



MX150 3D Universal Edge Router Hardware Guide



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About the Documentation

- Documentation and Release Notes on page xi
- Supported Platforms on page xi
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- Requesting Technical Support on page xiv

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>.

Supported Platforms

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

- MX150

Documentation Conventions

Table 1 on page xii 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 xii 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 <code>[edit protocols ospf area area-id]</code> 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 [community-ids]
Indentation and braces ({ })	Identifies a level in the configuration hierarchy.	<code>[edit] routing-options { static { route default { nexthop <i>address</i>; retain; } } }</code>
;(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, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

- Online feedback rating system—On any page of the Juniper Networks TechLibrary site at <https://www.juniper.net/documentation/index.html>, simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at <https://www.juniper.net/documentation/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/>.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

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

- Find CSC offerings: <https://www.juniper.net/customers/support/>
- Search for known bugs: <https://prsearch.juniper.net/>
- 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/>
- Open a case online in the CSC Case Management tool: <https://www.juniper.net/cm/>

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

Opening a Case with JTAC

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

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

PART 1

Overview

- [System Overview on page 3](#)
- [Chassis Components and Descriptions on page 5](#)
- [Cooling System and Airflow on page 13](#)
- [Power Supplies on page 15](#)

CHAPTER 1

System Overview

- [MX150 Router Overview on page 3](#)

MX150 Router Overview

The MX150 3D Universal Edge Router is a compact, high-performance edge router that is ideally suited for lower bandwidth service provider applications and distributed service architectures, and for enterprise WAN use-cases. MX150 offers 40 Gbps of throughput in a single rack-unit, while providing advanced services with high performance. The MX150 supports advanced technologies like telemetry that simplify your operations environment, and maximize network uptime.

The MX150 is 1 rack unit (U) tall. The MX150 can be mounted on a desk or any other level surface, on two posts in a Rack, and on four pots in a rack or Cabinet. The MX150 conserves space and contains costs associated with power and cooling.

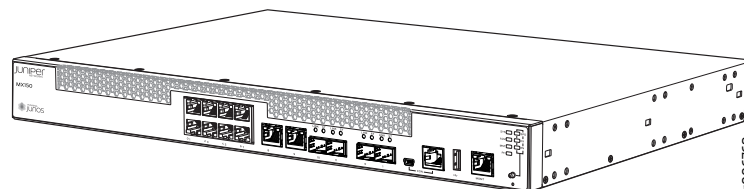
This topic covers:

- [MX150 Hardware on page 3](#)
- [System Software on page 4](#)

MX150 Hardware

The MX150 provide carrier-grade level of a rich set of Layer 2 and Layer 3 features. The MX150 has eight 1-Gigabit Ethernet network ports, two 1-Gigabit Ethernet RJ-45 ports that can be used as either access ports or as uplink ports, two SFP ports, two SFP+ ports, and one management port. The MX150 has a 1 U form factor and is shipped with built-in fans and power supply.

Figure 1: MX150 Port Panel



The MX150 can be used as:

- An integrated branch router.
- A secure router for distributed enterprises.

System Software

The MX150 use the Junos OS CLI. You can manage the device by using the Junos CLI, accessible through the console and the out-of-band management ports on the device.

Related Documentation

- [Chassis Physical Specifications for an MX150 on page 5](#)

CHAPTER 2

Chassis Components and Descriptions

- [Chassis Physical Specifications for an MX150 on page 5](#)
- [Front Panel of an MX150 on page 5](#)
- [Rear Panel of an MX150 on page 6](#)
- [Chassis Status LEDs on MX150 on page 7](#)
- [Network Port and Uplink Port LEDs on MX150 on page 8](#)
- [Management Port LEDs on MX150 on page 10](#)

Chassis Physical Specifications for an MX150

MX150 chassis is a rigid sheet-metal structure that houses the hardware components. [Table 3 on page 5](#) summarizes the physical specifications of the MX150 chassis.

Table 3: Physical Specifications for the MX150 Chassis

Product SKU	Height	Width	Depth	Weight
MX150	1.72 in. (4.3 cm)	17.36 in. (44.1 cm)	12 in. (30.5 cm)	9.4 lb (4.3 kg)

- Related Documentation**
- [Rack Requirements for an MX150 on page 23](#)
 - [Cabinet Requirements for an MX150 on page 24](#)

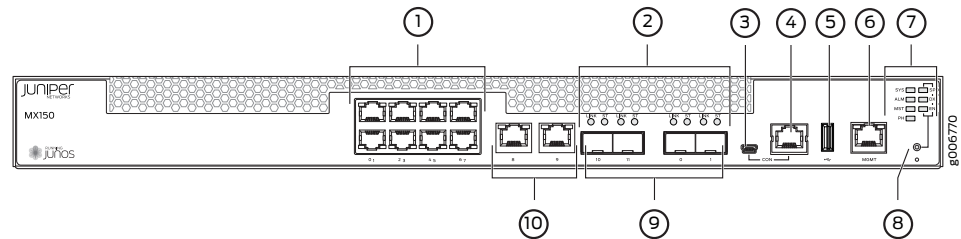
Front Panel of an MX150

The front panel of an MX150 consists of the following components:

- Eight 1-Gigabit Ethernet network ports
- Two 1-Gigabit Ethernet RJ-45 access ports or uplink ports
- Two 1-Gigabit SFP ports
- Two 1/10-Gigabit SFP+ ports
- Link (LINK) and status (ST) LEDs for SFP and SFP+ ports
- 1 Mini-USB Type-B console port

- 1 RJ-45 console port
- 1 USB port
- 1-Gigabit management port
- 4 system status LEDs
- 3 port parameter LEDs
- 1 Mode button

Figure 2: MX150 Front Panel Components



1—1-Gigabit Ethernet RJ-45 network ports	6—1-Gigabit management (mgmt) port
2—Link and Status LEDs for SFP and SFP+ ports	7—system status LEDs and port parameter LEDs
3—Mini-USB console port	8—Mode button
4—Console (CON) port	9—Port: 10 and 11 support SFP only; Port: 0 and 1 support SFP (1G) and SFP+ (10G)
5—USB port	10—1-Gigabit SFP network or uplink ports



CAUTION: Do not use the Reset button to restart the power sequence unless under the direction of Juniper Networks Technical Assistance Center (JTAC).

Related Documentation

- [Chassis Status LEDs on MX150 on page 7](#)
- [Cooling System and Airflow in an MX150 on page 13](#)
- [Prevention of Electrostatic Discharge Damage on page 125](#)
- [Connecting an MX150 to a Network for Out-of-Band Management on page 63](#)

Rear Panel of an MX150

The rear panel of the MX150 consists of the following components (see [Figure 3 on page 7](#)):

- Ground area
- Electrostatic discharge (ESD) point
- Exhaust vents

- Power switch
- AC power cord inlet

Figure 3: MX150 Rear Panel



1—Ground area	4—Power switch
2—Electrostatic discharge (ESD) point	5—AC power cord inlet
3—Exhaust vents	

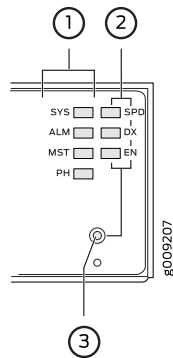
Related Documentation

- [Front Panel of an MX150 on page 5](#)
- [Cooling System and Airflow in an MX150 on page 13](#)

Chassis Status LEDs on MX150

The front panel of an MX150 has chassis status LEDs (labeled **ALM**, **SYS**, **MST** and **PH**), next to the **MGMT** port (see [Figure 4 on page 7](#)).

Figure 4: Chassis Status LEDs in an MX150



1—Chassis status LEDs (ALM , SYS , MST , and PH)	3—Mode button
2—Port parameter LEDs (SPD , DX , and EN)	

[Table 4 on page 8](#) describes the chassis status LEDs on an MX150, their colors and states, and the status they indicate. You can view the colors of the four LEDs remotely through the CLI by issuing the operational mode command **show chassis craft-interface**.

Table 4: Chassis Status LEDs in an MX150

LED Label	Color	State and Description
ALM (Alarm)	Unlit	There is no alarm or the device is halted.
	Red	There is a major alarm.
	Amber	There is a minor alarm.
SYS (System)	Green	<ul style="list-style-type: none"> On steadily—Junos OS has been loaded on the device. Blinking—The device is booting. Off—The device is powered off or is halted.
MST (Master)	Green	<ul style="list-style-type: none"> On steadily—The device is functioning normally. Off—The device is powered off or is halted.
PH	Unlit	This LED is not used. So, the status of this LED is off.

A major alarm (red) indicates a critical error condition that requires immediate action.

A minor alarm (amber) indicates a noncritical condition that requires monitoring or maintenance. A minor alarm left unchecked might cause interruption in service or performance degradation.

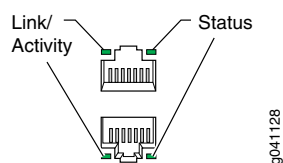
All three LEDs can be lit simultaneously.

Related Documentation

- [Front Panel of an MX150 on page 5](#)

Network Port and Uplink Port LEDs on MX150

Each network port and uplink port on the front panel of an MX150 has two LEDs that indicate link activity and port status (see [Figure 5 on page 8](#)).

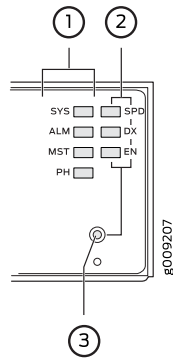
Figure 5: LEDs on the Network Port

[Table 5 on page 9](#) describes the link activity of the LED.

Table 5: Link activity LED on the Network Ports and Uplink Ports in MX150

LED	Color	State and Description
Link activity	Green	<ul style="list-style-type: none"> Blinking—The port and the link are active, and there is link activity. On steadily—The port and the link are active, but there is no link activity. Off—The port is not active.

Figure 6 on page 9 shows the LEDs that indicate the status of one of the three port parameters—speed, duplex mode, and administrative status. Use the Mode button on the far right side of the front panel to display the status LED for the different port parameters. You can tell which port parameter (speed, duplex mode, or administrative status) is indicated by the ST LED by looking at which port parameter LED (**SPD**, **DX**, or **EN**) is lit.

Figure 6: Port Parameter LEDs of an MX150

1—Chassis status LEDs (ALM , SYS , MST , and PH)	3—Mode button
2—Port parameter LEDs (SPD , DX , and EN)	

Table 6 on page 9 describes the port parameters LED.

Table 6: Port Parameter LED on the Network Ports and Uplink Ports in MX150

Port Parameter LED	State and Description
SPD (speed)	<p>Indicates the speed. The speed indicators for network ports and uplink ports are:</p> <ul style="list-style-type: none"> One blink per second—10 Mbps Two blinks per second—100 Mbps Three blinks per second—1000 Mbps
DX (duplex mode)	<p>Indicates the duplex mode. The status indicators are:</p> <ul style="list-style-type: none"> On steadily—Port is set to full-duplex mode. Off—Port is set to half-duplex mode.

Table 6: Port Parameter LED on the Network Ports and Uplink Ports in MX150 (continued)

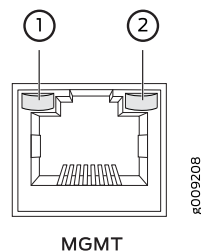
Port Parameter LED	State and Description
EN (administrative status)	Indicates the administrative status. The status indicators are: <ul style="list-style-type: none"> On steadily—Port is administratively enabled. Off—Port is administratively disabled.

You can tell which port parameter is indicated by the Status LED on network ports by issuing the operational mode command **show chassis craft-interface**.

- Related Documentation**
- [MX150 Router Overview on page 3](#)
 - [Front Panel of an MX150 on page 5](#)

Management Port LEDs on MX150

The management port on the front panel of an MX150 has two LEDs that indicate link activity and port status (see [Figure 7 on page 10](#)).

Figure 7: LEDs on the Management Port of an MX150

1—Link activity	2—Status
-----------------	----------

[Table 7 on page 10](#) describes the Link activity LED.

Table 7: Link activity LED on the Management Port of an MX150

LED	Color	State and Description
Link activity	Green	<ul style="list-style-type: none"> Blinking—The port and the link are active, and there is link activity. On steadily—The port and the link are active, but there is no link activity. Off—The port is not active.

[Table 8 on page 11](#) describes the status LED.

Table 8: Status LED on the Management Port of an MX150

LED	Color	State and Description
Status	Green	Indicates the speed. The speed indicators are: <ul style="list-style-type: none">• One blink per second—10 Mbps• Two blinks per second—100 Mbps• Three blinks per second—1000 Mbps

- Related Documentation**
- [Front Panel of an MX150 on page 5](#)
 - [Connecting an MX150 to a Network for Out-of-Band Management on page 63](#)

CHAPTER 3

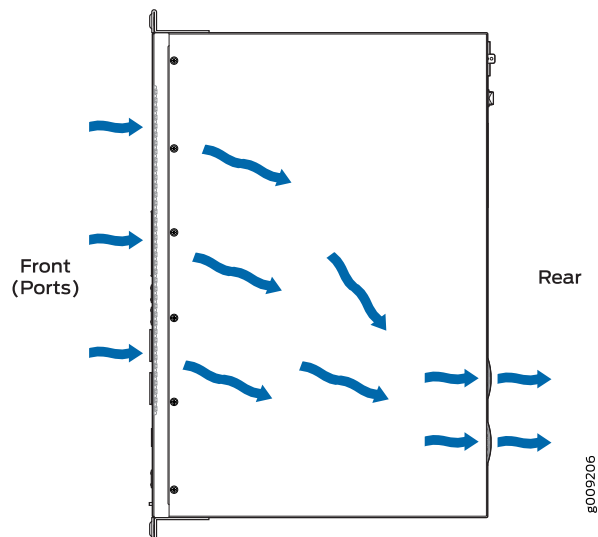
Cooling System and Airflow

- [Cooling System and Airflow in an MX150 on page 13](#)

Cooling System and Airflow in an MX150

The MX150 has front-to-back airflow. The air intake to cool the chassis is located at the front of the chassis. Air is pulled into the chassis and pushed toward the fans, which are built-in. Hot air exhausts from the rear of the chassis. See [Figure 8 on page 13](#).

Figure 8: Front-to-Back Airflow Through the MX150 Chassis



- Related Documentation**
- [Rear Panel of an MX150 on page 6](#)
 - [Prevention of Electrostatic Discharge Damage on page 125](#)

CHAPTER 4

Power Supplies

- [Power Supply in MX150 on page 15](#)

Power Supply in MX150

The MX150 routers use a fixed, internal AC power supply. The power supply distributes different output voltages to the device components according to their voltage requirements. The power supply is fixed in the chassis and is not field-replaceable.

The power supply has a single AC appliance inlet that requires a dedicated AC power feed. The AC power cord inlet is on the rear panel of the device.

Related Documentation

- [AC Power Supply Specifications for an MX150 on page 27](#)
- [AC Power Cord Specifications for an MX150 on page 27](#)
- [Connecting AC Power to an MX150 on page 60](#)

PART 2

Site Planning, Preparation, and Specifications

- [Preparation Overview on page 19](#)
- [Power Specifications and Requirements on page 27](#)
- [Port and Pinout Specifications on page 31](#)
- [Transceiver and Cable Specifications on page 37](#)

CHAPTER 5

Preparation Overview

- Site Preparation Checklist for MX150 on page 19
- Environmental Requirements and Specifications for an MX150 on page 21
- General Site Guidelines on page 21
- Site Electrical Wiring Guidelines on page 22
- Requirements for Mounting an MX150 on a Desktop or Other Level Surface on page 22
- Rack Requirements for an MX150 on page 23
- Cabinet Requirements for an MX150 on page 24
- Clearance Requirements for Airflow and Hardware Maintenance for an MX150 on page 25

Site Preparation Checklist for MX150

The checklist in [Table 9 on page 19](#) summarizes the tasks you need to perform when preparing a site for MX150 router installation.

Table 9: 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 device tolerances.	"Environmental Requirements and Specifications for an MX150" on page 21		
Power			
Measure distance between external power sources and device installation site.			
Locate sites for connection of system grounding.			
Calculate the power consumption and requirements.	"AC Power Supply Specifications for an MX150" on page 27		
Hardware Configuration			

Table 9: Site Preparation Checklist (continued)

Item or Task	For More Information	Performed by	Date
Choose the number of devices you want to install.	"MX150 Router Overview" on page 3		
Rack or Cabinet			
Verify that your rack or cabinet meets the minimum requirements for the installation of the device.	"Rack Requirements for an MX150" on page 23 "Cabinet Requirements for an MX150" on page 24		
Plan rack or cabinet location, including required space clearances.	"Clearance Requirements for Airflow and Hardware Maintenance for an MX150" on page 25		
Secure the rack or cabinet to the floor and building structure.			
Desk			
Verify that the desk meets the minimum requirements for the installation of the device.	"Requirements for Mounting an MX150 on a Desktop or Other Level Surface" on page 22		
Verify that there is appropriate clearance in your selected location.	"Clearance Requirements for Airflow and Hardware Maintenance for an MX150" on page 25		
Wall			
Verify that there is appropriate clearance in your selected location.	"Clearance Requirements for Airflow and Hardware Maintenance for an MX150" on page 25		
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. 			
Plan the cable routing and management.			

- Related Documentation**
- [General Safety Guidelines and Warnings on page 95](#)
 - [General Site Guidelines on page 21](#)
 - [Installing and Connecting an MX150 on page 51](#)
 - [Mounting an MX150 on page 52](#)

Environmental Requirements and Specifications for an MX150

The MX150 must be installed in a rack or cabinet. It must be housed in a dry, clean, well-ventilated, and temperature-controlled environment.

Follow these environmental guidelines:

- The site must be as dust-free as possible, because dust can clog air intake vents and filters, reducing the efficiency of the device cooling system.
- Maintain ambient airflow for normal operation of the device. If the airflow is blocked or restricted, or if the intake air is too warm, the device might overheat, leading to the device temperature monitor shutting down the device to protect the hardware components.

[Table 10 on page 21](#) provides the required environmental conditions for normal operation of the MX150.

Table 10: MX150 Environmental Tolerances

Description	Tolerance
Altitude	No performance degradation up to 6000 feet (1828 meters) at 86° F (30° C)
Relative humidity	Normal operation ensured in relative humidity range of 5% through 90%, noncondensing
Temperature	Normal operation ensured in temperature range of 32° F through 122° F (0° C through 50° C)
Seismic	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4

- Related Documentation**
- [Clearance Requirements for Airflow and Hardware Maintenance for an MX150 on page 25](#)
 - [Installing and Connecting an MX150 on page 51](#)

General Site Guidelines

Efficient device operation requires proper site planning and maintenance and proper layout of the equipment, rack or cabinet (if used), and wiring closet.

To plan and create an acceptable operating environment for your device and prevent environmentally caused equipment failures:

- Keep the area around the chassis free from dust and conductive material, such as metal flakes.
- Follow prescribed airflow guidelines to ensure that the cooling system functions properly and that exhaust from other equipment does not blow into the intake vents of the device.

- Follow the prescribed electrostatic discharge (ESD) prevention procedures to prevent damaging the equipment. Static discharge can cause components to fail completely or intermittently over time.
- Install the device in a secure area, so that only authorized personnel can access the device.

Site Electrical Wiring Guidelines

Table 11 on page 22 describes the factors you must consider while planning the electrical wiring at your site.



WARNING: It is particularly important to provide a properly grounded and shielded environment and to use electrical surge-suppression devices.

Table 11: Site Electrical Wiring Guidelines

Site Wiring Factor	Guidelines
Signaling limitations	<p>If your site experiences any of the following problems, consult experts in electrical surge suppression and shielding:</p> <ul style="list-style-type: none"> • Improperly installed wires cause radio frequency interference (RFI). • Damage from lightning strikes occurs when wires exceed recommended distances or pass between buildings. • Electromagnetic pulses (EMPs) caused by lightning damage unshielded conductors and electronic devices.
Radio frequency interference	<p>To reduce or eliminate RFI from your site wiring, do the following:</p> <ul style="list-style-type: none"> • Use a 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	<p>If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters, seek expert advice.</p> <p>Some of the problems caused by strong sources of electromagnetic interference (EMI) are:</p> <ul style="list-style-type: none"> • Destruction of the signal drivers and receivers in the device • Electrical hazards as a result of power surges conducted over the lines into the equipment

Requirements for Mounting an MX150 on a Desktop or Other Level Surface

You can install the MX150 on a desktop or other such level surface, by attaching the four rubber feet (provided) to the bottom of the chassis.

When choosing a location, allow at least 6 in. (15.2 cm) of clearance between the front and back of the chassis and adjacent equipment or walls.

Ensure that the desktop or other level surface on which the device is installed is stable and securely supported.

- Related Documentation**
- [Clearance Requirements for Airflow and Hardware Maintenance for an MX150 on page 25](#)

Rack Requirements for an MX150

You can mount the MX150 on two-post racks or four-post racks.

Rack requirements consist of:

- Rack type
- Mounting bracket hole spacing
- Rack size and strength
- Rack connection to the building structure

[Table 12 on page 23](#) provides the rack requirements and specifications for the MX150.

Table 12: Rack Requirements and Specifications for the MX150

Rack Requirement	Guidelines
Rack type	<p>Use a two-post rack or a four-post rack. You can mount the device on any two-post or four-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75 in. or 4.45 cm) increments and that meets the size and strength requirements to support the weight.</p> <p>A U is the standard rack unit defined in <i>Cabinets, Racks, Panels, and Associated Equipment</i> (document number EIA-310–D) published by the Electronics Industry Association (http://www.ecianow.org/standards-practices/standards/).</p> <p>The rack must meet the strength requirements to support the weight of the chassis.</p>
Mounting bracket hole spacing	<p>The holes in the mounting brackets are spaced at 1 U (1.75 in. or 4.45 cm), so that the device can be mounted in any rack that provides holes spaced at that distance.</p>
Rack size and strength	<ul style="list-style-type: none"> • Ensure that the rack complies with the standard defined for 19-in. rack as defined in <i>Cabinets, Racks, Panels, and Associated Equipment</i> (document number EIA-310–D) published by the Electronics Industry Association (http://www.ecianow.org/standards-practices/standards/). • Ensure that the rack rails are spaced widely enough to accommodate the device chassis' external dimensions of 1.72 in. (4.3 cm) height, 17.36 in. (44.1 cm) width, and 12 in. (30.5 cm) depth. The 19-in. rack brackets dimensions are 0.82 in. (2.1 cm) wide, 1.72 in. (4.3 cm) height, and 2.1 in. (5.4 cm) depth. The 23-in. rack brackets dimensions are 3.3 in. (8.4 cm) wide, 1.72 in. (4.3 cm) height, and 8.5 in. (21.6 cm) depth. • The rack must be strong enough to support the weight of the device. • Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the device and rack.
Rack connection to building structure	<ul style="list-style-type: none"> • Secure the rack to the building structure. • If earthquakes are a possibility in your geographical area, secure the rack to the floor. • Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.

One pair of mounting brackets for mounting the device on two posts of a rack is supplied with each device. For mounting the device on four posts of a rack or cabinet, you can order a four-post rack-mount kit separately.

Related Documentation

- [Chassis Physical Specifications for an MX150 on page 5](#)
- [Clearance Requirements for Airflow and Hardware Maintenance for an MX150 on page 25](#)
- [Rack-Mounting and Cabinet-Mounting Warnings on page 106](#)
- [Mounting an MX150 on Two Posts in a Rack on page 53](#)
- [Mounting an MX150 on Four Posts in a Rack or Cabinet on page 55](#)

Cabinet Requirements for an MX150

You can mount the MX150 in an enclosure or cabinet that contains a four-post 19-in. open rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Industry Association.

Cabinet requirements consist of:

- Cabinet size and clearance
- Cabinet airflow requirements

[Table 13 on page 24](#) provides the cabinet requirements and specifications for the MX150.

Table 13: Cabinet Requirements for the MX150

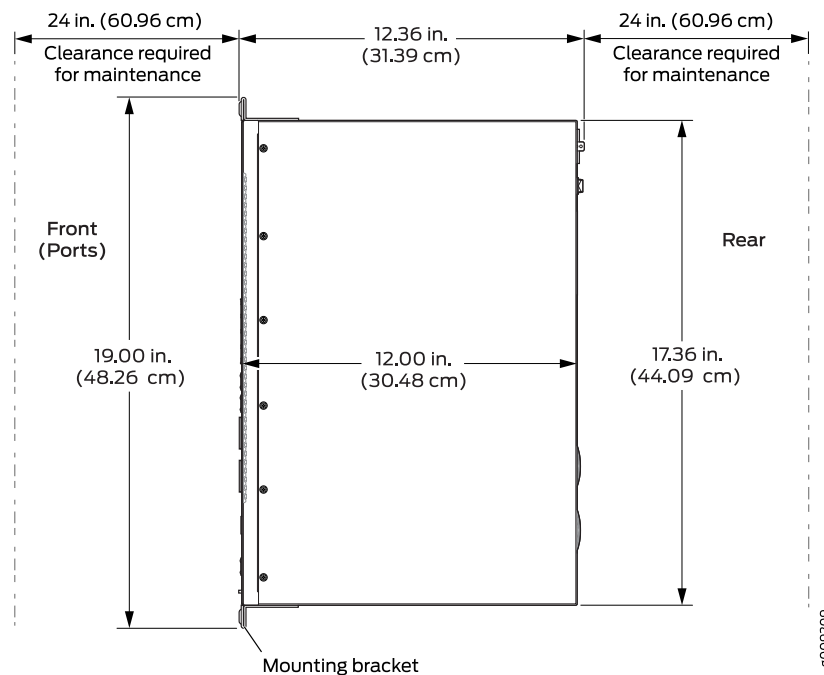
Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating an MX150 is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.
Cabinet airflow requirements	<p>When you mount the switch in a cabinet, ensure that ventilation through the cabinet is sufficient to prevent overheating.</p> <ul style="list-style-type: none"> • Ensure that the cool air supply you provide through the cabinet adequately dissipates the thermal output of the switch (or switches). • Ensure that the cabinet allows the chassis hot exhaust air to exit the cabinet without recirculating into the switch. 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. • Install the switch in the cabinet in a way that maximizes the open space on the side of the chassis that has the hot air exhaust. • Route and dress all cables to minimize the blockage of airflow to and from the chassis. • Ensure that the spacing of rails and adjacent cabinets allows for the proper clearance around the switch and cabinet. • A cabinet larger than the minimum required provides better airflow and reduces the chance of overheating.

- Related Documentation**
- [Clearance Requirements for Airflow and Hardware Maintenance for an MX150 on page 25](#)
 - [Rack Requirements for an MX150 on page 23](#)

Clearance Requirements for Airflow and Hardware Maintenance for an MX150

When planning the site for installing an MX150, you must allow sufficient clearance around the installed chassis (see [Figure 9 on page 25](#)).

Figure 9: Clearance Requirements for Airflow and Hardware Maintenance for an MX150



- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See [“Cooling System and Airflow in an MX150” on page 13](#) for more information about the airflow through the chassis.
- If you are mounting an MX150 in a rack or cabinet with other equipment, ensure that the exhaust from other equipment does not blow into the intake vents of the chassis.
- Leave at least 24 in. (61 cm) both in front of and behind the MX150. For service personnel to remove and install hardware components, you must leave adequate space at the front and back of the MX150. NEBS GR-63 recommends that you allow at least 30 in. (76.2 cm) in front of the rack or cabinet and 24 in. (61 cm) behind the rack or cabinet.

- Related Documentation**
- [Rack Requirements for an MX150 on page 23](#)
 - [Cabinet Requirements for an MX150 on page 24](#)
 - [General Site Guidelines on page 21](#)

CHAPTER 6

Power Specifications and Requirements

- [AC Power Supply Specifications for an MX150 on page 27](#)
- [AC Power Cord Specifications for an MX150 on page 27](#)

AC Power Supply Specifications for an MX150

Table 14 on page 27 describes the AC power specifications for an MX150.

Table 14: AC Power Specifications for an MX150

Item	Specification
AC input voltage	Operating range: <ul style="list-style-type: none">• 100 through 240 VAC
AC input line frequency	50–60 Hz nominal
AC input current rating	3 A at 240 VAC
Maximum power consumption	140 W

- Related Documentation**
- [AC Power Cord Specifications for an MX150 on page 27](#)
 - [General Safety Guidelines and Warnings on page 95](#)
 - [General Electrical Safety Guidelines and Warnings on page 123](#)

AC Power Cord Specifications for an MX150

A detachable AC power cord is supplied with the AC power supplies. The coupler is type C13 as described by International Electrotechnical Commission (IEC) standard 60320. The plug at the male end of the power cord fits into the power source outlet that is standard for your geographical location.



CAUTION: The AC power cord provided with each power supply is intended for use with that power supply only and not for any other use.



NOTE: In North America, AC power cords must not exceed 4.5 meters 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 switch are in compliance.

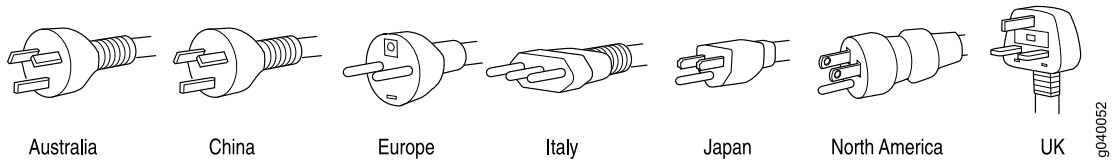
Table 15 on page 28 gives the AC power cord specifications for the countries and regions listed in the table.

Table 15: AC Power Cord Specifications

Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number
Argentina	250 VAC, 10 A, 50 Hz	IRAM 2073 Type RA/3	CBL-EX-PWR-C13-AR
Australia	250 VAC, 10 A, 50 Hz	AS/NZS 3112 Type SAA/3	CBL-EX-PWR-C13-AU
Brazil	250 VAC, 10 A, 50 Hz	NBR 14136 Type BR/3	CBL-EX-PWR-C13-BR
China	250 VAC, 10 A, 50 Hz	GB 1002-1996 Type PRC/3	CBL-EX-PWR-C13-CH
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 10 A, 50 Hz	CEE (7) VII Type VIIG	CBL-EX-PWR-C13-EU
India	250 VAC, 10 A, 50 Hz	IS 1293 Type IND/3	CBL-EX-PWR-C13-IN
Israel	250 VAC, 10 A, 50 Hz	SI 32/1971 Type IL/3G	CBL-EX-PWR-C13-IL
Italy	250 VAC, 10 A, 50 Hz	CEI 23-16 Type I/3G	CBL-EX-PWR-C13-IT
Japan	125 VAC, 12 A, 50 Hz or 60 Hz	SS-00259 Type VCTF	CBL-EX-PWR-C13-JP
Korea	250 VAC, 10 A, 50 Hz or 60 Hz	CEE (7) VII Type VIIGK	CBL-EX-PWR-C13-KR
North America	125 VAC, 13 A, 60 Hz	NEMA 5-15 Type N5-15	CBL-EX-PWR-C13-US
South Africa	250 VAC, 10 A, 50 Hz	SABS 164/1:1992 Type ZA/13	CBL-EX-PWR-C13-SA
Switzerland	250 VAC, 10 A, 50 Hz	SEV 6534-2 Type 12G	CBL-EX-PWR-C13-SZ
Taiwan	125 VAC, 11 A and 15 A, 50 Hz	NEMA 5-15P Type N5-15P	CBL-EX-PWR-C13-TW
United Kingdom	250 VAC, 10 A, 50 Hz	BS 1363/A Type BS89/13	CBL-EX-PWR-C13-UK

Figure 10 on page 29 illustrates the plug on the power cord for some of the countries or regions listed in Table 15 on page 28.

Figure 10: AC Plug Types



Related Documentation

- [General Safety Guidelines and Warnings on page 95](#)
- [General Electrical Safety Guidelines and Warnings on page 123](#)
- [Prevention of Electrostatic Discharge Damage on page 125](#)

CHAPTER 7

Port and Pinout Specifications

- [Mini-USB Type-B Console Port Specifications for an MX150 on page 31](#)
- [Console Port Connector Pinouts for MX150 on page 32](#)
- [USB Port Specifications for an MX150 on page 33](#)
- [Management Port Connector Pinout Information for an MX150 on page 33](#)
- [Network Port Connector Pinout Information for an MX150 on page 34](#)
- [RJ-45 to DB-9 Serial Port Adapter Pinout Information for an MX150 on page 35](#)

Mini-USB Type-B Console Port Specifications for an MX150

The MX150 has two console ports: an RJ-45 port, and a Mini-USB port.

By default, the RJ-45 port is set as the active console port. It can display all the early boot and low-level message output and you can access the device through this port in the debugger prompt.

The Mini-USB port is the passive console port. You can change the status of the port to active or passive using the **port-type** configuration statement. See *Configuring the Console Port Type (CLI Procedure)*.

The Mini-USB console port uses a Mini-B plug (5-pin) connector to connect to a console management device. The default baud rate for the console port is 9600 baud.

[Table 16 on page 31](#) provides the pinout information of the Mini-USB Type-B console port.

Table 16: Mini-USB Type-B Console Port Pinout Information for MX150

Pin	Signal	Description
1	VCC	+5 VDC
2	D-	Data -
3	D+	Data +
X	N/C	N/C, GND, or used as an attached device presence indicator

Table 16: Mini-USB Type-B Console Port Pinout Information for MX150 (continued)

Pin	Signal	Description
4	GND	Ground

- Related Documentation**
- [MX150 Router Overview on page 3](#)
 - [Configuring the Console Port Type \(CLI Procedure\)](#)

Console Port Connector Pinouts for MX150

The console port (labeled **CON**) is an RS-232 serial interface that uses an RJ-45 connector to connect to a console management device. The default baud rate for the console port is 9600 baud.

Table 17 on page 32 provides the pinout information for the RJ-45 console connector. An RJ-45 cable and RJ-45 to DB-9 adapter are supplied with the MX150 device.



NOTE: If your laptop or PC does not have a DB-9 male connector pin and you want to connect your laptop or PC directly to an MX150 device, use a combination of the RJ-45 cable and RJ-45 to DB-9 adapter supplied with the device and a USB to DB-9 male adapter. You must provide the USB to DB-9 male adapter.

Table 17: Console Port Connector Pinouts for the MX150

Pin	Signal	Description
1	RTS Output	Request to send
2	DTR Output	Data terminal ready
3	TxD Output	Transmit data
4	Signal Ground	Signal ground
5	Signal Ground	Signal ground
6	RxD Input	Receive data
7	DCD Input	Data carrier detect
8	CTS Input	Clear to send

- Related Documentation**
- [Connecting an MX150 to a Management Console on page 64](#)

USB Port Specifications for an MX150

The following Juniper Networks USB flash drives have been tested and are officially supported for the USB port in the MX150:

- RE-USB-1G-S—1-gigabyte (GB) USB flash drive
- RE-USB-2G-S—2-GB USB flash drive
- RE-USB-4G-S—4-GB USB flash drive



CAUTION: Any USB memory product not listed as supported for the MX150 has not been tested by Juniper Networks. The use of any unsupported USB memory product could expose your device to unpredictable behavior. Juniper Networks Technical Assistance Center (JTAC) can provide only limited support for issues related to unsupported hardware. We strongly recommend that you use only supported USB flash drives.



CAUTION: Remove the USB flash drive before upgrading Junos OS or rebooting the MX150. Failure to do so could expose your device to unpredictable behavior.



NOTE: Executing the request system snapshot CLI command on the MX150 requires an external USB flash drive with at least 4 GB of free space. We recommend using the RE-USB-4G-S flash drive.



NOTE: USB flash drives used with the MX150 must support USB 2.0 or later.

Related Documentation

- [Front Panel of an MX150 on page 5](#)

Management Port Connector Pinout Information for an MX150

The 1000BASE-T RJ-45 management port on an MX150 uses an RJ-45 connector to connect to a management device for out-of-band management.

[Table 18 on page 34](#) provides the pinout information of the RJ-45 management port connector.

Table 18: RJ-45 Management Port Connector Pinouts for the MX150

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1
2	TRP1-	Transmit/receive data pair 1
3	TRP2+	Transmit/receive data pair 2
4	TRP3+	Transmit/receive data pair 3
5	TRP3-	Transmit/receive data pair 3
6	TRP2-	Transmit/receive data pair 2
7	TRP4+	Transmit/receive data pair 4
8	TRP4-	Transmit/receive data pair 4

Related Documentation • [Management Port LEDs on MX150 on page 10](#)

Network Port Connector Pinout Information for an MX150

A network port on an MX150 uses an RJ-45 connector to connect to a device.

The port uses an autosensing RJ-45 connector to support a 10/100/1000Base-T connection. Two LEDs on the port indicate link activity on the port and the port status. See “[Network Port and Uplink Port LEDs on MX150](#)” on page 8.

[Table 19 on page 34](#) provides the pinout information for the RJ-45 connector. An RJ-45 cable, with a connector attached, is supplied with the switch.

Table 19: Network Port Connector Pinout Information for the MX150

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1 Negative Vport (in PoE models)
2	TRP1-	Transmit/receive data pair 1 Negative Vport (in PoE models)
3	TRP2+	Transmit/receive data pair 2 Positive Vport (in PoE models)
4	TRP3+	Transmit/receive data pair 3

Table 19: Network Port Connector Pinout Information for the MX150 (continued)

Pin	Signal	Description
5	TRP3-	Transmit/receive data pair 3
6	TRP2-	Transmit/receive data pair 2 Positive Vport (in PoE models)
7	TRP4+	Transmit/receive data pair 4
8	TRP4-	Transmit/receive data pair 4

Related Documentation

- [MX150 Router Overview on page 3](#)

RJ-45 to DB-9 Serial Port Adapter Pinout Information for an MX150

The console port is an RS-232 serial interface that uses an RJ-45 connector to connect to a management device such as a PC or a laptop. If your laptop or PC does not have a DB-9 male connector pin and you want to connect your laptop or PC to an MX150, use a combination of the RJ-45 to DB-9 female adapter supplied with the switch along with a USB to DB-9 male adapter.

[Table 20 on page 35](#) provides the pinout information for the RJ-45 to DB-9 serial port adapter.

Table 20: RJ-45 to DB-9 Serial Port Adapter Pinout Information

RJ-45 Pin	Signal	DB-9 Pin	Signal
1	RTS	8	CTS
2	DTR	6	DSR
3	TXD	2	RXD
4	GND	5	GND
6	RXD	3	TXD
7	DSR	4	DTR
8	CTS	7	RTS

Related Documentation

- [Connecting an MX150 to a Management Console on page 64](#)

Transceiver and Cable Specifications

- [Pluggable Transceivers Supported on MX150 on page 37](#)
- [SFP+ Direct Attach Copper Cables for MX150 on page 38](#)
- [Cable Specifications for Console and Management Connections for the MX150 on page 39](#)
- [Understanding MX150 Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 39](#)
- [Calculating the Fiber-Optic Cable Power Budget for an MX150 on page 41](#)
- [Calculating the Fiber-Optic Cable Power Margin for an MX150 on page 41](#)

Pluggable Transceivers Supported on MX150

Uplink ports on MX150 support SFP and SFP+ transceivers. This topic describes the optical interfaces supported for those transceivers. It also lists the copper interface supported for the SFP transceivers.



NOTE: We recommend that you use only optical transceivers and optical connectors purchased from Juniper Networks with your Juniper Networks device.



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



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

The list of supported transceivers for the MX Series is located at <https://pathfinder.juniper.net/hct/category/#catKey=100001&modelType;=All&pf;=MX+Series>.

- Related Documentation**
- [Front Panel of an MX150 on page 5](#)
 - [Installing a Transceiver in an MX150 on page 77](#)
 - [Removing a Transceiver from an MX150 on page 75](#)

SFP+ Direct Attach Copper Cables for MX150

Small form-factor pluggable plus transceiver (SFP+) direct attach copper (DAC) cables, also known as Twinax cables, are suitable for in-rack connections between servers and switches. They are suitable for short distances of up to 23 ft, making them ideal for highly cost-effective networking connectivity within a rack and between adjacent racks.

This topic describes:

- [Cable Specifications on page 38](#)
- [Standards Supported by These Cables on page 39](#)

Cable Specifications

MX150 routers support SFP+ passive DAC cables. The passive Twinax cable is a straight cable with no active electronic components. MX150 routers support 1 m, 3 m, and 5 m long SFP+ passive DAC cables.



NOTE: We recommend that you use only SFP+ DAC cables purchased from Juniper Networks with your Juniper Networks device.



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

The cables are hot-removable and hot-insertable: You can remove and replace them without powering off the switch or disrupting switch functions. A cable comprises a low-voltage cable assembly that connects directly into two SFP+ ports, one at each end of the cable. The cables use high-performance integrated duplex serial data links for bidirectional communication and are designed for data rates of up to 10 Gbps.



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

The list of supported transceivers for the MX Series is located at <https://pathfinder.juniper.net/hct/category/#catKey=100001&modelType=All&pf=MX+Series>.

Standards Supported by These Cables

The cables comply with the following standards:

- SFP mechanical standard SFF-843—see <ftp://ftp.seagate.com/sff/SFF-8431.PDF> .
- Electrical interface standard SFF-8432—see <ftp://ftp.seagate.com/sff/SFF-8432.PDF> .
- SFP+ Multi-Source Alliance (MSA) standards

Related Documentation

- [Pluggable Transceivers Supported on MX150 on page 37](#)
- [Installing a Transceiver in an MX150 on page 77](#)
- [Removing a Transceiver from an MX150 on page 75](#)

Cable Specifications for Console and Management Connections for the MX150

Table 21 on page 39 lists the specifications for the cables that connect the MX150 to a management device.

Table 21: Cable Specifications for Console and Management Connections for the MX150

Port on MX150 Device	Cable Specification	Cable Supplied	Maximum Length	Device Receptacle
Console port	RS-232 (EIA-232) serial cable	One 2.13-meter-long RJ-45 patch cable and RJ-45 to DB-9 adapter	2.13 meters	RJ-45
Management port	Category 5 cable or equivalent suitable for 1000BASE-T operation	One 2.13-meter-long RJ-45 patch cable	2.13 meters	RJ-45

Related Documentation

- [Console Port Connector Pinouts for MX150 on page 32](#)
- [Management Port Connector Pinout Information for an MX150 on page 33](#)
- [Connecting an MX150 to a Management Console on page 64](#)
- [Connecting an MX150 to a Network for Out-of-Band Management on page 63](#)

Understanding MX150 Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

To determine the power budget and power margin needed for fiber-optic connections, you need to understand how signal loss, attenuation, and dispersion affect transmission. The MX150 uses various types of network cable, including multimode and single-mode fiber-optic cables.

- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cables on page 40](#)
- [Attenuation and Dispersion in Fiber-Optic Cable on page 40](#)

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

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 light 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 (layers of lower refractive index material in close contact with a core material of higher refractive index), higher-order mode loss occurs. Together, these factors reduce the transmission distance of multimode fiber compared to that of single-mode fiber.

Single-mode fiber is so small in diameter that rays of light 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 to multimode fiber, single-mode fiber has a higher bandwidth and can carry signals for longer distances. It is consequently more expensive.

For information about the maximum transmission distance and supported wavelength range for the types of single-mode and multimode fiber-optic cables that are connected to the MX150, see [“Pluggable Transceivers Supported on MX150” on page 37](#). Exceeding the maximum transmission distances can result in significant signal loss, which causes unreliable transmission.

Attenuation and Dispersion in Fiber-Optic Cable

An optical data link functions correctly provided that modulated light reaching the receiver has enough power to be demodulated correctly. Attenuation is the reduction in strength of the light signal during transmission. Passive media components such as cables, cable splices, and connectors cause attenuation. 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 transmit enough light to overcome attenuation.

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

- Chromatic dispersion, which is the spreading of the signal over time caused by the different speeds of light rays.
- Modal dispersion, which is the spreading of the signal over time caused by 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 limits the 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 within the limits specified for the type of link in Telcordia Technologies document

GR-253-CORE (Section 4.3) and International Telecommunications Union (ITU) document G.957.

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

**Related
Documentation**

- [Calculating the Fiber-Optic Cable Power Budget for an MX150 on page 41](#)
- [Calculating the Fiber-Optic Cable Power Margin for an MX150 on page 41](#)

Calculating the Fiber-Optic Cable Power Budget for an MX150

Calculate the link's power budget when planning fiber-optic cable layout and distances to ensure that fiber-optic connections have sufficient power for correct operation. The power budget is the maximum amount of power the link 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 for fiber-optic cable power budget (P^B) for the link:

1. Determine values for the link's minimum transmitter power (P_T) and minimum receiver sensitivity (P_R). For example, here, (P_T) and (P_R) are measured in decibels, and decibels are referenced to 1 milliwatt (dBm).

$$P_T = -15 \text{ dBm}$$

$$P_R = -28 \text{ dBm}$$



NOTE: See the specifications for your transmitter and receiver to find the minimum transmitter power and minimum receiver sensitivity.

2. Calculate the power budget (PB) by subtracting (P_R) from (PT):

$$-15 \text{ dBm} - (-28 \text{ dBm}) = 13 \text{ dBm}$$

**Related
Documentation**

- [Understanding MX150 Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 39](#)
- [Calculating the Fiber-Optic Cable Power Margin for an MX150 on page 41](#)

Calculating the Fiber-Optic Cable Power Margin for an MX150

Calculate the link's power margin when planning fiber-optic cable layout and distances to ensure that fiber-optic connections have sufficient signal power to overcome system losses and still satisfy the minimum input requirements of the receiver for the required

performance level. The power margin (P_M) is the amount of power available after attenuation or link loss (LL) has been subtracted from the power budget (P_B).

When you calculate the power margin, 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 worst-case levels. A power margin (P_M) greater than zero indicates that the power budget is sufficient to operate the receiver and that it does not exceed the maximum receiver input power. This means the link will work. A (P_M) that is zero or negative indicates insufficient power to operate the receiver. See the specification for your receiver to find the maximum receiver input power.

Before you begin to calculate the power margin:

- Calculate the power budget. See “[Calculating the Fiber-Optic Cable Power Budget for an MX150](#)” on page 41.

To calculate the worst-case estimate for the power margin (P_M) for the link:

1. Determine the maximum value for link loss (LL) by adding estimated values for applicable link-loss factors—for example, use the sample values for various factors as provided in [Table 22 on page 42](#) (here, the link is 2 km long and multimode, and the (P_B) is 13 dBm):

Table 22: Estimated Values for Factors Causing Link Loss

Link-Loss Factor	Estimated Link-Loss Value	Sample Link Loss (LL) Calculation Values
Higher-order mode losses	Multimode—0.5 dBm	0.5 dBm
	Single-mode—None	0 dBm
Modal and chromatic dispersion	Multimode—None, if product of bandwidth and distance is less than 500 MHz/km	0 dBm
	Single-mode—None	0 dBm
Connector	0.5 dBm	This example assumes five connectors. Loss for five connectors: 5 (0.5 dBm) = 2.5 dBm.
Splice	0.5 dBm	This example assumes two splices. Loss for two splices: 2 (0.5 dBm) = 1 dBm.
Fiber attenuation	Multimode—1 dBm/km	This example assumes the link is 2 km long. Fiber attenuation for 2 km: 2 km (1 dBm/km) = 2 dBm.
	Single-mode—0.5 dBm/km	This example assumes the link is 2 km long. Fiber attenuation for 2 km: 2 km (0.5 dBm/km) = 1 dBm.
Clock Recovery Module (CRM)	1 dBm	1 dBm



NOTE: For information about the actual amount of signal loss caused by equipment and other factors, see your vendor documentation for that equipment.

2. Calculate the (P_M) by subtracting (LL) from (P_B):

$$P_B - LL = P_M$$

$$13 \text{ dBm} - 0.5 \text{ dBm [HOL]} - 5 (0.5 \text{ dBm}) - 2 (0.5 \text{ dBm}) - 2 \text{ km } (1.0 \text{ dBm/km}) - 1 \text{ dB [CRM]} = P_M$$

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

$$P_M = 6 \text{ dBm}$$

The calculated power margin is greater than zero, indicating that the link has sufficient power for transmission. Also, the power margin value does not exceed the maximum receiver input power. Refer to the specifications for your receiver to find the maximum receiver input power.

Related Documentation

- [Understanding MX150 Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 39](#)
- [Calculating the Fiber-Optic Cable Power Budget for an MX150 on page 41](#)

PART 3

Initial Installation and Configuration

- [Unpacking the MX150 on page 47](#)
- [Installing the MX150 on page 51](#)
- [Connecting the MX150 on page 59](#)
- [Connecting the MX150 to the Network on page 63](#)
- [Initially Configuring the MX150 on page 67](#)

CHAPTER 9

Unpacking the MX150

- [Unpacking an MX150 on page 47](#)
- [Parts Inventory \(Packing List\) for an MX150 on page 47](#)
- [Registering Products—Mandatory for Validating SLAs on page 48](#)

Unpacking an MX150

The MX150 is shipped in a cardboard carton, secured with foam packing material. The carton has an accessory compartment and contains the quick start instructions.



CAUTION: The MX150 is maximally protected inside the shipping carton. Do not unpack the devices until you are ready to begin installation.

To unpack the device:

1. Open the carton.
2. Pull out the packing material holding the device in place.
3. Verify the parts received against the inventory on the label attached to the carton. See [“Parts Inventory \(Packing List\) for an MX150” on page 47](#).
4. Save the shipping carton and packing materials in case you need to move or ship the switch later.

Related Documentation

- [Configuring the MX150 on page 67](#)

Parts Inventory (Packing List) for an MX150

The MX150 is shipped in a cardboard carton, secured with foam packing material. The carton contains an accessory box.

The device shipment includes a packing list. Check the parts you receive in the device shipping carton against the items on the packing list. The parts shipped depend on the configuration you order.

If any part on the packing list is missing, contact your customer service representative or contact Juniper customer care from within the U.S. or Canada by telephone at 1-888-314-5822. For international-dial or direct-dial options in countries without toll-free numbers, see <https://www.juniper.net/support/requesting-support.html>.

Table 23 on page 48 lists the parts and their quantities in the packing list.

Table 23: Packing List for an MX150

Component	Quantity
Device	1
AC power cord appropriate for your geographical location	1
AC power cord retainer clip	1
Mounting brackets	2
Mounting screws to attach the mounting brackets to the device chassis	8
Rubber feet	4
RJ-45 cable and RJ-45 to DB-9 serial port adapter	1
Quick Start installation instructions	1
Juniper Networks Product Warranty	1
End User License Agreement	1



NOTE: You must provide mounting screws that are appropriate for your rack or cabinet to mount the chassis on a rack or a cabinet.

Related Documentation

- [MX150 Router Overview on page 3](#)

Registering Products—Mandatory for Validating SLAs

Register all new Juniper Networks hardware products and changes to an existing installed product using the Juniper Networks website to activate your hardware replacement service-level agreements (SLAs).



CAUTION: Register product serial numbers on the Juniper Networks website and update the installation base data if there is any addition or change to the installation base or if the installation base is moved. Juniper Networks will not be held accountable for not meeting the hardware replacement service-level agreement for products that do not have registered serial numbers or accurate installation base data.

Register your product(s) at: <https://tools.juniper.net/svcreg/SRegSerialNum.jsp>.

Update your install base at:

<https://www.juniper.net/customers/csc/management/updateinstallbase.jsp>.

**Related
Documentation**

- *Contacting Customer Support to Obtain Return Material Authorization*
- *Contacting Customer Support to Obtain a Return Materials Authorization for an MX150 on page 87*

CHAPTER 10

Installing the MX150

- [Installing and Connecting an MX150 on page 51](#)
- [Mounting an MX150 on page 52](#)
- [Mounting an MX150 on a Desk or Other Level Surface on page 52](#)
- [Mounting an MX150 on Two Posts in a Rack on page 53](#)
- [Mounting an MX150 on Four Posts in a Rack or Cabinet on page 55](#)

Installing and Connecting an MX150

To install and connect an MX150:

1. Follow instructions in [“Unpacking an MX150” on page 47](#).
2. Mount the MX150 by following instructions appropriate for your site:
 - [“Mounting an MX150 on a Desk or Other Level Surface” on page 52](#) (using the rubber feet provided)
 - [“Mounting an MX150 on Two Posts in a Rack” on page 53](#) (using the mounting brackets provided)
 - [“Mounting an MX150 on Four Posts in a Rack or Cabinet” on page 55](#) (using the separately orderable four-post rack-mount kit)
3. Follow instructions in [“Connecting Earth Ground to an MX150” on page 59](#).
4. Follow instructions in [“Connecting AC Power to an MX150” on page 60](#).
5. Perform initial configuration of the device by following instructions in [“Configuring the MX150” on page 67](#).
6. Set the device’s management options by following the appropriate instructions:
 - [Connecting an MX150 to a Management Console on page 64](#)
 - [Connecting an MX150 to a Network for Out-of-Band Management on page 63](#)

- Related Documentation**
- [Rack Requirements for an MX150 on page 23](#)
 - [Cabinet Requirements for an MX150 on page 24](#)
 - [Clearance Requirements for Airflow and Hardware Maintenance for an MX150 on page 25](#)

Mounting an MX150

Table 24 on page 52 lists the methods you can use to mount an MX150.

Table 24: MX150 Mounting Methods

Mounting Method	Device Model	Comments
Desk or other level surface	<ul style="list-style-type: none"> • MX150 	On a desk or other level surface by using rubber feet provided with the device.
Two-post rack or cabinet	<ul style="list-style-type: none"> • MX150 	On two posts in a 19-in. rack or cabinet by using the mounting brackets.
Four-post rack or cabinet	<ul style="list-style-type: none"> • MX150 	<ul style="list-style-type: none"> • On four posts in a 19-in. rack or cabinet by using the separately orderable four-post rack-mount kit • On two posts in a 19-in. rack or cabinet by using the two-post rack mounting brackets.
Wall Mounting	MX150	On a wall by using separately orderable wall-mount kit

The holes in the mounting brackets are placed at 1 U (1.75 in. or 4.45 cm) apart so that the switch can be mounted in any rack or cabinet that provides holes spaced at that distance.

See the Related Documentation for detailed descriptions of the various rack or cabinet mounting options.

- Related Documentation**
- [Mounting an MX150 on a Desk or Other Level Surface on page 52](#)
 - [Mounting an MX150 on Two Posts in a Rack on page 53](#)
 - [Mounting an MX150 on Four Posts in a Rack or Cabinet on page 55](#)
 - [Connecting Earth Ground to an MX150 on page 59](#)

Mounting an MX150 on a Desk or Other Level Surface

You can mount an MX150 on a desk or other level surface by using the four rubber feet that are shipped with the router. The rubber feet stabilize the chassis.

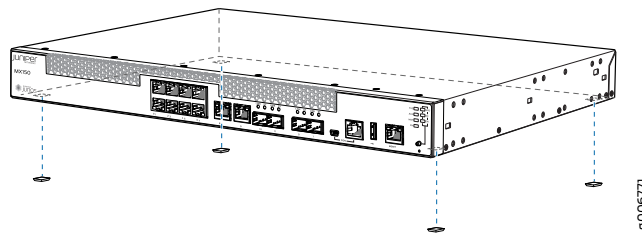
Before mounting the MX150 on a desk or other level surface:

- Verify that the site meets the requirements described in “[Site Preparation Checklist for MX150](#)” on page 19.
- Place the desk in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
- Read “[General Safety Guidelines and Warnings](#)” on page 95, with particular attention to “[Chassis Lifting Guidelines for MX150](#)” on page 104.
- Ensure that you have the four rubber feet to stabilize the chassis on the a desk or other level surface (provided in the accessory box in the router carton)

To mount an MX150 on a desk or other level surface:

1. Remove the device from the shipping carton (see “[Unpacking an MX150](#)” on page 47).
2. Turn the chassis upside down on the desk or the level surface where you intend to mount the device.
3. Attach the rubber feet to the bottom of the chassis as shown in [Figure 11](#) on page 53
4. Turn the chassis right side up on the desk or the level surface.

Figure 11: Attaching Rubber Feet to the MX150



Related Documentation

- [Connecting Earth Ground to an MX150](#) on page 59
- [Connecting AC Power to an MX150](#) on page 60
- [Clearance Requirements for Airflow and Hardware Maintenance for an MX150](#) on page 25

Mounting an MX150 on Two Posts in a Rack

You can mount an MX150 on two posts of a 19-in. rack (either a two-post or a four-post rack).



NOTE: If you need to mount the MX150 in a recessed position on either a two-post rack or a four-post rack, you can use the 2-in.-recess front brackets provided in the separately orderable four-post rack-mount kit.

Before mounting an MX150 on two posts in a rack:

- Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
- Read “[General Safety Guidelines and Warnings](#)” on page 95.
- Remove the router from the shipping carton.

Ensure that you have the following parts and tools available:

- Phillips (+) screwdriver, number 2
- Two mounting brackets and eight mounting screws (provided in the accessory box shipped with the router)
- Screws to secure the chassis to the rack (not provided)



NOTE: One person must be available to lift the device while another secures the device to the rack.

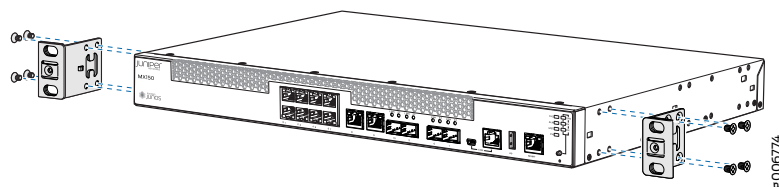


CAUTION: If you are mounting multiple devices on a rack, mount a device in the bottom of the rack first and proceed to mount the rest of the devices from bottom to top.

To mount the MX150 on two posts in a rack:

1. Place the MX150 on a flat, stable surface.
2. Align the mounting brackets along the front, rear, or center of the side panels of the device chassis depending on how you want to mount the device. For example, if you want to front-mount the device, align the brackets along the front of the side panel. See [Figure 12 on page 54](#).

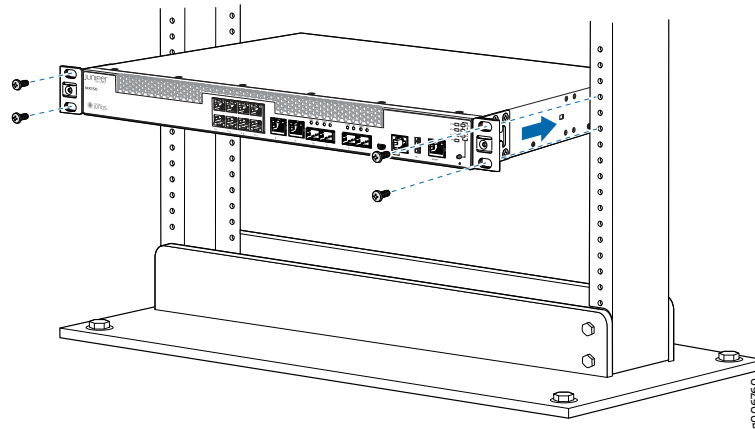
Figure 12: Attaching the Mounting Bracket to the Side Panel of the MX150



NOTE: If you need to mount the MX150 in a recessed position, use the 2-in.-recess front-mount brackets from the separately orderable four-post rack-mount kit.

3. Align the bottom holes in the mounting brackets with holes on the side panels of the chassis.
4. Insert mounting screws into the aligned holes. Tighten the screws.
5. Ensure that the other holes in the mounting brackets are aligned with the holes in the side panels. Insert a screw in each hole and tighten the screws.
6. Have one person grasp both sides of the device, lift the device, and position it in the rack, aligning the mounting bracket holes with the threaded holes in the rack or cabinet rail. Align the bottom hole in both the mounting brackets with a hole in each rack rail, making sure the chassis is level. See [Figure 13 on page 55](#).

Figure 13: Mounting the MX150 on Two Posts in a Rack



7. Have a second person secure the device to the rack by using the appropriate screws. Tighten the screws.
8. Ensure that the device chassis is level by verifying that all screws on one side of the rack are aligned with the screws on the other side.

Related Documentation

- [Connecting AC Power to an MX150 on page 60](#)
- [Connecting Earth Ground to an MX150 on page 59](#)
- [Rack-Mounting and Cabinet-Mounting Warnings on page 106](#)

Mounting an MX150 on Four Posts in a Rack or Cabinet

You can mount an MX150 on four posts of a 19-in. rack or cabinet by using the separately orderable four-post rack-mount kit. (The remainder of this topic uses *rack* to mean *rack or cabinet*.)

You can mount the MX150 on two posts in either a two-post rack or a four-post rack by using the mounting brackets provided with the router. See [“Mounting an MX150 on Two Posts in a Rack”](#) on page 53.



NOTE: If you are mounting the MX150 on four posts, ensure that the rack is 21.5 in. (54.61 cms) through 31.5 in. (80.01 cms) deep if you will mount the device flush with the rack front and that the rack is 23.5 in. (59.69 cms) through 32.5 in. (82.55 cms) deep if you will mount the device 2 in. recessed from the rack front, thus ensuring that the protective earthing terminal is accessible through the opening in the rear mounting-blade.

Before mounting the MX150 on four posts in a rack:

- Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
- Read [“General Safety Guidelines and Warnings”](#) on page 95, with particular attention to [“Chassis Lifting Guidelines for MX150”](#) on page 104.
- Remove the MX150 from the shipping carton (see [“Unpacking an MX150”](#) on page 47).
- Have two persons available to mount the router. One person supports the device in a level position, and the second person secures the router to the rack.

Ensure that you have the following parts and tools available:

- Phillips (+) screwdriver, number 2
- 12 flat-head M4x6-mm Phillips mounting screws (provided with the four-post rack-mount kit)
- One pair of front-mounting brackets
- One pair of rear mounting blades
- Screws to secure the front-mounting brackets and the rear mounting blades to the rack (not provided)



CAUTION: If you are mounting multiple units on a rack, mount the heaviest unit at the bottom of the rack and mount the other units from the bottom of the rack to the top in decreasing order of the weight of the units.

To mount the MX150 on four posts in a rack:

1. Place the router on a flat, stable surface.
2. Align a front-mounting bracket (either flush with the front of the chassis or 2-in.-recessed from the front of the chassis) along the side panel of the device chassis. Align the two holes in the front of the brackets with the two holes on the front of the side panel.

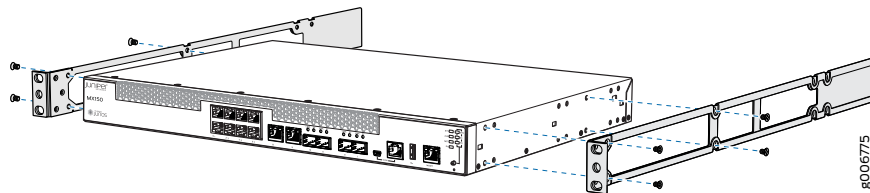


NOTE: Each side of the chassis has twelve holes for attaching the front-mounting brackets to the device.

Six holes on the chassis side align with six holes in the front bracket when the front bracket is mounted flush with the chassis front or recessed 2 in. from the front of the chassis.

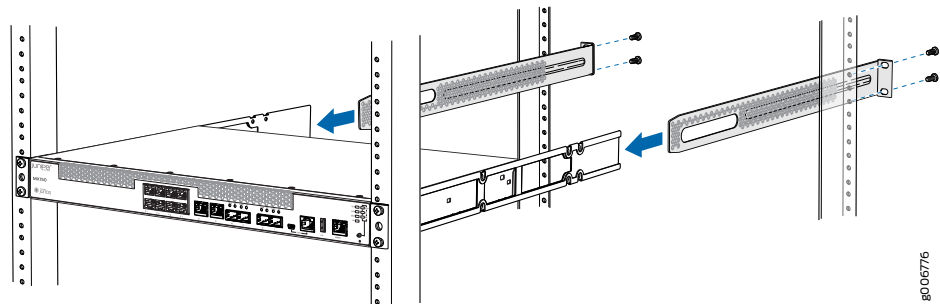
3. Insert M4x6-mm Phillips flat-head mounting screws into the two aligned holes and tighten the screws. Ensure that the remaining two holes in the front bracket are aligned with the two holes in the side panel. See [Figure 14 on page 57](#).

Figure 14: Attaching the Front-Mounting Bracket to the Chassis



4. Insert M4x6-mm Phillips flat-head mounting screws into the remaining two holes in the front bracket and tighten the screws.
5. Repeat Step 2 through Step 4 for attaching the front-mounting bracket to the other side of the chassis.
6. Have one person grasp both sides of the device, lift the device, and position it in the rack, aligning the front bracket holes with the threaded holes in the front post of the rack. Align the bottom hole in both the front-mounting brackets with a hole in each rack rail, making sure the chassis is level. See [Figure 15 on page 57](#).

Figure 15: Mounting the MX150 on the Front Posts in a Rack



7. Have a second person secure the front of the device to the rack by using the appropriate screws for your rack.

8. Slide the rear mounting blades into the front-mounting brackets.
9. Attach the rear mounting blades to the rear post by using the appropriate screws for your rack. Tighten the screws.
10. Ensure that the chassis is level by verifying that all the screws on the front of the rack are aligned with the screws at the back of the rack.

**Related
Documentation**

- [Connecting Earth Ground to an MX150 on page 59](#)
- [Connecting AC Power to an MX150 on page 60](#)
- [Rack-Mounting and Cabinet-Mounting Warnings on page 106](#)

Connecting the MX150

- [Connecting Earth Ground to an MX150 on page 59](#)
- [Connecting AC Power to an MX150 on page 60](#)

Connecting Earth Ground to an MX150

Earth grounding is recommended, but optional for the MX150. The device functions normally without earth grounding. Electromagnetic compatibility (EMC) and electrostatic discharge (ESD) requirements are met by the chassis. The AC power cord provides surge protection.

To connect MX150 to earth ground, you must use the protective earthing terminal on the device chassis. See [Figure 16 on page 60](#).

This topic describes:

- [Parts and Tools Required for Connecting an MX150 to Earth Ground on page 59](#)
- [Connecting Earth Ground to an MX150 on page 60](#)

Parts and Tools Required for Connecting an MX150 to Earth Ground

[Table 25 on page 59](#) lists the earthing terminal location, grounding cable requirements, grounding lug specifications, screws and washers required, and the screwdriver needed for connecting a device to earth ground. Before you begin connecting a switch to earth ground, ensure you have the parts and tools required for your device.

Table 25: Parts and Tools Required for Connecting an MX150 to Earth Ground

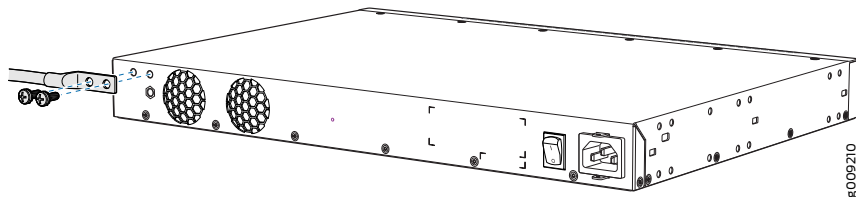
Device	Earthing Terminal Location	Grounding Cable Requirements	Grounding Lug Specifications	Screws and Washers	Screwdriver	Additional Information
MX150	Rear panel of chassis	14 AWG (2 mm ²), minimum 90°C wire, or as permitted by the local code	Panduit LCC10-14BWL or equivalent—not provided	<ul style="list-style-type: none"> • Two 10-32 x .25 in. screws with #10 split-lock washer—not provided • Two #10 flat washers—not provided 	Phillips (+) number 2	

Connecting Earth Ground to an MX150

To connect earth ground to the MX150:

1. Connect one end of the grounding cable to a proper earth ground, such as the rack in which the router is mounted.
2. Place the grounding lug attached to the grounding cable over the protective earthing terminal. See [Figure 16 on page 60](#).

Figure 16: Connecting a Grounding Cable to an MX150



3. Secure the grounding lug to the protective earthing terminal with the washers and screws.
4. Dress the grounding cable and ensure that it does not touch or block access to other device components.



WARNING: Ensure that the cable does not drape where people could trip over it.

Related Documentation

- [Connecting AC Power to an MX150 on page 60](#)

Connecting AC Power to an MX150

The power supply in an MX150 is located on the rear panel.

Ensure that you have the following parts and tools available:

- A power cord appropriate for your geographical location
- A power cord retainer clip



CAUTION: An MX150 gets additional grounding when you plug the power supply in the device into a grounded AC power outlet by using the AC power

cord appropriate for your geographical location (see “AC Power Cord Specifications for an MX150” on page 27).

To connect AC power to the device:

1. Squeeze the two sides of the power cord retainer clip and insert the L-shaped ends of the wire clip into the holes in the bracket on each side of the AC power cord inlet on the rear panel.

The power cord retainer clip extends out of the chassis by 3 in. (7.62 cms).

2. Locate the power cord or cords shipped with the device; the cords have plugs appropriate for your geographical location. See “AC Power Cord Specifications for an MX150” on page 27.



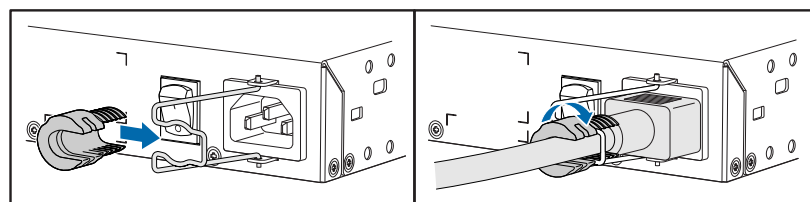
WARNING: Ensure that the power cord does not drape where people can trip on it or block access to switch components.

3. Insert the coupler end of the power cord into the AC power cord inlet on the rear panel.
4. Push the power cord into the slot in the adjustment nut of the power cord retainer clip. Turn the nut until it is tight against the base of the coupler and the slot in the nut is turned 90° from the top of the device.
5. If the AC power source outlet has a power switch, set it to the off (O) position.
6. Insert the power cord plug into an AC power source outlet.
7. If the AC power source outlet has a power switch, set it to the on (I) position.



NOTE: The retainer brackets on your switch might be above and below the power inlet rather than on either side.

Figure 17: Connecting an AC Power Cord to the AC Power Cord Inlet on MX150



Connecting the MX150 to the Network

- [Connecting an MX150 to a Network for Out-of-Band Management on page 63](#)
- [Connecting an MX150 to a Management Console on page 64](#)
- [Connecting an MX150 to a Management Console Using Mini-USB Type-B Console Port on page 65](#)

Connecting an MX150 to a Network for Out-of-Band Management

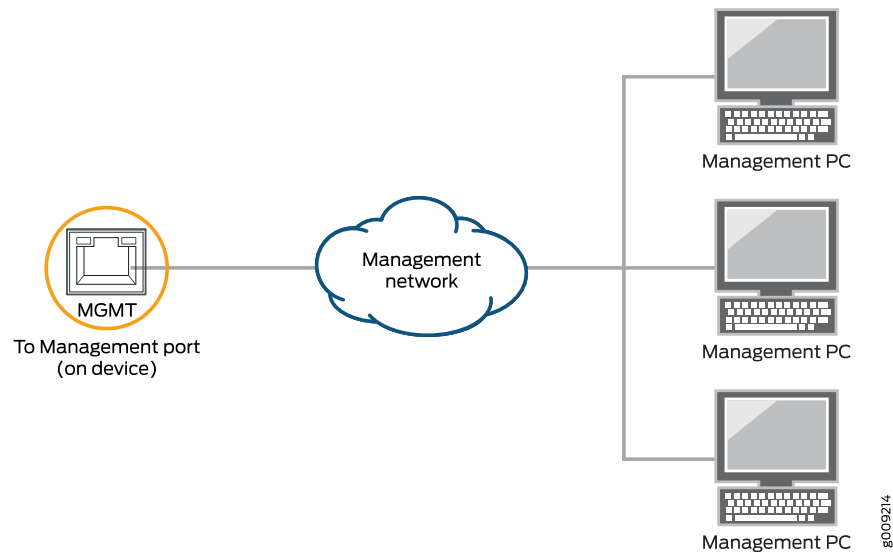
You can monitor and manage the MX150 by using a dedicated management channel. The MX150 has one management port, eight 1-Gigabit Ethernet RJ-45 ports, two 1-Gigabit Ethernet RJ-45 network or uplink ports, two 1-Gigabit Ethernet small form-factor pluggable (SFP) ports, and two 1/10-Gigabit Ethernet SFP+ ports. Use the management port to connect the MX150 device to a network for out-of-band management.

Ensure that you have an appropriate cable available.

To connect an MX150 to a network for out-of-band management (see [Figure 18 on page 64](#)):

1. Connect one end of the cable to the management port (labeled **MGMT**) on the MX150.
2. Connect the other end of the cable to the management switch (see [Figure 18 on page 64](#)).

Figure 18: Connecting an MX150 to a Network for Out-of-Band Management



Related Documentation

- [Front Panel of an MX150 on page 5](#)
- [Connecting an MX150 to a Management Console on page 64](#)

Connecting an MX150 to a Management Console

MX150 has a console port with an RJ-45 connector. Use the console port to connect the device to a management console or to a console server.

Ensure that you have an RJ-45 to DB-9 rollover cable available. An RJ-45 cable with an RJ-45 to DB-9 adapter is provided with the device.



NOTE: If your laptop or PC does not have a DB-9 male connector pin and you want to connect your laptop or PC directly to the MX150, use a combination of the RJ-45 cable and RJ-45 to DB-9 adapter supplied with the device and a USB to DB-9 male adapter. You must provide the USB to DB-9 male adapter.

To connect the MX150 to a management console (see [Figure 19 on page 65](#) and [Figure 20 on page 65](#)):

1. Connect one end of the Ethernet cable to the console port (labeled **CON**).
2. Connect the other end of the Ethernet cable into the console server (see [Figure 19 on page 65](#)) or management console (see [Figure 20 on page 65](#)).

Figure 19: Connecting the MX150 to a Management Console Through a Console Server

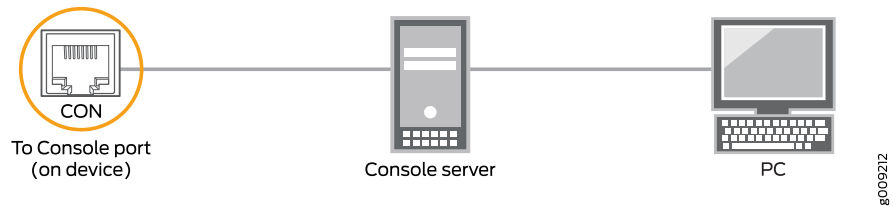


Figure 20: Connecting the MX150 Directly to a Management Console



Related Documentation

- [Console Port Connector Pinouts for MX150 on page 32](#)

Connecting an MX150 to a Management Console Using Mini-USB Type-B Console Port

You can configure and manage the MX150 by using the RJ-45 console port or the Mini-USB Type-B console port. However, the console input will be active only on one port at a time—only one port will be set active at a time.

By default, the RJ-45 port is set as an active console port and the Mini-USB Type-B port is the passive console port. For information about configuring the console port type, see *Configuring the Console Port Type (CLI Procedure)*.

If your laptop or PC does not have a DB-9 male connector pin or RJ-45 connector pin, you can connect your laptop or PC directly to an MX150 device by using a mini-USB cable that has a Standard-A USB connector on one end and a Mini-USB Type-B (5 pin) connector on the other end.

This section describes the process of connecting an MX150 to the management console by using the Mini-USB Type-B console port.

For information about configuring and managing an MX150 by using the RJ-45 console port, see [“Connecting an MX150 to a Management Console” on page 64](#).

Before you begin connecting an MX150 by using the Mini-USB Type-B console port:

- Ensure that the USB to Serial driver is installed on the host machine. You can download the driver from <https://webdownload.juniper.net/swdl/dl/secure/site/1/record/5029.html>
- Ensure that the hyper terminal properties of the console server or laptop are set as follows:

- Baud rate—9600
- Flow control—None
- Data—8
- Parity—None
- Stop bits—1
- DCD state—Disregard

Ensure that you have the following parts and tools available:

- 1 mini-USB cable with Standard-A and Mini-USB Type-B (5-pin) connectors (not provided).

To connect the MX150 to the console by using Mini-USB Type-B console port:

1. Connect the Standard-A connector of the mini-USB cable to the host machine (PC or Laptop).
2. Connect the Mini-USB Type-B (5-pin) connector of the mini-USB cable to the Mini-USB Type-B console port (labeled **CON**) on the MX150.
3. Set the Mini-USB Type-B console port as the active console port by using the command **port-type**.
For information about configuring the console port type, see *Configuring the Console Port Type (CLI Procedure)*.
4. Reboot the MX150.

After the connection is established, the Mini-USB Type-B becomes the active console port. The host machine connected to the Mini-USB Type-B console port displays log messages and lets you control MX150 functionality through it.

Related Documentation

- [Console Port Connector Pinouts for MX150 on page 32](#)
- [Connecting an MX150 to a Network for Out-of-Band Management on page 63](#)

Initially Configuring the MX150

- [Configuring the MX150 on page 67](#)

Configuring the MX150

You must perform the initial configuration of the MX150 through the console port using the command-line interface (CLI).

Before you begin connecting and configuring an MX150, set the following parameter values on the console server or PC:

- Baud Rate—9600
- Flow Control—None
- Data—8
- Parity—None
- Stop Bits—1
- DCD State—Disregard

To connect and configure the device from the console:

1. Connect the console port to a laptop or PC by using the supplied RJ-45 cable and RJ-45 to DB-9 adapter. The console (**CON**) port is located on the management panel of the device.

2. Start the CLI.

```
root@host% cli
```

3. Enter configuration mode.

```
root@host> configure
```

4. Add a password to the root administration user account.

```
[edit]  
root@host# set system root-authentication plain-text-password  
New password: password  
Retype new password: password
```

5. (Optional) Configure the name of the device. If the name includes spaces, enclose the name in quotation marks (" ").

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

6. Configure the IP address and prefix length for the device management interface.

```
[edit]
root@host# set interfaces fxp0 unit 0 family inet address address/prefix-length
fxp0 is the management interface.
```

To configure an IPV6 address, run the `root@host# set interface fxp0 family inet6 address address v6_address`.



NOTE: fxp0 is found on the front panel of the MX150 device.

7. Configure the default gateway.

```
[edit]
root@host# set routing-options static route default next-hop address
```

8. Enable the SSH service.

```
[edit]
root@host# set system services ssh
```

9. Enable the Telnet service.

```
[edit]
root@host# set system services telnet
```

10. Commit the configuration to activate it on the device.

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

Related Documentation

- [Installing and Connecting an MX150 on page 51](#)

PART 4

Installing, Maintaining, and Replacing Components

- [Removing the MX150 on page 71](#)
- [Replacing Transceivers on page 75](#)
- [Maintaining and Replacing Fiber-Optic Cable on page 79](#)
- [Contacting Customer Support and Returning the Chassis or Components on page 83](#)

Removing the MX150

- [Powering Off an MX150 on page 71](#)
- [Removing an MX150 from a Rack or Cabinet on page 73](#)

Powering Off an MX150

If you need to power off the MX150, follow the procedure in this topic.

Before you power off the device:

- Ensure that you understand how to prevent electrostatic discharge damage. See [“Prevention of Electrostatic Discharge Damage” on page 125](#).
- Ensure that you do not need to forward traffic through the device.

Ensure that you have the following parts and tools available to power off the device:

- An ESD grounding strap
- An external management device such as a PC
- A cable to connect the external management device to the console port (**CON**) or management port (**MGMT**) on the device

To power off the device:

1. Connect the management device (such as a PC) to the console (**CON**) port or the management (**MGMT**) port on the device:
 - For connecting a management device to the console port, see [“Connecting an MX150 to a Management Console” on page 64](#).
 - For connecting a management device to the management port, see [“Connecting an MX150 to a Network for Out-of-Band Management” on page 63](#)
2. From the PC connected to the device, issue the following operational mode CLI command:

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

This command shuts down the device gracefully and preserves system state information. A message displays on the console confirming that the operating system has halted.

You will see the following output (or something similar, depending on the hardware being shut down):

```

user@host> request system halt
warning: This command will halt all the members.
If planning to halt only one member use the member option
Halt the system ? [yes,no] (no) yes

*** FINAL System shutdown message from user@host ***
System going down IMMEDIATELY

Shutdown NOW!
[pid 14102]
message sent

{master:0}
user@host> Waiting (max 300 seconds) for system process `vnlru' to stop...done
Waiting (max 300 seconds) for system process `vnlru_mem' to stop...done
Waiting (max 300 seconds) for system process `bufdaemon' to stop...done
Waiting (max 300 seconds) for system process `syncer' to stop...
Syncing disks, vnodes remaining...3 3 1 2 2 0 0 0 done

syncing disks... All buffers synced.
Uptime: 38d18h0m6s
recorded reboot as normal shutdown

The operating system has halted.
Please press any key to reboot

```



CAUTION: The final output of any version of this command is the “The operating system has halted. Please press any key to reboot” message. Wait at least 60 seconds after first seeing this message before following the instructions in Step 3 and Step 4 to power off the device.



CAUTION: Ensure that you have halted your system safely before turning off the power supply.

3. Attach the ESD grounding strap to your bare wrist and connect the strap to the ESD point on the chassis.
4. Set the power switch to off (0) position.

Related Documentation

- [Connecting AC Power to an MX150 on page 60](#)

Removing an MX150 from a Rack or Cabinet

If you need to relocate an installed MX150, use the procedure described in this topic. (The remainder of this topic uses *rack* to mean *rack or cabinet*.)



NOTE: When you remove multiple devices from a rack, remove the device at the top of the rack first and proceed to remove the rest of the devices from top to bottom.



CAUTION: At least two people must be available to lift a device chassis out of a rack—one person to unscrew the mounting screws from the brackets and the second person to hold the chassis.

Before removing the MX150 from a rack:

- Ensure that the rack or cabinet is stable and secured to the building.
- Ensure that there is enough space to place the removed device in its new location and along the path to the new location.
- Read [“General Safety Guidelines and Warnings” on page 95](#), with particular attention to [“Chassis Lifting Guidelines for MX150” on page 104](#).
- Ensure that the device has been safely powered off and that you have unplugged (disconnected) the power cords.
- Ensure that you have disconnected any cables or wires attached to the device.

Ensure that you have the following parts and tools available to remove the device:

- A Phillips (+) screwdriver, number 2 or number 3, depending on the size of your rack mounting screws.
- A labeled bag to hold the removed screws.

To remove an MX150 from a rack:

1. Use the appropriate Phillips (+) screwdriver to remove the mounting screws that attach the chassis front-mounting brackets to the rack.
2. Place the removed screws in a labeled bag. You will need them when you reinstall the chassis.
3. Lift the chassis from the rack and carefully move the chassis to its new location.

Related Documentation

- [General Safety Guidelines and Warnings on page 95](#)
- [Chassis Lifting Guidelines for MX150 on page 104](#)

Replacing Transceivers

- [Removing a Transceiver from an MX150 on page 75](#)
- [Installing a Transceiver in an MX150 on page 77](#)

Removing a Transceiver from an MX150

The transceivers for the MX150 are hot-removable and hot-insertable field-replaceable units (FRUs). You can remove and replace them without powering off the device or disrupting device functions.

Before you begin removing a transceiver from the MX150, ensure that you have taken the necessary precautions for safe handling of lasers (see [“Laser and LED Safety Guidelines and Warnings for the MX150” on page 111](#)).

Ensure that you have the following parts and tools available:

- Electrostatic bag or an antistatic mat
- Rubber safety caps to cover the transceiver and fiber-optic cable connector
- Dust cover to cover the port

To remove a transceiver from the MX150:

1. Place the antistatic bag or antistatic mat on a flat, stable surface.
2. Label the cable connected to the transceiver so that you can reconnect it correctly.



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



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



.....

CAUTION: Do not bend fiber-optic cables beyond their minimum bend radius. Bending the cables beyond their minimum bend radius can damage the cables and cause problems that are difficult to diagnose.

.....

3. Remove the cable connected to the transceiver (see [“Disconnecting a Fiber-Optic Cable from an MX150” on page 80](#)). Cover the transceiver and the end of each fiber-optic cable connector with a rubber safety cap immediately after disconnecting the fiber-optic cables.

4. Using your fingers, pull the ejector lever away from the transceiver to unlock the transceiver.



.....

CAUTION: Before removing the transceiver, make sure you open the ejector lever completely until you hear it click. Doing this prevents damage to the transceiver.

.....

5. Grasp the transceiver ejector lever and gently slide the transceiver approximately 0.5 in. (1.3 cm) straight out of the port (see [Figure 21 on page 77](#)).



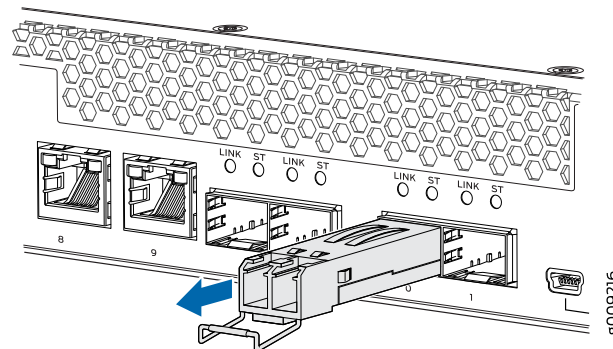
.....

CAUTION: To avoid electrostatic discharge (ESD) damage to the transceiver, do not touch the connector pins at the end of the transceiver.

.....

6. Using your fingers, grasp the body of the transceiver and pull it straight out of the port.
7. Place the transceiver in the electrostatic bag or on the antistatic mat placed on a flat, stable surface.
8. Place the dust cover over the empty port.

Figure 21: Removing a Transceiver from an MX150



Related Documentation • [Installing a Transceiver in an MX150 on page 77](#)

Installing a Transceiver in an MX150

The transceivers for the MX150 are hot-removable and hot-insertable field-replaceable units (FRUs). You can remove and replace them without powering off the device or disrupting device functions.

Before you begin installing a transceiver in an MX150, ensure that you have taken the necessary precautions for safe handling of lasers (see [“Laser and LED Safety Guidelines and Warnings for the MX150” on page 111](#)).

Ensure that you have a rubber safety cap available to cover the transceiver.

To install a transceiver in an MX150 :



CAUTION: To avoid electrostatic discharge (ESD) damage to the transceiver, do not touch the connector pins at the end of the transceiver.

1. Remove the transceiver from its bag.
2. Check to see whether the transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a rubber safety cap.



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

3. If the port in which you want to install the transceiver is covered with a dust cover, remove the dust cover and save it in case you need to cover the port later.
4. Using both hands, carefully place the transceiver in the empty port. The connectors must face the device chassis.



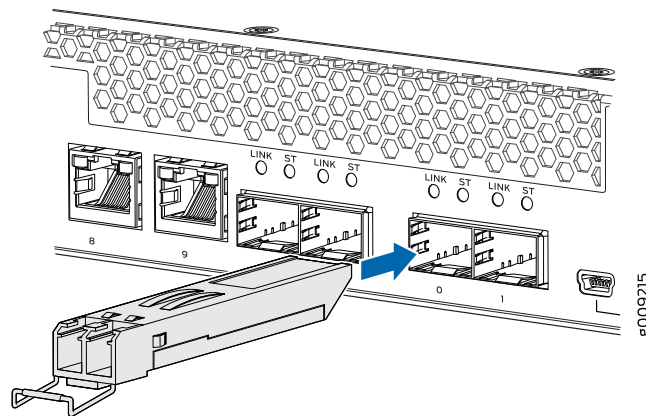
CAUTION: Before you slide the transceiver into the port, ensure that the transceiver is aligned correctly. Misalignment might cause the pins to bend, making the transceiver unusable. See [Figure 22 on page 78](#) for the correct orientation for your device.

5. Slide the transceiver in gently until it is fully seated. See [Figure 22 on page 78](#) for an example of inserting an SFP or SFP+ transceiver.
6. Remove the rubber safety cap when you are ready to connect the cable to 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 cables connected to transceivers emit laser light that can damage your eyes.

Figure 22: Installing a Transceiver in an MX150



Related Documentation

- [Removing a Transceiver from an MX150 on page 75](#)
- [Connecting a Fiber-Optic Cable to an MX150 on page 79](#)

Maintaining and Replacing Fiber-Optic Cable

- [Connecting a Fiber-Optic Cable to an MX150 on page 79](#)
- [Disconnecting a Fiber-Optic Cable from an MX150 on page 80](#)
- [Maintaining Fiber-Optic Cables in an MX150 on page 81](#)

Connecting a Fiber-Optic Cable to an MX150

You can connect fiber-optic cables to the field-replaceable unit (FRU) optical transceivers installed in MX150 routers.

Before you connect a fiber-optic cable to an optical transceiver installed in an MX150, ensure that you have taken the necessary precautions for safe handling of lasers (see [“Laser and LED Safety Guidelines and Warnings for the MX150” on page 111](#)).

To connect a fiber-optic cable to an optical transceiver installed in an MX150:



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



WARNING: Do not stare into the laser beam or view it directly with optical instruments even if the interface has been disabled.

1. If the fiber-optic cable connector is covered by a rubber safety cap, remove the cap. Save the cap.
2. If the optical transceiver is covered by a rubber safety cap, remove the cap. Save the cap.

3. Insert the cable connector into the optical transceiver (see [Figure 23 on page 80](#)).
4. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on a loop helps cables maintain their shape.

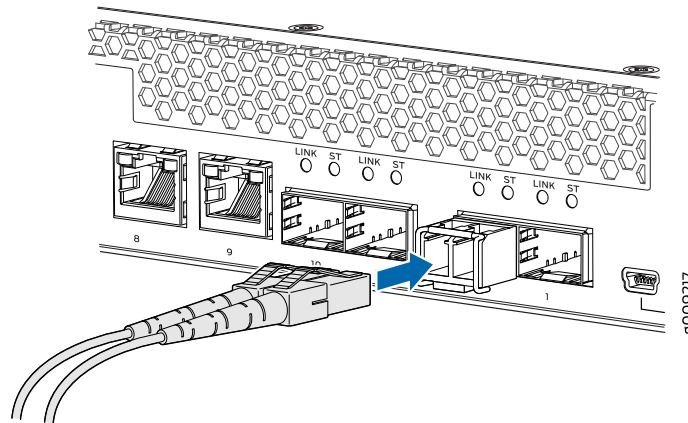


CAUTION: Do not bend fiber-optic cables beyond their minimum bend radius. Bending the cables beyond their minimum bend radius can damage the cables and cause problems that are difficult to diagnose.



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

Figure 23: Inserting a Fiber-Optic Cable into a Transceiver



Related Documentation

- [Disconnecting a Fiber-Optic Cable from an MX150 on page 80](#)
- [Maintaining Fiber-Optic Cables in an MX150 on page 81](#)

Disconnecting a Fiber-Optic Cable from an MX150

Before you disconnect a fiber-optic cable from an optical transceiver installed in an MX150, ensure that you have taken the necessary precautions for safe handling of lasers (see “[Laser and LED Safety Guidelines and Warnings for the MX150](#)” on page 111).

Ensure that you have the following parts and tools available:

- Rubber safety cap to cover the transceiver
- Rubber safety cap to cover the fiber-optic cable connector

To disconnect a fiber-optic cable from an optical transceiver installed in the MX150:

1. (Recommended) Disable the port in which the transceiver is installed by including the **disable** statement at the **[edit interfaces]** hierarchy level for the specific interface.



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



WARNING: Do not stare into the laser beam or view it directly with optical instruments even if the interface has been disabled.

2. Carefully unplug the fiber-optic cable connector from the transceiver.
3. Cover the transceiver with a rubber safety cap.



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

4. Cover the fiber-optic cable connector with the rubber safety cap.

Related Documentation

- [Installing a Transceiver in an MX150 on page 77](#)
- [Connecting a Fiber-Optic Cable to an MX150 on page 79](#)

Maintaining Fiber-Optic Cables in an MX150

To maintain fiber-optic cables in MX150:

- When you unplug a fiber-optic cable from a transceiver, place rubber safety caps over the transceiver and on the end of the cable.
- Anchor fiber-optic cable to avoid stress on the connectors. When attaching a fiber-optic cable to a transceiver, be sure to secure the fiber-optic cable so that it is not supporting its own weight as it hangs to the floor. Never let a fiber-optic cable hang free from the connector.
- Do not bend fiber-optic cables beyond their minimum bend radius. Bending the cables beyond their minimum bend radius can damage the cables and cause problems that are difficult to diagnose.
- Frequent plugging and unplugging of fiber-optic cables in and out of optical instruments can damage the instruments, which are expensive to repair. 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 easier and less expensive to replace than the instruments.

- Keep fiber-optic cable connections clean. Microdeposits of oil and dust in the canal of the transceiver or cable connector can cause loss of light, reduction in signal power, and possibly intermittent problems with the optical connection.

To clean the transceiver canal, use an appropriate fiber-cleaning device such as RIFOCS Fiber Optic Adaptor Cleaning Wands (part number 946). Follow the directions in the cleaning kit you use.

After cleaning the transceiver, make sure that the connector tip of the fiber-optic cable is clean. Use only an approved alcohol-free fiber-optic cable cleaning kit such as the Cletop-S[®] Fiber Cleaner. Follow the directions in the cleaning kit you use.

**Related
Documentation**

- [Disconnecting a Fiber-Optic Cable from an MX150 on page 80](#)
- [Connecting a Fiber-Optic Cable to an MX150 on page 79](#)

Contacting Customer Support and Returning the Chassis or Components

- [Returning a MX150 Router or Component for Repair or Replacement on page 83](#)
- [Locating the Serial Number on an MX150 on page 84](#)
- [Packing a MX150 Router or Component for Shipping on page 85](#)
- [Contacting Customer Support to Obtain a Return Materials Authorization for an MX150 on page 87](#)

Returning a MX150 Router or Component for Repair or Replacement

If you need to return a MX150 router or component to Juniper Networks for repair or replacement, follow this procedure:

1. Determine the serial number of the device or component. For instructions, see [“Locating the Serial Number on an MX150” on page 84](#).
2. Obtain a Return Materials Authorization (RMA) number from the Juniper Technical Assistance Center (JTAC) as described in [“Contacting Customer Support to Obtain a Return Materials Authorization for an MX150” on page 87](#).



NOTE: Do not return any device or component to Juniper Networks unless you have first obtained an RMA number. Juniper Networks reserves the right to refuse shipments that do not have an RMA. Refused shipments are returned to the customer through collect freight.

3. Pack the MX150 router or component for shipping as described in [“Packing a MX150 Router or Component for Shipping” on page 85](#).

For more information about return and repair policies, see the customer support page at <http://www.juniper.net/support/guidelines.html>.

Related Documentation

- [MX150 Router Overview on page 3](#)

Locating the Serial Number on an MX150

If you are returning a device to Juniper Networks for repair or replacement, you must locate the serial number of the device. You must provide the serial number to the Juniper Networks Technical Assistance Center (JTAC) when you contact them to obtain Return Materials Authorization (RMA).

If the device is operational and you can access the CLI, you can list serial numbers for the device with a CLI command.



NOTE: The MX150 does not have any field-replaceable unit. The power supply and fans are fixed.

- [Listing the Device and Components Details with the CLI on page 84](#)
- [Locating the Chassis Serial Number ID Label on an MX150 on page 85](#)

Listing the Device and Components Details with the CLI

To list the device and device components and their serial numbers, enter the following CLI command:

The following output lists the device components and serial numbers for an MX150:



NOTE: Log in to the Junos command-line interface (Junos CLI).

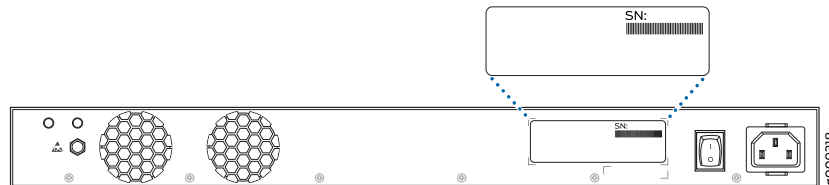
```
user@host> show chassis hardware
Hardware inventory:
Item          Version  Part number  Serial number  Description
Chassis
Midplane      REV 04   650-066113  DD2316AF0078  MX150
Power Supply 0
Routing Engine 0
  CB 0
  CB 1
  FPC 0
    CPU          Rev. 1.0 RIOT      BUILTIN
    MIC 0
      Xcvr 10     REV 02   740-013111  A331846
      Xcvr 11     REV 02   740-013111  C248517
  Fan Tray 0
  Back Airflow - AFO
  Fan Tray 1
  Back Airflow - AFO
                                RE-MX
                                MX SCB
                                MX SCB
                                Virtual FPC
                                Virtual
                                Virtual
                                SFP-T
                                SFP-T
                                fan-ctrl-0 0, Front to
                                fan-ctrl-0 1, Front to
```

For information about the **show chassis hardware** command, see the *Junos OS System Basics and Services Command Reference* at <https://www.juniper.net/documentation/software/junos/index.html>.

Locating the Chassis Serial Number ID Label on an MX150

The serial number ID label is located on the back of the chassis on an MX150. See [Figure 24 on page 85](#).

Figure 24: Location of the Serial Number ID Label on an MX150



Related Documentation

- [Contacting Customer Support to Obtain a Return Materials Authorization for an MX150 on page 87](#)

Packing a MX150 Router or Component for Shipping

If you are returning a MX150 router or component to Juniper Networks for repair or replacement, pack the item as described in this topic.

Before you pack a MX150 router or component:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See [“Prevention of Electrostatic Discharge Damage” on page 125](#).
- Retrieve the original shipping carton and packing materials. Contact your JTAC representative if you do not have these materials, to learn about approved packing materials. See [“Contacting Customer Support to Obtain a Return Materials Authorization for an MX150” on page 87](#).

Ensure that you have the following parts and tools available:

- ESD grounding strap.
- Antistatic bag, one for each component.
- If you are returning the chassis, an appropriate screwdriver for the mounting screws used on your rack or cabinet.

This topic describes:

- [Packing an MX150 for Shipping on page 85](#)
- [Packing MX150 Components for Shipping on page 86](#)

Packing an MX150 for Shipping

To pack an MX150 for shipping:

1. Power off the MX150 and remove the power cables. See [“Powering Off an MX150” on page 71](#).
2. Remove the cables that connect the device to all external devices.
3. Remove all field-replaceable units (FRUs) from the MX150.
4. Have one person support the weight of the device while another person unscrews and removes the mounting screws.
5. Remove the device from the rack or cabinet (see [“Chassis Lifting Guidelines for MX150” on page 104](#)) and place the device in an antistatic bag.
6. Place the device in the shipping carton.
7. Place the packing foam on top and around the device.
8. If you are returning accessories or FRUs with the device, pack them as instructed in [“Packing a MX150 Router or Component for Shipping” on page 85](#).
9. Replace the accessory box on top of the packing foam.
10. Close the top of the cardboard shipping box and seal it with packing tape.
11. Write the RMA number on the exterior of the box to ensure proper tracking.

Packing MX150 Components for Shipping



CAUTION: Do not stack the MX150 components. Return individual components in separate boxes if they do not fit together on one level in the shipping box.

To pack and ship MX150 components:

- Place individual FRUs in antistatic bags.
- Ensure that the components are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Close the top of the cardboard shipping box and seal it with packing tape.
- Write the RMA number on the exterior of the box to ensure proper tracking.

Related Documentation

- [Returning a MX150 Router or Component for Repair or Replacement on page 83](#)

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 Guidelines and Warnings on page 95](#)
 - [Installation Instructions Warning on page 103](#)
 - [Maintenance and Operational Safety Guidelines and Warnings on page 117](#)
 - [Grounded Equipment Warning](#)
 - [Laser and LED Safety Guidelines and Warnings](#)
 - [Laser and LED Safety Guidelines and Warnings for the ACX5000 Router](#)
 - [Laser and LED Safety Guidelines and Warnings for the QFX Series](#)
 - [Laser and LED Safety Guidelines and Warnings for the PTX10000 Series](#)
 - [Warning Statement for Norway and Sweden on page 99](#)

Qualified Personnel Warning



WARNING: Only trained and qualified personnel should install or replace the device.

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.

- Related Documentation**
- [General Safety Guidelines and Warnings on page 95](#)
 - [General Electrical Safety Guidelines and Warnings on page 123](#)