



MX5, MX10, MX40, and MX80 Universal Routing Platforms Hardware Guide



Modified: 2019-04-01

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

Juniper Networks, the Juniper Networks logo, Juniper, and Junos are registered trademarks of Juniper Networks, Inc. in the United States and other countries. All other trademarks, service marks, registered marks, or registered service marks are the property of their respective owners.

Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.

MX5, MX10, MX40, and MX80 Universal Routing Platforms Hardware Guide
Copyright © 2019 Juniper Networks, Inc. All rights reserved.

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

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

The Juniper Networks product that is the subject of this technical documentation consists of (or is intended for use with) Juniper Networks software. Use of such software is subject to the terms and conditions of the End User License Agreement ("EULA") posted at <https://support.juniper.net/support/eula/>. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.

Table of Contents

	About the Documentation	xiii
	Documentation and Release Notes	xiii
	Using the Examples in This Manual	xiii
	Merging a Full Example	xiv
	Merging a Snippet	xiv
	Documentation Conventions	xv
	Documentation Feedback	xvii
	Requesting Technical Support	xvii
	Self-Help Online Tools and Resources	xviii
	Creating a Service Request with JTAC	xviii
Chapter 1	Overview	19
	System Overview	19
	MX5, MX10, MX40, and MX80 Router Overview	19
	Benefits of the MX5, MX10, MX40, and MX80 Router	19
	MX5, MX10, MX40, and MX80 Hardware Overview	20
	MX5, MX10, MX40, and MX80 Router Models	22
	MX5, MX10, MX40, and MX80 Hardware Components and CLI Terminology	23
	MX5, MX10, MX40, and MX80 Chassis	24
	MX5, MX10, MX40, and MX80 Chassis Description	24
	MX5, MX10, MX40, and MX80 Baseboard Description	26
	Baseboard Components	27
	MX5, MX10, MX40, and MX80 Cable Management Bracket Description	27
	MX5, MX10, MX40, and MX80 Front Panel Description	28
	Front Panel Components	29
	Alarm LEDs on the MX5, MX10, MX40, and MX80 Front Panel	30
	Component LEDs on the MX5, MX10, MX40, and MX80 Front Panel	30
	Link LEDs on the Front Panel	30
	Routing Engine LED on the Front Panel	31
	System LED on the Front Panel	31
	MX5, MX10, MX40, and MX80 Power System	31
	MX5, MX10, MX40, and MX80 Power System Description	32
	AC Power Supply Description	33
	DC Power Supply Description	34
	MX5, MX10, MX40, and MX80 Power Supply LED	34
	MX5, MX10, MX40, and MX80 Routers AC Power Specifications	35
	Power Consumption for an AC-Powered MX5, MX10, MX40, and MX80 Router	35
	Router	35
	AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router	37

	AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers . . .	37
	MX5, MX10, MX40, and MX80 Routers DC Power Specifications	39
	Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router	39
	DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers	41
	DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers	41
	DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers	41
	DC Power Cable Lug Specifications	42
	DC Power Cable Specifications	42
	MX5, MX10, MX40, and MX80 Host Subsystem	42
	MX5, MX10, MX40, and MX80 Routing Engine Description	42
	MX5, MX10, MX40, and MX80 Routing Engine LED	43
	MX5, MX10, MX40, and MX80 Interface Modules	43
	MX5, MX10, MX40, and MX80 Modular Interface Card Description	43
	Front-Pluggable MICs	43
	Fixed (Built-in) MICs	44
	MICs Supported by MX Series Routers	46
	MX5, MX10, MX40, and MX80 Port and Interface Numbering	54
	Port and Interface Numbering on the MX5, MX10, MX40, and MX80 Routers	54
	Port and Interface Numbering on MX80-48T Routers	56
	MX5, MX10, MX40, and MX80 Modular Interface Card LEDs	57
Chapter 2	Site Planning, Preparation, and Specifications	59
	MX5, MX10, MX40, and MX80 Site Preparation Checklist	59
	MX5, MX10, MX40, and MX80 Site Guidelines and Requirements	61
	MX5, MX10, MX40, and MX80 Routers Physical Specifications	61
	MX5, MX10, MX40, and MX80 Router Environmental Specifications	62
	MX5, MX10, MX40, and MX80 Router Grounding Specifications	62
	Grounding Points Specifications	62
	Grounding Cable Lug Specifications	63
	Grounding Cable Specifications	63
	MX5, MX10, MX40, and MX80 Rack Requirements	64
	MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance	65

	MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications	66
	MX5, MX10, MX40, and MX80 Network Cable and Transceiver Planning	67
	Determining Transceiver Support and Specifications for M Series and T Series Routers	68
	Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion	68
	Signal Loss in Multimode and Single-Mode Fiber-Optic Cable	68
	Attenuation and Dispersion in Fiber-Optic Cable	69
	Calculating Power Budget and Power Margin for Fiber-Optic Cables	69
	Calculating Power Budget for Fiber-Optic Cable	70
	Calculating Power Margin for Fiber-Optic Cable	70
	Routing Engine Interface Cable Specifications for MX5, MX10, MX40, and MX80 Routers	71
	MX5, MX10, MX40, and MX80 Management, and Console Port Specifications and Pinouts	72
	RJ-45 Connector Pinouts for the AUX and CONSOLE Ports on MX5, MX10, MX40, and MX80 Routers	72
	RJ-45 Connector Pinouts for the ETHERNET Port on MX5, MX10, MX40, and MX80 Routers	73
Chapter 3	Initial Installation and Configuration	75
	MX5, MX10, MX40, and MX80 Installation Summary	75
	Unpacking and Mounting the MX5, MX10, MX40, and MX80	76
	Tools and Parts Required to Unpack MX5, MX10, MX40, and MX80 Routers	76
	Unpacking MX5, MX10, MX40, and MX80 Routers	76
	Verifying the MX5, MX10, MX40, and MX80 Routers Parts Received	77
	Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket	79
	Moving the Mounting Brackets for Center-Mounting MX5, MX10, MX40, and MX80 Routers	79
	Tools Required to Install MX5, MX10, MX40, and MX80 Chassis in the Rack	80
	Installing MX5, MX10, MX40, and MX80 Chassis in the Rack	81
	Connecting the MX5, MX10, MX40, and MX80 Routers to Power	82
	Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections	83
	Grounding MX5, MX10, MX40, and MX80 Routers	83
	Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router	84
	Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router	85
	Connecting Power to a DC-Powered MX5, MX10, MX40, and MX80 Router	86
	Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router	88
	Powering Off MX5, MX10, MX40, and MX80 Routers	90
	Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices	91
	Connecting the Router to a Network for Out-of-Band Management	91
	Connecting the Router to a Management Console or Auxiliary Device	91
	Initially Configuring MX5, MX10, MX40, and MX80 Routers	93

Chapter 4	Maintaining Components	97
	Maintaining MX5, MX10, MX40, and MX80 Components	97
	Tools and Parts Required to Maintain MX5, MX10, MX40, and MX80 Routers	97
	Routine Maintenance Procedures for MX5, MX10, MX40, and MX80 Routers	97
	Maintaining the MX5, MX10, MX40, and MX80 Routing Engine	97
	Maintaining the MX5, MX10, MX40, and MX80 Air Filter	98
	Maintaining the MX5, MX10, MX40, and MX80 Air Filter	98
	Replacing an MX5, MX10, MX40, and MX80 Air Filter	99
	Removing an MX5, MX10, MX40, and MX80 Air Filter	99
	Installing an MX5, MX10, MX40, and MX80 Air Filter	100
	Maintaining the MX5, MX10, MX40, and MX80 Fan Tray	101
	Maintaining the MX5, MX10, MX40, and MX80 Fan Tray	101
	Replacing an MX5, MX10, MX40, and MX80 Fan Tray	102
	Removing an MX5, MX10, MX40, and MX80 Fan Tray	102
	Installing an MX5, MX10, MX40, and MX80 Fan Tray	103
	Maintaining the MX5, MX10, MX40, and MX80 MICs and Transceivers	103
	Maintaining the MX5, MX10, MX40, and MX80 MICs	103
	Replacing an MX5, MX10, MX40, and MX80 MIC	104
	Removing an MX5, MX10, MX40, and MX80 MIC	104
	Installing an MX5, MX10, MX40, and MX80 MIC	106
	Installing an MX10, MX40, MX80, and MX104 Dual-Wide MIC	109
	Replacing an MX5, MX10, MX40, and MX80 SFP or XFP Transceiver	111
	Removing an MX5, MX10, MX40, and MX80 Transceiver	111
	Installing an MX5, MX10, MX40, and MX80 Transceiver	112
	Maintaining Cables That Connect to MX5, MX10, MX40, and MX80 MICs ..	113
	Maintaining the MX5, MX10, MX40, and MX80 Power Supplies and Cables	114
	Maintaining the MX5, MX10, MX40, and MX80 Power Supplies	114
	Replacing an MX5, MX10, MX40, and MX80 AC Power Supply	115
	Removing an MX5, MX10, MX40, and MX80 AC Power Supply	115
	Installing an MX5, MX10, MX40, and MX80 AC Power Supply	116
	Replacing an MX5, MX10, MX40, and MX80 AC Power Supply Cord	117
	Disconnecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord	117
	Connecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord	118
	Replacing an MX5, MX10, MX40, and MX80 DC Power Supply	118
	Removing an MX5, MX10, MX40, and MX80 DC Power Supply	118
	Installing an MX5, MX10, MX40, and MX80 DC Power Supply	120
	Replacing an MX5, MX10, MX40, and MX80 DC Power Supply Cable	122
	Disconnecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable	123
	Connecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable	124

Chapter 5	Troubleshooting Hardware	127
	Troubleshooting the MX5, MX10, MX40, and MX80	127
	Troubleshooting Resources for MX5, MX10, MX40, and MX80 Routers	127
	Command-Line Interface	127
	Chassis and Interface Alarm Messages	127
	Front Panel LEDs	128
	Component LEDs	128
	Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray	129
	Troubleshooting the MX5, MX10, MX40, and MX80 MICs	130
	Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies	130
Chapter 6	Contacting Customer Support and Returning the Chassis or Components	133
	Contacting Customer Support and Returning the Chassis or Components	133
	Returning a Hardware Component to Juniper Networks, Inc.	133
	Displaying MX5, MX10, MX40, and MX80 Components and Serial Numbers	134
	MX5, MX10, MX40, and MX80 Chassis Serial Number Label	135
	MX5, MX10, MX40, and MX80 Fan Tray Serial Number Label	135
	MX5, MX10, MX40, and MX80 MIC Serial Number Label	136
	MX5, MX10, MX40, and MX80 Power Supply Serial Number Label	137
	Contacting Customer Support to Obtain Return Material Authorization	138
	Guidelines for Packing Hardware Components for Shipment	138
	Packing MX5, MX10, MX40, and MX80 Routers for Shipment	139
Chapter 7	Safety and Compliance Information	141
	Definition of Safety Warning Levels	141
	General Safety Guidelines for Juniper Networks Devices	143
	General Safety Warnings for Juniper Networks Devices	144
	Qualified Personnel Warning	144
	Restricted-Access Area Warning	145
	Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router	146
	Fire Safety Requirements for Juniper Networks Devices	147
	General Fire Safety Requirements	147
	Fire Suppression	148
	Fire Suppression Equipment	148
	MX5, MX10, MX40 and MX80 Chassis Lifting Guidelines	149
	Installation Safety Warnings for Juniper Networks Devices	149
	Intrabuilding Ports Warning	149
	Installation Instructions Warning	150
	Rack-Mounting Requirements and Warnings	150
	Ramp Warning	154
	General Laser Safety Guidelines for Juniper Networks Devices	154
	Laser Safety Warnings for Juniper Networks Devices	155
	Class 1 Laser Product Warning	155
	Class 1 LED Product Warning	155
	Laser Beam Warning	156
	Radiation from Open Port Apertures Warning	157

Maintenance and Operational Safety Warnings for Juniper Networks Devices . .	158
Battery Handling Warning	158
Jewelry Removal Warning	159
Lightning Activity Warning	160
Operating Temperature Warning	161
Product Disposal Warning	162
In Case of an Electrical Accident	163
General Electrical Safety Warnings for Juniper Networks Devices	163
Grounded Equipment Warning	163
Grounding Requirements and Warning	164
Midplane Energy Hazard Warning	165
Multiple Power Supplies Disconnection Warning	165
Power Disconnection Warning	166
General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices	167
AC Power Electrical Safety Guidelines and Warnings for MX5, MX10, MX40, and MX80 Routers	167
DC Power Electrical Safety Warnings for Juniper Networks Devices	168
DC Power Copper Conductors Warning	168
DC Power Disconnection Warning	169
DC Power Wiring Terminations Warning	170
MX5, MX10, MX40, and MX80 DC Power Electrical Safety Guidelines	172
Site Electrical Wiring Guidelines for MX Series Routers	173
Distance Limitations for Signaling	173
Radio Frequency Interference	173
Electromagnetic Compatibility	173
Agency Approvals and Compliance Statements	173
Agency Approvals for MX5, MX10, MX40, and MX80 Routers	174
Compliance Statements for NEBS for MX5, MX10, MX40, and MX80 Routers	175
Compliance Statements for EMC Requirements for MX5, MX10, MX40, and MX80 Routers	175
Canada	175
European Community	175
Israel	175
Japan	176
United States	176
Compliance Statements for Environmental Requirements	176
Compliance Statements for Acoustic Noise for MX5, MX10, MX40, and MX80 Routers	176
Statements of Volatility for Juniper Network Devices	176

List of Figures

Chapter 1	Overview	19
	Figure 1: MX5 Router	21
	Figure 2: MX10 Router	21
	Figure 3: MX40 Router	21
	Figure 4: MX80 Router	22
	Figure 5: Front View of the MX5 Router	25
	Figure 6: Front View of the MX10 Router	25
	Figure 7: Front View of the MX40 Router	25
	Figure 8: Front View of the MX80 Router (Fixed Chassis)	26
	Figure 9: Front View of the MX80 Router (Modular Chassis)	26
	Figure 10: Rear View of the MX5, MX10, MX40, and MX80 Routers	26
	Figure 11: Cable Management Bracket for the MX5, MX10, MX40, and MX80 Routers	28
	Figure 12: Front Panel on the Fixed MX80 Router	28
	Figure 13: Front Panel on the Modular MX5, MX10, MX40, and MX80 Routers	29
	Figure 14: USB Memory Device in an MX5, MX10, MX40, and MX80 Router	30
	Figure 15: AC Power Supplies Installed in an MX5, MX10, MX40, and MX80 Router	33
	Figure 16: DC Power Supplies Installed in an MX5, MX10, MX40, and MX80 Router	33
	Figure 17: AC Power Supply	34
	Figure 18: DC Power Supply	34
	Figure 19: DC Power Cable Lug	42
	Figure 20: MICs Installed in an MX5, MX10, MX40, and MX80 Router	43
	Figure 21: MX5, MX10, MX40, and MX80 Interface Port Mapping	55
	Figure 22: MX80-48T Interface Port Mapping	56
Chapter 2	Site Planning, Preparation, and Specifications	59
	Figure 23: Grounding Points on MX5, MX10, MX40, and MX80 Routers	63
	Figure 24: Grounding Cable Lug	63
	Figure 25: Typical Open-Frame Rack	65
	Figure 26: MX5, MX10, MX40, and MX80 Chassis Dimensions and Clearance Requirements	66
	Figure 27: Airflow Through Chassis	67
Chapter 3	Initial Installation and Configuration	75
	Figure 28: Installing the Cable Management Bracket	79
	Figure 29: Front-Mounting the Brackets on MX5, MX10, MX40, and MX80 Routers	80
	Figure 30: Center-Mounting the Brackets on MX5, MX10, MX40, and MX80 Routers	80

	Figure 31: Installing the Front-Mounted Router in the Rack	82
	Figure 32: Installing the Center-Mounted Router in the Rack	82
	Figure 33: Grounding Points on MX5, MX10, MX40, and MX80 Routers	84
	Figure 34: Connecting DC Power to the Router	88
	Figure 35: Routing Engine Ethernet Cable Connector	91
	Figure 36: Ethernet Port	91
	Figure 37: Routing Engine Console and Auxiliary Cable Connector	92
	Figure 38: Auxiliary and Console Ports	92
Chapter 4	Maintaining Components	97
	Figure 39: Removing the Air Filter	100
	Figure 40: Installing the Air Filter	101
	Figure 41: Removing the Fan Tray	103
	Figure 42: Installing the Fan Tray	103
	Figure 43: Removing a MIC	106
	Figure 44: Removing a Dual-Wide MIC	106
	Figure 45: Installing the Septum	107
	Figure 46: Installing a MIC	108
	Figure 47: Removing the Septum	109
	Figure 48: Installing a Dual-Wide MIC	111
	Figure 49: Removing SFPs or XFPs	112
	Figure 50: Removing an AC Power Supply	116
	Figure 51: Installing an AC Power Supply	117
	Figure 52: Removing a DC Power Supply	120
	Figure 53: Disconnecting the DC Power Cables	120
	Figure 54: Installing a DC Power Supply	122
	Figure 55: Connecting the DC Power Cables	122
	Figure 56: Connecting Power Cables to the DC Power Supply	125
Chapter 6	Contacting Customer Support and Returning the Chassis or Components	133
	Figure 57: Serial Number ID Label	135
	Figure 58: MX5, MX10, MX40, and MX80 Chassis Serial Number Label	135
	Figure 59: MX5, MX10, MX40, and MX80 Fan Tray Serial Number Label	135
	Figure 60: 20-Port MIC Serial Number Label	136
	Figure 61: 40-Port MIC Serial Number Label	136
	Figure 62: 2-Port MIC Serial Number Label	137
	Figure 63: Power Supply Serial Number Label	137
Chapter 7	Safety and Compliance Information	141
	Figure 64: ESD Points on the MX5, MX10, MX40, and MX80 Chassis	147
	Figure 65: Placing a Component into an Electrostatic Bag	147

List of Tables

	About the Documentation	xiii
	Table 1: Notice Icons	xv
	Table 2: Text and Syntax Conventions	xvi
Chapter 1	Overview	19
	Table 3: MX5 Router Models	22
	Table 4: MX10 Router Models	22
	Table 5: MX40 Router Models	23
	Table 6: MX80 Router Models	23
	Table 7: MX5, MX10, MX40, and MX80 Routers Hardware Components and CLI Terminology	23
	Table 8: Alarm LEDs on the MX5, MX10, MX40, and MX80 Front Panel	30
	Table 9: Link LEDs on the Front Panel	31
	Table 10: Routing Engine LED on the Front Panel	31
	Table 11: System LED on the Front Panel	31
	Table 12: Power Supply LED	35
	Table 13: AC Power System Electrical Specifications	35
	Table 14: AC Power Supply Electrical Specifications	35
	Table 15: AC Base Router Power Requirements for the Fixed MX5, MX10, MX40, and MX80 Routers	36
	Table 16: AC Base Router Power Requirements for the Modular MX5, MX10, MX40, and MX80 Routers	36
	Table 17: Component Power Requirements	36
	Table 18: AC Power Cord Specifications	37
	Table 19: DC Power System Electrical Specifications	39
	Table 20: DC Power Supply Electrical Specifications	39
	Table 21: DC-Powered Base Router Power Requirements for the Fixed MX80 Router	40
	Table 22: DC-Powered Base Router Power Requirements for the MX5, MX10, MX40, and Modular MX80 Router	40
	Table 23: Component Power Requirements for DC-Powered Routers	40
	Table 24: MICs Supported by MX240, MX480, MX960 and MX2008 Routers ...	46
	Table 25: MICs Supported by MX2010 and MX2020 Routers	48
	Table 26: MICs Supported by MX5, MX10, and MX40 Routers	50
	Table 27: MICs Supported by MX80 and MX104 Routers	52
	Table 28: MICs Supported by MX10003 Router	53
	Table 29: MX5, MX10, MX40, and MX80 Components and Their Interface Names	55
	Table 30: MX80-48T Components and Interface Names	56
	Table 31: Tri-Rate MIC LEDs	57

Chapter 2	Site Planning, Preparation, and Specifications	59
	Table 32: MX80 Site Preparation Checklist	59
	Table 33: MX5, MX10, MX40, and MX80 Physical Specifications	61
	Table 34: Router Environmental Specifications	62
	Table 35: MX5, MX10, MX40, and MX80 Rack Requirements and Specifications	64
	Table 36: Cabinet Requirements and Specifications for an MX5, MX10, MX40, and MX80 Router	66
	Table 37: Estimated Values for Factors Causing Link Loss	70
	Table 38: Cable Specifications for Routing Engine Management	71
	Table 39: RJ-45 Connector Pinout for the AUX and CONSOLE Ports	72
	Table 40: RJ-45 Connector Pinout for the Routing Engine ETHERNET Port	73
Chapter 3	Initial Installation and Configuration	75
	Table 41: Parts List for a Fully Configured Router	77
	Table 42: Accessory Box Parts List	78

About the Documentation

- Documentation and Release Notes on page xiii
- Using the Examples in This Manual on page xiii
- Documentation Conventions on page xv
- Documentation Feedback on page xvii
- Requesting Technical Support on page xvii

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>.

Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

```
system {
  scripts {
    commit {
      file ex-script.xsl;
    }
  }
}
interfaces {
  fxp0 {
    disable;
    unit 0 {
      family inet {
        address 10.0.0.1/24;
      }
    }
  }
}
}
```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

```
[edit]
user@host# load merge /var/tmp/ex-script.conf
load complete
```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

```
commit {
  file ex-script-snippet.xsl; }
```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see [CLI Explorer](#).

Documentation Conventions

Table 1 on page xv 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 xvi 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>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level. The console port is labeled CONSOLE.
< > (angle brackets)	Encloses optional keywords or variables.	stub <default-metric metric>;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast <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.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	}

GUI Conventions

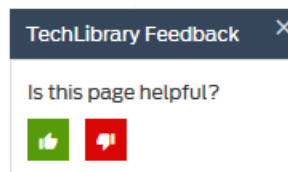
Table 2: Text and Syntax Conventions (continued)

Convention	Description	Examples
Bold text like this	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> In the Logical Interfaces box, select All Interfaces. To cancel the configuration, click Cancel.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select Protocols>Ospf .

Documentation Feedback

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

- Online feedback system—Click TechLibrary Feedback, on the lower right of any page on the [Juniper Networks TechLibrary](#) site, and do one of the following:



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

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active Juniper Care or Partner Support Services 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/>
- Create a service request online: <https://myjuniper.juniper.net>

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

Creating a Service Request with JTAC

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

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

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

CHAPTER 1

Overview

- [System Overview on page 19](#)
- [MX5, MX10, MX40, and MX80 Chassis on page 24](#)
- [MX5, MX10, MX40, and MX80 Power System on page 31](#)
- [MX5, MX10, MX40, and MX80 Host Subsystem on page 42](#)
- [MX5, MX10, MX40, and MX80 Interface Modules on page 43](#)

System Overview

- [MX5, MX10, MX40, and MX80 Router Overview on page 19](#)
- [MX5, MX10, MX40, and MX80 Router Models on page 22](#)
- [MX5, MX10, MX40, and MX80 Hardware Components and CLI Terminology on page 23](#)

MX5, MX10, MX40, and MX80 Router Overview

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

- [Benefits of the MX5, MX10, MX40, and MX80 Router on page 19](#)
- [MX5, MX10, MX40, and MX80 Hardware Overview on page 20](#)

Benefits of the MX5, MX10, MX40, and MX80 Router

- **System Capacity**—The MX80, MX40, MX10, and MX5 routers are software upgradeable from 20 Gbps to 80 Gbps. These platforms have up to four Modular Interface Card (MIC) slots and two fixed 10-Gigabit Ethernet interfaces for connecting to the network.
- **Always-on infrastructure base**—MX Series routers ensure network and service availability with a broad set of multilayered physical, logical, and protocol-level resiliency aspects. Junos OS Virtual Chassis technology on MX Series routers supports chassis-level redundancy and enables you to manage two routers as a single element.

Multichassis link aggregation group (MC-LAG) implementation supports stateful chassis, card, and port redundancy.

- **Application-Aware Networking**—On MX Series routers you can use deep packet inspection to detect applications, and by using the user-defined policies, you can determine traffic treatment for each application. This feature enables highly customized and differentiated services at scale.
- **Programmable Chipset**—The chipset implemented in the MX Series routers has a programmable forwarding data structure that allows fast microcode changes in the hardware itself, and a programmable lookup engine that allows inline service processing. The chip's programmable QoS engine supports coarse and fine-grained queuing to address the requirements of core, edge, and aggregation use cases.
- **Junos Continuity and Unified In-Service Software Upgrade (Unified ISSU)**—With the Junos continuity plug-in package, you can perform a smooth upgrade when new hardware is installed in your MX Series router.

Unified in-service software upgrade (unified ISSU) enables software upgrades and changes without disrupting network traffic.

- **Junos Telemetry Interface**—Using the Junos telemetry interface data, you can stream component-level data to monitor, analyze, and enhance the performance of the network. Analytics derived from this streaming telemetry can identify current and trending congestion, resource utilization, traffic volume, and buffer occupancy.
- **Integrated Hardware-Based Timing**—You do not need to use external clocks because MX Series routers support highly scalable and reliable hardware-based timing, including Synchronous Ethernet for frequency, and the Precision Time Protocol (PTP) for frequency and phase synchronization. Synchronous Ethernet and PTP can be combined in a hybrid mode to achieve a high level of frequency (10 ppb) and phase (<1.5 uS) accuracy.

[MX5, MX10, MX40, and MX80 Hardware Overview](#)

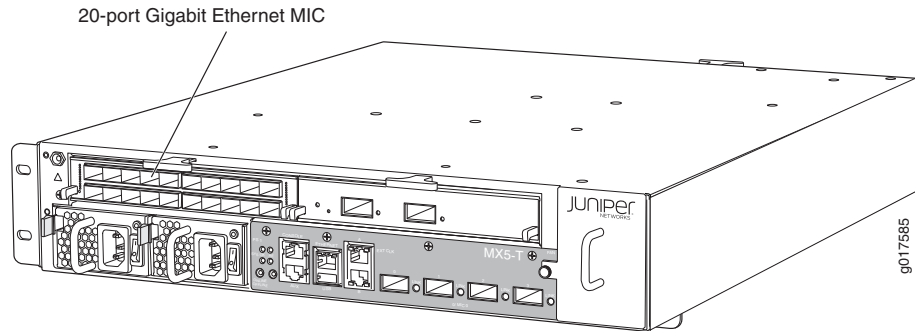
The routers each contain a built-in Routing Engine and one Packet Forwarding Engine. The Packet Forwarding Engine has two “pseudo” Flexible PIC Concentrators (FPC 0 and FPC1). Because there is no switching fabric, the single Packet Forwarding Engine takes care of both ingress and egress packet forwarding.

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

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

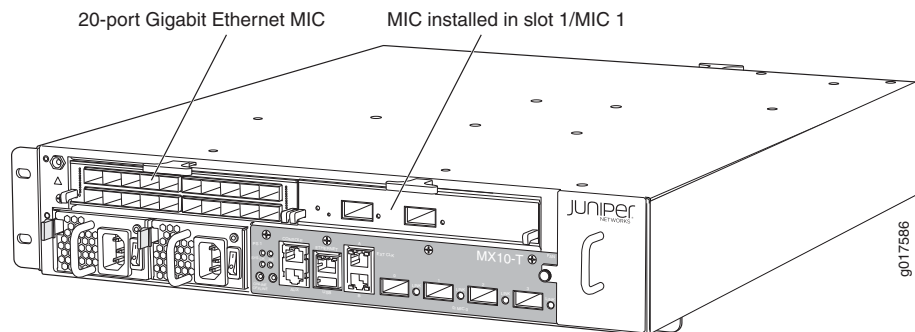
- MX5 router: Allows usage of the MIC slot labeled **1/MIC 0**, which comes prepopulated with the *Gigabit Ethernet MIC with SFP*.

Figure 1: MX5 Router



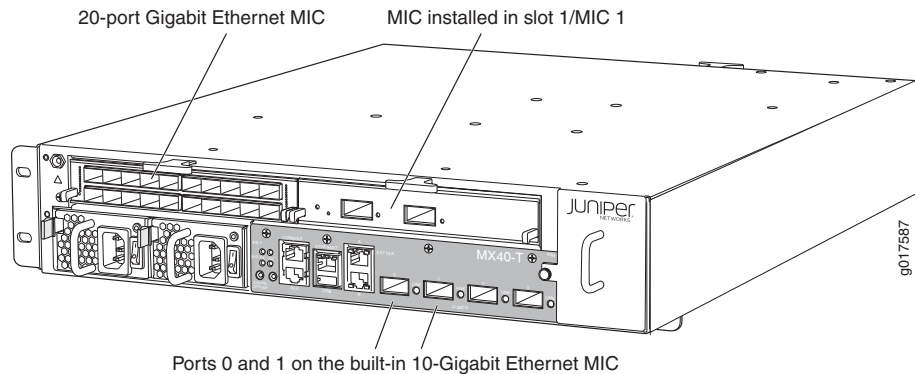
- MX10 router: Allows usage of the MIC slot labeled **1/MIC 0**, which comes prepopulated with the *Gigabit Ethernet MIC with SFP* and the second MIC slot labeled **1/MIC 1**.

Figure 2: MX10 Router



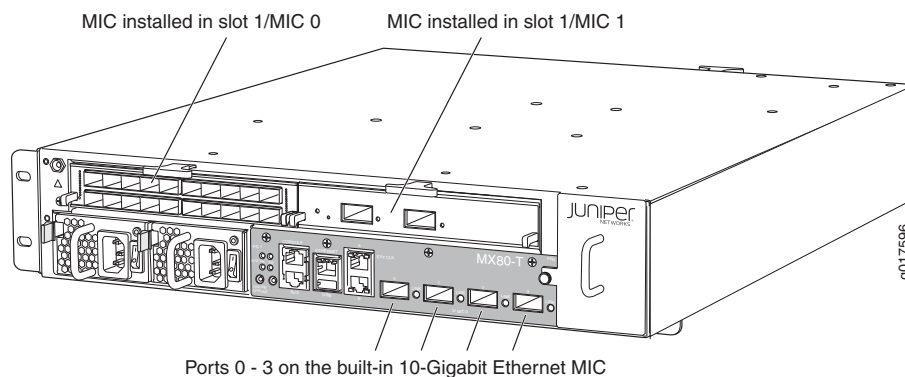
- MX40 router: Allows usage of the front MIC slots and ports **0** and **1** of the built-in 10-Gigabit Ethernet MIC (labeled **0/MIC 0**).

Figure 3: MX40 Router



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

Figure 4: MX80 Router



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

For a list of MICs supported on the MX5, MX10, MX40, and modular MX80 routers, see [“MICs Supported by MX Series Routers”](#) on page 46 in the *MX Series Interface Module Reference*.

MX5, MX10, MX40, and MX80 Router Models

[“MX5, MX10, MX40, and MX80 Routers Physical Specifications”](#) on page 61

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

[Table 3 on page 22](#) lists the different MX5 router models available.

Table 3: MX5 Router Models

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

[Table 4 on page 22](#) lists the different MX10 router models available.

Table 4: MX10 Router Models

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

[Table 5 on page 23](#) lists the different MX40 router models available.

Table 5: MX40 Router Models

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

[Table 6 on page 23](#) lists the different MX80 router models available.

Table 6: MX80 Router Models

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

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

The MX5, MX10, MX40, and MX80 routers support the components in [Table 7 on page 23](#), listed in alphabetic order.

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

Component	Hardware Model Number	CLI Name	Description
Chassis	N/A	<ul style="list-style-type: none"> • MX5 • MX10 • MX40 • MX80 • MX80-P • MX80-T • MX80-48T 	"MX5, MX10, MX40, and MX80 Chassis Description" on page 24

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

Component	Hardware Model Number	CLI Name	Description
Cooling system, including fan trays and air filters			<i>MX5, MX10, MX40, and MX80 Cooling System Description</i>
Air filter kit	FLTR-KIT-MX80	N/A	
Fan tray	FANTRAY-MX80	Fan Tray	
Power system components			"MX5, MX10, MX40, and MX80 Power System Description" on page 32
Power blank cover	PWR-BLANK-MX80	N/A	
Power supply	<ul style="list-style-type: none"> AC: PWR-MX80-AC DC: PWR-MX80-DC 	PEM	
MIC	See <i>MX Series Interface Module Reference</i> .		"MX5, MX10, MX40, and MX80 Modular Interface Card Description" on page 43
MPC	N/A (built-in)	FPC	"MX5, MX10, MX40, and MX80 Modular Interface Card Description" on page 43
Routing Engine	N/A (built-in)	Routing Engine	"MX5, MX10, MX40, and MX80 Routing Engine Description" on page 42
Transceiver	See <i>MX Series Interface Module Reference</i> .	Xcvr	

MX5, MX10, MX40, and MX80 Chassis

- [MX5, MX10, MX40, and MX80 Chassis Description on page 24](#)
- [MX5, MX10, MX40, and MX80 Baseboard Description on page 26](#)
- [MX5, MX10, MX40, and MX80 Cable Management Bracket Description on page 27](#)
- [MX5, MX10, MX40, and MX80 Front Panel Description on page 28](#)
- [Alarm LEDs on the MX5, MX10, MX40, and MX80 Front Panel on page 30](#)
- [Component LEDs on the MX5, MX10, MX40, and MX80 Front Panel on page 30](#)

MX5, MX10, MX40, and MX80 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components (see [Figure 5 on page 25](#), [Figure 6 on page 25](#), [Figure 7 on page 25](#), [Figure 8 on page 26](#), [Figure 9 on page 26](#), and [Figure 10 on page 26](#)). The chassis measures 3.5 in. (8.9 cm) high, 17.5 in. (44.5 cm) wide, and 23.46 in. (59.6 cm) deep. The chassis installs in standard 600-mm deep (or larger) enclosed cabinets, 19-in. equipment racks, or telco open-frame racks.

Figure 5: Front View of the MX5 Router

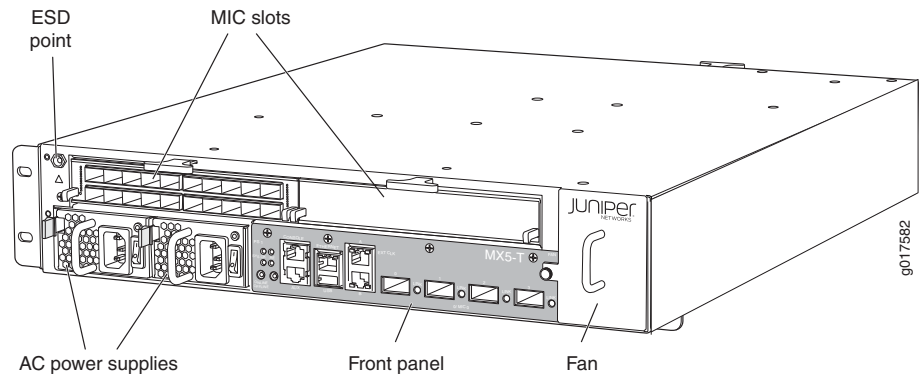


Figure 6: Front View of the MX10 Router

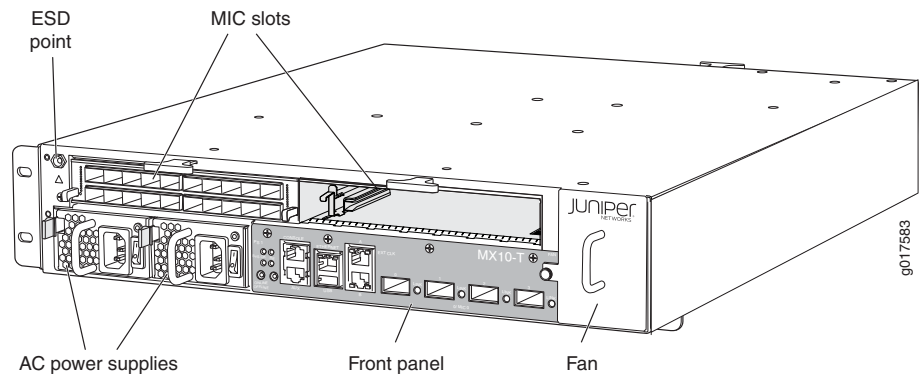


Figure 7: Front View of the MX40 Router

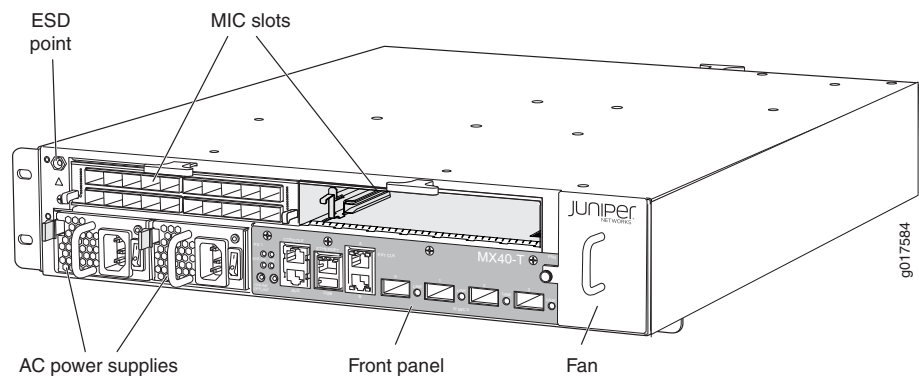


Figure 8: Front View of the MX80 Router (Fixed Chassis)

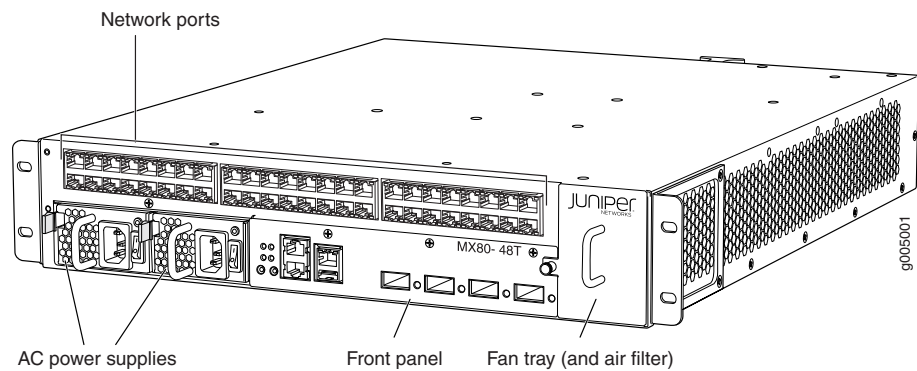


Figure 9: Front View of the MX80 Router (Modular Chassis)

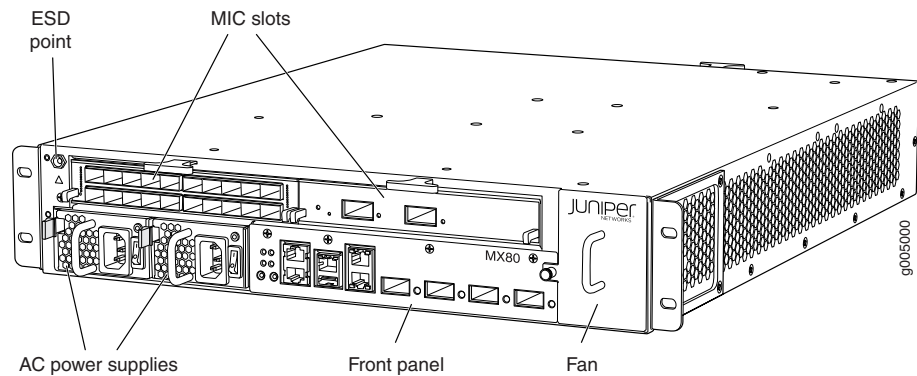
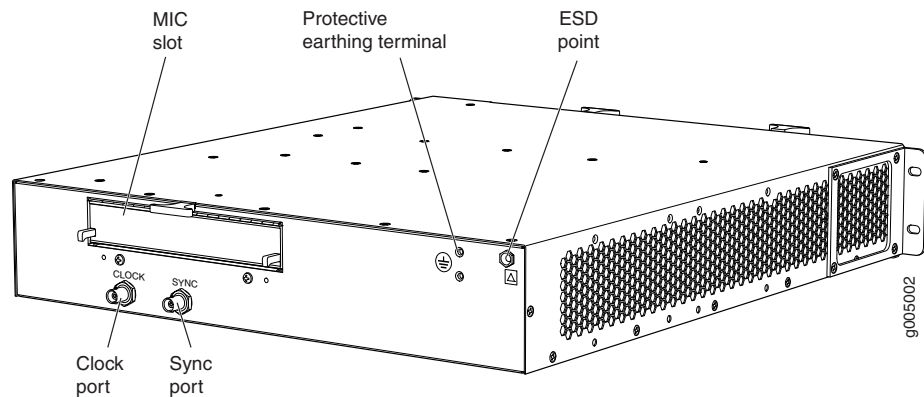


Figure 10: Rear View of the MX5, MX10, MX40, and MX80 Routers



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

MX5, MX10, MX40, and MX80 Baseboard Description

The baseboard is located in the center of the chassis and forms the rear of the MIC card cage. The baseboard is not replaceable. The MICs and power supplies install into the

baseboard from the front of the chassis. Data packets are transferred across the baseboard from the MIC to the Packet Forwarding Engine, and from the Packet Forwarding Engine across the baseboard to the destination MIC.

The baseboard provides the following functions:

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

Baseboard Components

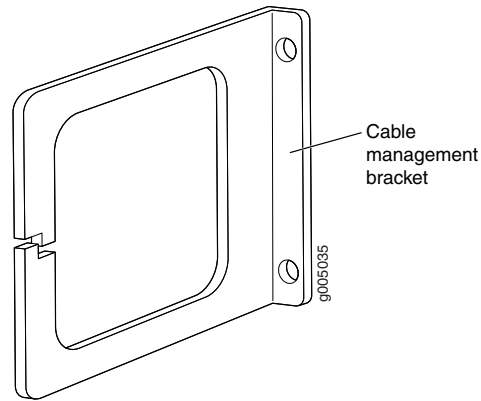
The baseboard consists of the following components:

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

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

The cable management bracket (see [Figure 11 on page 28](#)) consists of plastic dividers and installs on the left side of the chassis. The cable management bracket allows you to route the cables outside the router and away from the MICs.

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



- See Also**
- [Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket on page 79](#)
 - [Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices on page 91](#)
 - [Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers](#)
 - [Maintaining Cables That Connect to MX5, MX10, MX40, and MX80 MICs on page 113](#)

MX5, MX10, MX40, and MX80 Front Panel Description

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

Figure 12: Front Panel on the Fixed MX80 Router

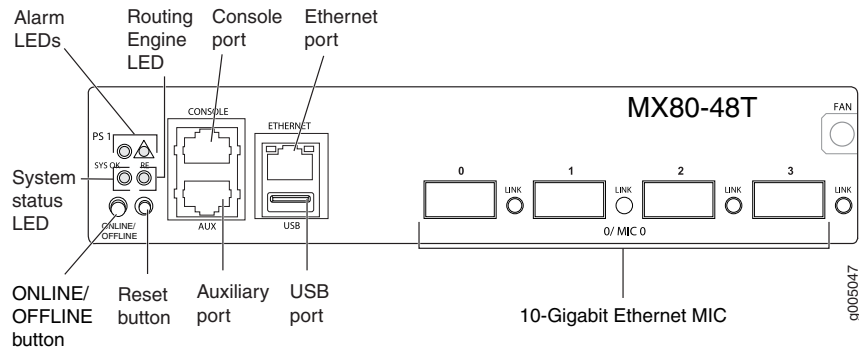
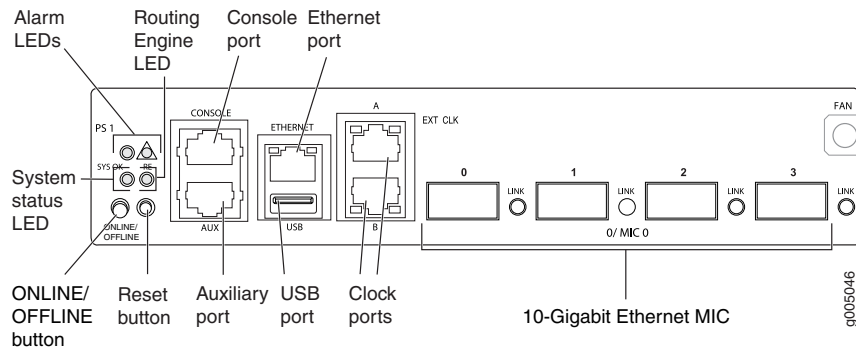


Figure 13: Front Panel on the Modular MX5, MX10, MX40, and MX80 Routers

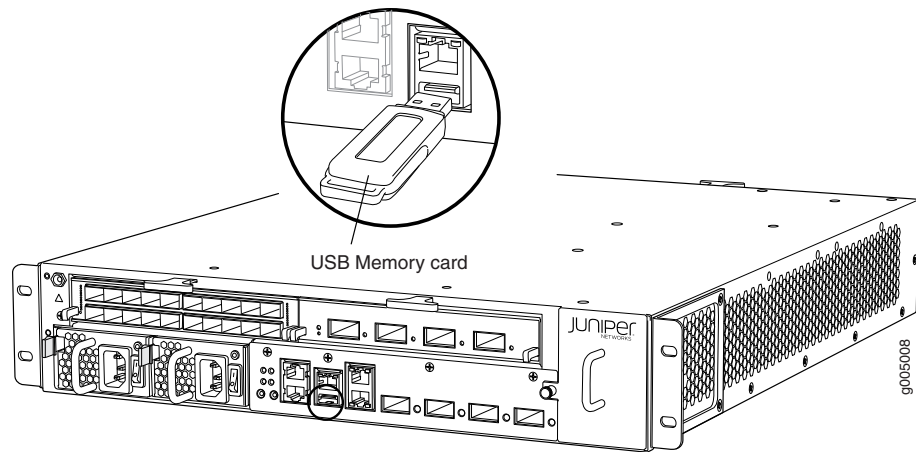


Front Panel Components

Each front panel consists of the following components:

- Interface ports—The **AUX**, **CONSOLE**, and **ETHERNET** ports provide access to management devices. Each Routing Engine has one 1-Gbps Ethernet port for connecting to a management network and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.
- Two ports for primary and secondary BITS clock input—Available on the modular MX80 chassis.
- One fixed 10-Gigabit Ethernet MIC with four ports for uplink connections. For more information see [“MX5, MX10, MX40, and MX80 Modular Interface Card Description” on page 43](#).
- **USB** port—Provides a removable media interface through which you can install the Junos OS manually. (See [Figure 14 on page 30](#).) Junos OS supports USB version 1.0.
- Router online/offline button—Takes the router online or offline when pressed.
- Reset button—Reboots the Routing Engine when pressed.
- LEDs—Indicate component and system status and troubleshooting information at a glance.

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





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

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

Table 8 on page 30 describes the alarm LEDs in more detail.

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

Shape	Color	State	Description
	Red	On steadily	Critical alarm LED—Indicates a critical condition that can cause the router to stop functioning. Possible causes include component removal, failure, or overheating.
	Yellow	On steadily	Warning alarm LED—Indicates a serious but nonfatal error condition, such as a maintenance alert or a significant increase in component temperature.

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

- Link LEDs on the Front Panel on page 30
- Routing Engine LED on the Front Panel on page 31
- System LED on the Front Panel on page 31

Link LEDs on the Front Panel

The front panel has a 10-Gigabit Ethernet MIC with four ports for uplink connections. Each port has one **LINK** LED located to the right of the port. Table 9 on page 31 describes the link LEDs in more detail.

Table 9: Link LEDs on the Front Panel

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

Routing Engine LED on the Front Panel

One LED on the left side of the front panel indicates the status of the Routing Engine. The LED is located below the **RE** label. [Table 10 on page 31](#) describes the Routing Engine LED in more detail.

Table 10: Routing Engine LED on the Front Panel

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

System LED on the Front Panel

One LED on the left side of the front panel indicates the status of the router. The LED is located below the **SYS OK** label. [Table 11 on page 31](#) describes the system LED in more detail.

Table 11: System LED on the Front Panel

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

- See Also**
- [Troubleshooting Resources for MX5, MX10, MX40, and MX80 Routers on page 127](#)
 - [Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray on page 129](#)
 - [Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 130](#)
 - [Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies on page 130](#)

MX5, MX10, MX40, and MX80 Power System

- [MX5, MX10, MX40, and MX80 Power System Description on page 32](#)
- [MX5, MX10, MX40, and MX80 Power Supply LED on page 34](#)

- [MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 35](#)
- [Power Consumption for an AC-Powered MX5, MX10, MX40, and MX80 Router on page 35](#)
- [AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router on page 37](#)
- [AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers on page 37](#)
- [MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 39](#)
- [Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router on page 39](#)
- [DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 41](#)
- [DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 41](#)
- [DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 41](#)

MX5, MX10, MX40, and MX80 Power System Description

The MX5, MX10, MX40, and MX80 routers use either AC or DC power supplies (see [Figure 15 on page 33](#) and [Figure 16 on page 33](#)). The router contains either one or two power supplies located at the front of the chassis in slots **PS0** and **PS1** (right to left). Each power supply has a handle, an ejection lever, a power switch, and a status LED. The power supplies connect to the baseboard, which distributes the different output voltages produced by the power supplies to the router components, depending on their voltage requirements. When two power supplies are present, they share power almost equally within a fully populated system. If one power supply in a redundant configuration fails or is removed, the remaining power supply assumes the entire electrical load without interruption. A single power supply provides the maximum configuration with full power for as long as the router is operational. A second power supply can be installed for redundancy. Each power supply is cooled by its own internal cooling system.

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



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



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

Figure 15: AC Power Supplies Installed in an MX5, MX10, MX40, and MX80 Router

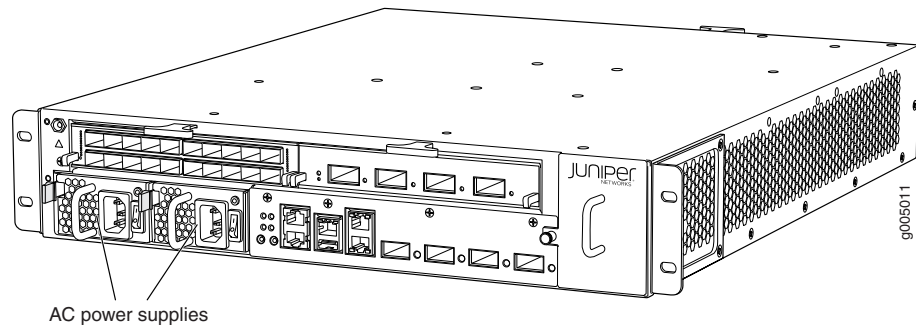
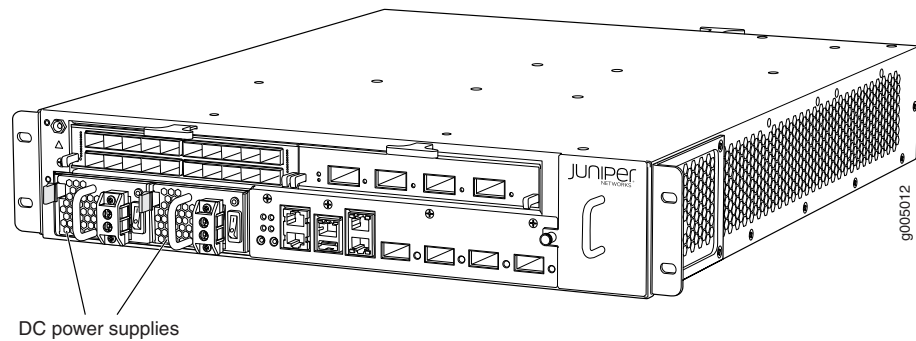


Figure 16: DC Power Supplies Installed in an MX5, MX10, MX40, and MX80 Router



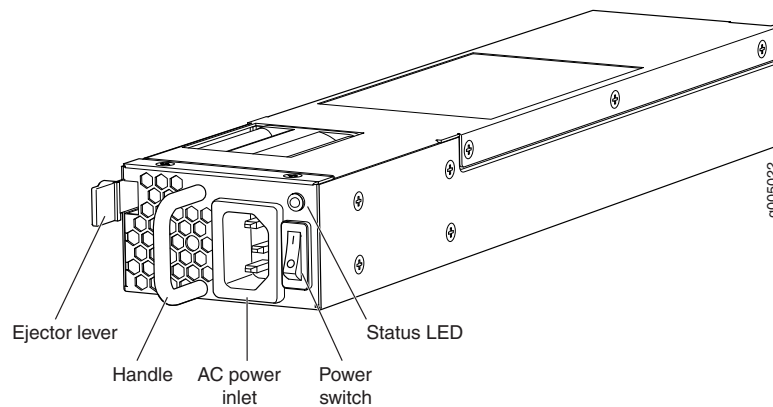
- [AC Power Supply Description on page 33](#)
- [DC Power Supply Description on page 34](#)

AC Power Supply Description

Each AC power supply weighs approximately 2.6 lb (1.18 kg) and consists of a handle, an ejection lever, an AC appliance inlet, an AC input switch, a fan, and an LED to monitor the status of the power supply. [Figure 17 on page 34](#) shows the power supply.

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

Figure 17: AC Power Supply

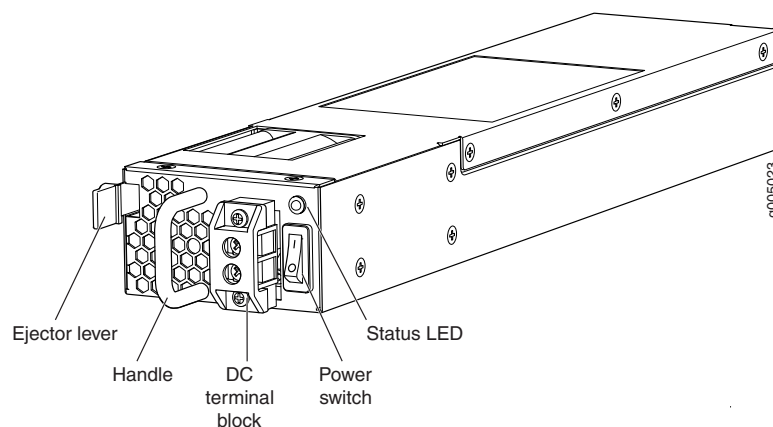


WARNING: The router is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for SAE 10-32 ground screws) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal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

DC Power Supply Description

Each DC power supply has a handle, an ejection lever, a power switch, a status LED, and a terminal block that provides a single DC input (-48 VDC and return) that requires a dedicated customer site circuit breaker. We recommend that you use a dedicated customer site circuit breaker rated for 13 A (-48 VDC) minimum, or as required by local code. Figure 18 on page 34 shows the power supply.

Figure 18: DC Power Supply



MX5, MX10, MX40, and MX80 Power Supply LED

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

Table 12: Power Supply LED

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

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

Table 13 on page 35 lists the AC power system electrical specifications.

Table 13: AC Power System Electrical Specifications

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

Table 14 on page 35 lists the AC power supply electrical specifications.

Table 14: AC Power Supply Electrical Specifications

Item	Specification
Maximum output power	500 W
AC input voltage	Operating range: 90 to 264 VAC (nominal)
AC input line frequency	50 to 60 Hz (nominal)
AC input current rating	6 A @ 110 VAC or 3 A @ 220 VAC maximum

- See Also**
- [AC Power Electrical Safety Guidelines and Warnings for MX5, MX10, MX40, and MX80 Routers on page 167](#)

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

To allow for future growth so that you can operate the router in any hardware configuration without upgrading the power infrastructure, we recommend that you provision 6 A @ 110 VAC (660 W) or 3 A @ 220 VAC (660 W) for each input.

[Table 15 on page 36](#) and [Table 16 on page 36](#) list the power requirements for base AC-powered routers operating under typical voltage conditions.

If you do not plan to provision 6 A @ 110 VAC (660 W) or 3 A @ 220 VAC (660 W) for each input, you can use the information in [Table 15 on page 36](#), [Table 16 on page 36](#), and [Table 17 on page 36](#) to calculate the power consumption and thermal output for your hardware configuration.

Table 15: AC Base Router Power Requirements for the Fixed MX5, MX10, MX40, and MX80 Routers

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

Table 16: AC Base Router Power Requirements for the Modular MX5, MX10, MX40, and MX80 Routers

Modular Chassis Configuration	Power Requirement (Watts)	Power Requirement (Watts) with 85% Efficiency
Chassis running at high activity, with four 10-Gigabit Ethernet XFPs, two MICs, and fans running at high speed	310 W	365 W
Chassis running at high activity without the two MICs	240 W	282 W

[Table 17 on page 36](#) lists the power requirements for various hardware components when the router is operating under typical voltage conditions.

Table 17: Component Power Requirements

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

These examples use generalized values per MIC. For exact MIC power requirements, see the [MX Series Interface Module Reference](#).

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

- Active AC-powered router with one MIC:

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

- Active AC-powered router with two MICs:

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

- Example of calculating system thermal output:

Watts AC PEM * 3.41 = BTU/hr
 $500\text{ W} * 3.41 = 1,705\text{ BTU/hr}$

- See Also**
- [Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 114](#)
 - [Replacing an MX5, MX10, MX40, and MX80 AC Power Supply on page 115](#)

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

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

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

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

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

[Table 18 on page 37](#) provides specifications on the AC power cord provided for each country or region.

Table 18: AC Power Cord Specifications

Country	Model Number	Electrical Specification	Plug Type
Australia	CBL-JX-PWR-AU	250 VAC, 10 A, 50 Hz	AS/NZ 3112-1993

Table 18: AC Power Cord Specifications (continued)

Country	Model Number	Electrical Specification	Plug Type
China	CBL-JX-PWR-CH	250 VAC, 10 A, 50 Hz	GB2099.1 1996 and GB1002 1996 (CHI-10P)
Europe (except Italy and United Kingdom)	CBL-JX-PWR-EU	250 VAC, 10 A, 50 Hz	CEE (7) VII
Italy	CBL-JX-PWR-IT	250 VAC, 10 A, 50 Hz	CEI 23-16/VII
Japan	CBL-JX-PWR-JP	125 VAC, 12 A, 50 Hz or 60 Hz	JIS 8303
North America	CBL-JX-PWR-US	125 VAC, 10 A, 60 Hz	NEMA 5-15
United Kingdom	CBL-JX-PWR-UK	250 VAC, 10 A, 50 Hz	BS 1363A



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



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

注意

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

9017253



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



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



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

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

Table 19 on page 39 lists the DC power system electrical specifications.

Table 19: DC Power System Electrical Specifications

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

Table 20 on page 39 lists the DC power supply electrical specifications.

Table 20: DC Power Supply Electrical Specifications

Item	Specification
Maximum output power	500 W
DC input voltage	Minimum: –40 VDC Nominal: –48 VDC, –60 VDC Operating range: –40 to –72 VDC
DC input current rating	13 A @ –48 VDC

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

To allow for future growth so that you can operate the router in any hardware configuration without upgrading the power infrastructure, we recommend that you provision at least 13 A @ –48 VDC for each input.

Table 21 on page 40 and Table 22 on page 40 list the power requirements for base DC-powered routers operating under typical voltage conditions.

If you do not plan to provision at least 13 A @ –48 VDC per input, you can use the information in Table 21 on page 40, Table 22 on page 40, and Table 23 on page 40 to calculate the power consumption @ –48 VDC and thermal output for your hardware configuration.

Table 21: DC-Powered Base Router Power Requirements for the Fixed MX80 Router

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

Table 22: DC-Powered Base Router Power Requirements for the MX5, MX10, MX40, and Modular MX80 Router

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

Table 23 on page 40 lists the power requirements for various hardware components when the router is operating under typical voltage conditions.

Table 23: Component Power Requirements for DC-Powered Routers

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

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

Typical power consumption for modular DC-powered routers:

- Active DC-powered router with one MIC:

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

- Active DC-powered router with two MICs:

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

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

$$(-54 \text{ VDC input}) * (\text{input current } X) = (-48 \text{ VDC input}) * (\text{input current } Y)$$

$$54 * X = 48 * 13 \text{ A}$$

$$X = 48 * 13 \text{ A} / 54 = 11.5 \text{ A}$$

- Example of calculating system thermal output:

$$\text{Watts DC} * 3.41 = \text{BTU/hr}$$

$$500 * 3.41 = 1,705 \text{ BTU/hr}$$

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

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

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

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

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



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



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



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

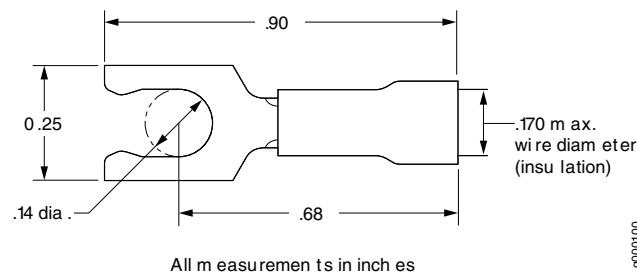
DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers

- DC Power Cable Lug Specifications on page 42
- DC Power Cable Specifications on page 42

DC Power Cable Lug Specifications

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

Figure 19: DC Power Cable Lug



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

DC Power Cable Specifications

You must supply four DC power cables that meet the following specifications: 16-AWG (1.3 mm²), minimum 60° C wire, or as required by the local code.

MX5, MX10, MX40, and MX80 Host Subsystem

- [MX5, MX10, MX40, and MX80 Routing Engine Description on page 42](#)
- [MX5, MX10, MX40, and MX80 Routing Engine LED on page 43](#)

MX5, MX10, MX40, and MX80 Routing Engine Description

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

The Routing Engine consists of the following components:

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

- See Also**
- [Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 97](#)
 - `show chassis routing-engine`

MX5, MX10, MX40, and MX80 Routing Engine LED

The Routing Engine LED appears on the left of the front panel and is labeled **RE**. For more information see “Component LEDs on the MX5, MX10, MX40, and MX80 Front Panel” on page 30.

MX5, MX10, MX40, and MX80 Interface Modules

- [MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 43](#)
- [MICs Supported by MX Series Routers on page 46](#)
- [MX5, MX10, MX40, and MX80 Port and Interface Numbering on page 54](#)
- [MX5, MX10, MX40, and MX80 Modular Interface Card LEDs on page 57](#)

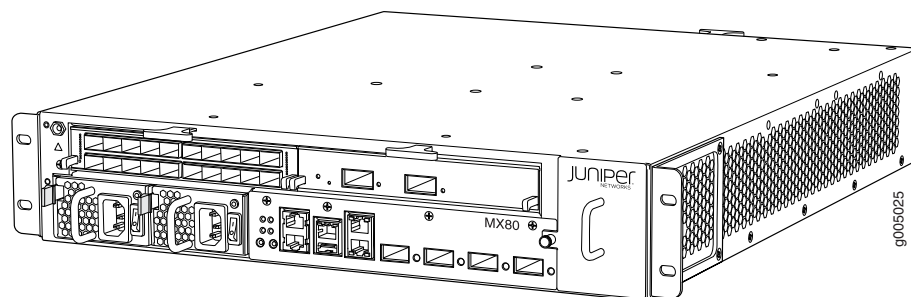
MX5, MX10, MX40, and MX80 Modular Interface Card Description

Modular Interface Cards (MICs) provide the physical connections to various network media types. MICs receive incoming packets from the network and transmit outgoing packets to the network. During this process, each MIC performs framing and high-speed signaling for its media type. Before transmitting outgoing data packets through the MIC interfaces, the router encapsulates the packets received.

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

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

Figure 20: MICs Installed in an MX5, MX10, MX40, and MX80 Router



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

- [Front-Pluggable MICs on page 43](#)
- [Fixed \(Built-in\) MICs on page 44](#)

Front-Pluggable MICs

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

You can install MICs of different media types as long as the router supports those MICs. For complete specifications, see [“MICs Supported by MX Series Routers” on page 46](#).

Fixed (Built-in) MICs

Built-in 10-Gigabit Ethernet MIC

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

Hardware features:

- Four 10-Gigabit Ethernet ports labeled **O** through **3**, left to right.
- High-performance throughput on each port at speeds up to 10 Gbps
- Line-rate on all four 10-Gigabit Ethernet ports
- LAN-PHY mode at 10.3125 Gbps
- WAN-PHY mode at 9.953 Gbps
- Maximum transmission units (MTUs) of up to 9192 bytes
- Link LED, one green per port. For more information, see [“Component LEDs on the MX5, MX10, MX40, and MX80 Front Panel” on page 30](#).

Software features:

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

Cables and connectors:

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

- 10GBASE-S (model number: XFP-10G-S)
- 10GBASE-Z (model number: XFP-10G-Z-OC192-LR2)

Optical interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct>

- DWDM Tunable XFP transceivers:
 - Connector: Duplex LC/PC (Rx and Tx)
 - 10GBASE-ZR (model number: XFP-10G-CBAND-T50-ZR)

DWDM supported wavelengths—see *10-Gigabit Ethernet DWDM Transceiver (XFP-10G-CBAND-T50-ZR) Wavelengths*



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

Optical interface specifications—see the Hardware Compatibility Tool at <https://apps.juniper.net/hct>

Built-in Tri-Rate MIC

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

- 48 autonegotiating 10Base-T, 100Base-TX, or 1000Base-T Megabit Ethernet ports.
- Autonegotiation between Gigabit Ethernet circuit partners.
- Maximum transmission units (MTUs) of up to 9192 bytes.
- Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector.
- Pinout: MDI/MDI-X.
- Maximum distance: 328 ft (100 m).
- Link LED, one green per port. For more information, see “MX5, MX10, MX40, and MX80 Modular Interface Card LEDs” on page 57.

- See Also**
- [Maintaining the MX5, MX10, MX40, and MX80 MICs on page 103](#)
 - [Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 130](#)
 - [Replacing an MX5, MX10, MX40, and MX80 MIC on page 104](#)

MICs Supported by MX Series Routers

The following tables list the first supported Junos OS release for the MX Series.

- [Table 24 on page 46](#) lists the first supported Junos OS release for MICs on MX240, MX480, MX960, and MX2008 routers.
- [Table 25 on page 48](#) lists the first supported Junos OS release for MICs on MX2010 and MX2020 routers.
- [Table 26 on page 50](#) list the first supported Junos OS release for MICs on MX5, MX10, and MX40 routers.
- [Table 27 on page 52](#) lists the first supported Junos OS release for MICs on MX80 and MX104 routers.
- [Table 28 on page 53](#) lists the first supported Junos OS release for MICs on MX10003 router.

Table 24: MICs Supported by MX240, MX480, MX960 and MX2008 Routers

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
ATM				
<i>ATM MIC with SFP</i>	MIC-3D-8OC3-2OC12-ATM	8	12.1	15.1F7
DS3/E3				
<i>DS3/E3 MIC</i>	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	15.1F7
Circuit Emulation				
<i>Channelized E1/T1 Circuit Emulation MIC</i>	MIC-3D-16CHE1-T1-CE	16	12.3	15.1F7
Gigabit Ethernet				
<i>Gigabit Ethernet MIC with SFP</i>	MIC-3D-20GE-SFP	20	10.1	15.1F7
<i>Gigabit Ethernet MIC with SFP (E)</i>	MIC-3D-20GE-SFP-E	20	13.3	15.1F7
<i>Gigabit Ethernet MIC with 256b-AES MACSEC</i>	MIC-MACSEC-20GE	20	18.3	-
10-Gigabit Ethernet				
<i>10-Gigabit Ethernet MICs with XFP</i>	MIC-3D-2XGE-XFP	2	10.2	15.1F7
<i>10-Gigabit Ethernet MICs with XFP</i>	MIC-3D-4XGE-XFP	4	10.1	15.1F7

Table 24: MICs Supported by MX240, MX480, MX960 and MX2008 Routers (continued)

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
10-Gigabit Ethernet MIC with SFP+ (10 Ports)	MIC3-3D-10XGE-SFPP	10	12.3	15.1F7
10-Gigabit Ethernet MIC with SFP+ (24 Ports)	MIC6-10G	24	-	15.1F7
10-Gigabit Ethernet OTN MIC with SFP+ (24 Ports)	MIC6-10G-OTN	24	-	15.1F7
40-Gigabit Ethernet				
40-Gigabit Ethernet MIC with QSFP+	MIC3-3D-2X40GE-QSFPP	2	12.2	15.1F7
100-Gigabit Ethernet				
100-Gigabit Ethernet MIC with CFP	MIC3-3D-1X100GE-CFP	1	12.1	15.1F7
100-Gigabit Ethernet MIC with CXP	MIC3-3D-1X100GE-CXP	1	12.2	15.1F7
100-Gigabit Ethernet MIC with CXP (4 Ports)	MIC6-100G-CXP	4	-	15.1F7
100-Gigabit Ethernet MIC with CFP2	MIC6-100G-CFP2	2	-	15.1F7
100-Gigabit DWDM OTN				
100-Gigabit DWDM OTN MIC with CFP2-ACO	MIC3-100G-DWDM	1	15.1F5 15.1F6 17.1R1	15.1F7
Multi-Rate				
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4OC3OC12-1OC48	4	11.2	15.1F7
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8OC3OC12-4OC48	8	11.2	15.1F7
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4CHOC3-2CHOC12	4	11.4	15.1F7
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8CHOC3-4CHOC12	8	11.4	15.1F7

Table 24: MICs Supported by MX240, MX480, MX960 and MX2008 Routers (continued)

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
<i>Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP</i>	MIC-3D-4COC3-1COC12-CE	4	12.2	15.1F7
<i>MIC MRATE (12-Port Multi-Rate MIC with QSFP+)</i>	MIC-MRATE	12	-	15.1F7
<i>Multi-Rate Ethernet MIC (12-Port Multi-Rate MACsec MIC with QSFP+)</i>	MIC-MACSEC-MRATE	12		17.4
Tri-Rate				
<i>Tri-Rate MIC</i>	MIC-3D-40GE-TX	40	10.2	15.1F7
Services				
<i>Multiservices MIC</i>	MS-MIC-16G	0	13.2	15.1F7
SONET/SDH				
<i>SONET/SDH OC192/STM64 MIC with XFP</i>	MIC-3D-1OC192-XFP	1	12.2	15.1F7

Table 25: MICs Supported by MX2010 and MX2020 Routers

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
ATM				
<i>ATM MIC with SFP</i>	MIC-3D-8OC3-2OC12-ATM	8	12.3	12.3
DS3/E3				
<i>DS3/E3 MIC</i>	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	12.3	12.3
Circuit Emulation				
<i>Channelized E1/T1 Circuit Emulation MIC</i>	MIC-3D-16CHE1-T1-CE	16	-	-
Gigabit Ethernet				
<i>Gigabit Ethernet MIC with SFP</i>	MIC-3D-20GE-SFP	20	12.3	12.3
<i>Gigabit Ethernet MIC with SFP (E)</i>	MIC-3D-20GE-SFP-E	20	13.3	13.3
10-Gigabit Ethernet				

Table 25: MICs Supported by MX2010 and MX2020 Routers (continued)

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
<i>10-Gigabit Ethernet MICs with XFP</i>	MIC-3D-2XGE-XFP	2	12.3	12.3
<i>10-Gigabit Ethernet MICs with XFP</i>	MIC-3D-4XGE-XFP	4	12.3	12.3
<i>10-Gigabit Ethernet MIC with SFP+ (10 Ports)</i>	MIC3-3D-10XGE-SFPP	10	12.3	12.3
<i>10-Gigabit Ethernet MIC with SFP+ (24 Ports)</i>	MIC6-10G	24	13.3R2	13.3R2
<i>10-Gigabit Ethernet OTN MIC with SFP+ (24 Ports)</i>	MIC6-10G-OTN	24	13.3R3	13.3R3
40-Gigabit Ethernet				
<i>40-Gigabit Ethernet MIC with QSFP+</i>	MIC3-3D-2X40GE-QSFPP	2	12.3	12.3
100-Gigabit Ethernet				
<i>100-Gigabit Ethernet MIC with CFP</i>	MIC3-3D-1X100GE-CFP	1	12.3	12.3
<i>100-Gigabit Ethernet MIC with CXP</i>	MIC3-3D-1X100GE-CXP	1	12.3	12.3
<i>100-Gigabit Ethernet MIC with CXP (4 Ports)</i>	MIC6-100G-CXP	4	13.3R2	13.3R2
<i>100-Gigabit Ethernet MIC with CFP2</i>	MIC6-100G-CFP2	2	13.3R3	13.3R3
100-Gigabit DWDM OTN				
<i>100-Gigabit DWDM OTN MIC with CFP2-ACO</i>	MIC3-100G-DWDM	1	15.1F5 15.1F6 17.1R1	15.1F5 15.1F6 17.1R1
Multi-Rate				
<i>SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-4OC3OC12-1OC48	4	12.3	12.3
<i>SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-8OC3OC12-4OC48	8	12.3	12.3
<i>Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-4CHOC3-2CHOC12	4	12.3	12.3

Table 25: MICs Supported by MX2010 and MX2020 Routers (continued)

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
<i>Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-8CHOC3-4CHOC12	8	12.3	12.3
<i>Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP</i>	MIC-3D-4COC3-1COC12-CE	4	12.3	12.3
<i>MIC MRATE (12-Port Multi-Rate MIC with QSFP+)</i>	MIC-MRATE	12	<ul style="list-style-type: none"> 15.1F5 with Junos Continuity 16.1R1 and later 	<ul style="list-style-type: none"> 15.1F5 with Junos Continuity 16.1R1 and later
<i>Multi-Rate Ethernet MIC (12-Port Multi-Rate MACsec MIC with QSFP+)</i>	MIC-MACSEC-MRATE	12	17.4	17.4
Tri-Rate				
<i>Tri-Rate MIC</i>	MIC-3D-40GE-TX	40	12.3	12.3
Services				
<i>Multiservices MIC</i>	MS-MIC-16G	0	13.2	13.2
SONET/SDH				
<i>SONET/SDH OC192/STM64 MIC with XFP</i>	MIC-3D-1OC192-XFP	1	12.3	12.3

Table 26: MICs Supported by MX5, MX10, and MX40 Routers

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40
ATM					
<i>ATM MIC with SFP</i>	MIC-3D-8OC3-2OC12-ATM	8	12.1	12.1	12.1
DS3/E3					
<i>DS3/E3 MIC</i>	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	11.4	11.4
Circuit Emulation					
<i>Channelized E1/T1 Circuit Emulation MIC</i>	MIC-3D-16CHE1-T1-CE	16	13.2R2	13.2R2	13.2R2
<i>Channelized E1/T1 Circuit Emulation MIC (H)</i>	MIC-3D-16CHE1-T1-CE-H	16	–	–	–
Gigabit Ethernet					
<i>Gigabit Ethernet MIC with SFP</i>	MIC-3D-20GE-SFP	20	11.2R4	11.2R4	11.2R4

Table 26: MICs Supported by MX5, MX10, and MX40 Routers (continued)

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40
<i>Gigabit Ethernet MIC with SFP (E)</i>	MIC-3D-20GE-SFP-E	20	13.2R2	13.2R2	13.2R2
<i>Gigabit Ethernet MIC with SFP (EH)</i>	MIC-3D-20GE-SFP-EH	20	–	–	–
10-Gigabit Ethernet					
<i>10-Gigabit Ethernet MICs with XFP</i>	MIC-3D-2XGE-XFP	2	11.2R4	11.2R4	11.2R4
Multi-Rate					
<i>SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-4OC3OC12-1OC48	4	11.2R4	11.2R4	11.2R4
<i>SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-8OC3OC12-4OC48	8	11.2R4	11.2R4	11.2R4
<i>Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-4CHOC3-2CHOC12	4	11.4	11.4	11.4
<i>Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-8CHOC3-4CHOC12	8	11.4	11.4	11.4
<i>Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP</i>	MIC-3D-4COC3-1COC12-CE	4	12.2	12.2	12.2
<i>Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP (H)</i>	MIC-4COC3-1COC12-CE-H	–	–	–	–
Tri-Rate					
<i>Tri-Rate MIC</i>	MIC-3D-40GE-TX	40	–	11.2R4	11.2R4
Services					
<i>Multiservices MIC</i>	MS-MIC-16G	0	13.2 Rear slot only.	13.2 Rear slot only.	13.2 Rear slot only.
<i>SONET/SDH OC192/STM64 MIC with XFP</i>	MIC-3D-1OC192-XFP	1	12.2	12.2	12.2

Table 27: MICs Supported by MX80 and MX104 Routers

MIC Name	MIC Model Number	Ports	MX80	MX104
ATM				
<i>ATM MIC with SFP</i>	MIC-3D-8OC3-2OC12-ATM	8	12.1	13.3
DS3/E3				
<i>DS3/E3 MIC</i>	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	13.3
Circuit Emulation				
<i>Channelized E1/T1 Circuit Emulation MIC</i>	MIC-3D-16CHE1-T1-CE	16	13.2R2	13.2R2
<i>Channelized E1/T1 Circuit Emulation MIC (H)</i>	MIC-3D-16CHE1-T1-CE-H	16	–	13.2R2
Gigabit Ethernet				
<i>Gigabit Ethernet MIC with SFP</i>	MIC-3D-20GE-SFP	20	10.2	13.2R2
<i>Gigabit Ethernet MIC with SFP (E)</i>	MIC-3D-20GE-SFP-E	20	13.2R2	13.2R2
<i>Gigabit Ethernet MIC with SFP (EH)</i>	MIC-3D-20GE-SFP-EH	20	–	13.2R2
<i>Gigabit Ethernet MIC with 256b-AES MACSEC</i>	MIC-MACSEC-20GE	20	18.3	18.3
<i>10-Gigabit Ethernet MICs with XFP</i>	MIC-3D-2XGE-XFP	2	10.2	13.2R2
Multi-Rate				
<i>SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-4OC3OC12-1OC48	4	11.2	13.3
<i>SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-8OC3OC12-4OC48	8	11.2	13.3
<i>Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-4CHOC3-2CHOC12	4	11.4	13.3
<i>Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP</i>	MIC-3D-8CHOC3-4CHOC12	8	11.4	13.3
<i>Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP</i>	MIC-3D-4COC3-1COC12-CE	4	12.2	13.2R2

Table 27: MICs Supported by MX80 and MX104 Routers (continued)

MIC Name	MIC Model Number	Ports	MX80	MX104
<i>Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP (H)</i>	MIC-4COC3-1COC12-CE-H	-	-	13.2R2
Tri-Rate				
<i>Tri-Rate MIC</i>	MIC-3D-40GE-TX	40	10.2	13.2R2
Services				
<i>Multiservices MIC</i>	MS-MIC-16G	0	13.2	13.3R2
			Rear slot only. Supported on the modular MX80 and fixed MX80-48T	NOTE See From Junos OS 13.3R3, 14.1R2, and 14.2R1, MX104 supports only two Multiservices MICs.
SONET/SDH				
<i>SONET/SDH OC192/STM64 MIC with XFP</i>	MIC-3D-1OC192-XFP	1	12.2	13.3

Table 28: MICs Supported by MX10003 Router

MIC Name	MIC Model Number	Ports	MX10003
Multi-Rate			
<i>Multi-Rate Ethernet MIC (12-Port Multi-Rate MIC with QSFP+)</i>	JNP-MIC1	12	17.3
<i>Multi-Rate Ethernet MIC (12-Port Multi-Rate MACsec MIC with QSFP+)</i>	JNP-MIC1-MACSEC	12	17.3R2

- See Also**
- *MX Series MIC Overview*
 - *MIC/MPC Compatibility*

MX5, MX10, MX40, and MX80 Port and Interface Numbering

In the physical part of the interface name, a hyphen (-) separates the media type from the MPC number (represented as an **FPC** in the CLI), and a slash (/) separates the logical PIC and port numbers:

type-fpc/pic/port

- *type*—Media type, which identifies the network device. For example:
 - *ge*—Gigabit Ethernet interface
 - *so*—SONET/SDH interface
 - *xe*—10-Gigabit Ethernet interface

For a complete list of media types, see *Interface Naming Overview* in the *MX Series Interface Module Reference* guide.

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



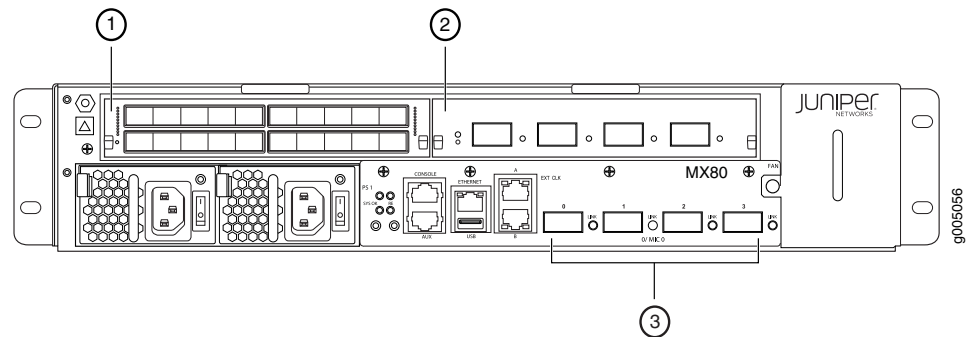
NOTE: The MIC number is not included in the interface name.

- [Port and Interface Numbering on the MX5, MX10, MX40, and MX80 Routers on page 54](#)
- [Port and Interface Numbering on MX80-48T Routers on page 56](#)

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

Each modular MX5, MX10, MX40, and MX80 router is capable of having the components shown in [Figure 21 on page 55](#).

Figure 21: MX5, MX10, MX40, and MX80 Interface Port Mapping



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

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

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

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

MX80 series routers also contain a MIC slot in the rear of the chassis that supports the optional Juniper Networks *Multiservices MIC*. The Multiservices MIC installed in the rear MIC slot is represented in the CLI as **FPC 0**, **MIC 1**, and **PIC 2**. The port number for the rear slot in the MX80 chassis is 0.

The port numbers on the MICs correspond to the port numbers in the interface. See the [MX Series Interface Module Reference](#) for more information on specific MICs.

[Table 29 on page 55](#) summarizes the relationship between the components and the interface names.

Table 29: MX5, MX10, MX40, and MX80 Components and Their Interface Names

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

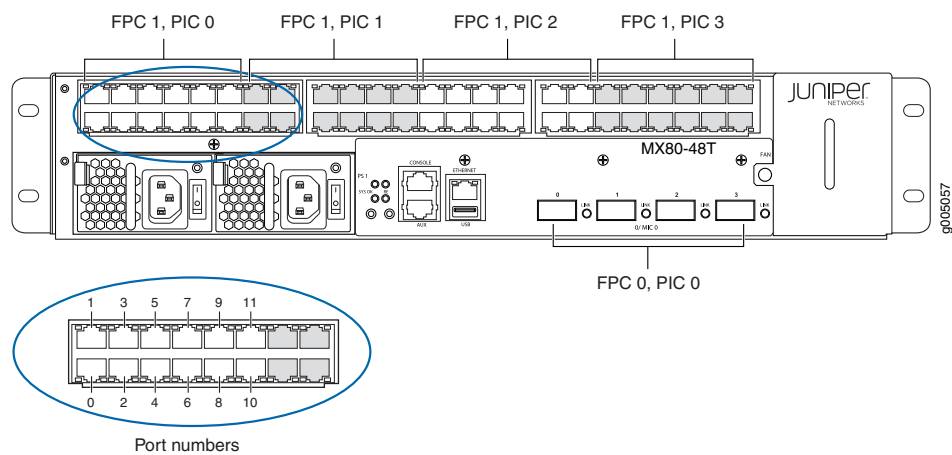
Table 29: MX5, MX10, MX40, and MX80 Components and Their Interface Names (continued)

Component	Name in the CLI	Interface Names
Multiservices MIC installed in the rear of the chassis (no external ports)	MS-MIC-16G	ge/0/2/0 <i>Type = ms</i> <i>fpc = 0</i> <i>pic = 2</i> <i>port = 0</i>

Port and Interface Numbering on MX80-48T Routers

Each MX80-48T router contains two built-in MPCs, which are represented in the CLI as **FPC 0** and **FPC 1** (see [Figure 22 on page 56](#)).

Figure 22: MX80-48T Interface Port Mapping



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

MPC 1 (**FPC 1**) contains a 48-port Tri-Rate MIC and is built into the front of the chassis. The MIC is represented as **MIC 0** in the CLI and is logically divided into four PICs, which are numbered 0 through 3. Each logical PIC on the built-in Tri-Rate MIC contains twelve ports, which are numbered 0 through 11 (see [Figure 22 on page 56](#)).

[Table 30 on page 56](#) summarizes the relationship between the components and the interface names.

Table 30: MX80-48T Components and Interface Names

Component	Name in the CLI	Interface Names
Built-in 4-port 10-Gigabit Ethernet MIC	4x 10GE XFP	xe-0/0/0 through xe-0/0/3

Table 30: MX80-48T Components and Interface Names (continued)

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

See Also • [MX5, MX10, MX40, and MX80 Hardware Components and CLI Terminology on page 23](#)

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

The fixed 10-Gigabit Ethernet Modular Interface Card (MIC) has link LEDs located on the front panel. For more information about the link LEDs for the 10-Gigabit Ethernet MIC, see [“Component LEDs on the MX5, MX10, MX40, and MX80 Front Panel” on page 30](#).

Each hot-removable and hot-insertable MIC has LEDs located on the faceplate. For more information about LEDs on the MIC faceplate, see the “LEDs” section for each MIC in the [MX Series Interface Module Reference](#).

On the fixed MX80 chassis, each of the 48 ports on the fixed Tri-Rate MIC has a link LED. [Table 31 on page 57](#) describes the link LEDs in more detail.

Table 31: Tri-Rate MIC LEDs

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

CHAPTER 2

Site Planning, Preparation, and Specifications

- [MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 59](#)
- [MX5, MX10, MX40, and MX80 Site Guidelines and Requirements on page 61](#)
- [MX5, MX10, MX40, and MX80 Network Cable and Transceiver Planning on page 67](#)
- [MX5, MX10, MX40, and MX80 Management, and Console Port Specifications and Pinouts on page 72](#)

MX5, MX10, MX40, and MX80 Site Preparation Checklist

The checklist in [Table 32 on page 59](#) summarizes the tasks you must perform when preparing a site for router installation.

Table 32: MX80 Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Environment			
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	"MX5, MX10, MX40, and MX80 Router Environmental Specifications" on page 62		
Power			
Locate sites for connection of system grounding.	"MX5, MX10, MX40, and MX80 Router Grounding Specifications" on page 62		
Measure distance between external power sources and router installation site.	"MX5, MX10, MX40, and MX80 Routers AC Power Specifications" on page 35 "MX5, MX10, MX40, and MX80 Routers DC Power Specifications" on page 39		

Table 32: MX80 Site Preparation Checklist (continued)

Item or Task	For More Information	Performed By	Date
Calculate the power consumption and requirements.	<p>"Power Consumption for an AC-Powered MX5, MX10, MX40, and MX80 Router" on page 35</p> <p>"Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router" on page 39</p>		
Rack			
Select the type of rack or cabinet.	<p>"MX5, MX10, MX40, and MX80 Rack Requirements" on page 64</p> <p>"MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications" on page 66</p>		
Plan rack or cabinet location, including required space clearances.	<p>"MX5, MX10, MX40, and MX80 Rack Requirements" on page 64</p> <p>"MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance" on page 65</p> <p>"MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications" on page 66</p>		
If a rack is used, secure rack to floor and building structure.	"MX5, MX10, MX40, and MX80 Rack Requirements" on page 64		
Cables			
<p>Acquire cables and connectors:</p> <ul style="list-style-type: none"> Determine the number of cables needed based on your planned configuration. Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected. 	"Calculating Power Budget and Power Margin for Fiber-Optic Cables" on page 69		

- Related Documentation**
- MX5, MX10, MX40, and MX80 Installation Summary on page 75
 - Tools Required to Install MX5, MX10, MX40, and MX80 Chassis in the Rack on page 80
 - Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 81

MX5, MX10, MX40, and MX80 Site Guidelines and Requirements

- [MX5, MX10, MX40, and MX80 Routers Physical Specifications on page 61](#)
- [MX5, MX10, MX40, and MX80 Router Environmental Specifications on page 62](#)
- [MX5, MX10, MX40, and MX80 Router Grounding Specifications on page 62](#)
- [MX5, MX10, MX40, and MX80 Rack Requirements on page 64](#)
- [MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance on page 65](#)
- [MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications on page 66](#)

MX5, MX10, MX40, and MX80 Routers Physical Specifications

Table 33 on page 61 summarizes the physical specifications for the router.

Table 33: MX5, MX10, MX40, and MX80 Physical Specifications

Description	Weight	Width	Depth	Height
Fixed chassis	Chassis with fan tray and power supplies: 28 lb (12.7 kg)	17.5 in. (44.5 cm)	23.46 in. (59.6 cm) (including cable management bracket and MIC release lever)	3.5 in. (8.9 cm)
Modular chassis	Chassis with fan tray, power supplies, and MICs: 30 lb (13.6 kg)	17.5 in. (44.5 cm)	23.46 in. (59.6 cm) (including cable management bracket and MIC release lever)	3.5 in. (8.9 cm)
Air filter	0.1 lb (0.05 kg)	0.25 in. (0.64 cm)	18.43 in. 46.81 cm)	3.35 in. (8.5 cm)
MIC	Maximum up to 1.2 lb (0.54 kg)	6.25 in. (15.9 cm)	6.8 in (17.3 cm)	1.2 in. (3.05 cm)
Dual-wide MIC	1.9 lb (0.9 kg)	12.5 in. (31.75 cm)	6.8 in (17.3 cm)	1.2 in. (3.05 cm)
Fan tray	2.3 lb (1.04 kg)	2.75 in. (6.96 cm)	20.5 in. 52.07 cm)	3.35 in. (8.5 cm)
DC power supply	2.6 lb (1.18 kg)	2.8 in. (7.1 cm)	13.2 in. (33.5 cm)	1.6 in. (4.1 cm)
AC power supply	2.6 lb (1.18 kg)	2.8 in. (7.1 cm)	13.2 in. (33.5 cm)	1.6 in. (4.1 cm)

- See Also**
- [MX5, MX10, MX40, and MX80 Router Overview on page 19](#)
 - [MX5, MX10, MX40, and MX80 Chassis Description on page 24](#)
 - [MX5, MX10, MX40 and MX80 Chassis Lifting Guidelines on page 149](#)

MX5, MX10, MX40, and MX80 Router Environmental Specifications

Table 34 on page 62 specifies the environmental specifications required for normal router operation. In addition, the site should be as dust-free as possible.

Table 34: Router Environmental Specifications

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



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

- See Also**
- [Routine Maintenance Procedures for MX5, MX10, MX40, and MX80 Routers on page 97](#)
 - [General Safety Guidelines for Juniper Networks Devices on page 143](#)
 - [General Safety Warnings for Juniper Networks Devices on page 144](#)

MX5, MX10, MX40, and MX80 Router Grounding Specifications

- [Grounding Points Specifications on page 62](#)
- [Grounding Cable Lug Specifications on page 63](#)
- [Grounding Cable Specifications on page 63](#)

Grounding Points Specifications

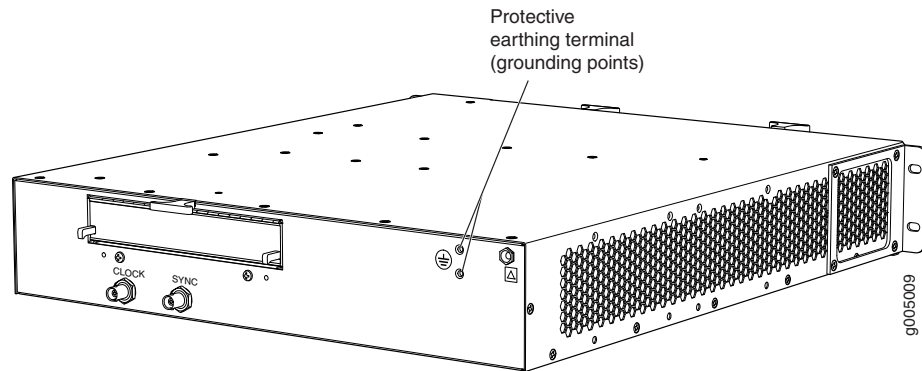
To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the router must be adequately grounded before power is connected. To ground AC-powered and DC-powered routers, you must connect a grounding cable to earth ground and then attach it to the chassis grounding points using the two screws provided (see [Figure 23 on page 63](#)).

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



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

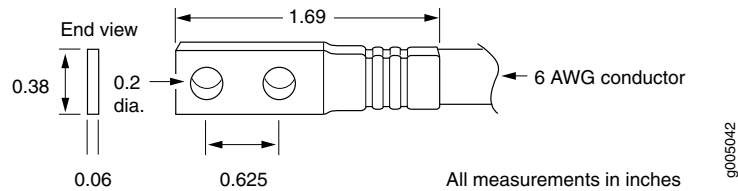
Figure 23: Grounding Points on MX5, MX10, MX40, and MX80 Routers



Grounding Cable Lug Specifications

The accessory box shipped with the router includes one cable lug that attaches to the grounding cable (see [Figure 24 on page 63](#)) and two SAE 10-32 screws used to secure the grounding cable to the grounding points.

Figure 24: Grounding Cable Lug



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

Grounding Cable Specifications

You must provide one grounding cable that meets the following specifications: 6-AWG (13.3 mm²), minimum 60° C wire, or as required by the local code.

- See Also**
- [Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections on page 83](#)

- [Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 146](#)
- [MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 35](#)
- [MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 39](#)

MX5, MX10, MX40, and MX80 Rack Requirements

The router can be installed in a rack. Many types of racks are acceptable, including four-post (telco) racks and open-frame racks. An example of an open-frame rack appears in [Figure 25 on page 65](#). [Table 35 on page 64](#) summarizes rack requirements and specifications for the MX5, MX10, MX40, and MX80 router.

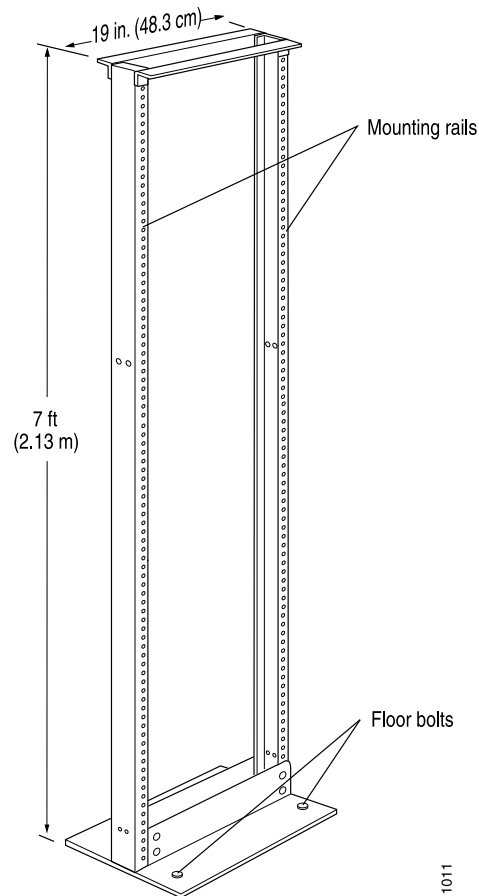
Table 35: MX5, MX10, MX40, and MX80 Rack Requirements and Specifications

Rack Requirement	Guidelines
Rack type and mounting bracket hole spacing	<p>Use a four-post rack or a two-post rack. You can mount the router on any four-post or two-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75-in./4.44-cm) increments and that meets the size and strength requirements specified in this table.</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 Components Industry Association (http://www.ecianow.org/).</p>
Rack size and strength	<ul style="list-style-type: none"> • Ensure that the rack is a 19-in. rack as defined in <i>Cabinets, Racks, Panels, and Associated Equipment</i> (document number EIA-310–D) published by the Electronics Components Industry Association (http://www.ecianow.org/). • Ensure that the rack is one of the following standard lengths: <ul style="list-style-type: none"> • 23.62 in. (600 mm) • 30.0 in. (762 mm) • 31.5 in. (800 mm) • The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions: 3.5 in. (8.9 cm) high, 23.46 in. (59.6 cm) deep, and 17.5 in. (44.5 cm) wide. The outer edges of the mounting brackets extend the width to 19.2 in. (48.7 cm). The spacing of rails and adjacent racks must also allow for the clearances around the router and rack that are specified in "MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance" on page 65. • The router ships with the mounting brackets installed in the front-mount position. You can also move the brackets to the center-mount position. For instructions about moving the mounting hardware, see "Moving the Mounting Brackets for Center-Mounting MX5, MX10, MX40, and MX80 Routers" on page 79. • The chassis height of 3.5 in. (8.9 cm) is approximately 2 U. • The rack must be strong enough to support the weight of the fully configured router, up to 30 lb (13.6 kg). • Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the router and rack as specified in "MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance" on page 65.

Table 35: MX5, MX10, MX40, and MX80 Rack Requirements and Specifications (continued)

Rack Requirement	Guidelines
Rack connection to the building structure	<ul style="list-style-type: none"> Secure the rack to the building structure. If earthquakes are a possibility in your geographic area, secure the rack to the floor. Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.

Figure 25: Typical Open-Frame Rack



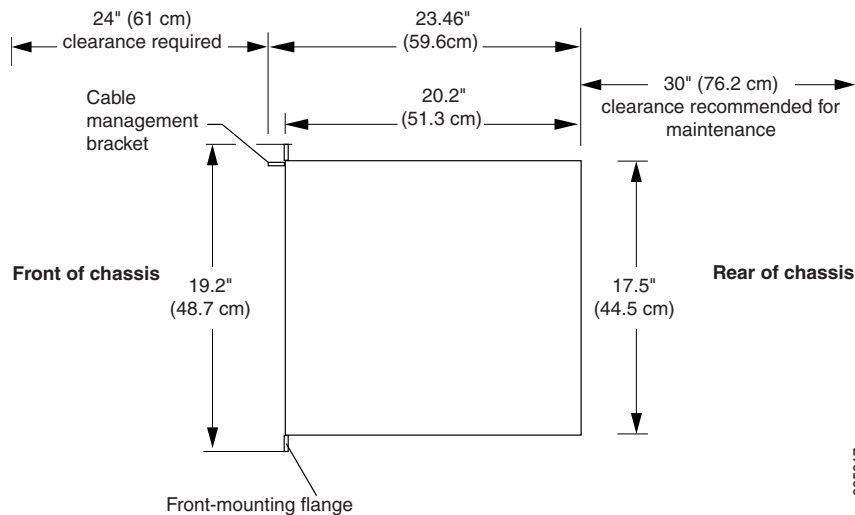
MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance

When planning the installation site, allow sufficient clearance around the rack (see [Figure 26 on page 66](#)):

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. Allow at least 6 in. (15.2 cm) of clearance between side-cooled routers. Allow 2.8 in. (7 cm) between the side of the chassis and any non-heat-producing surface such as a wall.

- For service personnel to remove and install hardware components, there must be adequate space at the front and back of the router. At least 24 in. (61 cm) are required both in front of and behind the router. NEBS GR-63 recommends that you allow at least 30 in. (76.2 cm) in front of the rack and 24 in. (61 cm) behind the router.

Figure 26: MX5, MX10, MX40, and MX80 Chassis Dimensions and Clearance Requirements



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

Table 36 on page 66 summarizes cabinet requirements and specifications for MX5, MX10, MX40, and MX80 routers.

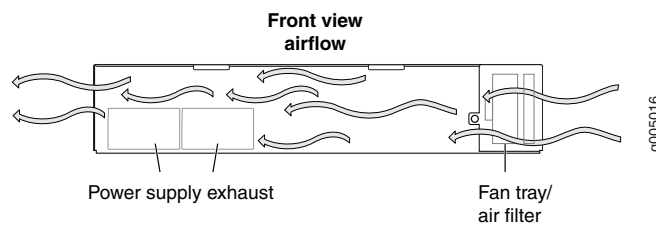
Table 36: Cabinet Requirements and Specifications for an MX5, MX10, MX40, and MX80 Router

Cabinet Requirement	Guidelines for the MX80 Router
Cabinet size and clearance	<ul style="list-style-type: none"> The minimum-sized cabinet that can accommodate the router is 19-in. (482-mm) wide and 23.62-in. (600-mm) deep. A cabinet larger than the minimum requirement provides better airflow and reduces the chance of overheating. If you provide adequate cooling air and airflow clearance, you can stack several routers in a cabinet that has sufficient usable vertical space. Each router requires 2 U. <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 Electronic Components Industry Association (ECIA) (http://www.ecianow.org).</p> <ul style="list-style-type: none"> With adequate cooling air and airflow clearance, you can stack multiple MX5, MX10, MX40, and MX80 routers in a cabinet with a four-post rack. In all cases, the rack must meet the strength requirements to support the weight. The minimum total clearance inside the cabinet is 30.7 in. (780 mm) between the inside of the front door and the inside of the rear door.

Table 36: Cabinet Requirements and Specifications for an MX5, MX10, MX40, and MX80 Router (continued)

Cabinet Requirement	Guidelines for the MX80 Router
Cabinet airflow requirements	<p>When you install the router in a cabinet, you must ensure that ventilation through the cabinet is sufficient to prevent overheating. Consider the following requirements to when planning for chassis cooling:</p> <ul style="list-style-type: none"> • Airflow must always be from front to back with respect to the rack. If the device has side to rear airflow, then provisions must be made to ensure that fresh air from the front of the rack is supplied to the inlets, and exhaust exits the rear of the rack. The device must not interfere with the cooling of other systems in the rack. Fillers must be used as appropriate in the rack to ensure there is no recirculation of heated exhaust air back to the front of the rack. Care must also be taken around cables to ensure no leakage of air in situations where recirculation may result. • Ensure that the cabinet allows the chassis hot exhaust air to exit from the cabinet without recirculating into the router. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. For an illustration of chassis airflow, see Figure 27 on page 67. • Ensure that the cool air supply you provide through the cabinet can adequately dissipate the thermal output of the router. • Route and dress all cables to minimize the blockage of airflow to and from the chassis. • Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the router and rack as specified in “MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance” on page 65. • Install the router as close as possible to the front of the cabinet so that the chassis just clears the inside of the front door. This maximizes the clearance in the rear of the cabinet for critical airflow.

Figure 27: Airflow Through Chassis



- See Also**
- [MX5, MX10, MX40, and MX80 Cooling System Description](#)
 - [Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 81](#)

MX5, MX10, MX40, and MX80 Network Cable and Transceiver Planning

- [Determining Transceiver Support and Specifications for M Series and T Series Routers on page 68](#)
- [Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 68](#)

- [Calculating Power Budget and Power Margin for Fiber-Optic Cables on page 69](#)
- [Routing Engine Interface Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 71](#)

Determining Transceiver Support and Specifications for M Series and T Series Routers

You can find information about the pluggable transceivers supported on your Juniper Networks device by using the Hardware Compatibility Tool. In addition to transceiver and connector type, the optical and cable characteristics—where applicable—are documented for each transceiver. The Hardware Compatibility Tool allows you to search by product, displaying all the transceivers supported on that device, or category, displaying all the transceivers by interface speed or type. The Hardware Compatibility Tool is located at <https://apps.juniper.net/hct/>.

Some transceivers support additional monitoring using the operational mode CLI command **show interfaces diagnostics optics**. Use the Hardware Compatibility Tool to determine if your transceiver supports monitoring. See the Junos OS documentation for your device for a description of the monitoring fields.



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.

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

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

- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cable on page 68](#)
- [Attenuation and Dispersion in Fiber-Optic Cable on page 69](#)

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

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

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

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

Attenuation and Dispersion in Fiber-Optic Cable

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

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

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

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

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

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

Calculating Power Budget and Power Margin for Fiber-Optic Cables

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



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

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

1. [Calculating Power Budget for Fiber-Optic Cable on page 70](#)
2. [Calculating Power Margin for Fiber-Optic Cable on page 70](#)

Calculating Power Budget for Fiber-Optic Cable

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

$$P_B = P_T - P_R$$

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

$$P_B = P_T - P_R$$

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

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

Calculating Power Margin for Fiber-Optic Cable

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

$$P_M = P_B - LL$$

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

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. [Table 37 on page 70](#) lists an estimated amount of loss for the factors used in the following sample calculations. For information about the actual amount of signal loss caused by equipment and other factors, refer to vendor documentation.

Table 37: Estimated Values for Factors Causing Link Loss

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

Table 37: Estimated Values for Factors Causing Link Loss (continued)

Link-Loss Factor	Estimated Link-Loss Value
Fiber attenuation	Single-mode—0.5 dB/km Multimode—1 dB/km

The following sample calculation for a 2-km-long multimode link with a power budget (P_B) of 13 dB uses the estimated values from [Table 37 on page 70](#) to calculate link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The power margin (P_M) is calculated as follows:

$$P_M = P_B - LL$$

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

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

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

The following sample calculation for an 8-km-long single-mode link with a power budget (P_B) of 13 dB uses the estimated values from [Table 37 on page 70](#) to calculate link loss (LL) as the sum of fiber attenuation (8 km @ 0.5 dB/km, or 4 dB) and loss for seven connectors (0.5 dB per connector, or 3.5 dB). The power margin (P_M) is calculated as follows:

$$P_M = P_B - LL$$

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

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

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

In both examples, the calculated power margin is greater than zero, indicating that the link has sufficient power for transmission and does not exceed the maximum receiver input power.

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

[Table 38 on page 71](#) lists the specifications for the cables that connect to management ports.

Table 38: Cable Specifications for Routing Engine Management

Port	Cable Specification	Cable/Wire Supplied	Maximum Length	Router Receptacle
Routing Engine console or auxiliary interface	RS-232 (EIA-232) serial cable	One 6-ft (1.83-m) length with RJ-45/DB-9 connectors	6 ft (1.83 m)	RJ-45 female

Table 38: Cable Specifications for Routing Engine Management (continued)

Port	Cable Specification	Cable/Wire Supplied	Maximum Length	Router Receptacle
Routing Engine Ethernet interface	Category 5 cable or equivalent suitable for 100Base-T operation	One 15-ft (4.57-m) length with RJ-45/RJ-45 connectors	328 ft (100 m)	RJ-45 autosensing

- See Also**
- [MX5, MX10, MX40, and MX80 Routing Engine Description on page 42](#)
 - [Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 97](#)

MX5, MX10, MX40, and MX80 Management, and Console Port Specifications and Pinouts

- [RJ-45 Connector Pinouts for the AUX and CONSOLE Ports on MX5, MX10, MX40, and MX80 Routers on page 72](#)
- [RJ-45 Connector Pinouts for the ETHERNET Port on MX5, MX10, MX40, and MX80 Routers on page 73](#)

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

The ports on the front panel labeled **AUX** and **CONSOLE** are asynchronous serial interfaces that accept an RJ-45 connector. The ports connect the Routing Engine to an auxiliary or console management device. [Table 39 on page 72](#) describes the RJ-45 connector pinout.

Table 39: RJ-45 Connector Pinout for the AUX and CONSOLE Ports

Pin	Signal	Description
1	RTS	Request to Send
2	DTR	Data Terminal Ready
3	TXD	Transmit Data
4	Ground	Signal Ground
5	Ground	Signal Ground
6	RXD	Receive Data
7	DSR/DCD	Data Set Ready
8	CTS	Clear to Send

- See Also**
- [MX5, MX10, MX40, and MX80 Routing Engine Description on page 42](#)
 - [Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 97](#)

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

The port on the front panel labeled **ETHERNET** is an autosensing 10/100-Mbps Ethernet RJ-45 receptacle that accepts an Ethernet cable for connecting the Routing Engine to a management LAN (or other device that supports out-of-band management).

[Table 40 on page 73](#) describes the RJ-45 connector pinout.

Table 40: RJ-45 Connector Pinout for the Routing Engine ETHERNET Port

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

CHAPTER 3

Initial Installation and Configuration

- [MX5, MX10, MX40, and MX80 Installation Summary on page 75](#)
- [Unpacking and Mounting the MX5, MX10, MX40, and MX80 on page 76](#)
- [Connecting the MX5, MX10, MX40, and MX80 Routers to Power on page 82](#)
- [Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices on page 91](#)
- [Initially Configuring MX5, MX10, MX40, and MX80 Routers on page 93](#)

MX5, MX10, MX40, and MX80 Installation Summary

To install the router:

1. Prepare your installation site.
[See “MX5, MX10, MX40, and MX80 Site Preparation Checklist” on page 59.](#)
2. Review the safety guidelines and warnings:
 - [See “General Safety Guidelines for Juniper Networks Devices” on page 143.](#)
 - [See “General Safety Warnings for Juniper Networks Devices” on page 144.](#)
3. Unpack the router and verify the parts:
 - a. [See “Unpacking MX5, MX10, MX40, and MX80 Routers” on page 76.](#)
 - b. [See “Verifying the MX5, MX10, MX40, and MX80 Routers Parts Received” on page 77.](#)
4. Install the mounting hardware.
[See “Moving the Mounting Brackets for Center-Mounting MX5, MX10, MX40, and MX80 Routers” on page 79.](#)
5. Lift the router onto the rack.
[See “Installing MX5, MX10, MX40, and MX80 Chassis in the Rack” on page 81.](#)
6. Connect cables to the network and external devices:

- See “Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices” on page 91.
 - See *Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers*.
7. Connect the grounding cable.
See “Grounding MX5, MX10, MX40, and MX80 Routers” on page 83.
 8. Connect the AC power cord or DC power cables:
 - See “Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router” on page 84.
 - See “Connecting Power to a DC-Powered MX5, MX10, MX40, and MX80 Router” on page 86.
 9. Power on the router:
 - See “Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router” on page 85.
 - See “Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router” on page 88.
 10. Perform the initial system configuration.
See “Initially Configuring MX5, MX10, MX40, and MX80 Routers” on page 93.

Unpacking and Mounting the MX5, MX10, MX40, and MX80

- Tools and Parts Required to Unpack MX5, MX10, MX40, and MX80 Routers on page 76
- Unpacking MX5, MX10, MX40, and MX80 Routers on page 76
- Verifying the MX5, MX10, MX40, and MX80 Routers Parts Received on page 77
- Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket on page 79
- Moving the Mounting Brackets for Center-Mounting MX5, MX10, MX40, and MX80 Routers on page 79
- Tools Required to Install MX5, MX10, MX40, and MX80 Chassis in the Rack on page 80
- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 81

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

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

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

Unpacking MX5, MX10, MX40, and MX80 Routers

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



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

To unpack the router:

1. Move the shipping carton to a staging area as close to the installation site as possible, but where you have enough room to remove the router.
2. Position the carton so that the arrows are pointing up.
3. Open the top flaps on the shipping carton.
4. Remove the accessory box, and verify the contents against the parts inventory on the label attached to the carton.
5. Pull out the packing material holding the router in place.
6. Verify the contents of the carton against the packing list included with the router.
7. Save the shipping carton and packing materials in case you later need to move or ship the router.

Verifying the MX5, MX10, MX40, and MX80 Routers Parts Received

A packing list is included in each shipment. Check the parts in the shipment against the items on the packing list. The packing list specifies the part numbers and descriptions of each part in your order.

If any part is missing, contact a customer service representative.

A fully configured router contains the router chassis with installed components, listed in [Table 41 on page 77](#), and an accessory box, which contains the parts listed in [Table 42 on page 78](#). The parts shipped with your router can vary depending on the configuration you ordered.

Table 41: Parts List for a Fully Configured Router

Component	Quantity
Chassis	1
Air filter	1
MICs (modular chassis only)	Up to 2
DC power supplies	1 or 2
AC power supplies	1 or 2
Fan tray	1
Cable management brackets	2

Table 41: Parts List for a Fully Configured Router (continued)

Component	Quantity
Documentation Roadmap	1
Blank panels for slots without components installed	One blank panel for each slot not occupied by a component

Table 42: Accessory Box Parts List

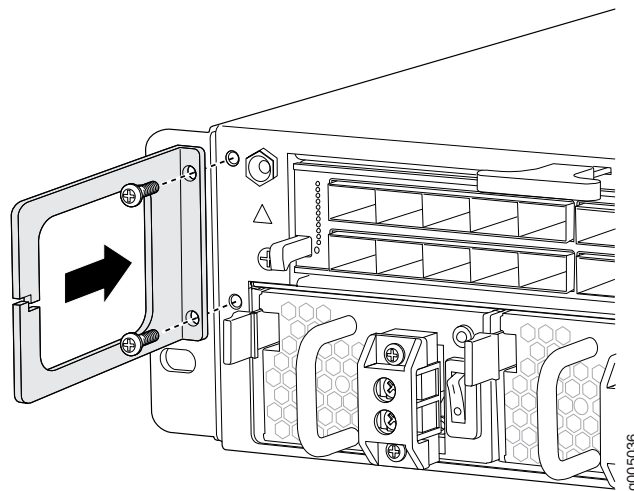
Part	Quantity
Screws to mount chassis	4
Screws to secure the ground cable lug	2
Ground terminal lug, 14 AWG, sized for #10 screw	1
DC power fork terminal lugs, 16-14 AWG, sized for #6 screw	9
Label, "Small Parts Enclosed"	1
Label, "Accessories Contents"	1
USB flash drive with Junos OS	1
Read me first document	1
Affidavit for T1 connection	1
Juniper Networks Product Warranty	1
End User License Agreement	1
Documentation addendum card, MX80	1
Document sleeve	1
3 in. x 5 in. pink bag	2
9 in. x 12 in. pink bag, ESD	2
Accessory box, 19 in. x 12 in. x 3 in.	1
Ethernet cable, RJ-45 to DB-9	1
ESD wrist strap with cable	1

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

The cable management bracket attaches to the left side of the router. To install the cable management bracket (see [Figure 28 on page 79](#)):

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

Figure 28: Installing the Cable Management Bracket



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

Two removable mounting brackets are attached to the mounting holes closest to the front of the chassis (see [Figure 29 on page 80](#)). You can move the pair of brackets to another position on the side of the chassis for center-mounting the router.

To move the mounting brackets from the front of the chassis toward the center of the chassis (see [Figure 30 on page 80](#)):

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

5. Tighten the four screws completely.
6. Repeat the procedure for the other bracket.

Figure 29: Front-Mounting the Brackets on MX5, MX10, MX40, and MX80 Routers

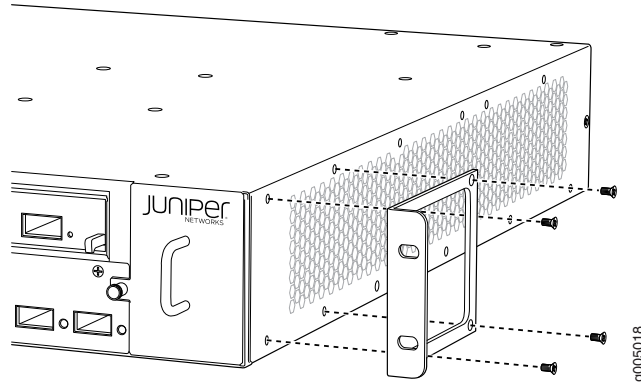
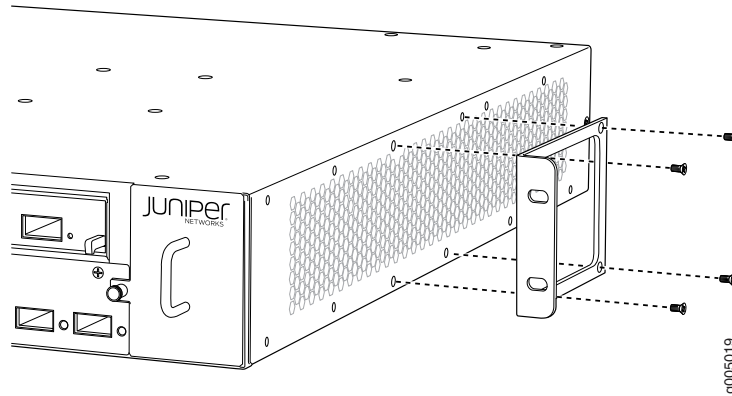


Figure 30: Center-Mounting the Brackets on MX5, MX10, MX40, and MX80 Routers



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

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

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

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

To install the router in the rack (see [Figure 31 on page 82](#) and [Figure 32 on page 82](#)):



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



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



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

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



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

4. Align the mounting brackets with the holes in the rack rails.
5. Install a mounting screw into each of the open mounting holes aligned with the rack, starting from the bottom.
6. Visually inspect the alignment of the router. If the router is installed properly in the rack, all the mounting screws on one side of the rack should be aligned with the mounting screws on the opposite side, and the router should be level.

Figure 31: Installing the Front-Mounted Router in the Rack

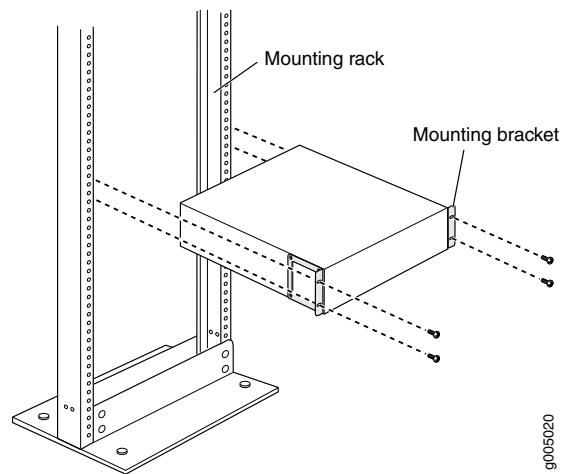
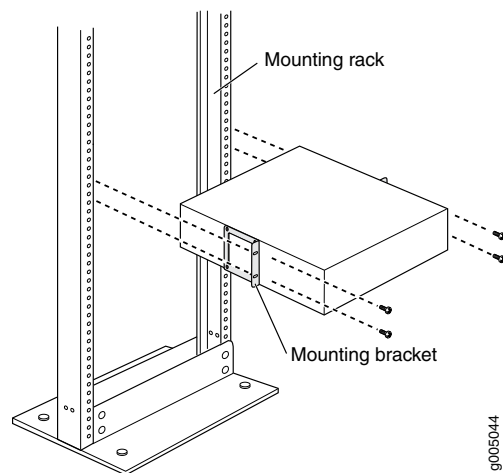


Figure 32: Installing the Center-Mounted Router in the Rack



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

- [Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections on page 83](#)
- [Grounding MX5, MX10, MX40, and MX80 Routers on page 83](#)
- [Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router on page 84](#)
- [Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router on page 85](#)
- [Connecting Power to a DC-Powered MX5, MX10, MX40, and MX80 Router on page 86](#)
- [Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router on page 88](#)
- [Powering Off MX5, MX10, MX40, and MX80 Routers on page 90](#)

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

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

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



CAUTION: The maximum torque rating of the terminal screws on the DC power supply is 6 lb-in. (0.7 Nm). The terminal screws may be damaged if excessive torque is applied. Use only a torque-controlled driver to tighten screws on the DC power supply terminals. Use an appropriately sized driver, with a maximum torque capacity of 6 lb-in. or less. Ensure that the driver is undamaged and properly calibrated and that you have been trained in its use. You may wish to use a driver that is designed to prevent overtorque when the preset torque level is achieved.

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

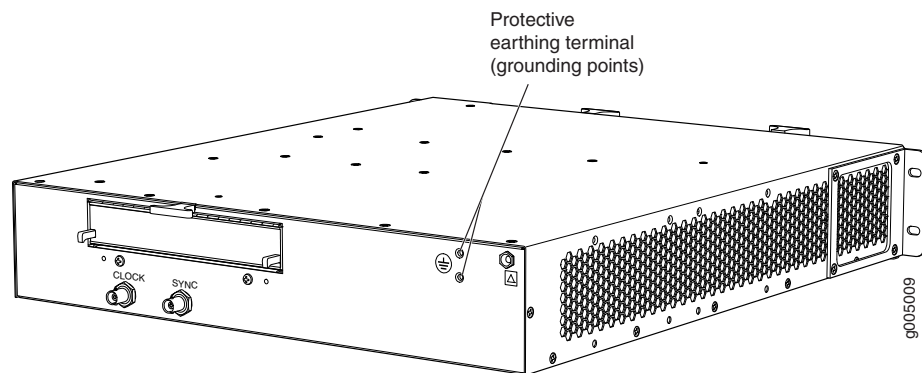
Grounding MX5, MX10, MX40, and MX80 Routers

You ground the router by connecting a grounding cable to earth ground and then attaching it to the chassis grounding points using two SAE 10-32 screws. You must provide the grounding cables (the cable lugs are supplied with the router). For grounding cable specifications, see [“MX5, MX10, MX40, and MX80 Router Grounding Specifications” on page 62](#). To ground the router:

1. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Ensure that all grounding surfaces are clean and brought to a bright finish before grounding connections are made.
4. Connect the grounding cable to a proper earth ground.
5. Detach the ESD grounding strap from the site ESD grounding point.
6. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

7. Place the grounding cable lug over the grounding points on the upper rear of the chassis (see [Figure 33 on page 84](#)).
8. Secure the grounding cable lug with the screws. The holes are sized for SAE 10-32 screws.
9. Dress the grounding cable, and verify that it does not touch or block access to router components, and that it does not drape where people could trip on it.

Figure 33: Grounding Points on MX5, MX10, MX40, and MX80 Routers



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



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

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

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

1. Locate power cords that have a plug appropriate for your geographic location. For more information, see [“Connecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord” on page 118](#).
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Move the AC input switch next to the appliance inlet on the power supply to the off (O) position.
4. Connect the power cord to the power supply.

5. Insert the power cord plug into an external AC power source receptacle.



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

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

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

To power on an AC-powered router:

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

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



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

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

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

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

See Also

- `request system halt`
- `show chassis power`

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



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



WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

You connect DC power to the router by attaching power cables from the external DC power sources to the terminal on the power supply faceplate. You must provide the power cables (the cable lugs are supplied with the router). For power cable specifications, see “DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers” on page 41.

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

1. Switch off the dedicated customer site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Switch the DC circuit breaker on the power supply faceplate to the off (O) position.
4. Remove the clear plastic cover protecting the terminal on the faceplate.
5. Verify that the DC power cables are correctly labeled before making connections to the power supply. In a typical power distribution scheme where the return is connected to chassis ground at the battery plant, you can use a multimeter to verify the resistance of the **-48V** and **RTN** DC cables to chassis ground:
 - The cable with very large resistance (indicating an open circuit) to chassis ground is **-48V**.
 - The cable with very low resistance (indicating a closed circuit) to chassis ground is **RTN**.



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

6. Remove the screws from the terminals.
7. Secure each power cable lug to the terminal with the screw (see [Figure 34 on page 88](#)). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to screw. Do not overtighten the nut. (Use a number 2 Phillips screwdriver.)
 - a. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal.
 - b. Secure the negative (-) DC source power cable lug to the **-48V** (input) terminal.



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



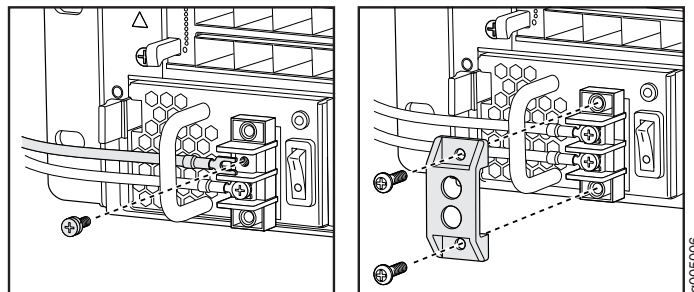
CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color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



NOTE: For information about connecting to DC power sources, see “MX5, MX10, MX40, and MX80 Routers DC Power Specifications” on page 39.

8. Replace the clear plastic cover over the terminals on the faceplate.
9. Verify that the power cables are connected correctly, that they are not touching or blocking access to router components, and that they do not drape where people could trip on them.
10. If you are installing two power supplies, repeat Steps 3 through 9 for the other power supply.

Figure 34: Connecting DC Power to the Router



See Also • [MX5, MX10, MX40, and MX80 Router Grounding Specifications on page 62](#)

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

To power on a DC-powered router:

1. Verify that an external management device is connected to one of the Routing Engine ports (**AUX**, **CONSOLE**, or **ETHERNET**).
2. Turn on the power to the external management device.
3. Verify that the power supplies are fully inserted in the chassis.

4. Verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminal (labeled **RTN**) and the negative (–) source cable to the input terminal (labeled **–48V**).
5. Switch on the dedicated customer site circuit breakers to provide power to the DC power cables.
6. Check that the status LED on the power supply faceplate is lit steadily blue to verify that power is present.
7. If power is not present:
 - Verify that the fuse is installed correctly, and turn on the breaker at the battery distribution fuse board or fuse bay.
 - Check the voltage with a meter at the terminals of the power supply for correct voltage level and polarity.
8. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
9. On each of the DC power supplies, switch the DC circuit breaker to the center position before moving it to the on (|) position.



NOTE: The circuit breaker may bounce back to the off (O) position if you move the breaker too quickly.

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

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



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

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

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

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

- See Also**
- `request system halt`
 - `show chassis power`

Powering Off MX5, MX10, MX40, and MX80 Routers



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

To power off the router:

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

```
user@host> request system halt
```
2. Wait until a message appears on the console confirming that the operating system has halted. For more information about the command, see the [CLI Explorer](#).
3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Switch the AC input switch on each AC power supply or the DC circuit breaker on each DC power supply to the off (O) position.

See Also • `request system halt`

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

- Connecting the Router to a Network for Out-of-Band Management on page 91
- Connecting the Router to a Management Console or Auxiliary Device on page 91

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

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

1. Turn off the power to the management device.
2. Plug one end of the Ethernet cable (Figure 35 on page 91 shows the connector) into the **ETHERNET** port on the Routing Engine. Figure 36 on page 91 shows the port.
3. Plug the other end of the cable into the network device.

Figure 35: Routing Engine Ethernet Cable Connector

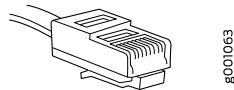
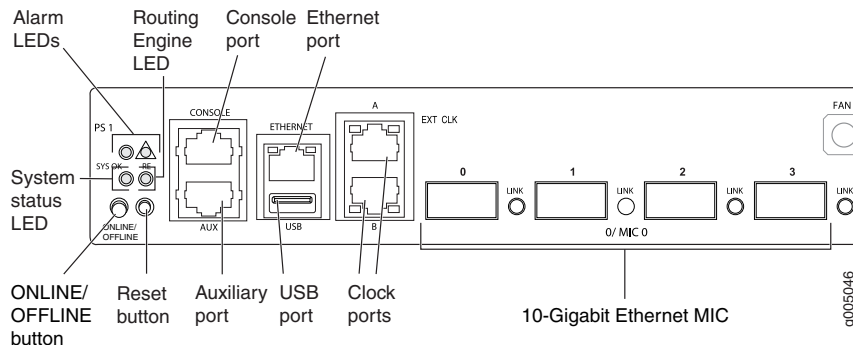


Figure 36: Ethernet Port



Connecting the Router to a Management Console or Auxiliary Device

To use a system console to configure and manage the Routing Engine, connect it to the appropriate **CONSOLE** port on the front panel. To use a laptop, modem, or other auxiliary device, connect it to the **AUX** port on the front panel. Both ports accept a cable with an RJ-45 connector. One serial cable with an RJ-45 connector and a DB-9 connector is provided with the router. To connect a device to the **CONSOLE** port and another device to the **AUX** port, you must supply an additional cable.

To connect a management console or auxiliary device:

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

2. Plug the RJ-45 end of the serial cable (Figure 37 on page 92 shows the connector) into the **AUX** port or **CONSOLE** port on the front panel. Figure 38 on page 92 shows the ports.
3. Plug the female DB-9 end into the device's serial port.



NOTE:

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

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



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

Figure 37: Routing Engine Console and Auxiliary Cable Connector

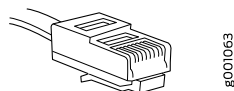
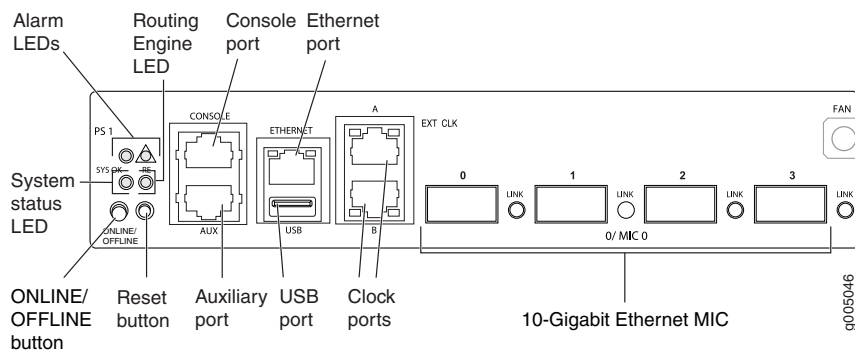


Figure 38: Auxiliary and Console Ports



Related Documentation

- [Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket on page 79](#)
- [Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers](#)
- [Initially Configuring MX5, MX10, MX40, and MX80 Routers on page 93](#)

Initially Configuring MX5, MX10, MX40, and MX80 Routers

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

When the router boots, it first attempts to start the image on the USB flash drive. If a USB flash drive is not inserted into the router or the attempt otherwise fails, the router next tries the primary boot device, and then tries the secondary boot device.

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

Gather the following information before configuring the router:

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

This procedure connects the router to the network but does not enable it to forward traffic. For complete information about enabling the router to forward traffic, including examples, see the Junos OS configuration guides.

To configure the software:

1. Verify that the router is powered on.
2. Log in as the “root” user. There is no password.
3. Start the CLI.

```
root# cli
root@>
```

4. Enter configuration mode.

```
cli> configure
[edit]
root@#
```

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

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

6. Create a management console user account.

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

7. Set the user account class to **super-user**.

```
[edit]
root@# set system login user user-name class super-user
```

8. Configure the router's domain name.

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

9. Configure the IP address and prefix length for the router's Ethernet interface.

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address/prefix-length
```

10. Configure the IP address of a backup router, which is used only while the routing protocol is not running.

```
[edit]
root@# set system backup-router address
```

11. Configure the IP address of a DNS server.

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

12. Set the root authentication password by entering either a clear-text password, an encrypted password, or an SSH public key string (DSA or RSA).

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

or

```
[edit]
root@# set system root-authentication encrypted-password encrypted-password
```

or

```
[edit]
root@# set system root-authentication ssh-dsa public-key
```

or

```
[edit]
root@# set system root-authentication ssh-rsa public-key
```

13. (Optional) Configure the static routes to remote subnets with access to the management port. Access to the management port is limited to the local subnet. To access the management port from a remote subnet, you need to add a static route to that subnet within the routing table. For more information about static routes, see the *Junos OS Administration Library*.

```
[edit]
root@# set routing-options static route remote-subnet next-hop destination-IP retain
no-readvertise
```

14. Configure the telnet service at the **[edit system services]** hierarchy level.

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

15. (Optional) Display the configuration to verify that it is correct.

```
[edit]
root@# show
system {
  host-name host-name;
  domain-name domain-name;
  backup-router address;
  root-authentication {
    authentication-method (password | public-key);
  }
  name-server {
    address;
  }
}
interfaces {
  fxp0 {
    unit 0 {
      family inet {
        address address/prefix-length;
      }
    }
  }
}
```

```
    }  
  }  
}
```

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

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

17. (Optional) Configure additional properties by adding the necessary configuration statements. Then commit the changes to activate them on the router.

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

18. When you have finished configuring the router, exit configuration mode.

```
[edit]  
root@host# exit  
root@host>
```

**Related
Documentation**

- [Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices on page 91](#)
- [Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router on page 85](#)
- [Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router on page 88](#)

CHAPTER 4

Maintaining Components

- Maintaining MX5, MX10, MX40, and MX80 Components on page 97
- Maintaining the MX5, MX10, MX40, and MX80 Air Filter on page 98
- Maintaining the MX5, MX10, MX40, and MX80 Fan Tray on page 101
- Maintaining the MX5, MX10, MX40, and MX80 MICs and Transceivers on page 103
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies and Cables on page 114

Maintaining MX5, MX10, MX40, and MX80 Components

- Tools and Parts Required to Maintain MX5, MX10, MX40, and MX80 Routers on page 97
- Routine Maintenance Procedures for MX5, MX10, MX40, and MX80 Routers on page 97
- Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 97

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

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

- ESD grounding wrist strap

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

Purpose For optimum router performance, perform preventive maintenance procedures.

- Action**
- Inspect the installation site for moisture, loose wires or cables, and excessive dust. Make sure that airflow is unobstructed around the router and into the air intake vents.
 - Check the status-reporting devices on the front panel—System alarms and LEDs.

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

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

Action On a regular basis:

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

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

- See Also**
- [MX5, MX10, MX40, and MX80 Routing Engine Description on page 42](#)
 - [Routing Engine Interface Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 71](#)
 - *show chassis routing-engine*

Maintaining the MX5, MX10, MX40, and MX80 Air Filter

- [Maintaining the MX5, MX10, MX40, and MX80 Air Filter on page 98](#)
- [Replacing an MX5, MX10, MX40, and MX80 Air Filter on page 99](#)

Maintaining the MX5, MX10, MX40, and MX80 Air Filter

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

- Action**
- Regularly inspect the air filter. A dirty air filter restricts airflow in the unit, producing a negative effect on the ventilation of the chassis. The filter degrades over time. You must replace the filter every 6 months.



CAUTION: Always keep the air filter in place while the device is operating. Because the fans are very powerful, they could pull small bits of wire or

other materials into the through the unfiltered air intake. This could damage the components.

- The shelf life of polyurethane filter varies from two years to five years depending on the storage conditions. Store in a cool, dry, and dark environment. Wrap the media in plastic and store in an environment with relative humidity between 40%- 80% and temperature between 40° F (4° C) to 90° F (32° C). Note that if the material flakes, or becomes brittle when rubbed or deformed, it is no longer usable.

See Also • *MX5, MX10, MX40, and MX80 Cooling System Description*

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

- [Removing an MX5, MX10, MX40, and MX80 Air Filter on page 99](#)
- [Installing an MX5, MX10, MX40, and MX80 Air Filter on page 100](#)

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



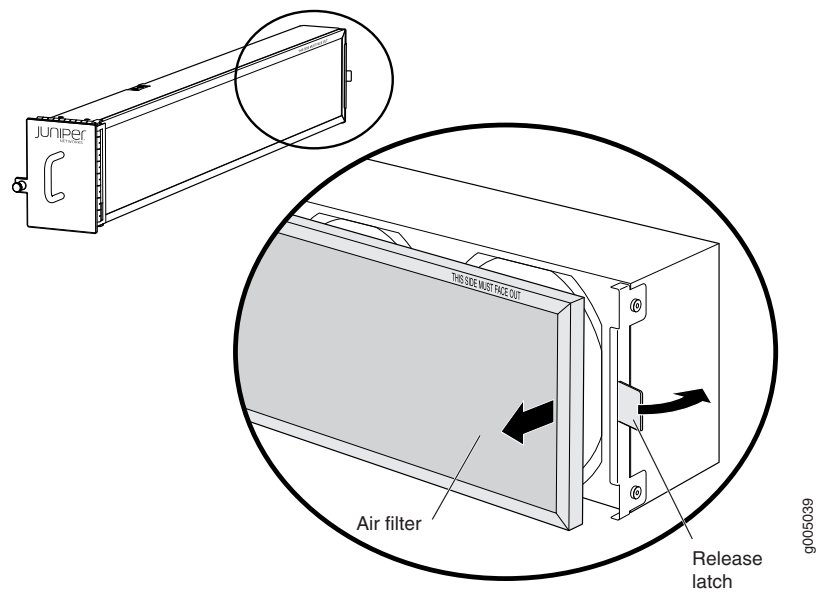
CAUTION: Do not run the router for more than a few minutes without the air filter in place.



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

The air filter is installed on the right side of the fan tray. To remove the air filter (see [Figure 39 on page 100](#)):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Remove the fan tray as described in "[Removing an MX5, MX10, MX40, and MX80 Fan Tray](#)" on page 102.
3. Press the release tab on the rear of the fan tray to release the air filter.
4. Grasp the sides of the air filter, and slide it away from the fan tray faceplate.

Figure 39: Removing the Air Filter

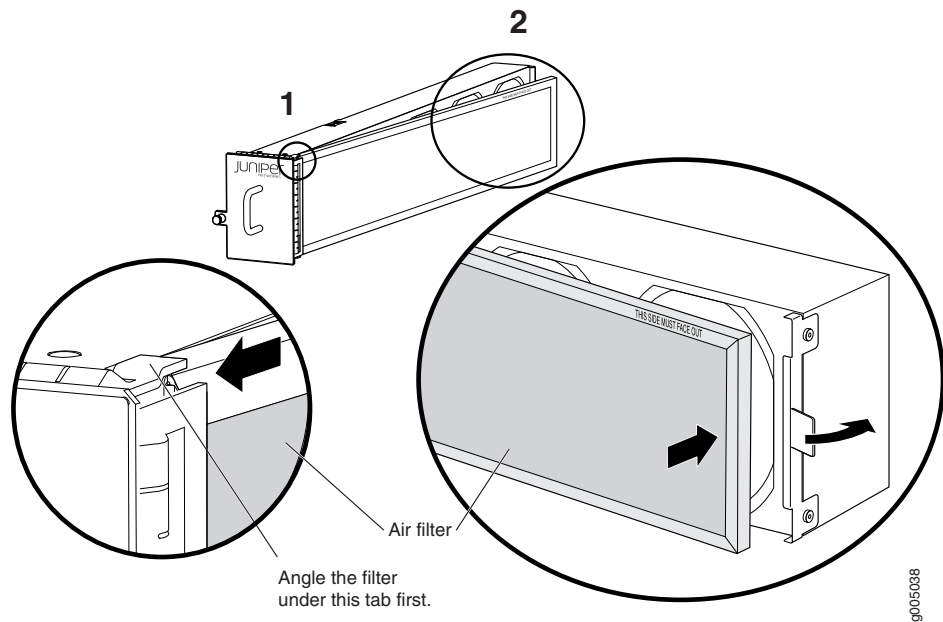
- See Also**
- [Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 146](#)

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

The air filter installs on the right side of the fan tray. To install the air filter (see [Figure 40 on page 101](#)):

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

Figure 40: Installing the Air Filter



1—Inserting the air filter into the fan tray

2—Securing the air filter in the fan tray

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

- Maintaining the MX5, MX10, MX40, and MX80 Fan Tray on page 101
- Replacing an MX5, MX10, MX40, and MX80 Fan Tray on page 102

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

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

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

```
user@host> show chassis environment
```

Class	Item	Status	Measurement
Temp	PEM 0	OK	45 degrees C / 113 degrees F
	PEM 1	OK	45 degrees C / 113 degrees F
	RE 0 Intake	OK	33 degrees C / 91 degrees F
	RE 0 Front Exhaust	OK	38 degrees C / 100 degrees F
	RE 0 Rear Exhaust	OK	38 degrees C / 100 degrees F
	Routing Engine	OK	33 degrees C / 91 degrees F
	Routing Engine CPU	OK	54 degrees C / 129 degrees F
	TFEB 0 QX 0 TSen	OK	44 degrees C / 111 degrees F
	TFEB 0 QX 0 Chip	OK	47 degrees C / 116 degrees F

	TFEB 0 LU 0 TSen	OK	44 degrees C / 111 degrees F
	TFEB 0 LU 0 Chip	OK	50 degrees C / 122 degrees F
	TFEB 0 MQ 0 TSen	OK	44 degrees C / 111 degrees F
	TFEB 0 MQ 0 Chip	OK	49 degrees C / 120 degrees F
	TFEB 0 TBB PFE TSen	OK	37 degrees C / 98 degrees F
	TFEB 0 TBB PFE Chip	OK	50 degrees C / 122 degrees F
	TFEB 0 TFEB PCIE TSen	OK	45 degrees C / 113 degrees F
	TFEB 0 TFEB PCIE Chip	OK	68 degrees C / 154 degrees F
Fans	Fan 1	OK	Spinning at intermediate-speed
	Fan 2	OK	Spinning at intermediate-speed
	Fan 3	OK	Spinning at intermediate-speed
	Fan 4	OK	Spinning at intermediate-speed
	Fan 5	OK	Spinning at intermediate-speed

See Also • [show chassis environment](#)

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

- [Removing an MX5, MX10, MX40, and MX80 Fan Tray on page 102](#)
- [Installing an MX5, MX10, MX40, and MX80 Fan Tray on page 103](#)

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



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

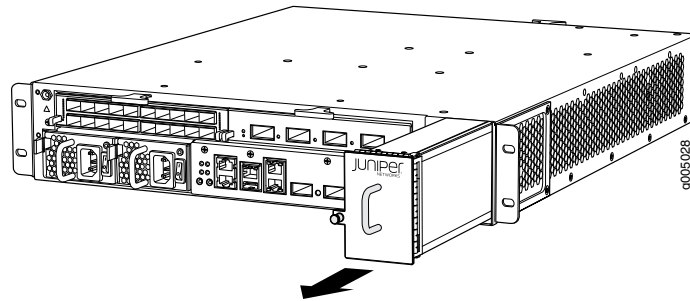
To remove the fan tray (see [Figure 41 on page 103](#)):

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



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

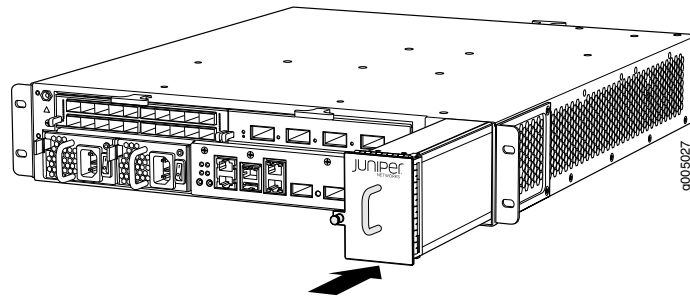
4. Press the latch located on the inside of the fan tray to release it from the chassis.
5. Place one hand under the fan tray to support it, and pull the fan tray completely out of the chassis.

Figure 41: Removing the Fan Tray

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

To install the fan tray (see [Figure 42 on page 103](#)):

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

Figure 42: Installing the Fan Tray

Maintaining the MX5, MX10, MX40, and MX80 MICs and Transceivers

- [Maintaining the MX5, MX10, MX40, and MX80 MICs on page 103](#)
- [Replacing an MX5, MX10, MX40, and MX80 MIC on page 104](#)
- [Replacing an MX5, MX10, MX40, and MX80 SFP or XFP Transceiver on page 111](#)
- [Maintaining Cables That Connect to MX5, MX10, MX40, and MX80 MICs on page 113](#)

Maintaining the MX5, MX10, MX40, and MX80 MICs

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

Action On a regular basis:

- Check the LEDs on MIC faceplates. The meaning of the LED states differs for various MICs. For more information, see the [MX Series Interface Module Reference](#). If the router detects a MIC failure, the router generates an alarm message to be sent to the Routing Engine.
- Issue the CLI `show chassis fpc pic-status` command. The MIC slots in the MX5, MX10, MX40, and modular MX80 router are numbered `1/MIC 0` and `1/MIC 1`. The fixed MIC is numbered `0/MIC 0`.

```
user@host> show chassis fpc pic-status
```

```
Slot 0  Online
  PIC 0  Online      4x 10GE XFP
  PIC 2  Online      1x 10GE XFP
  PIC 3  Online      1x 10GE XFP
Slot 1  Online
  PIC 0  Online      1x 10GE XFP
  PIC 1  Online      1x 10GE XFP
  PIC 2  Online      1x 10GE XFP
  PIC 3  Online      1x 10GE XFP
```

See Also • [show chassis fpc](#)

Replacing an MX5, MX10, MX40, and MX80 MIC

- [Removing an MX5, MX10, MX40, and MX80 MIC on page 104](#)
- [Installing an MX5, MX10, MX40, and MX80 MIC on page 106](#)
- [Installing an MX10, MX40, MX80, and MX104 Dual-Wide MIC on page 109](#)

Removing an MX5, MX10, MX40, and MX80 MIC

MICs are hot-insertable and hot-removable. When you remove a MIC, the router continues to function, although the MIC interfaces being removed no longer function.

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

To remove a MIC (see [Figure 43 on page 106](#) and [Figure 44 on page 106](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the MIC. If the MIC connects to fiber-optic cable, have ready a rubber safety cap for each transceiver and cable.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Use one of the following methods to take the MIC offline:

- Press its online/offline button. Use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the MIC **OK/FAIL** LED goes off (about 5 seconds).
- Issue the following CLI command:

```
user@host> request chassis mic fpc-slot slot-number mic-slot slot-number offline
```

4. Label the cables connected to the MIC so that you can later reconnect each cable to the correct MIC.
5. Disconnect the cables from the MIC. If the MIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.



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



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

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



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

7. Pull the ejector lever above the MIC you are removing away from the router. Pulling the ejector lever disconnects the MIC from the chassis.



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

8. Grasp the handles on the MIC faceplate, and slide the MIC out of the chassis. Place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a MIC into the emptied MIC slot within a short time, install a blank MIC panel over the slot to maintain proper airflow in the chassis card cage.

Figure 43: Removing a MIC

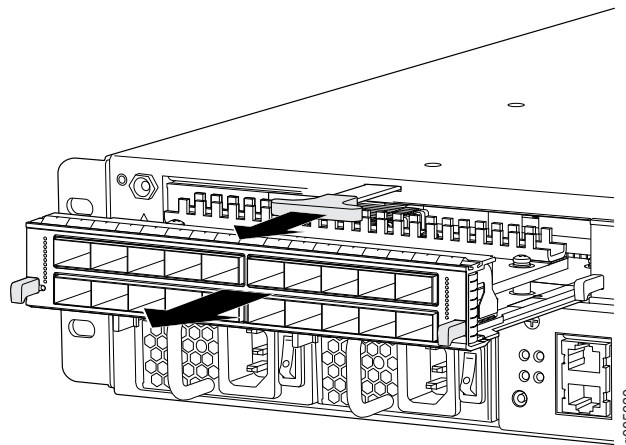
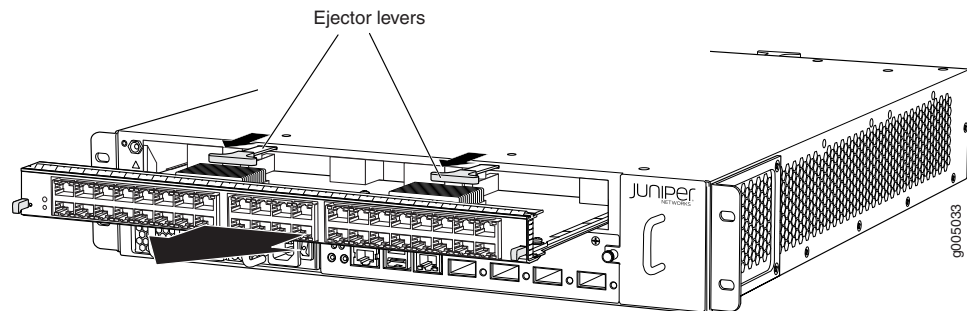


Figure 44: Removing a Dual-Wide MIC



Installing an MX5, MX10, MX40, and MX80 MIC

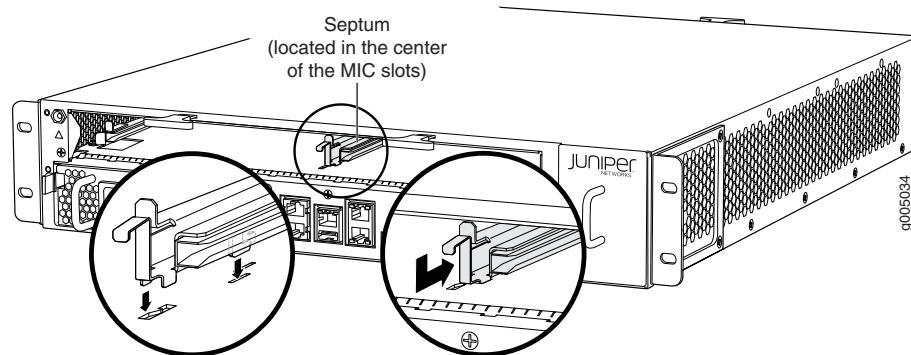
To install a MIC (see [Figure 46](#) on page 108):



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

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. If the MIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.
3. If you have used a dual-wide MIC and are now replacing it with two “single” MICs, install the septum (see [Figure 45](#) on page 107):
 - a. Align the bottom of the septum with the grooves in the center of the two MIC slots.
 - b. Slide the septum toward the rear of the chassis until it is seated firmly in place.

Figure 45: Installing the Septum



Insert the tabs on the bottom of the septum into the grooves in the center of the two MIC slots.

Slide the septum toward the rear of the chassis until it is seated firmly in place.

4. Pull the ejector lever above the MIC slot away from the router.
5. Align the rear of the MIC with the guides located at the corners of the MIC slot.
6. Slide the MIC into the MIC slot until it is firmly seated in the chassis.



CAUTION: Slide the MIC straight into the slot to avoid damaging the components on the MIC.

7. Verify that the ejector lever is engaged by pushing it toward the router.
8. If the MIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.



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



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

9. Insert the appropriate cables into the cable connectors on the MIC.

10. Arrange each cable to prevent the cable from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop.



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



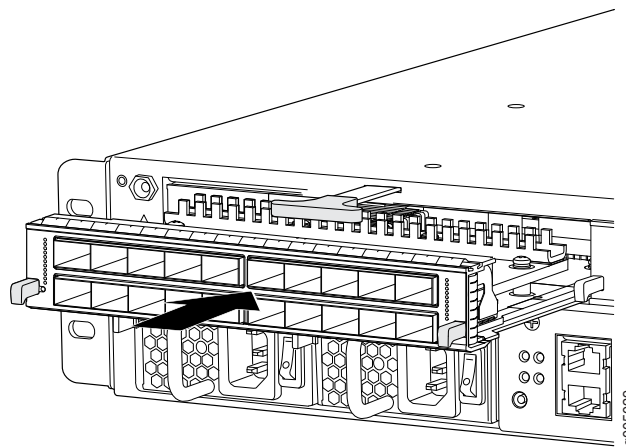
CAUTION: Avoid bending a fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

11. Use one of the following methods to bring the MIC online:
 - Press the MIC offline/online button until the MIC OK/FAIL LED lights green.
 - Issue the following CLI command:

```
user@host> request chassis mic fpc-slot slot-number mic-slot slot-number online
```

The normal functioning status LED confirms that the MIC is online. You can also verify correct MIC functioning by issuing the **show chassis fpc pic-status** command described in “Maintaining the MX5, MX10, MX40, and MX80 MICs” on page 103.

Figure 46: Installing a MIC

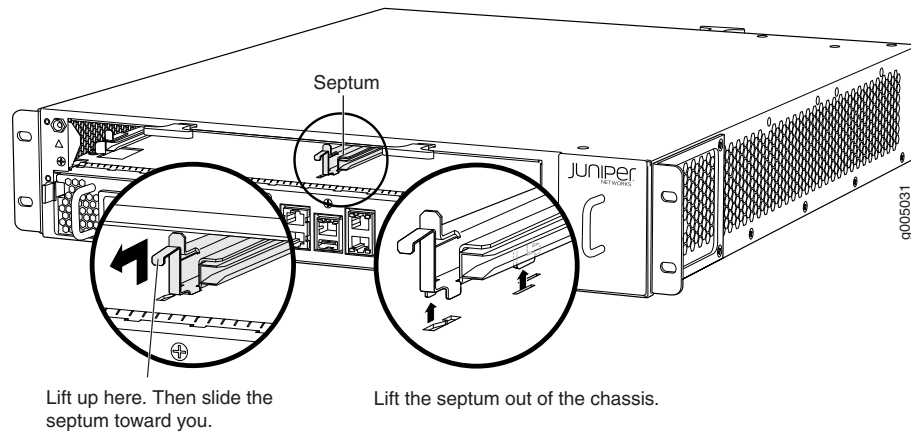


Installing an MX10, MX40, MX80, and MX104 Dual-Wide MIC

To install a dual-wide MIC (see [Figure 48 on page 111](#)):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. If the MIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.
3. Remove the septum, if necessary (see [Figure 47 on page 109](#)):
 - a. Lift the latch in the center of the two MIC slots to disengage the septum from the chassis.
 - b. Slide the septum toward you, and then lift the septum out of the slot.
 - c. Store the septum for later use.

Figure 47: Removing the Septum



Lift up here. Then slide the septum toward you.

Lift the septum out of the chassis.

4. Pull the ejector lever above both MIC slots away from the router.
5. Align the rear of the MIC with the guides located at the corners of the MIC slot.
6. Slide the MIC into the MIC slot until it is firmly seated in the chassis.



CAUTION: Slide the MIC straight into the slot to avoid damaging the components on the MIC.

7. Verify that the ejector levers are engaged by pushing them toward the router.
8. If the MIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.



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



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

9. Insert the appropriate cables into the cable connectors on the MIC.
10. Arrange each cable to prevent the cable from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop.



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



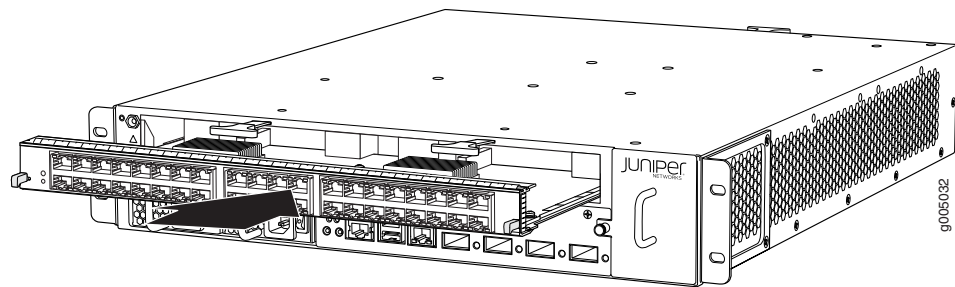
CAUTION: Avoid bending a fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

11. Use one of the following methods to bring the MIC online:
 - Press the MIC offline/online button until the MIC OK/FAIL LED lights green.
 - Issue the following CLI command:

```
user@host> request chassis mic fpc-slot slot-number mic-slot slot-number online
```

The normal functioning status LED confirms that the MIC is online. You can also verify correct MIC functioning by issuing the `show chassis fpc pic-status` command described in ["Maintaining the MX5, MX10, MX40, and MX80 MICs"](#) on page 103.

Figure 48: Installing a Dual-Wide MIC



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

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

- [Removing an MX5, MX10, MX40, and MX80 Transceiver on page 111](#)
- [Installing an MX5, MX10, MX40, and MX80 Transceiver on page 112](#)

Removing an MX5, MX10, MX40, and MX80 Transceiver

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

To remove an SFP or XFP transceiver (see [Figure 49 on page 112](#)):

1. Have ready a replacement transceiver or a transceiver slot plug, an antistatic mat, and a rubber safety cap for the transceiver.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Label the cables connected to the transceiver so that you can reconnect them correctly later.



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

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

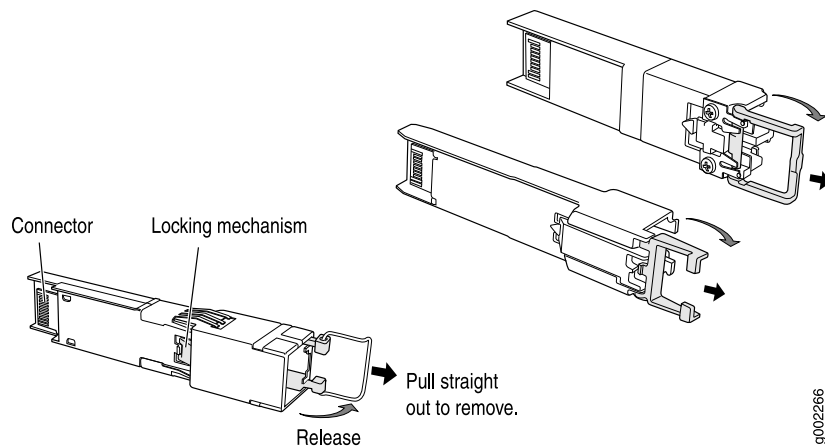


CAUTION: Make sure that you open the ejector handle completely until you hear it click. This prevents damage to the transceiver.

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

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

Figure 49: Removing SFPs or XFPs



8. Place a rubber safety cap over the transceiver.
9. Place the removed transceiver on an antistatic mat or in an electrostatic bag.



CAUTION: After removing a transceiver from the chassis, wait at least 30 seconds before reinserting it or inserting a transceiver into a different slot.

Installing an MX5, MX10, MX40, and MX80 Transceiver

To install an SFP or XFP:

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Take each transceiver to be installed out of its electrostatic bag, and identify the slot on the component where it will be installed.
3. Verify that each transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a safety cap.
4. Carefully align the transceiver with the slots in the component. The connectors should face the component.

5. Slide the transceiver until the connector is seated in the component slot. If you are unable to fully insert the transceiver, make sure the connector is facing the right way.
6. Close the ejector handle of the transceiver.
7. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.



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

8. Verify that the status LEDs on the component faceplate indicate that the SFP or XFP is functioning correctly. For more information about the component LEDs, see the [MX Series Interface Module Reference](#).

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

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

Action On a regular basis:

- Use the cable management bracket to support cables and prevent cables from dislodging or developing stress points.
- Place excess cable out of the way in the cable management bracket. Do not allow fastened loops of cable to dangle from the connector or cable management bracket, because this stresses the cable at the fastening point. Putting fasteners on the loops helps to maintain their shape.
- Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them if necessary before connecting an interface.
- Label both ends of the cables to identify them.

The following guidelines apply specifically to fiber-optic cables:

- When you unplug a fiber-optic cable, always place a rubber safety plug over the transceiver on the faceplate and on the end of the cable.
- Anchor fiber-optic cables to avoid stress on the connectors. Be sure to secure fiber-optic cables so that they do not support their own weight as they hang to the floor. Never let fiber-optic cable hang free from the connector.
- Avoid bending fiber-optic cable beyond its bend radius. An arc smaller than a few inches can damage the cable and cause problems that are difficult to diagnose.

- Frequent plugging and unplugging of fiber-optic cable into and out of optical instruments can cause damage to the instruments that is expensive to repair. Instead, attach a short fiber extension to the optical equipment. Any wear and tear due to frequent plugging and unplugging is then absorbed by the short fiber extension, which is easy and inexpensive to replace.
- Keep fiber-optic cable connections clean. Small microdeposits of oil and dust in the canal of the transceiver or cable connector could cause loss of light, reducing signal power and possibly causing intermittent problems with the optical connection.

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

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

- See Also**
- [MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 43](#)
 - [MX5, MX10, MX40, and MX80 Modular Interface Card LEDs on page 57](#)

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

- [Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 114](#)
- [Replacing an MX5, MX10, MX40, and MX80 AC Power Supply on page 115](#)
- [Replacing an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 117](#)
- [Replacing an MX5, MX10, MX40, and MX80 DC Power Supply on page 118](#)
- [Replacing an MX5, MX10, MX40, and MX80 DC Power Supply Cable on page 122](#)

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

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

Action On a regular basis:

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

```
user@host> show chassis environment pem
```

```
PEM 0 status:
  State           Online
  Temperature     OK
  DC Output:      OK
PEM 1 status:
  State           Online
  Temperature     OK
  DC Output:      OK
```

- Make sure that the power and grounding cables are arranged so that they do not obstruct access to other router components.
- Routinely check the status LEDs on the power supply faceplates and the front panel to determine if the power supplies are functioning normally.
- Check the alarm LEDs on the front panel. Power supply failure or removal triggers an alarm that causes one or both of the LEDs to light. You can display the associated error messages by issuing the **show chassis alarms** command:

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

- Periodically inspect the site to ensure that the grounding and power cables connected to the router are securely in place and that there is no moisture accumulating near the router.

- See Also**
- [MX5, MX10, MX40, and MX80 Power System Description on page 32](#)
 - [MX5, MX10, MX40, and MX80 Power Supply LED on page 34](#)

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



Video: [Replacing an MX5, MX10, MX40, and MX80 AC Power Supply](#)

- [Removing an MX5, MX10, MX40, and MX80 AC Power Supply on page 115](#)
- [Installing an MX5, MX10, MX40, and MX80 AC Power Supply on page 116](#)

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

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



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



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

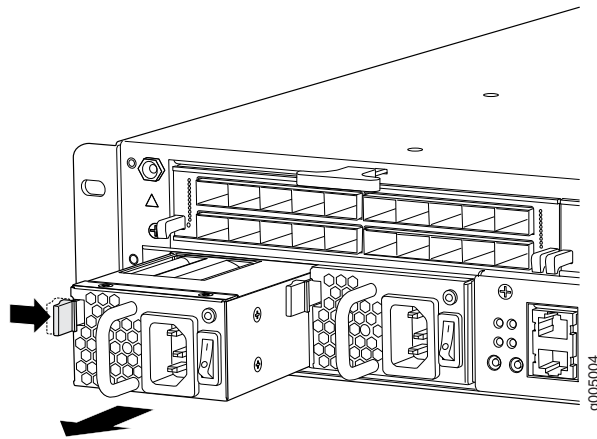


NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove an AC power supply (see [Figure 50 on page 116](#)):

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

Figure 50: Removing an AC Power Supply



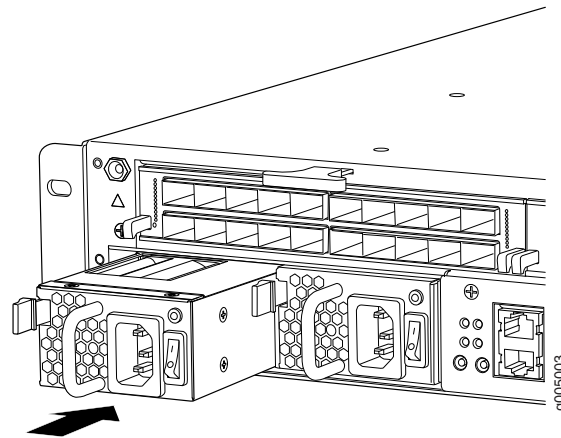
Installing an MX5, MX10, MX40, and MX80 AC Power Supply

To install an AC power supply (see [Figure 51 on page 117](#)):

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

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

Figure 51: Installing an AC Power Supply



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

- [Disconnecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 117](#)
- [Connecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 118](#)

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

To disconnect the AC power cord:

1. Switch off the dedicated customer site circuit breaker for the power supply, and remove the power cord from the AC power source. Follow the instructions for your site.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Move the AC input switch next to the appliance inlet on the power supply to the off (O) position.
4. Remove the power cord from the power supply.

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

To connect the AC power cord:

1. Locate a replacement power cord with the type of plug appropriate for your geographic location (see “AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers” on page 37).
2. Connect the power cord to the power supply.
3. Insert the power cord plug into an external AC power source receptacle.
4. Route the power cord appropriately. Verify that the power cord does not block the air exhaust and access to router components, or drape where people could trip on it.
5. Switch the AC input switch on the each power supply to the on (I) position, and observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

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

- [Removing an MX5, MX10, MX40, and MX80 DC Power Supply on page 118](#)
- [Installing an MX5, MX10, MX40, and MX80 DC Power Supply on page 120](#)

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

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



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



WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.



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

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



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

To remove a DC power supply (see [Figure 52 on page 120](#)):

1. Switch off the dedicated customer site circuit breaker for the power supply being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Verify that the status LED on the power supply is not lit.
4. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
5. Move the DC circuit breaker on the DC power supply faceplate to the off (O) position.
6. Remove the clear plastic cover protecting the terminal studs on the faceplate (see [Figure 53 on page 120](#)).
7. Remove the screw from each of the terminals. (Use a number 2 Phillips screwdriver.)
8. Remove the cable lugs from the terminals.
9. Carefully move the power cables out of the way.
10. Press the latch located on the left side of the power supply, to release it from the chassis.
11. Pull the power supply straight out of the chassis.

Figure 52: Removing a DC Power Supply

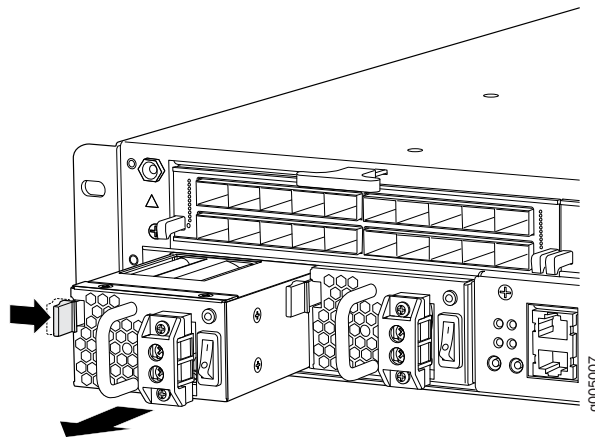
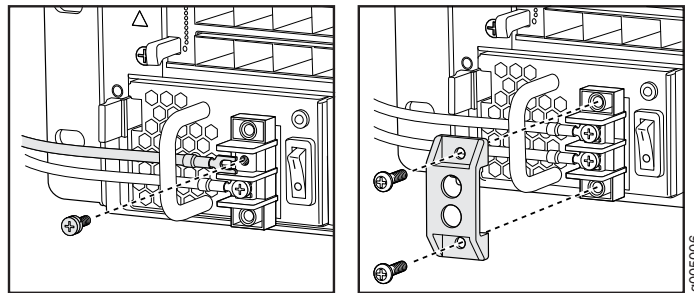


Figure 53: Disconnecting the DC Power Cables



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



WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

To install a DC power supply (see [Figure 54 on page 122](#)):

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Switch the DC circuit breaker on the DC power supply faceplate to the off (O) position.

4. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate should be flush with any adjacent power supply faceplate or blank installed in the power supply slot.
5. Remove the clear plastic cover protecting the terminal on the faceplate.
6. Remove the screws from the terminals.
7. Secure each power cable lug to the terminal with the screw (see [Figure 55 on page 122](#)). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to screw. Do not overtighten the nut. (Use a number 2 Phillips screwdriver.)
 - a. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal.
 - b. Secure the negative (–) DC source power cable lug to the **–48V** (input) terminal.



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



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



NOTE: For information about connecting to DC power sources, see “[MX5, MX10, MX40, and MX80 Routers DC Power Specifications](#)” on page 39.

8. Replace the clear plastic cover over the terminals on the faceplate.
9. Verify that the power cabling is correct, that the cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.
10. On each of the DC power supplies, switch the DC circuit breaker to the center position before moving it to the on (|) position.



NOTE: The circuit breaker may bounce back to the off (O) position if you move the breaker too quickly.



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

Figure 54: Installing a DC Power Supply

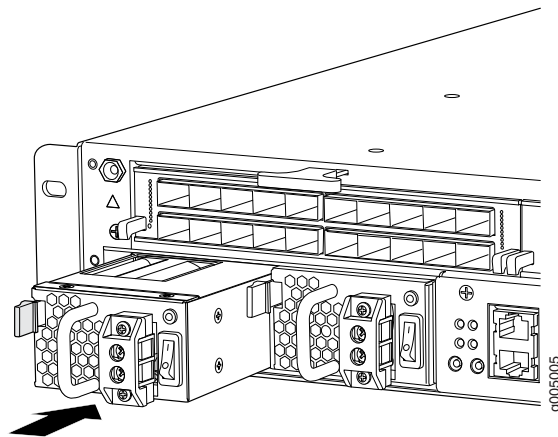
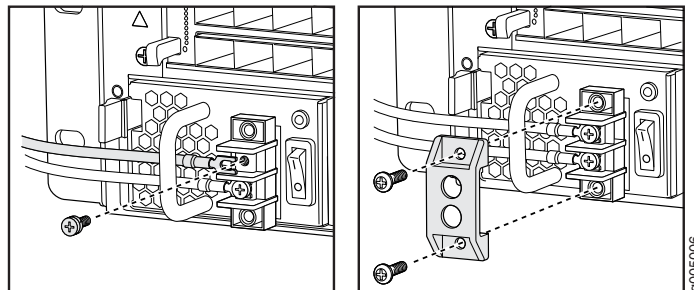


Figure 55: Connecting the DC Power Cables



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

- [Disconnecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable on page 123](#)
- [Connecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable on page 124](#)

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



WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

To disconnect a power cable for a DC power supply:

1. Switch off the dedicated customer site circuit breaker for the power supply being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Verify that the status LED on the power supply is not lit.
4. Remove the power cable from the external DC power source.
5. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
6. Move the DC circuit breaker on the DC power supply faceplate to the off (O) position.
7. Remove the clear plastic cover protecting the terminal studs on the faceplate.
8. Remove the screw from each of the terminals. (Use a number 2 Phillips screwdriver.)
9. Remove the cable lugs from the terminals.
10. Carefully move the power cables out of the way.

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



WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

To connect a power cable for a DC power supply:

1. Locate a replacement power cable that meets the specifications.
2. Verify that a licensed electrician has attached a cable lug to the replacement power cable.
3. Verify that the status LED is off.
4. Secure each power cable lug to the terminal with the screw (see [Figure 56 on page 125](#)). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to screw. Do not overtighten the nut. (Use a number 2 Phillips screwdriver.)
 - a. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal.
 - b. Secure the negative (–) DC source power cable lug to the **–48V** (input) terminal.

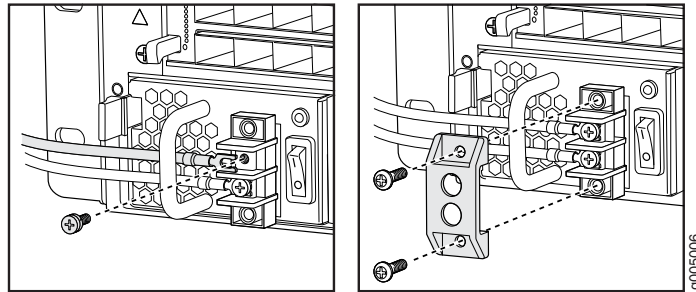


CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the screws. Ensure that each screw is properly threaded into the terminal. Applying installation torque to the screw when improperly threaded may result in damage to the terminal.



CAUTION: The maximum torque rating of the terminal screws on the DC power supply is 6 lb-in. (0.7 Nm). The terminal screws may be damaged if excessive torque is applied. Use only a torque-controlled driver to tighten screws on the DC power supply terminals. Use an appropriately-sized driver, with a maximum torque capacity of 6 lb-in. or less. Ensure that the driver is undamaged and properly calibrated and that you have been trained in its use. You may wish to use a driver that is designed to prevent overtorque when the preset torque level is achieved.

Figure 56: Connecting Power Cables to the DC Power Supply



5. Verify that the DC power cable is connected correctly, that it does not touch or block access to router components, and that it does not drape where people could trip on it.
6. Replace the clear plastic cover over the terminals on the faceplate.
7. Attach the power cable to the DC power source.
8. Turn on the dedicated customer site circuit breaker to the power supply.
9. Verify that the status LED on the power supply is lit green steadily.
10. On each of the DC power supplies, switch the DC circuit breaker to the center position before moving it to the on (|) position.



NOTE: The circuit breaker may bounce back to the off (O) position if you move the breaker too quickly.

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

- See Also**
- [MX5, MX10, MX40, and MX80 Power System Description on page 32](#)
 - [Installing an MX5, MX10, MX40, and MX80 DC Power Supply on page 120](#)
 - [Disconnecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable on page 123](#)
 - [Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 146](#)
 - [MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 39](#)
 - [DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 41](#)
 - [DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 41](#)

- [DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 41](#)

CHAPTER 5

Troubleshooting Hardware

- Troubleshooting the MX5, MX10, MX40, and MX80 on page 127

Troubleshooting the MX5, MX10, MX40, and MX80

- Troubleshooting Resources for MX5, MX10, MX40, and MX80 Routers on page 127
- Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray on page 129
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 130
- Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies on page 130

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

- Command-Line Interface on page 127
- Chassis and Interface Alarm Messages on page 127
- Front Panel LEDs on page 128
- Component LEDs on page 128

Command-Line Interface

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

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

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

Chassis and Interface Alarm Messages

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

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

There are two classes of alarm messages:

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

Front Panel LEDs

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

LEDs on the front panel include the following:

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

Component LEDs

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

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

- See Also**
- *ping*
 - *traceroute*
 - *show chassis alarms*

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

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

Solution Follow these guidelines to troubleshoot the fans:

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

user@host> **show chassis fan**

Item	Status	RPM	Measurement
Fan 1	OK	4560	Spinning at intermediate-speed
Fan 2	OK	4560	Spinning at intermediate-speed
Fan 3	OK	4560	Spinning at intermediate-speed
Fan 4	OK	4560	Spinning at intermediate-speed
Fan 5	OK	4560	Spinning at intermediate-speed

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

If the CLI output lists only one fan failure, and the other fans are functioning normally, the fan is most likely faulty and you must replace the fan tray.

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

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

user@host> **show chassis temperature-thresholds**

Item	Fan speed		Yellow alarm		Red alarm	
	Normal	High	Normal	Bad fan	Normal	Bad fan
Chassis default	48	54	65	55	75	65
Routing Engine	55	60	75	65	85	70

- See Also**
- *MX5, MX10, MX40, and MX80 Cooling System Description*
 - *show chassis fan*

- `show chassis alarms`
- `show chassis temperature-thresholds`

Troubleshooting the MX5, MX10, MX40, and MX80 MICs

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

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

```
user@host> show chassis fpc pic-status
```

```
Slot 0  Online
  PIC 0  Online      4x 10GE XFP
  PIC 2  Online      1x 10GE XFP
  PIC 3  Online      1x 10GE XFP
Slot 1  Online
  PIC 0  Online      1x 10GE XFP
  PIC 1  Online      1x 10GE XFP
  PIC 2  Online      1x 10GE XFP
  PIC 3  Online      1x 10GE XFP
```

For further description of the output from the command, see the [CLI Explorer](#).

- See Also**
- [MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 43](#)
 - `show chassis fpc`

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

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

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

```
user@host> show chassis environment pem
```

```
PEM 0 status:
  State           Online
  Temperature     OK
```

DC Output:	OK
PEM 1 status:	
State	Online
Temperature	OK
DC Output:	OK

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



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

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

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



NOTE: If the cause of power failure is due to lightening, power off the power supply module and then power it on again. If the power supply module is working properly, it comes back with its LED in the green state. If there are no abnormal causes for the power supply module failure, or if the power supply module LED is still red after powering off and powering on again, then try reseating the power supply module and if it does not work, then try to install it in a different slot.

- See Also**
- [MX5, MX10, MX40, and MX80 Power System Description on page 32](#)
 - [MX5, MX10, MX40, and MX80 Power Supply LED on page 34](#)
 - `show chassis environment pem`

- *show chassis alarms*

CHAPTER 6

Contacting Customer Support and Returning the Chassis or Components

- Contacting Customer Support and Returning the Chassis or Components on page 133

Contacting Customer Support and Returning the Chassis or Components

- Returning a Hardware Component to Juniper Networks, Inc. on page 133
- Displaying MX5, MX10, MX40, and MX80 Components and Serial Numbers on page 134
- MX5, MX10, MX40, and MX80 Chassis Serial Number Label on page 135
- MX5, MX10, MX40, and MX80 Fan Tray Serial Number Label on page 135
- MX5, MX10, MX40, and MX80 MIC Serial Number Label on page 136
- MX5, MX10, MX40, and MX80 Power Supply Serial Number Label on page 137
- Contacting Customer Support to Obtain Return Material Authorization on page 138
- Guidelines for Packing Hardware Components for Shipment on page 138
- Packing MX5, MX10, MX40, and MX80 Routers for Shipment on page 139

Returning a Hardware Component to Juniper Networks, Inc.

In the event of a hardware failure, please contact Juniper Networks, Inc. to obtain a Return Material Authorization (RMA) number. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.



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

For more information about return and repair policies, see the customer support Web page at <https://support.juniper.net/support/>.

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Service Request Manager link at <https://support.juniper.net/support/> or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

To return a defective hardware component:

1. Determine the part number and serial number of the defective component.
2. Obtain an RMA number from the Juniper Networks Technical Assistance Center (JTAC). You can send e-mail or telephone as described above.
3. Provide the following information in your e-mail message or during the telephone call:
 - Part number and serial number of component
 - Your name, organization name, telephone number, and fax number
 - Description of the failure
4. The support representative validates your request and issues an RMA number for return of the component.
5. Pack the component for shipment.

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

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

```
user@host> show chassis hardware
```

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

PIC 2			BUILTIN	BUILTIN	1x 10GE XFP
Xcvr 0	REV 01	740-014279	K9J03BF		XFP-10G-LR
PIC 3			BUILTIN	BUILTIN	1x 10GE XFP
Xcvr 0	REV 01	740-014279	K9J02UB		XFP-10G-LR
Fan Tray					Fan Tray

Most components also have a small rectangular serial number ID label (see [Figure 57 on page 135](#)) attached to the component body.

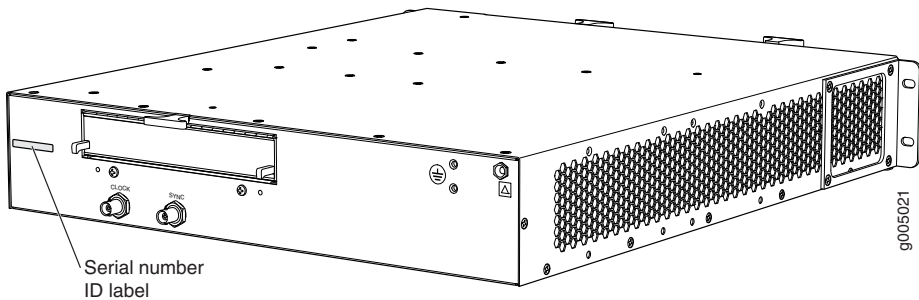
Figure 57: Serial Number ID Label



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

The chassis serial number is located on the rear of the chassis (see [Figure 58 on page 135](#)).

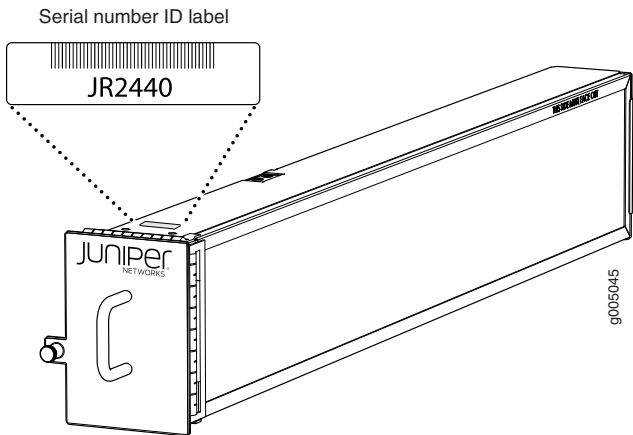
Figure 58: MX5, MX10, MX40, and MX80 Chassis Serial Number Label



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

The serial number label is located on the top of the fan tray toward the front (see [Figure 59 on page 135](#)).

Figure 59: MX5, MX10, MX40, and MX80 Fan Tray Serial Number Label



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

The exact location may be slightly different on different MICs, depending on the placement of components on the MIC board (see [Figure 60 on page 136](#), [Figure 61 on page 136](#), and [Figure 62 on page 137](#)).

Figure 60: 20-Port MIC Serial Number Label

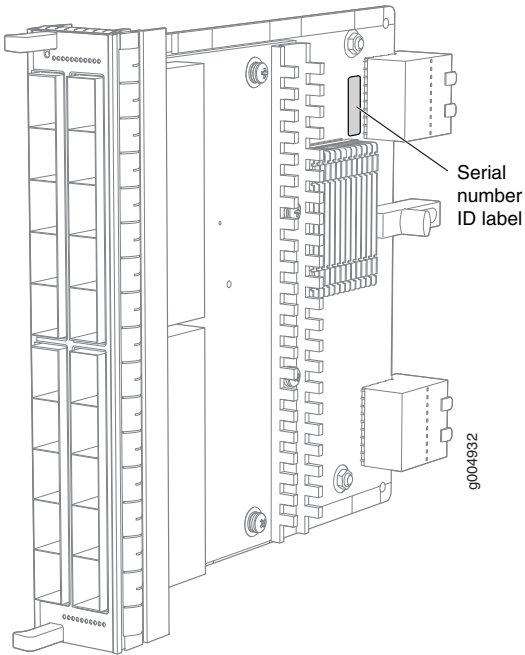


Figure 61: 40-Port MIC Serial Number Label

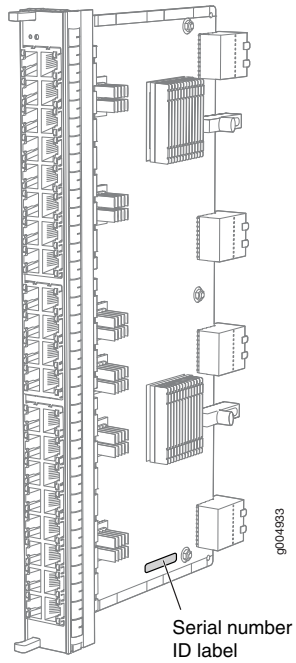
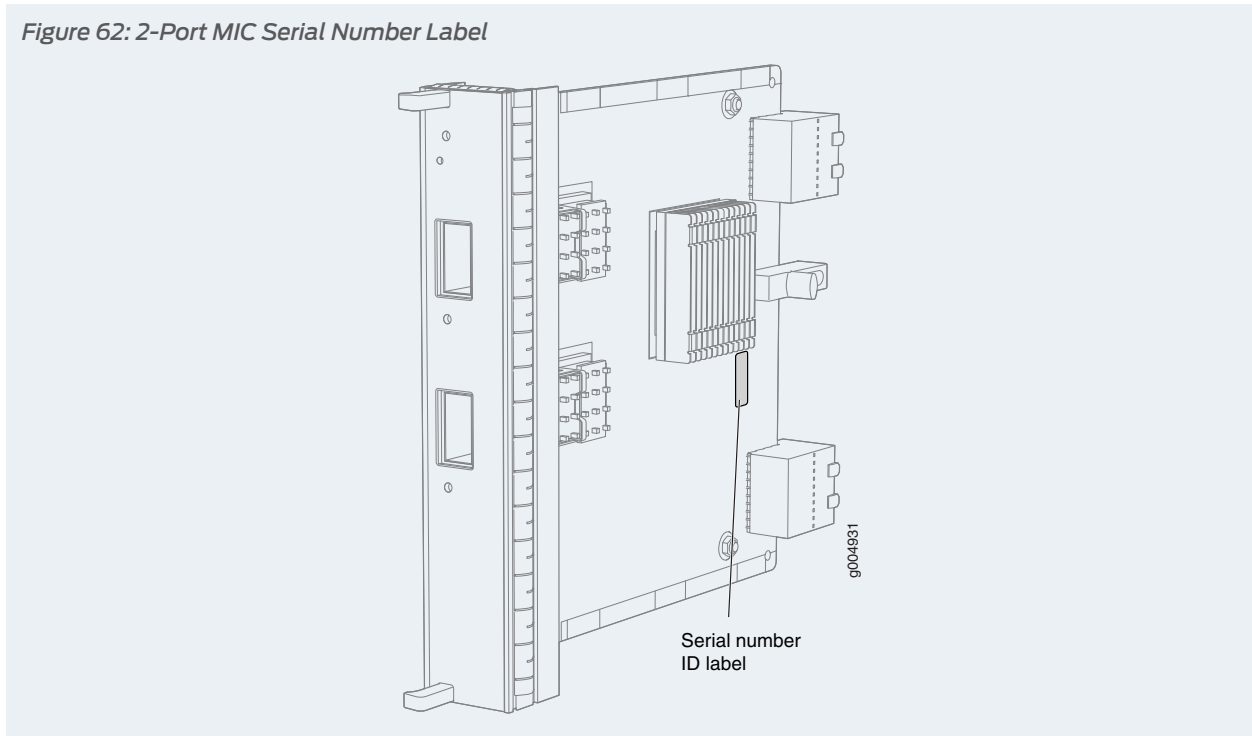


Figure 62: 2-Port MIC Serial Number Label

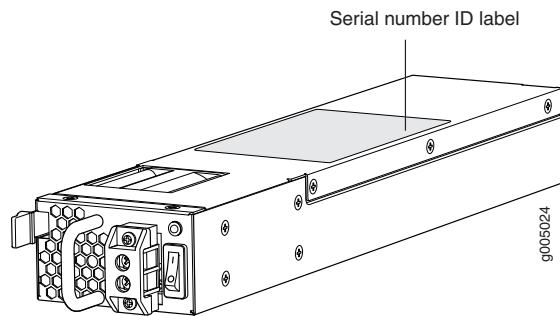


See Also • [MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 43](#)

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

The serial number label is located on the top of the power supply (see [Figure 63 on page 137](#)).

Figure 63: Power Supply Serial Number Label



See Also • [MX5, MX10, MX40, and MX80 Power System Description on page 32](#)

Contacting Customer Support to Obtain Return Material Authorization

If you are returning a device or hardware component to Juniper Networks for repair or replacement, obtain a Return Material Authorization (RMA) number from Juniper Networks Technical Assistance Center (JTAC).

After locating the serial number of the device or hardware component you want to return, open a service request with Juniper Networks Technical Assistance Center (JTAC) on the Web or by telephone.

Before you request an RMA number from JTAC, be prepared to provide the following information:

- Your existing service request number, if you have one
- Serial number of the component
- Your name, organization name, telephone number, fax number, and shipping address
- Details of the failure or problem
- Type of activity being performed on the device when the problem occurred
- Configuration data displayed by one or more **show** commands

You can contact JTAC 24 hours a day, seven days a week on the Web or by telephone:

- Service Request Manager: <https://support.juniper.net/support>
- Telephone: +1-888-314-JTAC (+1-888-314-5822), toll free in U.S., Canada, and Mexico



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

If you are contacting JTAC by telephone, enter your 12-digit service request number followed by the pound (#) key for an existing case, or press the star (*) key to be routed to the next available support engineer.

The support representative validates your request and issues an RMA number for return of the component.

Guidelines for Packing Hardware Components for Shipment

To pack and ship individual components:

- When you return components, make sure they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in antistatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.



CAUTION: Do not stack any of the hardware components.

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

To pack the router for shipment:

1. Retrieve the shipping box and packing materials in which the router was originally shipped. If you do not have these materials, contact your Juniper Networks representative about approved packaging materials.
2. On the console or other management device connected to the Routing Engine, enter CLI operational mode and issue the following command to shut down the router software.

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

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

For more information about the command, see the [CLI Explorer](#).

3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Shut down power to the router by pressing the AC input switch or DC circuit breaker for all power supplies to the off (O) position.
5. Disconnect power from the router.
6. Remove the cables that connect to all external devices.
7. Remove all field replaceable units (FRUs) from the router.
8. Remove the router from the rack. One person should grasp the router while a second person unscrews and removes the mounting screws from the rack. One lifter can then move the router to the shipping container.
9. Place the router in the shipping container.
10. Cover the router with an ESD bag and place the packing foam on top of and around the router.
11. Replace the accessory box on top of the packing foam.

12. Securely tape the box closed.

13. Write the RMA number on the exterior of the box to ensure proper tracking.

- See Also**
- [Returning a Hardware Component to Juniper Networks, Inc. on page 133](#)
 - *Contacting Customer Support*

CHAPTER 7

Safety and Compliance Information

- Definition of Safety Warning Levels on page 141
- General Safety Guidelines for Juniper Networks Devices on page 143
- General Safety Warnings for Juniper Networks Devices on page 144
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 146
- Fire Safety Requirements for Juniper Networks Devices on page 147
- MX5, MX10, MX40 and MX80 Chassis Lifting Guidelines on page 149
- Installation Safety Warnings for Juniper Networks Devices on page 149
- General Laser Safety Guidelines for Juniper Networks Devices on page 154
- Laser Safety Warnings for Juniper Networks Devices on page 155
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 158
- In Case of an Electrical Accident on page 163
- General Electrical Safety Warnings for Juniper Networks Devices on page 163
- General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices on page 167
- AC Power Electrical Safety Guidelines and Warnings for MX5, MX10, MX40, and MX80 Routers on page 167
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 168
- MX5, MX10, MX40, and MX80 DC Power Electrical Safety Guidelines on page 172
- Site Electrical Wiring Guidelines for MX Series Routers on page 173
- Agency Approvals and Compliance Statements on page 173
- Statements of Volatility for Juniper Network Devices on page 176

Definition of Safety Warning Levels

The documentation uses the following levels of safety warnings:



NOTE: You might find this information helpful in a particular situation, or might otherwise overlook it.



CAUTION: You must observe the specified guidelines to avoid minor injury or discomfort to you, or severe damage to the hardware device.



WARNING: This symbol alerts you to the risk of personal injury from a laser.



WARNING: This symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

Waarschuwing Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

Varoitus Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista.

Attention Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents.

Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du være oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos

elétricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes.

¡Atención! Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes.

Varning! Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador.

**Related
Documentation**

- [General Safety Warnings for Juniper Networks Devices on page 144](#)
- [Installation Safety Warnings for Juniper Networks Devices on page 149](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 158](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 163](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 168](#)

General Safety Guidelines for Juniper Networks Devices

The following guidelines help ensure your safety and protect the hardware equipment from damage. The list of guidelines might not address all potentially hazardous situations in your working environment, so be alert and exercise good judgment at all times.

- Perform only the procedures explicitly described in this documentation. Make sure that only authorized service personnel perform other system services.
- Keep the area around the chassis clear and free from dust before, during, and after installation.
- Keep tools away from areas where people could trip over them while walking.
- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, that could become caught in the chassis.
- Wear safety glasses if you are working under any conditions that could be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.
- Never install or manipulate wiring during electrical storms.
- Never install electrical jacks in wet locations unless the jacks are specifically designed for wet environments.
- Operate the hardware equipment only when the chassis is properly grounded.

- Do not open or remove chassis covers or sheet metal parts unless instructions are provided in this documentation. Such an action could cause severe electrical shock.
- Do not push or force any objects through any opening in the chassis frame. Such an action could result in electrical shock or fire.
- Avoid spilling liquid onto the chassis or onto any hardware component. Such an action could cause electrical shock or damage the hardware equipment.
- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Such an action could cause electrical shock.
- Some parts of the router might become hot. The following label provides the warning of the hot surfaces on the router:



Related Documentation

- [General Safety Warnings for Juniper Networks Devices on page 144](#)

General Safety Warnings for Juniper Networks Devices

- [Qualified Personnel Warning on page 144](#)
- [Restricted-Access Area Warning on page 145](#)

Qualified Personnel Warning



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

Waarschuwing Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.

Varoitus Ainoastaan koulutettu ja pätevä henkilökunta saa asentaa tai vaihtaa tämän laitteen.

Attention Tout installation ou remplacement de l'appareil doit être réalisé par du personnel qualifié et compétent.

Warnung Gerät nur von geschultem, qualifiziertem Personal installieren oder auswechseln lassen.

Avvertenza Solo personale addestrato e qualificato deve essere autorizzato ad installare o sostituire questo apparecchio.

Advarsel Kun kvalifisert personell med riktig opplæring bør montere eller bytte ut dette utstyret.

Aviso Este equipamento deverá ser instalado ou substituído apenas por pessoal devidamente treinado e qualificado.

¡Atención! Estos equipos deben ser instalados y reemplazados exclusivamente por personal técnico adecuadamente preparado y capacitado.

Varning! Denna utrustning ska endast installeras och bytas ut av utbildad och kvalificerad personal.

Restricted-Access Area Warning



WARNING: The hardware equipment is intended for installation in restricted-access areas. A restricted-access area is an area to which access can be gained only by service personnel through the use of a special tool, lock and key, or other means of security, and which is controlled by the authority responsible for the location.

Waarschuwing Dit toestel is bedoeld voor installatie op plaatsen met beperkte toegang. Een plaats met beperkte toegang is een plaats waar toegang slechts door servicepersoneel verkregen kan worden door middel van een speciaal instrument, een slot en sleutel, of een ander veiligheidsmiddel, en welke beheerd wordt door de overheidsinstantie die verantwoordelijk is voor de locatie.

Varoitus Tämä laite on tarkoitettu asennettavaksi paikkaan, johon pääsy on rajoitettua. Paikka, johon pääsy on rajoitettua, tarkoittaa paikkaa, johon vain huoltohenkilöstö pääsee jonkin erikoistyökalun, lukkoon sopivan avaimen tai jonkin muun turvalaitteen avulla ja joka on paikasta vastuussa olevien toimivaltaisten henkilöiden valvoma.

Attention Cet appareil est à installer dans des zones d'accès réservé. Ces dernières sont des zones auxquelles seul le personnel de service peut accéder en utilisant un outil spécial, un mécanisme de verrouillage et une clé, ou tout autre moyen de sécurité. L'accès aux zones de sécurité est sous le contrôle de l'autorité responsable de l'emplacement.

Warnung Diese Einheit ist zur Installation in Bereichen mit beschränktem Zutritt vorgesehen. Ein Bereich mit beschränktem Zutritt ist ein Bereich, zu dem nur Wartungspersonal mit einem Spezialwerkzeugs, Schloß und Schlüssel oder anderer Sicherheitsvorkehrungen Zugang hat, und der von dem für die Anlage zuständigen Gremium kontrolliert wird.

Avvertenza Questa unità deve essere installata in un'area ad accesso limitato. Un'area ad accesso limitato è un'area accessibile solo a personale di assistenza tramite un'attrezzo speciale, lucchetto, o altri dispositivi di sicurezza, ed è controllata dall'autorità responsabile della zona.

Advarsel Denne enheten er laget for installasjon i områder med begrenset adgang. Et område med begrenset adgang gir kun adgang til servicepersonale som bruker et spesielt verktøy, lås og nøkkel, eller en annen

sikkerhedsanordning, og det kontrolleres av den autoriteten som er ansvarlig for området.

Aviso Esta unidade foi concebida para instalação em áreas de acesso restrito. Uma área de acesso restrito é uma área à qual apenas tem acesso o pessoal de serviço autorizado, que possua uma ferramenta, chave e fechadura especial, ou qualquer outra forma de segurança. Esta área é controlada pela autoridade responsável pelo local.

¡Atención! Esta unidad ha sido diseñada para instalarse en áreas de acceso restringido. Área de acceso restringido significa un área a la que solamente tiene acceso el personal de servicio mediante la utilización de una herramienta especial, cerradura con llave, o algún otro medio de seguridad, y que está bajo el control de la autoridad responsable del local.

Varning! Denna enhet är avsedd för installation i områden med begränsat tillträde. Ett område med begränsat tillträde får endast tillträdas av servicepersonal med ett speciellt verktyg, lås och nyckel, eller annan säkerhetsanordning, och kontrolleras av den auktoritet som ansvarar för området.

Related Documentation

- [Installation Safety Warnings for Juniper Networks Devices on page 149](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 158](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 163](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 168](#)

Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router

Many router hardware components are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

- Always use an ESD wrist strap or ankle strap, and make sure that it is in direct contact with your skin.



CAUTION: For safety, periodically check the resistance value of the ESD strap. The measurement should be in the range of from 1 to 10 Mohms.

- When handling any component that is removed from the chassis, make sure the equipment end of your ESD strap is attached to one of the electrostatic discharge points on the chassis (see [Figure 64 on page 147](#)).

- Avoid contact between the component and your clothing. ESD voltages emitted from clothing can still damage components.
- When removing or installing a component, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an electrostatic bag (see [Figure 65 on page 147](#)). If you are returning a component, place it in an electrostatic bag before packing it.

Figure 64: ESD Points on the MX5, MX10, MX40, and MX80 Chassis

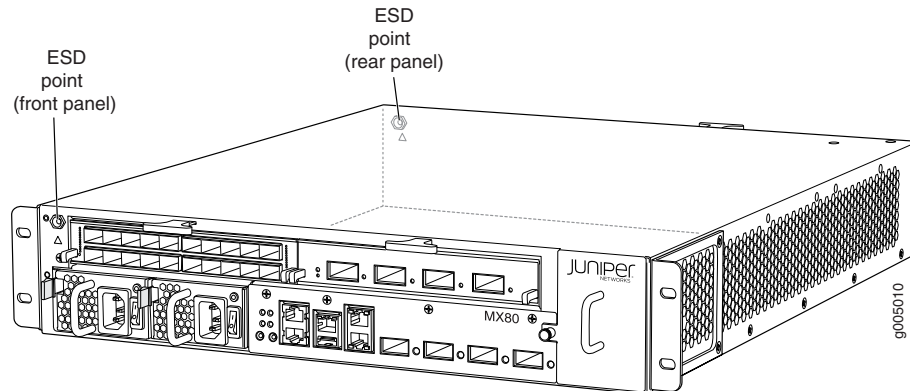
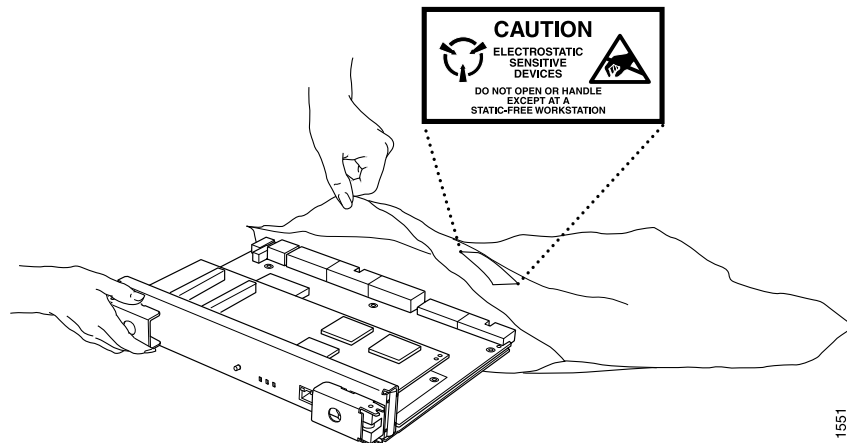


Figure 65: Placing a Component into an Electrostatic Bag



Fire Safety Requirements for Juniper Networks Devices

- [General Fire Safety Requirements on page 147](#)
- [Fire Suppression on page 148](#)
- [Fire Suppression Equipment on page 148](#)

General Fire Safety Requirements

In the event of a fire emergency involving network devices, the safety of people is the primary concern. Establish procedures for protecting people in a fire emergency, provide safety training, and properly provision fire-control equipment and fire extinguishers.

In addition, establish procedures to protect your equipment in a fire emergency. Juniper Networks products must be installed in an environment suitable for electronic equipment. We recommend that fire suppression equipment be available in the event of a fire in the vicinity of the equipment, and that you observe all local fire, safety, and electrical codes and ordinances when installing and operating your equipment.

Fire Suppression

In the event of an electrical hazard or an electrical fire, first turn off power to the equipment at the source. Then use a Type C fire extinguisher, which uses noncorrosive fire retardants, to extinguish the fire.

Fire Suppression Equipment

Type C fire extinguishers, which use noncorrosive fire retardants such as carbon dioxide (CO₂) and Halotron, are most effective for suppressing electrical fires. Type C fire extinguishers displace the oxygen from the point of combustion to eliminate the fire. For extinguishing fire on or around equipment that draws air from the environment for cooling, use this type of inert oxygen displacement extinguisher instead of an extinguisher that leave residues on equipment.

Do not use multipurpose Type ABC chemical fire extinguishers (dry chemical fire extinguishers) near Juniper Networks devices. The primary ingredient in these fire extinguishers is monoammonium phosphate, which is very sticky and difficult to clean. In addition, in minute amounts of moisture, monoammonium phosphate can become highly corrosive and corrodes most metals.

Any equipment in a room in which a chemical fire extinguisher has been discharged is subject to premature failure and unreliable operation. The equipment is considered to be irreparably damaged.



NOTE: To keep warranties effective, do not use a dry chemical fire extinguisher to control a fire at or near a Juniper Networks device. If a dry chemical fire extinguisher is used, the unit is no longer eligible for coverage under a service agreement.

We recommend that you dispose of any irreparably damaged equipment in an environmentally responsible manner.

Related Documentation

- [General Safety Guidelines for Juniper Networks Devices on page 143](#)
- [General Safety Warnings for Juniper Networks Devices on page 144](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 163](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 168](#)

MX5, MX10, MX40 and MX80 Chassis Lifting Guidelines

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

- Before moving the router, read the guidelines in [“MX5, MX10, MX40, and MX80 Site Preparation Checklist” on page 59](#) to verify that the intended site meets the specified power, environmental, and clearance requirements.
- Before lifting or moving the router, disconnect all external cables.

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

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

Installation Safety Warnings for Juniper Networks Devices

Observe the following warnings before and during hardware equipment installation:

- [Intrabuilding Ports Warning on page 149](#)
- [Installation Instructions Warning on page 150](#)
- [Rack-Mounting Requirements and Warnings on page 150](#)
- [Ramp Warning on page 154](#)

Intrabuilding Ports Warning



WARNING: The intrabuilding ports of the equipment or subassembly are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of the equipment or subassembly **MUST NOT** be metallically connected to interfaces that connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Installation Instructions Warning



WARNING: Read the installation instructions before you connect the hardware equipment to a power source.

Waarschuwing Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

Attention Avant de brancher le système sur la source d'alimentation, consulter les directives d'installation.

Warnung Lesen Sie die Installationsanweisungen, bevor Sie das System an die Stromquelle anschließen.

Avvertenza Consultare le istruzioni di installazione prima di collegare il sistema all'alimentatore.

Advarsel Les installasjonsinstruksjonene før systemet kobles til strømkilden.

Aviso Leia as instruções de instalação antes de ligar o sistema à sua fonte de energia.

¡Atención! Ver las instrucciones de instalación antes de conectar el sistema a la red de alimentación.

Varning! Läs installationsanvisningarna innan du kopplar systemet till dess strömförsörjningsenhet.

Rack-Mounting Requirements and Warnings

Ensure that the equipment rack into which the chassis is installed is evenly and securely supported, to avoid the hazardous condition that could result from uneven mechanical loading.



WARNING: To prevent bodily injury when mounting or servicing the chassis in a rack, take the following precautions to ensure that the system remains stable. The following directives help maintain your safety:

- The chassis must be installed into a rack that is secured to the building structure.
- The chassis should be mounted at the bottom of the rack if it is the only unit in the rack.

- When mounting the chassis in a partially-filled rack, load the rack from the bottom to the top, with the heaviest component at the bottom of the rack.
- If the rack is provided with stabilizing devices, install the stabilizers before mounting the chassis in the rack or servicing the hardware equipment.

Waarschuwing Om lichamelijk letsel te voorkomen wanneer u dit toestel in een rek monteert of het daar een servicebeurt geeft, moet u speciale voorzorgsmaatregelen nemen om ervoor te zorgen dat het toestel stabiel blijft. De onderstaande richtlijnen worden verstrekt om uw veiligheid te verzekeren:

- De router moet in een stellage worden geïnstalleerd die aan een bouwsel is verankerd.
- Dit toestel dient onderaan in het rek gemonteerd te worden als het toestel het enige in het rek is.
- Wanneer u dit toestel in een gedeeltelijk gevuld rek monteert, dient u het rek van onderen naar boven te laden met het zwaarste onderdeel onderaan in het rek.
- Als het rek voorzien is van stabiliseringshulpmiddelen, dient u de stabilisatoren te monteren voordat u het toestel in het rek monteert of het daar een servicebeurt geeft.

Varoitus Kun laite asetetaan telineeseen tai huolletaan sen ollessa telineessä, on noudatettava erityisiä varotoimia järjestelmän vakavuuden säilyttämiseksi, jotta vältetään loukkaantumiselta. Noudata seuraavia turvallisuusohjeita:

- Router on asennettava telineeseen, joka on kiinnitetty rakennukseen.
- Jos telineessä ei ole muita laitteita, aseta laite telineen alaosaan.
- Jos laite asetetaan osaksi täytettyyn telineeseen, aloita kuormittaminen sen alaosasta kaikkein raskaimmalla esineellä ja siirry sitten sen yläosaan.
- Jos telinettä varten on vakaimet, asenna ne ennen laitteen asettamista telineeseen tai sen huoltamista siinä.

Attention Pour éviter toute blessure corporelle pendant les opérations de montage ou de réparation de cette unité en casier, il convient de prendre des précautions spéciales afin de maintenir la stabilité du système. Les directives ci-dessous sont destinées à assurer la protection du personnel:

- Le rack sur lequel est monté le router doit être fixé à la structure du bâtiment.
- Si cette unité constitue la seule unité montée en casier, elle doit être placée dans le bas.

- Si cette unité est montée dans un casier partiellement rempli, charger le casier de bas en haut en plaçant l'élément le plus lourd dans le bas.
- Si le casier est équipé de dispositifs stabilisateurs, installer les stabilisateurs avant de monter ou de réparer l'unité en casier.

Warnung Zur Vermeidung von Körperverletzung beim Anbringen oder Warten dieser Einheit in einem Gestell müssen Sie besondere Vorkehrungen treffen, um sicherzustellen, daß das System stabil bleibt. Die folgenden Richtlinien sollen zur Gewährleistung Ihrer Sicherheit dienen:

- Der router muß in einem Gestell installiert werden, das in der Gebäudestruktur verankert ist.
- Wenn diese Einheit die einzige im Gestell ist, sollte sie unten im Gestell angebracht werden.
- Bei Anbringung dieser Einheit in einem zum Teil gefüllten Gestell ist das Gestell von unten nach oben zu laden, wobei das schwerste Bauteil unten im Gestell anzubringen ist.
- Wird das Gestell mit Stabilisierungszubehör geliefert, sind zuerst die Stabilisatoren zu installieren, bevor Sie die Einheit im Gestell anbringen oder sie warten.

Avvertenza Per evitare infortuni fisici durante il montaggio o la manutenzione di questa unità in un supporto, occorre osservare speciali precauzioni per garantire che il sistema rimanga stabile. Le seguenti direttive vengono fornite per garantire la sicurezza personale:

- Il router deve essere installato in un telaio, il quale deve essere fissato alla struttura dell'edificio.
- Questa unità deve venire montata sul fondo del supporto, se si tratta dell'unica unità da montare nel supporto.
- Quando questa unità viene montata in un supporto parzialmente pieno, caricare il supporto dal basso all'alto, con il componente più pesante sistemato sul fondo del supporto.
- Se il supporto è dotato di dispositivi stabilizzanti, installare tali dispositivi prima di montare o di procedere alla manutenzione dell'unità nel supporto.

Advarsel Unngå fysiske skader under montering eller reparasjonsarbeid på denne enheten når den befinner seg i et kabinett. Vær nøye med at systemet er stabilt. Følgende retningslinjer er gitt for å verne om sikkerheten:

- Router må installeres i et stativ som er forankret til bygningsstrukturen.
- Denne enheten bør monteres nederst i kabinettet hvis dette er den eneste enheten i kabinettet.

- Ved montering av denne enheten i et kabinett som er delvis fylt, skal kabinettet lastes fra bunnen og opp med den tyngste komponenten nederst i kabinettet.
- Hvis kabinettet er utstyrt med stabiliseringsutstyr, skal stabilisatorene installeres før montering eller utføring av reparasjonsarbeid på enheten i kabinettet.

Aviso Para se prevenir contra danos corporais ao montar ou reparar esta unidade numa estante, deverá tomar precauções especiais para se certificar de que o sistema possui um suporte estável. As seguintes directrizes ajudá-lo-ão a efectuar o seu trabalho com segurança:

- O router deverá ser instalado numa prateleira fixa à estrutura do edifício.
- Esta unidade deverá ser montada na parte inferior da estante, caso seja esta a única unidade a ser montada.
- Ao montar esta unidade numa estante parcialmente ocupada, coloque os itens mais pesados na parte inferior da estante, arrumando-os de baixo para cima.
- Se a estante possuir um dispositivo de estabilização, instale-o antes de montar ou reparar a unidade.

¡Atención! Para evitar lesiones durante el montaje de este equipo sobre un bastidor, o posteriormente durante su mantenimiento, se debe poner mucho cuidado en que el sistema quede bien estable. Para garantizar su seguridad, proceda según las siguientes instrucciones:

- El router debe instalarse en un bastidor fijado a la estructura del edificio.
- Colocar el equipo en la parte inferior del bastidor, cuando sea la única unidad en el mismo.
- Cuando este equipo se vaya a instalar en un bastidor parcialmente ocupado, comenzar la instalación desde la parte inferior hacia la superior colocando el equipo más pesado en la parte inferior.
- Si el bastidor dispone de dispositivos estabilizadores, instalar éstos antes de montar o proceder al mantenimiento del equipo instalado en el bastidor.

Varning! För att undvika kroppsskada när du installerar eller utför underhållsarbete på denna enhet på en ställning måste du vidta särskilda försiktighetsåtgärder för att försäkra dig om att systemet står stadigt. Följande riktlinjer ges för att trygga din säkerhet:

- Router måste installeras i en ställning som är förankrad i byggnadens struktur.
- Om denna enhet är den enda enheten på ställningen skall den installeras längst ned på ställningen.

- Om denna enhet installeras på en delvis fylld ställning skall ställningen fyllas nedifrån och upp, med de tyngsta enheterna längst ned på ställningen.
 - Om ställningen är försedd med stabiliseringsdon skall dessa monteras fast innan enheten installeras eller underhålls på ställningen.
-

Ramp Warning



WARNING: When installing the hardware equipment, do not use a ramp inclined at more than 10 degrees.

Waarschuwing Gebruik een oprijplaat niet onder een hoek van meer dan 10 graden.

Varoitus Älä käytä sellaista kaltevaa pintaa, jonka kaltevuus ylittää 10 astetta.

Attention Ne pas utiliser une rampe dont l'inclinaison est supérieure à 10 degrés.

Warnung Keine Rampen mit einer Neigung von mehr als 10 Grad verwenden.

Avvertenza Non usare una rampa con pendenza superiore a 10 gradi.

Advarsel Bruk aldri en rampe som heller mer enn 10 grader.

Aviso Não utilize uma rampa com uma inclinação superior a 10 graus.

¡Atención! No usar una rampa inclinada más de 10 grados

Varning! Använd inte ramp med en lutning på mer än 10 grader.

Related Documentation

- [General Safety Guidelines for Juniper Networks Devices on page 143](#)
- [General Safety Warnings for Juniper Networks Devices on page 144](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 158](#)

General Laser Safety Guidelines for Juniper Networks Devices

Devices with single-mode optical interfaces are equipped with laser transmitters, which are considered Class 1 Laser product by the U.S. Food and Drug Administration, and are evaluated as a Class 1 Laser Product according to EN 60825–1 +A11 +A2 requirements.

When working around devices with optical interfaces, observe the following safety guidelines to prevent eye injury:

- Do not look into unterminated ports or at fibers that connect to unknown sources.
- Do not examine unterminated optical ports with optical instruments.

- Avoid direct exposure to the beam.



WARNING: Unterminated optical connectors can emit invisible laser radiation. The lens in the human eye focuses all the laser power on the retina, so focusing the eye directly on a laser source—even a low-power laser—could permanently damage the eye.

Related Documentation

- [Laser Safety Warnings for Juniper Networks Devices on page 155](#)
- [General Safety Warnings for Juniper Networks Devices on page 144](#)

Laser Safety Warnings for Juniper Networks Devices

- [Class 1 Laser Product Warning on page 155](#)
- [Class 1 LED Product Warning on page 155](#)
- [Laser Beam Warning on page 156](#)
- [Radiation from Open Port Apertures Warning on page 157](#)

Class 1 Laser Product Warning



WARNING: Class 1 laser product.

Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Attention Produit laser de classe I.

Warnung Laserprodukt der Klasse 1.

Avvertenza Prodotto laser di Classe 1.

Advarsel Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning



WARNING: Class 1 LED product.

Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Attention Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning



WARNING: Do not stare into the laser beam or view it directly with optical instruments.

Waarschuwing Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

Varoitus Älä katso säteeseen äläkä tarkastele sitä suoraan optisen laitteen avulla.

Attention Ne pas fixer le faisceau des yeux, ni l'observer directement à l'aide d'instruments optiques.

Warnung Nicht direkt in den Strahl blicken und ihn nicht direkt mit optischen Geräten prüfen.

Avvertenza Non fissare il raggio con gli occhi né usare strumenti ottici per osservarlo direttamente.

Advarsel Stirr eller se ikke direkte p strlen med optiske instrumenter.

Aviso Não olhe fixamente para o raio, nem olhe para ele directamente com instrumentos ópticos.

¡Atención! No mirar fijamente el haz ni observarlo directamente con instrumentos ópticos.

Varning! Rikta inte blicken in mot strålen och titta inte direkt på den genom optiska instrument.

Radiation from Open Port Apertures Warning



WARNING: Because invisible radiation might be emitted from the aperture of the port when no fiber-optic cable is connected, avoid exposure to radiation and do not stare into open apertures.

Waarschuwing Aangezien onzichtbare straling vanuit de opening van de poort kan komen als er geen fiberkabel aangesloten is, dient blootstelling aan straling en het kijken in open openingen vermeden te worden.

Varoitus Koska portin aukosta voi emittoitua näkymätöntä säteilyä, kun kuitukaapelia ei ole kytkettynä, vältä säteilylle altistumista äläkä katso avoimiin aukkoihin.

Attention Des radiations invisibles à l'il nu pouvant traverser l'ouverture du port lorsqu'aucun câble en fibre optique n'y est connecté, il est recommandé de ne pas regarder fixement l'intérieur de ces ouvertures.

Warnung Aus der Port-Öffnung können unsichtbare Strahlen emittieren, wenn kein Glasfaserkabel angeschlossen ist. Vermeiden Sie es, sich den Strahlungen auszusetzen, und starren Sie nicht in die Öffnungen!

Avvertenza Quando i cavi in fibra non sono inseriti, radiazioni invisibili possono essere emesse attraverso l'apertura della porta. Evitate di esporvi alle radiazioni e non guardate direttamente nelle aperture.

Advarsel Unngå utsettelse for stråling, og stirr ikke inn i åpninger som er åpne, fordi usynlig stråling kan emitteres fra portens åpning når det ikke er tilkoblet en fiberkabel.

Aviso Dada a possibilidade de emissão de radiação invisível através do orifício da via de acesso, quando esta não tiver nenhum cabo de fibra conectado, deverá evitar a exposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.

¡Atención! Debido a que la apertura del puerto puede emitir radiación invisible cuando no existe un cable de fibra conectado, evite mirar directamente a las aperturas para no exponerse a la radiación.

Varning! Osynlig strålning kan avges från en portöppning utan ansluten fiberkabel och du bör därför undvika att bli utsatt för strålning genom att inte stirra in i oskyddade öppningar.

Related Documentation

- [General Safety Guidelines for Juniper Networks Devices on page 143](#)
- [General Safety Warnings for Juniper Networks Devices on page 144](#)
- [Installation Safety Warnings for Juniper Networks Devices on page 149](#)

Maintenance and Operational Safety Warnings for Juniper Networks Devices

As you maintain the hardware equipment, observe the following warnings:

- [Battery Handling Warning on page 158](#)
- [Jewelry Removal Warning on page 159](#)
- [Lightning Activity Warning on page 160](#)
- [Operating Temperature Warning on page 161](#)
- [Product Disposal Warning on page 162](#)

Battery Handling Warning



WARNING: Replacing the battery incorrectly might result in an explosion. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Waarschuwing Er is ontploffingsgevaar als de batterij verkeerd vervangen wordt. Vervang de batterij slechts met hetzelfde of een equivalent type dat door de fabrikant aanbevolen is. Gebruikte batterijen dienen overeenkomstig fabrieksvoorschriften weggeworpen te worden.

Varoitus Räjähdyksen vaara, jos akku on vaihdettu väärään akkuun. Käytä vaihtamiseen ainoastaan saman- tai vastaaventyyppistä akkua, joka on valmistajan suosittelema. Hävitä käytetyt akut valmistajan ohjeiden mukaan.

Attention Danger d'explosion si la pile n'est pas remplacée correctement. Ne la remplacer que par une pile de type semblable ou équivalent, recommandée par le fabricant. Jeter les piles usagées conformément aux instructions du fabricant.

Warnung Bei Einsetzen einer falschen Batterie besteht Explosionsgefahr. Ersetzen Sie die Batterie nur durch den gleichen oder vom Hersteller empfohlenen Batterietyp. Entsorgen Sie die benutzten Batterien nach den Anweisungen des Herstellers.

Avvertenza Pericolo di esplosione se la batteria non è installata correttamente. Sostituire solo con una di tipo uguale o equivalente, consigliata dal produttore. Eliminare le batterie usate secondo le istruzioni del produttore.

Advarsel Det kan være fare for eksplosjon hvis batteriet skiftes på feil måte. Skift kun med samme eller tilsvarende type som er anbefalt av produsenten. Kasser brukte batterier i henhold til produsentens instruksjoner.

Aviso Existe perigo de explosão se a bateria for substituída incorrectamente. Substitua a bateria por uma bateria igual ou de um tipo equivalente recomendado pelo fabricante. Destrua as baterias usadas conforme as instruções do fabricante.

¡Atención! Existe peligro de explosión si la batería se reemplaza de manera incorrecta. Reemplazar la batería exclusivamente con el mismo tipo o el equivalente recomendado por el fabricante. Desechar las baterías gastadas según las instrucciones del fabricante.

Varning! Explosionsfara vid felaktigt batteribyte. Ersätt endast batteriet med samma batterityp som rekommenderas av tillverkaren eller motsvarande. Följ tillverkarens anvisningar vid kassering av använda batterier.

Jewelry Removal Warning



WARNING: Before working on equipment that is connected to power lines, remove jewelry, including rings, necklaces, and watches. Metal objects heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

Waarschuwing Alvorens aan apparatuur te werken die met elektrische leidingen is verbonden, sieraden (inclusief ringen, kettingen en horloges) verwijderen. Metalen voorwerpen worden warm wanneer ze met stroom en aarde zijn verbonden, en kunnen ernstige brandwonden veroorzaken of het metalen voorwerp aan de aansluitklemmen lassen.

Varoitus Ennen kuin työskentelet voimavirtajohtoihin kytkettyjen laitteiden parissa, ota pois kaikki korut (sormukset, kaulakorut ja kellot mukaan lukien). Metalliesineet kuumenevat, kun ne ovat yhteydessä sähkövirran ja maan kanssa, ja ne voivat aiheuttaa vakavia palovammoja tai hitsata metalliesineet kiinni liitäntänapoihin.

Attention Avant d'accéder à cet équipement connecté aux lignes électriques, ôter tout bijou (anneaux, colliers et montres compris). Lorsqu'ils sont branchés à l'alimentation et reliés à la terre, les objets métalliques chauffent, ce qui peut provoquer des blessures graves ou souder l'objet métallique aux bornes.

Warnung Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzen sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.

Avvertenza Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

Advarsel Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som

er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.

Aviso Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

iAtención! Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.

Varning! Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.

Lightning Activity Warning



WARNING: Do not work on the system or connect or disconnect cables during periods of lightning activity.

Waarschuwing Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.

Varoitus Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.

Attention Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.

Warnung Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.

Avvertenza Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.

Advarsel Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.

Aviso Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).

iAtención! No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

Varning! Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

Operating Temperature Warning



WARNING: To prevent the hardware equipment from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of 104° F (40° C). To prevent airflow restriction, allow at least 6 inches (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke router van de router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

Varoitus Ettei router-sarjan reititin ylikuumentuusi, sitä ei saa käyttää tilassa, jonka lämpötila ylittää korkeimman suositellun ympäristölämpötilan 40° C. Ettei ilmanvaihto estyisi, tuuletusaukkojen ympärille on jätettävä ainakin 15,2 cm tilaa.

Attention Pour éviter toute surchauffe des routeurs de la gamme router, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40° C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

Warnung Um einen router der router vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene Maximum von 40° C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsöffnungen herum frei bleibt.

Avvertenza Per evitare il surriscaldamento dei router, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

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

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

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

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

Product Disposal Warning



WARNING: Disposal of this product must be handled according to all national laws and regulations.

Waarschuwing Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

Varoitus Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

Attention La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

Warnung Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

Avvertenza L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

Advarsel Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

Aviso A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

¡Atención! El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

Varning! Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

Related Documentation

- [General Safety Guidelines for Juniper Networks Devices on page 143](#)
- [General Safety Warnings for Juniper Networks Devices on page 144](#)

In Case of an Electrical Accident

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

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

Related Documentation

- [General Safety Guidelines for Juniper Networks Devices on page 143](#)
- [General Safety Warnings for Juniper Networks Devices on page 144](#)

General Electrical Safety Warnings for Juniper Networks Devices

- [Grounded Equipment Warning on page 163](#)
- [Grounding Requirements and Warning on page 164](#)
- [Midplane Energy Hazard Warning on page 165](#)
- [Multiple Power Supplies Disconnection Warning on page 165](#)
- [Power Disconnection Warning on page 166](#)

Grounded Equipment Warning



WARNING: The network device is intended to be grounded. Ensure that the network device is connected to earth ground during normal use.

Waarschuwing Deze apparatuur hoort geaard te worden. Zorg dat de host-computer tijdens normaal gebruik met aarde is verbonden.

Varoitus Tämä laitteisto on tarkoitettu maadoitettavaksi. Varmista, että isäntälaitte on yhdistetty maahan normaalikäytön aikana.

Attention Cet équipement doit être relié à la terre. S'assurer que l'appareil hôte est relié à la terre lors de l'utilisation normale.

Warnung Dieses Gerät muß geerdet werden. Stellen Sie sicher, daß das Host-Gerät während des normalen Betriebs an Erde gelegt ist.

Avvertenza Questa apparecchiatura deve essere collegata a massa. Accertarsi che il dispositivo host sia collegato alla massa di terra durante il normale utilizzo.

Advarsel Dette utstyret skal jordes. Forviss deg om vertsterminalen er jordet ved normalt bruk.

Aviso Este equipamento deverá estar ligado à terra. Certifique-se que o host se encontra ligado à terra durante a sua utilização normal.

¡Atención! Este equipo debe conectarse a tierra. Asegurarse de que el equipo principal esté conectado a tierra durante el uso normal.

Varning! Denna utrustning är avsedd att jordas. Se till att värdenheten är jordad vid normal användning.

Grounding Requirements and Warning

An insulated grounding conductor that is identical in size to the grounded and ungrounded branch circuit supply conductors, but is identifiable by green and yellow stripes, is installed as part of the branch circuit that supplies the unit. The grounding conductor is a separately derived system at the supply transformer or motor generator set.



WARNING: When installing the network device, you must always make the ground connection first and disconnect it last.

Waarschuwing Bij de installatie van het toestel moet de aardverbinding altijd het eerste worden gemaakt en het laatste worden losgemaakt.

Varoitus Laitetta asennettaessa on maahan yhdistäminen aina tehtävä ensiksi ja maadoituksen irti kytkeminen viimeiseksi.

Attention Lors de l'installation de l'appareil, la mise à la terre doit toujours être connectée en premier et déconnectée en dernier.

Warnung Der Erdanschluß muß bei der Installation der Einheit immer zuerst hergestellt und zuletzt abgetrennt werden.

Avvertenza In fase di installazione dell'unità, eseguire sempre per primo il collegamento a massa e disconnetterlo per ultimo.

Advarsel Når enheten installeres, må jordledningen alltid tilkobles først og frakobles sist.

Aviso Ao instalar a unidade, a ligação à terra deverá ser sempre a primeira a ser ligada, e a última a ser desligada.

¡Atención! Al instalar el equipo, conectar la tierra la primera y desconectarla la última.

Varning! Vid installation av enheten måste jordledningen alltid anslutas först och kopplas bort sist.

Midplane Energy Hazard Warning



WARNING: High levels of electrical energy are distributed across the midplane. Be careful not to contact the midplane connectors, or any component connected to the midplane, with any metallic object while servicing components.

Multiple Power Supplies Disconnection Warning



WARNING: The network device has more than one power supply connection. All connections must be removed completely to remove power from the unit completely.

Waarschuwing Deze eenheid heeft meer dan één stroomtoevoerverbinding; alle verbindingen moeten volledig worden verwijderd om de stroom van deze eenheid volledig te verwijderen.

Varoitus Tässä laitteessa on useampia virtalähdekytkentöjä. Kaikki kytkennät on irrotettava kokonaan, jotta virta poistettaisiin täysin laitteesta.

Attention Cette unité est équipée de plusieurs raccordements d'alimentation. Pour supprimer tout courant électrique de l'unité, tous les cordons d'alimentation doivent être débranchés.

Warnung Diese Einheit verfügt über mehr als einen Stromanschluß; um Strom gänzlich von der Einheit fernzuhalten, müssen alle Stromzufuhren abgetrennt sein.

Avvertenza Questa unità ha più di una connessione per alimentatore elettrico; tutte le connessioni devono essere completamente rimosse per togliere l'elettricità dall'unità.

Advarsel Denne enheten har mer enn én strømtilkobling. Alle tilkoblinger må kobles helt fra for å eliminere strøm fra enheten.

Aviso Este dispositivo possui mais do que uma conexão de fonte de alimentação de energia; para poder remover a fonte de alimentação de energia, deverão ser desconectadas todas as conexões existentes.

¡Atención! Esta unidad tiene más de una conexión de suministros de alimentación; para eliminar la alimentación por completo, deben desconectarse completamente todas las conexiones.

Varning! Denna enhet har mer än en strömförsörjningsanslutning; alla anslutningar måste vara helt avlägsnade innan strömtillförseln till enheten är fullständigt bruten.

Power Disconnection Warning



WARNING: Before working on the chassis or near power supplies, switch off the power at the DC circuit breaker.

Waarschuwing Voordat u aan een frame of in de nabijheid van voedingen werkt, dient u bij wisselstroom toestellen de stekker van het netsnoer uit het stopcontact te halen; voor gelijkstroom toestellen dient u de stroom uit te schakelen bij de stroomverbreker.

Varoitus Kytke irti vaihtovirtalaitteiden virtajohto ja katkaise tasavirtalaitteiden virta suojakytkimellä, ennen kuin teet mitään asennuspohjalle tai työskentelet virtalähteiden läheisyydessä.

Attention Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif; couper l'alimentation des unités en courant continu au niveau du disjoncteur.

Warnung Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw. schalten Sie bei Gleichstromeinheiten den Strom am Unterbrecher ab.

Avvertenza Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA; scollegare l'alimentazione all'interruttore automatico sulle unità CC.

Advarsel Før det utføres arbeid på kabinettet eller det arbeides i nærheten av strømforsyningsenheter, skal strømledningen trekkes ut p vekselstrømsenheter og strømmen kobles fra ved strømbryteren på likestrømsenheter.

Aviso Antes de trabalhar num chassis, ou antes de trabalhar perto de unidades de fornecimento de energia, desligue o cabo de alimentação nas unidades de corrente alternada; desligue a corrente no disjuntor nas unidades de corrente contínua.

¡Atención! Antes de manipular el chasis de un equipo o trabajar cerca de una fuente de alimentación, desenchufar el cable de alimentación en los equipos de corriente alterna (CA); cortar la alimentación desde el interruptor automático en los equipos de corriente continua (CC).

Varning! Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden och för likströmsenheter bryta strømmen vid överspänningsskyddet.

Related Documentation • [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 168](#)

General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices

- Install the router in compliance with the following local, national, or international electrical codes:
 - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.
 - Canada—Canadian Electrical Code, Part 1, CSA C22.1.
 - Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.
- Locate the emergency power-off switch for the room in which you are working so that if an electrical accident occurs, you can quickly turn off the power.
- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.
- Never assume that power is disconnected from a circuit. Always check the circuit before starting to work.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, and missing safety grounds.
- Operate the router within marked electrical ratings and product usage instructions.
- For the router and peripheral equipment to function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

Many router components can be removed and replaced without powering off or disconnecting power to the router. Never install equipment if it appears damaged.

Related Documentation

- [In Case of an Electrical Accident on page 163](#)

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

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

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



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

The power cable warning in Japanese is as follows:

注意

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

9017253

Related Documentation

- [Replacing an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 117](#)
- [MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 35](#)

DC Power Electrical Safety Warnings for Juniper Networks Devices

When working with DC-powered equipment, observe the following warnings:

- [DC Power Copper Conductors Warning on page 168](#)
- [DC Power Disconnection Warning on page 169](#)
- [DC Power Wiring Terminations Warning on page 170](#)

DC Power Copper Conductors Warning



WARNING: Use copper conductors only.

Waarschuwing Gebruik alleen koperen geleiders.

Varoitus Käytä vain kuparijohtimia.

Attention Utilisez uniquement des conducteurs en cuivre.

Warnung Verwenden Sie ausschließlich Kupferleiter.

Avvertenza Usate unicamente dei conduttori di rame.

Advarsel Bruk bare kobberledninger.

Aviso Utilize apenas fios condutores de cobre.

¡Atención! Emplee sólo conductores de cobre.

Varning! Använd endast ledare av koppar.

DC Power Disconnection Warning



WARNING: Before performing any procedures on power supplies, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

Waarschuwing Voordat u een van de onderstaande procedures uitvoert, dient u te controleren of de stroom naar het gelijkstroom circuit uitgeschakeld is. Om u ervan te verzekeren dat alle stroom UIT is geschakeld, kiest u op het schakelbord de stroomverbreker die het gelijkstroom circuit bedient, draait de stroomverbreker naar de UIT positie en plakt de schakelaarhendel van de stroomverbreker met plakband in de UIT positie vast.

Varoitus Varmista, että tasavirtapiirissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paikanna tasavirrasta huolehtivassa kojetaulussa sijaitseva suojakytkin, käännä suojakytkin KATKAISTU-asentoon ja teippaa suojakytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

Attention Avant de pratiquer l'une quelconque des procédures ci-dessous, vérifiez que le circuit en courant continu n'est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le disjoncteur en position fermée (OFF) et, à l'aide d'un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

Warnung Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

Avvertenza Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

Advarsel Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.

Aviso Antes de executar um dos seguintes procedimentos, certifique-se que desligou a fonte de alimentação de energia do circuito de corrente contínua. Para se assegurar que toda a corrente foi DESLIGADA, localize o disjuntor no painel que serve o circuito de corrente contínua e coloque-o na posição OFF

(Desligado), segurando nessa posição a manivela do interruptor do disjuntor com fita isoladora.

¡Atención! Antes de proceder con los siguientes pasos, comprobar que la alimentación del circuito de corriente continua (CC) esté cortada (OFF). Para asegurarse de que toda la alimentación esté cortada (OFF), localizar el interruptor automático en el panel que alimenta al circuito de corriente continua, cambiar el interruptor automático a la posición de Apagado (OFF), y sujetar con cinta la palanca del interruptor automático en posición de Apagado (OFF).

Warning! Innan du utför någon av följande procedurer måste du kontrollera att strömförsörjningen till likströmskretsen är bruten. Kontrollera att all strömförsörjning är BRUTEN genom att slå AV det överspänningskydd som skyddar likströmskretsen och tejpa fast överspänningskyddets omkopplare i FRÅN-läget.

DC Power Wiring Terminations Warning



WARNING: When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations must be the appropriate size for the wires and must clamp both the insulation and conductor.

Waarschuwing Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingspunten, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

Varoitus Jos säikeellinen johdin on tarpeen, käytä hyväksyttyä johdinliitäntää, esimerkiksi suljettua silmukkaa tai kourumaista liitäntää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitäntöjen tulee olla kooltaan johtimiin sopivia ja niiden tulee puristaa yhteen sekä eristeen että johdinosan.

Attention Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

Warnung Wenn Litzenverdrahtung erforderlich ist, sind zugelassene Verdrahtungsabschlüsse, z.B. Ringoesen oder gabelförmige Kabelschuhe mit nach oben gerichteten Enden zu verwenden. Diese Abschlüsse sollten die angemessene Größe für die Drähte haben und sowohl die Isolierung als auch den Leiter festklemmen.

Avvertenza Quando occorre usare trecce, usare connettori omologati, come quelli a occhiello o a forcella con linguette rivolte verso l'alto. I connettori devono avere la misura adatta per il cablaggio e devono serrare sia l'isolante che il conduttore.

Advarsel Hvis det er nødvendig med flertrådede ledninger, brukes godkjente ledningsavslutninger, som for eksempel lukket sløyfe eller spadetype med oppverbøyde kabelsko. Disse avslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og ledaren.

Aviso Quando forem requeridas montagens de instalação eléctrica de cabo torcido, use terminações de cabo aprovadas, tais como, terminações de cabo em circuito fechado e planas com terminais de orelha voltados para cima. Estas terminações de cabo deverão ser do tamanho apropriado para os respectivos cabos, e deverão prender simultaneamente o isolamento e o fio condutor.

¡Atención! Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

Varning! När flertrådiga ledningar krävs måste godkända ledningskontakter användas, t.ex. kabelsko av slutet eller öppen typ med uppåtvänd tapp. Storleken på dessa kontakter måste vara avpassad till ledningarna och måste kunna hålla både isoleringen och ledaren fastklämda.

**Related
Documentation**

- [General Safety Warnings for Juniper Networks Devices on page 144](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 163](#)

MX5, MX10, MX40, and MX80 DC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to a DC-powered router:

- A DC-powered router is equipped with a DC terminal block that is rated for the power requirements of a maximally configured router. To supply sufficient power, terminate the DC input wiring on a facility DC source capable of supplying at least 13 A @ –48 VDC per input for each power supply. We recommend that the 48-VDC facility DC source should be equipped with a circuit breaker rated at 13 A (–48 VDC) minimum, or as required by local code.

Incorporate an easily accessible disconnect device into the facility wiring. In the United States and Canada, the 48 VDC facility should be equipped with a circuit breaker rated a minimum of 125 percent of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada.

- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 13 A.
- Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- A DC-powered router that is equipped with a DC terminal block is intended only for installation in a restricted access location. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.



NOTE: Primary overcurrent protection is provided by the building circuit breaker. This breaker should protect against excess currents, short circuits, and earth faults in accordance with NEC ANSI/NFPA70.

- Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.
- For personal safety, connect the green and yellow wire to safety (earth) ground at both the router and the supply side of the DC wiring.
- The marked input voltage of –48 VDC for a DC-powered router is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.
- Because the router is a positive ground system, you must connect the positive lead to the terminal labeled **RTN**, the negative lead to the terminal labeled **–48V**, and the earth ground to the chassis grounding points.

Site Electrical Wiring Guidelines for MX Series Routers

- [Distance Limitations for Signaling on page 173](#)
- [Radio Frequency Interference on page 173](#)
- [Electromagnetic Compatibility on page 173](#)

Distance Limitations for Signaling

Improperly installed wires can emit radio interference. In addition, the potential for damage from lightning strikes increases if wires exceed recommended distances or if wires pass between buildings. The electromagnetic pulse (EMP) caused by lightning can damage unshielded conductors and destroy electronic devices. If your site has previously experienced such problems, you might want to consult experts in electrical surge suppression and shielding.

Radio Frequency Interference

You can reduce or eliminate the emission of radio frequency interference (RFI) from your site wiring by using twisted-pair cable with a good distribution of grounding conductors. If you must exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal when applicable.

Electromagnetic Compatibility

If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters, you might want to seek expert advice. Strong sources of electromagnetic interference (EMI) can destroy the signal drivers and receivers in the router and conduct power surges over the lines into the equipment, resulting in an electrical hazard. It is particularly important to provide a properly grounded and shielded environment and to use electrical surge-suppression devices.



WARNING: The intrabuilding port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding port(s) of the equipment or subassembly **MUST NOT** be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

Agency Approvals and Compliance Statements

- [Agency Approvals for MX5, MX10, MX40, and MX80 Routers on page 174](#)
- [Compliance Statements for NEBS for MX5, MX10, MX40, and MX80 Routers on page 175](#)
- [Compliance Statements for EMC Requirements for MX5, MX10, MX40, and MX80 Routers on page 175](#)

- [Compliance Statements for Environmental Requirements on page 176](#)
- [Compliance Statements for Acoustic Noise for MX5, MX10, MX40, and MX80 Routers on page 176](#)

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

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

- Safety
 - CAN/CSA-22.2 No. 60950-00/UL 1950 Third Edition, Safety of Information Technology Equipment
 - UL 60950-1 Information Technology Equipment - Safety - Part 1: General Requirements
 - EN 60950-1 European Norm, Safety of Information Technology Equipment
 - IEC 60950-1 Information Technology Equipment - Safety - Part 1: General Requirements (with country deviations)
 - EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EMC
 - EN 300 386 V1.3.3 Telecom Network Equipment - EMC Requirements
- EMI
 - FCC Part 15 Class A USA Radiated Emissions
 - EN 55022 Class A European Radiated Emissions
 - VCCI Class A Japanese Radiated Emissions
- Immunity
 - EN 55024 Information Technology Equipment Immunity Characteristics
 - EN-61000-3-2 Power Line Harmonics
 - EN-61000-3-3 Voltage Fluctuations and Flicker
 - EN-61000-4-2 ESD
 - EN-61000-4-3 Radiated Immunity
 - EN-61000-4-4 EFT
 - EN-61000-4-5 Surge
 - EN-61000-4-6 Conducted Disturbances Immunity
 - EN-61000-4-11 Voltage Dips and Sags

The router is designed to comply with the following standards:

- GR-63-Core: NEBS, Physical Protection

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

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

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (that is, DC-I), as defined in GR-1089-CORE.
- You must provision a readily accessible device outside of the equipment to disconnect power. The device must also be rated based on local electrical code practice.

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

- [Canada on page 175](#)
- [European Community on page 175](#)
- [Israel on page 175](#)
- [Japan on page 176](#)
- [United States on page 176](#)

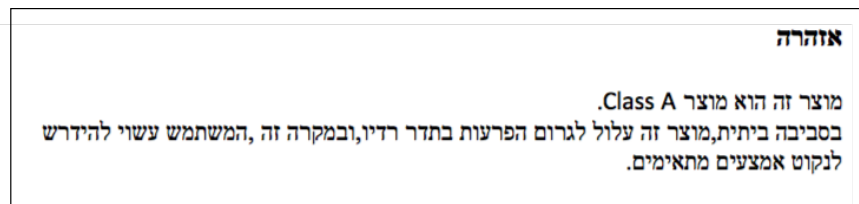
Canada

CAN ICES-3 (A)/NMB-3(A)

European Community

This is a Class A product. In a domestic environment, this product might cause radio interference in which case the user might be required to take adequate measures.

Israel



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

Japan

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

The preceding translates as follows:

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

United States

The hardware equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Compliance Statements for Environmental Requirements

Batteries in this product are not based on mercury, lead, or cadmium substances. The batteries used in this product are in compliance with EU Directives 91/157/EEC, 93/86/EEC, and 98/101/EEC. The product documentation includes instructional information about the proper method of reclamation and recycling.

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

The router complies with NEBS Level 3 requirements:

- GR-63-CORE: NEBS, Physical Protection
- GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment

Statements of Volatility for Juniper Network Devices

A *statement of volatility*—sometimes known as *letter of volatility*—identifies the volatile and non-volatile storage components in Juniper Networks devices, and describes how to remove non-volatile storage components from the device.



NOTE: Statements of volatility are not available for all Juniper Networks devices.

CTP Series:

- CTP2000

EX Series:

- EX2200 and EX2200-C
- EX2300-24P, EX2300-24T, and EX2300-24T-DC
- EX2300-48P and EX2300-48T
- EX2300-C
- EX3300
- EX3400-24P, EX3400-24T, EX3400-24T-DC
- EX3400-48P, EX3400-48T, EX3400-48T-AFI
- EX4200
- EX4300
- EX4300-48MP
- EX4500
- EX4550
- EX4600
- EX8200
- XRE200 External Routing Engine

LN Series:

- LN1000-CC

MX Series:

- M7i
- M7i Compact Forwarding Engine Board (CFEB)
- M40e and M10i
- M320
- MX5, MX10, MX40, and MX80
- MX240, MX480, and MX960
- RE-A-2000 Route Engine
- RE-S-X6-64G Routing Engine

QFX Series:

- QFX3008-I
- QFX3100
- QFX3500
- QFX3600
- QFX5100-24Q
- QFX5100-48S
- QFX5100-48T
- QFX5110-32Q
- QFX5110-48S
- QFX5200
- QFX5200-32C
- QFX10008 and QFX10016

SRX Series:

- SRX100
- SRX110
- SRX210B
- SRX210H-POE
- SRX210H-P-MGW
- SRX220
- SRX240H
- SRX240H-POE
- SRX300
- SRX320
- SRX340 and SRX345
- SRX550
- SRX650
- SRX1400
- SRX1500
- SRX3400 and SRX3600
- SRX5400, SRX5600, and SRX5800

- SRX-MP-1SERIAL
- SSG-520M

T Series:

- RE-A-2000 Route Engine

