefully pull the AC power cord through the cable restraint until you have the desired amount of slack in the power cord.
10. Tighten the cable restraint retainer screw to hold the power cord in place.
11. Insert the power cord 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.

Figure 65: Connecting AC Power to the M320 Router



Related Documentation

- [M320 AC Power Supplies Description on page 82](#)
- [M320 AC Power Electrical Safety Guidelines on page 385](#)
- [M320 AC Power Electrical Safety Warning on page 386](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Connecting Power to a DC-Powered M320 Router

You connect DC power to the router by attaching power cables from the DC power sources to the terminal studs on the power supply faceplates. To connect power to the router, you must provide grounding and power cables (the cable lugs are supplied with the router). For grounding DC power cable specifications, see [“M320 DC Power Cable Specifications” on page 115](#).



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

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

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point.
3. Verify that the 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.
4. Switch the circuit breaker on the DC power supply faceplate to the off position (O).
5. Remove the clear plastic cover protecting the terminal studs on the faceplate.
6. Remove the nut and washer from each power terminal stud. If no washers and nuts are already installed, they should be in the accessory box.
7. Attach the lugs on the DC source power cables to the terminal studs.
 - a. Attach the lugs on the positive (+) DC source power cables to the terminal studs.
 - b. Attach the lugs on the negative (–) DC source power cables to the terminal studs.

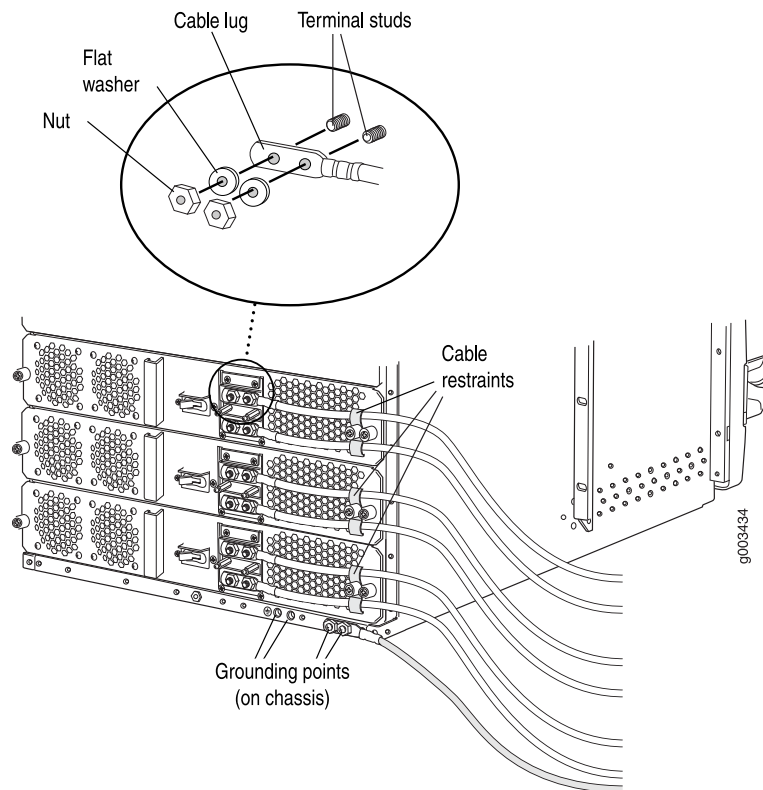
Secure each cable lug to the terminal stud, first with a washer, then with a nut. Use a 7/16-in. (11 mm) nut driver or wrench to tighten the nut. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut.



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

8. Loosen the captive screw on the cable restraint on the right edge of the power supply faceplate.
9. Route the positive and negative DC power cables through the top and bottom of the cable restraint.
10. Tighten the cable restraint captive screw to hold the power cables in place.
11. Verify that the power cabling is correct, that the power cables do not touch or block access to Router components, or drape where people could trip on them.
12. Replace the clear plastic cover over the terminal studs on the faceplate.

Figure 66: Connecting DC Power to the M320 Router



- Related Documentation**
- [M320 DC Power Supplies Description on page 82](#)
 - [M320 DC Power Electrical Safety Guidelines on page 386](#)
 - [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Powering On the M320 Router

To power on the router:

1. Verify that the power supplies are fully inserted in the chassis and that the captive screws on their faceplates are tightened.
2. For each power supply on an AC-powered router, verify that the source power cord is securely inserted into the appliance inlet. For each power supply on a DC-powered router, verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminal (labeled **RETURN**) and the negative (-) source cable to the input terminal (labeled **-48V**).
3. Verify that an external management device is connected to one of the Routing Engine ports on the CIP (**AUX**, **CONSOLE**, or **ETHERNET**). For more information about connecting management devices, see [“Overview of Connecting the M320 Router to Management and Alarm Devices” on page 182](#).
4. Turn on the power to the external management device.
5. Switch the circuit breaker on one of the DC power supplies to the on position (I) and observe the output status LED (**OUTPUT OK**) on the power supply faceplate. If the power supply is correctly installed and functioning properly, the **OUTPUT OK** status LED on the power supply faceplate blinks, then lights steadily approximately 1 minute after you switch the power supply circuit breaker on.



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

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

After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the output status LED on the power supply, the `show chassis` command display, 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.

- Repeat Step 5 for the remaining power supplies.



NOTE: If any of the output status LEDs do not light steadily, repeat the installation and cabling procedures described in “Reinstalling the M320 Power Supplies” on page 173, and “Connecting Power to an AC-Powered M320 Router” on page 193 or “Connecting Power to a DC-Powered M320 Router” on page 195.

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

Related Documentation

- Powering Off the M320 Router on page 198
- Preventing Electrostatic Discharge Damage to an M320 Router on page 358

Powering Off the M320 Router

To power off a T320 router:

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

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

For more information about these commands, see *request system halt*.

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

```
Halt the system ? [yes,no] (no) yes
*** FINAL System shutdown message from root@section2 ***
System going down IMMEDIATELY
Terminated
...
syncing disks... 11 8 done
The operating system has halted.
Please press any key to reboot.
```

3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Switch the circuit breakers on each power supply faceplate to the off position (O).

**Related
Documentation**

- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Configuring the Junos OS Software

- [Initially Configuring the M320 Router on page 201](#)

Initially Configuring the M320 Router

The MX240 router is shipped with Junos OS preinstalled and ready to be configured when the MX240 router is powered on. There are three copies of the software: one on a CompactFlash card in the Routing Engine, one on a rotating hard disk in the Routing Engine, and one on a USB flash drive that can be inserted into the slot in the Routing Engine faceplate.

When the router boots, it first attempts to start the image on the USB flash drive. If a USB flash drive is not inserted into the Routing Engine or the attempt otherwise fails, the router next tries the CompactFlash card (if installed), and finally the hard disk.

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

Gather the following information before configuring the router:

- Name the router will use on the network
- Domain name the router will use
- IP address and prefix length information for the Ethernet interface
- IP address of a default router
- IP address of a DNS server
- Password for the root user

This procedure connects the router to the network but does not enable it to forward traffic. For complete information about enabling the router to forward traffic, including examples, see the Junos OS configuration guides.

To configure the software:

1. Verify that the router is powered on.
2. Log in as the “root” user. There is no password.

3. Start the CLI.

```
root# cli
root@>
```

4. Enter configuration mode.

```
cli> configure
[edit]
root@#
```

5. Configure the name of the router. If the name includes spaces, enclose the name in quotation marks (" ").

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

6. Create a management console user account.

```
[edit]
root@# set system login user user-name authentication plain-text-password
New password: password
Retype new password: password
```

7. Set the user account class to super-user.

```
[edit]
root@# set system login user user-name class super-user
```

8. Configure the router's domain name.

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

9. Configure the IP address and prefix length for the router's Ethernet interface.

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address/prefix-length
```

10. Configure the IP address of a backup router, which is used only while the routing protocol is not running.

```
[edit]
root@# set system backup-router address
```

11. Configure the IP address of a DNS server.

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

12. Set the root authentication password by entering either a clear-text password, an encrypted password, or an SSH public key string (DSA or RSA).

```
[edit]
root@# set system root-authentication plain-text-password
New password: password
Retype new password: password
```

or

```
[edit]
root@# set system root-authentication encrypted-password encrypted-password
```

or

```
[edit]
root@# set system root-authentication ssh-dsa public-key
```

or

```
[edit]
root@# set system root-authentication ssh-rsa public-key
```

13. (Optional) Configure the static routes to remote subnets with access to the management port. Access to the management port is limited to the local subnet. To access the management port from a remote subnet, you need to add a static route to that subnet within the routing table. For more information about static routes, see the *Junos OS Administration Library*.

```
[edit]
root@# set routing-options static route remote-subnet next-hop destination-IP retain
no-readvertise
```

14. Configure the telnet service at the [edit system services] hierarchy level.

```
[edit]
root@# set system services telnet
```

15. (Optional) Display the configuration to verify that it is correct.

```
[edit]
root@# show
system {
  host-name host-name;
  domain-name domain-name;
  backup-router address;
```

```

root-authentication {
  authentication-method (password | public-key);
}
name-server {
  address;
}
}
interfaces {
  fxp0 {
    unit 0 {
      family inet {
        address address/prefix-length;
      }
    }
  }
}
}
}

```

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

```

[edit]
root@# commit

```

17. (Optional) Configure additional properties by adding the necessary configuration statements. Then commit the changes to activate them on the router.

```

[edit]
root@host# commit

```

18. When you have finished configuring the router, exit configuration mode.

```

[edit]
root@host# exit
root@host>

```



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

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

**Related
Documentation**

- [M320 Chassis Description on page 7](#)
- [M320 Router Description on page 3](#)
- [Powering On the M320 Router on page 197](#)

PART 4

Installing and Replacing Components

- [Overview of Installing and Replacing Components on page 209](#)
- [Replacing Chassis Components on page 213](#)
- [Replacing Cooling System Components on page 229](#)
- [Replacing Host Subsystem Components on page 243](#)
- [Replacing Line Card Components on page 259](#)
- [Replacing Power System Components on page 283](#)
- [Replacing Switch Fabric Components on page 297](#)

Overview of Installing and Replacing Components

- [M320 Field Replaceable Units on page 209](#)
- [Tools and Parts Required to Replace the M320 Hardware Components on page 210](#)

M320 Field Replaceable Units

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

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

Before you replace a CB or a Routing Engine, you must take the host subsystem offline.

[Table 81 on page 210](#) lists the FRUs for the M320 router.

Table 81: Field-Replaceable Units

| Hot-removable and hot-insertable FRUs | Hot-pluggable FRUs |
|---|---|
| Air filters | Connector Interface Panel (CIP) |
| Craft interface | Control Board (CB) (if not redundant) |
| Flexible PIC Concentrators (FPCs) | Routing Engine (if not redundant) |
| Front and rear fan trays | Master Control Board (CB) (if nonstop active routing is not configured) |
| Physical Interface Cards (PICs) | Master Routing Engine (if nonstop active routing is not configured) |
| Power supplies | |
| Switch Interface Boards (SIBs) | |
| Backup Control Board (CB) | |
| Backup Routing Engine | |
| Master Control Board (CB) (if nonstop active routing is configured) | |
| Master Routing Engine (if nonstop active routing is configured) | |

- Related Documentation**
- [M320 Chassis Description on page 7](#)
 - [Taking the M320 Host Subsystem Offline on page 243](#)

Tools and Parts Required to Replace the M320 Hardware Components

To replace hardware components, you need the tools and parts listed in [Table 82 on page 210](#).

Table 82: Tools and Parts Required

| Tool or Part | Components |
|--|---|
| 7/16-in. (11 mm) nut driver | Cables and connectors DC power supply |
| Blank panels (if component is not reinstalled) | CB FPC PIC Routing Engine SIB |

Table 82: Tools and Parts Required (continued)

| Tool or Part | Components |
|---|---|
| Electrostatic bag or antistatic mat | CB FPC PIC Routing Engine SIB |
| Electrostatic discharge (ESD) grounding wrist strap | All |
| Flat-blade (–) screwdriver | Cables and connectors PIC (in an FPC1) Serial cable to AUX or CONSOLE Routing Engine port |
| Insulated fuse removal tool | Fuses |
| Phillips (+) screwdrivers, numbers 1 and 2 | Air filter (front or rear) Cable guards Cables and connectors CB CIP Craft interface FPC Fan tray (front or rear) PIC Power supply (AC or DC) Routing Engine SIB |
| Rubber safety cap | Fiber-optic PIC or PIC cable |
| Wire cutters | Cables and connectors DC power supply |



NOTE: If you have installed the cable cover, you must remove it before you can replace any hardware component or cable in the front of the chassis between the cable management system and the craft interface. To remove the cable cover, pull the lower tabs of the cover out of the slots of the lower cable guards, then pull the upper tabs of the cover out of the slots of the upper cable guards. To install the cable cover, insert the upper tabs of the cover into the slots of the upper cable guards, then insert the lower tabs of the cover into the slots of the lower cable guards (see [“Connecting PIC Cables to the M320 Router” on page 189](#)).

**Related
Documentation**

- [M320 Chassis Description on page 7](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 347](#)
- [Contacting Customer Support on page 337](#)

Replacing Chassis Components

- [Replacing the M320 CIP on page 213](#)
- [Replacing the M320 Alarm Relay Wires on page 216](#)
- [Replacing an M320 Management Ethernet Cable on page 217](#)
- [Replacing an M320 Console or Auxiliary Cable on page 219](#)
- [Replacing an M320 Craft Interface on page 223](#)
- [Replacing an M320 Fuse on page 225](#)

Replacing the M320 CIP

1. [Removing an M320 CIP on page 213](#)
2. [Installing an M320 CIP on page 215](#)

Removing an M320 CIP

The CIP is located to the left side of the FPC card cage. It houses the Routing Engine interface ports, which accept connections to external management and alarm-reporting devices.

The CIP is hot-pluggable. It weighs approximately 6.8 lb (3.1 kg). When the CIP is removed, you cannot control or communicate with the router using an external device.

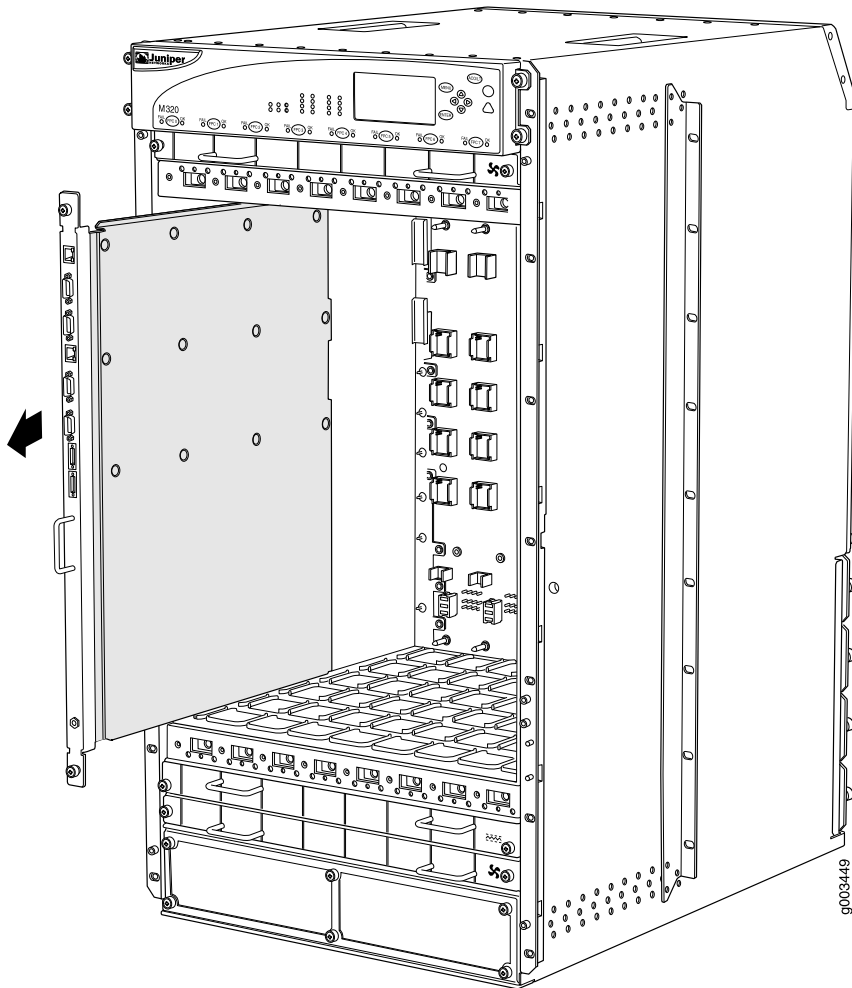
To remove the CIP (see [Figure 67 on page 214](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. .
2. Disconnect any external devices connected to the CIP. For instructions, see [“Removing an M320 Console or Auxiliary Cable” on page 219](#), [“Replacing an M320 Management Ethernet Cable” on page 217](#), and [“Replacing the M320 Alarm Relay Wires” on page 216](#).
3. Loosen the captive screws at the top and bottom of the CIP faceplate.
4. Grasp the handle on the CIP faceplate, and carefully pull the CIP straight out of the chassis.



CAUTION: Be sure to slide the CIP straight within the slot to avoid damaging the connector pins on the front of the midplane.

Figure 67: Removing the CIP



- See Also**
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [M320 Router Description on page 3](#)
 - [M320 Chassis Description on page 7](#)
 - [Installing an M320 CIP on page 215](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Installing an M320 CIP

To install the CIP (see [Figure 68 on page 216](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the CIP handle with one hand and hold the bottom edge of the CIP with the other hand to support its weight.



NOTE: The components on the CIP are on the left side of the board, unlike the components of an FPC, which are on the right side. Verify that the components are on the left before inserting the CIP.

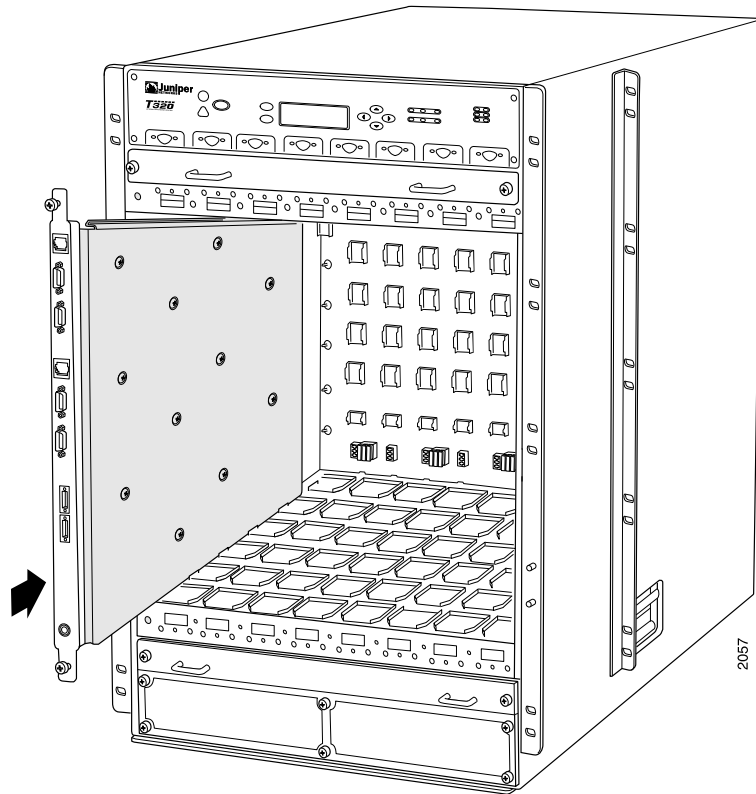
3. Insert the CIP into the leftmost slot of the FPC card cage, carefully aligning the top and bottom of the CIP with the guides in the card cage.
4. Carefully push the CIP straight into the chassis until it contacts the midplane.
5. Tighten the screws at the top and bottom of the CIP faceplate.
6. Reattach any external devices connected to the CIP.



CAUTION: Be sure to slide the CIP straight within the slot to avoid damaging the connector pins on the front of the midplane.

7. To verify that the CIP is installed correctly, plug an Ethernet cable into the Ethernet port on the CIP. If the host module is operational, the **ACTIVE** LED blinks to indicate Ethernet activity. If you can run the CLI, the CIP is installed correctly.

Figure 68: Installing a CIP



- See Also**
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [M320 Router Description on page 3](#)
 - [M320 Chassis Description on page 7](#)
 - [Removing an M320 CIP on page 213](#)

- Related Documentation**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Routing Engine Description on page 24](#)
 - [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [Connecting the M320 Router to a Management Console or Auxiliary Device on page 183](#)
 - [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)

Replacing the M320 Alarm Relay Wires

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

The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²), which is not provided. Use the gauge of wire appropriate for the external device you are connecting.

To replace the wires connecting to an alarm-reporting device:

1. Disconnect the existing wire at the external device.
2. Prepare the required length of replacement wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²).
3. Using a 2.5-mm flat-blade screwdriver, loosen the small screws on the face of the terminal block and remove the block from the relay contact.
4. Using the 2.5-mm flat-blade screwdriver, loosen the small screws on the side of the terminal block. Remove existing wires from the slots in the front of the block and insert replacement wires. Tighten the screws to secure the wire.
5. Plug the terminal block into the relay contact and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.
6. Attach the other end of the wires to the external device.

**Related
Documentation**

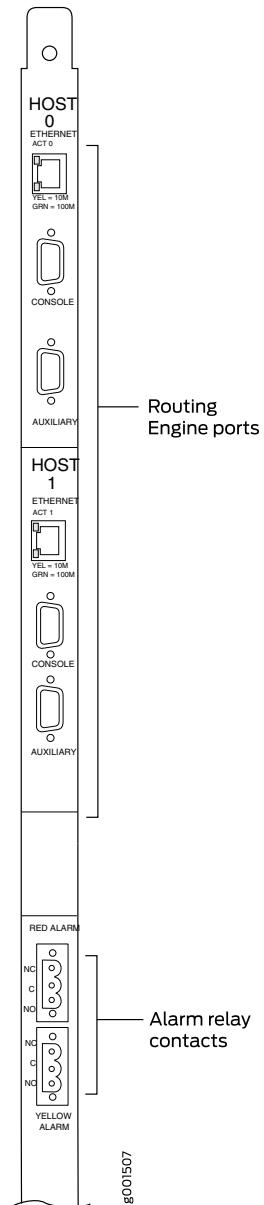
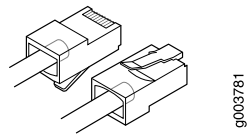
- [Connecting the M320 Router to an External Alarm-Reporting Device on page 186](#)
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [M320 Chassis and Interface Alarm Messages on page 325](#)

Replacing an M320 Management Ethernet Cable

To replace the management Ethernet cable:

1. Press the tab on the connector and pull the connector straight out of the **ETHERNET** port. [Figure 69 on page 218](#) shows the connector.
2. Disconnect the cable from the network device.
3. Plug one end of the replacement cable into the appropriate **ETHERNET** port. The ports labeled **HOST 0** connect to the Routing Engine in the upper Routing Engine slot (**RE0**), and the ports labeled **HOST 1** connect to the Routing Engine in the lower Routing Engine slot (**RE1**).
4. Plug the other end of the cable into the network device.

Figure 69: Ethernet Cable Connectors



- Related Documentation**
- [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)
 - [M320 Routing Engine Description on page 24](#)
 - [M320 Connector Interface Panel \(CIP\) Description on page 13](#)

Replacing an M320 Console or Auxiliary Cable

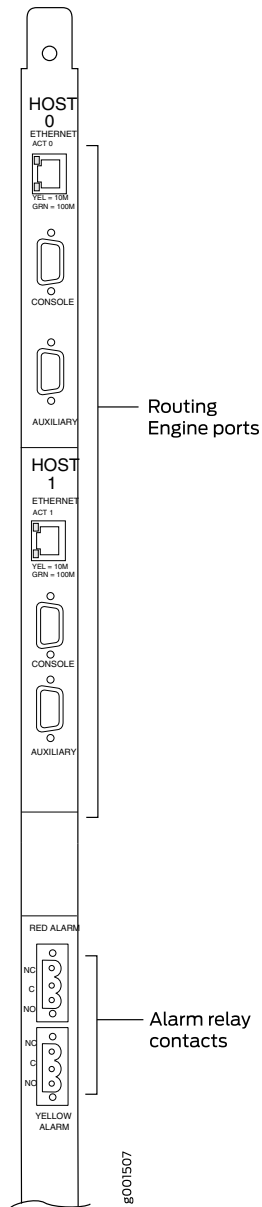
1. [Removing an M320 Console or Auxiliary Cable on page 219](#)
2. [Installing an M320 Console or Auxiliary Cable on page 220](#)

Removing an M320 Console or Auxiliary Cable

To remove a serial cable connected to a management console or auxiliary device (see [Figure 70 on page 220](#)):

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.

Figure 70: Routing Engine Console or Auxiliary Cable



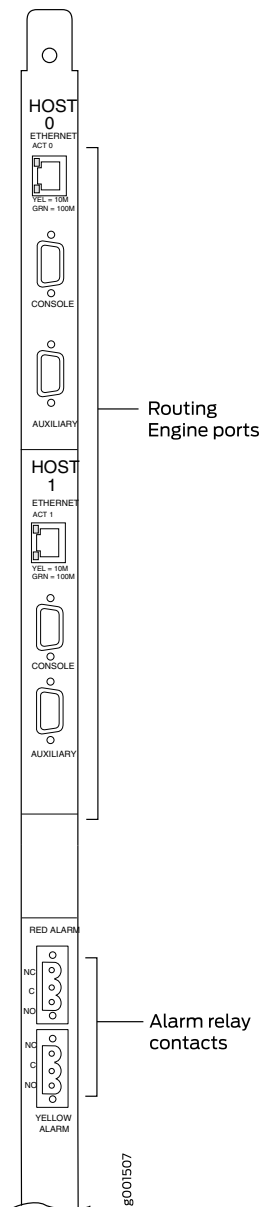
- See Also**
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)
 - [Installing an M320 Console or Auxiliary Cable on page 220](#)

Installing an M320 Console or Auxiliary Cable

To install a console or auxiliary cable:

1. Turn off the power to the console or auxiliary device.
2. Connect one end (shown in [Figure 71 on page 222](#)) of the replacement serial cable into the appropriate CONSOLE or AUX port. The external device ports on the CIP. The ports labeled **HOST 0** connect to the Routing Engine in the upper Routing Engine slot (**RE0**), and the ports labeled **HOST 1** connect to the Routing Engine in the lower Routing Engine slot (**RE1**).
3. Using a 2.5-mm flat-blade screwdriver, tighten the screws on the connector.
4. Attach the other end of the cable to the console or auxiliary device.

Figure 71: Routing Engine Console or Auxiliary Cable



5. Connect the other end of the serial cable into the serial port on the console or auxiliary device.

- See Also**
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)
 - [Removing an M320 Console or Auxiliary Cable on page 219](#)

- Related Documentation**
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
 - [M320 Routing Engine Interface Cable and Wire Specifications on page 123](#)
 - [M320 Chassis Description on page 7](#)

Replacing an M320 Craft Interface

1. [Removing an M320 Craft Interface on page 223](#)
2. [Installing an M320 Craft Interface on page 224](#)

Removing an M320 Craft Interface

The craft interface is located on the front of the chassis above the FPC card cage.

The craft interface is hot-insertable and hot-removable. The craft interface weighs approximately 2 lb (0.9 kg). When you install the craft interface, allow several minutes for the display to reflect the current state of the router.

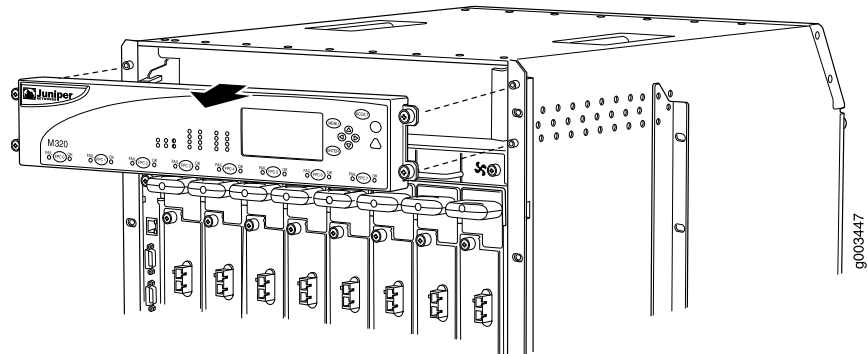
To remove the craft interface (see [Figure 72 on page 224](#)):



NOTE: Removing the front upper fan tray before you remove the craft interface might make it easier to grasp the craft interface as you remove it. For instructions on removing a front fan tray, see [“Removing an M320 Front Fan Tray” on page 235](#).

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the upper cable guards by loosening the three captive screws on each cable guard.
3. Completely loosen the four captive screws that attach the craft interface to the chassis.
4. Grasp the craft interface by the left and right flanges and carefully pull it straight out of the chassis.

Figure 72: Removing the Craft Interface



- See Also**
- [M320 Craft Interface Description on page 15](#)
 - [M320 Chassis Description on page 7](#)
 - [Installing an M320 Craft Interface on page 224](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Installing an M320 Craft Interface

To install the craft interface (see [Figure 73 on page 225](#)):

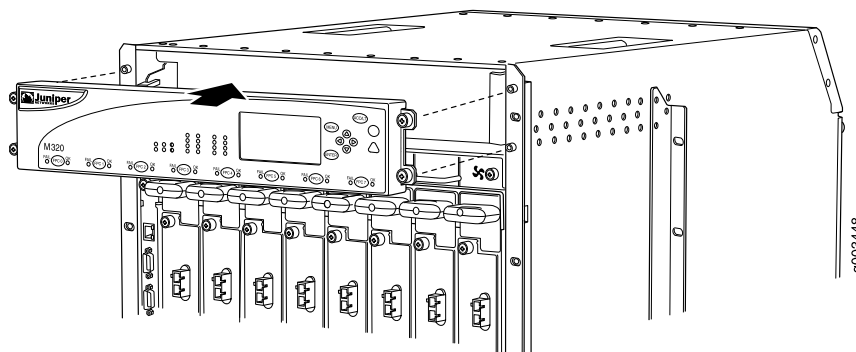
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasping the craft interface by the left and right flanges, press it into place.
3. Tighten the four captive screws to attach the craft interface to the chassis.



NOTE: When you install the craft interface in an operating router, allow several minutes for the LEDs on the craft interface to reflect the current state of the router.

4. Place one of the upper cable guards over one of the front-mounting flanges of the chassis, aligning the top of the cable guard with the top of the flange. Each of the three captive screws on the guard should be aligned with a corresponding standoff on the flange.
5. Tighten each of the three captive screws partway on the cable guard.
6. Tighten each of the three captive screws completely.

Figure 73: Installing the Craft Interface



- See Also**
- [M320 Craft Interface Description on page 15](#)
 - [M320 Chassis Description on page 7](#)
 - [Removing an M320 Craft Interface on page 223](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- Related Documentation**
- [M320 Craft Interface Description on page 15](#)
 - [M320 Craft Interface LED Display and Navigation Buttons on page 17](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Replacing an M320 Fuse



WARNING: You must power off the router before removing or installing a fuse.

To replace a fuse, you remove the power supply in slot **PEMO**—while the router is powered on—to determine which fuse has blown. Before you remove the fuse, you must power off the router, then remove the power supply in slot **PEM1** to access the fuse.

To replace a fuse (see [Figure 74 on page 228](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Power off and remove the power supply in slot **PEMO**. For complete instructions, see “[Replacing an M320 AC Power Supply](#)” on page 283 or “[Replacing an M320 DC Power Supply](#)” on page 287.



CAUTION: Consider the following before you remove a power supply:

- An AC-powered router can continue to provide power for all router hardware configurations with three operating power supplies. If removing the power supply from slot PEM0 leaves only two power supplies in the router, you must first ensure that the router does not consume more than 2500 W. If the router does not consume more than 2500 W, you can safely operate the router with a total of two AC power supplies. To calculate the power consumption for various hardware configurations, see [“M320 Power Requirements” on page 104](#).
- If you remove a DC power supply from slot PEM0, slot PEM2 must contain an operating DC power supply in order to keep the router operating.

For more information about power supply redundancy, see [“M320 AC Power Supplies Description” on page 82](#) and [“M320 DC Power Supplies Description” on page 82](#).

3. Determine which fuse has blown. The yellow LED under the fuse lights and the indicator bulb becomes visible through the clear cover on the fuse.
4. Power off the router as described in [“Powering Off the M320 Router” on page 198](#).
5. Remove the power supply in slot PEM1. For complete instructions, see [“Replacing an M320 AC Power Supply” on page 283](#) or [“Replacing an M320 DC Power Supply” on page 287](#).
6. Grasp the blown fuse by the edges and rock it up and down in its slot until it disconnects. If the cover slips off the fuse, snap the cover back into place and begin again.

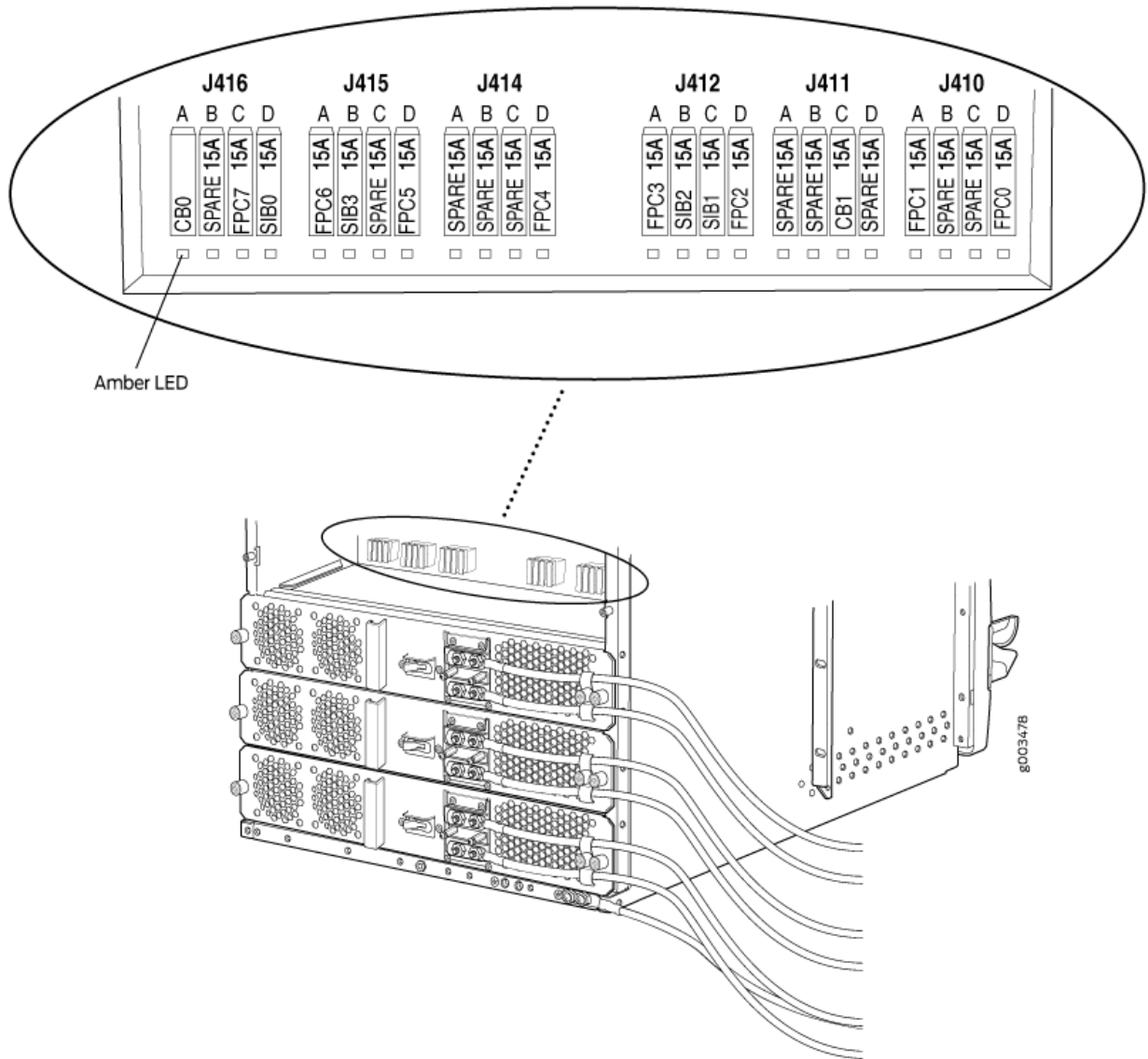


NOTE: We recommend that you use an insulated fuse removal tool to remove fuses.

7. Remove the appropriate fuse from the selection of spare fuses labeled **SPARE** in [Figure 74 on page 228](#). (The labels shown in the figure do not appear on the actual fuses—the clear cover on every fuse reads **BUSS GMT-X**—and might not match the labels on the midplane. Ignore the labels on the midplane.) Verify that the spare has the same rating and color coding as the fuse it is replacing, as specified in [“M320 Fuse Specifications” on page 107](#). To see the indicator bulb and printed rating, look at the fuse from the side.
8. Orient the replacement fuse over the slot so that the text on the fuse cover (**BUSS GMT-X**) reads from bottom to top.
9. Press the new fuse into the slot.

10. Reinstall the power supply into slot **PEM1**. For complete instructions, see [“Installing an M320 AC Power Supply” on page 285](#) or [“Installing an M320 DC Power Supply” on page 290](#).
11. Power on the router as described in [“Powering On the M320 Router” on page 197](#).
12. Verify that the yellow LED under the replacement fuse is no longer lit.
13. Reinstall the power supply into slot **PEM0** and power it on. For complete instructions, see [“Installing an M320 AC Power Supply” on page 285](#) or [“Installing an M320 DC Power Supply” on page 290](#).
14. Order new fuses from an electrical supply house to replace the spare fuses. The Cooper Bussman product number for each fuse is **GMT-X**, where *X* is the amperage rating. For example, product number **GMT-15** is a 15-A fuse, required for an FPC.

Figure 74: Fuses in the Midplane



Related Documentation

- [M320 Fuses on page 12](#)
- [Troubleshooting the M320 Fuses on page 330](#)
- [M320 Power System Description on page 81](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Replacing Cooling System Components

- Replacing an M320 Air Filter on page 229
- Replacing an M320 Fan Tray on page 235

Replacing an M320 Air Filter

- Removing an M320 Front Air Filter on page 229
- Installing an M320 Front Air Filter on page 230
- Removing an M320 Rear Air Filter on page 231
- Installing an M320 Rear Air Filter on page 233

Removing an M320 Front Air Filter

The front air filter, located below the FPC card cage in the front of the chassis, and installs horizontally. The front air filter weighs approximately 1 lb (0.5 kg). The air filters are hot-insertable and hot-removable.

To remove the front air filter (see [Figure 75 on page 230](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Unwrap any PIC cables from the spools on the cable management system, and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable management system and tray, and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.



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

3. Simultaneously pull the two releases on the cable management system. Lift it up and outward to lock it in place to access the air filter.
4. Loosen the captive screws on the corners of the air filter faceplate.

5. Grasp the handles and pull the air filter straight out of the chassis.
6. Remove the filter element from the air filter frame (see [Figure 76 on page 230](#)).

Figure 75: Removing the Front Air Filter

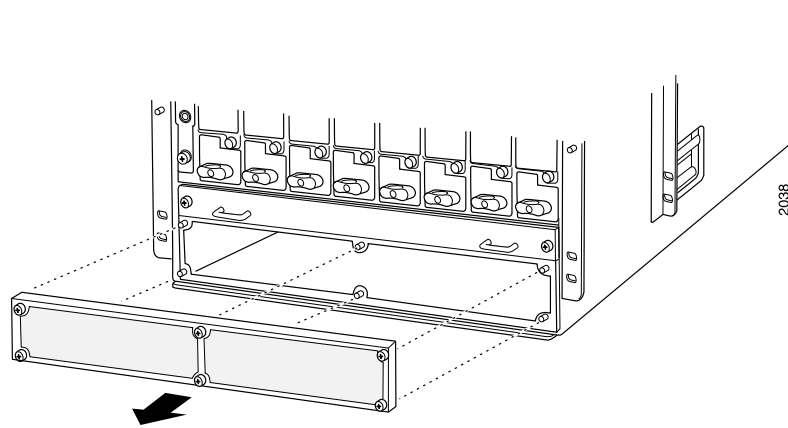
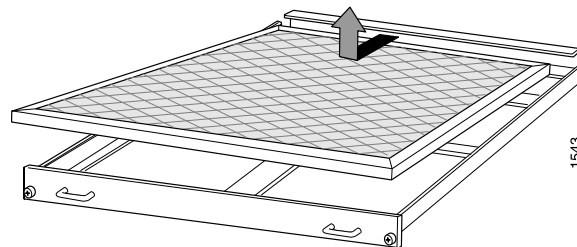


Figure 76: Replacing the Front Filter Element



- See Also**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Maintaining the M320 Air Filters on page 305](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Installing an M320 Front Air Filter on page 230](#)

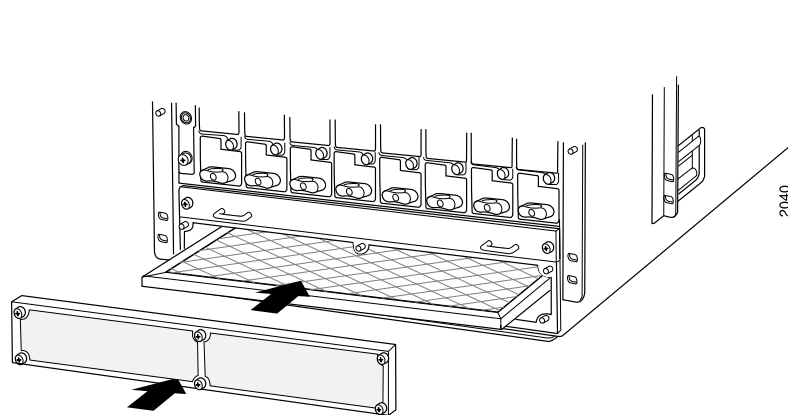
Installing an M320 Front Air Filter

To install the front air filter (see [Figure 77 on page 231](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Insert the filter element into the air filter frame.

3. Grasp the air filter by the handles on its faceplate, and slide it straight into the chassis.
4. Tighten the captive screws on the corners of the faceplate.
5. Unlock the cable management system, and lower it to the fully lowered position.
6. Rearrange the PIC cables in the cable management system.

Figure 77: Installing the Front Air Filter



- See Also**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Maintaining the M320 Air Filters on page 305](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Removing an M320 Front Air Filter on page 229](#)

Removing an M320 Rear Air Filter

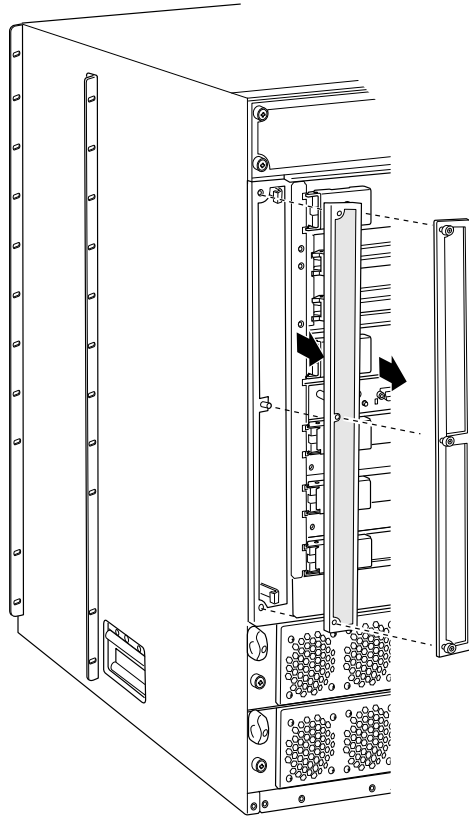
The rear air filter is located at the left rear edge of the chassis. The rear air filter weighs less than 1 lb (0.5 kg).

To remove the rear air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws at the top, center, and bottom of the air filter, using a Phillips (+) screwdriver, number 2.
3. Grasp the air filter cover by the captive screws, and pull firmly to remove the cover and honeycomb assembly from the chassis (see [Figure 78 on page 232](#)).

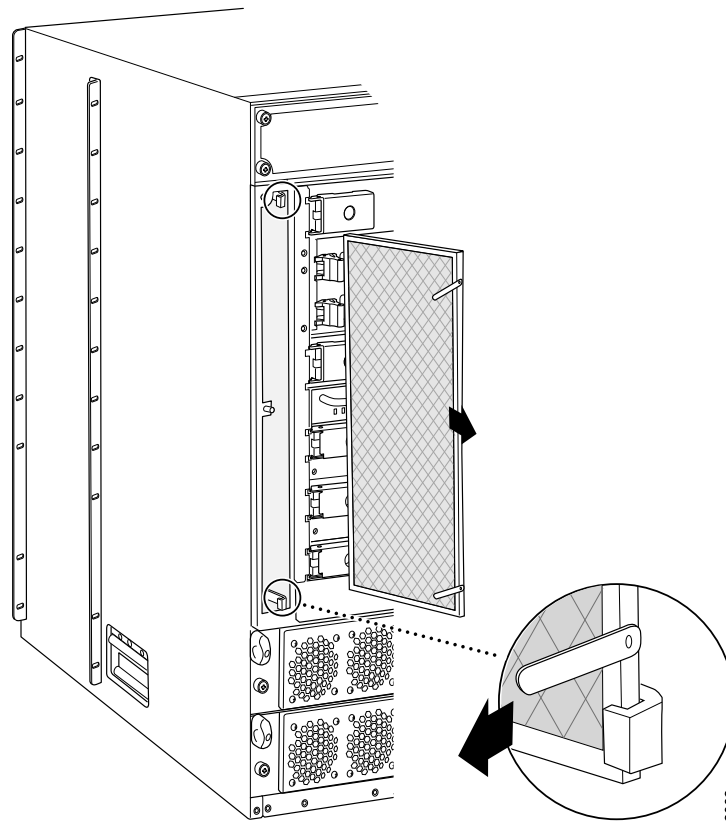
4. Press the filter element inward until it clears the hooks at the top and bottom of the air filter slot, then push it to the left to unseat it.
5. Move the tabs on the filter element to a horizontal position.
6. Grasp the tabs on the filter element and carefully pull it straight out from the chassis (see [Figure 79 on page 233](#)).

Figure 78: Removing the Rear Air Filter



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Figure 79: Removing the Rear Air Filter Element



- See Also**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Maintaining the M320 Air Filters on page 305](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Installing an M320 Rear Air Filter on page 233](#)

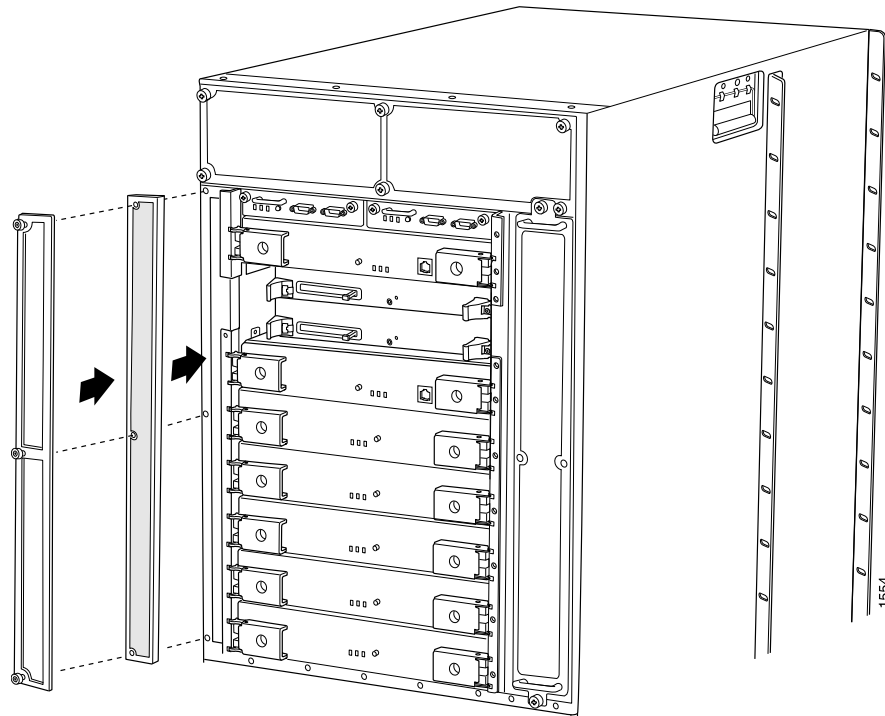
Installing an M320 Rear Air Filter

To install the rear air filter (see [Figure 80 on page 234](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Align the filter with the right side of the air filter slot and carefully push the filter all the way into the slot. The top and bottom air filter guides direct the filter to the left as it is pushed into the slot.

3. Holding the filter all the way in, push it to the right side of the slot until it is held in place behind the hooks.
4. Place the right edge of the honeycomb against the flange of the air filter slot.
5. Line up the holes at the top, center, and bottom of the honeycomb with the pins in the slot and press the honeycomb into place.
6. Replace the air filter cover.
7. Firmly tighten the captive screws at the top, center, and bottom of the filter cover to secure it to the chassis, using a Phillips (+) screwdriver, number 2.

Figure 80: Installing the Rear Air Filter



- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Maintaining the M320 Air Filters on page 305](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Removing an M320 Rear Air Filter on page 231](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- Related Documentation**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Maintaining the M320 Air Filters on page 305](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)

Replacing an M320 Fan Tray


- [Removing an M320 Front Fan Tray on page 235](#)
- [Installing an M320 Front Fan Tray on page 236](#)
- [Removing an M320 Rear Fan Tray on page 237](#)
- [Installing an M320 Rear Fan Tray on page 239](#)

Removing an M320 Front Fan Tray

The router has two front fan trays. The front fan trays install horizontally in the front of the chassis. Each front fan tray contains four fans. The two front fan trays are interchangeable, but the rear fan tray is not interchangeable with the front fan trays. The fan trays are hot-insertable and hot-removable.

The upper front fan tray is located above the FPC card cage, and the lower front fan tray is located below the front air filter. Each fan tray weighs about 11 lb (5.1 kg).

To remove a front fan tray (see [Figure 81 on page 236](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
 2. If you are removing the lower fan tray, perform the following steps:
 - a. Unwrap any PIC cables from the spools on the cable management system and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable management system and tray, and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.
-
- 

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

.....
- b. Simultaneously pull the two releases labeled **PULL** on the cable management system. Lift it up and outward to lock it in place to access the lower fan tray.
 3. Loosen the captive screw on each side of the fan tray faceplate.

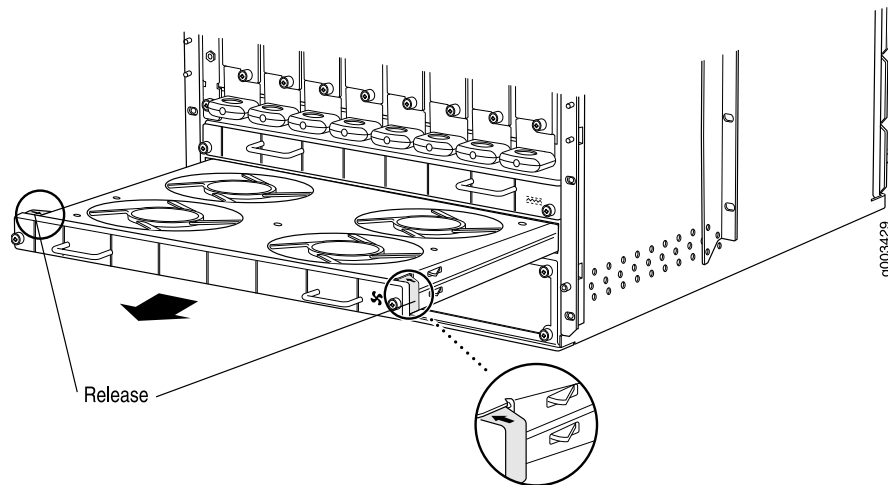
4. Grasp the handles and pull the fan tray until it stops.



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

5. Press the tabs on both sides of the fan tray and pull the fan tray halfway out of the chassis.
6. When the fans stop spinning, place one hand under the fan tray to support it, and pull the fan tray completely out of the chassis.

Figure 81: Removing a Front Fan Tray



- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Maintaining the M320 Air Filters on page 305](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Installing an M320 Front Fan Tray on page 236](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

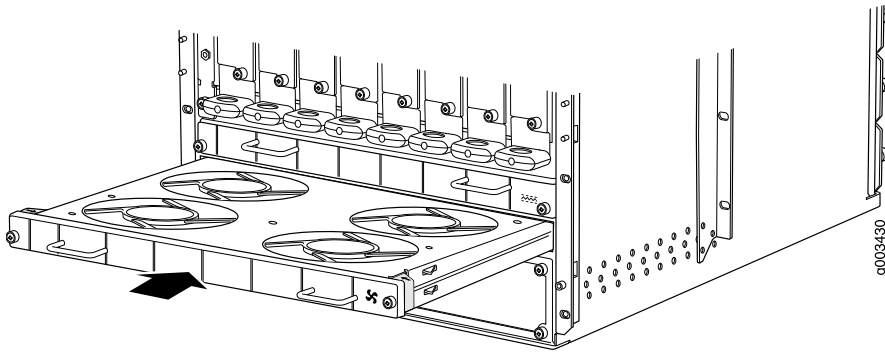
Installing an M320 Front Fan Tray

To install a front fan tray (see [Figure 82 on page 237](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan tray by its handles and insert it straight into the chassis.

3. Tighten the captive screws on each side of the fan tray faceplate to secure it in the chassis.
4. If you are installing the lower fan tray, follow these steps:
 - a. Unlock the cable management system and lower it to the fully lowered position.
 - b. Rearrange the PIC cables in the cable management system. For more information about proper cable arrangement, see [“Maintaining M320 PICs and PIC Cables”](#) on page 314.

Figure 82: Installing a Front Fan Tray



- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Removing an M320 Front Fan Tray on page 235](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Removing an M320 Rear Fan Tray

The rear fan tray is mounted vertically on the right side of the rear of the chassis. The rear fan tray contains seven fans. The fan tray weighs about 8.4 lb (3.8 kg).



CAUTION: To maintain proper cooling, do not operate the router with the rear fan tray removed for more than 1 minute.

To remove the rear fan tray (see [Figure 83 on page 239](#)):

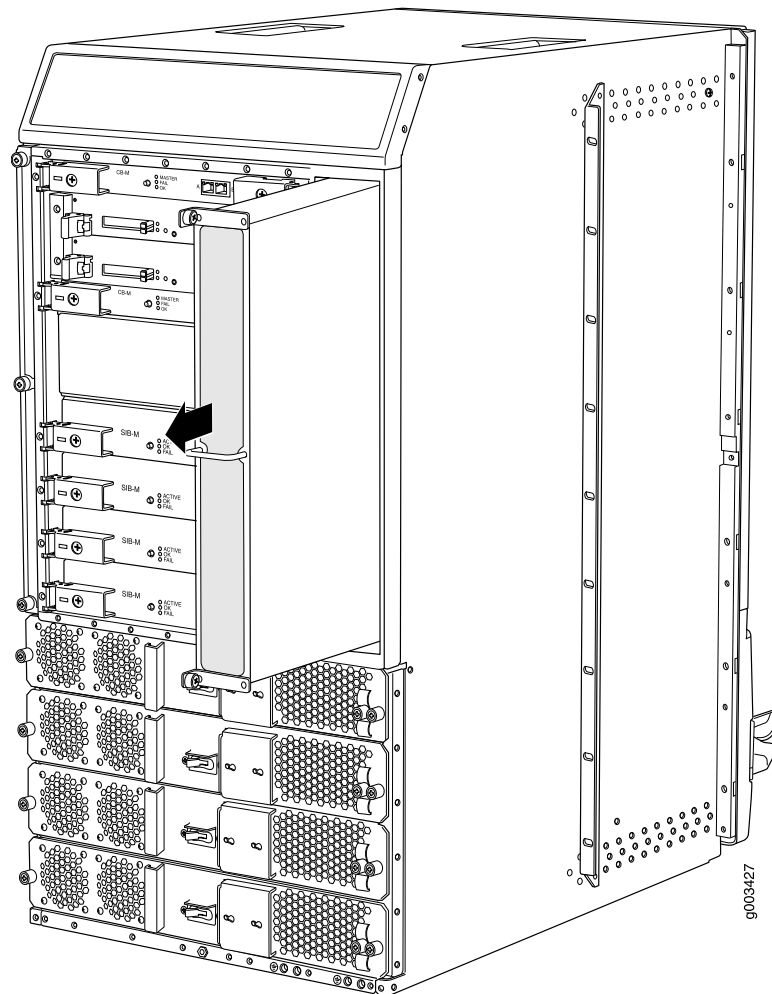
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws on the top and bottom of the fan tray faceplate, using a Phillips (+) screwdriver, number 2.
3. Grasp the handle and pull the fan tray halfway out of the chassis.



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

4. When the fans stop spinning, place one hand under the fan tray to support it, and pull the fan tray completely out of the chassis.

Figure 83: Removing the Rear Fan Tray



- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Installing an M320 Rear Fan Tray on page 239](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

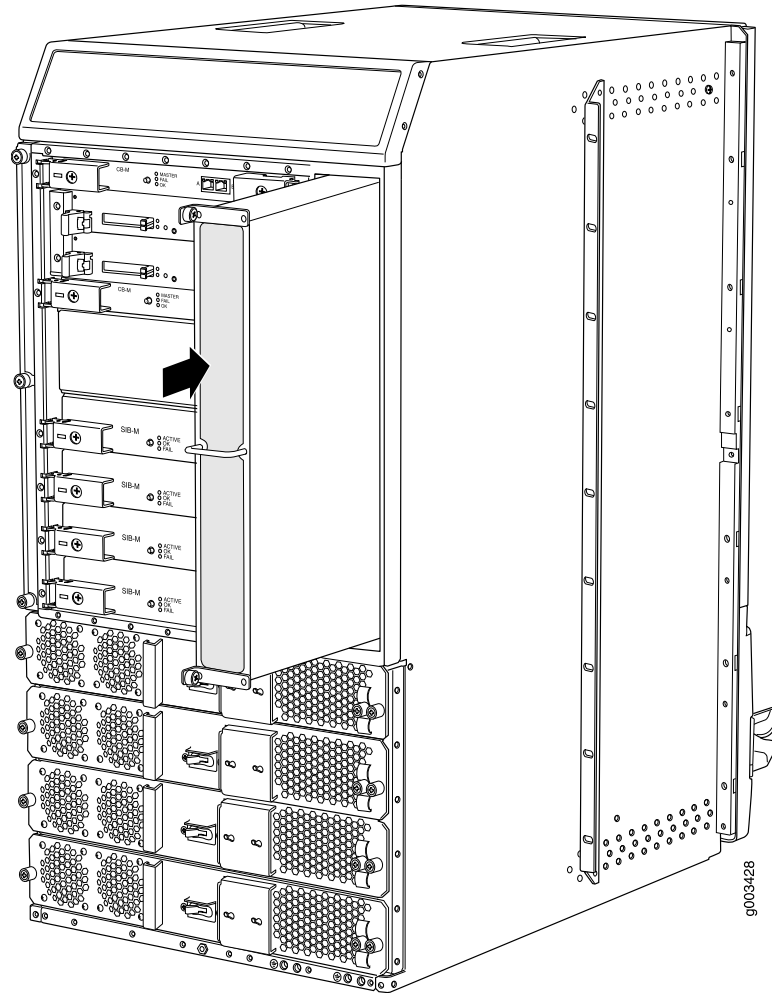
Installing an M320 Rear Fan Tray

To install a replacement rear fan tray (see [Figure 84 on page 240](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

2. Grasp the handle with one hand and place the other hand under the fan tray. Insert the fan tray straight into the chassis.
3. Tighten the captive screws on the fan tray faceplate to secure it in the chassis, using a Phillips (+) screwdriver, number 2.

Figure 84: Installing a Rear Fan Tray



- See Also**
- [M320 Cooling System Description on page 21](#)
 - [Maintaining the M320 Fan Trays on page 306](#)
 - [Maintaining the M320 Air Filters on page 305](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Removing an M320 Rear Fan Tray on page 237](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

**Related
Documentation**

- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
- [M320 Cooling System Description on page 21](#)
- [Maintaining the M320 Fan Trays on page 306](#)
- [Maintaining the M320 Air Filters on page 305](#)
- [Troubleshooting the M320 Cooling System on page 327](#)

Replacing Host Subsystem Components

- [Taking the M320 Host Subsystem Offline on page 243](#)
- [Replacing an M320 Routing Engine on page 246](#)
- [Replacing a Solid-State Disk on an M320 RE-A-1800 Routing Engine on page 249](#)
- [Inserting or Removing a PC Card from an M320 Routing Engine on page 251](#)
- [Replacing a DIMM Module in an M320 Routing Engine on page 253](#)
- [Replacing an M320 Control Board on page 256](#)

Taking the M320 Host Subsystem Offline

The host subsystem is taken offline and brought online as a unit. Before you replace a CB or a Routing Engine, you must take the host subsystem offline.

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

[Table 83 on page 243](#) explains the effect of taking the host subsystem offline.

Table 83: Effect of Taking the Host Subsystem Offline

| Type of Host Subsystem | Effect of Taking the Host Subsystem Offline |
|-----------------------------|--|
| Nonredundant host subsystem | The router shuts down. |
| Backup host subsystem | The functioning of the router is not interrupted. The backup host subsystem is hot-removable and hot-insertable. |

Table 83: Effect of Taking the Host Subsystem Offline (continued)

| Type of Host Subsystem | Effect of Taking the Host Subsystem Offline |
|------------------------|--|
| Master host subsystem | <p>The backup host subsystem becomes the master. The backup Routing Engine assumes Routing Engine functions. The master host subsystem is hot-pluggable. Removal or failure of the master Routing Engine affects forwarding and routing based on the high availability configuration:</p> <ul style="list-style-type: none"> • Dual Routing Engines without any high availability features enabled—Traffic is interrupted while the Packet Forwarding Engine is reinitialized. All kernel and forwarding processes are restarted. When the switchover to the new master Routing Engine is complete, routing convergence takes place and traffic is resumed. • Graceful Routing Engine switchover (GRES) is enabled—Graceful Routing Engine switchover preserves interface and kernel information. Traffic is not interrupted. However, graceful Routing Engine switchover does not preserve the control plane. Neighboring routers detect that the router has restarted and react to the event in a manner prescribed by individual routing protocol specifications. To preserve routing without interruption during a switchover, graceful Routing Engine switchover must be combined with nonstop active routing. • Nonstop active routing is enabled (graceful Routing Engine switchover must be configured for nonstop active routing to be enabled)—Nonstop active routing supports Routing Engine switchover without alerting peer nodes that a change has occurred. Nonstop active routing uses the same infrastructure as graceful Routing Engine switchover to preserve interface and kernel information. However, nonstop active routing also preserves routing information and protocol sessions by running the routing protocol process (rpd) on both Routing Engines. In addition, nonstop active routing preserves TCP connections maintained in the kernel. • Graceful restart is configured—Graceful restart provides extensions to routing protocols so that neighboring helper routers restore routing information to a restarting router. These extensions signal neighboring routers about the graceful restart and prevent the neighbors from reacting to the router restart and from propagating the change in state to the network during the graceful restart period. Neighbors provide the routing information that enables the restarting router to stop and restart routing protocols without causing network reconvergence. Neighbors are required to support graceful restart. The routing protocol process (rpd) restarts. A graceful restart interval is required. For certain protocols, a significant change in the network can cause graceful restart to stop. |



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



NOTE: For information about configuring graceful Routing Engine switchover, graceful restart, and nonstop active routing, see the *High Availability Feature Guide*.



NOTE: The first supported release for graceful Routing Engine switchover and nonstop active routing on the M320 router is Junos OS Release 6.2 and Junos OS Release 8.4, respectively. However, we recommend Junos OS Release 7.0 or later for graceful Routing Engine switchover. Graceful restart software requirements are dependent on the routing protocols configured on the router. For the minimum software requirements for graceful restart, see the *High Availability Feature Guide*.

To take a host subsystem offline:

1. Determine whether the host subsystem is functioning as the master or as the backup, using one of the two following methods:
 - Check the Routing Engine LEDs on the craft interface. If the green **MASTER** LED is lit, the corresponding host subsystem is functioning as the master.
 - Issue the following CLI command. The master Routing Engine is designated **Master** in the **Current state** field:

```
user@host> show chassis routing-engine

Routing Engine status:
Slot 0:
  Current state           Master
...
```

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

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



NOTE: Router performance might change if the standby Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to a Routing Engine, such as the hostname defined at the [edit system] hierarchy level and the management interface (fxp0 or equivalent) defined at the [edit interfaces] hierarchy level.

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

3. On the console or other management device connected to the Routing Engine for the affected host subsystem, enter CLI operational mode and issue the following command. The command shuts down the Routing Engine cleanly, so its state information is preserved:

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

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

For more information about the command, see the [CLI Explorer](#).



NOTE: The SIB might continue forwarding traffic for approximately five minutes after the `request system halt` command has been issued.

4. On the console or other management device connected to the other Routing Engine, enter CLI operational mode and issue the following command.

```
user@host>> request chassis cb offline slot n , where n is 0 or 1 for the slot number of the affected host subsystem.
```

5. Verify that the control board is offline:

```
user@host> show chassis environment cb
```

Related Documentation

- [M320 Host Subsystem Description on page 23](#)
- [Maintaining the M320 Host Subsystem on page 307](#)
- [M320 Chassis Description on page 7](#)

Replacing an M320 Routing Engine

1. [Removing an M320 Routing Engine on page 246](#)
2. [Installing an M320 Routing Engine on page 248](#)

Removing an M320 Routing Engine

The router can have one or two Routing Engines. They are located in the upper rear of the chassis in the slots marked **RE0** and **RE1**. Each Routing Engine weighs approximately 2.4 lb (1.1 kg).

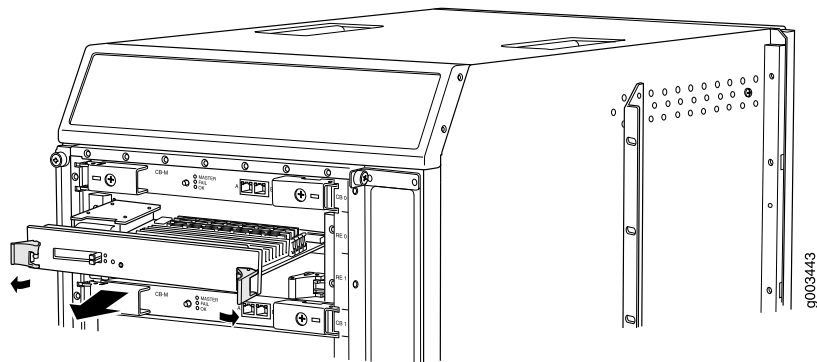


CAUTION: Before you replace a Routing Engine, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router. See [“Taking the M320 Host Subsystem Offline”](#) on page 243.

To remove a Routing Engine (see [Figure 85](#) on page 248):

1. Take the host subsystem offline as described in [“Taking the M320 Host Subsystem Offline”](#) on page 243.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. If applicable, loosen the screws on the extractor handles at either end of the Routing Engine faceplate, using a Phillips screwdriver.
5. Press the red tabs on the ejector handles on both sides of the Routing Engine faceplate.
6. Flip the ejector handles outward to unseat the Routing Engine.
7. Grasp the Routing Engine by the ejector handles, and slide it about halfway out of the chassis.
8. Place one of your hands underneath the Routing Engine to support it, and slide it completely out of the chassis.
9. Place the Routing Engine on the antistatic mat.
10. If you are not replacing the Routing Engine now, install a blank panel over the empty slot.

Figure 85: Removing a Routing Engine



- See Also**
- [M320 Routing Engine Description on page 24](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [Installing an M320 Routing Engine on page 248](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Installing an M320 Routing Engine

To install a Routing Engine (see [Figure 86 on page 249](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the ejector handles are not in the locked position. If necessary, press the red tabs and flip the ejector handles outward.
3. Place one hand underneath the Routing Engine to support it. With the other hand, grasp one of the ejector handles on the faceplate.
4. Carefully align the sides of the Routing Engine with the guides inside the chassis.
5. Slide the Routing Engine into the chassis until you feel resistance, then press the Routing Engine's faceplate until it engages the midplane connectors.
6. Press both the ejector handles inward to seat the Routing Engine.
The Routing Engine might require several minutes to boot.
7. If applicable, tighten the screws on the extractor handles, using a Phillips screwdriver. Be sure to tighten the screws enough to seat the Routing Engine properly.
8. After the Routing Engine boots, verify that it is installed correctly by checking the **RE0** and **RE1** LEDs on the craft interface. If the router is operational and the Routing Engine

is functioning properly, the green **OK** LED lights steadily. If the red **FAIL** LED lights steadily instead, remove and install the Routing Engine again. If the red **FAIL** LED still lights steadily, the Routing Engine is not functioning properly. Contact your customer support representative.

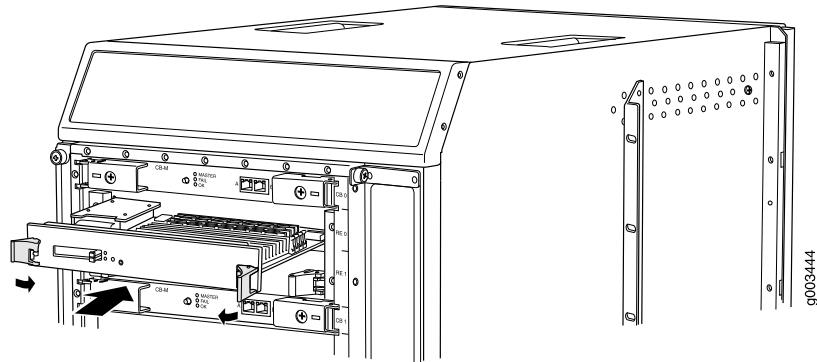
To check the status of the Routing Engine, use the CLI command:

```
user@host> show chassis routing-engine

Routing Engine status:
Slot 0:
  Current state           Master
...
```

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

Figure 86: Installing a Routing Engine



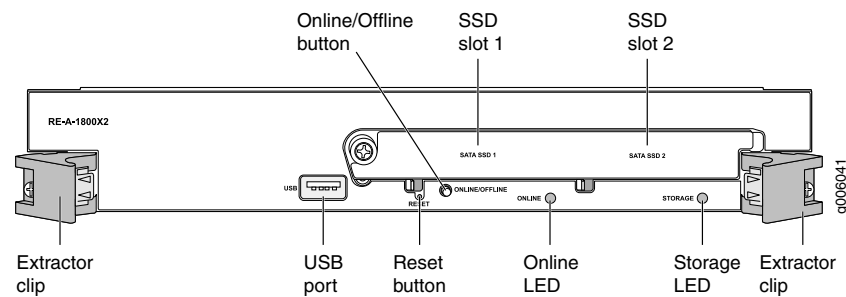
- See Also**
- [M320 Routing Engine Description on page 24](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [Removing an M320 Routing Engine on page 246](#)

- Related Documentation**
- [M320 Routing Engine Description on page 24](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [Synchronizing Routing Engines](#)

Replacing a Solid-State Disk on an M320 RE-A-1800 Routing Engine

Each RE-1800 Routing Engine supports two solid-state disks (SSD) specified by Juniper Networks. The RE-1800 ships with one SSD installed. [Figure 87 on page 250](#) shows the arrangement of SSD slots on a RE-1800 Routing Engine.

Figure 87: RE-A-1800 Routing Engine SSD Slots



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

- SSD SLC 32 GB
1. [Removing an Solid-State Disk From an M320 RE-A-1800 Routing Engine on page 250](#)
 2. [Installing an Solid-State Disk on an M320 RE-A-1800 Routing Engine on page 250](#)

Removing an Solid-State Disk From an M320 RE-A-1800 Routing Engine

To remove an SSD:

1. Disable and deactivate the SSD.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an ESD point on the chassis.
3. Unfasten the thumbscrew that secures the access door in front of the SSD slots, and open the door.
4. Slide the lock on the ejector to the unlocked position.
5. Carefully slide the SSD out of the slot.

- See Also**
- [M320 RE-A-1800 Routing Engine Description on page 28](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [Returning a Hardware Component to Juniper Networks, Inc. on page 347](#)

Installing an Solid-State Disk on an M320 RE-A-1800 Routing Engine

To install an SSD:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an ESD point on the chassis.
2. Carefully align the sides of the SSD with the guides in the slot.

3. Slide the SSD into the slot until you feel resistance, carefully ensuring that it is correctly aligned.
4. Close the access door and tighten the thumbscrew to secure the door.
5. Mount the new SSD.

- See Also**
- [M320 RE-A-1800 Routing Engine Description on page 28](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- Related Documentation**
- [M320 RE-A-1800 Routing Engine Description on page 28](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [Returning a Hardware Component to Juniper Networks, Inc. on page 347](#)

Inserting or Removing a PC Card from an M320 Routing Engine

The slots labeled **PC CARD** on the Routing Engine faceplate accept a Type I PC Card, as defined in the *PC Card Standard* published by the Personal Computer Memory Card International Association (PCMCIA). The router is shipped with a PC Card that contains the Junos OS. The PC Card can be used to copy Junos OS from the PC Card onto the Routing Engine. 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 Support Web site (<http://www.juniper.net/support/>). After logging in, navigate to the Customer Support Center, then to the download page for Junos OS.



NOTE: The software on a PC Card is loaded only onto the Routing Engine into which the PC Card is inserted. It is not automatically copied to the other Routing Engine.

- [Inserting a PC Card into an M320 Routing Engine on page 251](#)
- [Removing an M320 PC Card on page 252](#)

Inserting a PC Card into an M320 Routing Engine

To insert a PC card (see [Figure 88 on page 252](#)):

1. Insert the PC card into either PC card slot on the Routing Engine, with the Juniper Networks logo facing downward.



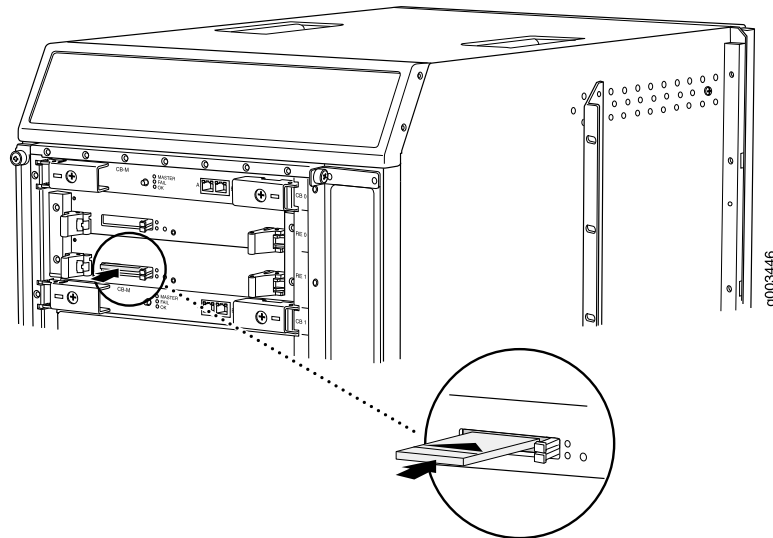
CAUTION: Be sure to insert the PC card with the label facing downward. Inserting the PC card incorrectly might damage the Routing Engine.



CAUTION: Do not install more than one PC card in the Routing Engine.

2. Press the card firmly all the way into the slot.
3. To verify the PC card is installed correctly, check that the corresponding slot LED (labeled **0** or **1 SLOT**) is lit.

Figure 88: Installing a PC Card



- See Also**
- [M320 Host Subsystem Description on page 23](#)
 - [M320 Routing Engine Description on page 24](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [M320 Chassis Description on page 7](#)

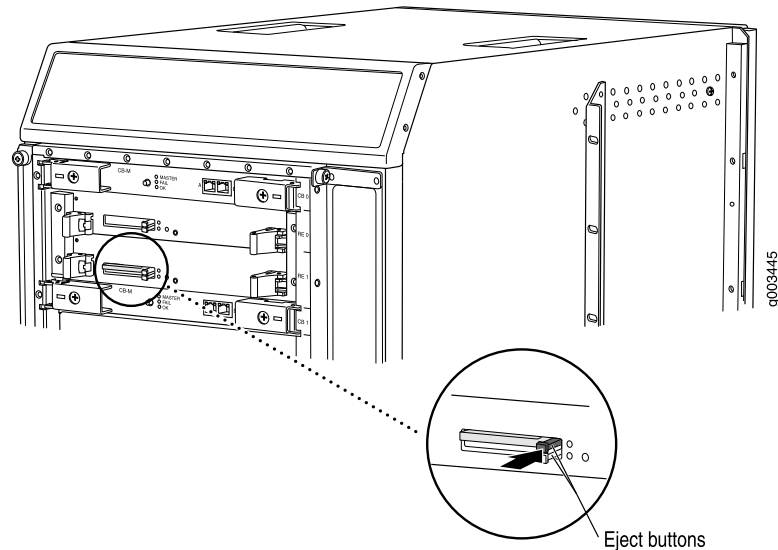
Removing an M320 PC Card

The PC card is inserted into one of the two slots—**0** or **1**—labeled **PC CARD** on the Routing Engine. To remove the PC card (see [Figure 89 on page 253](#)):

1. Have ready an antistatic mat, placed on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. On the Routing Engine faceplate, press the eject button on the right side of the PC card slot once to release the button. Press again to release the PC card.

4. The PC card pops partially out of the slot. Grasp the card and pull it completely out of the slot.
5. Place the PC card on the antistatic mat.

Figure 89: Removing a PC Card



- See Also**
- [M320 Host Subsystem Description on page 23](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [M320 Chassis Description on page 7](#)
 - [Installing an M320 Control Board on page 257](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- Related Documentation**
- [M320 Host Subsystem Description on page 23](#)
 - [M320 Routing Engine Description on page 24](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [M320 Chassis Description on page 7](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Replacing a DIMM Module in an M320 Routing Engine

1. [Removing an M320 DIMM Module on page 254](#)
2. [Installing an M320 DIMM Module on page 254](#)

Removing an M320 DIMM Module



CAUTION: Before you remove a DIMM module from a Routing Engine, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router. See [“Taking the M320 Host Subsystem Offline” on page 243](#).

The DIMM modules are located on the top of the Routing Engine. To remove a DIMM 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.
3. Remove the Routing Engine.
See [“Removing an M320 Routing Engine” on page 246](#).
4. Depending on which Routing Engine you are using, there are two different procedures for ejecting the DIMMs:
 - For Routing Engines with an ejector on one side of the DIMM, press the plastic ejector of the DIMM module. The edge of the module raises upward.
 - For Routing Engines with ejectors on each side of the DIMM, press the plastic ejectors on both sides of the DIMM module.
5. Grasp the DIMM 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 DIMM module on the antistatic mat or in the electrostatic bag.
7. Push the plastic ejectors to close the empty DIMM module slot.

- See Also**
- [M320 Routing Engine Description on page 24](#)
 - [Installing an M320 DIMM Module on page 254](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Installing an M320 DIMM Module

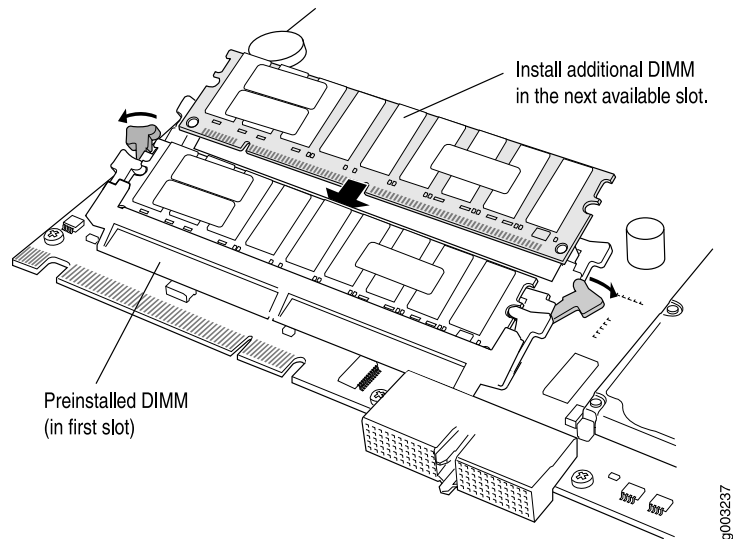


NOTE: When installing DIMMs on an RE-1800, make sure that all DIMMs are manufactured by the same vendor. If necessary, replace an existing DIMM with a new DIMM.

To insert a DIMM module into the Routing Engine:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the DIMM module from its electrostatic bag.
3. To open the empty DIMM slot, press the plastic ejectors open.
4. Grasp the DIMM 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. See “Installing an M320 Routing Engine” on page 248.
7. You can view the SDRAM configuration and verify the DIMM was installed correctly by issuing the `show chassis routing-engine` command.

Figure 90: Installing the DIMM Module



- See Also**
- [M320 Routing Engine Description on page 24](#)
 - [Replacing an M320 Routing Engine on page 246](#)
 - [Removing an M320 DIMM Module on page 254](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- Related Documentation**
- [M320 Routing Engine Description on page 24](#)
 - [Replacing an M320 Routing Engine on page 246](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Replacing an M320 Control Board

1. [Removing an M320 Control Board on page 256](#)
2. [Installing an M320 Control Board on page 257](#)

Removing an M320 Control Board

The router can have one or two CBs. They are located in the upper rear of the chassis in the slots marked **CB0** and **CB1**. Each weighs approximately 3.4 lb (1.5 kg).

To remove a CB, (see [Figure 91 on page 257](#)):

1. Take the host subsystem offline.



CAUTION:

Before you replace a CB, you must take the host subsystem offline:

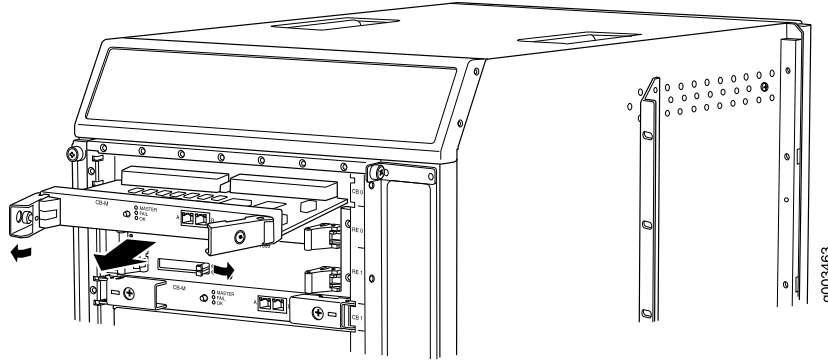
- Before taking the host subsystem offline, switch the Routing Engine to be the backup if the CB to be replaced is associated with the Routing Engine currently functioning as the master Routing engine.
- Taking the host subsystem offline includes both the Routing Engine and CB. If there is only one host subsystem, taking the host subsystem offline shuts down the router.

See [“Taking the M320 Host Subsystem Offline” on page 243](#).

2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. If applicable, disconnect the cables plugged into the ports labeled **EXTERNAL CLOCK INPUTS**.
5. Loosen the captive screws (using a Phillips (+) screwdriver, number 2) on the ejector handles on both sides of the CB faceplate.
6. Flip the ejector handles outward to unseat the CB.
7. Grasp the ejector handles, and slide the CB about halfway out of the chassis.
8. Place one hand underneath the CB to support it, and slide it completely out of the chassis.

9. Place the CB on the antistatic mat.
10. If you are not replacing the CB now, install a blank panel over the empty slot.

Figure 91: Removing a CB



- See Also**
- [M320 Host Subsystem Description on page 23](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [M320 Control Board \(CB\) Description on page 51](#)
 - [Installing an M320 Control Board on page 257](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Installing an M320 Control Board

To install a CB (see [Figure 92 on page 258](#)):

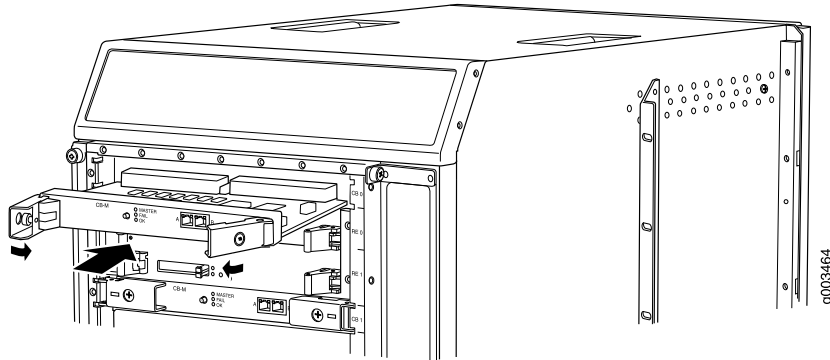
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Carefully align the sides of the CB with the guides inside the chassis.
3. Slide the CB into the chassis, carefully ensuring that it is correctly aligned.
4. Grasp both ejector handles, and press them inward to seat the CB.
5. Tighten the captive screws on the ejector handles, using a Phillips (+) screwdriver, number 2.
6. If applicable, reconnect the cable previously plugged into the port or ports.
7. If power is applied to the Routing Engine and its corresponding CB is functioning normally, the CB comes online automatically. To verify that the CB is functioning normally, check the LEDs on its faceplate. The green **OK** LED should light steadily a

few minutes after the CB is installed. If the **FAIL** LED is lit steadily, remove and install the CB again. If the **FAIL** LED still lights steadily, the CB is not functioning properly. Contact your customer support representative.

To check the status of the CB, use the CLI command:

```
user@host> show chassis environment cb
```

Figure 92: Installing a CB



- See Also**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Host Subsystem Description on page 23](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [M320 Control Board \(CB\) Description on page 51](#)
 - [Removing an M320 Control Board on page 256](#)

- Related Documentation**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Host Subsystem Description on page 23](#)
 - [Maintaining the M320 Host Subsystem on page 307](#)
 - [Taking the M320 Host Subsystem Offline on page 243](#)
 - [M320 Control Board \(CB\) Description on page 51](#)

CHAPTER 27

Replacing Line Card Components

- [Replacing an M320 FPC on page 259](#)
- [Replacing an M320 PIC on page 266](#)
- [Replacing M320 PIC Cables on page 272](#)
- [Replacing an M320 SFP on page 275](#)
- [Replacing an M320 XENPAK Module on page 278](#)

Replacing an M320 FPC

1. [Removing an M320 FPC on page 259](#)
2. [Installing an M320 FPC on page 262](#)

Removing an M320 FPC

When you remove an FPC, the router continues to function, although the PIC interfaces installed on the FPC being removed no longer function.

The router holds up to eight FPCs, which are installed vertically in the front of the router. The FPCs are hot-insertable and hot-removable. An empty FPC1 or FPC2 weighs 15 lb (6.8 kg), and an empty FPC3 weighs 16 lb (7.3 kg). A fully configured FPC can weigh up to 29 lb (13.2 kg)

To remove an FPC (see [Figure 93 on page 262](#)):

1. Have ready a replacement FPC or FPC blank panel and an antistatic mat for the FPC. Also have ready rubber safety caps for each PIC using an optical interface on the FPC that you are removing.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Label the cables connected to each PIC on the FPC so that you can later reconnect the cables to the correct PICs.
4. Use one of the following methods to take the FPC offline:

- Press and hold the FPC online/offline button. The green **OK** LED next to the button begins to blink. Hold the button down until the LED goes out. The LEDs and online/offline button for each FPC are located directly above it on the craft interface.
- Issue the following CLI command:

```
user@host>request chassis fpc slot slot-number offline
```

For more information about the command, see the [CLI Explorer](#).

5. Disconnect the cables from the PICs installed in the FPC. If a PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap. Arrange the disconnected cables in the cable management system, to prevent the cables from developing stress points.



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



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



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

6. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.
7. Grasp the handles and slide the FPC straight out of the card cage halfway.
8. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.



CAUTION: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 29 lb (13.2 kg)—as you slide the FPC out of the chassis.

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

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

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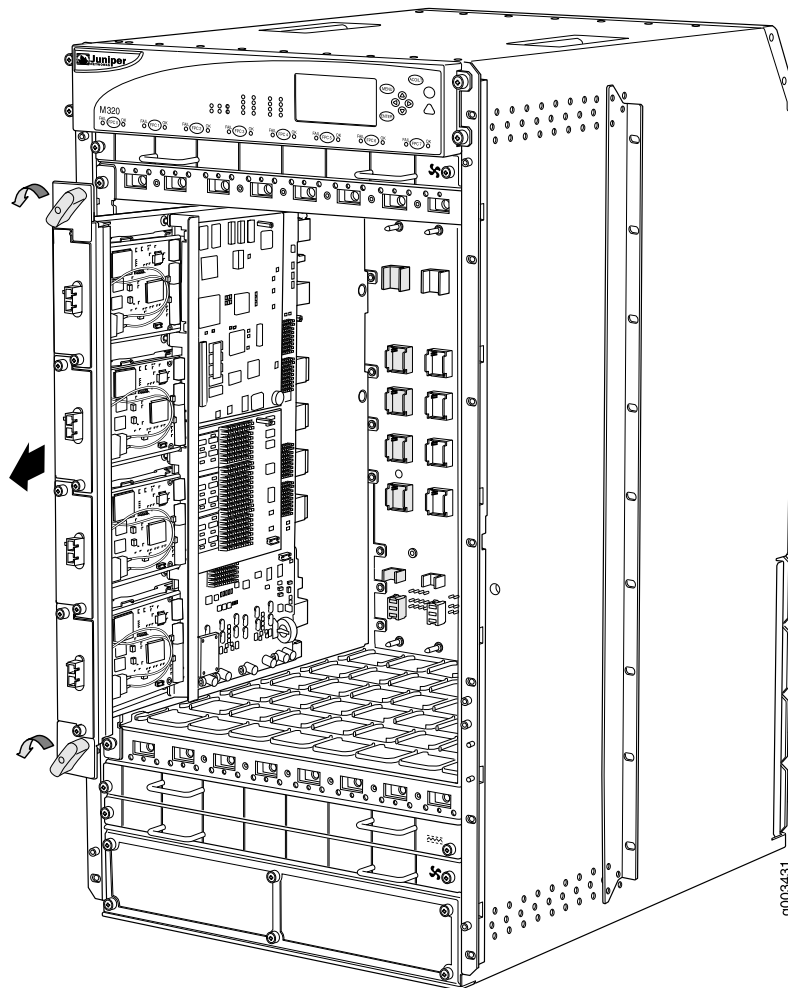
9. If necessary, remove each installed PIC from the FPC. For information on removing a PIC, see [“Removing an M320 PIC” on page 267](#).
 10. After you remove each PIC, immediately place it on an antistatic mat or in an electrostatic bag.
 11. If you are not reinstalling a FPC into the emptied FPC slot within a short time, install a blank FPC panel over the slot to maintain proper airflow in the FPC card cage.
-



CAUTION: After removing an FPC from the chassis, wait at least 30 seconds before reinserting it, removing an FPC from a different slot, or inserting an FPC into a different slot.

.....

Figure 93: Removing an FPC



- See Also**
- [M320 FPCs Supported on page 59](#)
 - [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Maintaining M320 FPCs on page 309](#)
 - [Installing an M320 FPC on page 262](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Installing an M320 FPC

To install an FPC (see [Figure 94 on page 265](#) and [Figure 95 on page 266](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Place the FPC on an antistatic mat.

3. Take each PIC to be installed in the replacement FPC out of its electrostatic bag and identify the slot on the FPC where it will be connected.
4. Verify that each fiber-optic PIC has a rubber safety cap covering the PIC transceiver. If it does not, cover the transceiver with a safety cap.
5. Install each PIC into the appropriate slot on the FPC. For information on installing a PIC, see [“Installing an M320 PIC” on page 269](#).
6. Locate the slot in the FPC card cage in which you plan to install the FPC.
7. Lift the FPC into place and carefully align first the bottom, then the top of the FPC with the guides inside the card cage. Be sure the FPC is right-side up, with the components on the right of the FPC.



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

8. Slide the FPC all the way into the card cage until you feel resistance.
9. Starting with the ejector handles on the FPC faceplate nearly horizontal, simultaneously turn both ejector handles clockwise to seat the FPC.
10. If any of the PICs on the FPC connect to fiber-optic cable, remove the rubber safety cap from each transceiver and cable.



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

11. Insert the appropriate cable into the cable connector ports on each PIC on the FPC. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.



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



.....

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

.....

12. Use one of the following methods to bring the FPC online:

- Press and hold the FPC online/offline button until the green **OK** LED next to the button lights steadily, in about 5 seconds. The LEDs and online/offline button for each FPC are located directly above it on the craft interface.
- Issue the following CLI command:

```
user@host>request chassis fpc slot slot-number online
```

For more information about the command, see the [CLI Explorer](#).



.....

CAUTION: After the OK LED lights steadily, wait at least 30 seconds before removing the FPC again, removing an FPC from a different slot, or inserting an FPC in a different slot.

.....

You can also verify correct FPC and PIC functioning by issuing the **show chassis fpc** and **show chassis fpc pic-status** commands, as described in [“Maintaining M320 FPCs” on page 309](#) and [“Maintaining M320 PICs and PIC Cables” on page 314](#).

Figure 94: Installing an FPC

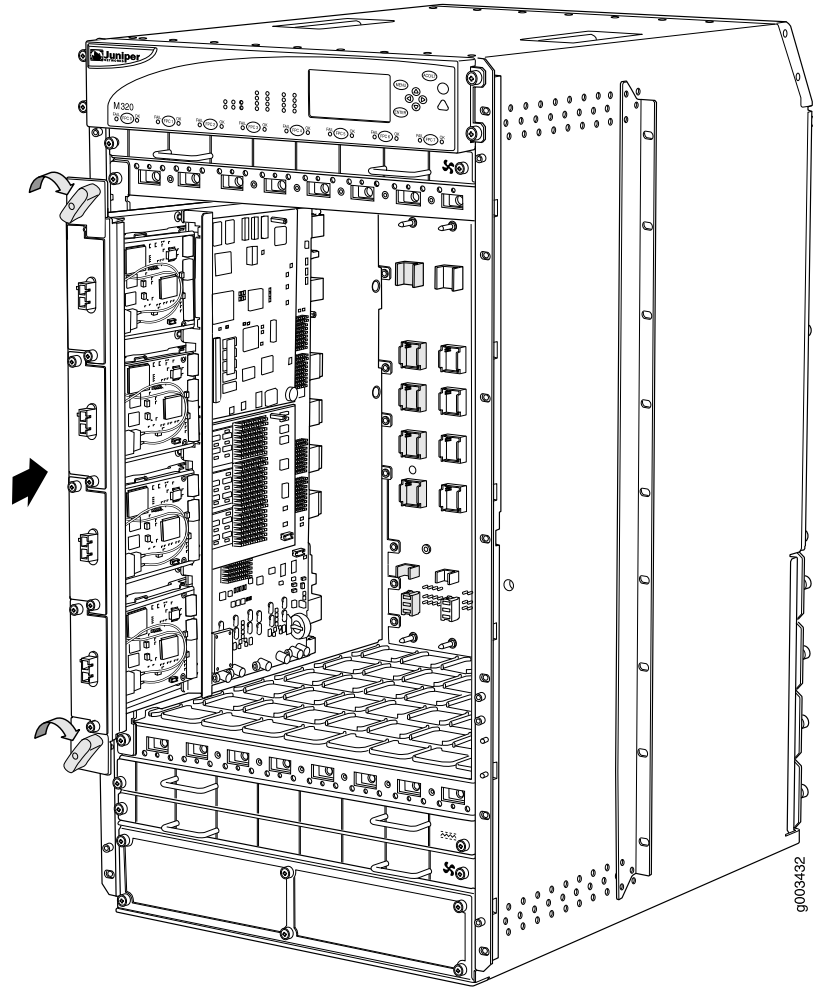
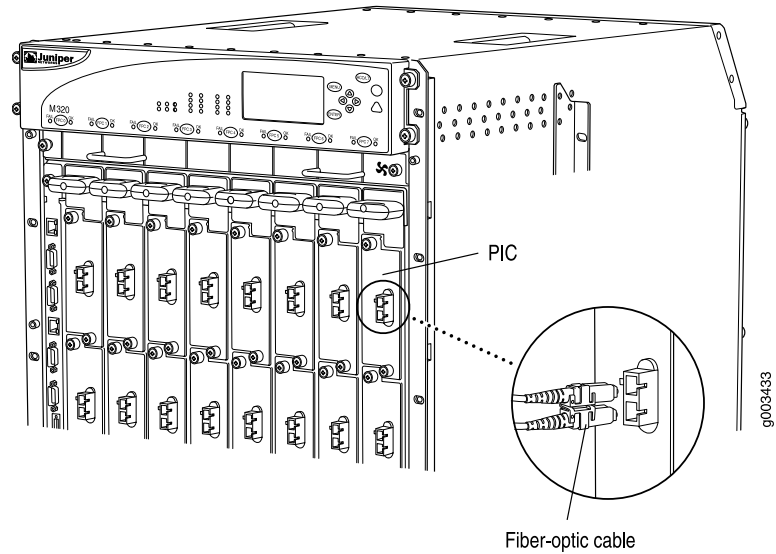


Figure 95: Connecting Fiber-Optic Cable to a PIC



- See Also**
- [M320 FPCs Supported on page 59](#)
 - [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Removing an M320 FPC on page 259](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- Related Documentation**
- [M320 FPCs Supported on page 59](#)
 - [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Replacing an M320 PIC

1. [Removing an M320 PIC on page 267](#)
2. [Installing an M320 PIC on page 269](#)

Removing an M320 PIC

PICs are hot-insertable and hot-removable. When you remove a PIC, the router continues to function, although the PIC interfaces being removed no longer function.

The PICs are located in the FPCs installed in the front of the router. A PIC weighs less than 2 lb (0.9 kg).

To remove a PIC (see [Figure 96 on page 269](#)):

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.

3. Use one of the following methods to take the PIC offline:

- Press and hold the online/offline button until the PIC LED goes out (about 5 seconds).

For a PIC installed in a Type 1 FPC, use a tool—such as a flat-blade screwdriver—to press the button slightly beneath the faceplate of the PIC. For a PIC installed in a Type 2 FPC or Type 3 FPC, use a narrow-ended tool that fits inside the opening that leads to the button.

- Issue the following CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline
```

For more information about the command, see *request chassis pic*.

4. Label the cables connected to the PIC so that you can later reconnect each cable to the correct PIC.
5. Disconnect the cables from the PIC. If the PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.



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



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

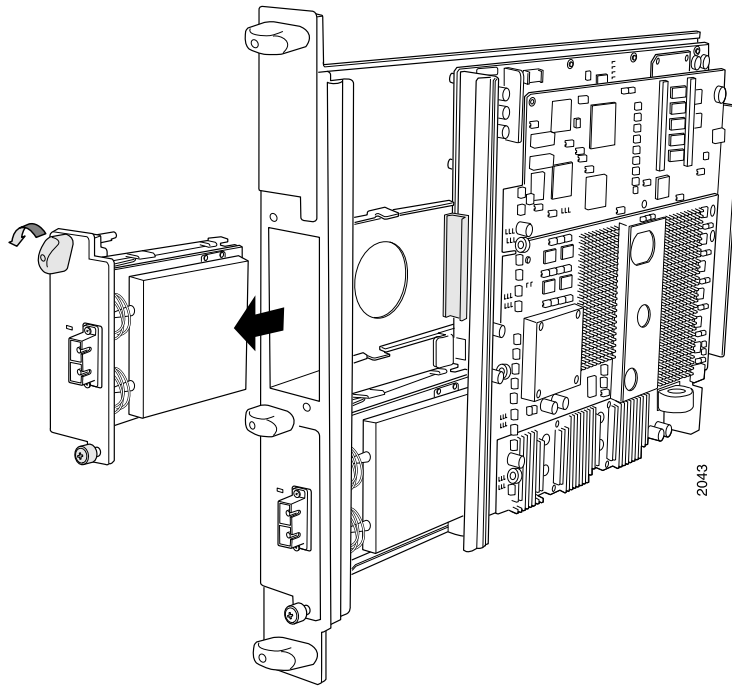
6. Arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners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



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

7. Unseat the PIC:
 - Type 1 or Type 2 PIC—Loosen the captive screws at the top and bottom of the PIC faceplate.
 - Type 3 PIC—Loosen the captive screw at the bottom of the PIC faceplate, then twist the ejector handle at the top of the faceplate and counterclockwise to unseat the PIC.
 - Type 4 PIC—Twist the ejector handle at the bottom of the PIC faceplate, then twist the ejector handle at the top of the faceplate and counterclockwise to unseat the PIC.
8. Slide the PIC out of the FPC card carrier, and place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a PIC into the emptied PIC slot within a short time, install a blank PIC panel over the slot to maintain proper airflow in the FPC card cage.

Figure 96: Removing a PIC



- See Also**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 PIC Description on page 60](#)
 - [Maintaining M320 PICs and PIC Cables on page 314](#)
 - [Troubleshooting the M320 PICs on page 331](#)
 - [Installing an M320 PIC on page 269](#)

Installing an M320 PIC

To install a PIC (see [Figure 97 on page 271](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. If 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. Align the notches in the connector at the rear of the PIC with the notches in the PIC slot in the FPC and then slide the PIC in until it lodges firmly in the FPC.



CAUTION: Slide the PIC straight into the slot to avoid damaging the components on the bottom of the PIC.

4. Secure the PIC to the FPC faceplate:
 - Type 1 or Type 2 PICs—Tighten the captive screws at the top and bottom of the faceplate.
 - Type 3 PICs—Turn the ejector handle at the top of the PIC faceplate clockwise, then tighten the captive screw at the bottom of the faceplate.
 - Type 4 PIC—Twist the ejector handle at the bottom of the PIC faceplate, then twist the ejector handle at the top of the faceplate and counterclockwise to unseat the PIC.
5. If the PIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.



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



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

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



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



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

8. Use one of the following methods to bring the PIC online:
 - Press the PIC offline/online button until the PIC LED lights green. For a PIC installed in a Type 1 FPC, use a tool—such as a flat-blade screwdriver—to press the button

slightly beneath the faceplate of the PIC. For a PIC installed in a Type 2 FPC or Type 3 FPC, use a narrow-ended tool that fits inside the opening that leads to the button.

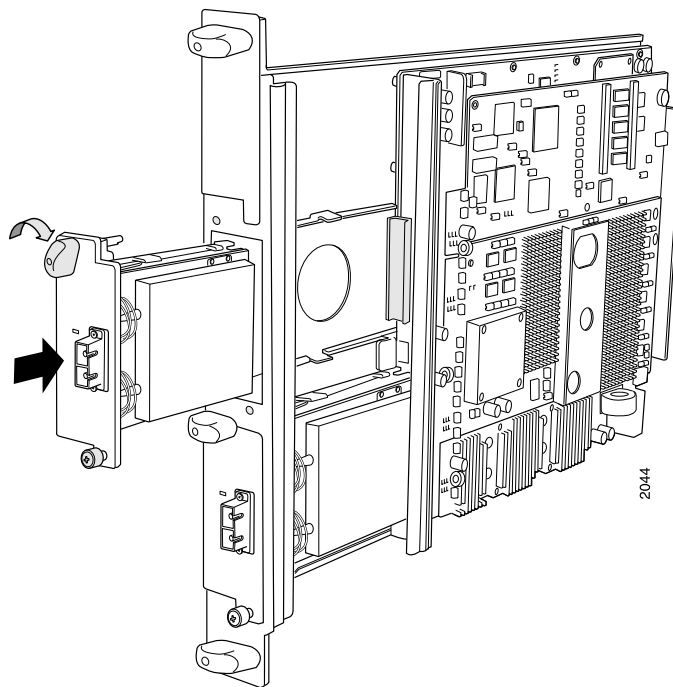
- Issue the following CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot online
```

For more information about the command, see *request chassis pic*.

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

Figure 97: Installing a PIC



- See Also**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 PIC Description on page 60](#)
 - [Troubleshooting the M320 PICs on page 331](#)
 - [Removing an M320 PIC on page 267](#)

- Related Documentation**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 PIC Description on page 60](#)
 - [Maintaining M320 PICs and PIC Cables on page 314](#)
 - [Troubleshooting the M320 PICs on page 331](#)

Replacing M320 PIC Cables

1. [Removing an M320 PIC Cable on page 272](#)
2. [Installing an M320 PIC Cable on page 273](#)

Removing an M320 PIC Cable

Removing and installing PIC cables do not affect router function, except that a PIC does not receive or transmit data while its cable is disconnected.

To remove a PIC cable:

1. If the PIC connects to fiber-optic cable, have ready a rubber safety cap for each cable and transceiver.
2. If removing all cables connected to the PIC, use one of the following methods to take the PIC offline:
 - Press its online/offline button. For a PIC installed in an FPC1, use a tool—such as a flat-blade screwdriver—to press the button slightly beneath the faceplate of the PIC. For a PIC installed in an FPC2 or FPC3, use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the PIC LED goes out (about 5 seconds).
 - Issue the following CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline
```

For more information about the command, see the [CLI Explorer](#).

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



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



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

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

See Also • [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- [M320 PIC Description on page 60](#)
- [Maintaining M320 PICs and PIC Cables on page 314](#)
- [Connecting PIC Cables to the M320 Router on page 189](#)
- [Installing an M320 PIC Cable on page 273](#)

Installing an M320 PIC Cable

To install a PIC cable (see [Figure 98 on page 274](#)):

1. Have ready a length of the type of cable used by the PIC. For cable specifications, see the *M320 Multiservice Edge Router Interface Module Reference*.
2. If the PIC cable connector port is covered by a rubber safety plug, remove the plug.



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



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

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



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



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

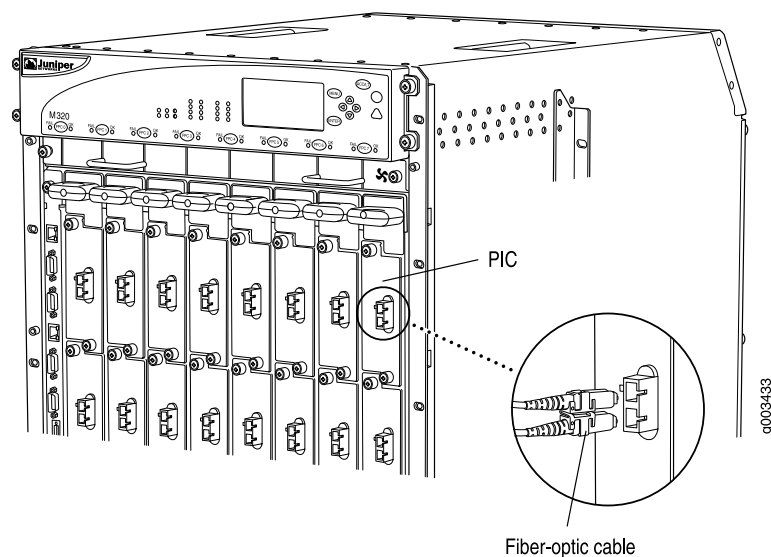
5. After you have draped the PIC cables, you can optionally install the cable cover (the cable cover prevents the PIC and CIP cables from being disturbed or snagged). To install the cable cover, insert the upper tabs of the cover into the slots of the upper cable guards, then insert the lower tabs of the cover into the slots of the lower cable guards (see [“Connecting PIC Cables to the M320 Router” on page 189](#)).
6. Insert the other end of the cable into the destination port.
7. Repeat the previous steps for any additional cables.
8. If the PIC is offline (its failure indicator LED is lit), use one of the following methods to bring the PIC online:
 - Press the PIC offline/online button until the PIC LED lights green. For a PIC installed in an FPC1, use a tool—such as a flat-blade screwdriver—to press the button slightly beneath the faceplate of the PIC. For a PIC installed in an FPC2 or FPC3, use a narrow-ended tool that fits inside the opening that leads to the button.
 - Issue the following CLI command:

```
user@host>request chassis pic fpc-slot fpc-slot pic-slot pic-slot online
```

For more information about the command, see the [CLI Explorer](#).

The normal functioning indicator LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the `show chassis fpc pic-status` command described in [“Maintaining M320 PICs and PIC Cables” on page 314](#).

Figure 98: Connecting Fiber-Optic Cable to a PIC



- See Also**
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 PIC Description on page 60](#)

- Troubleshooting the M320 PICs on page 331
- Removing an M320 PIC Cable on page 272

Related Documentation

- Preventing Electrostatic Discharge Damage to an M320 Router on page 358
- M320 PIC Description on page 60
- Maintaining M320 PICs and PIC Cables on page 314
- Connecting PIC Cables to the M320 Router on page 189

Replacing an M320 SFP

1. Removing an M320 SFP on page 275
2. Installing an M320 SFP on page 277

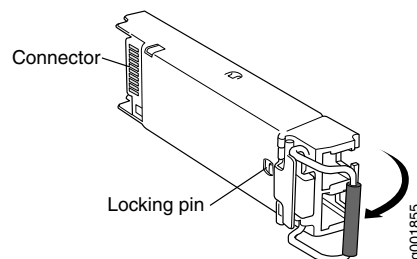
Removing an M320 SFP

Small form-factor pluggables (SFPs) are transceivers that can be removed from a PIC. 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.



NOTE: When you remove a PIC transceiver, the router continues to function, although the PIC interface being removed no longer functions.

Figure 99: Small Form-Factor Pluggable (SFP)



NOTE: This procedure applies to both SFP and SFP+ transceivers.

To remove an SFP transceiver (see [Figure 99](#) on page 275):

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 electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

3. Label the cable connected to the 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.



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



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

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



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

6. Pull the ejector 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.

- See Also**
- [M320 PIC Description on page 60](#)
 - [M320 Chassis Description on page 7](#)
 - [Maintaining M320 PICs and PIC Cables on page 314](#)
 - [Installing an M320 SFP on page 277](#)

Installing an M320 SFP

To install a replacement SFP:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the 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.
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.



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



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

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



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



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

7. Verify that the status LEDs on the PIC faceplate indicate that the SFP is functioning correctly (there is an LED for each SFP port). For more information about the PIC LEDs, see the interface module reference for your device. You can also verify PIC functioning by issuing the **show chassis fpc pic-status** command.

- See Also**
- [M320 Multiservice Edge Router Interface Module Reference](#)
 - [M320 PIC Description on page 60](#)
 - [M320 Chassis Description on page 7](#)
 - [Troubleshooting the M320 PICs on page 331](#)
 - [Removing an M320 SFP on page 275](#)

- Related Documentation**
- [M320 PIC Description on page 60](#)
 - [M320 Chassis Description on page 7](#)
 - [Maintaining M320 PICs and PIC Cables on page 314](#)

Replacing an M320 XENPAK Module

1. [Removing an M320 XENPAK Module on page 278](#)
2. [Installing an M320 XENPAK Module on page 280](#)

Removing an M320 XENPAK Module

To remove a XENPAK module (see [Figure 100 on page 279](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the XENPAK module. Have ready a rubber safety cap for the XENPAK transceiver and the cable.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Label the cable connected to the XENPAK module so that you can later reconnect it to the correct module.
4. Disconnect the cable from the XENPAK module. Immediately cover the transceiver and the end of the cable with a rubber safety cap.



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



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

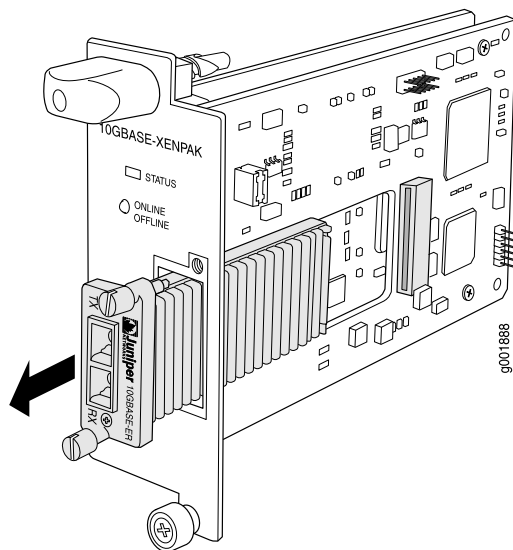
5. Arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners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



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

6. Unscrew the thumbscrews at the top and bottom of the XENPAK module.
7. Slide the module out of the PIC and place it in the electrostatic bag or on the antistatic mat.

Figure 100: Removing a XENPAK Module



- See Also**
- [M320 PIC Description on page 60](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [M320 Chassis Description on page 7](#)
 - [Installing an M320 XENPAK Module on page 280](#)

Installing an M320 XENPAK Module

To install a replacement XENPAK module (see [Figure 101 on page 281](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the XENPAK transceiver. Install one if necessary.
3. Orient the XENPAK module so that the optical port faces out, and the transmit (TX) port is above the receive (RX) port (see [Figure 101 on page 281](#)).
4. Slide the XENPAK module into the slot.
5. Tighten the thumbscrews at the top and bottom of the XENPAK module. Verify that the module is seated properly.
6. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.



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



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

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



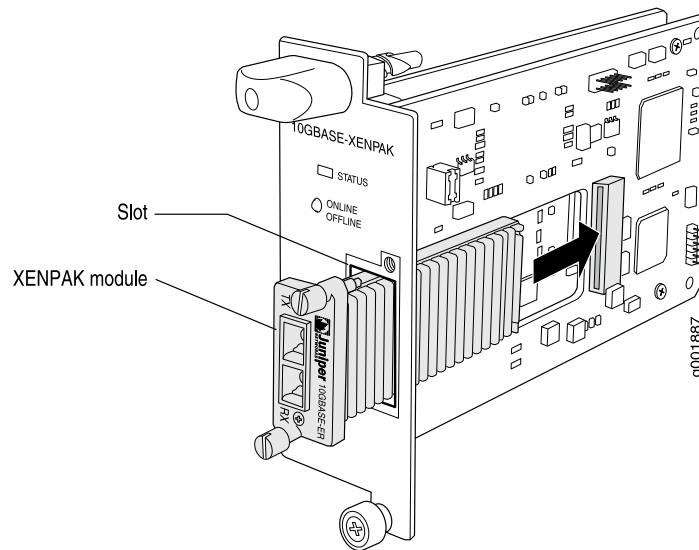
CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.



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

- Verify that the status LEDs on the PIC faceplate indicate that the XENPAK module is functioning correctly. For more information about the PIC LEDs, see the interface module reference for your device. You can also verify PIC functioning by issuing the `show chassis fpc pic-status` command.

Figure 101: Installing a XENPAK Module



NOTE: Orient the XENPAK module in the slot so it does not touch the faceplate opening.

- See Also**
- [M320 PIC Description on page 60](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
 - [Maintaining M320 PICs and PIC Cables on page 314](#)
 - [M320 Chassis Description on page 7](#)
 - [Removing an M320 XENPAK Module on page 278](#)

- Related Documentation**
- [M320 PIC Description on page 60](#)

- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
- [Maintaining M320 PICs and PIC Cables on page 314](#)
- [M320 Chassis Description on page 7](#)

Replacing Power System Components

- [Replacing an M320 AC Power Supply on page 283](#)
- [Replacing an M320 DC Power Supply on page 287](#)
- [Replacing an M320 AC Power Supply Cord on page 292](#)
- [Replacing an M320 DC Power Supply Cable on page 294](#)

Replacing an M320 AC Power Supply

1. [Removing an M320 AC Power Supply on page 283](#)
2. [Installing an M320 AC Power Supply on page 285](#)

Removing an M320 AC Power Supply

The power supplies are located at the rear of the chassis below the SIBs. Each power supply weighs approximately 10 lb (4.5 kg).



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

To remove an AC power supply:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Switch power switch on the AC power supply faceplate to the off position (O).
3. Unplug the power cord from the power source receptacle.
4. Remove the cable restraint from the right edge of the power supply faceplate by removing its retainer screw.
5. Unplug the power cord from the appliance inlet on the power supply faceplate.
6. Loosen the captive screw on each side of the power supply faceplate completely.

- [M320 AC Power Electrical Specifications on page 109](#)
- [Connecting Power to an AC-Powered M320 Router on page 193](#)
- [M320 AC Power Electrical Safety Guidelines on page 385](#)
- [M320 AC Power Electrical Safety Warning on page 386](#)
- [Installing an M320 AC Power Supply on page 285](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Installing an M320 AC Power Supply

To install an AC power supply (see [Figure 104 on page 286](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Switch the power switch on the AC power supply faceplate to the off position (O).
3. Using both hands, slide the power supply into the chassis until you feel resistance.
4. Firmly push the power supply into the chassis until it comes to a stop. The power supply faceplate should be flush with any adjacent power supply faceplates.
5. Tighten the captive screws on each side of the power supply faceplate to secure the power supply in the chassis.
6. Insert the appliance coupler end of a power cord into the appliance inlet on the power supply faceplate.
7. Remove the cable restraint from the right edge of the power supply faceplate by removing its retainer screw.
8. Wrap the cable restraint around the power cord, then slide it along the power cord to a position that enables you to reinstall it in the power supply faceplate.
9. Reinstall the cable restraint by tightening its retainer screw partway into the power supply faceplate.
10. Carefully pull the AC power cord through the cable restraint until you have the desired amount of slack in the power cord.
11. Tighten the cable restraint retainer screw to hold the power cord in place.

Replacing an M320 DC Power Supply

1. [Removing an M320 DC Power Supply on page 287](#)
2. [Installing an M320 DC Power Supply on page 290](#)

Removing an M320 DC Power Supply

The power supplies are located at the rear of the chassis below the SIBs. Each power supply weighs approximately 10 lb (4.5 kg).

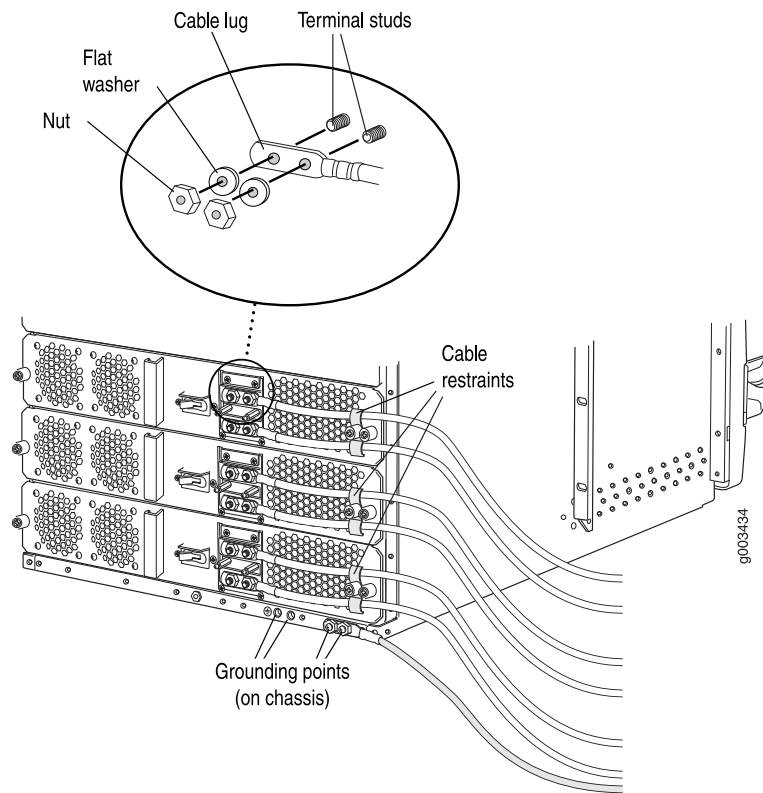


NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove a DC power supply:

1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Switch the circuit breaker on the DC power supply faceplate to the off position (O).
4. Remove the clear plastic cover protecting the terminal studs on the faceplate.
5. Remove the nuts and washers from the terminal studs (see [Figure 105 on page 288](#)). (Use a 7/16-in. (11 mm) nut driver.)

Figure 105: Disconnecting Power Cables from the DC Power Supply



6. Remove the cable lugs from the terminal studs.
7. Loosen the captive screws on the cable restraints on the right edge of the power supply faceplate.
8. Carefully move the power cables out of the way.
9. Loosen the captive screw on each side of the power supply faceplate completely.
10. Twist the ejector handles on the upper corners of the faceplate counterclockwise to unseat the power supply.
11. Pull firmly to start removing the power supply. Slide it halfway out of the chassis (see [Figure 106 on page 289](#)).



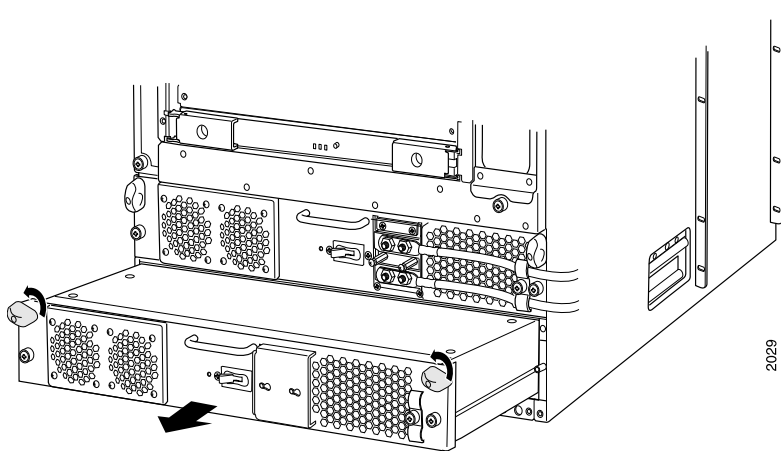
WARNING: Do not touch the power connectors on the rear of the power supply (see “[Removing an M320 AC Power Supply](#)” on page 283). They can contain dangerous voltages.

12. Place one hand underneath the power supply to support it, and slide it completely out of the chassis.



CAUTION: Each power supply weighs approximately 10 lb (4.5 kg). Be prepared to support the full weight of the power supply as you remove it from the router.

Figure 106: Removing a DC Power Supply



- See Also**
- [M320 DC Power Supplies Description](#) on page 82
 - [M320 DC Power Electrical Specifications](#) on page 113
 - [Connecting Power to a DC-Powered M320 Router](#) on page 195
 - [Installing an M320 DC Power Supply](#) on page 290
 - [Preventing Electrostatic Discharge Damage to an M320 Router](#) on page 358

Installing an M320 DC Power Supply

To install a DC power supply (see [Figure 107 on page 291](#)):

1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during installation.



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

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Switch the circuit breaker on the DC power supply faceplate to the off position (O).
4. Using both hands, slide the power supply into the chassis until you feel resistance.
5. Firmly push the power supply into the chassis until it comes to a stop. The power supply faceplate should be flush with any adjacent power supply faceplates.
6. Tighten the captive screws on each side of the power supply faceplate to secure the power supply in the chassis.
7. Remove the clear plastic cover protecting the terminal studs on the faceplate.
8. Remove the nuts and washers from the terminal studs.
9. Attach the lugs on the DC source power cables to the terminal studs.
 - a. Attach the lugs on the positive (+) DC source power cables to the terminal studs.
 - b. Attach the lugs on the negative (–) DC source power cables to the terminal studs.

Secure each cable lug to the terminal stud, first with a washer, then with a nut. Use a 7/16-in. (11 mm) nut driver or socket wrench to tighten the nut. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut.



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

10. Loosen the captive screw on the cable restraint on the right edge of the power supply faceplate.
11. Route the positive and negative DC power cables through the top and bottom of the cable restraint.
12. Tighten the cable restraint captive screw to hold the power cables in place.
13. Verify that the ground and power 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.
14. Replace the clear plastic cover over the terminal studs on the faceplate.
15. Switch on the external circuit breakers to provide voltage to the DC power source cable leads.
16. Switch the circuit breaker on the power supply faceplate to the on position (I). Verify that the **OUTPUT OK** status LED on the power supply faceplate blinks, then lights steadily approximately 1 minute after you switch the power supply circuit breaker on.

Figure 107: Installing a DC Power Supply

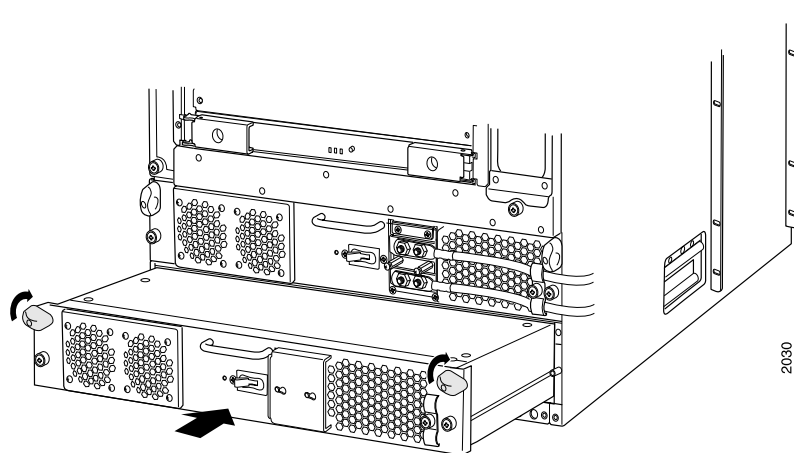
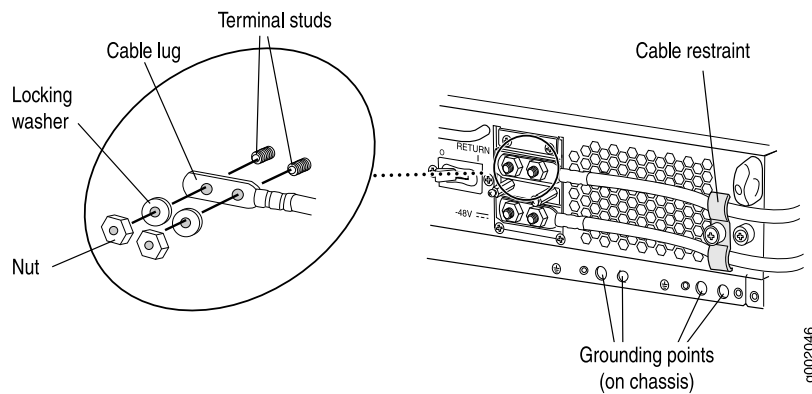


Figure 108: Connecting Power Cables to the DC Power Supply



- See Also**
- [M320 DC Power Supplies Description on page 82](#)
 - [M320 DC Power Electrical Specifications on page 113](#)
 - [Connecting Power to a DC-Powered M320 Router on page 195](#)
 - [Removing an M320 DC Power Supply on page 287](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- Related Documentation**
- [M320 DC Power Supplies Description on page 82](#)
 - [M320 DC Power Electrical Specifications on page 113](#)
 - [Connecting Power to a DC-Powered M320 Router on page 195](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Replacing an M320 AC Power Supply Cord

To replace the power cord for an AC power supply:

1. Locate a replacement power cord with the type of plug appropriate for your geographical location (see "[M320 AC Power Cord Specifications](#)" on page 110).
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Switch the power switch on the power supply faceplate to the off position (O).
4. Unplug the power cord from the power source receptacle.
5. Remove the cable restraint from the right edge of the power supply faceplate by removing its retainer screw.

6. Remove the cable restraint from the power cord and save it so you can use it on the replacement power cord.
7. Unplug the power cord from the appliance inlet on the power supply faceplate.
8. Insert the appliance coupler end of the replacement power cord into the appliance inlet on the power supply faceplate.
9. Wrap the cable restraint around the power cord, then slide it along the power cord to a position that enables you to reinstall it in the power supply faceplate.
10. Reinstall the cable restraint by tightening its retainer screw partway into the power supply faceplate.
11. Carefully pull the AC power cord through the cable restraint until you have the desired amount of slack in the power cord.
12. Tighten the cable restraint retainer screw to hold the power cord in place.
13. Insert the power cord 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.
14. Switch the power switch on the power supply faceplate to the on position (I). Verify that the **OUTPUT OK** status LED on the power supply faceplate blinks, then lights steadily approximately 1 minute after you switch the power switch on.

**Related
Documentation**

- [M320 AC Power Supplies Description on page 82](#)
- [M320 AC Power Electrical Specifications on page 109](#)
- [Connecting Power to an AC-Powered M320 Router on page 193](#)
- [M320 AC Power Electrical Safety Guidelines on page 385](#)
- [M320 AC Power Electrical Safety Warning on page 386](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Replacing an M320 DC Power Supply Cable

To replace a power cable for a DC power supply:

1. Locate a replacement power cable that meets the specifications defined in “[M320 DC Power Cable Specifications](#)” on page 115.



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

2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.



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

3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Switch the circuit breaker on the DC power supply faceplate to the off position (O).
5. Remove the power cable from the DC power source.
6. Remove the clear plastic cover protecting the terminal studs on the faceplate.
7. Remove the nuts and washers from the terminal studs (see [Figure 109 on page 296](#)). (Use a 7/16-in. (11 mm) nut driver.)
8. Remove the cable lug from the terminal studs.
9. Loosen the captive screw on the cable restraint on the right edge of the power supply faceplate.
10. Carefully move the power cable out of the way.

11. Attach the lug on the replacement power cable to the terminal studs, making sure the cable is not touching or in the way of any router components.
12. Attach the lugs on the DC source power cables to the terminal studs.
 - a. Attach the lugs on the positive (+) DC source power cables to the terminal studs.
 - b. Attach the lugs on the negative (–) DC source power cables to the terminal studs.

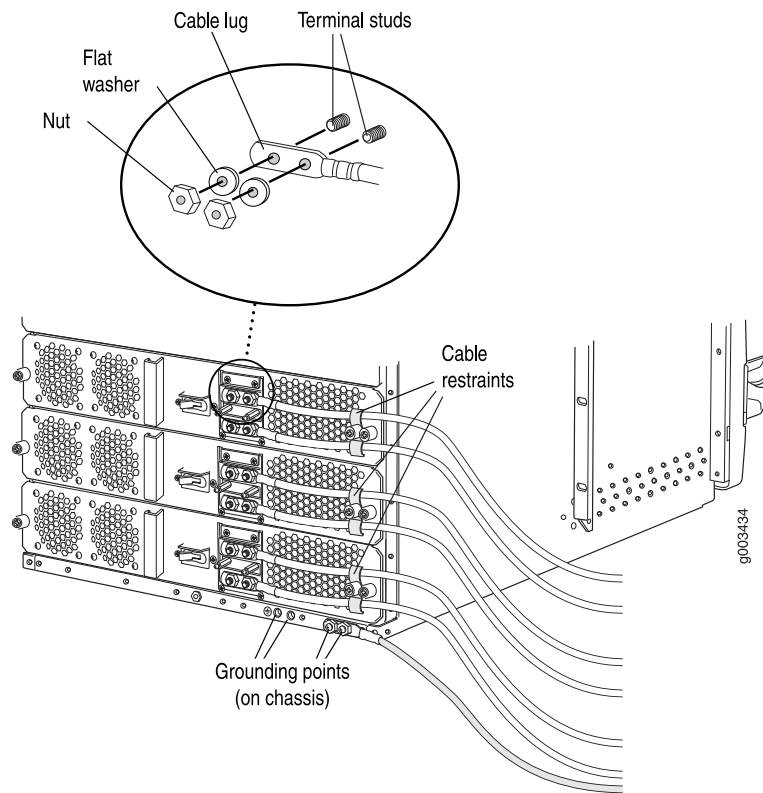
Secure each cable lug to the terminal stud, first with a washer, then with a nut. Use a 7/16-in. (11 mm) nut driver or socket wrench to tighten the nut. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut.



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

13. Route the power cable through the cable restraint.
14. Tighten the cable restraint captive screw to hold the power cable in place.
15. Replace the clear plastic cover over the terminal studs on the faceplate.
16. Attach the power cable to the DC power source.
17. Verify that the DC source power cabling and 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.
18. Switch the circuit breaker on the DC power supply faceplate to the on position (I). Verify that the **OUTPUT OK** status LED on the power supply faceplate blinks, then lights steadily approximately 1 minute after you switch the power supply circuit breaker on.

Figure 109: Disconnecting or Connecting a Power Cable from a DC Power Supply



Related Documentation

- [M320 DC Power Supplies Description on page 82](#)
- [M320 DC Power Electrical Specifications on page 113](#)
- [Connecting Power to a DC-Powered M320 Router on page 195](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Replacing Switch Fabric Components

- [Replacing an M320 SIB on page 297](#)

Replacing an M320 SIB

1. [Removing an M320 SIB on page 297](#)
2. [Installing an M320 SIB on page 298](#)

Removing an M320 SIB

Two to four SIBs are installed in the router. The SIBs are located in the rear of the chassis in the slots marked **SIB0** through **SIB3**. SIBs are hot-insertable and hot-removable. Each SIB weighs approximately 4 lb (1.8 kg).

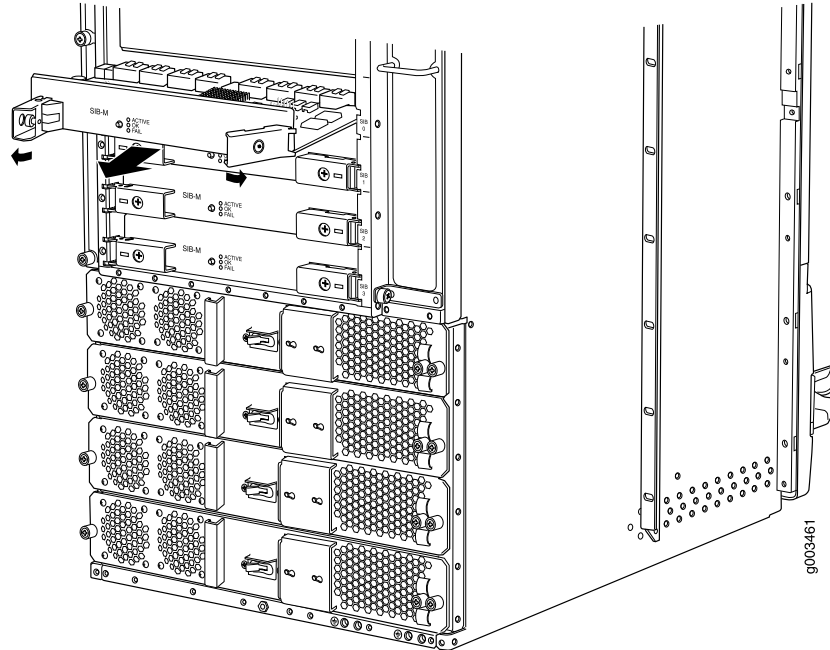
To remove a SIB (see [Figure 110 on page 298](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Press the online/offline button on the SIB faceplate. Press and hold down the button until the green **OK** LED goes out (about 5 seconds).
4. Loosen the captive screws (using a Phillips (+) screwdriver, number 2) on the ejector handles on each side of the SIB faceplate.
5. Flip the ejector handles outward to unseat the SIB.
6. Grasp both ejector handles, pull firmly, and slide the SIB about three-quarters of the way out of the chassis.
7. Place one hand underneath the SIB to support it, and slide it completely out of the chassis. Place it on the antistatic mat.



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

Figure 110: Removing a SIB



- See Also**
- [M320 SIB Description on page 87](#)
 - [Reinstalling the M320 SIBs on page 172](#)
 - [Maintaining the M320 SIBs on page 318](#)
 - [Installing an M320 SIB on page 298](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Installing an M320 SIB

To install a SIB into the rear of the chassis (see [Figure 111 on page 299](#)):

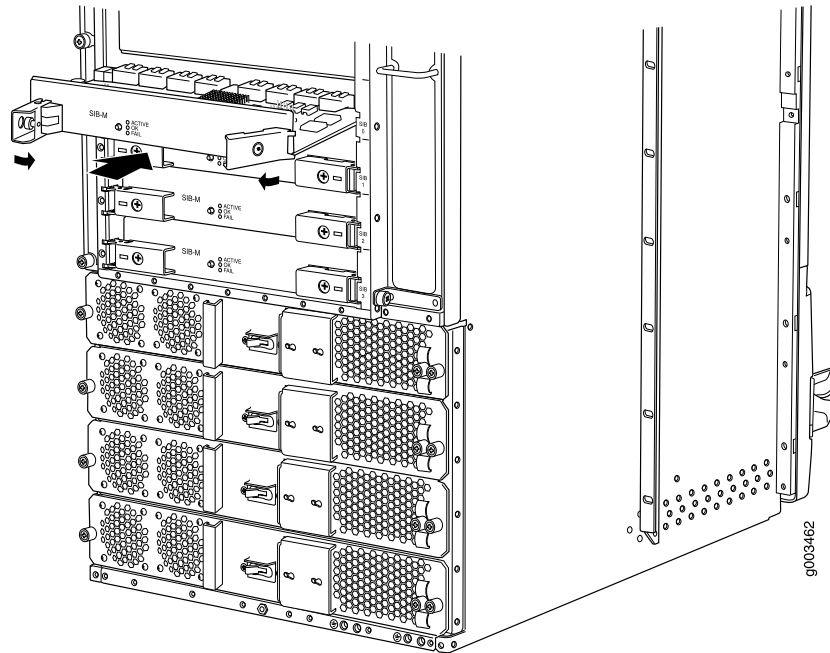
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Place one hand underneath the SIB to support it. With the other hand, hold one of the ejector handles on the SIB faceplate.
3. Carefully align the sides of the SIB with the guides inside the chassis.

4. Slide the SIB into the chassis, carefully ensuring that it is correctly aligned.
5. Grasp both ejector handles and press them inward to seat the SIB.
6. Tighten the captive screws on the ejector handles.
7. Press the offline/online button until the green **OK** LED blinks to bring the SIB online.
8. To verify that the SIB is functioning normally, check the LEDs on its faceplate. The green **OK** LED should light steadily a few minutes after the SIB is installed. If the **FAIL** LED is lit steadily, remove and install the SIB again. If the **FAIL** LED still lights steadily, the SIB is not functioning properly. Contact your customer support representative.

To check the status of the SIBs, issue the following CLI command:

```
user@host> show chassis environment sib
```

Figure 111: Installing a SIB



- See Also**
- [M320 SIB Description on page 87](#)
 - [Maintaining the M320 SIBs on page 318](#)
 - [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

- Related Documentation**
- [M320 SIB Description on page 87](#)
 - [Maintaining the M320 SIBs on page 318](#)

- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

PART 5

Maintaining the Chassis and Components

- [Routine Maintenance Procedures on page 303](#)
- [Maintaining Components and Cables on page 305](#)

Routine Maintenance Procedures

- [Routine Maintenance Procedures for the M320 Router on page 303](#)

Routine Maintenance Procedures for the M320 Router

Purpose For optimum router performance, perform preventive maintenance procedures.



NOTE: Some components, such as the Connector Interface Panel (CIP) and the craft interface, require no maintenance.

Action On a regular basis:

- 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, LEDs, and LCD.
- Inspect the air filters at the bottom front and left rear of the router, replacing them every 6 months. Do not run the router for more than a few minutes without the air filters in place.

Related Documentation

- [M320 Chassis Description on page 7](#)
- [M320 Craft Interface Description on page 15](#)
- [Maintaining the M320 Air Filters on page 305](#)

CHAPTER 31

Maintaining Components and Cables

- [Tools and Parts Required to Maintain the M320 Hardware Components on page 305](#)
- [Maintaining the M320 Air Filters on page 305](#)
- [Maintaining the M320 Fan Trays on page 306](#)
- [Maintaining the M320 Host Subsystem on page 307](#)
- [Maintaining M320 FPCs on page 309](#)
- [Holding and Storing M320 FPCs on page 310](#)
- [Maintaining M320 PICs and PIC Cables on page 314](#)
- [Maintaining the M320 Power Supplies on page 316](#)
- [Maintaining the M320 SIBs on page 318](#)

Tools and Parts Required to Maintain the M320 Hardware Components

To maintain the T320 hardware components, you need the following tools and parts:

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

Related Documentation

- [Contacting Customer Support on page 337](#)
- [M320 Router Description on page 3](#)
- [M320 Chassis Description on page 7](#)

Maintaining the M320 Air Filters

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

Action On a regular basis:

- Check the air filters for dust and debris. Replace the filter elements . The filter elements degrade over time, so the filter elements in use, as well as spares, must be replaced

every six months. For procedures to replace the air filters, see [“Replacing an M320 Air Filter” on page 229](#).

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



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

Related Documentation

- [M320 Cooling System Description on page 21](#)
- [Troubleshooting the M320 Cooling System on page 327](#)
- [Replacing an M320 Air Filter on page 229](#)
- [Replacing an M320 Fan Tray on page 235](#)

Maintaining the M320 Fan Trays

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

Action On a regular basis:

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

```
user@host> show chassis environment
```

| Class | Item | Status | Measurement |
|-------|------------------------|--------|--------------------------|
| ... | | | |
| Fans | Top Left Front fan | OK | Spinning at normal speed |
| | Top Left Middle fan | OK | Spinning at normal speed |
| | Top Left Rear fan | OK | Spinning at normal speed |
| | Top Right Front fan | OK | Spinning at normal speed |
| | Top Right Middle fan | OK | Spinning at normal speed |
| | Top Right Rear fan | OK | Spinning at normal speed |
| | Bottom Left Front fan | OK | Spinning at normal speed |
| | Bottom Left Middle fan | OK | Spinning at normal speed |
| | Bottom Left Rear fan | OK | Spinning at normal speed |
| | Bottom Right Front fan | OK | Spinning at normal speed |

```

Bottom Right Middle fan OK      Spinning at normal speed
Bottom Right Rear fan   OK      Spinning at normal speed
Fourth Blower from top  OK      Spinning at normal speed
Bottom Blower           OK      Spinning at normal speed
Middle Blower           OK      Spinning at normal speed
Top Blower              OK      Spinning at normal speed
Second Blower from top  OK      Spinning at normal speed
...

```

- Related Documentation**
- [M320 Cooling System Description on page 21](#)
 - [Troubleshooting the M320 Cooling System on page 327](#)
 - [Replacing an M320 Air Filter on page 229](#)
 - [Replacing an M320 Fan Tray on page 235](#)

Maintaining the M320 Host Subsystem

Purpose For optimum router performance, verify the condition of the host subsystem. The host subsystem comprises a Routing Engine and up to two adjacent CBs functioning together.

Action On a regular basis:

- Check the host subsystem LEDs (**RE0** and **RE1**) on the craft interface. If the red **RE0** or **RE1** LED is lit, look at the LED display to get more information about the cause of the problem. For more information about the LEDs and the display, see “[M320 Craft Interface Description](#)” on page 15.
- Check the LED display on the craft interface to view information about the router temperature and the status of the Routing Engines.
- Check the LEDs on the CB faceplate to see information about the CB.
- To check the status of the Routing Engines, issue the **show chassis routing-engine** command. The output is similar to the following:

```

user@host> show chassis routing-engine

Routing Engine status:
  Slot 0:
    Current state           Backup
    Election priority       Master (default)
    Temperature              50 degrees C / 122 degrees F
    DRAM                     2048 MB
    Memory utilization       10 percent
    CPU utilization:
      User                   25 percent
      Background             0 percent
      Kernel                 38 percent
      Interrupt              4 percent
      Idle                   33 percent
    Model                   RE-4.0
    Serial ID                212058900125

```

```

Start time                2003-09-30 16:34:15 PDT
Uptime                    18 hours, 57 minutes, 9 seconds
Routing Engine status:
Slot 1:
Current state             Master
Election priority         Backup (default)
Temperature               29 degrees C / 84 degrees F
DRAM                     2048 MB
Memory utilization        11 percent
CPU utilization:
  User                    0 percent
  Background              0 percent
  Kernel                  1 percent
  Interrupt               0 percent
  Idle                    99 percent
Model                     RE-4.0
Serial ID                 212047100107
Start time                2003-09-30 13:04:27 PDT
Uptime                    22 hours, 27 minutes, 8 seconds
Load averages:           1 minute  5 minute 15 minute
                          0.01      0.01   0.00

```

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

```

user@host> show chassis environment cb

CB 0 status:
State                Online Standby
Temperature          33 degrees C / 91 degrees F
Power:
  1.8 V              1816 mV
  2.5 V              2477 mV
  3.3 V              3278 mV
  4.6 V              4615 mV
  5.0 V              5023 mV
  12.0 V             11511 mV
  3.3 V bias         3286 mV
  8.0 V bias         7257 mV
BUS Revision         16
FPGA Revision        39

CB 1 status:
State                Online Master
Temperature          28 degrees C / 82 degrees F
Power:
  1.8 V              1809 mV
  2.5 V              2471 mV
  3.3 V              3304 mV
  4.6 V              4610 mV
  5.0 V              5003 mV
  12.0 V             11555 mV
  3.3 V bias         3301 mV
  8.0 V bias         7413 mV
BUS Revision         12
FPGA Revision        15

```

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

- Related Documentation**
- [M320 Host Subsystem Description on page 23](#)
 - [Taking the M320 Host Subsystem Offline on page 243](#)

Maintaining M320 FPCs

Purpose For optimum router performance, verify the condition of the FPCs. The router can have up to eight FPCs mounted vertically in the FPC card cage at the front of the chassis.

Action On a regular basis:

- Check the LCD on the craft interface and the LEDs on the craft interface directly above each FPC slot. The green LED labeled **OK** lights steadily when an FPC is functioning normally.

During normal operation:

- The green **OK** LED above the FPC on the craft interface lights steadily when the FPC is online and functioning normally.
- The green **OK** LED blinks during startup.
- Issue the CLI **show chassis fpc** command to check the status of installed FPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the FPC is functioning normally:

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

| Slot | State | Temp (C) | CPU Total | Utilization (%) Interrupt | Memory DRAM (MB) | Utilization (%) Heap | Buffer |
|------|--------|----------|-----------|---------------------------|------------------|----------------------|--------|
| 0 | Online | 37 | 2 | 0 | 256 | 9 | 41 |
| 1 | Empty | | | | | | |
| 2 | Online | 37 | 3 | 0 | 256 | 8 | 41 |
| 3 | Empty | | | | | | |
| 4 | Empty | | | | | | |
| 5 | Empty | | | | | | |
| 6 | Empty | | | | | | |
| 7 | Empty | | | | | | |

For more detailed output, add the **detail** option. The following example also specifies a slot number (**0**), which is optional:

```
user@host> show chassis fpc detail 0
```

```
Slot 0 information:
State                Online
Temperature          37 degrees C / 98 degrees F
Total CPU DRAM       256 MB
Total SRAM           28 MB
Total SDRAM          256 MB
Start time:          2003-10-01 04:19:30 PDT
Uptime:              10 days, 7 hours, 16 minutes, 48 seconds
```

For further description of the output from the commands, see the [CLI Explorer](#).

- Related Documentation**
- [M320 Chassis Description on page 7](#)
 - [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [M320 Craft Interface FPC LEDs and Online/Offline Buttons on page 18](#)
 - [Troubleshooting the M320 FPCs on page 329](#)
 - [Replacing an M320 FPC on page 259](#)

Holding and Storing M320 FPCs

- [Holding M320 FPCs on page 310](#)
- [Storing M320 FPCs on page 313](#)

Holding M320 FPCs



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



NOTE: An FPC configured with PICs installed can weigh as much as An empty FPC1 or FPC2 weighs 15 lb (6.8 kg), and an empty FPC3 weighs 16 lb (7.3 kg). A fully configured FPC can weigh up to 29 lb (13.2 kg). Be prepared to accept the full weight of the FPC as you lift it.



CAUTION: To prevent damage when handling or carrying FPCs:

- As you carry the FPC, do not bump it against anything. FPC components are fragile.
- Do not grasp the FPC anywhere except places that this document indicates. In particular, never grasp the connector edge, especially at the power connector in the corner where the connector and bottom edges meet (see [Figure 112 on page 311](#)).
- Do not carry the FPC by the faceplate with only one hand (see [Figure 113 on page 311](#)).
- Do not rest any edge of an FPC directly against a hard surface (see [Figure 114 on page 312](#)). If you must rest the FPC temporarily on an edge while changing its orientation between vertical and horizontal, use your hand as a cushion between the edge and the surface.

Figure 112: Do Not Grasp the Connector Edge

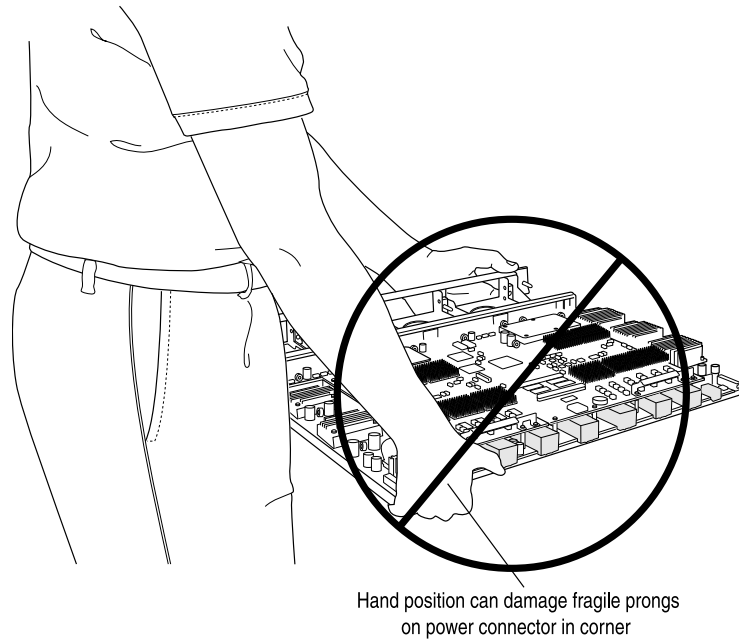


Figure 113: Do Not Carry an FPC with Only One Hand

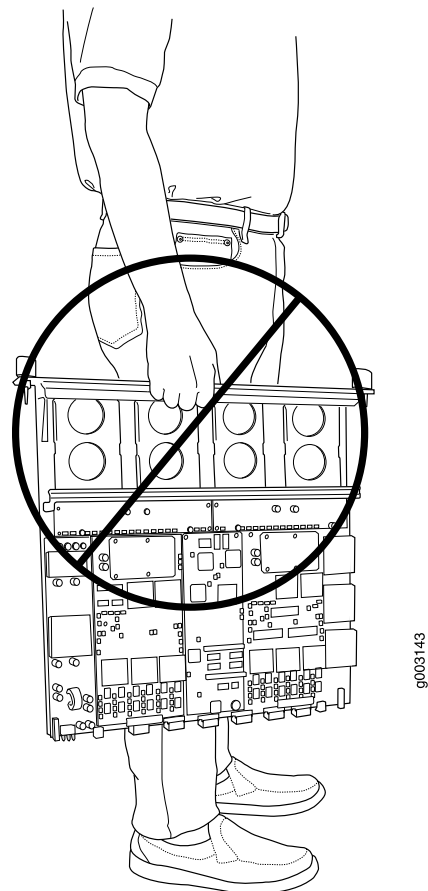
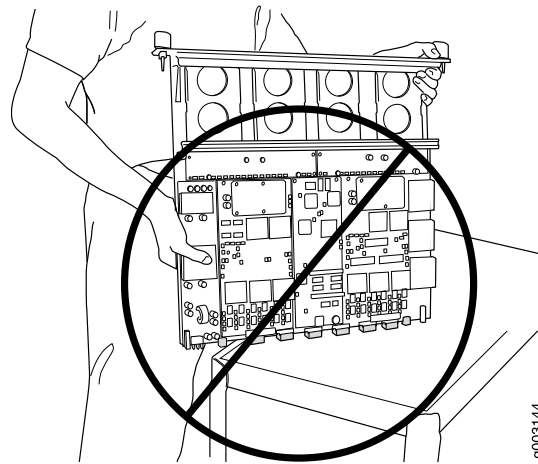


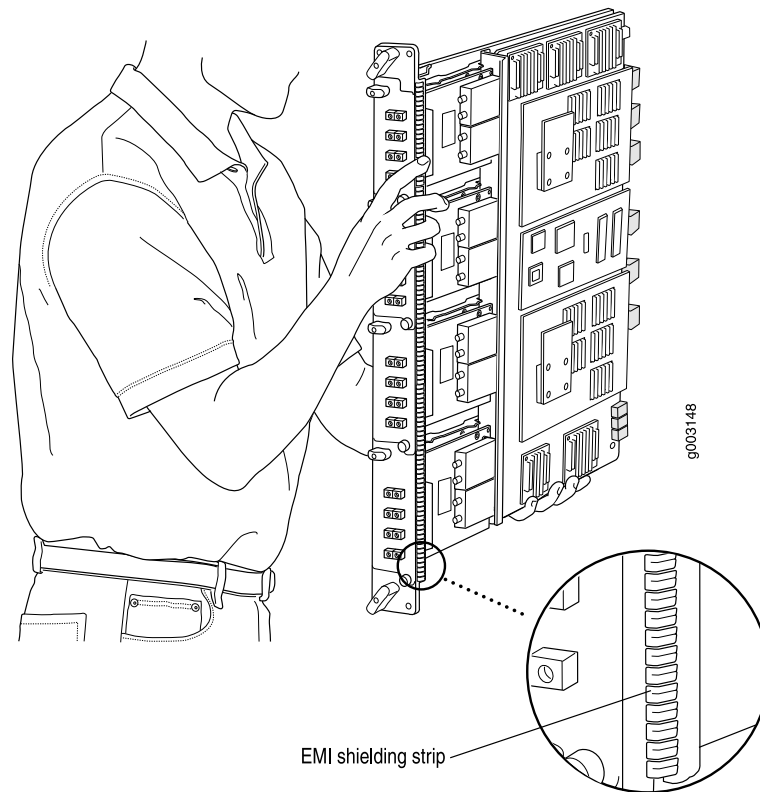
Figure 114: Do Not Rest the FPC on an Edge



You hold an FPC vertically when installing it into the chassis. To hold an FPC vertically (see [Figure 115 on page 313](#)):

1. Orient the FPC so that the faceplate faces you.
2. Place one hand around the FPC faceplate about a quarter of the way down from the top edge. To avoid deforming the electromagnetic interference (EMI) shielding strip, do not press hard on it.
3. Place your other hand at the bottom edge of the FPC. If the FPC has heat sinks about midway between the faceplate and connector edge, place your other hand against the heat sinks.

Figure 115: Holding an FPC Vertically



- See Also**
- [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Replacing an M320 FPC on page 259](#)
 - [Storing M320 FPCs on page 313](#)

Storing M320 FPCs

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

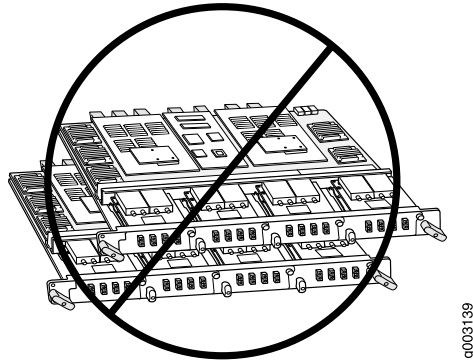
- When storing an FPC with two people, one person holds the FPC in the horizontal position with the faceplate facing their body, the other person slides the opening of the bag over the FPC connector edge.
- When storing an FPC with one person, you must insert the FPC into a bag by yourself. First lay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



CAUTION: To prevent damage when storing FPCs:

- Never lay an FPC component-side down.

Figure 116: Do Not Stack FPCs



- Never stack an FPC under or on top of any other component (see [Figure 116 on page 314](#)).

- See Also**
- [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Replacing an M320 FPC on page 259](#)
 - [Troubleshooting the M320 FPCs on page 329](#)

- Related Documentation**
- [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
 - [Troubleshooting the M320 FPCs on page 329](#)
 - [Replacing an M320 FPC on page 259](#)

Maintaining M320 PICs and PIC Cables

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

Action On a regular basis:

- Check the LEDs on PIC faceplates. The meaning of the LED states differs for various PICs. For more information, see the *M320 Multiservice Edge Router Interface Module Reference*. If the FPC that houses the PIC detects a PIC failure, the FPC generates an alarm message to be sent to the Routing Engine.
- Issue the CLI `show chassis fpc pic-status` command. The PIC slots in an FPC are numbered from 0 through 3, top to bottom:

```
user@host> show chassis fpc pic-status
```

```

Slot 0 Online
PIC 0    4x OC-3 SONET, MM
PIC 1    1x CSTM1, SMIR
PIC 3    2x OC-3 ATM, MM
Slot 1 Online
PIC 0    1x OC-12 SONET, MM
PIC 1    1x OC-12 ATM, MM
PIC 2    2x OC-3 ATM, MM
PIC 3    2x OC-3 ATM, MM

```

For further description of the output from the command, see the [CLI Explorer](#).

- Use the cable management system (shown in “M320 Chassis Description” on page 7) to support cables and prevent cables from dislodging or developing stress points.
- Place excess cable out of the way in the cable management system. Do not allow fastened loops of cable to dangle from the connector or cable management system, because this stresses the cable at the fastening point. Putting fasteners on the loops helps to maintain their shape.
- Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them if necessary before connecting an interface.
- Label both ends of PIC cables to identify them.
- Use the cable guards and cable cover to protect the PIC and CIP cables from rubbing against the front edges of the chassis and to prevent them from being dislodged from the PIC and CIP ports.

The following guidelines apply specifically to fiber-optic cable:

- When you unplug a fiber-optic cable from a PIC, always place a rubber safety plug over the transceiver on the PIC faceplate and on the end of the cable.
- Anchor fiber-optic cable to avoid stress on the connectors. When attaching fiber to a PIC, 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 microdeposits of oil and dust in the canal of the transceiver or cable connector could cause loss of light, reducing signal power and possibly causing intermittent problems with the optical connection.

To clean the transceivers, use an appropriate fiber-cleaning device, such as RIFOCS Fiber Optic Adaptor Cleaning Wands (part number 946). Follow the directions for the cleaning kit you use.

After you have cleaned the transceiver on the fiber-optic PIC, make sure that the connector tip of the fiber-optic cable is clean. Use only an approved alcohol-free fiber-optic cable cleaning kit, such as the Opptex Cletop-S[®] Fiber Cleaner. Follow the directions for the cleaning kit you use.

- Related Documentation**
- [M320 PIC Description on page 60](#)
 - [Replacing M320 PIC Cables on page 272](#)
 - [Troubleshooting the M320 FPCs on page 329](#)

Maintaining the M320 Power Supplies

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

Action On a regular basis:

- The power supplies require an unobstructed airflow at both the front and rear of the chassis. Periodically check the site to ensure that both the air intake at the bottom front of the chassis and the exhaust from the power supply faceplates are unobstructed.
- Periodically inspect the site to ensure that the grounding cable, DC power cables, and AC power cords connected to the router are securely in place and that no moisture is accumulating near the router. To review grounding and site wiring requirements for the router, see [“M320 Chassis Grounding Cable and Lug Specifications” on page 102](#) and [M320 General Electrical Safety Guidelines and Electrical Codes](#).
- Make sure that the DC power cables or AC power cords are arranged so that they do not obstruct access to other router components.
- Check the status of the power supplies by issuing the **show chassis environment pem** command. The output is similar to the following:

```
user@host> show chassis environment pem
PEM 0 status:
  State           Online
  Temperature     OK
  DC input        OK
  Load            Less than 20 percent
  48.0 V input    54701 mV
  48.0 V fan supply 49165 mV
  8.0 V bias      8505 mV
  5.0 V bias      4991 mV
PEM 1 status:
  State           Online
  Temperature     OK
  DC input        OK
  Load            Less than 20 percent
  48.0 V input    54219 mV
  48.0 V fan supply 49002 mV
  8.0 V bias      8485 mV
  5.0 V bias      4996 mV
PEM 2 status:
```

```

State                               Online
Temperature                          OK
DC input                             OK
Load                                  Less than 20 percent
  48.0 V input                        54701 mV
  48.0 V fan supply                   49165 mV
  8.0 V bias                          8505 mV
  5.0 V bias                          4991 mV
PEM 3 status:
State                               Online
Temperature                          OK
DC input                             OK
Load                                  Less than 20 percent
  48.0 V input                        54219 mV
  48.0 V fan supply                   49002 mV
  8.0 V bias                          8485 mV
  5.0 V bias                          4996 mV

```



NOTE: Isolated DC power supplies share current over the full input operating voltage range.

The current sharing between nonisolated power supplies relies on equal voltages at the power supply input terminals. The M320 system power is divided into two load zones. One load zone consists of PEM0 and PEM2, and the other load zone consists of PEM1 and PEM3. For nonisolated power supplies, load sharing occurs only between the power supplies of each load zone (PEM0 and PEM2 or PEM1 and PEM3). Therefore, the voltages for each nonisolated power supply in a load zone should be equal for current sharing. However, if the voltages do not match, the router operates normally as long as the DC input voltages are within the operating range provided in “M320 DC Power Electrical Specifications” on page 113. See “M320 DC Power Cable Specifications” on page 115 for a typical DC source cabling arrangement.

- Routinely check the **OUTPUT OK** and the **POWER OK** status LEDs on the power supply faceplates and the craft interface. If these output status LEDs are lit, the power supplies are functioning normally. For more information about the power supply LEDs, see “M320 Power System Description” on page 81.
- Check the red and yellow alarm LEDs and the LED display on the craft interface. Power supply failure or removal triggers an alarm that causes one or both of the LEDs to light and an error message to appear on the LED display. 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 “M320 Chassis and Interface Alarm Messages” on page 325.

- Related Documentation**
- [Troubleshooting the M320 Power System on page 332](#)
 - [Replacing an M320 AC Power Supply on page 283](#)
 - [Replacing an M320 DC Power Supply on page 287](#)

Maintaining the M320 SIBs

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

Action On a regular basis:

- Observe the status of the SIBs by checking the LEDs on the SIB faceplate or craft interface. For more information on the SIB LEDs, see [“M320 SIB LEDs” on page 89](#) and [“M320 Craft Interface SIB LEDs” on page 19](#).
- To check the status of the SIBs using the CLI, issue the **show chassis environment sib** command. The output is similar to the following:

```
user@host> show chassis environment sib
```

```
SIB 0 status:
State                Online
Temperature          37 degrees C / 98 degrees F
Power:
  GROUND              0 mV
  1.8 V               1797 mV
  2.5 V               2493 mV
  3.3 V               3315 mV
  1.8 V bias          1789 mV
  3.3 V bias          3284 mV
  5.0 V bias          5023 mV
  8.0 V bias          7452 mV
SIB 1 status:
State                Online
Temperature          38 degrees C / 100 degrees F
Power:
  GROUND              0 mV
  1.8 V               1798 mV
  2.5 V               2495 mV
  3.3 V               3321 mV
  1.8 V bias          1797 mV
  3.3 V bias          3289 mV
  5.0 V bias          4971 mV
  8.0 V bias          7462 mV
SIB 2 status:
State                Online
Temperature          38 degrees C / 100 degrees F
Power:
  GROUND              0 mV
  1.8 V               1810 mV
  2.5 V               2492 mV
  3.3 V               3327 mV
  1.8 V bias          1794 mV
  3.3 V bias          3306 mV
  5.0 V bias          4996 mV
  8.0 V bias          7499 mV
```

```
SIB 3 status:
State                Online
Temperature          41 degrees C / 105 degrees F
Power:
  GROUND              0 mV
  1.8 V               1796 mV
  2.5 V               2483 mV
  3.3 V               3328 mV
  1.8 V bias         1802 mV
  3.3 V bias         3286 mV
  5.0 V bias         4967 mV
  8.0 V bias         7570 mV
```

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

- Related Documentation**
- [M320 SIB Description on page 87](#)
 - [M320 Performance for Different SIB Configurations on page 88](#)
 - [Replacing an M320 SIB on page 297](#)

PART 6

Troubleshooting Hardware

- [Troubleshooting Components on page 323](#)

Troubleshooting Components

- [M320 Troubleshooting Resources Overview on page 323](#)
- [M320 LED Overview on page 324](#)
- [M320 Chassis and Interface Alarm Messages on page 325](#)
- [Troubleshooting the M320 Cooling System on page 327](#)
- [Troubleshooting the M320 FPCs on page 329](#)
- [Troubleshooting the M320 Fuses on page 330](#)
- [Troubleshooting the M320 PICs on page 331](#)
- [Troubleshooting the M320 Power System on page 332](#)

M320 Troubleshooting Resources Overview

To troubleshoot an M320 router, you use the Junos OS command-line interface (CLI), LCD, alarms, devices connected to the alarm relay contacts, and LEDs on both the components and craft interface.

- **LEDs**—When the Routing Engine detects an alarm condition, it lights the red or yellow alarm LED on the craft interface as appropriate. In addition, you can also use the component-specific LEDs on the craft interface and on the faceplate of a component to troubleshoot the router.
- **LCD**—When a red or yellow alarm occurs, the cause of the alarm messages is displayed on the craft interface LCD. Use the CLI to display more information about the alarm.
- **Alarm devices connected to the alarm relay contact on the CIP**—When a red or yellow alarm occurs, it trips the corresponding alarm relay contact on the CIP.
- **CLI**—The CLI is the primary tool for controlling and troubleshooting hardware, Junos OS, routing protocols, and network connectivity. CLI commands display information from routing tables, information specific to routing protocols, and information about network connectivity derived from the ping and traceroute utilities. For information about using the CLI to troubleshoot the Junos OS, see the appropriate Junos OS configuration guide.
- **JTAC**—If you need assistance during troubleshooting, you can contact the Juniper Networks Technical Assistance Center (JTAC) by using the Web or by telephone. If you encounter software problems, or problems with hardware components not discussed here, contact JTAC.

- Related Documentation**
- [Contacting Customer Support on page 337](#)

M320 LED Overview

- [Craft Interface LEDs on page 324](#)
- [Component LEDs on page 324](#)

Craft Interface LEDs

The craft interface displays system status messages and allows you to troubleshoot the router.

LEDs on the craft interface include:

- **Host subsystem LEDs**—Three LEDs (one green **MASTER**, one green **OK**, and one red **FAIL**) indicate the status of each host subsystem. The host subsystem LEDs are located on the upper right of the craft interface, and are labeled **RE0** and **RE1**. For more information, see [“M320 Craft Interface Host Subsystem LEDs” on page 18](#).
- **SIB LEDs**—Two LEDs (one red **FAIL** and one green **OK**) indicate the status of each SIB. The SIB LEDs are located in the middle of the craft interface, and are labeled **0** through **3**. For more information, see [“M320 Craft Interface SIB LEDs” on page 19](#).
- **Power supply LEDs**—Two LEDs (one red **FAIL** and one green **OK**) indicate the status of each power supply. The power supply LEDs are located in the middle of the craft interface, and are labeled **0** through **3**. For more information, see [“M320 Craft Interface Power Supply LEDs” on page 19](#).
- **FPC LEDs**—Two LEDs (one red **FAIL** and one green **OK**) indicate the status of each FPC. The FPC LEDs are located along the bottom edge of the craft interface, and are labeled **FPC0** through **FPC7**. For more information, see [“M320 Craft Interface FPC LEDs and Online/Offline Buttons” on page 18](#).
- **Alarm LEDs**—One large red circular LED and one large yellow triangular LED, located on the upper left of the craft interface, indicate two levels of alarm conditions. You can determine the cause of the alarm condition by looking at the LCD on the craft interface. For more information, see [“M320 Craft Interface Alarm LEDs and ACO/LT Button” on page 16](#).

Component LEDs

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

- **SIB LEDs**—Three LEDs on each SIB faceplate—**ACTIVE**, **OK**, and **FAIL**—indicate the status of that SIB.
See [“M320 SIB LEDs” on page 89](#).
- **CB LEDs**—Three LEDs on each CB faceplate indicate the status of that CB. If no LEDs are lit, the CB is not receiving power.

[M320 Control Board \(CB\) LEDs on page 53](#)

- PIC LEDs—Each PIC has one or more LEDs that indicates the status of the PIC. For more information, see the *M320 Multiservice Edge Router Interface Module Reference*.
- Power supply LEDs—One LED on each power supply faceplate indicates the status of that power supply.

See “M320 Power Supply LEDs” on page 84.

- Related Documentation**
- [M320 Craft Interface Description on page 15](#)
 - [M320 Chassis and Interface Alarm Messages on page 325](#).

M320 Chassis and Interface Alarm Messages

In both [Table 84 on page 325](#) and [Table 85 on page 326](#), the text in the column labeled “LCD Message” appears in the LCD. The text in the column labeled “CLI Message” appears in the output from the **show chassis alarms** command.

Table 84: M320 Chassis Alarm Messages

| Component | Alarm Type | LCD Display Message | CLI Message |
|---------------------|------------|-----------------------------------|--|
| Fans | Red | Fan Failure | <i>fan-name</i> Failure |
| | | Fans Missing | Too many fans missing or failing |
| | Yellow | Fan Removed | <i>fan-name</i> Removed |
| Temperature sensors | Red | Temperature Hot | Temperature Hot |
| | | Sensor Failure | Temperature sensor failure |
| | Yellow | Temperature Warm | Temperature Warm |
| Power supplies | Red | PEM <i>pem-number</i> Over Temp | PEM <i>pem-number</i> Over Temperature |
| | | PEM <i>pem-number</i> Output Fail | PEM <i>pem-number</i> Output Failure |
| | | PEM <i>pem-number</i> Input Fail | PEM <i>pem-number</i> Input Failure |
| | Yellow | PEM <i>pem-number</i> Removed | PEM <i>pem-number</i> Removed |

Table 84: M320 Chassis Alarm Messages (continued)

| Component | Alarm Type | LCD Display Message | CLI Message |
|-----------------|-----------------|---|---|
| SIBs | Red | SIB <i>sib-number</i> Failure | SIB <i>sib-number</i> Fault |
| | | SIB <i>sib-number</i> Removed | SIB <i>sib-number</i> Absent |
| | Yellow | Spare SIB Failure | Spare SIB Fault |
| | | Spare SIB Removed | Spare SIB Absent |
| | | Check SIB | Check SIB |
| | Host subsystems | Red | Host <i>host-number</i> Removed |
| Yellow | | Host <i>host-number</i> Failure | Host <i>host-number</i> Failure |
| CB | Red | CB <i>cb-number</i> Removed | CB <i>cb-number</i> Removed |
| | | CB <i>cb-number</i> Failure | CB <i>cb-number</i> Failure |
| | Yellow | CB <i>cb-number</i> Ethernet Switch Failure | CB <i>cb-number</i> Ethernet Switch Failure |
| Craft interface | Yellow | Craft Failure | Craft Failure |

Table 85: SONET/SDH Interface Alarm Messages

| LED Display Message | CLI Message |
|--|---|
| <i>interface-name</i> so-x/x/x BERR-SD | <i>interface-name</i> so-x/x/x - SONET bit error rate defect |
| <i>interface-name</i> so-x/x/x BERR-SF | <i>interface-name</i> so-x/x/x - SONET bit error rate fault |
| <i>interface-name</i> so-x/x/x LAIS | <i>interface-name</i> so-x/x/x - SONET line AIS |
| <i>interface-name</i> so-x/x/x LOF | <i>interface-name</i> so-x/x/x - SONET loss of frame |
| <i>interface-name</i> so-x/x/x LOL | <i>interface-name</i> so-x/x/x - SONET loss of light |
| <i>interface-name</i> so-x/x/x LOP | <i>interface-name</i> so-x/x/x - SONET loss of pointer |
| <i>interface-name</i> so-x/x/x LOS | <i>interface-name</i> so-x/x/x - SONET loss of signal |
| <i>interface-name</i> so-x/x/x LRDI | <i>interface-name</i> so-x/x/x - SONET line remote defect indicator |
| <i>interface-name</i> so-x/x/x PAIS | <i>interface-name</i> so-x/x/x - SONET path AIS |
| <i>interface-name</i> so-x/x/x PLL | <i>interface-name</i> so-x/x/x - SONET PLL lock |

Table 85: SONET/SDH Interface Alarm Messages (continued)

| LED Display Message | CLI Message |
|-------------------------------------|---|
| <i>interface-name</i> so-x/x/x PMIS | <i>interface-name</i> so-x/x/x - SONET path mismatch |
| <i>interface-name</i> so-x/x/x PRDI | <i>interface-name</i> so-x/x/x - SONET path remote defect indicator |
| <i>interface-name</i> so-x/x/x REI | <i>interface-name</i> so-x/x/x - SONET remote error indicator |
| <i>interface-name</i> so-x/x/x SEF | <i>interface-name</i> so-x/x/x - SONET severely errored frame |
| <i>interface-name</i> so-x/x/x UNEQ | <i>interface-name</i> so-x/x/x - SONET unequipped |

Related Documentation

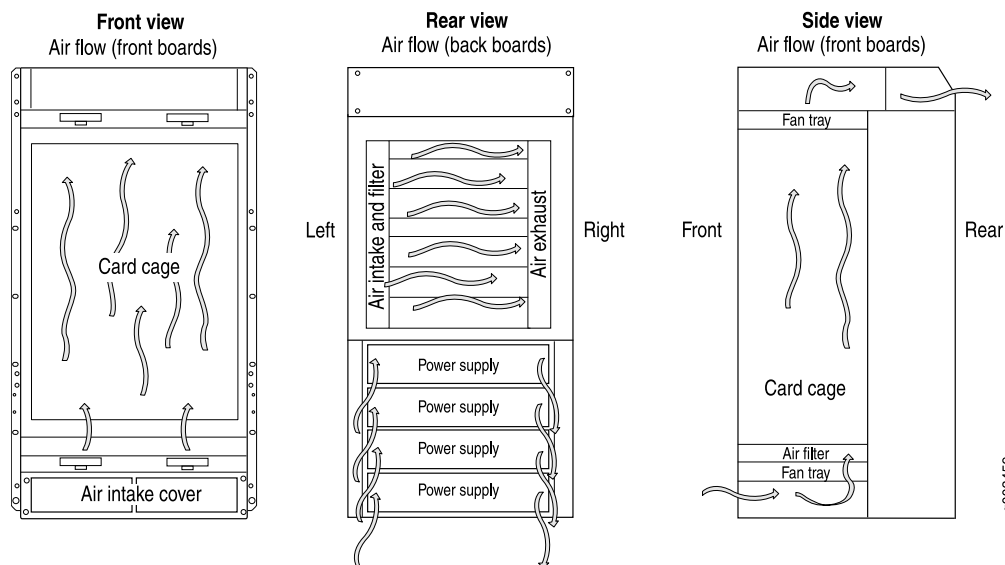
- [M320 Craft Interface Alarm LEDs and ACO/LT Button on page 16](#)

Troubleshooting the M320 Cooling System

The M320 router cooling system comprises two front and one rear fan tray (see “[M320 Chassis Description](#)” on page 7). The front fan trays each contain four fans and are interchangeable. The rear fan tray contains seven fans and is not interchangeable with the front trays. The front fan trays cool the components installed in the front card cage (the FPCs, PICs, CIP, and midplane). The rear fan tray cools the components installed in the rear card cage (the Routing Engines, CBs, and the SIBs). Each power supply has two fans that cool that power supply. [Figure 117 on page 328](#) shows the airflow through the router.

Air filters for both the front and rear fan trays help keep dust and other particles from entering the cooling system. To function properly, the entire cooling system requires an unobstructed airflow and proper clearance around the site, as described in “[M320 Site Preparation Checklist Requirements](#)” on page 93.

Figure 117: Airflow Through the Chassis



During normal operation, the fans in each fan tray function at less than full speed. The CB constantly monitors the temperatures detected by sensors on the midplane and router components, adjusting the speed of the fans as necessary. If the router temperature exceeds the acceptable maximum, the CB turns off the power supplies. The following conditions automatically cause the fans to run at full speed and also trigger the indicated alarm:

- A fan fails (red alarm).
- One of the fan trays is removed (yellow alarm).
- The router temperature exceeds the “temperature warm” threshold (yellow alarm).
- The temperature of the router exceeds the maximum (“temperature hot”) threshold (red alarm and automatic shutdown of the power supplies).

To troubleshoot the fans, follow these guidelines:

- If the red alarm LED on the craft interface lights, find the source of the problem by looking at the display on the craft interface. The number of alarm conditions, as well as the source of each alarm, appears on the screen.
- Use the CLI to check the status of the fans. For example, you can issue the following command to get information about the source of an alarm condition:

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

For information about the alarms, see [“M320 Chassis and Interface Alarm Messages” on page 325](#).

- Place your hand near the exhaust vents at the rear of the chassis to determine whether the fans are pushing air out of the chassis.

- If the **OUTPUT OK** LED on one or more of the power supplies (or the corresponding **POWER OK** LED on the craft interface) is not lit, check the power supply fans to see if they are operating.
- If all power supplies have failed, the system temperature might have exceeded the threshold, causing the system to shut down.
- If the display on the craft interface lists only one fan failure and the other fans are functioning normally, the fan is probably faulty and you need to replace the fan tray, as described in “Replacing an M320 Fan Tray” on page 235.

Related Documentation

- [M320 Cooling System Description on page 21](#)
- [Maintaining the M320 Fan Trays on page 306](#)
- [Maintaining the M320 Air Filters on page 305](#)
- [Replacing an M320 Air Filter on page 229](#)
- [Replacing an M320 Fan Tray on page 235](#)

Troubleshooting the M320 FPCs

As soon as an FPC is seated in an operating M320 router, the Routing Engine downloads the FPC software to it. The FPC then runs diagnostics and enables the PICs housed on it. During this time, the green LED labeled **STATUS** above the FPC on the craft interface blinks. When the FPC is online and functioning normally, the **STATUS** LED lights steadily.

To troubleshoot the FPCs:

- If the red **FAIL** LED above the FPC is on, look at the display on the craft interface to check the status of the FPC and the PICs that are plugged into it.
- Make sure the FPC is properly seated in the midplane. Check that each ejector handle has been turned clockwise and is tight. Use a screwdriver to check that the screws inside the ejector handles are tight.
- To check the status of an FPC, use the following CLI command:

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

To display more detailed information, use the following option:

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

Related Documentation

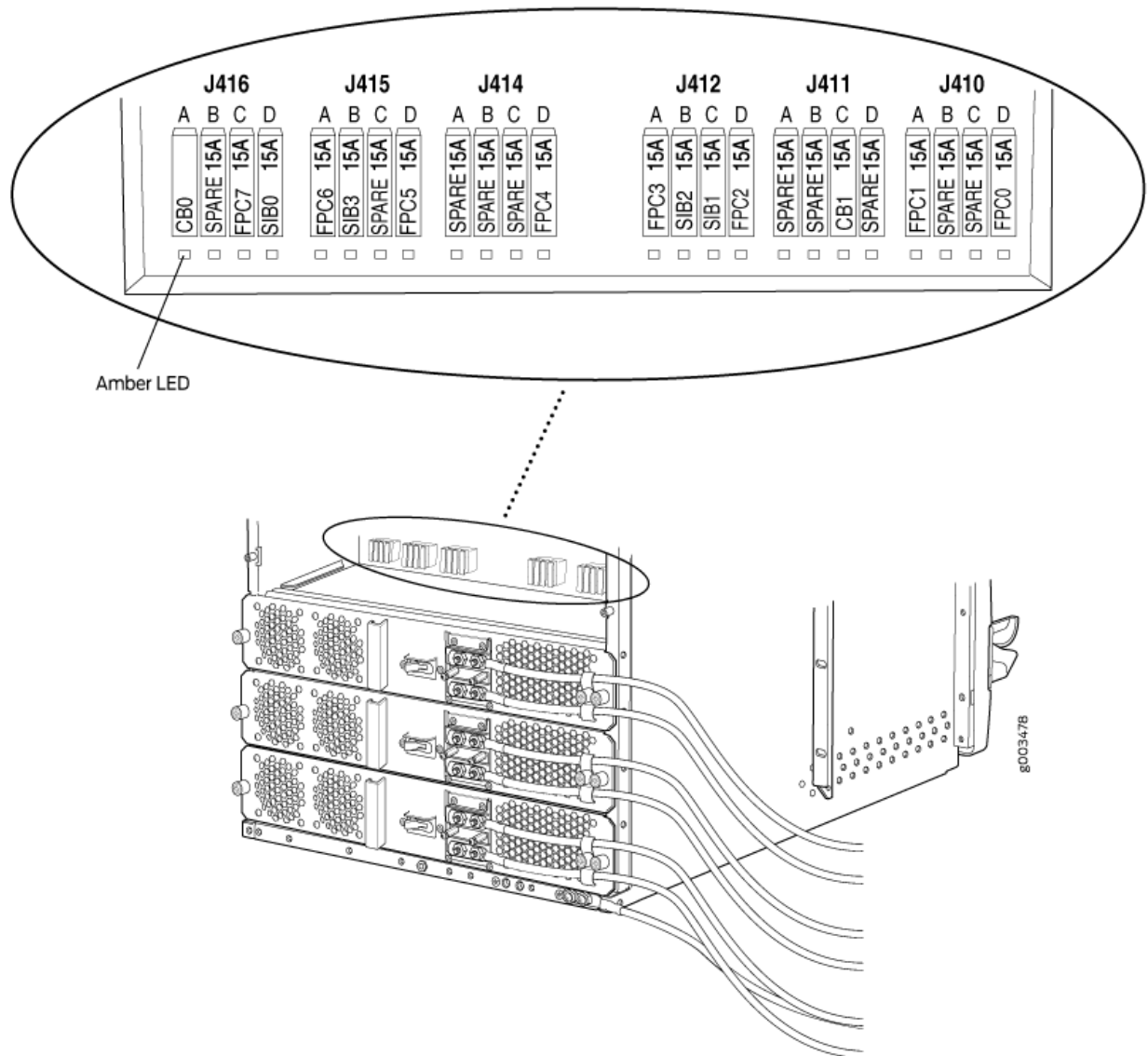
- [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
- [M320 Craft Interface Description on page 15](#)
- [Replacing an M320 Craft Interface on page 223](#)

Troubleshooting the M320 Fuses

The router uses fuses from the Cooper Bussman brand GMT series for the CB, SIBs, and FPCs. The fuses are located in the rear of the midplane behind the power supply in slot **PEMO**. When the fuse for a component blows, the component stops functioning even though it is installed correctly and the power supplies are providing power to the router.

Figure 118 on page 330 shows the location of the fuses in the rear of the midplane for each component. (The labels shown in the figure do not appear on the actual fuses—the clear cover on every fuse reads **BUSS GMT-X**—and might not match the labels on the midplane. Ignore the labels on the midplane.)

Figure 118: Fuses in the Midplane



When a fuse has blown but the power supplies are still delivering power to the router, the yellow LED below the fuse lights. The colored indicator bulb inside the fuse becomes visible through the clear cover on the fuse.



NOTE: The LEDs are each about 0.1in. (2 mm) square. They might be difficult to see when not lit.

A blown fuse can cause a component to fail even though it is correctly installed and the power supplies are functioning. Check for a blown fuse in the following circumstances:

- The LED that indicates normal operation for the component fails to light.
- The appropriate CLI **show chassis environment** command indicates that the component is installed but is not receiving power.

Related Documentation

- [M320 Fuses on page 12](#)
- [M320 Chassis and Interface Alarm Messages on page 325](#)

Troubleshooting the M320 PICs

To troubleshoot the PICs:

- To check the status of each port on a PIC, look at the LED located on the PIC faceplate. For information about the meaning of LED states on different PICs, see the *M320 Multiservice Edge Router Interface Module Reference*.
- To check the status of a PIC, issue the following CLI command. The PIC slots in the FPC are numbered from 0 through 3, top to bottom:

```
user@host> show chassis fpc pic-status
```

```
Slot 0 Online
  PIC 0   4x OC-3 SONET, MM
  PIC 1   1x CSTM1, SMIR
  PIC 3   2x OC-3 ATM, MM
Slot 1 Online
  PIC 0   1x OC-12 SONET, MM
  PIC 1   1x OC-12 ATM, MM
  PIC 2   2x OC-3 ATM, MM
  PIC 3   2x OC-3 ATM, MM
```

For further description of the output from the command, see the [CLI Explorer](#).

Related Documentation

- [M320 PIC Description on page 60](#)
- [Maintaining M320 PICs and PIC Cables on page 314](#)
- [Replacing M320 PIC Cables on page 272](#)

Troubleshooting the M320 Power System

To verify that a power supply is functioning normally, perform the following steps:

- Check the **OUTPUT OK** LED on each power supply faceplate (or the corresponding **POWER OK** LED on the craft interface). If this LED is on, the power source is good and the power supply is functional.
- Check the display on the craft interface. The Junos OS constantly updates the screen with status information for each component. For more information about the display, see [“M320 Craft Interface Description” on page 15](#).



NOTE: On the display and in the CLI, the power supplies are referred to as **PEM0** through **PEM3**, from top to bottom.

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

- If the **OUTPUT OK** power supply LED is off, check the red alarm LED on the craft interface. The Junos OS monitors the system temperature, and if it exceeds a certain limit, the software triggers a red alarm, a condition that shuts down the power supplies.
- If a red alarm condition occurs, check the display on the craft interface to determine the source of the problem.



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

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

- If the **OUTPUT OK** power supply LED is off and no red alarm condition exists, check that the circuit breaker on a DC power supply or the power switch on an AC power supply is switched to the on position (I).
- Verify that the source circuit breaker has the proper current rating. Each power supply must be connected to a separate source circuit breaker.
- Verify that the power cord (AC) or power cables (DC) from the power source to the router are not damaged. If the insulation is cracked or broken, immediately replace the cord or cable. See [“Replacing an M320 AC Power Supply Cord” on page 292](#) or [“Replacing an M320 DC Power Supply Cable” on page 294](#).
- Connect the power supply to a different power source with a new power cord or power cables. If the power supply **OUTPUT OK** LED still does not light, the power supply is the source of the problem. Replace the power supply with a spare, as described in [“Replacing an M320 AC Power Supply” on page 283](#) or [“Replacing an M320 DC Power Supply” on page 287](#).

- If the **OUTPUT OK** LED on the installed spare lights, the replaced power supply is faulty, and you should return it for replacement.
- If you cannot determine the cause of the problem or need additional assistance, see [“Contacting Customer Support” on page 337](#).

**Related
Documentation**

- [M320 Power System Description on page 81](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)

PART 7

Contacting Customer Support and Returning the Chassis or Components

- [Contacting Customer Support on page 337](#)
- [Locating Component Serial Numbers on page 339](#)
- [Packing and Returning Components on page 347](#)

Contacting Customer Support

- [Contacting Customer Support on page 337](#)

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

Locating Component Serial Numbers

- [Locating M320 Component Serial Numbers Using the CLI on page 339](#)
- [Locating the M320 Chassis Serial Number Label on page 340](#)
- [Locating the M320 CIP Serial Number Label on page 340](#)
- [Locating the M320 Craft Interface Serial Number Label on page 341](#)
- [Locating the M320 Routing Engine Serial Number Label on page 342](#)
- [Locating the M320 CB Serial Number Label on page 342](#)
- [Locating the M320 FPC Serial Number Label on page 343](#)
- [Locating the M320 PIC Serial Number Label on page 343](#)
- [Locating the M320 Power Supply Serial Number Labels on page 344](#)
- [Locating the M320 SIB Serial Number Label on page 346](#)

Locating M320 Component Serial Numbers Using the CLI

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 of the router components and their serial numbers, enter the following command-line interface (CLI) command:

```
user@host> show chassis hardware
```

```
Hardware inventory:
Item          Version  Part number  Serial number  Description
Chassis                               19206          M320
Midplane      REV 01   710-009120   RA1277
FPM GBUS      REV 02   710-005928   HL7863
FPM Display   REV 01   710-009351   HP8406
CIP           REV 02   710-005926   BE1813
PEM 0         Rev 01   740-009148   0000005
PEM 1         Rev 01   740-009148   0000006
PEM 2         Rev 01   740-009148   0000007
PEM 3         Rev 01   740-009148   0000008
Routing Engine 0 REV 01   740-008883   212047100102  RE-4.0
Routing Engine 1 REV 01   740-008883   212047100107  RE-4.0
CB 0          REV 01   710-009115   HK0109
CB 1          REV 01   710-009115   HK0110
FPC 0         REV 01   710-008994   HP1418          FPC Type 1
  CPU         REV 01   710-009141   HL7870
  PIC 0       REV 04   750-001894   HE5409          1x G/E, 1000 BASE-SX
```

| | | | | |
|-------|--------|------------|---------|-----------------------|
| PIC 1 | REV 01 | 750-010240 | CB5373 | 1x G/E SFP, 1000 BASE |
| SFP 0 | REV 01 | 740-007326 | P11EAW5 | SFP-SX |
| PIC 3 | REV 02 | 750-002332 | AG1661 | 1x COC12, SMIR |
| SIB 0 | REV 03 | 750-004762 | HL9370 | SIB-I-M |
| SIB 1 | REV 03 | 710-009184 | HP8459 | SIB-I-M |

Most components also have a small rectangular serial number ID label (see [Figure 119 on page 340](#)) attached to the component body.

Figure 119: Serial Number ID Label



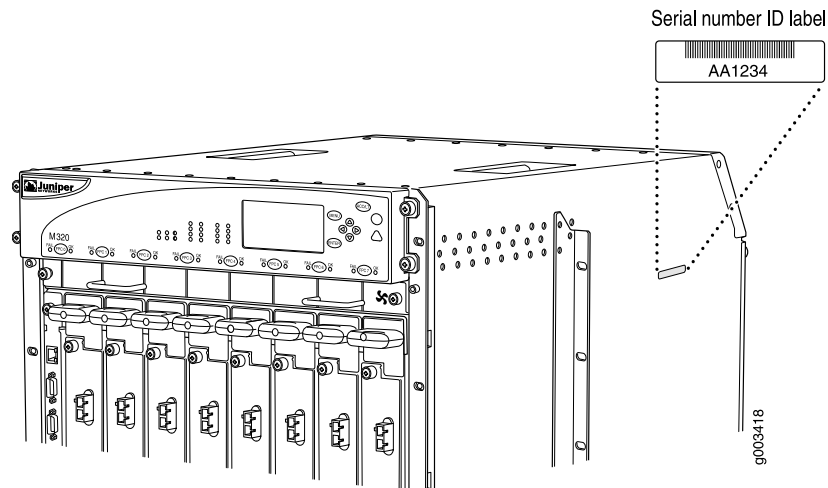
Related Documentation

- [M320 Chassis Description on page 7](#)
- [M320 Component Redundancy on page 4](#)
- [Removing M320 Components from the Chassis on page 157](#)

Locating the M320 Chassis Serial Number Label

The chassis serial number is located on the side of the chassis (see [Figure 120 on page 340](#)).

Figure 120: M320 Chassis Serial Number Label



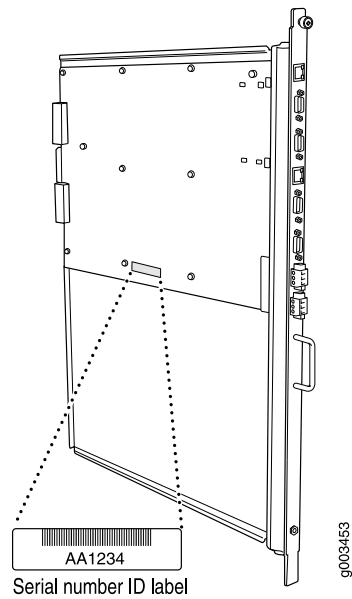
Related Documentation

- [M320 Chassis Description on page 7](#)
- [M320 Chassis and Interface Alarm Messages on page 325](#)

Locating the M320 CIP Serial Number Label

The serial number label is located at the middle of the left side of the CIP (see [Figure 121 on page 341](#)).

Figure 121: CIP Serial Number Label



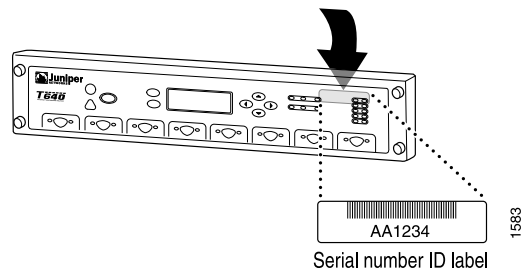
Related Documentation

- [M320 Chassis Description on page 7](#)
- [M320 Connector Interface Panel \(CIP\) Description on page 13](#)
- [Replacing the M320 CIP on page 213](#)

Locating the M320 Craft Interface Serial Number Label

The serial number is located on the back of the craft interface panel, behind the alarm LEDs (see [Figure 122 on page 341](#)).

Figure 122: Craft Interface Serial Number Label



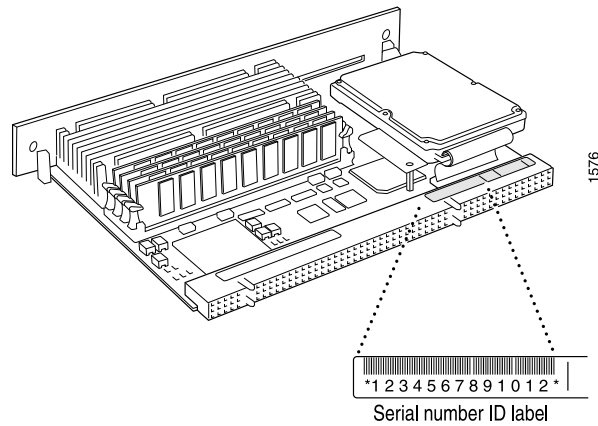
Related Documentation

- [M320 Craft Interface Description on page 15](#)
- [Replacing an M320 Craft Interface on page 223](#)

Locating the M320 Routing Engine Serial Number Label

The serial number label is located on the right side of the top of the Routing Engine (see Figure 123 on page 342).

Figure 123: Routing Engine Serial Number Label



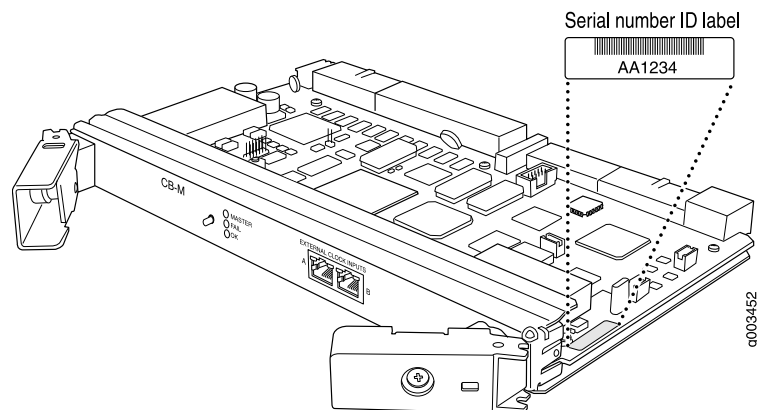
Related Documentation

- [M320 Routing Engine Description on page 24](#)
- [Replacing an M320 Routing Engine on page 246](#)

Locating the M320 CB Serial Number Label

The serial number is located on the right side of the top of the CB (see Figure 124 on page 342).

Figure 124: CB Serial Number Label



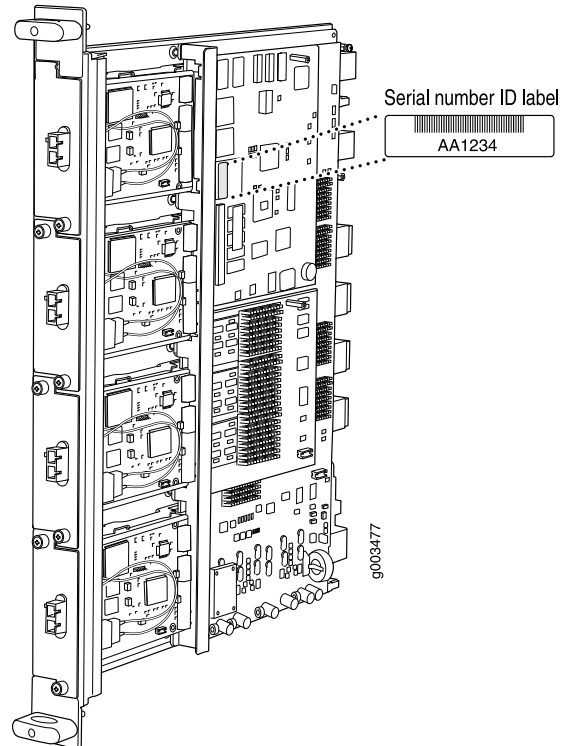
Related Documentation

- [M320 Control Board \(CB\) Description on page 51](#)
- [Replacing an M320 Control Board on page 256](#)

Locating the M320 FPC Serial Number Label

The serial number label is located on the center of the right side of the FPC3 (see [Figure 125 on page 343](#)). On an FPC2, the serial number label is located near the top PIC slot.

Figure 125: FPC Serial Number Label

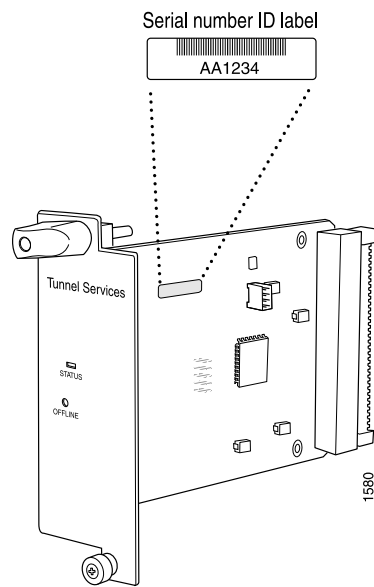


Related Documentation

- [M320 Flexible PIC Concentrator \(FPC\) Description on page 55](#)
- [Maintaining M320 FPCs on page 309](#)
- [Troubleshooting the M320 FPCs on page 329](#)
- [Replacing an M320 FPC on page 259](#)

Locating the M320 PIC Serial Number Label

The serial number label is located on the right side of the PIC (see [Figure 126 on page 344](#)), when the PIC is vertically oriented (as it would be installed in the router). The exact location may be slightly different on different PICs, depending on the placement of components on the PIC board.

Figure 126: PIC Serial Number Label**Related Documentation**

- [M320 PIC Description on page 60](#)
- [Maintaining M320 PICs and PIC Cables on page 314](#)
- [Troubleshooting the M320 PICs on page 331](#)
- [Replacing an M320 PIC on page 266](#)

Locating the M320 Power Supply Serial Number Labels

The serial number label is located on the AC power supply faceplate under the circuit breaker switch (see [Figure 127 on page 345](#)).

The serial number label is located on the DC power supply faceplate under the circuit breaker switch (see [Figure 128 on page 345](#)).

Figure 127: AC Power Supply Serial Number Label

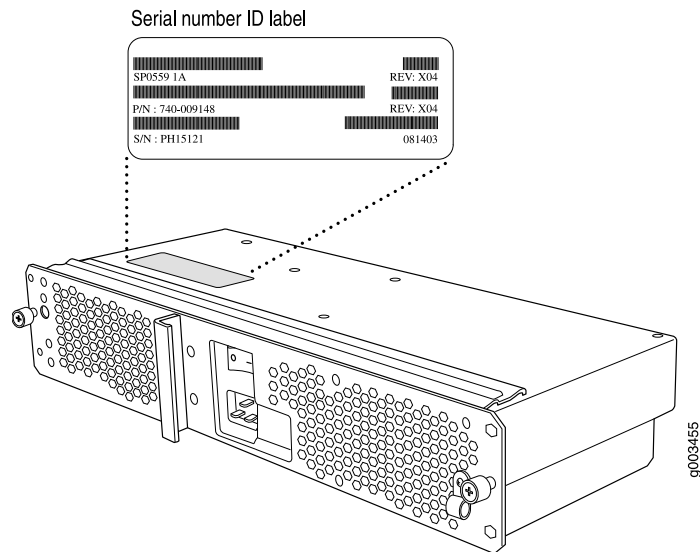
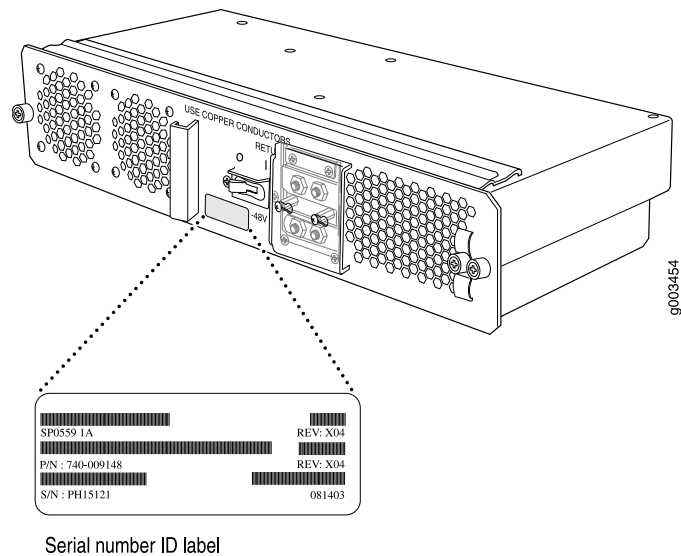


Figure 128: DC Power Supply Serial Number Label



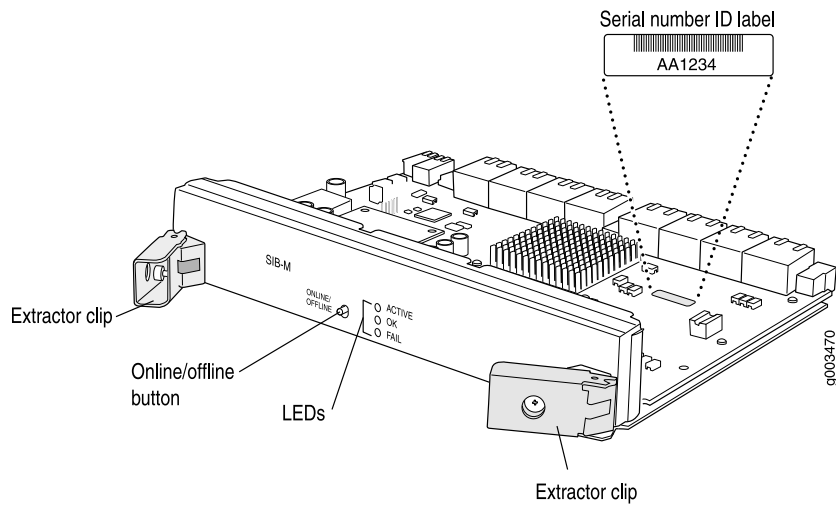
Related Documentation

- [M320 Power System Description on page 81](#)
- [Maintaining the M320 Power Supplies on page 316](#)
- [Troubleshooting the M320 Power System on page 332](#)
- [Replacing an M320 AC Power Supply on page 283](#)
- [Replacing an M320 DC Power Supply on page 287](#)

Locating the M320 SIB Serial Number Label

The serial number label is located on the right side of the top of the SIB (see [Figure 129 on page 346](#)).

Figure 129: SIB Serial Number Label



Related Documentation

- [M320 SIB Description on page 87](#)
- [Maintaining the M320 SIBs on page 318](#)
- [Replacing an M320 SIB on page 297](#)

Packing and Returning Components

- [Returning a Hardware Component to Juniper Networks, Inc. on page 347](#)
- [Tools and Parts Required to Remove Components From an M320 Router on page 348](#)
- [Packing the M320 Router for Shipment on page 348](#)
- [Packing M320 Router Components for Shipment on page 350](#)

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 M320 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 337](#)
- [M320 Chassis and Interface Alarm Messages on page 325](#)

Packing the M320 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.
3. On the console or other management device connected to the master Routing Engine, enter CLI operational mode and issue the following command to shut down the router software. (If two Routing Engines are installed, also issue the command on the backup Routing Engine.)

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

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

For more information about the command, see the [CLI Explorer](#).



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

4. 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.
5. Disconnect power from the router. For instructions, see [“Replacing an M320 AC Power Supply Cord” on page 292](#) or [“Replacing an M320 DC Power Supply Cable” on page 294](#).
6. Remove the cables that connect to all external devices. For instructions, see [“Removing an M320 PIC Cable” on page 272](#), [“Removing an M320 Console or Auxiliary Cable” on page 219](#), [“Replacing the M320 Alarm Relay Wires” on page 216](#), and [“Replacing an M320 Management Ethernet Cable” on page 217](#).
7. Remove all Field Replaceable Units (FRUs) from the router.
See [“Removing M320 Components from the Chassis” on page 157](#).
8. Remove the router from the rack:
 - If you are using a mechanical lift, place the lift platform under the router, unscrew and remove the mounting screws from the rack, and move the router to the shipping crate.
 - If you are not using a mechanical lift and the router weight is fully supported by a shelf or another router, unscrew and remove the mounting screws from the rack. Three people can then lift the router and move it to the shipping crate.
 - If you are not using a mechanical lift and the router weight is not fully supported by a shelf or another router, three people should grasp the router while a fourth person unscrews and removes the mounting screws from the rack. The three lifters can then move the router to the shipping crate.
9. Place the router in the shipping crate or onto the pallet. If on a pallet, bolt the router to the pallet.
10. Cover the router with an ESD bag and place the packing foam on top of and around the router.
11. Replace the accessory box on top of the packing foam.

12. Securely tape the box closed or place the crate cover over the router.
13. Write the RMA number on the exterior of the box to ensure proper tracking.

**Related
Documentation**

- [M320 Router Description on page 3](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 347](#)
- [Contacting Customer Support on page 337](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)

Packing M320 Router Components for Shipment

To pack and ship individual components:

- When you return components, make sure they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in 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**

- [M320 Chassis and Interface Alarm Messages on page 325](#)
- [Preventing Electrostatic Discharge Damage to an M320 Router on page 358](#)
- [Contacting Customer Support on page 337](#)

PART 8

Safety and Compliance Information

- General Safety Guidelines and Warnings on page 353
- Fire Safety Requirements on page 361
- Installation Safety Guidelines and Warnings on page 363
- Laser and LED Safety Guidelines and Warnings on page 371
- Maintenance and Operational Safety Guidelines and Warnings on page 375
- Electrical Safety Guidelines and Warnings on page 381
- Agency Approvals and Compliance Statements on page 391

General Safety Guidelines and Warnings

- Definition of Safety Warning Levels on page 353
- General Safety Guidelines for Juniper Networks Devices on page 355
- General Safety Warnings for Juniper Networks Devices on page 356
- M320 In Case of an Electrical Accident on page 358
- Preventing Electrostatic Discharge Damage to an M320 Router on page 358

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 være 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 356](#)
- [Installation Safety Warnings for Juniper Networks Devices on page 364](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 375](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)

- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 387](#)

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 356](#)

General Safety Warnings for Juniper Networks Devices

- [Qualified Personnel Warning on page 356](#)
- [Restricted-Access Area Warning on page 356](#)

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 364](#)
 - [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 375](#)
 - [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)
 - [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 387](#)

M320 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

Preventing Electrostatic Discharge Damage to an M320 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:

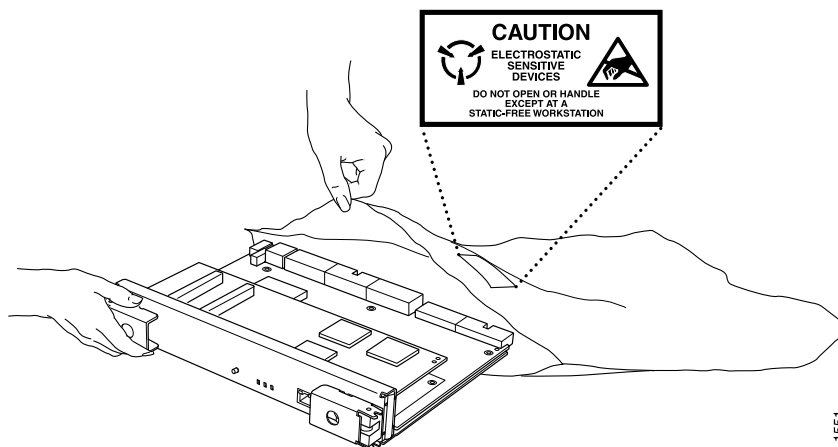
- Always use an ESD wrist strap or ankle strap, and make sure that it is in direct contact with your skin.



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 130 on page 359](#)). If you are returning a component, place it in an electrostatic bag before packing it.

Figure 130: Placing a Component into an Electrostatic Bag



Related Documentation

- [M320 Router Description on page 3](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)
- [Installation Safety Warnings for Juniper Networks Devices on page 364](#)
- [Contacting Customer Support on page 337](#)

CHAPTER 37

Fire Safety Requirements

- [Fire Safety Requirements for Juniper Networks Devices on page 361](#)

Fire Safety Requirements for Juniper Networks Devices

- [General Fire Safety Requirements on page 361](#)
- [Fire Suppression on page 361](#)
- [Fire Suppression Equipment on page 361](#)

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 (CO₂) 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 355](#)
- [General Safety Warnings for Juniper Networks Devices on page 356](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 387](#)

CHAPTER 38

Installation Safety Guidelines and Warnings

- [M320 Installation Safety Guidelines on page 363](#)
- [Installation Safety Warnings for Juniper Networks Devices on page 364](#)

M320 Installation Safety Guidelines

- [M320 General Installation Safety Guidelines on page 363](#)
- [M320 Chassis Lifting Guidelines on page 363](#)

M320 General Installation Safety Guidelines

Before installing the router, verify that the intended site meets the specified power, environmental, and clearance requirements.

- [M320 Clearance Requirements on page 99](#)
- [Rack Requirements for the M320 Router on page 95](#)
- [M320 Environmental Specifications on page 101](#)
- [M320 DC Power Distribution on page 117](#)
- [M320 Power Requirements on page 104](#)

M320 Chassis Lifting Guidelines

The weight of a fully configured M320 router is about 439 lb (199.6 kg). Observe the following guidelines for lifting and moving the router:

- Do not attempt to lift a fully configured router by yourself. Using a mechanical lift to maneuver the router into a rack is recommended. If a lift cannot be used, a minimum of three people are required to lift the router, and you must remove components from the chassis before lifting.
- 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 364](#)

Installation Safety Warnings for Juniper Networks Devices

Observe the following warnings before and during hardware equipment installation:

- [Intrabuilding Ports Warning on page 364](#)
- [Installation Instructions Warning on page 364](#)
- [Rack-Mounting Requirements and Warnings on page 365](#)
- [Ramp Warning on page 368](#)

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 edifício.
- 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 355](#)
- [General Safety Warnings for Juniper Networks Devices on page 356](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 375](#)

CHAPTER 39

Laser and LED Safety Guidelines and Warnings

- [M320 General Laser Safety Guidelines on page 371](#)
- [Laser Safety Warnings for Juniper Networks Devices on page 371](#)

M320 General Laser Safety Guidelines

Devices with single-mode optical interfaces are equipped with laser transmitters, which are considered Class 1 Laser product by the U.S. Food and Drug Administration, and are evaluated as a Class 1 Laser Product according to EN 60825–1 +A11 +A2 requirements.

When working around devices with optical interfaces, observe the following safety guidelines to prevent eye injury:

- Do not look into unterminated ports or at fibers that connect to unknown sources.
- Do not examine unterminated optical ports with optical instruments.
- Avoid direct exposure to the beam.



WARNING: Unterminated optical connectors can emit invisible laser radiation. The lens in the human eye focuses all the laser power on the retina, so focusing the eye directly on a laser source—even a low-power laser—could permanently damage the eye.

Related Documentation

- [M320 Router Description on page 3](#)
- [M320 Site Preparation Checklist Requirements on page 93](#)
- [Laser Safety Warnings for Juniper Networks Devices on page 371](#)

Laser Safety Warnings for Juniper Networks Devices

- [Class 1 Laser Product Warning on page 372](#)
- [Class 1 LED Product Warning on page 372](#)

- [Laser Beam Warning on page 373](#)
- [Radiation from Open Port Apertures Warning on page 373](#)

Class 1 Laser Product Warning



WARNING: Class 1 laser product.

Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Attention Produit laser de classe I.

Warnung Laserprodukt der Klasse 1.

Avvertenza Prodotto laser di Classe 1.

Advarsel Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning



WARNING: Class 1 LED product.

Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Attention Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning



WARNING: Do not stare into the laser beam or view it directly with optical instruments.

Waarschuwing Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

Varoitus Älä katso säteeseen äläkä tarkastele sitä suoraan optisen laitteen avulla.

Attention Ne pas fixer le faisceau des yeux, ni l'observer directement à l'aide d'instruments optiques.

Warnung Nicht direkt in den Strahl blicken und ihn nicht direkt mit optischen Geräten prüfen.

Avvertenza Non fissare il raggio con gli occhi né usare strumenti ottici per osservarlo direttamente.

Advarsel Stirr eller se ikke direkte p strlen med optiske instrumenter.

Aviso Não olhe fixamente para o raio, nem olhe para ele directamente com instrumentos ópticos.

¡Atención! No mirar fijamente el haz ni observarlo directamente con instrumentos ópticos.

Varning! Rikta inte blicken in mot strålen och titta inte direkt på den genom optiska instrument.

Radiation from Open Port Apertures Warning



WARNING: Because invisible radiation might be emitted from the aperture of the port when no fiber-optic 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 altistumisista 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 emitteres fra portens åpning når det ikke er tilkoblet en fiberkabel.

Aviso Dada a possibilidade de emissão de radiação invisível através do orifício da via de acesso, quando esta não tiver nenhum cabo de fibra conectado, deverá evitar a exposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.

¡Atención! Debido a que la apertura del puerto puede emitir radiación invisible cuando no existe un cable de fibra conectado, evite mirar directamente a las aperturas para no exponerse a la radiación.

Varning! Osynlig strålning kan avges från en portöppning utan ansluten fiberkabel och du bör därför undvika att bli utsatt för strålning genom att inte stirra in i oskyddade öppningar.

**Related
Documentation**

- [General Safety Guidelines for Juniper Networks Devices on page 355](#)
- [General Safety Warnings for Juniper Networks Devices on page 356](#)
- [Installation Safety Warnings for Juniper Networks Devices on page 364](#)

Maintenance and Operational Safety Guidelines and Warnings

- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 375](#)

Maintenance and Operational Safety Warnings for Juniper Networks Devices

As you maintain the hardware equipment, observe the following warnings:

- [Battery Handling Warning on page 375](#)
- [Jewelry Removal Warning on page 376](#)
- [Lightning Activity Warning on page 377](#)
- [Operating Temperature Warning on page 378](#)
- [Product Disposal Warning on page 379](#)

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 vastaaventyypistä 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 ylikuumentuusi, 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 355](#)
- [General Safety Warnings for Juniper Networks Devices on page 356](#)

Electrical Safety Guidelines and Warnings

- General Electrical Safety Warnings for Juniper Networks Devices on page 381
- General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices on page 385
- M320 AC Power Electrical Safety Guidelines on page 385
- M320 AC Power Electrical Safety Warning on page 386
- M320 DC Power Electrical Safety Guidelines on page 386
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 387

General Electrical Safety Warnings for Juniper Networks Devices

- Grounded Equipment Warning on page 381
- Grounding Requirements and Warning on page 382
- Midplane Energy Hazard Warning on page 383
- Multiple Power Supplies Disconnection Warning on page 383
- Power Disconnection Warning on page 384

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 isäntälaitte 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 strømmen vid överspänningsskyddet.

- Related Documentation**
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 387](#)

General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices

- Install the router in compliance with the following local, national, or international electrical codes:
 - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.
 - Canada—Canadian Electrical Code, Part 1, CSA C22.1.
 - Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.
- Locate the emergency power-off switch for the room in which you are working so that if an electrical accident occurs, you can quickly turn off the power.
- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.
- Never assume that power is disconnected from a circuit. Always check the circuit before starting to work.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, and missing safety grounds.
- Operate the router within marked electrical ratings and product usage instructions.
- For the router and peripheral equipment to function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

Many router components can be removed and replaced without powering off or disconnecting power to the router. Never install equipment if it appears damaged.

- Related Documentation**
- [In Case of an Electrical Accident](#)

M320 AC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to an AC-powered M320 router:

- AC-powered routers are shipped with three-wire electrical cords with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding should comply with local and national electrical codes.
- You must provide an external listed circuit breaker rated minimum 15 A (250 VAC) for each AC power supply.
- The cores in the mains lead are colored in accordance with the following code:
 - Green and yellow—Earth
 - Blue—Neutral

- Brown—Live

**Related
Documentation**

- [M320 AC Power Supplies Description on page 82](#)
- [Connecting Power to an AC-Powered M320 Router on page 193](#)
- [M320 AC Power Electrical Specifications on page 109](#)

M320 AC Power Electrical Safety Warning

The power cable warning in Japanese is as follows:



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

注意

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

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M320 DC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to an M320 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 65 A @ –48 VDC for the system, or at least 48 A @ –48 VDC for each power supply. We recommend that the 48 VDC facility DC source be equipped with a circuit breaker rated at 60 A (–48 VDC) minimum, or as required by local code. Incorporate an easily accessible disconnect device into the facility wiring. In the United States and Canada, the –48 VDC facility should be equipped with a circuit breaker rated a minimum of 125% of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada. Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 60 A.
- 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 **RETURN**, the negative lead to the terminal labeled **–48V**, and the earth ground to the chassis grounding points.

Related Documentation

- [M320 DC Power Supplies Description on page 82](#)
- [Connecting Power to a DC-Powered M320 Router on page 195](#)
- [M320 DC Power Electrical Specifications on page 113](#)

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 387](#)
- [DC Power Disconnection Warning on page 388](#)
- [DC Power Wiring Terminations Warning on page 389](#)

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, vérifiez 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.

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- Related Documentation**
- [General Safety Warnings for Juniper Networks Devices on page 356](#)
 - [General Electrical Safety Warnings for Juniper Networks Devices on page 381](#)

CHAPTER 42

Agency Approvals and Compliance Statements

- M320 Agency Approvals on page 391
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada) on page 392
- M320 Compliance Statements for EMC Requirements (European Community) on page 392
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Israel) on page 393
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) on page 393
- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) on page 393
- Compliance Statements for Environmental Requirements on page 394
- M320 Compliance Statements for NEBs on page 394
- M320 Compliance Statements for Acoustic Noise on page 394
- Statements of Volatility for Juniper Network Devices on page 394

M320 Agency Approvals

The router complies with the following standards:

- Safety
 - CAN/CSA-22.2 No. 60950-1-07/UL 60950-1, 2nd Ed., Safety of Information Technology Equipment
 - EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EMC
 - AS/NZS 3548 Class A (Australia/New Zealand)
 - EN55022 Class A (Europe)

- FCC Part 15 Class A (USA)
- VCCI Class A (Japan)
- Immunity
 - 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
- 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

- [M320 Router Description on page 3](#)
- [M320 Environmental Specifications on page 101](#)
- [M320 Chassis Description on page 7](#)

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

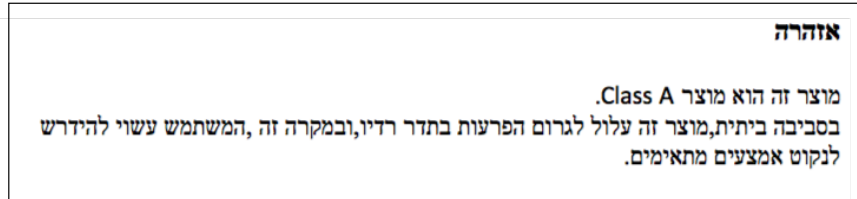
- [Compliance Statements for EMC Requirements for Juniper Networks Devices \(Israel\) on page 393](#)
- [Compliance Statements for EMC Requirements for Juniper Networks Devices \(Japan\) on page 393](#)
- [Compliance Statements for EMC Requirements for Juniper Networks Devices \(United States\) on page 393](#)

M320 Compliance Statements for EMC Requirements (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**
- [M320 Agency Approvals on page 391](#)

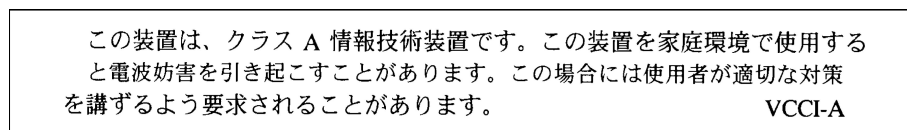
Compliance Statements for EMC Requirements for Juniper Networks Devices (Israel)



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 392](#)
 - [Compliance Statements for EMC Requirements for Juniper Networks Devices \(Japan\) on page 393](#)
 - [Compliance Statements for EMC Requirements for Juniper Networks Devices \(United States\) on page 393](#)

Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan)



Translation from Japanese—This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. VCCI-A

- 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.

M320 Compliance Statements for NEBs

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (i.e. DC-I), as defined in GR-1089-CORE.
- For Juniper systems with AC power supplies, an external surge protective device (SPD) must be used at the AC power source.

Related • [M320 Agency Approvals on page 391](#)
Documentation

M320 Compliance Statements for Acoustic Noise

- Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 74 dB(A) oder weniger gemäss EN ISO 7779
- Translation—The emitted sound pressure resulted in 74 dB(A) per EN ISO 7779.

Related • [M320 Router Description on page 3](#)
Documentation • [M320 Chassis Description on page 7](#)
• [M320 Environmental Specifications on page 101](#)

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](#)

