



# M7i Multiservice Edge Router

## Hardware Guide



Published: 2012-08-12

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

This product includes the Envoy SNMP Engine, developed by Epilogue Technology, an Integrated Systems Company. Copyright © 1986–1997, Epilogue Technology Corporation. All rights reserved. This program and its documentation were developed at private expense, and no part of them is in the public domain.

This product includes memory allocation software developed by Mark Moraes, copyright © 1988, 1989, 1993, University of Toronto.

This product includes FreeBSD software developed by the University of California, Berkeley, and its contributors. All of the documentation and software included in the 4.4BSD and 4.4BSD-Lite Releases is copyrighted by the Regents of the University of California. Copyright © 1979, 1980, 1983, 1986, 1988, 1989, 1991, 1992, 1993, 1994. The Regents of the University of California. All rights reserved.

GateD software copyright © 1995, the Regents of the University. All rights reserved. Gate Daemon was originated and developed through release 3.0 by Cornell University and its collaborators. Gated is based on Kirton's EGP, UC Berkeley's routing daemon (routed), and DCN's HELLO routing protocol. Development of Gated has been supported in part by the National Science Foundation. Portions of the GateD software copyright © 1988, Regents of the University of California. All rights reserved. Portions of the GateD software copyright © 1991, D. L. S. Associates.

This product includes software developed by Maker Communications, Inc., copyright © 1996, 1997, Maker Communications, Inc.

Juniper Networks, Junos, Steel-Belted Radius, NetScreen, and ScreenOS are registered trademarks of Juniper Networks, Inc. in the United States and other countries. The Juniper Networks Logo, the Junos logo, and JunosE are trademarks of Juniper Networks, Inc. All other trademarks, service marks, registered trademarks, 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.

Products made or sold by Juniper Networks or components thereof might be covered by one or more of the following patents that are owned by or licensed to Juniper Networks: U.S. Patent Nos. 5,473,599, 5,905,725, 5,909,440, 6,192,051, 6,333,650, 6,359,479, 6,406,312, 6,429,706, 6,459,579, 6,493,347, 6,538,518, 6,538,899, 6,552,918, 6,567,902, 6,578,186, and 6,590,785.

#### *M71 Multiservice Edge Router Hardware Guide*

Copyright © 2012, Juniper Networks, Inc.

All rights reserved.

#### Revision History

August 2012—RE-B-1800 information updated.

March 2012—RE-B-1800 information added.

October 2010—Corporate rebranding.

August 2010—Corporate rebranding.

May 2010—Updated VCCI class B compliance for Japan. Corrected the chassis grounding procedure.

July 2009—Updated product names.

10 April 2009—530-018005-01 Revision 3. Added related topics to aid in navigation.

26 January 2009—530-018005-01 Revision 2. Added Enhanced Compact Forwarding Engine Board (CFEB-E) support.

12 January 2007—530-018005-01 Revision 1. Corrected the input operating voltage range and the nominal input voltage for DC power supplies and AC power supplies. Corrected the clearance requirements. Corrected the system architecture.

20 October 2006—530-017392-01 Revision 1. Added European Community EMC Declaration of Conformity.

28 June 2006—530-014300-01 Revision 3. Added maximum aggregate throughput of the FIC. Corrected the packet forwarding rate. Added how much torque to apply when securing the cable on a power supply.

30 May 2006—530-014300-01 Revision 2. Corrected maximum aggregate throughput. Added power cable warning in Japanese. Added Lithium battery statement.

14 September 2005—530-014300-01 Revision 1. General updates.

5 January 2004—530-009331-01 Revision 3. Cable management information.

22 September 2003—530-009331-01 Revision 2. DC power supply information.

24 July 2003—530-009331-01 Revision 1. First edition.

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 <http://www.juniper.net/support/eula.html>. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.



# Table of Contents

	<b>About the Documentation</b> . . . . .	<b>xix</b>
	Junos OS Documentation and Release Notes . . . . .	xix
	Documentation Conventions . . . . .	xix
	Documentation Feedback . . . . .	xxi
	Requesting Technical Support . . . . .	xxi
	Self-Help Online Tools and Resources . . . . .	xxi
	Opening a Case with JTAC . . . . .	xxii
<b>Part 1</b>	<b>Overview of the M7i Multiservice Edge Router</b>	
<b>Chapter 1</b>	<b>Overview of the M7i Router</b> . . . . .	<b>3</b>
	M7i Router Description . . . . .	3
<b>Chapter 2</b>	<b>M7i Hardware Components</b> . . . . .	<b>5</b>
	M7i Component Redundancy . . . . .	5
	M7i Chassis Description . . . . .	6
	M7i Midplane Description . . . . .	7
	M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description . . . . .	8
	CFEB . . . . .	9
	CFEB-E . . . . .	10
	M7i Adaptive Services Module . . . . .	12
	M7i MultiServices Module . . . . .	13
	M7i CFEB and CFEB-E LEDs . . . . .	14
	M7i Fixed Interface Card (FIC) Description . . . . .	15
	M7i FIC LEDs . . . . .	16
	M7i PICs Description . . . . .	16
	M7i PIC LEDs . . . . .	17
	M7i Flexible PIC Concentrators (FPCs) Description . . . . .	18
	M7i Routing Engine Description . . . . .	18
	Boot Sequence . . . . .	19
	M7i Routing Engine Management Ports . . . . .	20
	M7i Routing Engine RE-B-1800 Description . . . . .	21
	M7i Routing Engine LEDs . . . . .	22
	M7i Routing Engine 1800 LEDs . . . . .	22
	M7i Power Supply Overview . . . . .	23
	M7i Power System Description . . . . .	23
	M7i AC Power Supply . . . . .	24
	M7i DC Power Supply . . . . .	25
	M7i Power Supply LEDs . . . . .	25

	M7i Cooling System Overview . . . . .	26
	M7i Airflow Through the Chassis . . . . .	26
	M7i Cable Management System . . . . .	27
<b>Chapter 3</b>	<b>System Architecture Overview . . . . .</b>	<b>29</b>
	System Architecture Overview . . . . .	29
	M7i and M10i Packet Forwarding Engine Architecture . . . . .	30
	Packet Forwarding Engine Components . . . . .	30
	Data Flow Through the Packet Forwarding Engine . . . . .	30
	Routing Engine Architecture . . . . .	31
	Routing Engine Functions . . . . .	32
<b>Part 2</b>	<b>Setting Up the M7i Router</b>	
<b>Chapter 4</b>	<b>Preparing the Site for M7i Router Installation . . . . .</b>	<b>37</b>
	M7i Router Site Preparation Checklist . . . . .	37
	M7i Router Rack Requirements . . . . .	38
	M7i Router Clearance Requirements for Airflow and Hardware Maintenance . . . . .	40
<b>Chapter 5</b>	<b>Overview of M7i Router Installation . . . . .</b>	<b>41</b>
	Overview of M7i Router Installation . . . . .	41
<b>Chapter 6</b>	<b>Unpacking the M7i Router . . . . .</b>	<b>43</b>
	Tools and Parts Required to Unpack the M7i Router . . . . .	43
	Unpacking the M7i Router . . . . .	43
	Verifying the M7i Router Parts Received . . . . .	44
<b>Chapter 7</b>	<b>Installing the M7i Router Mounting Hardware . . . . .</b>	<b>47</b>
	Installing the M7i Cable Management System . . . . .	47
	Moving the Mounting Brackets . . . . .	48
<b>Chapter 8</b>	<b>Installing the M7i Router . . . . .</b>	<b>49</b>
	Tools and Parts Required to Install the M7i Router Into a Rack . . . . .	49
	Installing the M7i Router Into the Rack . . . . .	49
<b>Chapter 9</b>	<b>Grounding the M7i Router . . . . .</b>	<b>53</b>
	Connecting the Grounding Cable to the M7i Router . . . . .	53
<b>Chapter 10</b>	<b>Connecting the M7i Router to External Devices . . . . .</b>	<b>55</b>
	Tools and Parts Required for M7i Router Connections . . . . .	55
	Connecting the M7i Router to Management and Alarm Devices . . . . .	55
	Connecting the M7i Router to a Network for Out-of-Band Management . . . . .	56
	Connecting the M7i Router to a Management Console or Auxiliary Device . . . . .	56
	Inserting an SFP into the 1-Port Gigabit Ethernet FIC . . . . .	57
	Connecting FIC and PIC Cables to the M7i Router . . . . .	58
<b>Chapter 11</b>	<b>Providing Power to the M7i Router . . . . .</b>	<b>61</b>
	Connecting Power to an AC-Powered M7i Router . . . . .	61
	Connecting Power to a DC-Powered Router . . . . .	61
	Powering On the M7i Router . . . . .	63
	Powering Off the M7i Router . . . . .	64

---

<b>Chapter 12</b>	<b>Configuring Junos OS</b> . . . . .	<b>67</b>
	Initially Configuring the M7i Router . . . . .	67
<b>Part 3</b>	<b>Hardware Maintenance, Troubleshooting, and Replacement Procedures</b>	
<b>Chapter 13</b>	<b>Maintaining M7i Router Hardware Components</b> . . . . .	<b>73</b>
	Routine Maintenance Procedures for the M7i Router . . . . .	73
	Maintaining the M7i CFEB and CFEB-E . . . . .	73
	Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables . . . . .	74
	Maintaining the M7i Routing Engine . . . . .	76
	Maintaining the M7i Power Supplies . . . . .	76
	Maintaining the M7i Cooling System . . . . .	77
<b>Chapter 14</b>	<b>Troubleshooting M7i Hardware Components</b> . . . . .	<b>79</b>
	Overview of Troubleshooting Resources for the M7i Router . . . . .	79
	LEDs on the FIC . . . . .	79
	LEDs on Hardware Components . . . . .	80
	Hardware and Interface Alarm Messages . . . . .	80
	Troubleshooting the M7i CFEB and CFEB-E . . . . .	84
	Troubleshooting the M7i FIC or PICs . . . . .	84
	Troubleshooting the M7i Power System . . . . .	85
	Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off . . . . .	85
	Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off . . . . .	85
	Troubleshooting the M7i Fan Tray . . . . .	86
<b>Chapter 15</b>	<b>Replacing M7i Hardware Components</b> . . . . .	<b>89</b>
	M7i Field-Replaceable Units (FRUs) . . . . .	89
	Tools and Parts Required to Replace M Series Hardware Components . . . . .	90
	Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E . . . . .	90
	Removing the M7i CFEB and CFEB-E . . . . .	91
	Installing the M7i CFEB and CFEB-E . . . . .	92
	Upgrading and Downgrading the CFEB and CFEB-E . . . . .	92
	Replacing an M7i PIC . . . . .	93
	Removing an M7i PIC . . . . .	93
	Installing an M7i PIC . . . . .	94
	Replacing an M7i FIC or PIC Cable . . . . .	96
	Removing an M7i FIC or PIC Cable . . . . .	96
	Installing an M7i FIC or PIC Cable . . . . .	97

Replacing an SFP on an M7i Router . . . . .	98
Removing an SFP from an M7i Router . . . . .	98
Installing an SFP into an M7i Router . . . . .	100
Replacing the M7i Routing Engine and Routing Engine Components . . . . .	101
Replacing the M7i Routing Engine . . . . .	101
Removing an M7i Routing Engine . . . . .	101
Installing the Routing Engine in a M7i Router . . . . .	102
Replacing the Routing Engine Interface Port Cables . . . . .	103
Replacing the Management Ethernet Cable . . . . .	103
Replacing the Console or Auxiliary Cable . . . . .	104
Replacing the SSD on an RE-B-1800 Routing Engine . . . . .	104
Removing and Inserting the CompactFlash Card . . . . .	105
Removing the CompactFlash Card from a Routing Engine . . . . .	106
Inserting the CompactFlash Card . . . . .	106
Configuring the CompactFlash Card . . . . .	107
Removing and Inserting SDRAM Modules . . . . .	108
Removing an SDRAM Module . . . . .	108
Inserting an SDRAM Module . . . . .	108
Removing and Inserting the PC Card . . . . .	109
Removing the PC Card . . . . .	110
Replacing the PC Card Adapter Flash Disk . . . . .	110
Inserting the PC Card . . . . .	111
Replacing M7i Power System Components . . . . .	111
Replacing an M7i AC Power Supply . . . . .	111
Removing an M7i AC Power Supply . . . . .	112
Installing an M7i AC Power Supply . . . . .	113
Replacing an M7i AC Power Cord . . . . .	114
Removing an M7i AC Power Cord . . . . .	115
Installing an M7i AC Power Cord . . . . .	115
Installing an M7i AC Power Cord . . . . .	115
Replacing a DC Power Supply . . . . .	116
Removing a DC Power Supply . . . . .	117
Installing a DC Power Supply . . . . .	118
Replacing an M7i DC Power Cable . . . . .	120
Removing an M7i DC Power Cable . . . . .	120
Installing an M7i DC Power Cable . . . . .	120
Replacing the M7i Fan Tray . . . . .	122
Removing the M7i Fan Tray . . . . .	122
Installing the M7i Fan Tray . . . . .	123



<b>Part 4</b>	<b>Appendixes</b>	
<b>Appendix A</b>	<b>Safety and Regulatory Compliance Information for the M7i Router . . . . .</b>	<b>127</b>
	Definition of Safety Warning Levels . . . . .	127
	Safety Guidelines and Warnings for the M7i Router . . . . .	129
	General Safety Guidelines for Juniper Networks Devices . . . . .	129
	General Safety Warnings for Juniper Networks Devices . . . . .	130
	Qualified Personnel Warning . . . . .	130
	Restricted Access Area Warning . . . . .	130
	Preventing Electrostatic Discharge Damage to an M7i Router . . . . .	132
	Fire Safety Requirements for Juniper Networks Devices . . . . .	133
	General Fire Safety Requirements . . . . .	133
	Fire Suppression . . . . .	133
	Fire Suppression Equipment . . . . .	133
	M7i Router Installation Safety Guidelines and Warnings . . . . .	134
	M7i Chassis Lifting Guidelines . . . . .	134
	Installation Safety Warnings for Juniper Networks Devices . . . . .	135
	Laser and LED Safety Guidelines and Warnings for the M7i Router . . . . .	139
	General Laser Safety Guidelines for the M7i Router . . . . .	139
	M7i Laser and LED Safety Warnings . . . . .	140
	Maintenance and Operational Safety Warnings for Juniper Networks Devices . . . . .	143
	Battery Handling Warning . . . . .	143
	Jewelry Removal Warning . . . . .	144
	Lightning Activity Warning . . . . .	145
	Operating Temperature Warning . . . . .	146
	Product Disposal Warning . . . . .	147
	Electrical Safety Guidelines and Warnings for the M7i Router . . . . .	148
	General Electrical Safety Warnings for Juniper Networks Devices . . . . .	148
	General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers . . . . .	151
	In Case of an Electrical Accident . . . . .	152
	M7i AC Power Electrical Safety Guidelines and Warnings . . . . .	152
	M7i DC Power Electrical Safety Guidelines . . . . .	153
	DC Power Electrical Safety Warnings for Juniper Networks Devices . . . . .	154
	Agency Approvals and Compliance Statements for the M7i Router . . . . .	157
	Agency Approvals for M7i Routers . . . . .	157
	M7i Compliance Statements for NEBS . . . . .	159
	Compliance Statements for EMC Requirements for the M7i Router . . . . .	159
	Canada . . . . .	159
	European Community . . . . .	159
	Declaration of Conformity . . . . .	159
	United States . . . . .	160
	Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) . . . . .	161
	Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada) . . . . .	161
	Compliance Statements for Environmental Requirements for Juniper Networks Devices . . . . .	161

	Compliance Statements for Acoustic Noise for the M7i Router . . . . .	161
<b>Appendix B</b>	<b>M7i Router Physical Specifications . . . . .</b>	<b>163</b>
	M7i Router Physical Specifications . . . . .	163
<b>Appendix C</b>	<b>M7i Router Environmental Specifications . . . . .</b>	<b>165</b>
	M7i Router Environmental Specifications . . . . .	165
<b>Appendix D</b>	<b>Power Guidelines, Requirements, and Specifications for the M7i Router . . . . .</b>	<b>167</b>
	M7i Router Power Requirements . . . . .	167
	M7i Router AC Power Specifications and Requirements . . . . .	168
	M7i Router AC Power, Connection, and Power Cord Specifications . . . . .	168
	M7i Router AC Power Supply Specifications . . . . .	170
	M7i Router DC Power Specifications and Requirements . . . . .	171
	M7i Chassis Grounding, Connection, and Cable Specifications . . . . .	171
	M7i DC Power Cable and Cable Lug Specifications . . . . .	172
	DC Power Cables . . . . .	172
	DC Power Lugs . . . . .	173
	M7i Router DC Power Supply Specifications . . . . .	174
	Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers . . . . .	174
<b>Appendix E</b>	<b>Cable and Wire Guidelines and Specifications for the M7i Router . . . . .</b>	<b>177</b>
	FIC Specifications for the M7i Router . . . . .	177
	Fiber-Optic Specifications and Guidelines for the M7i Router . . . . .	178
	Fiber-Optic and Network Cable Specifications for the M7i Router . . . . .	178
	Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router . . . . .	179
	Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers . . . . .	179
	Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers . . . . .	180
	Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers . . . . .	181
	Routing Engine Interface Cable and Wire Specifications for the M7i Router . . . . .	183
<b>Appendix F</b>	<b>M7i Cable Connector Pinouts . . . . .</b>	<b>185</b>
	RJ-45 Connector Pinouts for the M7i Routing Engine MGMT Port . . . . .	185
	DB-9 Connector Pinouts for the M7i Routing Engine AUX/MODEM and CONSOLE Ports . . . . .	186
	RJ-48 Cable Pinouts for E1 and T1 PICs . . . . .	186
<b>Appendix G</b>	<b>Contacting Customer Support and Returning M7i Hardware . . . . .</b>	<b>191</b>
	Locating M7i Component Serial Numbers . . . . .	191
	Displaying M7i Router Components and Serial Numbers . . . . .	191
	CFEB and CFEB-E Serial Number ID Label . . . . .	192
	PIC Serial Number ID Label . . . . .	193
	Power Supply Serial Number ID Label . . . . .	194

---

	Routing Engine Serial Number ID Label . . . . .	194
	Contacting Customer Support . . . . .	195
	Returning a Hardware Component to Juniper Networks, Inc. . . . .	195
	Tools and Parts Required to Remove Components from an M7i Router . . . . .	196
	Packing the M7i Router for Shipment . . . . .	197
	Guidelines for Packing M7i Components for Shipment . . . . .	198
<b>Part 5</b>	<b>Index</b>	
	Index . . . . .	201



# List of Figures

<b>Part 1</b>	<b>Overview of the M7i Multiservice Edge Router</b>	
<b>Chapter 2</b>	<b>M7i Hardware Components</b>	<b>5</b>
	Figure 1: Front of Chassis	6
	Figure 2: Rear of Chassis	6
	Figure 3: Midplane	7
	Figure 4: CFEB	10
	Figure 5: CFEB with Adaptive Services Module	10
	Figure 6: CFEB-E	12
	Figure 7: CFEB-E with Adaptive Services Module	12
	Figure 8: CFEB-E with MultiServices Module	12
	Figure 9: FIC with Fast Ethernet Ports	15
	Figure 10: FIC with Gigabit Ethernet Port	15
	Figure 11: FPC Slot Numbering	18
	Figure 12: Routing Engine	19
	Figure 13: Routing Engine Interface Ports	20
	Figure 14: Routing Engine RE-B-1800	21
	Figure 15: AC Power Supply	24
	Figure 16: DC Power Supply	25
	Figure 17: Fan Tray	26
	Figure 18: Airflow Through the Chassis	27
<b>Chapter 3</b>	<b>System Architecture Overview</b>	<b>29</b>
	Figure 19: System Architecture	29
	Figure 20: Packet Forwarding Engine Components and Data Flow	31
	Figure 21: Routing Engine Architecture	32
	Figure 22: Control Packet Handling for Routing and Forwarding Table Updates	33
<b>Part 2</b>	<b>Setting Up the M7i Router</b>	
<b>Chapter 4</b>	<b>Preparing the Site for M7i Router Installation</b>	<b>37</b>
	Figure 23: Typical Open-Frame Rack	39
	Figure 24: Chassis Dimensions and Clearance Requirements	40
<b>Chapter 6</b>	<b>Unpacking the M7i Router</b>	<b>43</b>
	Figure 25: Unpacking the Router	44
<b>Chapter 7</b>	<b>Installing the M7i Router Mounting Hardware</b>	<b>47</b>
	Figure 26: Installing the Cable Management System	47
<b>Chapter 8</b>	<b>Installing the M7i Router</b>	<b>49</b>
	Figure 27: Installing the Router	50

<b>Chapter 10</b>	<b>Connecting the M7i Router to External Devices</b> . . . . .	<b>55</b>
	Figure 28: Routing Engine Ethernet Cable Connector . . . . .	56
	Figure 29: Routing Engine Interface Ports . . . . .	56
	Figure 30: Console and Auxiliary Serial Port Connector . . . . .	57
	Figure 31: Attaching the Cable to a PIC . . . . .	59
<b>Chapter 11</b>	<b>Providing Power to the M7i Router</b> . . . . .	<b>61</b>
	Figure 32: Connecting DC PowerCables . . . . .	63
<b>Part 3</b>	<b>Hardware Maintenance, Troubleshooting, and Replacement Procedures</b>	
<b>Chapter 15</b>	<b>Replacing M7i Hardware Components</b> . . . . .	<b>89</b>
	Figure 33: Removing the CFEB or CFEB-E . . . . .	91
	Figure 34: Installing a CFEB or CFEB-E . . . . .	92
	Figure 35: Removing a PIC . . . . .	94
	Figure 36: Installing a PIC . . . . .	95
	Figure 37: Connecting Fiber-Optic Cable to a PIC . . . . .	98
	Figure 38: Small Form-Factor Pluggable (SFP) . . . . .	99
	Figure 39: Small Form-Factor Pluggable (SFP) . . . . .	101
	Figure 40: Removing the Routing Engine . . . . .	102
	Figure 41: Installing the Routing Engine . . . . .	103
	Figure 42: Routing Engine Ethernet Cable Connector . . . . .	103
	Figure 43: Routing Engine Interface Ports . . . . .	103
	Figure 44: Console and Auxiliary Serial Port Connector . . . . .	104
	Figure 45: RE-B-1800 Storage Drive Slots . . . . .	104
	Figure 46: Removing the CompactFlash Card . . . . .	106
	Figure 47: Inserting the CompactFlash Card . . . . .	107
	Figure 48: Installing the SDRAM Module . . . . .	109
	Figure 49: Removing the PC Card . . . . .	110
	Figure 50: Inserting the PC Card Flash Disk . . . . .	110
	Figure 51: Inserting the PC Card . . . . .	111
	Figure 52: Removing an AC Power Supply . . . . .	113
	Figure 53: Installing an AC Power Supply . . . . .	114
	Figure 54: Removing a DC Power Supply . . . . .	118
	Figure 55: Installing a DC Power Supply . . . . .	119
	Figure 56: Connecting DC Power Cables . . . . .	121
	Figure 57: Removing the Fan Tray . . . . .	122
	Figure 58: Installing the Fan Tray . . . . .	123
<b>Part 4</b>	<b>Appendixes</b>	
	Figure 59: Placing a Component into an Electrostatic Bag . . . . .	133
	Figure 60: M7i Declaration of Conformity . . . . .	160
	Figure 61: AC Plug Types . . . . .	170
	Figure 62: Grounding Cable Connection . . . . .	172
	Figure 63: DC Power Cable Connections . . . . .	173
	Figure 64: Serial Number ID Label . . . . .	192
	Figure 65: CFEB or CBEF-E Serial Number ID Label . . . . .	193
	Figure 66: PIC Serial Number ID Label . . . . .	193

---

	Figure 67: Power Supply Serial Number ID Label . . . . .	194
<b>Appendix A</b>	<b>Safety and Regulatory Compliance Information for the M7i Router . . . . .</b>	<b>127</b>
	Figure 59: Placing a Component into an Electrostatic Bag . . . . .	133
	Figure 60: M7i Declaration of Conformity . . . . .	160
<b>Appendix D</b>	<b>Power Guidelines, Requirements, and Specifications for the M7i Router . . . . .</b>	<b>167</b>
	Figure 61: AC Plug Types . . . . .	170
	Figure 62: Grounding Cable Connection . . . . .	172
	Figure 63: DC Power Cable Connections . . . . .	173
<b>Appendix G</b>	<b>Contacting Customer Support and Returning M7i Hardware . . . . .</b>	<b>191</b>
	Figure 64: Serial Number ID Label . . . . .	192
	Figure 65: CFEB or CBEF-E Serial Number ID Label . . . . .	193
	Figure 66: PIC Serial Number ID Label . . . . .	193
	Figure 67: Power Supply Serial Number ID Label . . . . .	194





# List of Tables

	<b>About the Documentation</b> . . . . .	<b>xix</b>
	Table 1: Notice Icons . . . . .	xix
	Table 2: Text and Syntax Conventions . . . . .	xx
<b>Part 1</b>	<b>Overview of the M7i Multiservice Edge Router</b>	
<b>Chapter 2</b>	<b>M7i Hardware Components</b> . . . . .	<b>5</b>
	Table 3: States for CFEB or CFEB-E LEDs . . . . .	14
	Table 4: Alarm LEDs . . . . .	16
	Table 5: FIC Interface LEDs . . . . .	16
	Table 6: States for Routing Engine LEDs . . . . .	22
	Table 7: States for RE-B-1800 Routing Engine LEDs . . . . .	23
	Table 8: States for the M7i Power Supply LED . . . . .	26
<b>Part 2</b>	<b>Setting Up the M7i Router</b>	
<b>Chapter 4</b>	<b>Preparing the Site for M7i Router Installation</b> . . . . .	<b>37</b>
	Table 9: Site Preparation Checklist . . . . .	37
	Table 10: Rack Requirements and Specifications for an M7i Router . . . . .	38
<b>Chapter 6</b>	<b>Unpacking the M7i Router</b> . . . . .	<b>43</b>
	Table 11: Generic Inventory of Router Components Installed in the M7i Chassis . . . . .	45
	Table 12: Accessory Box Parts List . . . . .	45
<b>Part 3</b>	<b>Hardware Maintenance, Troubleshooting, and Replacement Procedures</b>	
<b>Chapter 14</b>	<b>Troubleshooting M7i Hardware Components</b> . . . . .	<b>79</b>
	Table 13: Chassis Alarm Messages . . . . .	80
	Table 14: SONET/SDH Interface Alarm Messages . . . . .	83
<b>Chapter 15</b>	<b>Replacing M7i Hardware Components</b> . . . . .	<b>89</b>
	Table 15: Field-Replaceable Units . . . . .	89
	Table 16: Tools and Parts Required . . . . .	90
<b>Part 4</b>	<b>Appendixes</b>	
	Table 17: Chassis Physical Specifications . . . . .	163
	Table 18: Router Environmental Tolerances . . . . .	165
	Table 19: M7i Component Power Requirements . . . . .	167
	Table 20: AC Power Cord Specifications . . . . .	169

	Table 21: Electrical Specifications for AC Power Supply . . . . .	170
	Table 22: Grounding Cable Specifications . . . . .	171
	Table 23: DC Power Cable Specifications . . . . .	172
	Table 24: Electrical Specifications for DC Power Supply . . . . .	174
	Table 25: FIC Specifications . . . . .	177
	Table 26: Estimated Values for Factors Causing Link Loss . . . . .	181
	Table 27: Cable Specifications for Routing Engine Management Ports . . . . .	183
	Table 28: RJ-45 Connector Pinout . . . . .	185
	Table 29: DB-9 Connector Pinout . . . . .	186
	Table 30: RJ-48 Connector to RJ-48 Connector (Straight) Pinout for the Router . . . . .	187
	Table 31: RJ-48 Connector to RJ-48 Connector (Crossover) Pinout for the Router . . . . .	187
	Table 32: RJ-48 Connector to DB-15 Connector (Straight) Pinout for the Router . . . . .	188
	Table 33: RJ-48 Connector to DB-15 Connector (Crossover) Pinout for the Router . . . . .	189
<b>Appendix B</b>	<b>M7i Router Physical Specifications . . . . .</b>	<b>163</b>
	Table 17: Chassis Physical Specifications . . . . .	163
<b>Appendix C</b>	<b>M7i Router Environmental Specifications . . . . .</b>	<b>165</b>
	Table 18: Router Environmental Tolerances . . . . .	165
<b>Appendix D</b>	<b>Power Guidelines, Requirements, and Specifications for the M7i Router . . . . .</b>	<b>167</b>
	Table 19: M7i Component Power Requirements . . . . .	167
	Table 20: AC Power Cord Specifications . . . . .	169
	Table 21: Electrical Specifications for AC Power Supply . . . . .	170
	Table 22: Grounding Cable Specifications . . . . .	171
	Table 23: DC Power Cable Specifications . . . . .	172
	Table 24: Electrical Specifications for DC Power Supply . . . . .	174
<b>Appendix E</b>	<b>Cable and Wire Guidelines and Specifications for the M7i Router . . . . .</b>	<b>177</b>
	Table 25: FIC Specifications . . . . .	177
	Table 26: Estimated Values for Factors Causing Link Loss . . . . .	181
	Table 27: Cable Specifications for Routing Engine Management Ports . . . . .	183
<b>Appendix F</b>	<b>M7i Cable Connector Pinouts . . . . .</b>	<b>185</b>
	Table 28: RJ-45 Connector Pinout . . . . .	185
	Table 29: DB-9 Connector Pinout . . . . .	186
	Table 30: RJ-48 Connector to RJ-48 Connector (Straight) Pinout for the Router . . . . .	187
	Table 31: RJ-48 Connector to RJ-48 Connector (Crossover) Pinout for the Router . . . . .	187
	Table 32: RJ-48 Connector to DB-15 Connector (Straight) Pinout for the Router . . . . .	188
	Table 33: RJ-48 Connector to DB-15 Connector (Crossover) Pinout for the Router . . . . .	189

# About the Documentation

- Junos OS Documentation and Release Notes on page xix
- Documentation Conventions on page xix
- Documentation Feedback on page xxi
- Requesting Technical Support on page xxi

## Junos OS Documentation and Release Notes

---

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

If the information in the latest release notes differs from the information in the documentation, follow the *Junos OS 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 <http://www.juniper.net/techpubs/>.

## Documentation Conventions

---

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

Table 1: Notice Icons





Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.

Table 2 on page xx defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
<b>Bold text like this</b>	Represents text that you type.	To enter configuration mode, type the <b>configure</b> command:  user@host> <b>configure</b>
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> <b>show chassis alarms</b>  No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> <li>Introduces or emphasizes important new terms.</li> <li>Identifies book names.</li> <li>Identifies RFC and Internet draft titles.</li> </ul>	<ul style="list-style-type: none"> <li>A policy <i>term</i> is a named structure that defines match conditions and actions.</li> <li><i>Junos OS System Basics Configuration Guide</i></li> <li>RFC 1997, <i>BGP Communities Attribute</i></li> </ul>
<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@# <b>set system domain-name</b> <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"> <li>To configure a stub area, include the <b>stub</b> statement at the [edit protocols ospf area area-id] hierarchy level.</li> <li>The console port is labeled <b>CONSOLE</b>.</li> </ul>
< > (angle brackets)	Enclose optional keywords or variables.	<b>stub &lt;default-metric metric&gt;;</b>
(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.	<b>broadcast   multicast</b>  <i>(string1   string2   string3)</i>
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	<b>rsvp { # Required for dynamic MPLS only</b>
[ ] (square brackets)	Enclose a variable for which you can substitute one or more values.	<b>community name members [</b> <i>community-ids</i> <b>]</b>
Indentation and braces ( { } )	Identify 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.	<b>;</b>

Table 2: Text and Syntax Conventions (*continued*)

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

## Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can send your comments to [techpubs-comments@juniper.net](mailto:techpubs-comments@juniper.net), or fill out the documentation feedback form at <https://www.juniper.net/cgi-bin/docbugreport/>. If you are using e-mail, be sure to include the following information with your comments:

- Document or topic name
- URL or page number
- Software release version (if applicable)

## Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC 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 <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <http://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: <http://www.juniper.net/customers/support/>
- Search for known bugs: <http://www2.juniper.net/kb/>
- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>
- Download the latest versions of software and review release notes: <http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://www.juniper.net/alerts/>
- Join and participate in the Juniper Networks Community Forum: <http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

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

## Opening a Case with JTAC

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

- Use the Case Management tool in the CSC at <http://www.juniper.net/cm/> .
- 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 <http://www.juniper.net/support/requesting-support.html> .

## PART 1

# Overview of the M7i Multiservice Edge Router

- [Overview of the M7i Router on page 3](#)
- [M7i Hardware Components on page 5](#)
- [System Architecture Overview on page 29](#)





## CHAPTER 1

# Overview of the M7i Router

- [M7i Router Description on page 3](#)

## M7i Router Description

---

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

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

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

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

### Related Documentation

- [M7i Component Redundancy on page 5](#)
- [M7i Chassis Description on page 6](#)
- [M7i Router Physical Specifications on page 163](#)
- [Overview of M7i Router Installation on page 41](#)



## CHAPTER 2

# M7i Hardware Components

- [M7i Component Redundancy on page 5](#)
- [M7i Chassis Description on page 6](#)
- [M7i Midplane Description on page 7](#)
- [M7i Compact Forwarding Engine Board \(CFEB\) and Enhanced Compact Forwarding Engine Board \(CFEB-E\) Description on page 8](#)
- [M7i CFEB and CFEB-E LEDs on page 14](#)
- [M7i Fixed Interface Card \(FIC\) Description on page 15](#)
- [M7i FIC LEDs on page 16](#)
- [M7i PICs Description on page 16](#)
- [M7i PIC LEDs on page 17](#)
- [M7i Flexible PIC Concentrators \(FPCs\) Description on page 18](#)
- [M7i Routing Engine Description on page 18](#)
- [M7i Routing Engine RE-B-1800 Description on page 21](#)
- [M7i Routing Engine LEDs on page 22](#)
- [M7i Routing Engine 1800 LEDs on page 22](#)
- [M7i Power Supply Overview on page 23](#)
- [M7i Cooling System Overview on page 26](#)
- [M7i Cable Management System on page 27](#)

## M7i Component Redundancy

---

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

### Related Documentation

- [M7i Router Description on page 3](#)
- [M7i Chassis Description on page 6](#)
- [Overview of M7i Router Installation on page 41](#)
- [M7i Router Physical Specifications on page 163](#)

## M7i Chassis Description

The router chassis is a rigid sheet metal structure that houses the other hardware components. The chassis is 17.5 in. (44.5 cm) wide and 18 in. (45.7 cm) deep. The chassis height of 3.5 in. (8.9 cm) enables stacked installation of 21 M7i routers in a single floor-to-ceiling rack. For more information, see “[M7i Router Rack Requirements](#)” on page 38.

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

Figure 1: Front of Chassis

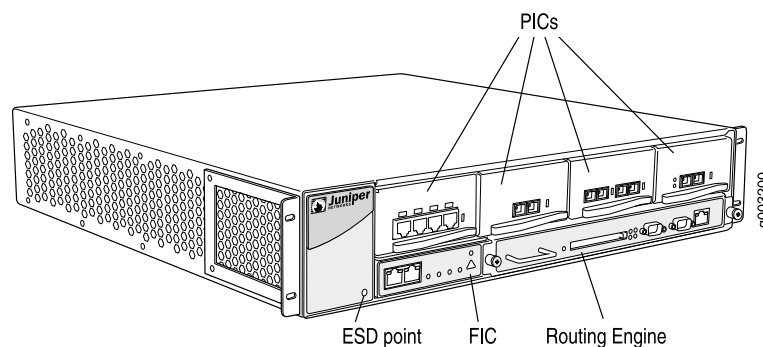
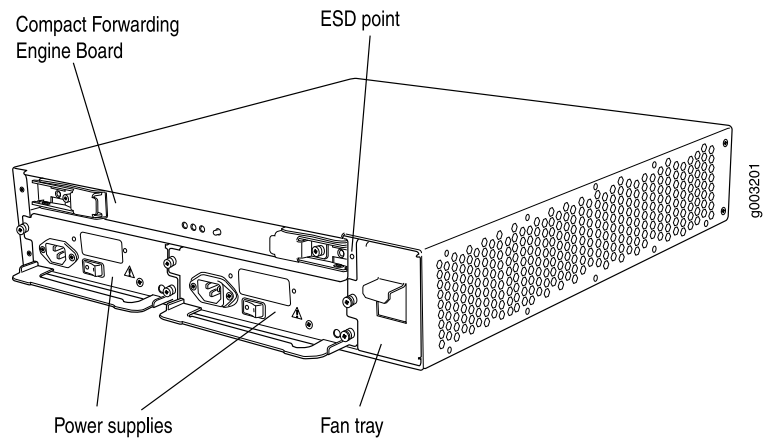


Figure 2: Rear of Chassis



The chassis includes the following electrical safety components:

- One electrostatic discharge (ESD) points (banana plug receptacles), at the front of the chassis, as shown in [Figure 1](#) on page 6.
- Two internally threaded inserts providing grounding points for the router.



**WARNING:** Before removing or installing components of a functioning router, attach an ESD strap to an ESD point and place the other end of the strap

around your bare wrist. Failure to use an ESD strap could result in damage to the router.

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

For further safety information, see [“General Safety Guidelines for Juniper Networks Devices”](#) on page 129 and [“General Safety Warnings for Juniper Networks Devices”](#) on page 130.

For chassis serial number information, see [“Displaying M7i Router Components and Serial Numbers”](#) on page 191.

#### Related Documentation

- [M7i Router Physical Specifications](#) on page 163
- [Overview of M7i Router Installation](#) on page 41
- [M7i Router Description](#) on page 3

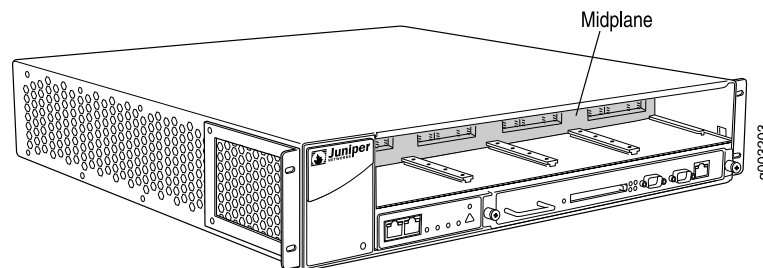
## M7i Midplane Description

The midplane is a panel located in the center of the chassis, running from side to side and forming the rear of the PIC card cage (see [Figure 3 on page 7](#)). All router components plug directly into the midplane. The midplane contains an EEPROM that stores the serial number and revision level of the midplane.

The midplane performs the following functions:

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

**Figure 3: Midplane**



For midplane serial number information, see [“Displaying M7i Router Components and Serial Numbers”](#) on page 191.

- Related Documentation**
- [M7i Router Description on page 3](#)
  - [M7i Chassis Description on page 6](#)

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

---

The M7i Multiservice Edge Router houses either a Compact Forwarding Engine Board (CFEB) or an Enhanced Compact Forwarding Engine Board (CFEB-E), which is located on the rear of the router above the power supplies, as shown in [Figure 2 on page 6](#). It provides route lookup, filtering, and switching on incoming data packets, then directs outbound packets to the appropriate interface for transmission to the network. It can process 16 million packets per second (Mpps). The CFEB or CFEB-E communicates with the Routing Engine using a dedicated 100-Mbps link that transfers routing table data from the Routing Engine to the forwarding table. The link is also used to transfer routing link-state updates and other packets destined for the router from the CFEB or CFEB-E to the Routing Engine.

The CFEB or CFEB-E provides the following functions:

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

The built-in tunnel interface on the CFEB or CFEB-E is configured the same way as a PIC. For information about configuring the built-in tunnel interface, see the [Junos OS Services Interfaces Configuration Guide](#).

- Optional Adaptive Services Module (ASM)—Provides one or more services on one PIC. See [“M7i Adaptive Services Module” on page 12](#) for more information.

The CFEB and CFEB-E are hot-pluggable when you replace a CFEB with a CFEB or a CFEB-E with a CFEB-E. Upgrading or downgrading a CFEB device requires a system reboot, as described in [“Upgrading and Downgrading the CFEB and CFEB-E” on page 92](#). You can remove and replace the CFEB or CFEB-E without powering down the router, but the routing functions of the system are interrupted when it is removed.

## CFEB

The CFEB has the following major components:

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

Figure 4: CFEB

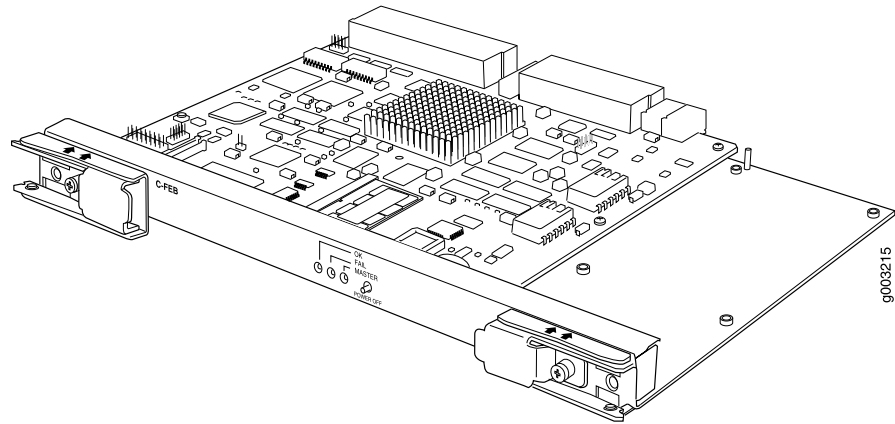
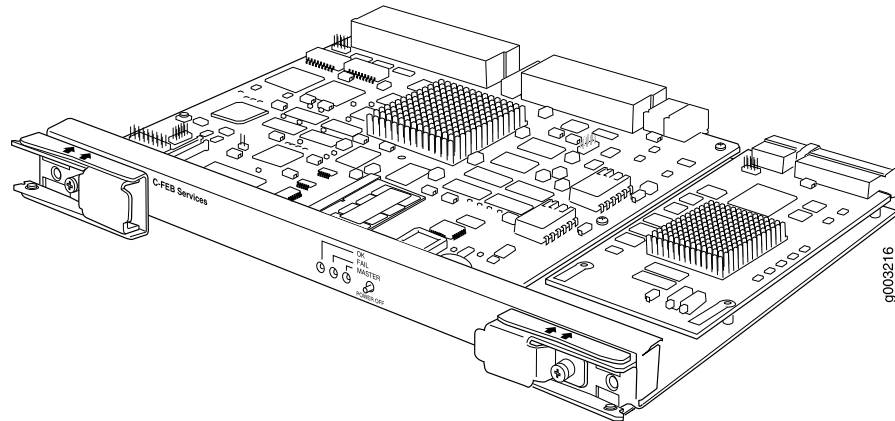


Figure 5: CFEB with Adaptive Services Module



## CFEB-E

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

- Optional MultiServices Module (MSM)—Provides one or more services on one PIC. See [“M7i MultiServices Module” on page 13](#) for more information.
- Increased number of logical interfaces.
- Increased route, nexthop, and interface lookup memory.
- Increased FPC throughput.
- Enhanced class of service features, including:
  - More queues and priority levels
  - Increased drop precedence per queue
  - Excess bandwidth allocation in proportion to weights
  - Hierarchical policing
  - Increased number of WRED profiles



- Independent EXP and DSCP rewrite
- Independent Layer 2 and Layer 3 classification on same port

The CFEB-E has the following major components:

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

Figure 6: CFEB-E

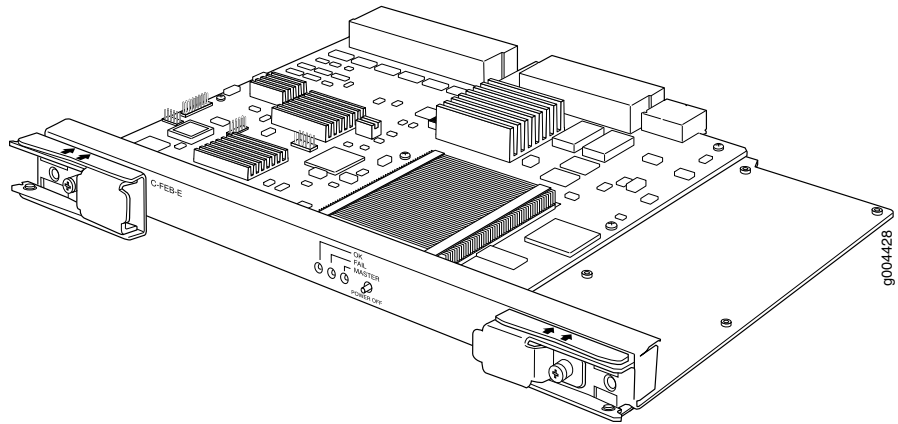


Figure 7: CFEB-E with Adaptive Services Module

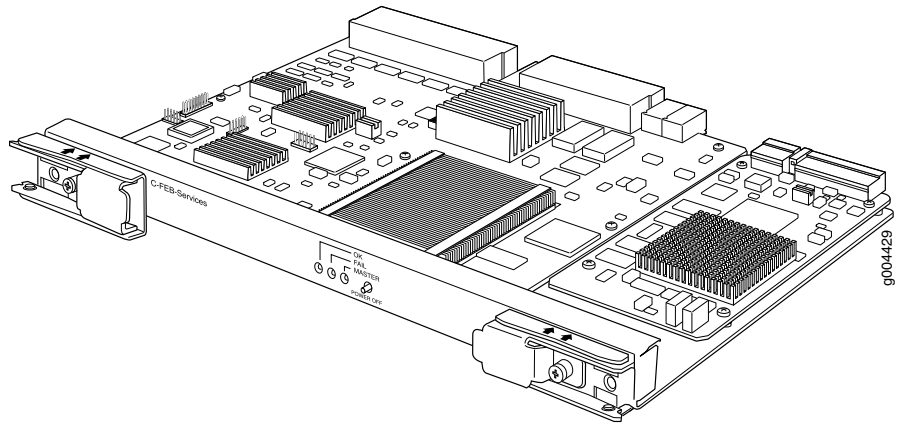
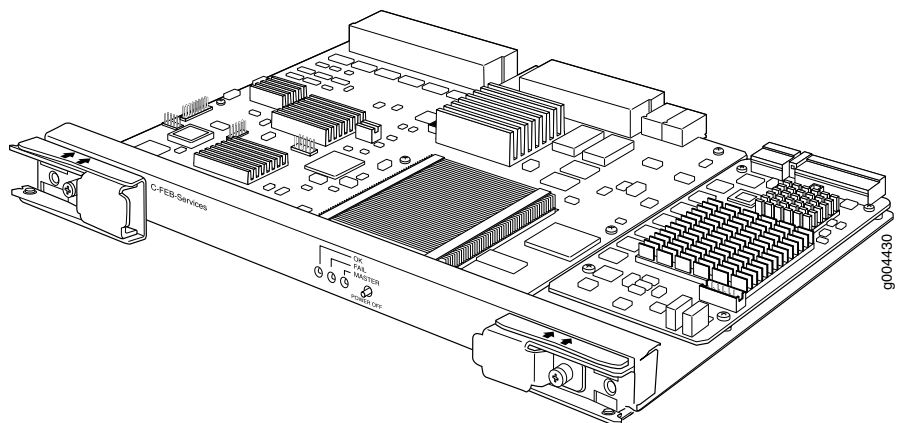


Figure 8: CFEB-E with MultiServices Module



## M7i Adaptive Services Module

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

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

The Adaptive Services Module provides the following services:

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

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

For information about configuring interfaces on the ASM, see the [Junos OS Services Interfaces Configuration Guide](#).

## M7i MultiServices Module

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

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

- Layer 2 Services:
  - MLPPP
  - MLFR
  - cRTP
  - IPsec
  - Multiclass MLPPP
  - RPM



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

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

For information about configuring interfaces on the MSM, see the [Junos OS Services Interfaces Configuration Guide](#).

#### Related Documentation

- [M7i CFEB and CFEB-E LEDs on page 14](#)
- [M7i and M10i Packet Forwarding Engine Architecture on page 30](#)
- [M7i Router Description on page 3](#)
- [M7i Router Physical Specifications on page 163](#)

## M7i CFEB and CFEB-E LEDs

**Table 3: States for CFEB or CFEB-E LEDs**

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

- Related Documentation**
- [M7i Compact Forwarding Engine Board \(CFEB\) and Enhanced Compact Forwarding Engine Board \(CFEB-E\) Description on page 8](#)

## M7i Fixed Interface Card (FIC) Description

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

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

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

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

Each FIC consists of the following components:

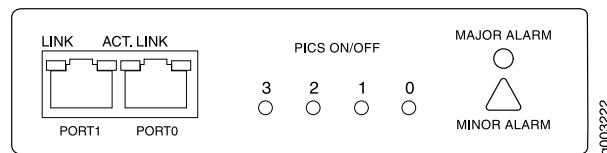
- The FIC has either two 100Base-TX Fast Ethernet ports or one Gigabit Ethernet port, depending on which type of FIC is installed in the router. [Table 25 on page 177](#) describes the interface connectors. See [Figure 9 on page 15](#) and [Figure 10 on page 15](#).

For more information about Fast Ethernet and Gigabit Ethernet interfaces, see the [M7i Multiservice Edge Router PIC Guide](#). The networking interface on the FIC is configured the same way as a PIC. For more information about configuring interfaces see the [Junos OS Network Interfaces Configuration Guide](#).

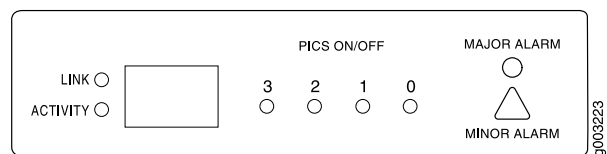
- Buttons on the FIC labeled **PICS ON/OFF** to take a Physical Interface Card (PIC) offline when it needs to be removed, or bring it online when it is replaced.

- Alarm LEDs and interface LEDs.

**Figure 9: FIC with Fast Ethernet Ports**



**Figure 10: FIC with Gigabit Ethernet Port**



- Related Documentation**
- [M7i FIC LEDs on page 16](#)
  - [Connecting FIC and PIC Cables to the M7i Router on page 58](#)
  - [M7i Chassis Description on page 6](#)

- [M7i Midplane Description on page 7](#)



## M7i FIC LEDs

Two large alarm LEDs are located on the right of the FIC (see [Figure 9 on page 15](#) and [Figure 10 on page 15](#)). The circular red LED lights to indicate a critical condition that can result in a system shutdown. The triangular yellow LED lights to indicate a less severe condition that requires monitoring or maintenance. Both LEDs can be lit simultaneously.

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

[Table 4 on page 16](#) describes the alarm LEDs in more detail.

**Table 4: Alarm LEDs**

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

[Table 5 on page 16](#) describes the FIC interface LEDs in more detail.

**Table 5: FIC Interface LEDs**

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

### Related Documentation

- [M7i Fixed Interface Card \(FIC\) Description on page 15](#)
- [Connecting FIC and PIC Cables to the M7i Router on page 58](#)

## M7i PICs Description

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

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

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

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

The M7i router has a maximum throughput of 3.2 Gbps full duplex for the FPC with 4 PIC slots. Inserting a combination of PICs with an aggregate higher than the maximum throughput is supported, but constitutes oversubscription of the FPC. The fixed interface card (FIC) has a maximum throughput of 1 Gbps full duplex.

PICs are hot-removable and hot-insertable.

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

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

**Related Documentation**

- [M7i PICs Supported](#)
- [M7i End-of-Life PICs Supported](#)
- [M7i PIC LEDs on page 17](#)
- [M7i Field-Replaceable Units \(FRUs\) on page 89](#)
- [M7i Flexible PIC Concentrators \(FPCs\) Description on page 18](#)
- [PIC Serial Number ID Label on page 193](#)
- [Replacing an M7i PIC on page 93](#)
- [Troubleshooting the M7i FIC or PICs on page 84](#)

## M7i PIC LEDs

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

**Related Documentation**

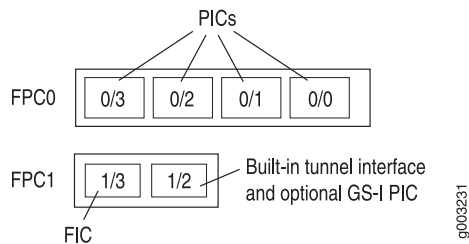
- [M7i PICs Description on page 16](#)
- [Installing an M7i PIC on page 94](#)

- [PIC Serial Number ID Label on page 193](#)
- [Replacing an M7i PIC on page 93](#)
- [Troubleshooting the M7i FIC or PICs on page 84](#)

## M7i Flexible PIC Concentrators (FPCs) Description

Flexible PIC Concentrators (FPCs) house the PICs that connect the router to network media (for information about PICs, see “[M7i PICs Description](#)” on page 16). On the M7i router, each FPC is built in (it cannot be removed from the chassis as on other M Series routers). The networking and services interfaces in the M7i router are grouped onto two logical FPCs by the router, (see [Figure 11 on page 18](#)). PICs are located on **FPC 0**. On **FPC 1** the FIC is located in slot **3** and the built-in tunnel interface is located in slot **2**. If the ASM is installed on the CFEB or CFEB-E, it is located on slot **2** with the built-in tunnel interface.

**Figure 11: FPC Slot Numbering**



### Related Documentation

- [M7i Router Description on page 3](#)
- [M7i Router Physical Specifications on page 163](#)
- [Overview of M7i Router Installation on page 41](#)

## M7i Routing Engine Description

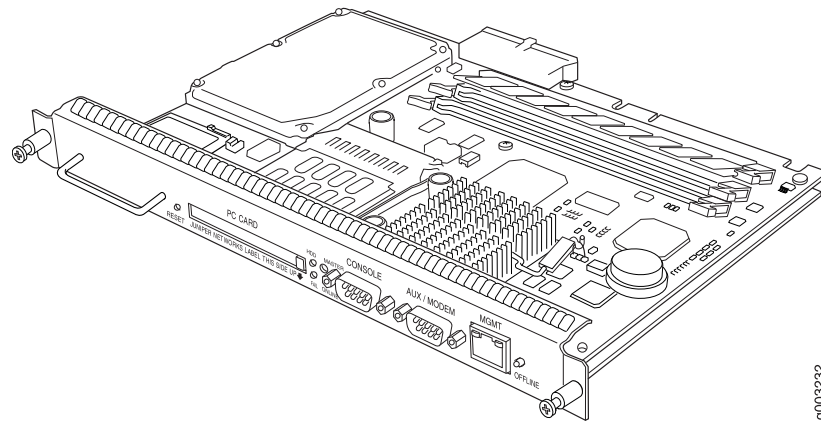
The Routing Engine runs Junos OS. The software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router's interfaces, control some chassis components, and provide the interface for system management and user access to the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

The Routing Engine is installed into the midplane from the front of the chassis, as shown in [Figure 1 on page 6](#). When two Routing Engines are installed, both are powered on, but only one is active (the master); the second Routing Engine is in standby mode and performs no functions. At boot time, both Routing Engines run an arbitration algorithm and elect one as master. For a more detailed description of the Routing Engine's role in router architecture, see “[Routing Engine Architecture](#)” on page 31.

The Routing Engine is hot-pluggable. If you have only one Routing Engine, you can remove and replace the Routing Engine without powering down the router, but the routing functions of the system are interrupted when it is removed. If the host system is redundant, the backup Routing Engine is hot-removable and hot-insertable. A backup Routing Engine can be removed without interrupting routing functions.



Figure 12: Routing Engine



The Routing Engine (shown in [Figure 12 on page 19](#)) is a two-board system with the following components:

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

## Boot Sequence

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

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

- PC Card
- CompactFlash card
- Hard disk



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

## M7i Routing Engine Management Ports

On the right half of the Routing Engine are ports for connecting the Routing Engine to one or more external devices on which system administrators can issue Junos OS command-line interface (CLI) commands to manage the router.

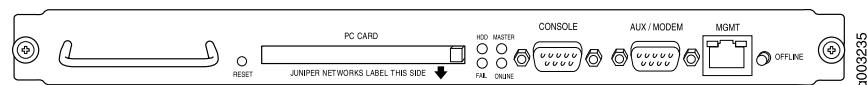
The ports are labeled and function as follows:

- **CONSOLE**—Connects the Routing Engine to a system console through an RS-232 (EIA-232) serial cable.
- **AUX/MODEM**— Connects the Routing Engine to a laptop, modem, or other auxiliary device through an RS-232 (EIA-232) serial cable.
- **MGMT**—Connects the Routing Engine through an Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for out-of-band management. The port uses an autosensing RJ-45 connector to support both 10- and 100-Mbps connections. Two small LEDs on the left edge of the port indicate the connection in use: the yellow LED lights for a 10-Mbps connection and the green LED lights for a 100-Mbps connection.

For information about the pinouts for the connectors, see “[RJ-45 Connector Pinouts for the M7i Routing Engine MGMT Port](#)” on page 185.

[Figure 13 on page 20](#) shows the ports that connect to the Routing Engine.

**Figure 13: Routing Engine Interface Ports**

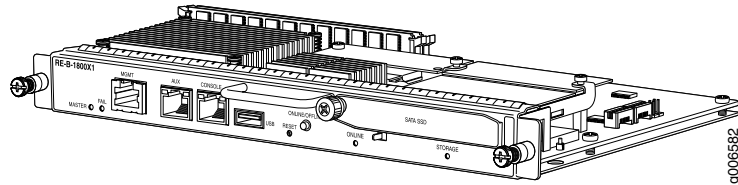


### Related Documentation

- [M7i Routing Engine LEDs on page 22](#)
- [M7i Router Description on page 3](#)
- [M7i Router Physical Specifications on page 163](#)
- [M7i Router Power Requirements on page 167](#)

## M7i Routing Engine RE-B-1800 Description

Figure 14: Routing Engine RE-B-1800



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

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols. It has Intel's single core Jasper Forest processor.
- USB port—Provides a removable media interface through which you can install the Junos OS manually. Junos OS supports USB version 2.0.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- CompactFlash card—Provides primary storage for software images, configuration files, and microcode. The CompactFlash card is field-replaceable.
- Solid-state Disk (SSD)—Provides secondary storage for log files and memory dumps, and can reboot the system if the CompactFlash card fails. SSD is front-pluggable and hot-swappable.
- Interface ports—The **AUX**, **CONSOLE**, and **MGMT** ports provide access to management devices. Each Routing Engine has one 10/100/1000-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.
- EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.
- Online/Offline button—Takes the Routing Engine online or offline when pressed.
- Real-time clock—Provides real-time integrated clock with batter backup for data retention.
- Extractor handle—Used for inserting and extracting the Routing Engine.
- Captive screws—Secure the Routing Engine in place.
- Four LEDs—A green LED labeled **STORAGE**, a blue LED labeled **MASTER**, a red LED labeled **FAIL**, and a green LED labeled **ONLINE** indicate Routing Engine status.



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

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

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

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

#### Related Documentation

- [M7i Routing Engine 1800 LEDs on page 22](#)
- [Replacing the M7i Routing Engine on page 101](#)
- [Replacing the SSD on an RE-B-1800 Routing Engine on page 104](#)

## M7i Routing Engine LEDs

Four LEDs—A green LED labeled **HDD**, a blue LED labeled **MASTER**, a red LED labeled **FAIL**, and a green LED labeled **ONLINE** indicate Routing Engine status. [Table 6 on page 22](#) describes the LED states.

**Table 6: States for Routing Engine LEDs**

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

#### Related Documentation

- [M7i Routing Engine Description on page 18](#)
- [M7i Router Description on page 3](#)
- [M7i Router Physical Specifications on page 163](#)
- [M7i Router Power Requirements on page 167](#)

## M7i Routing Engine 1800 LEDs

Four LEDs—a blue LED labeled **MASTER**, a red LED labeled **FAIL**, a green LED labeled **STORAGE**, and a green LED labeled **ONLINE**—located on the faceplate, indicate Routing Engine status. [Table 7 on page 23](#) describes the Routing Engine 1800 LED states.

Table 7: States for RE-B-1800 Routing Engine LEDs

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

- Related Documentation**
- [Displaying M7i Router Components and Serial Numbers on page 191](#)
  - [M7i Router Physical Specifications on page 163](#)

## M7i Power Supply Overview

- [M7i Power System Description on page 23](#)
- [M7i AC Power Supply on page 24](#)
- [M7i DC Power Supply on page 25](#)
- [M7i Power Supply LEDs on page 25](#)

### M7i Power System Description

The router uses either AC or DC power. You can install one or two load-sharing power supplies at the bottom rear of the chassis, as shown in [Figure 2 on page 6](#). The power supplies connect to the midplane, which distributes power to router components according to their individual voltage requirements.

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

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

Power supplies are hot-removable and hot-insertable, as described in [“M7i Field-Replaceable Units \(FRUs\)” on page 89](#). To avoid electrical injury, carefully follow the instructions in [“Replacing an M7i AC Power Supply” on page 111](#) and [“Replacing a DC Power Supply” on page 116](#).



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

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

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

#### Related Documentation

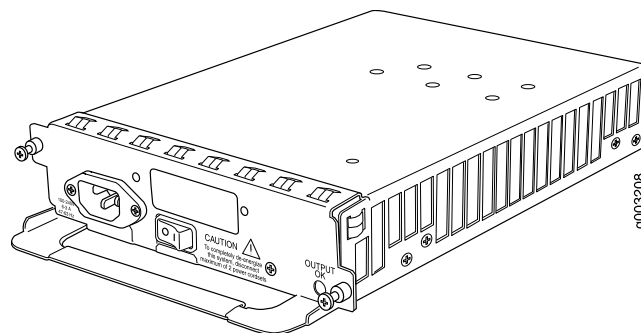
- [M7i AC Power Supply on page 24](#)
- [M7i DC Power Supply on page 25](#)
- [Removing an M7i AC Power Supply on page 112](#)
- [Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 85](#)

## M7i AC Power Supply

An AC-powered router has one or two load-sharing AC power supplies, located at the bottom rear of the chassis, as shown in [Figure 2 on page 6](#). For information about power supply redundancy and replaceability, see “[M7i Power System Description](#)” on [page 23](#).

[Figure 15 on page 24](#) shows the power supply.

**Figure 15: AC Power Supply**



#### Related Documentation

- [Table 21 on page 170](#)
- [M7i Power Supply LEDs on page 25](#)
- [Installing an M7i AC Power Cord on page 115](#)

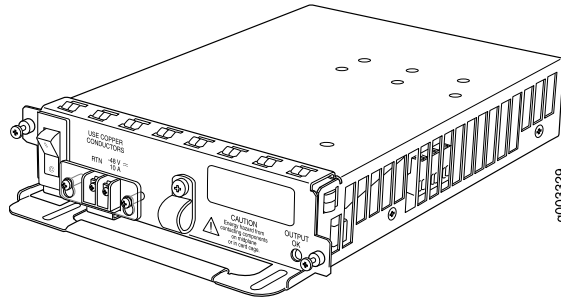
- [M7i AC Power Electrical Safety Guidelines and Warnings on page 152](#)
- [Removing an M7i AC Power Cord on page 115](#)
- [Replacing an M7i AC Power Supply on page 111](#)

## M7i DC Power Supply

A DC-powered router has one or two load-sharing DC power supplies, located at the bottom rear of the chassis, as shown in [Figure 2 on page 6](#). For information about power supply redundancy and replaceability, see “[M7i Power System Description](#)” on [page 23](#).

[Figure 16 on page 25](#) shows the power supply.

**Figure 16: DC Power Supply**



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

### Related Documentation

- [Table 24 on page 174](#)
- [M7i Power Supply LEDs on page 25](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154](#)
- [M7i DC Power Electrical Safety Guidelines on page 153](#)
- [Replacing a DC Power Supply on page 116](#)

## M7i Power Supply LEDs

[Table 8 on page 26](#) describes the LED on both AC and DC power supplies.

Table 8: States for the M7i Power Supply LED

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

**Related Documentation**

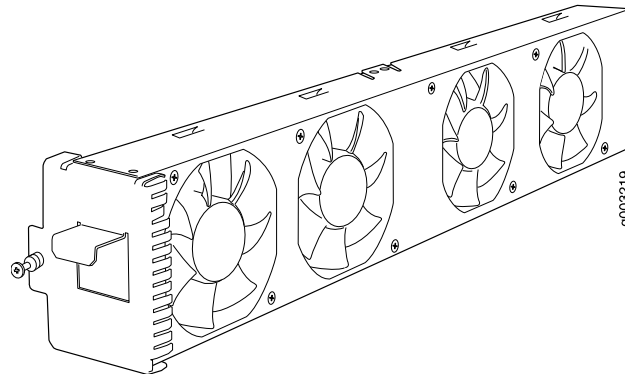
- [Installing an M7i AC Power Supply on page 113](#)
- [M7i Power System Description on page 23](#)
- [Replacing an M7i AC Power Supply on page 111](#)
- [Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 85](#)

## M7i Cooling System Overview

The router cooling system consists of a fan tray, located along the left side of the chassis, that provides side-to-side cooling (see [Figure 18 on page 27](#)). It connects directly to the router midplane. The fan tray is a single unit containing four individually fault-tolerant fans. If a single fan fails, the remaining fans continue to function indefinitely.

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

Figure 17: Fan Tray

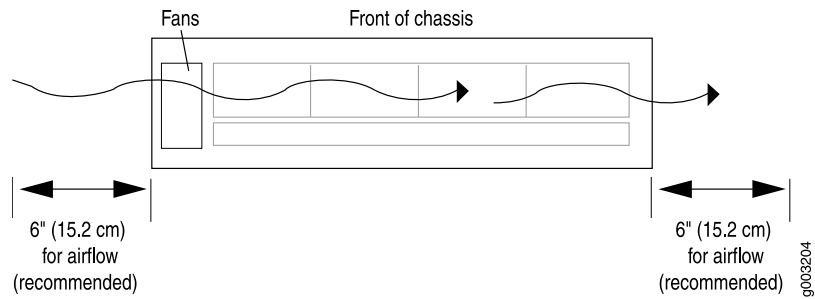


## M7i Airflow Through the Chassis

[Figure 18 on page 27](#) shows airflow through the chassis and the location of the fan tray.



Figure 18: Airflow Through the Chassis



- Related Documentation**
- [Maintaining the M7i Cooling System on page 77](#)
  - [M7i Router Clearance Requirements for Airflow and Hardware Maintenance on page 40](#)
  - [M7i Router Description on page 3](#)

## M7i Cable Management System

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

- Related Documentation**
- [Installing the M7i Cable Management System on page 47](#)
  - [M7i Router Description on page 3](#)
  - [Overview of M7i Router Installation on page 41](#)



## CHAPTER 3

# System Architecture Overview

- [System Architecture Overview on page 29](#)
- [M7i and M10i Packet Forwarding Engine Architecture on page 30](#)
- [Routing Engine Architecture on page 31](#)

## System Architecture Overview

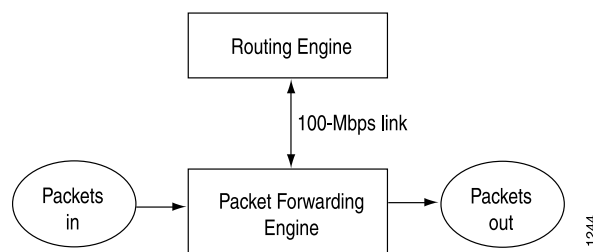
---

The router architecture consists of two major components:

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

The Packet Forwarding Engine and the Routing Engine perform independently but communicate constantly through a 100-Mbps internal link. This arrangement provides streamlined forwarding and routing control and the ability to run Internet-scale networks at high speeds. [Figure 19 on page 29](#) illustrates the relationship between the Packet Forwarding Engine and the Routing Engine.

**Figure 19: System Architecture**



### Related Documentation

- [M7i Chassis Description on page 6](#)
- [M7i Midplane Description on page 7](#)
- [M7i Power System Description on page 23](#)

## M7i and M10i Packet Forwarding Engine Architecture

---

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

- [Packet Forwarding Engine Components on page 30](#)
- [Data Flow Through the Packet Forwarding Engine on page 30](#)

### Packet Forwarding Engine Components

The Packet Forwarding Engine architecture includes the following components:

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

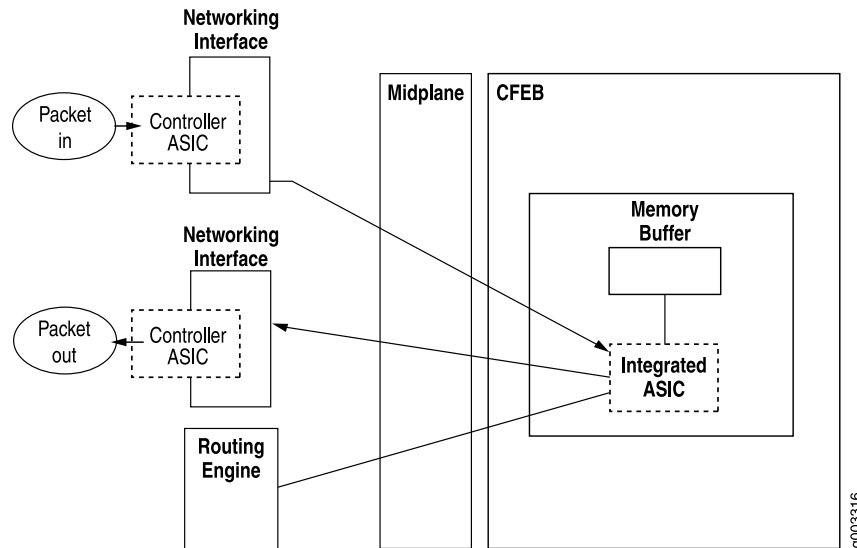
### Data Flow Through the Packet Forwarding Engine

Use of ASICs promotes efficient movement of data packets through the system. Packets flow through the Packet Forwarding Engine in the following sequence (see [Figure 20 on page 31](#)):

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

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

Figure 20: Packet Forwarding Engine Components and Data Flow



**Related Documentation**

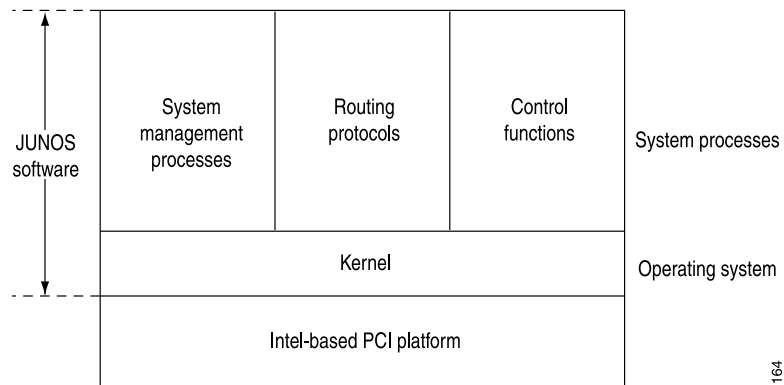
- [M7i Compact Forwarding Engine Board \(CFEB\) and Enhanced Compact Forwarding Engine Board \(CFEB-E\) Description on page 8](#)
- [M7i Router Description on page 3](#)

## Routing Engine Architecture

The Routing Engine runs the Junos OS, which Juniper Networks has developed and optimized to handle large numbers of network interfaces and routes. The software consists of a set of system processes running in protected memory modules on top of an independent operating system. The Junos kernel supports Junos system processes, which handle system management processes, routing protocols, and control functions (see [Figure 21 on page 32](#)).

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

Figure 21: Routing Engine Architecture



## Routing Engine Functions

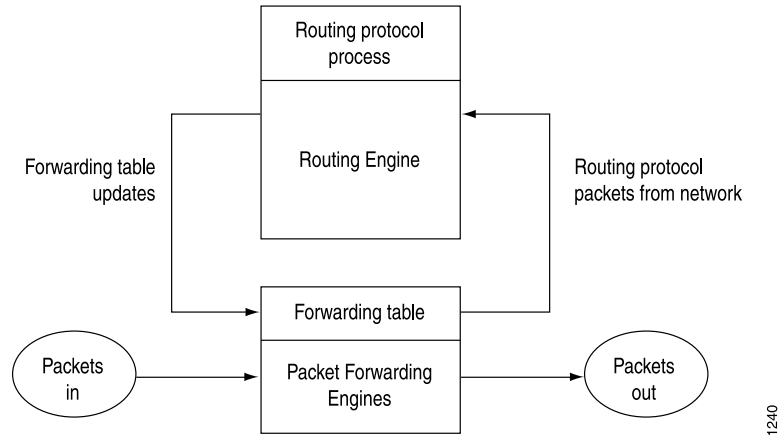
The Routing Engine handles all routing protocol processes, as well as the software processes that control the router's interfaces, the chassis components, system management, and user access to the router. These routing and software processes run on top of a kernel that interacts with the Packet Forwarding Engine. For more information about the processes, see the [Junos OS System Basics and Services Command Reference](#).

The Routing Engine includes the following functions and features:

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

The Routing Engine constructs and maintains one or more routing tables (see [Figure 22 on page 33](#)). From the routing tables, the Routing Engine derives a table of active routes, called the forwarding table, which is then copied into the Packet Forwarding Engine. The design of the ASICs allow the forwarding table in the Packet Forwarding Engine to be updated without interrupting forwarding performance.

**Figure 22: Control Packet Handling for Routing and Forwarding Table Updates**



1240

**Related Documentation**

- [M7i Routing Engine Description on page 18](#)
- [Maintaining the M7i Routing Engine on page 76](#)
- [Replacing the M7i Routing Engine on page 101](#)





## PART 2

# Setting Up the M7i Router

- [Preparing the Site for M7i Router Installation on page 37](#)
- [Overview of M7i Router Installation on page 41](#)
- [Unpacking the M7i Router on page 43](#)
- [Installing the M7i Router Mounting Hardware on page 47](#)
- [Installing the M7i Router on page 49](#)
- [Grounding the M7i Router on page 53](#)
- [Connecting the M7i Router to External Devices on page 55](#)
- [Providing Power to the M7i Router on page 61](#)
- [Configuring Junos OS on page 67](#)



## CHAPTER 4

# Preparing the Site for M7i Router Installation

- [M7i Router Site Preparation Checklist on page 37](#)
- [M7i Router Rack Requirements on page 38](#)
- [M7i Router Clearance Requirements for Airflow and Hardware Maintenance on page 40](#)

## M7i Router Site Preparation Checklist

---

The checklist in [Table 9 on page 37](#) summarizes the tasks you need to perform when preparing a site for router installation.

**Table 9: Site Preparation Checklist**

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

### Related Documentation

- [M7i Router Description on page 3](#)

- [M7i Router Physical Specifications on page 163](#)
- [M7i Router Clearance Requirements for Airflow and Hardware Maintenance on page 40](#)

## M7i Router Rack Requirements

The router can be installed in many types of racks, including four-post (telco) racks and open-frame racks. An example of an open-frame rack appears in [Figure 23 on page 39](#). [Table 10 on page 38](#) summarizes rack requirements and specifications for an M7i router.

**Table 10: Rack Requirements and Specifications for an M7i Router**

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 Industry Association (<a href="http://www.eia.org">http://www.eia.org</a>).</p>
Rack size and strength	<ul style="list-style-type: none"> <li>• 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 Industry Association (<a href="http://www.eia.org">http://www.eia.org</a>).</li> <li>• Ensure that the rack is one of the following standard lengths: <ul style="list-style-type: none"> <li>• 23.62 in. (600 mm) With the use of adaptors, the router can fit into a rack that is 600 mm wide and 600 mm deep as defined in the four-part <i>Equipment Engineering (EE); European telecommunications standard for equipment practice</i> (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute (<a href="http://www.etsi.org">http://www.etsi.org</a>). Use approved wing devices to narrow the opening between the rails as required.</li> <li>• 30.0 in. (762 mm)</li> <li>• 21.5 in. (800 mm)</li> </ul> </li> <li>• The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions: 3.5 in. (8.9 cm) high, 18 in. (45.7 cm) deep, and 17.5 in. (44.5 cm) wide. The outer edges of the mounting brackets extend the width to 19 in. (48.2 cm). The spacing of rails and adjacent racks must also allow for the clearances around the router and rack that are specified in "<a href="#">M7i Router Clearance Requirements for Airflow and Hardware Maintenance</a>" on page 40.</li> <li>• The chassis height of 3.5 in. (8.9 cm) is approximately 2 U. A U is the standard rack unit defined in <i>Cabinets, Racks, Panels, and Associated Equipment</i> (document number EIA-310-D) published by the Electronics Industry Association. You can stack 21 M7i routers in a rack that has at least 42 U (73.5 in. or 1.87 m) of usable vertical space.</li> <li>• The rack must be strong enough to support the weight of the fully configured router, up to 36.5 lb (16.6 kg). If you stack multiple fully configured routers in one rack, it must be capable of supporting the combined weight of the routers.</li> <li>• Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the switch and rack as specified in "<a href="#">M7i Router Clearance Requirements for Airflow and Hardware Maintenance</a>" on page 40.</li> </ul>

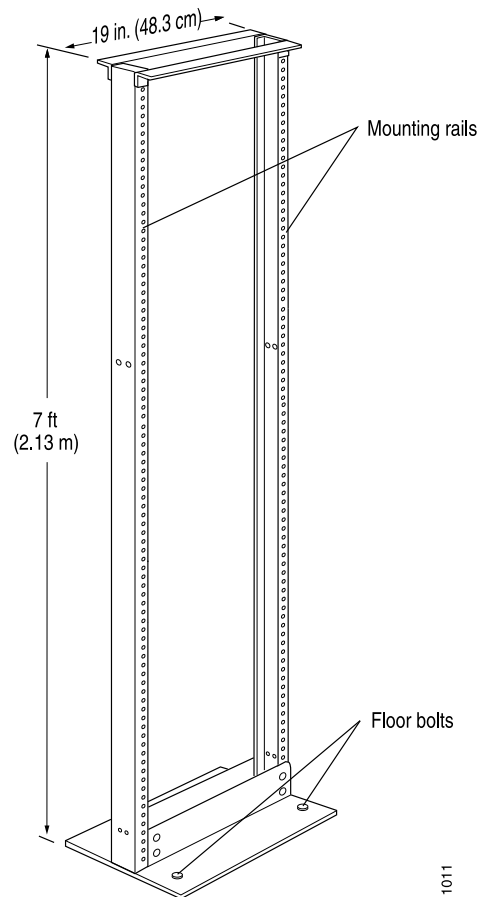
Table 10: Rack Requirements and Specifications for an M7i Router (*continued*)

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



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

Figure 23: Typical Open-Frame Rack



**Related Documentation**

- [Installation Safety Warnings for Juniper Networks Devices on page 135](#)
- [M7i Router Clearance Requirements for Airflow and Hardware Maintenance on page 40](#)
- [M7i Router Physical Specifications on page 163](#)
- [M7i Router Site Preparation Checklist on page 37](#)

## M7i Router Clearance Requirements for Airflow and Hardware Maintenance

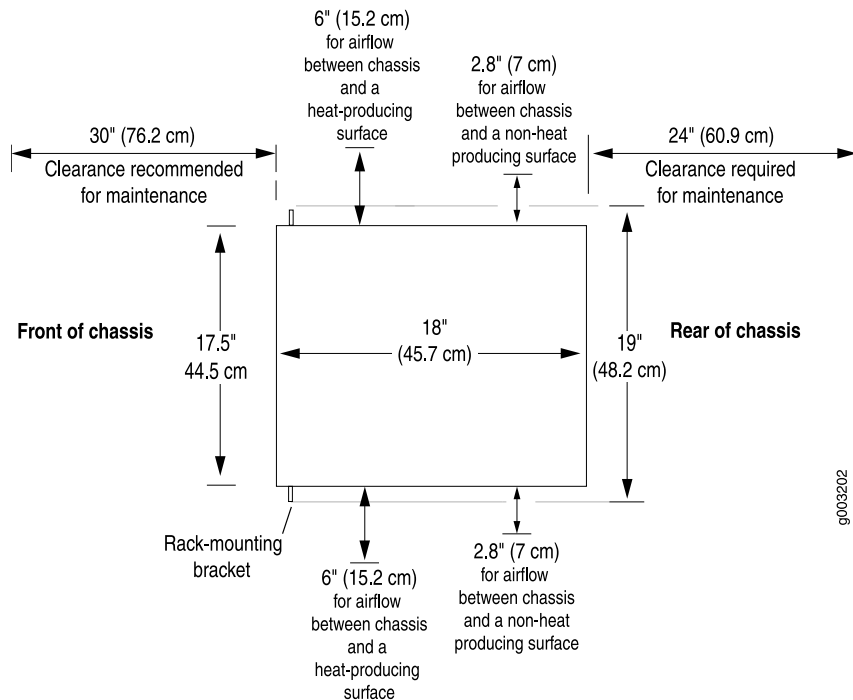
When planning the installation site, you need to allow sufficient clearance around the rack (see [Figure 24 on page 40](#)):

- For the cooling system of side-cooled routers to function properly, the airflow around the chassis must be unrestricted. Allow at least 6 in. (15.2 cm) of clearance between side-cooled routers. Allow 2.8 in. (7 cm) between the side of the chassis and any non-heat-producing surface such as a wall.
- For service personnel to remove and install hardware components, there must be adequate space at the front and back of the router. Allow at least 24 in. (61 cm) both in front of and behind the chassis. NEBS GR-63 recommends at least 30 in. (76.2 cm) clearance in front of the chassis.



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

**Figure 24: Chassis Dimensions and Clearance Requirements**



- Related Documentation**
- [M7i Router Description on page 3](#)
  - [M7i Router Physical Specifications on page 163](#)

## CHAPTER 5

# Overview of M7i Router Installation

- [Overview of M7i Router Installation on page 41](#)

## Overview of M7i Router Installation

---

After you have prepared your installation site as described in [“M7i Router Site Preparation Checklist” on page 37](#), you are ready to unpack and install the router. It is important to proceed through the installation process in the following order:

1. Review the safety guidelines explained in [“General Safety Guidelines for Juniper Networks Devices” on page 129](#) and [“General Safety Warnings for Juniper Networks Devices” on page 130](#).
2. Follow the instructions in [“Unpacking the M7i Router” on page 43](#) and [“Verifying the M7i Router Parts Received” on page 44](#).
3. Install the cable management system as described in [“Installing the M7i Cable Management System” on page 47](#).
4. If you are center-mounting the router, move the mounting brackets as described in [“Moving the Mounting Brackets” on page 48](#).
5. Install the router as described in [“Installing the M7i Router Into the Rack” on page 49](#).
6. Connect the grounding cable as described in [“Connecting the Grounding Cable to the M7i Router” on page 53](#).
7. Connect cables to external devices as described in [“Connecting the M7i Router to Management and Alarm Devices” on page 55](#).
8. Connect the AC power cords as described in [“Connecting Power to an AC-Powered M7i Router” on page 61](#) or DC power cables [“Connecting Power to a DC-Powered Router” on page 61](#).
9. Power on the router as described in [“Powering On the M7i Router” on page 63](#).
10. Perform the initial system startup as described in [“Initially Configuring the M7i Router” on page 67](#).

### Related Documentation

- [Connecting the M7i Router to a Management Console or Auxiliary Device on page 56](#)
- [Connecting the M7i Router to a Network for Out-of-Band Management on page 56](#)

- [M7i Chassis Description on page 6](#)
- [M7i Chassis Lifting Guidelines on page 134](#)



## CHAPTER 6

# Unpacking the M7i Router

- [Tools and Parts Required to Unpack the M7i Router on page 43](#)
- [Unpacking the M7i Router on page 43](#)
- [Verifying the M7i Router Parts Received on page 44](#)

## Tools and Parts Required to Unpack the M7i Router

---

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

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

### Related Documentation

- [M7i Router Description on page 3](#)
- [M7i Chassis Description on page 6](#)
- [M7i Chassis Lifting Guidelines on page 134](#)

## Unpacking the M7i Router

---

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



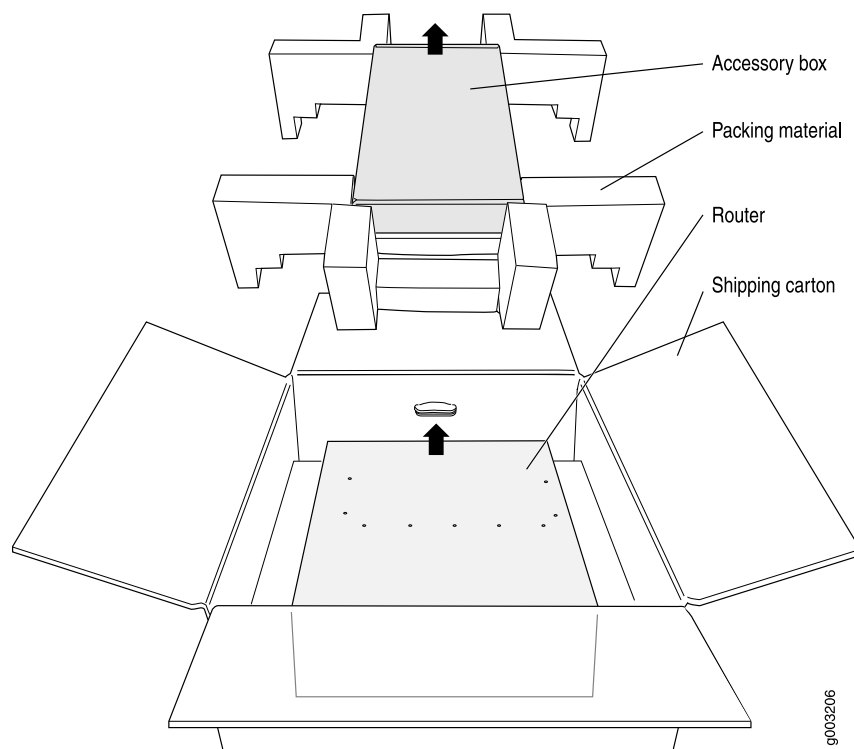
**NOTE:** The router is maximally protected inside the shipping carton. Do not unpack it until you are ready to begin installation.

To unpack the router, perform these steps (see [Figure 25 on page 44](#)):

1. Move the shipping carton to a staging area as close to the installation site as possible, but where you have enough room to remove the system components.
2. Position the carton so that the arrows are pointing up.

3. Open the top flaps on the shipping carton.
4. Remove the accessory box and verify the contents against the parts inventory on the label attached to the carton.
5. Pull out the packing material holding the router in place.
6. Verify the chassis components received against the packing list included with the router. A generic parts inventory appears in [Table 11 on page 45](#).
7. Save the shipping crate, packing materials, and pallet in case you later need to move or ship the router.

**Figure 25: Unpacking the Router**



- Related Documentation**
- [M7i Router Description on page 3](#)
  - [M7i Router Physical Specifications on page 163](#)
  - [M7i Router Rack Requirements on page 38](#)

## Verifying the M7i Router Parts Received

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

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

A fully configured router contains the router chassis with installed components, listed in [Table 11 on page 45](#), and an accessory box, which contains the parts listed in [Table 12 on page 45](#). The parts shipped with your router can vary depending on the configuration you ordered.

**Table 11: Generic Inventory of Router Components Installed in the M7i Chassis**

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

**Table 12: Accessory Box Parts List**

Part	Quantity
Screws, Screw, Pan hd, Phil, 12-24 x 1/2", self-tapping	4
Screws, Flat Hd, Phil, 5 x 10.5mm Long, 1.6mm Pitch, self-tapping	4
Terminal lugs, 16-AWG to 14-AWG, #6 stud, ring terminal, vinyl insulated	2
Terminal fork lugs, 14-AWG, #6, 0.25 Wide, insulation strain relieved, for DC power cables	9 (2 per power supply)
Terminal lugs, 14-AWG, #8 stud, ring tongue, insulated	2
Terminal lugs, 14-AWG, two hole for grounding	1
DB-9 (male) to DB-25 (female) serial adapter	1
Serial cable, Console, DB9F/DB9F	1

Table 12: Accessory Box Parts List (*continued*)

Part	Quantity
Label, contents, 3-1/3" x 4", M7i/M10i	1
Label, Accessory Kit Label, Green "Small Parts Enclosed"	1
Read me first document	1
JNPR Compliance Form Letter, RoHS Worldwide	1
Affidavit for T1 connection	1
Juniper Networks Product Warranty	1
End User License Agreement	1
Addendum, Documentation Card for Routing Platforms	1
Document sleeve	1
3" x 5" pink bag	2
9" x 12" pink bag, ESD	2
Accessory box, 19 x 12 x 3"	1
Ethernet cable, RJ-45/RJ-45, 4-pair stranded UTP, Category 5E, 15'	1
ESD wrist strap with cable	1

**Related  
Documentation**

- [M7i Router Description on page 3](#)
- [M7i Router Physical Specifications on page 163](#)
- [M7i Chassis Description on page 6](#)

## CHAPTER 7

# Installing the M7i Router Mounting Hardware

- [Installing the M7i Cable Management System on page 47](#)
- [Moving the Mounting Brackets on page 48](#)

## Installing the M7i Cable Management System

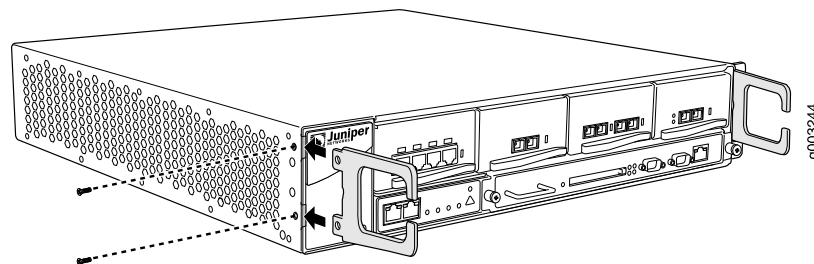
---

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

To install the cable management system (see [Figure 26 on page 47](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Use a number 2 Phillips screwdriver to loosen the screws that secure the mounting brackets to the chassis, and remove the mounting brackets.
3. Locate the cable management racks and appropriate screws in the accessory box.
4. Slide the cable management rack into the slots at the front of the chassis.
5. Use a number 2 Phillips screwdriver to tighten the screws that secure the cable management system to the chassis.
6. Reinstall the mounting brackets.

**Figure 26: Installing the Cable Management System**



### Related Documentation

- [M7i Cable Management System on page 27](#)
- [M7i Chassis Description on page 6](#)

## Moving the Mounting Brackets

---

For an open-frame rack, center-mounting is preferable, because the more even distribution of weight provides greater stability. The router is shipped with the mounting brackets already installed for front-mounting, as shown in [Figure 1 on page 6](#).

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

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

**Related  
Documentation**

- [Installation Safety Warnings for Juniper Networks Devices on page 135](#)
- [Installing the M7i Router Into the Rack on page 49](#)

## CHAPTER 8

# Installing the M7i Router

- [Tools and Parts Required to Install the M7i Router Into a Rack on page 49](#)
- [Installing the M7i Router Into the Rack on page 49](#)

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

---

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

- Phillips (+) screwdriver, number 2
- Related Documentation**
- [Initially Configuring the M7i Router on page 67](#)
  - [M7i Chassis Description on page 6](#)
  - [M7i Chassis Lifting Guidelines on page 134](#)

## Installing the M7i Router Into the Rack

---



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

---

First, perform the following prerequisite procedures:

- Verify that the router site meets the requirements described in [“M7i Router Site Preparation Checklist” on page 37](#).
- Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure. For details, see [“M7i Router Rack Requirements” on page 38](#).
- Read the information in [“General Safety Guidelines for Juniper Networks Devices” on page 129](#) and [“General Safety Warnings for Juniper Networks Devices” on page 130](#).
- Review the guidelines in [“M7i Chassis Lifting Guidelines” on page 134](#).
- Remove the router from the shipping carton, as described in [“Unpacking the M7i Router” on page 43](#).

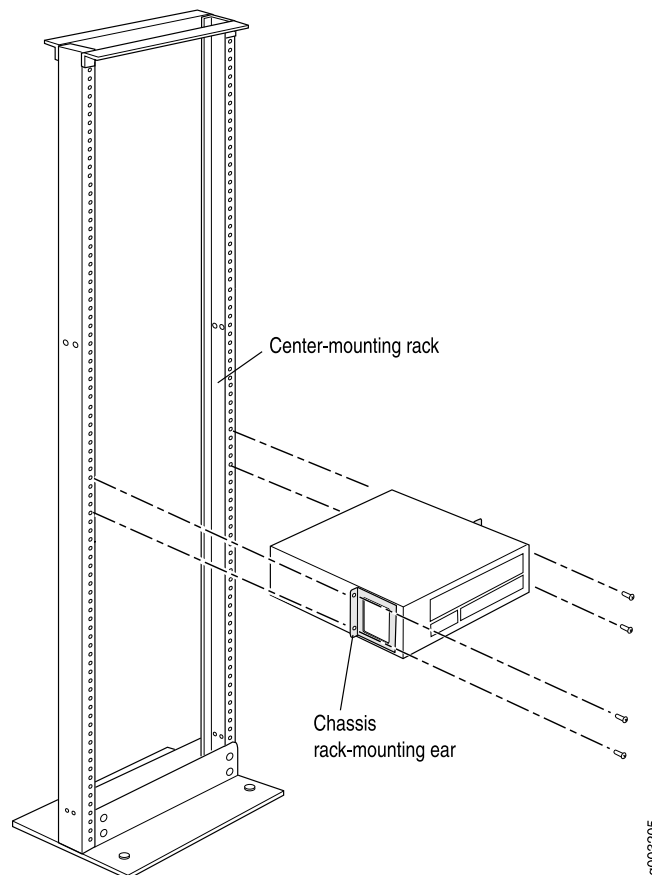
Then, perform the following procedures to install the router:



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

1. If you are center-mounting the router, move the mounting brackets on the chassis as described in [“Moving the Mounting Brackets”](#) on page 48.
2. Have one person grasp each side of the router, lift the router, and position it in the rack.
3. Align the bottom hole in both mounting brackets with a hole in each rack rail, making sure the chassis is level.
4. Install one of the mounting screws provided (in the accessory box shipped with the router) into each of the two aligned holes. Use a Phillips screwdriver to tighten the screws.

**Figure 27: Installing the Router**



5. Install the second screw in each mounting ear.



6. Verify that all the mounting screws on one side of the rack are aligned with the mounting screws on the opposite side and that the router is level.
7. To continue the installation, proceed to [“Connecting the M7i Router to Management and Alarm Devices”](#) on page 55.

**Related  
Documentation**

- [Overview of M7i Router Installation](#) on page 41
- [Initially Configuring the M7i Router](#) on page 67
- [M7i Chassis Lifting Guidelines](#) on page 134
- [M7i Router Physical Specifications](#) on page 163



## CHAPTER 9

# Grounding the M7i Router

- [Connecting the Grounding Cable to the M7i Router on page 53](#)

## Connecting the Grounding Cable to the M7i Router

---

To connect the grounding cable:

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

### Related Documentation

- [M7i Chassis Description on page 6](#)
- [Preventing Electrostatic Discharge Damage to an M7i Router on page 132](#)
- [M7i Chassis Grounding, Connection, and Cable Specifications on page 171](#)



## CHAPTER 10

# Connecting the M7i Router to External Devices

After installing the router into the rack as described in “Installing the M7i Router Into the Rack” on page 49, complete the installation by performing the procedures described in the following topics:

- [Tools and Parts Required for M7i Router Connections on page 55](#)
- [Connecting the M7i Router to Management and Alarm Devices on page 55](#)
- [Inserting an SFP into the 1-Port Gigabit Ethernet FIC on page 57](#)
- [Connecting FIC and PIC Cables to the M7i Router on page 58](#)

## Tools and Parts Required for M7i Router Connections

---

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

- Electrostatic discharge (ESD) grounding wrist strap

### Related Documentation

- [M7i Router Power Requirements on page 167](#)
- [M7i Router Site Preparation Checklist on page 37](#)

## Connecting the M7i Router to Management and Alarm Devices

---

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

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

- [Connecting the M7i Router to a Network for Out-of-Band Management on page 56](#)
- [Connecting the M7i Router to a Management Console or Auxiliary Device on page 56](#)

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

To connect the Routing Engine to a network for out-of-band management, insert an Ethernet cable with RJ-45/RJ-45 connectors into the **MGMT** port on the Routing Engine. One such cable is provided with the router (see “[Routing Engine Interface Cable and Wire Specifications for the M7i Router](#)” on page 183). Follow this procedure:

1. Plug one end of the Ethernet cable (Figure 28 on page 56 shows the connector) into the **MGMT** port on the Routing Engine (Figure 29 on page 56 shows the layout of the ports on the Routing Engine).
2. Plug the other end of the cable into the network device.

Figure 28: Routing Engine Ethernet Cable Connector

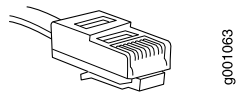
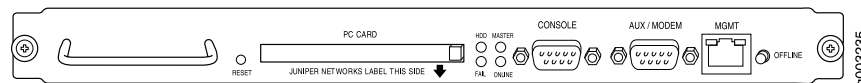


Figure 29: Routing Engine Interface Ports



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

To use a system console to configure and manage the Routing Engine, connect it to the **CONSOLE** port on the Routing Engine. To use a laptop, modem, or other auxiliary device, connect it to the **AUX/MODEM** port on the Routing Engine. Both ports accept an RS-232 (EIA-232) serial cable with DB-9/DB-9 connectors. One such cable is provided with the router. If you want to connect a device to both ports, you must supply another cable. See “[Routing Engine Interface Cable and Wire Specifications for the M7i Router](#)” on page 183. To connect a management console or auxiliary device:

1. Turn off the power to the console or auxiliary device.
2. Plug the female end (shown in Figure 30 on page 57) of the provided console cable into the **CONSOLE** or **AUX/MODEM** port. “[Connecting the M7i Router to a Network for Out-of-Band Management](#)” on page 56 shows the layout of the ports on the Routing Engine.



NOTE:

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

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

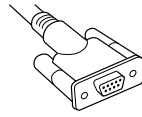
3. Tighten the screws on the connector.

**NOTE:**

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

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

**Figure 30: Console and Auxiliary Serial Port Connector**



**Related Documentation**

- [Routing Engine Interface Cable and Wire Specifications for the M7i Router on page 183.](#)
- [M7i Power System Description on page 23](#)
- [M7i Router Power Requirements on page 167](#)
- [M7i Router Site Preparation Checklist on page 37](#)
- [Initially Configuring the M7i Router on page 67](#)
- [Connecting Power to an AC-Powered M7i Router on page 61](#)
- [Connecting Power to a DC-Powered Router on page 61](#)

## Inserting an SFP into the 1-Port Gigabit Ethernet FIC

Before inserting cables into the 1-port Gigabit Ethernet FIC, you must install a small form-factor pluggable (SFP). Small form-factor pluggable (SFP) optical transceiver modules provide support for SX, LX, and LH optics.

To install an SFP into the FIC, follow this procedure:

1. Verify that each SFP has a rubber safety cap covering the optical transceiver. If it does not, cover the transceiver with a safety cap.
2. Carefully align the SFP with the slot in the FIC. The connector should face down.
3. Slide the SFP until the connector is seated in the FIC slot. If you are unable to fully insert the SFP, make sure the connector is facing the proper direction.

**Related Documentation**

- [Installing an SFP into an M7i Router on page 100](#)
- [Replacing an SFP on an M7i Router on page 98](#)

## Connecting FIC and PIC Cables to the M7i Router

---



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



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

- Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.
- Do not bend fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.
- Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

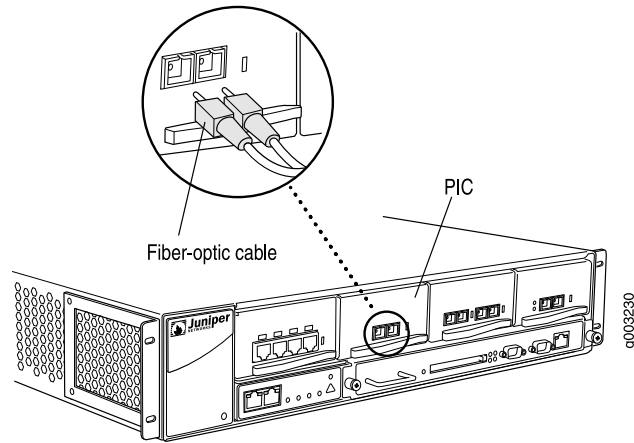
Plug network cables into the FIC and the PICs housed in the router.

To connect cables into the cable connector ports in the FIC or a PIC faceplate (see [Figure 31 on page 59](#), which shows a fiber-optic PIC):

1. Have ready a length of the type of cable used by the FIC or PIC, as specified in “[FIC Specifications for the M7i Router](#)” on [page 177](#) or the [M7i Multiservice Edge Router PIC Guide](#).
2. If the cable connector port is covered by a rubber safety plug, remove the plug.
3. Insert the cable connector into the cable connector port on the FIC or PIC faceplate.
4. Arrange the cable to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.



Figure 31: Attaching the Cable to a PIC

**Related Documentation**

- [Fiber-Optic and Network Cable Specifications for the M7i Router on page 178](#)
- [M7i Fixed Interface Card \(FIC\) Description on page 15](#)
- [M7i Flexible PIC Concentrators \(FPCs\) Description on page 18](#)



## CHAPTER 11

# Providing Power to the M7i Router

- [Connecting Power to an AC-Powered M7i Router on page 61](#)
- [Connecting Power to a DC-Powered Router on page 61](#)
- [Powering On the M7i Router on page 63](#)
- [Powering Off the M7i Router on page 64](#)

## Connecting Power to an AC-Powered M7i Router

---

To connect power to an AC-powered router:

1. Locate the power cords shipped with the router, which should have a plug appropriate for your geographical location (see [“M7i Router AC Power, Connection, and Power Cord Specifications” on page 168](#)).
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Verify that the switch on each power supply faceplate is in the **OFF (O)** position.
4. For each power supply, insert the appliance coupler end of a power cord into the appliance inlet on a power supply faceplate and insert the plug into an AC power source receptacle. Verify that the power cord does not block access to router components or drape where people could trip on it.

### Related Documentation

- [Preventing Electrostatic Discharge Damage to an M7i Router on page 132](#)
- [Removing an M7i AC Power Cord on page 115](#)
- [M7i AC Power Electrical Safety Guidelines and Warnings on page 152](#)
- [M7i AC Power Supply on page 24](#)
- [M7i Router AC Power Supply Specifications on page 170](#)

## Connecting Power to a DC-Powered Router

---

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



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

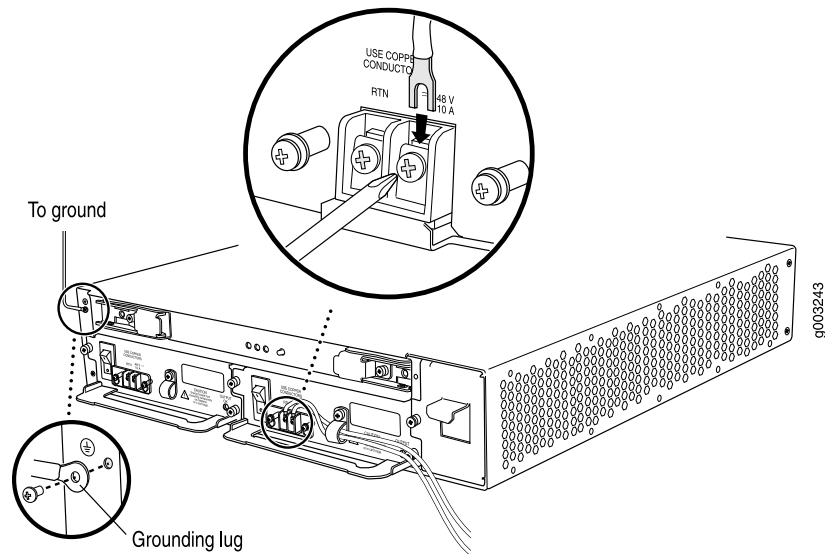


**CAUTION:** There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on each power supply. You must ensure that power connections maintain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

To connect DC power to the router (see [Figure 32 on page 63](#)):

1. Verify that there is no power flowing from either external power source, so that the voltage across the leads of the power cables is 0 V. Ensure that there is no chance that the cable leads might become active during the procedure.
2. Verify that a licensed electrician has attached a listed power cable lug to each power source cable.
3. Loop the power cables through the hook located on the faceplate to the right of the field-wiring terminals.
4. Depending on the type of power cable lugs used, loosen or remove the screws on the field-wiring terminals.
5. Insert the power cable lugs into the appropriate field-wiring terminals. Using a number 1 Phillips screwdriver, turn the screw on each field-wiring terminal clockwise to secure the power cable lug. Apply between 8 lb-in. (.9 Nm) and 9 lb-in. (1.02 Nm) of torque to each screw.
  - a. Insert the positive (+) source cable into the return terminal, which is labeled **RTN**.
  - b. Insert the negative (–) source cable into the input terminal, which is labeled **–48V**.
6. Verify that the DC source power cabling and the grounding cabling are correct, that they are not touching or blocking access to router components, and that they do not drape where people could trip on them.

Figure 32: Connecting DC PowerCables



#### Related Documentation

- [Removing an M7i DC Power Cable on page 120](#)
- [M7i DC Power Electrical Safety Guidelines on page 153](#)
- [M7i DC Power Supply on page 25](#)
- [M7i Router DC Power Supply Specifications on page 174](#)

## Powering On the M7i Router

To power on the router:

1. Verify that the power supplies are fully inserted in the chassis and the thumbscrews on their faceplates are tightened.
2. For each power supply on an AC-powered router, verify that the ends of the power cord are firmly plugged into the appliance inlet on the power supply faceplate and the external power source receptacle.

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

3. Verify that an external management device is connected to one of the Routing Engine ports on the Routing Engine (**AUX/MODEM**, **CONSOLE**, or **MGMT**). For more information on connecting management devices, see [“Connecting the M7i Router to Management and Alarm Devices” on page 55](#).
4. Turn on the power to the external management device.
5. Press the power switch for one power supply to the **ON** ( | ) position. On both AC and DC power supplies, the switch is located on the power supply faceplate.

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



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

If the router is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the router again, see [“Powering Off the M7i Router” on page 64](#).

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

- Press the power switch for the second power supply to the **ON** ( I ) position and verify that the **OUTPUT OK** LED lights steadily. If the LED does not light after 60 seconds, verify that the power supply is properly inserted into the chassis and repeat the cable installation procedures described in [“Connecting Power to an AC-Powered M7i Router” on page 61](#) or [“Connecting Power to a DC-Powered Router” on page 61](#).
- On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.

#### Related Documentation

- [Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 85](#)
- [Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off on page 85](#)
- [General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers on page 151](#)

## Powering Off the M7i Router

To power off the router:

- On the console or other management device connected to the master Routing Engine, enter CLI operational mode and issue the following command to shut down the router software. (If two Routing Engines are installed, also issue the command on the backup Routing Engine.)

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



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

For more information about the command, see the [Junos OS System Basics and Services Command Reference](#).



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

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





# Configuring Junos OS

- [Initially Configuring the M7i Router on page 67](#)

## Initially Configuring the M7i Router

---

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

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

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

If the Routing Engine has an CompactFlash card, three copies of the Junos OS are preinstalled on the router and the boot order is as follows. The router first attempts to access the image on the PC card. If a PC card is not inserted into the Routing Engine or the attempt otherwise fails, the router next tries the CompactFlash card, and finally the hard disk.

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

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

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

To configure the software:

1. Verify that the router is powered on as described in [“Powering On the M7i Router” on page 63](#).

2. Log in as the “root” user. There is no password.

3. Start the CLI.

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

4. Enter configuration mode.

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

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

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

6. Configure the router’s domain name.

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

7. Configure the IP address and prefix length for the router’s Ethernet interface.

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

8. Configure the IP address of a DNS server.

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

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

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

or

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

or

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

or

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

10. Optionally, display the configuration to verify that it is correct.

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

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

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

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

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

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

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



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

When the router boots from the storage media (removable media, internal CompactFlash card, or hard disk) it expands its search in the `/config` directory of the routing platform for the following files in the following order: **juniper.conf** (the main configuration file), **rescue.conf** (the rescue configuration file), and **juniper.conf.1** (the first rollback configuration file). When the search finds the first configuration file that can be loaded properly, the file loads and the search ends. If none of the file can be loaded properly,

the routing platform does not function properly. If the router boots from an alternate boot device, the Junos OS displays a message indicating this when you log in to the router.

- Related Documentation**
- [M7i Router Description on page 3](#)
  - [Overview of M7i Router Installation on page 41](#)

## PART 3

# Hardware Maintenance, Troubleshooting, and Replacement Procedures

- [Maintaining M7i Router Hardware Components on page 73](#)
- [Troubleshooting M7i Hardware Components on page 79](#)
- [Replacing M7i Hardware Components on page 89](#)



## CHAPTER 13

# Maintaining M7i Router Hardware Components

For information about returning a part to Juniper Networks for repair or replacement, see “Contacting Customer Support and Returning M7i Hardware” on page 191.

- [Routine Maintenance Procedures for the M7i Router on page 73](#)
- [Maintaining the M7i CFEB and CFEB-E on page 73](#)
- [Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 74](#)
- [Maintaining the M7i Routing Engine on page 76](#)
- [Maintaining the M7i Power Supplies on page 76](#)
- [Maintaining the M7i Cooling System on page 77](#)

### Routine Maintenance Procedures for the M7i Router

---

<b>Purpose</b>	For optimum router performance, perform preventive maintenance procedures.
<b>Action</b>	<ul style="list-style-type: none"><li>• 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.</li><li>• Check the status-reporting devices on the craft interface—System alarms and LEDs.</li></ul>
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">M7i Router Environmental Specifications on page 165</a></li><li>• <a href="#">M7i Router Physical Specifications on page 163</a></li><li>• <a href="#">Packing the M7i Router for Shipment on page 197</a></li><li>• <a href="#">Overview of Troubleshooting Resources for the M7i Router on page 79</a></li></ul>

### Maintaining the M7i CFEB and CFEB-E

---

<b>Purpose</b>	For optimum cooling, verify the condition of the CFEB.
<b>Action</b>	<ul style="list-style-type: none"><li>• Check the LEDs on the CFEB or CFEB-E faceplate. The green LED labeled OK lights steadily on the CFEB or CFEB-E when it is functioning normally. For more information, see “<a href="#">M7i Compact Forwarding Engine Board (CFEB) and Enhanced Compact Forwarding Engine Board (CFEB-E) Description</a>” on page 8.</li></ul>

- Issue the CLI **show chassis cfeb** command to check the status of the CFEB (first output example) or the CFEB-E (second output example):

```
user@host> show chassis cfeb
CFEB status:
  State                               Online
  Intake Temperature                   27 degrees C / 80 degrees F
  Exhaust Temperature                   33 degrees C / 91 degrees F
  CPU utilization                       3 percent
  Interrupt utilization                 0 percent
  Heap utilization                      8 percent
  Buffer utilization                    21 percent
  Total CPU DRAM                       128 MB
  Internet Processor II                 Version 1, Foundry IBM, Part number 164
  Start time:                          2003-06-11 11:41:22 PDT
  Uptime:                               1 hour, 39 minutes, 31 seconds
```

```
user@host> show chassis cfeb
CFEB-E status:
  State                               Online
  Intake Temperature                   27 degrees C / 80 degrees F
  Exhaust Temperature                   33 degrees C / 91 degrees F
  CPU utilization                       3 percent
  Interrupt utilization                 0 percent
  Heap utilization                      8 percent
  Buffer utilization                    21 percent
  Total CPU DRAM                       128 MB
  Internet Processor II                 Version 1, Foundry IBM, Part number 164
  Start time:                          2003-06-11 11:41:22 PDT
  Uptime:                               1 hour, 39 minutes, 31 seconds
```

For further description of the output from the command, see the [Junos OS System Basics and Services Command Reference](#).

#### Related Documentation

- [Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E on page 90](#)
- [Installing the M7i CFEB and CFEB-E on page 92](#)
- [Troubleshooting the M7i CFEB and CFEB-E on page 84](#)

## Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables

**Purpose** For optimum performance, verify the condition of the FIC and FIC cables and PICs and PIC cables.

- Action**
- Check the LEDs on the FIC faceplate. The Fast Ethernet and Gigabit Ethernet ports on the FIC have LEDs that display the status of the ports. For more information, see "[M7i Fixed Interface Card \(FIC\) Description](#)" on page 15.
  - Check the LEDs on PIC faceplates. Most PIC faceplates have an LED labeled **STATUS**. Some PICs have additional LEDs, often one per port. The meaning of the LED states differs for various PICs. For more information, see the [M7i Multiservice Edge Router PIC Guide](#).
  - Issue the CLI **show chassis fpc pic-status** command. The following example specifies an FPC slot number (**0**), which is optional.



```

user@host> show chassis fpc pic-status 0
Slot 0 OnLine
  PIC 0    2x OC-3 ATM, MM
  PIC 1    2x CT3-NxDS0
  PIC 2    2x OC-3 ATM, MM

```

For further description of the output from the command, see the [Junos OS System Basics and Services Command Reference](#).

- Support cables to prevent them from dislodging or developing stress points.
- Place excess cable out of the way, using the cable management system on the rack. Do not allow fastened loops of cable to dangle from the ladder rack because this stresses the cable at the fastening point. Putting fasteners on the loops help to maintain their shape.
- Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them if necessary before connecting an interface.
- Label all interface cables to identify them, labeling each end of the cable the same.

The following guidelines apply specifically to fiber-optic cable:

- When you unplug a fiber-optic cable from a FIC or PIC, always place a rubber safety plug over the transceiver on the FIC or PIC faceplate and on the end of the cable.
- Anchor fiber-optic cable to avoid stress on the connectors. When attaching fiber to an interface, be sure to secure the fiber so it is not supporting its own weight as it hangs to the floor. Never let fiber-optic cable hang free from the connector.
- Avoid bending fiber-optic cable beyond its bend radius. An arc smaller than a few inches can damage the cable and cause problems that are difficult to diagnose.
- Frequent plugging and unplugging of fiber-optic cable into and out of optical instruments, such as ATM or SONET/SDH analyzers, can cause damage to the instruments that is expensive to repair. Instead, attach a short fiber extension to the optical equipment. Any wear and tear due to frequent plugging and unplugging is then absorbed by the short fiber extension, which is easy and inexpensive to replace.
- Keep fiber-optic cable connections clean. Small micro-deposits of oil and dust in the canal of the transceiver or cable connector can cause loss of light, reducing signal power and possibly causing intermittent problems with the optical connection.

To clean the transceivers, use an appropriate fiber-cleaning device, such as RIFOCS 945/946 Fiber Optic Connector Cleaning System. Follow the directions for the cleaning kit you use.

After you have cleaned the transceiver on the fiber-optic interface, make sure that the connector tip of the fiber-optic cable is clean. Use only an approved alcohol-free fiber-optic cable cleaning kit such as the Cletop - Cletop Reel-Type Cleaner – Part# CLETOP-RL. Follow the directions for the cleaning kit you use.

#### Related Documentation

- [Replacing an M7i FIC or PIC Cable on page 96](#)
- [Troubleshooting the M7i FIC or PICs on page 84](#)

## Maintaining the M7i Routing Engine

**Purpose** For optimum performance, verify the condition of the Routing Engine.

- Action**
- Check the LEDs on the Routing Engine. The green LED labeled **ONLINE** lights steadily when it is functioning normally. For more information about the LEDs, see “[M7i Routing Engine Description](#)” on page 18.
  - Issue the CLI **show chassis routing-engine** command to check the status of the Routing Engines:

```
user@host> show chassis routing-engine
Routing Engine status:

    Temperature                26 degrees C / 78 degrees F
    DRAM                        256 MB
    Memory utilization          27 percent
    CPU utilization:
      User                      0 percent
      Background                0 percent
      Kernel                    4 percent
      Interrupt                 0 percent
      Idle                      96 percent
    Model                       RE-5.0
    Serial ID                   1000392782
    Start time                  2003-06-11 11:39:32 PDT
    Uptime                      1 hour, 41 minutes, 51 seconds
    Load averages:             1 minute   5 minute   15 minute
                               0.00        0.03      0.05
```

For further description of the output from the command, see the [Junos OS System Basics and Services Command Reference](#).

- Related Documentation**
- [Replacing the M7i Routing Engine on page 101](#)
  - [Routing Engine Interface Cable and Wire Specifications for the M7i Router on page 183](#)

## Maintaining the M7i Power Supplies

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

- Action**
- Check that the green **OUTPUT OK** LED is lit on the faceplate of both power supplies. For more information about the LED, see “[M7i Power Supply LEDs](#)” on page 25.
  - Issue the following CLI command to check the status of the power supplies. As shown in the sample output, the value **OK** in the **Status** column indicates that the power supply is operating normally:

```
user@host> show chassis environment
Class Item                    Status   Measurement
Power Power Supply 0           OK
      Power Supply 1         OK
Temp  Intake                  OK       24 degrees C / 75 degrees F
      PICs                   OK       27 degrees C / 80 degrees F
      Power Supplies         OK       27 degrees C / 80 degrees F
```

```

CFEB Intake           OK           27 degrees C / 80 degrees F
CFEB Exhaust         OK           33 degrees C / 91 degrees F
Routing Engine       OK           26 degrees C / 78 degrees F
Fans Left Fan Tray   Present
Left Tray front fan  OK           Spinning at normal speed
Left Tray second fan OK           Spinning at normal speed
Left Tray third fan  OK           Spinning at normal speed
Left Tray fourth fan OK           Spinning at normal speed

```

For further description of the output from the command, see the [Junos OS System Basics and Services Command Reference](#).

- Check the red and yellow alarm LEDs on the FIC. Power supply failure or removal triggers an alarm that causes one or both of the LEDs to light. You can display the associated error messages by issuing the following CLI command:

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

For a list of possible alarm messages, see “[Hardware and Interface Alarm Messages](#)” on page 80.

- Verify that the power source has the proper current rating and that each power supply is connected to a separate power source.
- Verify that the cable or cord connecting the power supply to the external power source is securely in place and that there is no moisture accumulating near the router.
- Verify that the cable or cord from the power source to the router is not damaged. If the insulation is cracked or broken, replace the cable or cord immediately.
- Verify that the power cables or cord do not touch or obstruct access to other router components, and that they do not drape where people could trip on them.
- Verify that the air flow in and out of cooling system components is not obstructed.

#### Related Documentation

- [M7i Power System Description on page 23](#)
- [M7i Router Power Requirements on page 167](#)
- [Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 85](#)
- [Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off on page 85](#)

## Maintaining the M7i Cooling System

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

**Action** The router has a single fan tray that installs into the back of the chassis, as shown in [Figure 2 on page 6](#).

To check the status of the fans in the fan tray, issue the **show chassis environment** command. The output includes an entry for each fan in the fan tray:

```

user@host> show chassis environment
Class Item           Status   Measurement
Power Power Supply 0   OK

```

	Power Supply 1	OK	
Temp	Intake	OK	24 degrees C / 75 degrees F
	PICs	OK	27 degrees C / 80 degrees F
	Power Supplies	OK	27 degrees C / 80 degrees F
	CFEB Intake	OK	27 degrees C / 80 degrees F
	CFEB Exhaust	OK	33 degrees C / 91 degrees F
	Routing Engine	OK	26 degrees C / 78 degrees F
Fans	Left Fan Tray	Present	
	Left Tray front fan	OK	Spinning at normal speed
	Left Tray second fan	OK	Spinning at normal speed
	Left Tray third fan	OK	Spinning at normal speed
	Left Tray fourth fan	OK	Spinning at normal speed

For further description of the output from the command, see the [Junos OS System Basics and Services Command Reference](#).

- Related Documentation**
- [M7i Cooling System Overview on page 26](#)
  - [Replacing the M7i Fan Tray on page 122](#)

# Troubleshooting M7i Hardware Components

- Overview of Troubleshooting Resources for the M7i Router on page 79
- Troubleshooting the M7i CFEB and CFEB-E on page 84
- Troubleshooting the M7i FIC or PICs on page 84
- Troubleshooting the M7i Power System on page 85
- Troubleshooting the M7i Fan Tray on page 86

## Overview of Troubleshooting Resources for the M7i Router

---

- LEDs on the FIC on page 79
- LEDs on Hardware Components on page 80
- Hardware and Interface Alarm Messages on page 80

### LEDs on the FIC

The FIC provides status and troubleshooting information at a glance. It is located on the front of the chassis below the PICs, as shown in [Figure 1 on page 6](#). The LEDs on the FIC include the following:

- Alarm—The circular red **MAJOR ALARM** LED indicates a critical condition that can result in a system shutdown. The triangular yellow **MINOR ALARM** LED next to it indicates a less severe condition that requires monitoring or maintenance. Both alarms can occur simultaneously. When an alarm LED is lit, issue the **show chassis alarms** command in the CLI to determine the cause of the alarm. For more information about the alarm LEDs, see “[M7i Fixed Interface Card \(FIC\) Description](#)” on page 15. For more information about the causes of alarms, see “[Hardware and Interface Alarm Messages](#)” on page 80.
- Interface—Each interface on a FIC has a **LINK** LED that indicates the port is online, and a **ACTIVITY** LED that indicates activity on the port.
- PIC—Each PIC has an LED on the FIC labeled **PICS ON/OFF** that shows whether the PIC is online.

## LEDs on Hardware Components

LEDs on the faceplates of many hardware components report component status:

- AC power supply—A green LED labeled **OUTPUT OK**. For more information, see “[M7i AC Power Supply](#)” on page 24.
- Routing Engine—Four LEDs on the Routing Engine faceplate indicate the status of the Routing Engine. Two upper LEDs—a green one labeled **HDD**, and a blue one labeled **MASTER**—and two lower LEDs—a red one labeled **FAIL**, and a green one labeled **ONLINE**. For more information, see “[M7i Routing Engine Description](#)” on page 18.
- PIC—Most PICs have an LED labeled **STATUS** on the PIC faceplate. Some PICs have additional LEDs, often one per port. The meaning of the LED states differs for various PICs. For more information, see the [M7i Multiservice Edge Router PIC Guide](#).
- CFEB or CFEB-E—A green LED labeled **OK**, a red one labeled **FAIL**, and a blue one labeled **MASTER**. For more information, see “[M7i Compact Forwarding Engine Board \(CFEB\) and Enhanced Compact Forwarding Engine Board \(CFEB-E\) Description](#)” on page 8.

## Hardware and Interface Alarm Messages

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

There are two classes of alarm messages:

- Chassis alarms—Indicate a problem with a chassis component such as the cooling system or power supplies, as described in [Table 13 on page 80](#).
- Interface alarms—Indicate a problem with a specific network interface, as described in [Table 14 on page 83](#).

**Table 13: Chassis Alarm Messages**

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Alternative Media	The router has an CompactFlash card but boots from alternate boot device. If you configure your router to boot from the hard disk, ignore this alarm condition.	Contact technical support. See “ <a href="#">Contacting Customer Support</a> ” on page 195 for more information.	Yellow

Table 13: Chassis Alarm Messages (*continued*)

Chassis Component	Alarm Condition	Remedy	Alarm Severity
CFEB/CFEB-E	CFEB/CFEB-E has failed. If this occurs, the board attempts to reboot.	Replace failed CFEB/CFEB-E.	Red
	Too many hard errors in CFEB/CFEB-E memory.	Replace failed CFEB/CFEB-E.	Red
	Too many soft errors in CFEB/CFEB-E memory.	Replace failed CFEB/CFEB-E.	Red
	A CFEB/CFEB-E microcode download has failed.	Replace failed CFEB/CFEB-E.	Red
Fan Trays	A fan has failed.	Replace failed fan tray.	Red
	The fan tray has been removed from the chassis.	Install missing fan tray.	Red
Hot swapping	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's midplane from the front is broken.	Contact technical support. See <a href="#">"Contacting Customer Support"</a> on page 195 for more information.	Red
Power supplies	A power supply has been removed.	Insert missing power supply.	Yellow
	A power supply has failed.	Replace failed power supply	Red

Table 13: Chassis Alarm Messages (*continued*)

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Routing Engine	Error in reading or writing hard disk.	Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	Error in reading or writing CompactFlash card.	Reformat CompactFlash card and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk. This alarm only applies if you have an optional CompactFlash card installed.	Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
	Routing Engine failed to boot.	Replace failed Routing Engine.	Red



Table 13: Chassis Alarm Messages (*continued*)

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55° C and the fans have been turned on to full speed and one or more fans have failed.	<ul style="list-style-type: none"> <li>• Check room temperature.</li> <li>• Check air flow.</li> <li>• Check fan tray.</li> </ul>	Yellow
	The chassis temperature has exceeded 65° C and the fans have been turned on to full speed.	<ul style="list-style-type: none"> <li>• Check room temperature.</li> <li>• Check air flow.</li> <li>• Check fan tray.</li> </ul>	Yellow
	The chassis temperature has exceeded 65° C and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> <li>• Check room temperature.</li> <li>• Check air flow.</li> <li>• Check fan tray.</li> </ul>	Red
	The chassis temperature has exceeded 75° C. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> <li>• Check room temperature.</li> <li>• Check air flow.</li> <li>• Check fan tray.</li> </ul>	Red
	The temperature sensor has failed.	Contact technical support. See <a href="#">“Contacting Customer Support” on page 195</a> for more information.	Red

Table 14: SONET/SDH Interface Alarm Messages

CLI Message
<i>interface-name</i> so-x/x/x - SONET bit error rate defect
<i>interface-name</i> so-x/x/x - SONET bit error rate fault
<i>interface-name</i> so-x/x/x - SONET line AIS
<i>interface-name</i> so-x/x/x - SONET line remote defect indicator
<i>interface-name</i> so-x/x/x - SONET loss of frame
<i>interface-name</i> so-x/x/x - SONET loss of light
<i>interface-name</i> so-x/x/x - SONET loss of pointer
<i>interface-name</i> so-x/x/x - SONET loss of signal
<i>interface-name</i> so-x/x/x - SONET path AIS

Table 14: SONET/SDH Interface Alarm Messages (*continued*)

CLI Message
<i>interface-name</i> so-x/x/x - SONET path mismatch
<i>interface-name</i> so-x/x/x - SONET path remote defect indicator
<i>interface-name</i> so-x/x/x - SONET PLL lock
<i>interface-name</i> so-x/x/x - SONET remote error indicator
<i>interface-name</i> so-x/x/x - SONET severely errored frame
<i>interface-name</i> so-x/x/x - SONET unequipped

- Related Documentation**
- [Displaying M7i Router Components and Serial Numbers on page 191](#)
  - [M7i Midplane Description on page 7](#)
  - [M7i Router Description on page 3](#)

## Troubleshooting the M7i CFEB and CFEB-E

**Problem** The CFEB or CFEB-E is not functioning normally.

**Solution** To troubleshoot the CFEB or CFEB-E:

- Make sure the CFEB or CFEB-E is properly seated in the midplane. Use a Phillips screwdriver to ensure that the screws on the CFEB or CFEB-E handles are securely tightened.
- Check the alarm LEDs on the FIC. A CFEB or CFEB-E failure generates a red alarm.

- Related Documentation**
- [Installing the M7i CFEB and CFEB-E on page 92](#)
  - [M7i Compact Forwarding Engine Board \(CFEB\) and Enhanced Compact Forwarding Engine Board \(CFEB-E\) Description on page 8](#)
  - [Maintaining the M7i CFEB and CFEB-E on page 73](#)

## Troubleshooting the M7i FIC or PICs

**Problem** The FIC or PICs are not functioning normally.

**Solution** To troubleshoot the FIC or PICs:

- To check the status of each port on a FIC or PIC, look at the LED located on the faceplate. For information about the meaning of LED states on different PICs, see the [M7i Multiservice Edge Router PIC Guide](#).
- To check the status of an interface, issue the **show chassis fpc pic-status** command.

The following example specifies an FPC slot number (0), which is optional.

```
user@host> show chassis fpc pic-status 0
Slot 0 OnLine PIC 0 2x OC-3 ATM, MM PIC 1 2x CT3-NxDS0 PIC 2 2x
OC-3 ATM, MM
```

For further description of the output from the command, see the [Junos OS System Basics and Services Command Reference](#).

- Related Documentation**
- [Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 74](#)
  - [Replacing an M7i FIC or PIC Cable on page 96](#)

## Troubleshooting the M7i Power System

When a power supply is functioning correctly, the green LED labeled **OUTPUT OK** is lit steadily.

If any other LED states apply, consult the following topics:

- [Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off on page 85](#)
- [Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 85](#)

### Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off

**Problem** If the LED is off on all power supply faceplates, either someone has switched off power to the router or the system temperature has exceeded the acceptable maximum. In the latter case, the Routing Engine shuts down all power supplies. There is no power to the router, so no LED is lit, including the alarm LEDs on the craft interface.

**Solution** Excessive system temperature is almost always caused by excessive environmental temperature. Correct the environmental temperature before repowering the router.

- Related Documentation**
- [M7i Power System Description on page 23](#)
  - [M7i Router Power Requirements on page 167](#)
  - [Maintaining the M7i Power Supplies on page 76](#)
  - [Powering On the M7i Router on page 63](#)

### Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off

**Problem** The LED on one power supply is off, but the LED on the other supplies indicate that they are functioning properly.

**Solution** Perform the following diagnostic procedure:

1. Check the red alarm LED on the craft interface:
  - If it is lit, issue the following CLI command for information about the cause of an alarm condition:  

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

For a list of messages that can appear in the output, see [“Hardware and Interface Alarm Messages” on page 80](#).  
  
A common cause of power supply shutdown is that the temperature of the power supply or another router component has exceeded the maximum limit.
  - If the red alarm LED is not lit, check that the power switch is in the **ON** position on the power supply faceplate.
2. Replace the faulty power supply with a spare. For instructions, see [“Replacing an M7i AC Power Supply” on page 111](#) and [“Replacing a DC Power Supply” on page 116](#). If the LED lights correctly on the spare, the original power supply is faulty. Return it to Juniper Networks for replacement, as described in [“Contacting Customer Support” on page 195](#).
3. If the spare power supply also does not work, connect the router to a different power source. You might also try replacing the AC power cord (on an AC-powered router) or DC power cables (on a DC-powered router). For instructions, see [Replacing an AC Power Cord](#) and [“Replacing an M7i DC Power Cable” on page 120](#) (you do not need to disconnect and reconnect the grounding cable).
4. If you cannot determine the cause of the problem or need additional assistance, see [“Contacting Customer Support” on page 195](#).

**Related Documentation**

- [M7i Power System Description on page 23](#)
- [M7i Router Power Requirements on page 167](#)
- [Maintaining the M7i Power Supplies on page 76](#)
- [Powering On the M7i Router on page 63](#)

---

## Troubleshooting the M7i Fan Tray

---

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

**Solution** The router's single fan tray provides cooling for the router, including the CFEB or CFEB-E, PICs, power supplies, and Routing Engine.

The cooling system draws in room air through the air intake vent on the left side of the chassis. After entering the chassis, the air stream separates into separate flows for the front and rear components. For a graphic depiction of the airflow, see [Figure 18 on page 27](#).

For the cooling system to function properly, the clearance around the chassis must be sufficient for unobstructed airflow. See [“M7i Router Clearance Requirements for Airflow and Hardware Maintenance” on page 40](#).

During normal operation, the fans in the fan tray function at less than full speed. The router constantly monitors the temperatures detected by sensors on the router components, adjusting the speed of the fans as necessary. If the router temperature exceeds the acceptable maximum, the router turns off the power supplies.

The following conditions automatically cause the fans to run at full speed and trigger the indicated alarm:

- A fan fails (red alarm).
- The router temperature exceeds the “temperature warm” threshold (yellow alarm).
- The temperature of the router exceeds the maximum (“temperature hot”) threshold (red alarm and automatic shutdown of the power supplies).

For more information about cooling-related alarms, see [“Hardware and Interface Alarm Messages” on page 80](#).

To troubleshoot the fans:

- If the red alarm LED on the craft interface lights, use the **show chassis alarms** command to determine the source of the problem. The display reports the number of alarm conditions and the source of each alarm. For a list of messages, see [“Hardware and Interface Alarm Messages” on page 80](#).
- Issue the **show chassis alarms** command for more information about the source of an alarm condition.
- If both power supplies have failed, the system temperature might have exceeded the threshold, causing the system to shut down. See [“Troubleshooting the M7i Power System When the LEDs on All M7i Power Supplies Are Blinking or Off” on page 85](#).
- If the fan tray has failed, it must be replaced for the router to operate normally. For replacement instructions, see [“Replacing the M7i Fan Tray” on page 122](#). For instructions about returning a faulty component to Juniper Networks, see [“Contacting Customer Support” on page 195](#).

#### Related Documentation

- [M7i Power System Description on page 23](#)
- [M7i Router Power Requirements on page 167](#)
- [Maintaining the M7i Power Supplies on page 76](#)
- [Powering On the M7i Router on page 63](#)



# Replacing M7i Hardware Components

- [M7i Field-Replaceable Units \(FRUs\) on page 89](#)
- [Tools and Parts Required to Replace M Series Hardware Components on page 90](#)
- [Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E on page 90](#)
- [Replacing an M7i PIC on page 93](#)
- [Replacing an M7i FIC or PIC Cable on page 96](#)
- [Replacing an SFP on an M7i Router on page 98](#)
- [Replacing the M7i Routing Engine and Routing Engine Components on page 101](#)
- [Replacing M7i Power System Components on page 111](#)
- [Replacing the M7i Fan Tray on page 122](#)

## M7i Field-Replaceable Units (FRUs)

---

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

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

[Table 15 on page 89](#) lists the FRUs for the M7i router.

**Table 15: Field-Replaceable Units**

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs
<ul style="list-style-type: none"> <li>• Fan tray</li> <li>• Physical Interface Card (PIC)</li> <li>• Power supply</li> </ul>	<ul style="list-style-type: none"> <li>• Compact Forwarding Engine Board (CFEB) (when swapping for an existing CFEB)</li> <li>• Enhanced Compact Forwarding Engine Board (CFEB-E) (when swapping for an existing CFEB-E)</li> <li>• Routing Engine</li> </ul>

- Related Documentation**
- [Replacing the M7i Fan Tray on page 122](#)
  - [Replacing an M7i PIC on page 93](#)
  - [Replacing an M7i AC Power Supply on page 111](#)
  - [Replacing a DC Power Supply on page 116](#)
  - [Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E on page 90](#)
  - [Replacing the M7i Routing Engine on page 101](#)

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

To replace hardware components, you need the tools and parts listed in [Table 16 on page 90](#).

**Table 16: Tools and Parts Required**

Tool or part	Components
Electrostatic bag or antistatic mat	<ul style="list-style-type: none"> <li>• CFEB/CFEB-E</li> <li>• Routing Engine</li> </ul>
Electrostatic discharge (ESD) grounding wrist strap	All
Phillips (+) screwdriver, number 2	<ul style="list-style-type: none"> <li>• CFEB/CFEB-E</li> <li>• Fan tray</li> <li>• Power supply</li> <li>• Routing Engine</li> </ul>
Flat-blade screwdriver, 2.5-mm	Routing Engine console port cable
Needlenose pliers	CompactFlash card
Rubber safety cap	Fiber-optic PIC or PIC cable

- Related Documentation**
- [Displaying M7i Router Components and Serial Numbers on page 191](#)
  - [M7i Chassis Description on page 6](#)
  - [M7i Component Redundancy on page 5](#)

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

The CFEB and CFEB-E are hot-pluggable when you replace a CFEB with a CFEB or a CFEB-E with a CFEB-E, as described in [“M7i Field-Replaceable Units \(FRUs\)” on page 89](#). Upgrading or downgrading a CFEB device requires a system reboot, as described in



“Upgrading and Downgrading the CFEB and CFEB-E” on page 92. To replace the CFEB or CFEB-E, perform the following procedures:

- Removing the M7i CFEB and CFEB-E on page 91
- Installing the M7i CFEB and CFEB-E on page 92
- Upgrading and Downgrading the CFEB and CFEB-E on page 92

## Removing the M7i CFEB and CFEB-E

To remove the CFEB or CFEB-E (see [Figure 33 on page 91](#)):

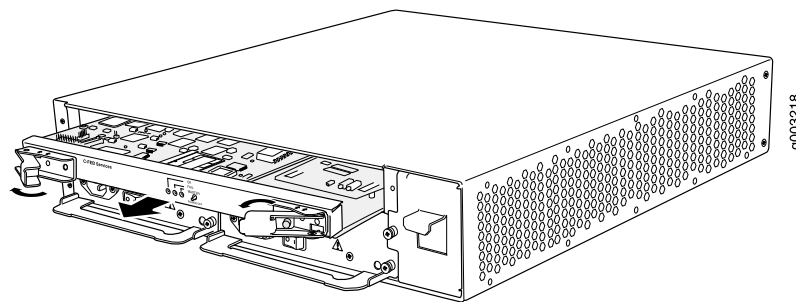
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Press and hold the **ONLINE/OFFLINE** button on the faceplate of the CFEB or CFEB-E until the green **OK** LED turns off, which takes about 5 seconds.
4. Loosen the thumbscrew on each ejector locking tab (shown in [Figure 4 on page 10](#)), using a Phillips screwdriver if necessary.
5. Pull the ends of the ejector handles outward until they are nearly perpendicular to the faceplate of the CFEB or CFEB-E.
6. Grasp the ejector handles and pull firmly to slide the CFEB or CFEB-E about halfway out of the chassis.
7. Place one hand under the CFEB or CFEB-E to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.



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

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

**Figure 33: Removing the CFEB or CFEB-E**



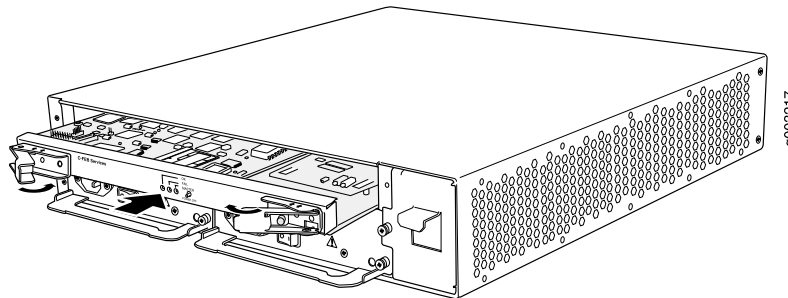
## Installing the M7i CFEB and CFEB-E

To install the CFEB or CFEB-E (see [Figure 34 on page 92](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that the ends of the ejector handles are pulled outward to a position nearly perpendicular to the faceplate of the CFEB or CFEB-E.
3. Place one hand under the CFEB or CFEB-E to support it and grasp one of the ejector handles at the front with the other hand.
4. Align the rear of the CFEB or CFEB-E with the guides inside the chassis and slide it in completely.
5. Press the ejector handle at each end of the CFEB or CFEB-E inward.
6. Tighten the thumbscrew on each ejector locking tab (shown in [Figure 4 on page 10](#)) to seat the CFEB or CFEB-E firmly in the chassis.
7. Press and hold the **ONLINE/OFFLINE** button on the CFEB or CFEB-E faceplate until the green **OK** LED lights steadily.

You can verify correct CFEB or CFEB-E functioning by issuing the **show chassis cfeb** command described in [“Maintaining the M7i CFEB and CFEB-E” on page 73](#).

**Figure 34: Installing a CFEB or CFEB-E**



## Upgrading and Downgrading the CFEB and CFEB-E

To upgrade by replacing a CFEB with a CFEB-E or to downgrade by replacing a CFEB-E with a CFEB requires a system reboot after swapping the CFEB devices.

To upgrade from a CFEB to a CFEB-E or downgrade from a CFEB-E to a CFEB:

1. Remove the CFEB or CFEB-E as described in [“Removing the M7i CFEB and CFEB-E” on page 91](#).
2. Install the upgrade CFEB-E or downgrade CFEB as described in [“Installing the M7i CFEB and CFEB-E” on page 92](#).
3. Reboot the router by issuing the following CLI command:

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

After the reboot, the router recognizes the new CFEB or CFEB-E.

- Related Documentation**
- [Preventing Electrostatic Discharge Damage to an M7i Router on page 132](#)
  - [Maintaining the M7i CFEB and CFEB-E on page 73](#)
  - [Troubleshooting the M7i CFEB and CFEB-E on page 84](#)

## Replacing an M7i PIC

PICs are housed in the front of the router, as shown in [Figure 1 on page 6](#). PICs are hot-insertable and hot-removable, as described in “M7i Field-Replaceable Units (FRUs)” on [page 89](#). Removing a PIC does not affect router function, except that the PIC no longer receives or transmits data.

To replace a PIC, perform the following procedures:

- [Removing an M7i PIC on page 93](#)
- [Installing an M7i PIC on page 94](#)

## Removing an M7i PIC



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



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

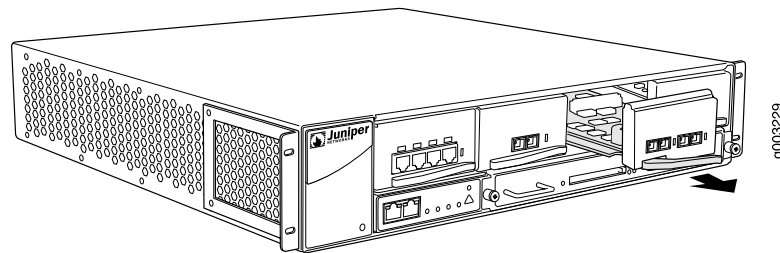
- Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.
- Do not bend fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.
- Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

To remove a PIC (see [Figure 35 on page 94](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the PIC. If the PIC connects to fiber-optic cable, have ready a rubber safety cap for each transceiver and cable.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.

3. If the PIC has multiple cable connector ports, label the cable connected to each port so that you can later reconnect the cables correctly.
4. Press and hold the PIC offline button on the FIC until its failure indicator LED lights, which usually takes about 5 seconds. The failure LED is usually red; for more information, see the *M7i Multiservice Edge Router PIC Guide*.
5. Disconnect the cables from the PIC. If the PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.
6. Arrange the cable to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.
7. Pull the right end of the PIC ejector lever away from the PIC faceplate. This disconnects the PIC from the midplane.
8. Slide the PIC out of the chassis and place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a PIC into the empty PIC slot within a short time, install a blank PIC panel over the slot to maintain proper airflow in the chassis.

Figure 35: Removing a PIC



## Installing an M7i PIC



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



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

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

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

To install a PIC (see [Figure 36 on page 95](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. If the PIC uses fiber-optic cable, verify that there is a rubber safety cap over each transceiver on the faceplate. Install a cap if necessary.
3. Pull the ejector lever away from the PIC faceplate and hold it while you insert the PIC.
4. Align the rear of the PIC with the guides located at the bottom corners of the PIC slot.
5. Slide the PIC into the card cage until about 0.5 in. (1 cm) of the PIC remains outside the slot and you feel some resistance. Release the ejector lever.

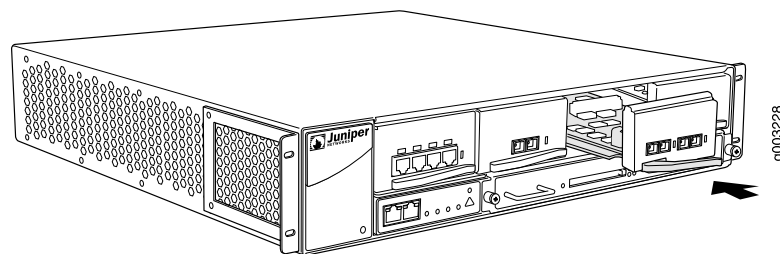


**CAUTION:** Be careful to insert the PIC straight into the chassis to avoid damaging the components on the bottom of the PIC.

6. Continue pushing the PIC until it contacts the midplane and you hear a click. The ejector lever engages and closes automatically.
7. If the PIC uses fiber-optic cable, remove the rubber safety cap from each transceiver.
8. Insert the appropriate cable into the cable connector ports on the PIC.
9. Arrange the cable to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.
10. Press and hold the PIC offline button on the FIC until the normal function indicator LED lights, which usually takes about 5 seconds. The normal function indicator LED is usually green; for more information, see the [M7i Multiservice Edge Router PIC Guide](#).

You can verify correct PIC functioning by issuing the **show chassis fpc pic-status** command, described in [“Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables” on page 74](#).

**Figure 36: Installing a PIC**



- Related Documentation**
- [M7i PICs Description on page 16](#)
  - [M7i Chassis Description on page 6](#)
  - [M7i Midplane Description on page 7](#)

## Replacing an M7i FIC or PIC Cable

---

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

- [Removing an M7i FIC or PIC Cable on page 96](#)
- [Installing an M7i FIC or PIC Cable on page 97](#)

## Removing an M7i FIC or PIC Cable



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



**CAUTION:**

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

- Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.
- Do not bend fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.
- Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

To remove a FIC or PIC cable:

1. If the interface connects to fiber-optic cable, have ready a rubber safety cap for each cable you are removing.
2. If removing all cables connected to the interface, press and hold the PIC offline button on the FIC until its failure indicator LED lights, which usually takes about 5 seconds. The failure LED is usually red; for more information, see the [M7i Multiservice Edge Router PIC Guide](#).

3. Unplug the cable from the cable connector port. If the interface uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.
4. Arrange the cable to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

## Installing an M7i FIC or PIC Cable



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



**CAUTION:**

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

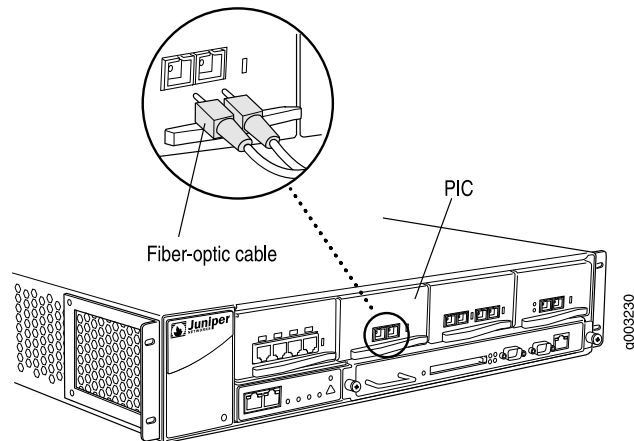
- Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.
- Do not bend fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.
- Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

To install a PIC cable (see [Figure 37 on page 98](#)):

1. Have ready a length of the type of cable used by the interface, as specified in “[FIC Specifications for the M7i Router](#)” on page 177.
2. If the interface cable connector port is covered by a rubber safety plug, remove the plug.
3. Insert the cable connector into the cable connector port on the interface faceplate.
4. Arrange the cable to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.
6. Verify that the FIC or PIC is functioning correctly by noting whether the normal function indicator LED is lit. The normal function indicator LED is usually green; for more information, see the [M7i Multiservice Edge Router PIC Guide](#).

You can also verify correct PIC functioning by issuing the `show chassis fpc pic-status` command, described in “Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables” on page 74.

**Figure 37: Connecting Fiber-Optic Cable to a PIC**



**Related Documentation**

- [M7i Flexible PIC Concentrators \(FPCs\) Description on page 18](#)
- [M7i PICs Description on page 16](#)
- [Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 74](#)
- [Troubleshooting the M7i FIC or PICs on page 84](#)

## Replacing an SFP on an M7i Router

Small form-factor pluggables (SFPs) are optical transceivers that can be removed from a PIC (for more information, see “M7i PICs Description” on page 16).

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

- [Removing an SFP from an M7i Router on page 98](#)
- [Installing an SFP into an M7i Router on page 100](#)

### Removing an SFP from an M7i Router



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



**CAUTION:**



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

- Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.
- Do not bend fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.
- Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

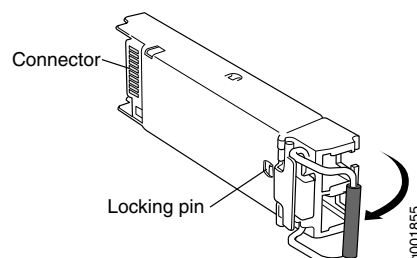
To remove an SFP (see [Figure 38 on page 99](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the SFP. Have ready a rubber safety cap for the SFP transceiver and the cable.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Label the cable connected to the SFP so that you can later reconnect it to the correct SFP.
4. Disconnect the cable from the SFP. Immediately cover the transceiver and the end of the cable with a rubber safety cap.
5. Arrange the cable to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.
6. Pull the ejector handle away from the SFP faceplate to unseat the SFP from the PIC. Pull the SFP out of the PIC and place it on the antistatic mat or in the electrostatic bag.



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

**Figure 38: Small Form-Factor Pluggable (SFP)**



## Installing an SFP into an M7i Router



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



**CAUTION:**

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

- Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.
- Do not bend fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.
- Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

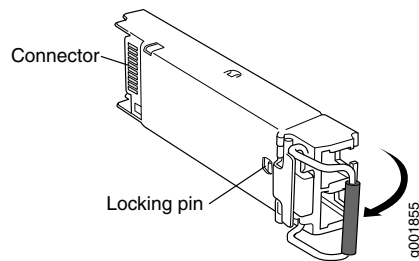
To install a replacement SFP (see [Figure 39 on page 101](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the SFP transceiver, installing one if necessary.
3. Orient the SFP over the port in the PIC so that the connector end will enter the slot first and the SFP connector faces the appropriate direction:
  - If the PIC has ten SFP ports, the ports are arranged in two columns. The SFP connector faces to the right for ports in the left column, and to the left for ports in the right column.
  - If the PIC has one or two SFP ports, the SFP connector faces to the left on platforms in which FPCs install vertically in the chassis, and faces upward on platforms in which FPCs install horizontally in the chassis.
4. Slide the SFP into the slot. If there is resistance, remove the SFP and flip it so that the connector faces the other direction.
5. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.
6. Arrange the cable in the cable management system to prevent the cable from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled

loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

7. Verify that the status LEDs on the PIC faceplate indicate that the SFP is functioning correctly (there is an LED for each SFP port). For more information about the PIC LEDs, see the *M7i Multiservice Edge Router PIC Guide*. You can also verify PIC functioning by issuing the **show chassis fpc pic-status** command described in “Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables” on page 74.

Figure 39: Small Form-Factor Pluggable (SFP)



**Related Documentation**

- Preventing Electrostatic Discharge Damage to an M7i Router on page 132
- M7i Chassis Description on page 6
- M7i Router Physical Specifications on page 163

## Replacing the M7i Routing Engine and Routing Engine Components

- Replacing the M7i Routing Engine on page 101
- Replacing the Routing Engine Interface Port Cables on page 103
- Replacing the SSD on an RE-B-1800 Routing Engine on page 104
- Removing and Inserting the CompactFlash Card on page 105
- Removing and Inserting SDRAM Modules on page 108
- Removing and Inserting the PC Card on page 109

### Replacing the M7i Routing Engine

The Routing Engine is hot-pluggable, as described in “M7i Field-Replaceable Units (FRUs)” on page 89. To replace a Routing Engine, perform the following procedures:

- Removing an M7i Routing Engine on page 101
- Installing the Routing Engine in a M7i Router on page 102

#### Removing an M7i Routing Engine

To remove a Routing Engine (see Figure 40 on page 102):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

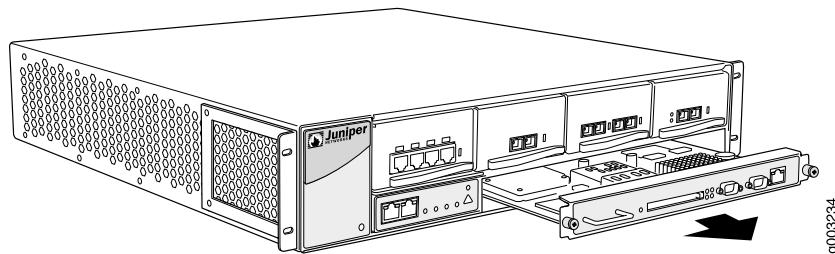
3. Press and hold the offline button on the faceplate of the Routing Engine until the green **ONLINE** LED turns off, which takes about 5 seconds.
4. Loosen the thumbscrews securing the Routing Engine, using a Phillips screwdriver if necessary.
5. Grasp the handle and slide the unit about halfway out of the chassis.



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

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

**Figure 40: Removing the Routing Engine**



### Installing the Routing Engine in a M7i Router

To install the Routing Engine (see [Figure 41](#) on page 103):

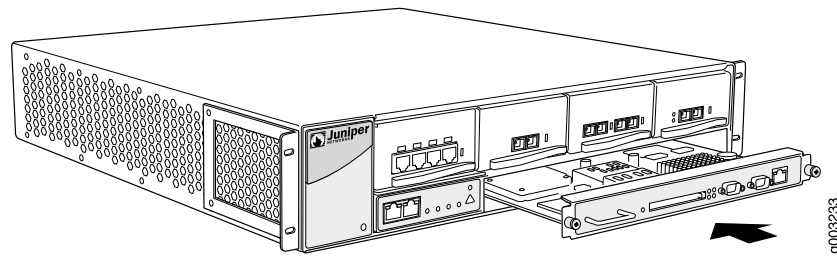
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Place one hand under the Routing Engine to support it and grasp the handle on the faceplate with the other hand.
3. Align the rear of the Routing Engine with the guide rails inside the chassis and slide it in completely.



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

4. Tighten the thumbscrews at each end of the Routing Engine.
5. You can verify correct Routing Engine functioning by issuing the **show chassis routing-engine** command, described in [“Maintaining the M7i Routing Engine”](#) on page 76.

Figure 41: Installing the Routing Engine



#### Related Documentation

- [Preventing Electrostatic Discharge Damage to an M7i Router on page 132](#)
- [M7i Chassis Description on page 6](#)
- [M7i Routing Engine Description on page 18](#)
- [Maintaining the M7i Routing Engine on page 76](#)

## Replacing the Routing Engine Interface Port Cables

The Routing Engine is located on the front of the router, as shown in [Figure 1 on page 6](#). It houses the Routing Engine interface ports, which accept connections to external management devices.

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

- [Replacing the Management Ethernet Cable on page 103](#)
- [Replacing the Console or Auxiliary Cable on page 104](#)

### Replacing the Management Ethernet Cable

To replace the management Ethernet cable:

1. Press the tab on the connector on the management Ethernet cable and pull the connector straight out of the port. [Figure 42 on page 103](#) shows the connector.
2. Disconnect the cable from the network device.
3. Plug one end of the replacement Ethernet cable into the **MGMT** port (see [Figure 43 on page 103](#)).
4. Plug the other end of the cable into the network device.

Figure 42: Routing Engine Ethernet Cable Connector

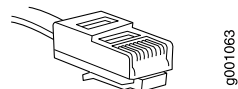
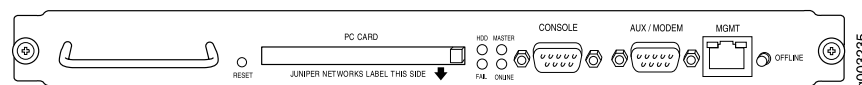


Figure 43: Routing Engine Interface Ports



## Replacing the Console or Auxiliary Cable

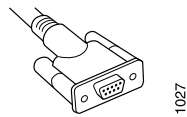
If a cable is already connected to the **CONSOLE** or **AUX/MODEM** port, follow these steps to remove it:

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

To connect the new cable, follow these steps:

1. Plug the female end of the replacement serial cable into the **CONSOLE** or **AUX/MODEM** port (see “Replacing the Management Ethernet Cable” on page 103).
2. Tighten the screws on the connector.
3. Power on the auxiliary or console device.

**Figure 44: Console and Auxiliary Serial Port Connector**



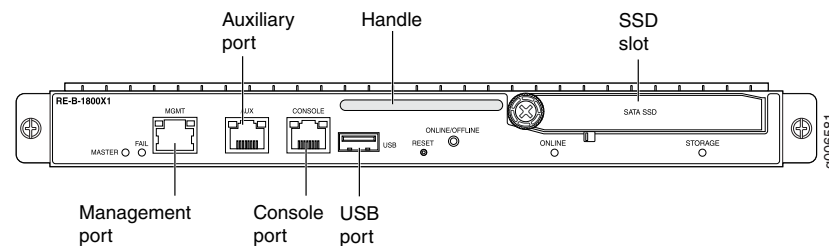
### Related Documentation

- [Fiber-Optic and Network Cable Specifications for the M7i Router on page 178](#)
- [M7i Chassis Description on page 6](#)
- [FIC Specifications for the M7i Router on page 177](#)

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

The RE-B-1800 Routing Engine supports a solid-state drive (SSD) specified by Juniper Networks and ships with one SSD installed. [Figure 45 on page 104](#) shows the arrangement of storage drive slots on an RE-B-1800 Routing Engine.

**Figure 45: RE-B-1800 Storage Drive Slots**



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

- SSD SLC 64 GB

To replace a storage drive:

1. Disable and deactivate the storage drive.
2. Remove the storage drive.
  - a. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an ESD point on the appliance.
  - b. Unfasten the thumbscrew that secures the access door in front of the storage drive slots, and open the door.
  - c. Slide the lock on the ejector to the unlocked position.
  - d. Carefully slide the drive out of the slot.
3. Reinstall the storage drive.
  - a. Carefully align the sides of the drive with the guides in the slot.
  - b. Slide the drive into the slot until you feel resistance, carefully ensuring that it is correctly aligned.
  - c. Close the access door and tighten the thumbscrew to secure the door.
4. Mount the new storage drive.

**Related  
Documentation**

- [Returning a Hardware Component to Juniper Networks, Inc.](#)

## Removing and Inserting the CompactFlash Card

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

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

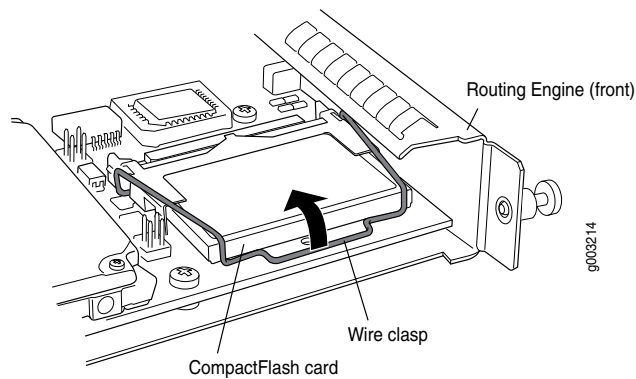
- [Removing the CompactFlash Card from a Routing Engine on page 106](#)
- [Inserting the CompactFlash Card on page 106](#)
- [Configuring the CompactFlash Card on page 107](#)

### Removing the CompactFlash Card from a Routing Engine

The CompactFlash card is located inside the Routing Engine. To remove the CompactFlash card (see [Figure 46 on page 106](#)):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Remove the Routing Engine as described in “[Removing an M7i Routing Engine](#)” on [page 101](#).
4. Use needlenose pliers with grooved jaws to pull the wire clasp out from under the CompactFlash card and lift it up (see [Figure 46 on page 106](#)).
5. Use the needlenose pliers to gently grasp the CompactFlash card and slide it out of the connector. Place the CompactFlash card on the antistatic mat or in the electrostatic bag.

**Figure 46: Removing the CompactFlash Card**



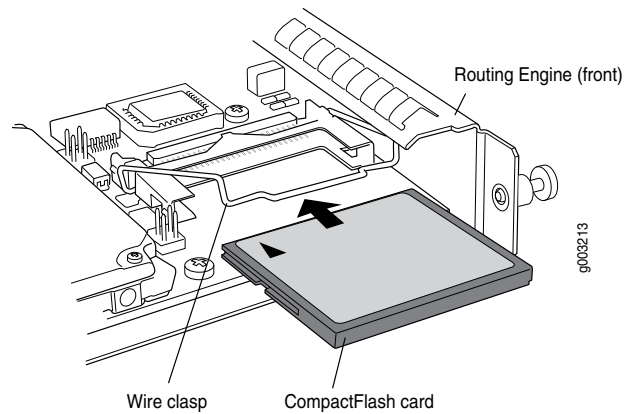
### Inserting the CompactFlash Card

To install the CompactFlash card (see [Figure 47 on page 107](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. If the CompactFlash card is in a PCMCIA card adapter, slide it out of the adapter.
3. Slide the CompactFlash card into the connector on the Routing Engine (see [Figure 47 on page 107](#)).
4. Use needlenose pliers with grooved jaws to lower and secure the wire clasp.
5. Install the Routing Engine as described in “[Installing the Routing Engine in a M7i Router](#)” on [page 102](#).



Figure 47: Inserting the CompactFlash Card



### Configuring the CompactFlash Card

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

To copy software to the CompactFlash card:

1. Install the CompactFlash card and replace the Routing Engine as described in ["Inserting the CompactFlash Card" on page 106](#) and ["Installing the Routing Engine in a M7i Router" on page 102](#).
2. On the console or other management device connected to the Routing Engine, enter CLI operational mode and issue the following command to copy the currently running and active file system partitions on the router to standby partitions on the CompactFlash card.

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

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

For more information about the command, see the [Junos OS System Basics and Services Command Reference](#).

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

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

The CompactFlash card will now be the primary boot device.

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

For more information about the command, see the [Junos OS System Basics and Services Command Reference](#).

#### Related Documentation

- [M7i Chassis Description on page 6](#)
- [M7i Midplane Description on page 7](#)
- [Maintaining the M7i Routing Engine on page 76](#)

## Removing and Inserting SDRAM Modules

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

To modify the SDRAM configuration, use the following procedures:

- [Removing an SDRAM Module on page 108](#)
- [Inserting an SDRAM Module on page 108](#)

---

### Removing an SDRAM Module

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

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Remove the Routing Engine as described in [“Removing an M7i Routing Engine” on page 101](#).
4. To release the SDRAM module, press the plastic ejectors on both sides of the module.
5. Grasp the SDRAM module, being careful not to touch any electrical components on the module, and firmly pull it out of the slot on the Routing Engine.
6. Place the SDRAM module on the antistatic mat or in the electrostatic bag.
7. Push the plastic ejectors to close the empty SDRAM module slot.

---

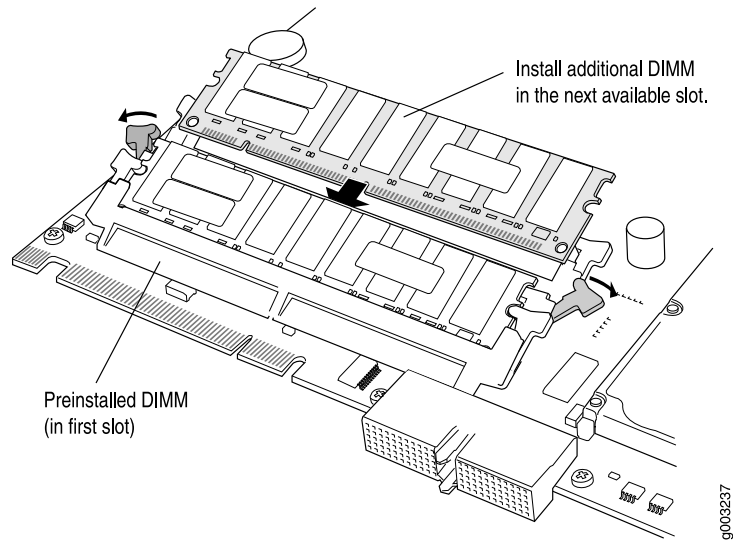
### Inserting an SDRAM Module

To insert a SDRAM module onto the Routing Engine (see [Figure 48 on page 109](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Remove the SDRAM module from its electrostatic bag.
3. To open the empty SDRAM slot, press the plastic ejectors on both sides.
4. Grasp the SDRAM module by the edges, being careful not to touch any electrical components.
5. Pressing firmly on both ends, push the module into the slot until the ejectors return completely to the closed position.
6. Install the Routing Engine as described in [“Installing the Routing Engine in a M7i Router” on page 102](#).

You can view the SDRAM configuration and verify it was installed correctly by issuing the `show chassis routing-engine` command, described in “Maintaining the M7i Routing Engine” on page 76.

Figure 48: Installing the SDRAM Module



- Related Documentation**
- [M7i Chassis Description on page 6](#)
  - [M7i Midplane Description on page 7](#)
  - [Maintaining the M7i Routing Engine on page 76](#)

## Removing and Inserting the PC Card

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

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

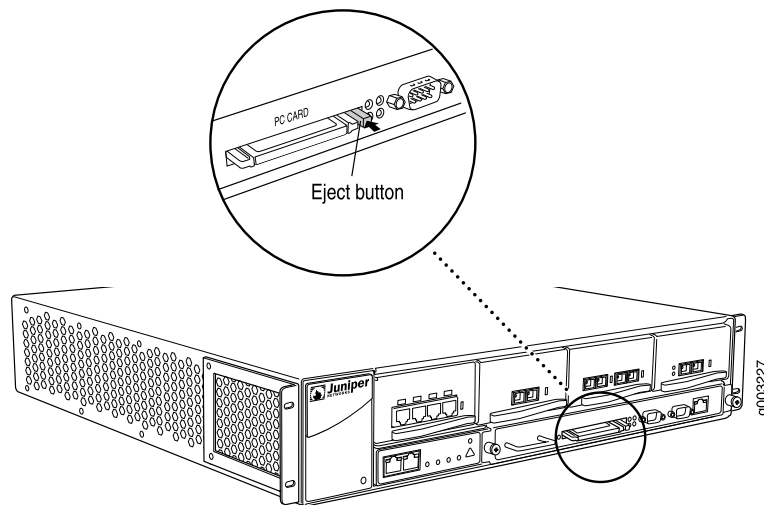
- [Removing the PC Card on page 110](#)
- [Replacing the PC Card Adapter Flash Disk on page 110](#)
- [Inserting the PC Card on page 111](#)

## Removing the PC Card

The PC card is inserted in the slot labeled **PC CARD** in the Routing Engine faceplate. To remove the PC card (see [Figure 49 on page 110](#)):

1. Press the eject button located to the right of the PC card slot in the Routing Engine faceplate.
2. When the PC card pops partially out of the slot, grasp the card and pull it straight out of the slot.

**Figure 49: Removing the PC Card**

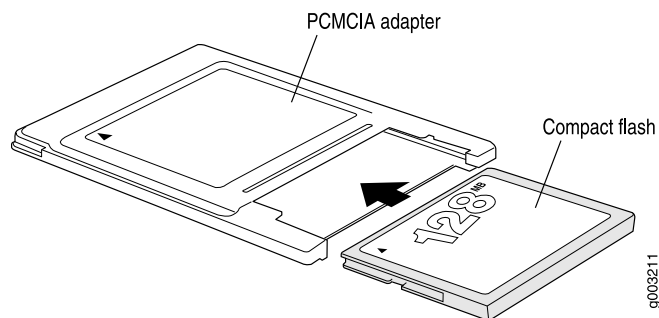


## Replacing the PC Card Adapter Flash Disk

The PC card is an adapter that holds a flash disk. To replace the flash disk (see [Figure 50 on page 110](#)):

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

**Figure 50: Inserting the PC Card Flash Disk**

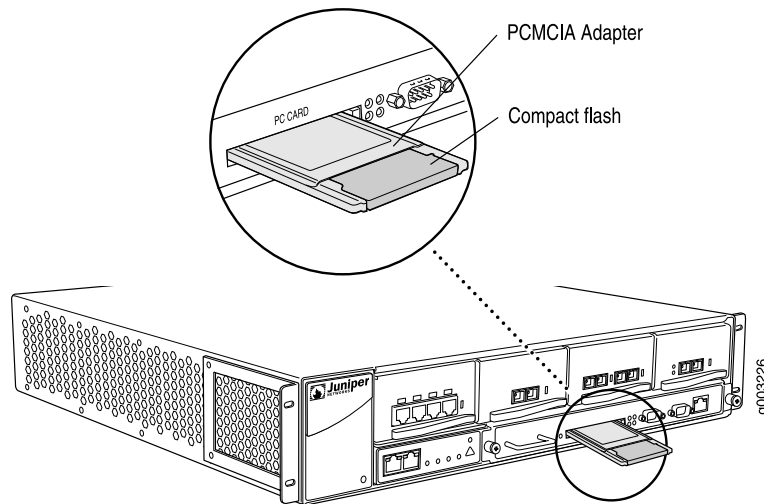


## Inserting the PC Card

To insert the PC card (see [Figure 51 on page 111](#)):

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

**Figure 51: Inserting the PC Card**



### Related Documentation

- [M7i Chassis Description on page 6](#)
- [M7i Midplane Description on page 7](#)
- [Maintaining the M7i Routing Engine on page 76](#)

## Replacing M7i Power System Components

For instructions on replacing power system components, see the following topics:

- [Replacing an M7i AC Power Supply on page 111](#)
- [Replacing an M7i AC Power Cord on page 114](#)
- [Replacing a DC Power Supply on page 116](#)
- [Replacing an M7i DC Power Cable on page 120](#)

### Replacing an M7i AC Power Supply

An AC-powered router has one or two load-sharing, redundant AC power supplies. Each power supply is hot-removable and hot-insertable, as described in “[M7i Field-Replaceable Units \(FRUs\)](#)” on [page 89](#). For full redundancy, two power supplies are required. If a power supply stops functioning for any reason, the remaining power supply instantly begins providing all the power the router needs for normal functioning, and can provide full

power indefinitely. For more information about AC power supplies, see [“M7i AC Power Supply” on page 24](#).

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

- [Removing an M7i AC Power Supply on page 112](#)
- [Installing an M7i AC Power Supply on page 113](#)

### Removing an M7i AC Power Supply

---

Before removing the AC power supply from an M7i router with only one power supply, you must power off the router. See [“Powering Off the M7i Router” on page 64](#). The AC power supplies are located at the bottom rear of the chassis, as shown in [Figure 2 on page 6](#). Each AC power supply weighs approximately 12 lb (5.5 kg).



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

---

To remove an AC power supply (see [Figure 52 on page 113](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
  2. Press the power switch on the power supply faceplate to the **OFF (O)** position.
- 

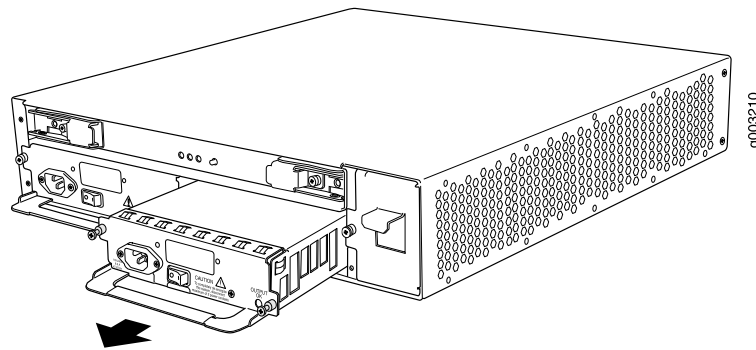


**NOTE:** If you are not removing the power supply, but simply powering it off, wait at least 60 seconds before turning it back on. If you need to power it off again, wait for at least 60 seconds after powering it on.

---

3. Unplug the power cord from the appliance inlet on the faceplate.
4. Loosen the thumbscrew at each corner of the power supply faceplate, using a Phillips screwdriver if necessary.
5. Grasp the handle on the power supply faceplate and pull firmly to slide the unit about halfway out of the chassis.
6. Place one hand under the power supply to support it, then slide it completely out of the chassis.

Figure 52: Removing an AC Power Supply



### Installing an M7i AC Power Supply

To install an AC power supply (see [Figure 53 on page 114](#)):

1. Verify that the switch on the power supply faceplate is in the **OFF (O)** position.
2. Locate the power cord shipped with the router, which should be appropriate for your geographical location (see “[M7i Router AC Power, Connection, and Power Cord Specifications](#)” on page 168).
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
4. Place one hand under the power supply and grasp the handle on the faceplate with the other hand. Slide the power supply into the chassis until it contacts the midplane.
5. Starting with the bottom screw, tighten (but do not overtighten) the thumbscrews at each corner of the power supply faceplate.
6. Insert the appliance coupler end of the power cord into the appliance inlet on the power supply faceplate and insert the plug into an AC power source receptacle. Verify that the power cord does not block access to router components or drape where people could trip on it.
7. Press the power switch on the faceplate to the **ON (I)** position. When the power supply has powered on successfully, the green **OUTPUT OK** LED lights steadily.

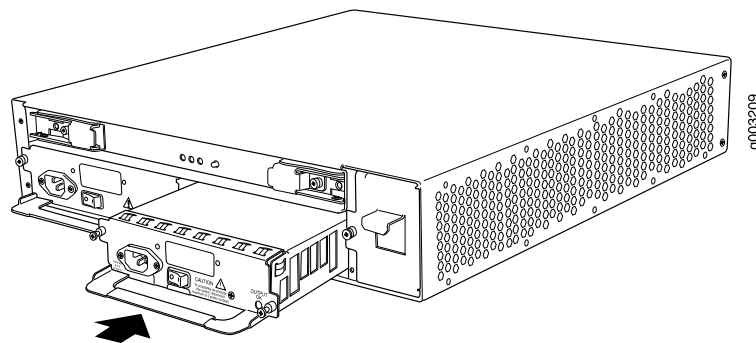


**NOTE:** After powering off a power supply, wait at least 60 seconds before turning it back on. After powering on a power supply, wait at least 60 seconds before turning it off.

If the router is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the router again, see [“Powering Off the M7i Router” on page 64](#).

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

Figure 53: Installing an AC Power Supply



**Related Documentation**

- [Connecting Power to an AC-Powered M7i Router on page 61](#)
- [Removing an M7i AC Power Cord on page 115](#)
- [M7i AC Power Electrical Safety Guidelines and Warnings on page 152](#)
- [M7i AC Power Supply on page 24](#)
- [M7i Router AC Power Supply Specifications on page 170](#)

## Replacing an M7i AC Power Cord

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

1. [Removing an M7i AC Power Cord on page 115](#)
2. [Installing an M7i AC Power Cord on page 115](#)
3. [Installing an M7i AC Power Cord on page 115](#)



### Removing an M7i AC Power Cord

---

Before removing the AC power cord from an M7i router with only one power supply, you must power off the router. See [“Powering Off the M7i Router” on page 64](#). To remove the AC power cord:

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

### Installing an M7i AC Power Cord

---

To install an M7i AC power cord:


1. Locate a replacement power cord with the type of plug appropriate for your geographical location (see [“M7i Router AC Power, Connection, and Power Cord Specifications” on page 168](#)).
2. Verify that the router is attached to a proper earth ground.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Press the power switch on the power supply faceplate to the **OFF (O)** position.
5. Insert the appliance coupler end of the replacement power cord into the appliance inlet on the power supply faceplate
6. Insert the plug into an AC power source receptacle.
7. Verify that the power cord does not block access to router components or drape where people could trip on it.
8. Press the power switch on the power supply faceplate to the **ON (I)** position. When the power supply has powered on successfully, the green **OUTPUT OK** LED lights steadily.

### Installing an M7i AC Power Cord

---

To install an AC power cord:

1. Locate a replacement power cord with the type of plug appropriate for your geographical location (see [“M7i Router AC Power, Connection, and Power Cord Specifications” on page 168](#)).
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Insert the appliance coupler end of the replacement power cord into the appliance inlet on the power supply faceplate and insert the plug into an AC power source receptacle.
4. Verify that the power cord does not block access to router components or drape where people could trip on it.

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



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

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

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



**NOTE:** If the Routing Engine finishes booting and you need to power off the router again, see [“Powering Off the M7i Router” on page 64](#). After powering off a power supply, wait at least 60 seconds before turning it back on.

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

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

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

#### Related Documentation

- [M7i AC Power Electrical Safety Guidelines and Warnings on page 152](#)
- [M7i Router AC Power Supply Specifications on page 170](#)
- [Replacing an M7i AC Power Supply on page 111](#)

## Replacing a DC Power Supply

A DC-powered router has one or two load-sharing, redundant DC power supplies that install into the rear of the router as shown in [Figure 2 on page 6](#). Each power supply is hot-removable and hot-insertable, as described in [“M7i Field-Replaceable Units \(FRUs\)” on page 89](#). When one power supply fails or is powered down, the remaining power supplies automatically assume the entire electrical load for the router. For more information about DC power supplies, see [“M7i DC Power Supply” on page 25](#).

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

- [Removing a DC Power Supply on page 117](#)
- [Installing a DC Power Supply on page 118](#)

## Removing a DC Power Supply

Before removing a DC power supply from an M7i router with only one power supply, you must power off the router. See “Powering Off the M7i Router” on page 64. The DC power supplies are located at the bottom rear of the chassis, as shown in Figure 2 on page 6. Each DC power supply weighs approximately 7 lb (3.2 kg).



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

To remove a DC power supply (see Figure 54 on page 118):

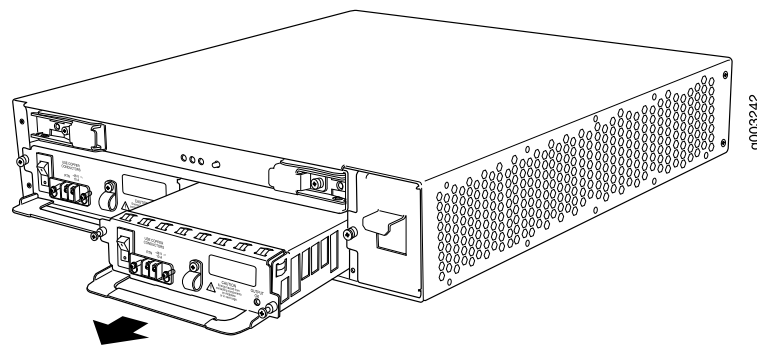
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Press the power switch for the power supply (located on the power supply faceplate) to the **OFF (O)** position.



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

3. Shut off the power flowing to the power supply from the external power source, so that the voltage across the leads of the power cables is 0 V. Ensure that there is no chance that the cable leads might become active during the procedure.
4. Using a number 1 Phillips screwdriver, turn the screw on each field-wiring terminal counter-clockwise to loosen the terminal connector from around the cable lug.
5. Remove the cables from the terminal connectors and from the hook located on the faceplate to the right of the field-wiring terminals.
6. Loosen the thumbscrew at each corner of the power supply faceplate, using a Phillips screwdriver if necessary.
7. Grasp the handle on the power supply faceplate and pull firmly to slide the unit about halfway out of the chassis.
8. Place one hand under the power supply to support it, then slide it completely out of the chassis.

Figure 54: Removing a DC Power Supply



### Installing a DC Power Supply

To install a DC power supply (see [Figure 55 on page 119](#)):

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

- b. Insert the negative (–) source cable into the input terminal, which is labeled **–48V**.
11. Verify that the DC source power cabling is correct, that the DC power cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.
12. Turn on the DC power source so that voltage flows to the power supply.
13. Press the switch on the power supply faceplate to the **ON ( | )** position.



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

14. If the M7i has only one power supply or the router is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the router again, see [“Powering Off the M7i Router” on page 64](#).

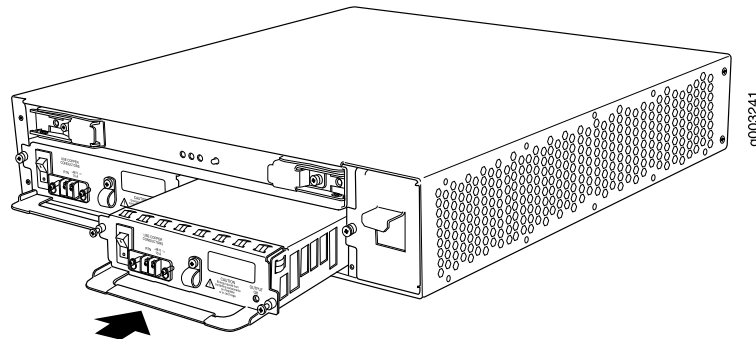


**NOTE:** After powering off a power supply, wait at least 60 seconds before turning it back on.

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

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

**Figure 55: Installing a DC Power Supply**



**Related Documentation**

- [M7i Router DC Power Supply Specifications on page 174](#)
- [M7i DC Power Electrical Safety Guidelines on page 153](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154](#)

## Replacing an M7i DC Power Cable

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

- [Removing an M7i DC Power Cable on page 120](#)
- [Installing an M7i DC Power Cable on page 120](#)

### Removing an M7i DC Power Cable

---

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

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



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

---

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

### Installing an M7i DC Power Cable

---

For information about the required DC power cables, see “[M7i DC Power Cable and Cable Lug Specifications](#)” on page 172.

---



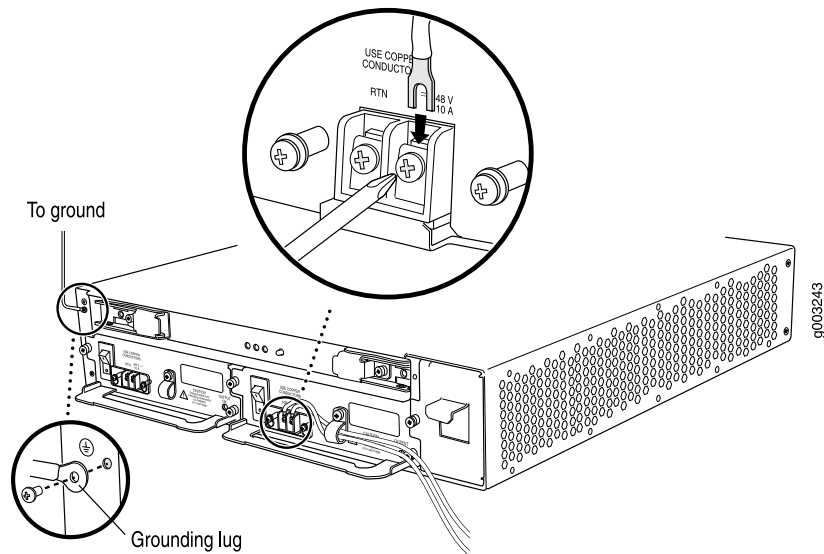
**CAUTION:** There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on each power supply. You must ensure that power connections maintain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

---

To install a DC power cable (see [Figure 56 on page 121](#)):

1. Verify that there is no power flowing from either external power source, so that the voltage across the leads of the power cables is 0 V. Ensure that there is no chance that the cable leads might become active during the procedure.
2. Verify that a licensed electrician has attached a listed power cable lug to each power source cable.
3. Loop the power cables through the hook located on the faceplate to the right of the field-wiring terminals.
4. Depending on the type of power cable lugs used, loosen or remove the screws on the field-wiring terminals.
5. Insert the power cable lugs into the appropriate field-wiring terminals. Using a number 1 Phillips screwdriver, turn the screw on each field-wiring terminal clockwise to secure the power cable lug. Apply between 8 lb-in. (.9 Nm) and 9 lb-in. (1.02 Nm) of torque to each screw.
  - a. Insert the positive (+) source cable into the return terminal, which is labeled **RTN**.
  - b. Insert the negative (–) source cable into the input terminal, which is labeled **–48V**.
6. Verify that the DC source power cabling is correct, that the DC power cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.

**Figure 56: Connecting DC Power Cables**



**Related Documentation**

- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154](#)
- [M7i Router DC Power Supply Specifications on page 174](#)
- [M7i DC Power Electrical Safety Guidelines on page 153](#)

## Replacing the M7i Fan Tray

- Removing the M7i Fan Tray on page 122
- Installing the M7i Fan Tray on page 123

### Removing the M7i Fan Tray

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

To remove the fan tray (see [Figure 57](#) on page 122):

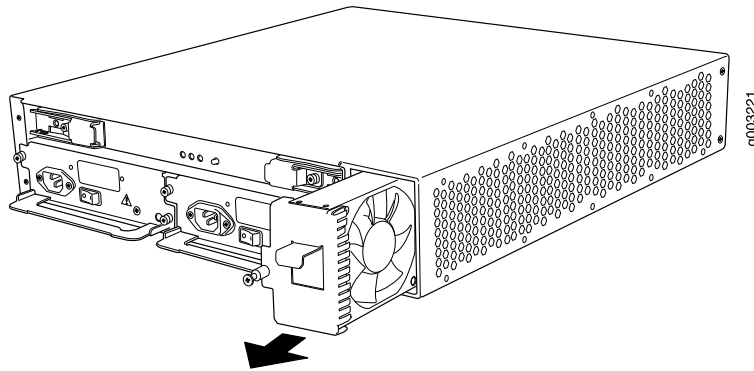
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Loosen the thumbscrew securing the fan tray, using a Phillips screwdriver if necessary.
3. Grasp the handle on the fan tray and pull firmly to slide it halfway out of the chassis.



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

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

**Figure 57: Removing the Fan Tray**





## Installing the M7i Fan Tray

To install the fan tray (see [Figure 58 on page 123](#)):



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

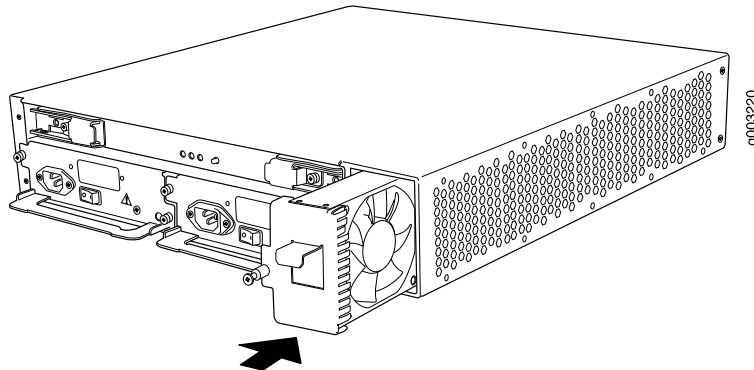
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Grasp the sides of the fan tray and align the rear of the tray with the guides inside the chassis.
3. Slide the fan tray all the way into the chassis.



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

4. Tighten the thumbscrew on the fan tray.

**Figure 58: Installing the Fan Tray**



### Related Documentation

- [M7i Cooling System Overview on page 26](#)
- [M7i Chassis Description on page 6](#)
- [Troubleshooting the M7i Fan Tray on page 86](#)



## PART 4

# Appendixes

- [Safety and Regulatory Compliance Information for the M7i Router on page 127](#)
- [M7i Router Physical Specifications on page 163](#)
- [M7i Router Environmental Specifications on page 165](#)
- [Power Guidelines, Requirements, and Specifications for the M7i Router on page 167](#)
- [Cable and Wire Guidelines and Specifications for the M7i Router on page 177](#)
- [M7i Cable Connector Pinouts on page 185](#)
- [Contacting Customer Support and Returning M7i Hardware on page 191](#)



## APPENDIX A

# Safety and Regulatory Compliance Information for the M7i Router

- Definition of Safety Warning Levels on page 127
- Safety Guidelines and Warnings for the M7i Router on page 129
- Agency Approvals and Compliance Statements for the M7i Router on page 157

## Definition of Safety Warning Levels

---

The documentation uses the following levels of safety warnings:



NOTE: You might find this information helpful in a particular situation, or might otherwise overlook it.



CAUTION: You must observe the specified guidelines to avoid minor injury or discomfort to you, or severe damage to the hardware device.



WARNING: This symbol alerts you to the risk of personal injury from a laser.



WARNING: This symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

**Waarschuwing** Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

**Varoitus** Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa,

ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista.

**Attention** Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents.

**Warnung** Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt.

**Avvertenza** Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti.

**Advarsel** Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du være oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.

**Aviso** Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes.

**¡Atención!** Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes.

**Varning!** Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador.

---

**Related  
Documentation**

- [General Safety Warnings for Juniper Networks Devices on page 130](#)
- [Installation Safety Warnings for Juniper Networks Devices on page 135](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 143](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 148](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154](#)

## Safety Guidelines and Warnings for the M7i Router

---

- [General Safety Guidelines for Juniper Networks Devices on page 129](#)
- [General Safety Warnings for Juniper Networks Devices on page 130](#)
- [Preventing Electrostatic Discharge Damage to an M7i Router on page 132](#)
- [Fire Safety Requirements for Juniper Networks Devices on page 133](#)
- [M7i Router Installation Safety Guidelines and Warnings on page 134](#)
- [Laser and LED Safety Guidelines and Warnings for the M7i Router on page 139](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 143](#)
- [Electrical Safety Guidelines and Warnings for the M7i Router on page 148](#)

### General Safety Guidelines for Juniper Networks Devices

The following guidelines help ensure your safety and protect the hardware equipment from damage. The list of guidelines might not address all potentially hazardous situations in your working environment, so be alert and exercise good judgment at all times.

- Perform only the procedures explicitly described in this documentation. Make sure that only authorized service personnel perform other system services.
- Keep the area around the chassis clear and free from dust before, during, and after installation.
- Keep tools away from areas where people could trip over them while walking.
- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, which could become caught in the chassis.
- Wear safety glasses if you are working under any conditions that could be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.
- Never install or manipulate wiring during electrical storms.
- Never install electrical jacks in wet locations unless the jacks are specifically designed for wet environments.
- Operate the hardware equipment only when the chassis is properly grounded.
- Do not open or remove chassis covers or sheet metal parts unless instructions are provided in this documentation. Such an action could cause severe electrical shock.
- Do not push or force any objects through any opening in the chassis frame. Such an action could result in electrical shock or fire.

- Avoid spilling liquid onto the chassis or onto any hardware component. Such an action could cause electrical shock or damage the hardware equipment.
- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Such an action could cause electrical shock.

**Related  
Documentation**

- [General Safety Warnings for Juniper Networks Devices on page 130](#)

## General Safety Warnings for Juniper Networks Devices

- [Qualified Personnel Warning on page 130](#)
- [Restricted Access Area Warning on page 130](#)

### Qualified Personnel Warning

---



**WARNING:** Only trained and qualified personnel should install or replace the hardware equipment.

**Waarschuwing** Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.

**Varoitus** Ainoastaan koulutettu ja pätevä henkilökunta saa asentaa tai vaihtaa tämän laitteen.

**Attention** Tout installation ou remplacement de l'appareil doit être réalisé par du personnel qualifié et compétent.

**Warnung** Gerät nur von geschultem, qualifiziertem Personal installieren oder auswechseln lassen.

**Avvertenza** Solo personale addestrato e qualificato deve essere autorizzato ad installare o sostituire questo apparecchio.

**Advarsel** Kun kvalifisert personell med riktig opplæring bør montere eller bytte ut dette utstyret.

**Aviso** Este equipamento deverá ser instalado ou substituído apenas por pessoal devidamente treinado e qualificado.

**¡Atención!** Estos equipos deben ser instalados y reemplazados exclusivamente por personal técnico adecuadamente preparado y capacitado.

**Varning!** Denna utrustning ska endast installeras och bytas ut av utbildad och kvalificerad personal.

---

### Restricted Access Area Warning

---



**WARNING:** The hardware equipment is intended for installation in restricted access areas. A restricted access area is an area to which access can be



gained only by service personnel through the use of a special tool, lock and key, or other means of security, and which is controlled by the authority responsible for the location.

**Waarschuwing** Dit toestel is bedoeld voor installatie op plaatsen met beperkte toegang. Een plaats met beperkte toegang is een plaats waar toegang slechts door servicepersoneel verkregen kan worden door middel van een speciaal instrument, een slot en sleutel, of een ander veiligheidsmiddel, en welke beheerd wordt door de overheidsinstantie die verantwoordelijk is voor de locatie.

**Varoitus** Tämä laite on tarkoitettu asennettavaksi paikkaan, johon pääsy on rajoitettua. Paikka, johon pääsy on rajoitettua, tarkoittaa paikkaa, johon vain huoltohenkilöstö pääsee jonkin erikoistyökalun, lukkoon sopivan avaimen tai jonkin muun turvalaitteen avulla ja joka on paikasta vastuussa olevien toimivaltaisten henkilöiden valvoma.

**Attention** Cet appareil est à installer dans des zones d'accès réservé. Ces dernières sont des zones auxquelles seul le personnel de service peut accéder en utilisant un outil spécial, un mécanisme de verrouillage et une clé, ou tout autre moyen de sécurité. L'accès aux zones de sécurité est sous le contrôle de l'autorité responsable de l'emplacement.

**Warnung** Diese Einheit ist zur Installation in Bereichen mit beschränktem Zutritt vorgesehen. Ein Bereich mit beschränktem Zutritt ist ein Bereich, zu dem nur Wartungspersonal mit einem Spezialwerkzeugs, Schloß und Schlüssel oder anderer Sicherheitsvorkehrungen Zugang hat, und der von dem für die Anlage zuständigen Gremium kontrolliert wird.

**Avvertenza** Questa unità deve essere installata in un'area ad accesso limitato. Un'area ad accesso limitato è un'area accessibile solo a personale di assistenza tramite un'attrezzo speciale, lucchetto, o altri dispositivi di sicurezza, ed è controllata dall'autorità responsabile della zona.

**Advarsel** Denne enheten er laget for installasjon i områder med begrenset adgang. Et område med begrenset adgang gir kun adgang til servicepersonale som bruker et spesielt verktøy, lås og nøkkel, eller en annen sikkerhetsanordning, og det kontrolleres av den autoriteten som er ansvarlig for området.

**Aviso** Esta unidade foi concebida para instalação em áreas de acesso restrito. Uma área de acesso restrito é uma área à qual apenas tem acesso o pessoal de serviço autorizado, que possua uma ferramenta, chave e fechadura especial, ou qualquer outra forma de segurança. Esta área é controlada pela autoridade responsável pelo local.

**¡Atención!** Esta unidad ha sido diseñada para instalarse en áreas de acceso restringido. Área de acceso restringido significa un área a la que solamente tiene acceso el personal de servicio mediante la utilización de una herramienta

especial, cerradura con llave, o algún otro medio de seguridad, y que está bajo el control de la autoridad responsable del local.

**Varning!** Denna enhet är avsedd för installation i områden med begränsat tillträde. Ett område med begränsat tillträde får endast tillträdas av servicepersonal med ett speciellt verktyg, lås och nyckel, eller annan säkerhetsanordning, och kontrolleras av den auktoritet som ansvarar för området.

**Related  
Documentation**

- [Installation Safety Warnings for Juniper Networks Devices on page 135](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 143](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 148](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154](#)

## Preventing Electrostatic Discharge Damage to an M7i Router

Many router hardware components are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

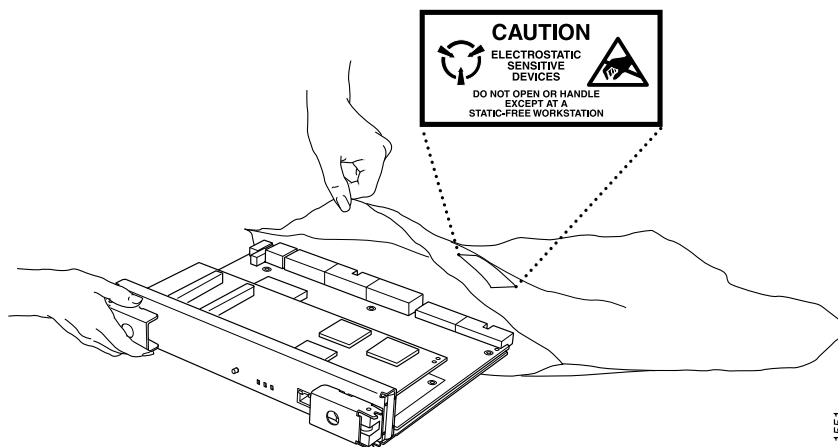
- Always use an ESD wrist strap or ankle strap, and make sure that it is in direct contact with your skin.



**CAUTION:** For safety, periodically check the resistance value of the ESD strap. The measurement should be in the range of 1 to 10 Mohms.

- When handling any component that is removed from the chassis, make sure the equipment end of your ESD strap is attached to one of the electrostatic discharge points on the chassis.
- Avoid contact between the component and your clothing. ESD voltages emitted from clothing can still damage components.
- When removing or installing a component, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an electrostatic bag (see [Figure 59 on page 133](#)). If you are returning a component, place it in an electrostatic bag before packing it.

Figure 59: Placing a Component into an Electrostatic Bag



#### Related Documentation

- [Definition of Safety Warning Levels on page 127](#)
- [General Safety Warnings for Juniper Networks Devices on page 130](#)
- [M7i AC Power Electrical Safety Guidelines and Warnings on page 152](#)
- [M7i DC Power Electrical Safety Guidelines on page 153](#)

## Fire Safety Requirements for Juniper Networks Devices

- [General Fire Safety Requirements on page 133](#)
- [Fire Suppression on page 133](#)
- [Fire Suppression Equipment on page 133](#)

### General Fire Safety Requirements

In the event of a fire emergency involving network devices, the safety of people is the primary concern. Establish procedures for protecting people in a fire emergency, provide safety training, and properly provision fire-control equipment and fire extinguishers.

In addition, establish procedures to protect your equipment in a fire emergency. Juniper Networks products should be installed in an environment suitable for electronic equipment. We recommend that fire suppression equipment be available in the event of a fire in the vicinity of the equipment, and that all local fire, safety, and electrical codes and ordinances be observed when installing and operating your equipment.

### Fire Suppression

In the event of an electrical hazard or an electrical fire, first turn power off to the equipment at the source. Then use a Type C fire extinguisher, which uses noncorrosive fire retardants, to extinguish the fire.

### Fire Suppression Equipment

Type C fire extinguishers, which use noncorrosive fire retardants such as carbon dioxide (CO<sub>2</sub>) 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 129](#)
- [General Safety Warnings for Juniper Networks Devices on page 130](#)
- [General Electrical Safety Warnings for Juniper Networks Devices on page 148](#)
- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154](#)

## M7i Router Installation Safety Guidelines and Warnings

- [M7i Chassis Lifting Guidelines on page 134](#)
- [Installation Safety Warnings for Juniper Networks Devices on page 135](#)

### M7i Chassis Lifting Guidelines

---

The weight of a fully configured chassis is about 36.5 lb (16.6 kg). Observe the following guidelines for lifting and moving the router:

- Before moving the router, read the guidelines in “[M7i Router Site Preparation Checklist](#)” on [page 37](#) to verify that the intended site meets the specified power, environmental, and clearance requirements.
- If a lift cannot be used, one person can lift the router. Another person is required install the mounting screws.

- Before lifting or moving the router, disconnect all external cables.
- As when lifting any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

**Related  
Documentation**

- [Installation Safety Warnings for Juniper Networks Devices on page 135](#)

### Installation Safety Warnings for Juniper Networks Devices

Observe the following warnings before and during hardware equipment installation:

- [Installation Instructions Warning on page 135](#)
- [Rack-Mounting Requirements and Warnings on page 135](#)
- [Ramp Warning on page 139](#)

#### ***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 stelling 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 129](#)
- [Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 143](#)

## Laser and LED Safety Guidelines and Warnings for the M7i Router

- [General Laser Safety Guidelines for the M7i Router on page 139](#)
- [M7i Laser and LED Safety Warnings on page 140](#)

### General Laser Safety Guidelines for the M7i Router

Physical Interface Cards (PICs) with single-mode optical interfaces are equipped with laser transmitters, which are considered a Class 1 Laser Product by the U.S. Food and

Drug Administration, and are evaluated as a Class 1 Laser Product per EN 60825–1 +A11 +A2 requirements.

When working around PICs, observe the following safety guidelines to prevent eye injury:

- Do not look into unterminated ports or at fibers that connect to unknown sources.
- Do not examine unterminated optical ports with optical instruments.
- Avoid direct exposure to the beam.



**WARNING:** Unterminated optical connectors can emit invisible laser radiation. The lens in the human eye focuses all the laser power on the retina, so focusing the eye directly on a laser source—even a low-power laser—could permanently damage the eye.

**Related Documentation**

- [M7i Laser and LED Safety Warnings on page 140](#)

**M7i Laser and LED Safety Warnings**

---

- [Class 1 Laser Product Warning on page 140](#)
- [Class 1 LED Product Warning on page 141](#)
- [Laser Beam Warning on page 141](#)
- [Radiation from Open Port Apertures Warning on page 142](#)

***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 1.

**Warnung** Class 1 LED-Produktwarnung.

**Avvertenza** Avvertenza prodotto LED di Classe 1.

**Advarsel** LED-produkt i klasse 1.

**Aviso** Produto de classe 1 com LED.

**¡Atención!** Aviso sobre producto LED de Clase 1.

**Varning!** Lysdiodprodukt av klass 1.

---

### ***Laser Beam Warning***

---



**WARNING:** Do not stare into the laser beam or view it directly with optical instruments.

**Waarschuwing** Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

**Varoitus** Älä katso säteeseen äläkä tarkastele sitä suoraan optisen laitteen avulla.

**Attention** Ne pas fixer le faisceau des yeux, ni l'observer directement à l'aide d'instruments optiques.

**Warnung** Nicht direkt in den Strahl blicken und ihn nicht direkt mit optischen Geräten prüfen.

**Avvertenza** Non fissare il raggio con gli occhi né usare strumenti ottici per osservarlo direttamente.

**Advarsel** Stirr eller se ikke direkte p strlen med optiske instrumenter.

**Aviso** Não olhe fixamente para o raio, nem olhe para ele directamente com instrumentos ópticos.

**¡Atención!** No mirar fijamente el haz ni observarlo directamente con instrumentos ópticos.

**Varning!** Rikta inte blicken in mot strålen och titta inte direkt på den genom optiska instrument.

---

### **Radiation from Open Port Apertures Warning**

---



**WARNING:** Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.

**Waarschuwing** Aangezien onzichtbare straling vanuit de opening van de poort kan komen als er geen fiberkabel aangesloten is, dient blootstelling aan straling en het kijken in open openingen vermeden te worden.

**Varoitus** Koska portin aukosta voi emittoitua näkymätöntä säteilyä, kun kuitukaapelia ei ole kytkettynä, vältä säteilylle altistumista äläkä katso avoimiin aukkoihin.

**Attention** Des radiations invisibles à l'il nu pouvant traverser l'ouverture du port lorsqu'aucun câble en fibre optique n'y est connecté, il est recommandé de ne pas regarder fixement l'intérieur de ces ouvertures.

**Warnung** Aus der Port-Öffnung können unsichtbare Strahlen emittieren, wenn kein Glasfaserkabel angeschlossen ist. Vermeiden Sie es, sich den Strahlungen auszusetzen, und starren Sie nicht in die Öffnungen!

**Avvertenza** Quando i cavi in fibra non sono inseriti, radiazioni invisibili possono essere emesse attraverso l'apertura della porta. Evitate di esporvi alle radiazioni e non guardate direttamente nelle aperture.

**Advarsel** Unngå utsettelse for stråling, og stirr ikke inn i åpninger som er åpne, fordi usynlig stråling kan 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 Laser Safety Guidelines for the M7i Router on page 139](#)

## Maintenance and Operational Safety Warnings for Juniper Networks Devices

As you maintain the hardware equipment, observe the following warnings:

- [Battery Handling Warning on page 143](#)
- [Jewelry Removal Warning on page 144](#)
- [Lightning Activity Warning on page 145](#)
- [Operating Temperature Warning on page 146](#)
- [Product Disposal Warning on page 147](#)

### Battery Handling Warning



**WARNING:** Replacing the battery incorrectly might result in an explosion. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

**Waarschuwing** Er is ontploffingsgevaar als de batterij verkeerd vervangen wordt. Vervang de batterij slechts met hetzelfde of een equivalent type dat door de fabrikant aanbevolen is. Gebruikte batterijen dienen overeenkomstig fabrieksvoorschriften weggeworpen te worden.

**Varoitus** Räjähdyksen vaara, jos akku on vaihdettu väärään akkuun. Käytä vaihtamiseen ainoastaan saman- tai vastaavantyyppistä akkua, joka on valmistajan suosittama. 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. Metallgenstander 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 luftåpningene 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 129](#)
- [General Safety Warnings for Juniper Networks Devices on page 130](#)

## Electrical Safety Guidelines and Warnings for the M7i Router

- General Electrical Safety Warnings for Juniper Networks Devices on page 148
- General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers on page 151
- In Case of an Electrical Accident on page 152
- M7i AC Power Electrical Safety Guidelines and Warnings on page 152
- M7i DC Power Electrical Safety Guidelines on page 153
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154

### General Electrical Safety Warnings for Juniper Networks Devices

---

- Grounded Equipment Warning on page 148
- Grounding Requirements and Warning on page 149
- Midplane Energy Hazard Warning on page 149
- Multiple Power Supplies Disconnection Warning on page 150
- Power Disconnection Warning on page 150

#### ***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.

**Warning!** 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, the ground connection must always be made first and disconnected 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.

**Warning!** 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 överspänningskyddet.

**Related Documentation**

- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154](#)

**General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers**

- Install the router in compliance with the following local, national, or international electrical codes:
  - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.
  - Canada—Canadian Electrical Code, Part 1, CSA C22.1.

- Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.
- Locate the emergency power-off switch for the room in which you are working so that if an electrical accident occurs, you can quickly turn off the power.
- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.
- Never assume that power is disconnected from a circuit. Always check the circuit before starting to work.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, and missing safety grounds.
- Operate the router within marked electrical ratings and product usage instructions.
- For the router and peripheral equipment to function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

Many router components can be removed and replaced without powering off or disconnecting power to the router. Never install equipment if it appears damaged.

**Related Documentation**

- [M7i Field-Replaceable Units \(FRUs\) on page 89](#)

### [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 Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers on page 151](#)
- [M7i AC Power Electrical Safety Guidelines and Warnings on page 152](#)
- [M7i DC Power Electrical Safety Guidelines on page 153](#)

### [M7i AC Power Electrical Safety Guidelines and Warnings](#)

---

The following electrical safety guidelines apply to AC-powered routers:

- AC-powered routers are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding should comply with local and national electrical codes.
- You must provide an external circuit breaker rated minimum 15 A (250 VAC) in the building installation.

- The power cord serves as the main disconnecting device. The socket outlet must be near the router and be easily accessible.
- The cores in the mains lead are colored in accordance with the following code:
  - Green and yellow—Earth
  - Blue—Neutral
  - Brown—Live
- When a router is equipped with two AC power supplies, both power cords (one for each power supply) must be unplugged to completely disconnect power to the router.
- Note the following warnings printed on the AC power supply faceplate:
  - To completely de-energize the system disconnect maximum of 2 power cordsets.
  - Apparaten skall anslutas till jordat uttag när den ansluts till ett nätverk. [Swedish]

**Related Documentation**

- [In Case of an Electrical Accident on page 152](#)
- [General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers on page 151](#)
- [M7i DC Power Electrical Safety Guidelines on page 153](#)

### M7i DC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to a DC-powered router:

- A DC-powered router is equipped with a DC terminal block that is rated for the power requirements of a maximally configured router. To supply sufficient power, terminate the DC input wiring on a facility DC source capable of supplying at least 31 A @ –48 VDC per input for each power supply.
- Incorporate an easily accessible disconnect device into the facility wiring. We recommend that the 48 VDC facility DC source should be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum, or as required by local code. In the United States and Canada, the 48 VDC facility should be equipped with a circuit breaker rated a minimum of 125% of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada.
- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 50 A.
- Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- A DC-powered router that is equipped with a DC terminal block is intended only for installation in a restricted access location. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.



**NOTE:** Primary overcurrent protection is provided by the building circuit breaker. This breaker should protect against excess currents, short circuits, and earth faults in accordance with NEC ANSI/NFPA70.

- Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.
- For personal safety, connect the green and yellow wire to safety (earth) ground at both the router and the supply side of the DC wiring.
- The marked input voltage of –48 VDC for a DC-powered router is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.
- Because the router is a positive ground system, you must connect the positive lead to the terminal labeled **RTN**, the negative lead to the terminal labeled **–48V**, and the earth ground to the chassis grounding points.

#### Related Documentation

- [DC Power Electrical Safety Warnings for Juniper Networks Devices on page 154](#)

#### [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 154](#)
- [DC Power Disconnection Warning on page 155](#)
- [DC Power Wiring Terminations Warning on page 156](#)

#### ***DC Power Copper Conductors Warning***



**WARNING:** Use copper conductors only.

**Waarschuwing** Gebruik alleen koperen geleiders.

**Varoitus** Käytä vain kuparijohtimia.

**Attention** Utilisez uniquement des conducteurs en cuivre.

**Warnung** Verwenden Sie ausschließlich Kupferleiter.

**Avvertenza** Usate unicamente dei conduttori di rame.

**Advarsel** Bruk bare kobberledninger.

**Aviso** Utilize apenas fios condutores de cobre.

**¡Atención!** Emplee sólo conductores de cobre.

**Varning!** Använd endast ledare av koppar.



**DC Power Disconnection Warning**

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

**Waarschuwing** Voordat u een van de onderstaande procedures uitvoert, dient u te controleren of de stroom naar het gelijkstroom circuit uitgeschakeld is. Om u ervan te verzekeren dat alle stroom UIT is geschakeld, kiest u op het schakelbord de stroomverbreker die het gelijkstroom circuit bedient, draait de stroomverbreker naar de UIT positie en plakt de schakelaarhendel van de stroomverbreker met plakband in de UIT positie vast.

**Varoitus** Varmista, että tasavirtapiirissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paikanna tasavirrasta huolehtivassa kojetaulussa sijaitseva suojakytkin, käännä suojakytkin KATKAISTU-asentoon ja teippaa suojakytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

**Attention** Avant de pratiquer l'une quelconque des procédures ci-dessous, vérifiez que le circuit en courant continu n'est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le disjoncteur en position fermée (OFF) et, à l'aide d'un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

**Warnung** Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

**Avvertenza** Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

**Advarsel** Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.

**Aviso** Antes de executar um dos seguintes procedimentos, certifique-se que desligou a fonte de alimentação de energia do circuito de corrente contínua. Para se assegurar que toda a corrente foi DESLIGADA, localize o disjuntor no painel que serve o circuito de corrente contínua e coloque-o na posição OFF

(Desligado), segurando nessa posição a manivela do interruptor do disjuntor com fita isoladora.

**¡Atención!** Antes de proceder con los siguientes pasos, comprobar que la alimentación del circuito de corriente continua (CC) esté cortada (OFF). Para asegurarse de que toda la alimentación esté cortada (OFF), localizar el interruptor automático en el panel que alimenta al circuito de corriente continua, cambiar el interruptor automático a la posición de Apagado (OFF), y sujetar con cinta la palanca del interruptor automático en posición de Apagado (OFF).

**Varning!** Innan du utför någon av följande procedurer måste du kontrollera att strömförsörjningen till likströmskretsen är bruten. Kontrollera att all strömförsörjning är BRUTEN genom att slå AV det överspänningsskydd som skyddar likströmskretsen och tejpa fast överspänningsskyddets omkopplare i FRÅN-läget.

---

#### **DC Power Wiring Terminations Warning**

---



**WARNING:** When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations should be the appropriate size for the wires and should clamp both the insulation and conductor.

**Waarschuwing** Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingspunten, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

**Varoitus** Jos säikeellinen johdin on tarpeen, käytä hyväksyttyä johdinliitäntää, esimerkiksi suljettua silmukkaa tai kourumaista liitäntää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitäntöjen tulee olla kooltaan johtimiin sopivia ja niiden tulee puristaa yhteen sekä eristeen että johdinosan.

**Attention** Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

**Warnung** Wenn Litzenverdrahtung erforderlich ist, sind zugelassene Verdrahtungsabschlüsse, z.B. Ringoesen oder gabelförmige Kabelschuhe mit nach oben gerichteten Enden zu verwenden. Diese Abschlüsse sollten die angemessene Größe für die Drähte haben und sowohl die Isolierung als auch den Leiter festklemmen.

**Avvertenza** Quando occorre usare trecce, usare connettori omologati, come quelli a occhiello o a forcilla con linguette rivolte verso l'alto. I connettori

devono avere la misura adatta per il cablaggio e devono serrare sia l'isolante che il conduttore.

**Advarsel** Hvis det er nødvendig med flertrådede ledninger, brukes godkjente ledningsavslutninger, som for eksempel lukket sløyfe eller spadetype med oppoverbøyde kabelsko. Disse avslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og 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 Electrical Safety Warnings for Juniper Networks Devices on page 148](#)

## Agency Approvals and Compliance Statements for the M7i Router

- [Agency Approvals for M7i Routers on page 157](#)
- [M7i Compliance Statements for NEBS on page 159](#)
- [Compliance Statements for EMC Requirements for the M7i Router on page 159](#)
- [Compliance Statements for EMC Requirements for Juniper Networks Devices \(United States\) on page 161](#)
- [Compliance Statements for EMC Requirements for Juniper Networks Devices \(Canada\) on page 161](#)
- [Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 161](#)
- [Compliance Statements for Acoustic Noise for the M7i Router on page 161](#)

### Agency Approvals for M7i Routers

The router complies with the following standards:

- Safety

- CAN/CSA-22.2 No. 60950-00/UL 1950 Third Edition, Safety of Information Technology Equipment
- EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EN 60950 Safety of Information Technology Equipment
- EMC
  - AS/NZS 3548 Class A (Australia/New Zealand)
  - EN55022 Class A (Europe)
  - FCC Part 15 Class A (USA)
  - VCCI Class B (Japan)
- Immunity
  - EN-61000-3-2 Power Line Harmonics
  - EN-61000-3-3 Voltage Fluctuations and Flicker
  - EN-61000-4-2 ESD
  - EN-61000-4-3 Radiated Immunity
  - EN-61000-4-4 EFT
  - EN-61000-4-5 Surge
  - EN-61000-4-6 Low Frequency Common Immunity
  - EN-61000-4-11 Voltage Dips and Sags
- ETSI EN-300386-2 Telecommunication Network Equipment. Electromagnetic Compatibility Requirements
- NEBS
  - GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment
  - SR-3580 NEBS Criteria Levels (Level 3 Compliance)
  - GR-63-Core: NEBS, Physical Protection

**Related Documentation**

- [M7i Compliance Statements for NEBS on page 159](#)
- [Compliance Statements for EMC Requirements for the M7i Router on page 159](#)
- [Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 161](#)
- [Compliance Statements for Acoustic Noise for the M7i Router on page 161](#)

## M7i Compliance Statements for NEBS

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (i.e. DC-I), as defined in GR-1089-CORE.

### Related Documentation

- [Agency Approvals for M7i Routers on page 157](#)
- [Compliance Statements for EMC Requirements for the M7i Router on page 159](#)
- [Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 161](#)
- [Compliance Statements for Acoustic Noise for the M7i Router on page 161](#)

## Compliance Statements for EMC Requirements for the M7i Router

- [Canada on page 159](#)
- [European Community on page 159](#)
- [Declaration of Conformity on page 159](#)
- [United States on page 160](#)

### Canada

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.



### European Community

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

### Declaration of Conformity

This topic shows the Declaration of Conformity for the router.

Figure 60: M7i Declaration of Conformity

	DOC 0008
<b>Declaration of Conformity</b>	
Juniper Networks, Inc. 1194 N. Mathilda Ave Sunnyvale, CA. 94089 USA	
declares that under our sole responsibility the product(s)	
<b>Internet Router Model M7i</b>	
are in conformity with the provisions of the following EC Directives, including all amendments, and with national legislation implementing these directives:	
<b>Low Voltage Directive 73/23/EEC EMC Directive 89/336/EEC</b>	
and that the following harmonized standards have been applied	
<b>EN 60950:1992+A1+A2+A3+A4+A11</b> EN 60825-1:1994+A11 EN 60825-2:1994	
<b>EN 300 386 V1.3.1:2001</b> EN 55024:1998 EN 55022:1991+A1+A2 EN 61000-3-2, EN 61000-3-3 EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11	
Place Sunnyvale, CA	 Signature John Lockwood
	Date 08/09/2005

### United States

The router has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

#### Related Documentation

- [Agency Approvals for M7i Routers on page 157](#)
- [M7i Compliance Statements for NEBS on page 159](#)
- [Compliance Statements for Environmental Requirements for Juniper Networks Devices on page 161](#)
- [Compliance Statements for Acoustic Noise for the M7i Router on page 161](#)

## Compliance Statements for EMC Requirements for Juniper Networks Devices (United States)

The hardware equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

### Related Documentation

- [Site Electrical Wiring Guidelines for Juniper Networks Devices](#)
- [General Safety Guidelines for Juniper Networks Devices on page 129](#)
- [General Safety Warnings for Juniper Networks Devices on page 130](#)

## Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada)

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

### Related Documentation

- [Compliance Statements for EMC Requirements for Juniper Networks Devices \(Japan\)](#)
- [Compliance Statements for EMC Requirements for Juniper Networks Devices \(United States\) on page 161](#)

## Compliance Statements for Environmental Requirements for Juniper Networks Devices

Batteries in this product are not based on mercury, lead, or cadmium substances. The batteries used in this product are in compliance with EU Directives 91/157/EEC, 93/86/EEC, and 98/101/EEC. The product documentation includes instructional information about the proper method of reclamation and recycling.

### Related Documentation

- [General Safety Guidelines for Juniper Networks Devices on page 129](#)
- [General Safety Warnings for Juniper Networks Devices on page 130](#)

## Compliance Statements for Acoustic Noise for the M7i Router

- The emitted sound pressure is 70 dB(A) or less as per EN ISO 7779.
- Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 70 dB(A) oder weniger gemäss EN ISO 7779

### Related Documentation

- [Agency Approvals for M7i Routers on page 157](#)
- [M7i Compliance Statements for NEBS on page 159](#)
- [Compliance Statements for EMC Requirements for the M7i Router on page 159](#)

- [Compliance Statements for Environmental Requirements for Juniper Networks Devices](#) on page 161



## APPENDIX B

# M7i Router Physical Specifications

- M7i Router Physical Specifications on page 163

## M7i Router Physical Specifications

---

Table 17 on page 163 summarizes the physical specifications for the router chassis.

**Table 17: Chassis Physical Specifications**

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

- Related Documentation**
- [M7i Router Environmental Specifications on page 165](#)
  - [M7i Router Power Requirements on page 167](#)
  - [M7i Router Description on page 3](#)

# M7i Router Environmental Specifications

- [M7i Router Environmental Specifications on page 165](#)

## M7i Router Environmental Specifications

---

Table 18 on page 165 specifies the environmental conditions required for normal router operation. In addition, the site should be as dust-free as possible. Dust can clog air intake vents and filters, reducing cooling system efficiency. Check the filters and vents frequently, cleaning them as necessary. For more information, see “[Routine Maintenance Procedures for the M7i Router](#)” on page 73.

**Table 18: Router Environmental Tolerances**

Description	Tolerance
Altitude	No performance degradation to 10,000 ft (3048 m)
Relative humidity	Normal operation ensured in relative humidity range of 5% to 90%, noncondensing
Temperature	Normal operation ensured in temperature range of 32°F to 104°F (0°C to 40°C)
Seismic	Tested to meet Telcordia Technologies Zone 4 earthquake requirements
Thermal output	<ul style="list-style-type: none"> <li>• AC: 1400 BTU</li> <li>• DC: 1600 BTU</li> </ul>



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

For additional safety guidelines and requirements, see “[General Safety Guidelines for Juniper Networks Devices](#)” on page 129.

- Related Documentation**
- [M7i Router Physical Specifications on page 163](#)

- [M7i Router Power Requirements on page 167](#)
- [M7i Router Description on page 3](#)

## APPENDIX D

# Power Guidelines, Requirements, and Specifications for the M7i Router

- [M7i Router Power Requirements on page 167](#)
- [M7i Router AC Power Specifications and Requirements on page 168](#)
- [M7i Router DC Power Specifications and Requirements on page 171](#)
- [Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers on page 174](#)

## M7i Router Power Requirements

---

[Table 19 on page 167](#) lists the power requirements for various hardware components when the router is operating under typical voltage conditions. For PIC power requirements, see the [M7i Multiservice Edge Router PIC Guide](#).

**Table 19: M7i Component Power Requirements**

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

You can use the information in [Table 19 on page 167](#) and the [M7i Multiservice Edge Router PIC Guide](#) to calculate power consumption for various hardware configurations, input current from a different source voltage, and thermal output, as shown in the following examples. (For an added safety margin, the examples use a generalized value for PICs of 0.625 A @ 48 V each.)

- Power consumption for minimum configuration:

$$\begin{aligned} &\text{Base system} + 1 \text{ CFEB} + 1 \text{ RE} + 1 \text{ PIC} = \\ &0.6 \text{ A} + 1.4 \text{ A} + 0.7 \text{ A} + 0.625 \text{ A} = 3.3 \text{ A @ } 48 \text{ V} = 159 \text{ W DC} \end{aligned}$$

- Power consumption for maximum configuration:
  - Base system + 1 CFEB with ASM + 1 RE + 4 PICs =
  - $0.6\text{ A} + 1.9\text{ A} + 0.7\text{ A} + 4(0.625\text{ A}) =$
  - $0.6\text{ A} + 1.9\text{ A} + 0.7\text{ A} + 2.5\text{ A} = 5.7\text{ A @ } 48\text{ V} = 274\text{ W DC}$
- Input current from a DC source other than  $-48\text{ VDC}$  (based on maximum configuration):
  - $(-54\text{ VDC input}) \times (\text{input current X}) = (-48\text{ VDC}) \times (\text{input current Y})$
  - $54 \times X = 48 \times 48.2$
  - $X = 48 \times 48.2 / 54 = 42.8\text{ A}$
- System thermal output for maximally configured AC-powered router:
  - Watts DC/85% AC PEM efficiency/0.293 = BTU/hr
  - $274 / 0.85 / 0.293 = 1100\text{ BTU/hr}$
- System thermal output for maximally configured DC-powered router:
  - Watts DC/0.293 = BTU/hr
  - $274 / 0.293 = 935\text{ BTU/hr}$



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

#### Related Documentation

- [M7i Router AC Power Supply Specifications on page 170](#)
- [M7i Router DC Power Supply Specifications on page 174](#)
- [Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers on page 174](#)

## M7i Router AC Power Specifications and Requirements

- [M7i Router AC Power, Connection, and Power Cord Specifications on page 168](#)
- [M7i Router AC Power Supply Specifications on page 170](#)

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

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



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



WARNING:

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

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



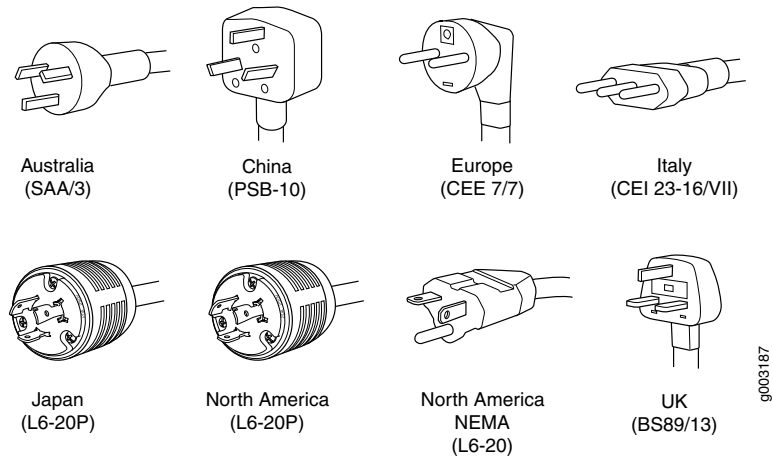
**NOTE:** In North America, AC power cords must not exceed 4.5 m (approximately 14.75 ft) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52, and Canadian Electrical Code (CEC) Section 4-010(3). The cords supplied with the router are in compliance.

Table 20 on page 169 provides specifications and Figure 61 on page 170 depicts the plug on the AC power cord provided for each country or region.

Table 20: AC Power Cord Specifications

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

Figure 61: AC Plug Types



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

#### Related Documentation

- [M7i AC Power Supply on page 24](#)
- [Connecting Power to an AC-Powered M7i Router on page 61](#)
- [Replacing an M7i AC Power Supply on page 111](#)
- [Replacing an AC Power Cord](#)
- [M7i Router Power Requirements on page 167](#)
- [M7i Router AC Power Supply Specifications on page 170](#)

## M7i Router AC Power Supply Specifications

Table 21 on page 170 lists electrical specifications for the AC Power Supply.

**Table 21: Electrical Specifications for AC Power Supply**

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



- Related Documentation**
- [M7i AC Power Supply on page 24](#)
  - [Connecting Power to an AC-Powered M7i Router on page 61](#)
  - [Replacing an M7i AC Power Supply on page 111](#)
  - [Replacing an AC Power Cord](#)
  - [M7i Router Power Requirements on page 167](#)
  - [M7i Router AC Power, Connection, and Power Cord Specifications on page 168](#)

## M7i Router DC Power Specifications and Requirements

- [M7i Chassis Grounding, Connection, and Cable Specifications on page 171](#)
- [M7i DC Power Cable and Cable Lug Specifications on page 172](#)
- [M7i Router DC Power Supply Specifications on page 174](#)

### M7i Chassis Grounding, Connection, and Cable Specifications

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

Table 22 on page 171 summarizes the specifications for the grounding cable, which you must supply.

**Table 22: Grounding Cable Specifications**

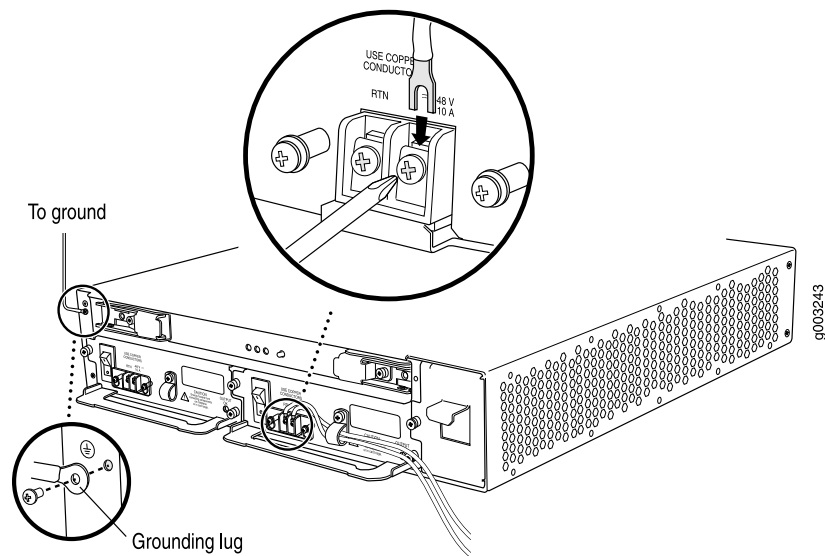
Quantity and Specification	Maximum Equal Length
One 14-AWG (2.08 mm <sup>2</sup> ) single-strand-count wire cable	None

Figure 62 on page 172 shows the location of the grounding point on the upper left side of the M7i router above the power supplies.



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

Figure 62: Grounding Cable Connection



#### Related Documentation

- [M7i Chassis Description on page 6](#)
- [Connecting the Grounding Cable to the M7i Router on page 53](#)

## M7i DC Power Cable and Cable Lug Specifications

- [DC Power Cables on page 172](#)
- [DC Power Lugs on page 173](#)

### DC Power Cables

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

[Table 23 on page 172](#) summarizes the specifications for the DC power cables, which you must supply.

**Table 23: DC Power Cable Specifications**

Quantity and Specification	Maximum Equal Length
Two 14-AWG (2.08 mm <sup>2</sup> ) single-strand-count wire cables for each power supply	None



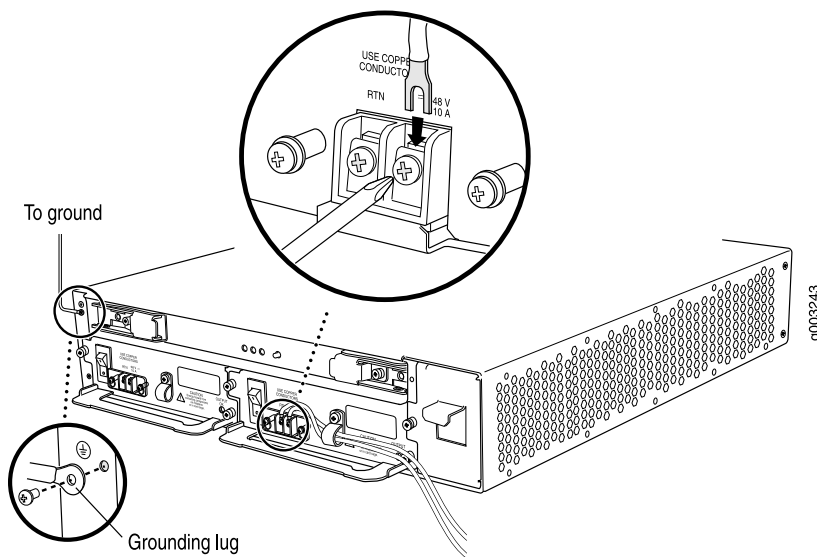
**WARNING:** For field-wiring connections, use copper conductors only.



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

Figure 63 on page 173 shows how to attach the DC power cables. The power cables insert into the field-wiring terminals located on each power supply—the input terminal is labeled -48V and the return terminal is labeled RTN.

Figure 63: DC Power Cable Connections



### DC Power Lugs



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

**Related Documentation**

- [M7i DC Power Supply on page 25](#)
- [Replacing a DC Power Supply on page 116](#)
- [Replacing an M7i DC Power Cable on page 120](#)
- [M7i Router Power Requirements on page 167](#)
- [M7i Router DC Power Supply Specifications on page 174](#)
- [General Electrical Safety Guidelines and Electrical Codes for M Series, MX Series, and T Series Routers on page 151](#)

## M7i Router DC Power Supply Specifications

Table 24 on page 174 lists electrical specifications for the DC power supply.

**Table 24: Electrical Specifications for DC Power Supply**

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



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

### Related Documentation

- [M7i DC Power Supply on page 25](#)
- [Replacing a DC Power Supply on page 116](#)
- [Replacing an M7i DC Power Cable on page 120](#)
- [M7i Router Power Requirements on page 167](#)
- [M7i Chassis Grounding, Connection, and Cable Specifications on page 171](#)
- [M7i Power Supply LEDs on page 25](#)

## Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers

- Distance limitations for signaling—Improperly installed wires can emit radio interference. In addition, the potential for damage from lightning strikes increases if wires exceed recommended distances or if wires pass between buildings. The electromagnetic pulse (EMP) caused by lightning can damage unshielded conductors and destroy electronic devices. If your site has previously experienced such problems, you might want to consult experts in electrical surge suppression and shielding.
- Radio frequency interference—You can reduce or eliminate the emission of radio frequency interference (RFI) from your site wiring by using twisted-pair cable with a good distribution of grounding conductors. If you must exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal when applicable.
- Electromagnetic compatibility—If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters,

you might want to seek expert advice. Strong sources of electromagnetic interference (EMI) can destroy the signal drivers and receivers in the router and conduct power surges over the lines into the equipment, resulting in an electrical hazard. It is particularly important to provide a properly grounded and shielded environment and to use electrical surge-suppression devices.

---



**CAUTION:** To comply with intrabuilding lightning and surge requirements, intrabuilding wiring must be shielded, and the shield for the wiring must be grounded at both ends.

---

**Related  
Documentation**

- [M7i Router Power Requirements on page 167](#)
- [M7i Router AC Power Supply Specifications on page 170](#)
- [M7i Router DC Power Supply Specifications on page 174](#)



## APPENDIX E

# Cable and Wire Guidelines and Specifications for the M7i Router

The FIC and the various PICs supported on the router accept different kinds of network cable, including multimode and single-mode fiber-optic cable. For more information, see the following topics:

- [FIC Specifications for the M7i Router on page 177](#)
- [Fiber-Optic Specifications and Guidelines for the M7i Router on page 178](#)
- [Routing Engine Interface Cable and Wire Specifications for the M7i Router on page 183](#)

## FIC Specifications for the M7i Router

---

[Table 25 on page 177](#) lists the specifications for the type of network cable accepted by the FIC. For information about the network cables for the PICs in your router, refer to the *M7i Multiservice Edge Router PIC Guide*.

**Table 25: FIC Specifications**

Interface Type	Cable Specification	Cable Supplied	Maximum Length	Router Receptacle
2-port Fast Ethernet FIC	RJ-45 connectors (one for each port); MDI noncrossover	No	328 ft (100 m)	RJ-45
1-port Gigabit Ethernet FIC with SX SFP	Duplex LC	No	656 ft/200 m reach on 62.5/125 micrometer multimode fiber (MMF) 1640 ft/500 m reach on 50/125 micrometer MMF	LC

Table 25: FIC Specifications (*continued*)

Interface Type	Cable Specification	Cable Supplied	Maximum Length	Router Receptacle
1-port Gigabit Ethernet FIC with LX SFP	Duplex LC	No	6.2 mile/10 km reach on 9/125 micrometer single-mode fiber (SMF)	LC
1-port Gigabit Ethernet FIC with LH SFP	Duplex LC	No	43.5 mile/70 km reach on 8.2 micrometer SMF	LC

- Related Documentation**
- [M7i PICs Description on page 16](#)
  - [M7i Fixed Interface Card \(FIC\) Description on page 15](#)
  - [Connecting FIC and PIC Cables to the M7i Router on page 58](#)

## Fiber-Optic Specifications and Guidelines for the M7i Router

- [Fiber-Optic and Network Cable Specifications for the M7i Router on page 178](#)
- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 179](#)
- [Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 179](#)
- [Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 180](#)
- [Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 181](#)

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

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

- Related Documentation**
- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 179](#)
  - [Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 179](#)
  - [Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 180](#)
  - [Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 181](#)



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

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

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

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

For information about the maximum transmission distances and wavelength ranges supported by multimode and single-mode (ATM and SONET/SDH) PIC interfaces, see the *M7i Multiservice Edge Router PIC Guide*. Exceeding the maximum transmission distances can result in significant signal loss, which causes unreliable transmission.

### Related Documentation

- [Fiber-Optic and Network Cable Specifications for the M7i Router on page 178](#)
- [Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 179](#)
- [Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 180](#)
- [Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 181](#)

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

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

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

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

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

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

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

#### Related Documentation

- [Fiber-Optic and Network Cable Specifications for the M7i Router on page 178](#)
- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 179](#)
- [Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 180](#)
- [Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 181](#)

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

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

$$P_B = P_T - P_R$$

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

$$P_B = P_T - P_R$$

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

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

**Related Documentation**

- [Fiber-Optic and Network Cable Specifications for the M7i Router on page 178](#)
- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 179](#)
- [Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 179](#)
- [Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 181](#)

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

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

$$P_M = P_B - LL$$

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

Factors that can cause link loss include higher-order mode losses (HOL), modal and chromatic dispersion, connectors, splices, and fiber attenuation. [Table 26 on page 181](#) 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 26: 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 26: 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 example uses the estimated values in [Table 26 on page 181](#) to calculate link loss (LL) for a 2-km-long multimode link with a power budget ( $P_B$ ) of 13 dB:

- Fiber attenuation for 2 km @ 1.0 dB/km = 2 dB
- Loss for five connectors @ 0.5 dB per connector = 5(0.5 dB) = 2.5 dB
- Loss for two splices @ 0.5 dB per splice = 2(0.5 dB) = 1 dB
- Higher-order mode loss = 0.5 dB
- Clock recovery module = 1 dB

The power margin ( $P_M$ ) is calculated as follows:

$$P_M = P_B - LL$$

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

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

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

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 26 on page 181](#) 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:

$$P_M = P_B - LL$$

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

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

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

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.

#### Related Documentation

- [Fiber-Optic and Network Cable Specifications for the M7i Router on page 178](#)
- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M7i Router on page 179](#)

- [Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 179](#)
- [Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 180](#)

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

For management and service operations, you connect the Routing Engine to an external console or management network. (For more information, see [“M7i Routing Engine Description” on page 18.](#))

[Table 27 on page 183](#) lists the specifications for the cables that connect to management ports.

**Table 27: Cable Specifications for Routing Engine Management Ports**

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

### Related Documentation

- [Replacing the Routing Engine Interface Port Cables on page 103](#)
- [Maintaining the M7i Routing Engine on page 76](#)
- [Replacing the M7i Routing Engine on page 101](#)



## APPENDIX F

# M7i Cable Connector Pinouts

- [RJ-45 Connector Pinouts for the M7i Routing Engine MGMT Port on page 185](#)
- [DB-9 Connector Pinouts for the M7i Routing Engine AUX/MODEM and CONSOLE Ports on page 186](#)
- [RJ-48 Cable Pinouts for E1 and T1 PICs on page 186](#)

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

---

The port on the Routing Engine labeled **MGMT** is an autosensing 10/100-Mbps Ethernet RJ-45 receptacle that accepts an Ethernet cable for connecting the Routing Engine to a management LAN (or another device that supports out-of-band management). [Table 28 on page 185](#) describes the RJ-45 connector pinout.

**Table 28: RJ-45 Connector Pinout**

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

### Related Documentation

- [M7i Routing Engine Description on page 18](#)
- [Maintaining the M7i Routing Engine on page 76](#)
- [Replacing the M7i Routing Engine on page 101](#)

- [Replacing the Routing Engine Interface Port Cables on page 103](#)
- [DB-9 Connector Pinouts for the M7i Routing Engine AUX/MODEM and CONSOLE Ports on page 186](#)

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

The ports on the CIP labeled **AUX/MODEM** and **CONSOLE** are DB-9 receptacles that accept RS-232 (EIA-232) cable. The **AUX/MODEM** port connects the Routing Engine to a laptop, modem, or other auxiliary unit, and the **CONSOLE** port connects it to a management console. The ports are configured as data terminal equipment (DTE). [Table 29 on page 186](#) describes the DB-9 connector pinouts.

**Table 29: DB-9 Connector Pinout**

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

- Related Documentation**
- [M7i Routing Engine Description on page 18](#)
  - [Maintaining the M7i Routing Engine on page 76](#)
  - [Replacing the M7i Routing Engine on page 101](#)
  - [Replacing the Routing Engine Interface Port Cables on page 103](#)
  - [RJ-45 Connector Pinouts for the M7i Routing Engine MGMT Port on page 185](#)

## RJ-48 Cable Pinouts for E1 and T1 PICs

The E1 and T1 PICs use an RJ-48 cable, which is not supplied with the PIC.





**CAUTION:** To maintain agency approvals, use only a properly constructed, shielded cable.

Table 30 on page 187, Table 31 on page 187, Table 32 on page 188, and Table 33 on page 189 describe the RJ-48 connector pinouts.

**Table 30: RJ-48 Connector to RJ-48 Connector (Straight) Pinout for the Router**

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	RJ-48 Pin (Data numbering form)	Signal
1	1	RX, Ring, –
2	2	RX, Tip, +
4	4	TX, Ring, –
5	5	TX, Tip, +
3	3	Shield/Return/Ground
6	6	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect

**Table 31: RJ-48 Connector to RJ-48 Connector (Crossover) Pinout for the Router**

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	RJ-48 Pin (Data numbering form)	Signal
1	4	RX/Ring/– <--->TX/Ring/–
2	5	RX/Tip/+ <--->TX/Tip/+
4	1	TX/Ring/– <--->RX/Ring/–
5	2	TX/Tip/+ <--->RX/Tip/+
3	3	Shield/Return/Ground
6	6	Shield/Return/Ground

**Table 31: RJ-48 Connector to RJ-48 Connector (Crossover) Pinout for the Router (continued)**

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	RJ-48 Pin (Data numbering form)	Signal
7	No connect	No connect
8	No connect	No connect

**Table 32: RJ-48 Connector to DB-15 Connector (Straight) Pinout for the Router**

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
1	11	RX/Ring/- <--->RX/Ring/-
2	3	RX/Tip/+ <--->RX/Tip/+
4	9	TX/Ring/- <--->TX/Ring/-
5	1	TX/Tip/+ <--->TX/Tip/+
3	4	Shield/Return/Ground
6	2	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect
12	No connect	No connect
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

**Table 33: RJ-48 Connector to DB-15 Connector (Crossover) Pinout for the Router**

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
1	9	RX/Ring/- <--->TX/Ring/-
2	1	RX/Tip/+ <--->TX/Tip/+
4	11	TX/Ring/- <--->RX/Ring/-
5	3	TX/Tip/+ <--->RX/Tip/+
3	4	Shield/Return/Ground
6	2	Shield/Return/Ground
7	No connect	No connect
8	No connect	No connect
9	No connect	No connect
10	No connect	No connect
11	No connect	No connect
12	No connect	No connect
13	No connect	No connect
14	No connect	No connect
15	No connect	No connect

- Related Documentation**
- [M7i PICs Description on page 16](#)
  - [Replacing an M7i FIC or PIC Cable on page 96](#)
  - [Connecting FIC and PIC Cables to the M7i Router on page 58](#)
  - [Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 74](#)
  - [Troubleshooting the M7i FIC or PICs on page 84](#)



## APPENDIX G

# Contacting Customer Support and Returning M7i Hardware

- [Locating M7i Component Serial Numbers on page 191](#)
- [Contacting Customer Support on page 195](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 195](#)
- [Tools and Parts Required to Remove Components from an M7i Router on page 196](#)
- [Packing the M7i Router for Shipment on page 197](#)
- [Guidelines for Packing M7i Components for Shipment on page 198](#)

## Locating M7i Component Serial Numbers

---

- [Displaying M7i Router Components and Serial Numbers on page 191](#)
- [CFEB and CFEB-E Serial Number ID Label on page 192](#)
- [PIC Serial Number ID Label on page 193](#)
- [Power Supply Serial Number ID Label on page 194](#)
- [Routing Engine Serial Number ID Label on page 194](#)

## Displaying M7i Router Components and Serial Numbers

Before contacting Juniper Networks, Inc. to request a Return Materials Authorization (RMA), you must find the serial number on the router or component. To list all the router components and their serial numbers, enter the following command-line interface (CLI) command (the first example output is for a CFEB, the second example output is for a CFEB-E):

```
user@host> show chassis hardware
Hardware inventory:
Item          Version  Part number  Serial number  Description
Chassis
Midplane     REV 02   710-008761   CA0213
Power Supply 0 Rev 04   740-008537   PD10302        AC
Power Supply 1 Rev 04   740-008537   PD10290        AC
Routing Engine REV 01   740-008846   1000392782    RE-5.0
CFEB         REV 01   750-009346   CA0189        Internet Processor II
FPC 0
  PIC 1      REV 05   750-005656   BE1873        2x EIA-530
```

```

FPC 1
  PIC 0          REV 01  750-009098  CA0148          2x F/E, 100 BASE-TX

user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number  Description
Chassis
Midplane         REV 05  710-008761  PP1018        M7i Midplane
Power Supply 0   Rev 08  740-008537  UE64425       AC Power Supply
Power Supply 1   Rev 08  740-008537  UE64436       AC Power Supply
Routing Engine   REV 08  740-011202  1000744799    RE-850
CFEB             REV 06  750-023594  PW7856        Enhanced CFEB
FPC 0
  PIC 0          REV 11  750-002971  DC5173        4x OC-3 SONET, MM
  PIC 1          REV 12  750-005633  HN0432        1x CHOC12 IQ SONET, SMIR

  PIC 3          REV 14  750-014895  DE6782        MultiServices 100
FPC 1
  PIC 2          BUILTIN BUILTIN      BUILTIN       1x Tunnel
  PIC 3          REV 09  750-009099  PP8480        1x G/E, 1000 BASE
  Xcvr 0         REV 01  740-011782  PBE2BU8       SFP-SX
Fan Tray
Fan Tray        Rear Fan Tray

```

Most components also have a small rectangular serial number ID label (see [Figure 64 on page 192](#)) attached to the component body.

**Figure 64: Serial Number ID Label**



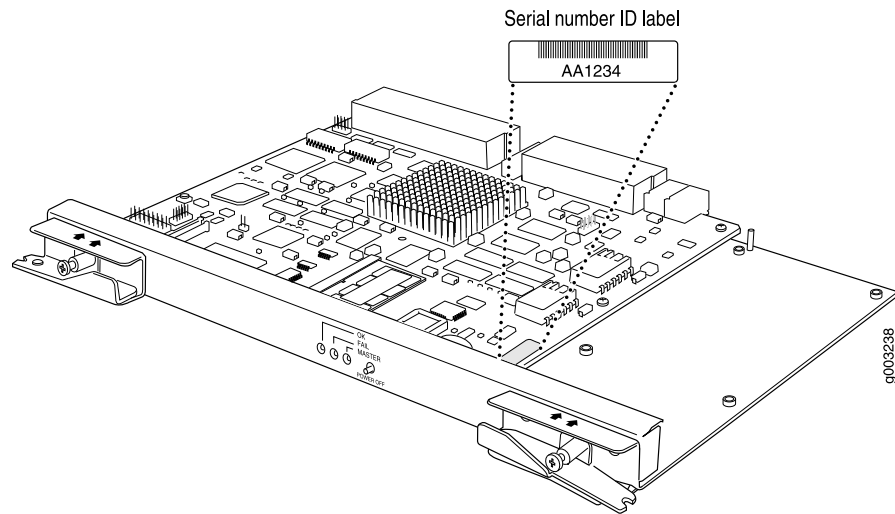
**Related Documentation**

- [CFEB and CFEB-E Serial Number ID Label on page 192](#)
- [PIC Serial Number ID Label on page 193](#)
- [Power Supply Serial Number ID Label on page 194](#)
- [Routing Engine Serial Number ID Label on page 194](#)
- [Contacting Customer Support on page 195](#)

## CFEB and CFEB-E Serial Number ID Label

The serial number ID label on a CFEB or CFEB-E is located on the right side of the top panel, as shown in [Figure 65 on page 193](#).

Figure 65: CFEB or CBEF-E Serial Number ID Label



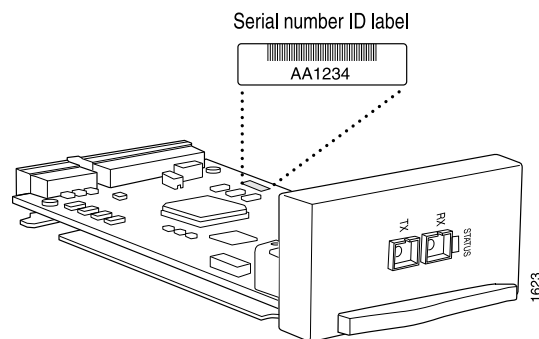
#### Related Documentation

- [M7i Compact Forwarding Engine Board \(CFEB\) and Enhanced Compact Forwarding Engine Board \(CFEB-E\) Description on page 8](#)
- [Maintaining the M7i CFEB and CFEB-E on page 73](#)
- [Troubleshooting the M7i CFEB and CFEB-E on page 84](#)
- [Replacing, Upgrading, and Downgrading the M7i CFEB and CFEB-E on page 90](#)
- [Contacting Customer Support on page 195](#)

#### PIC Serial Number ID Label

The serial number ID label for a PIC is located on the right side of the PIC, as shown in Figure 66 on page 193.

Figure 66: PIC Serial Number ID Label



#### Related Documentation

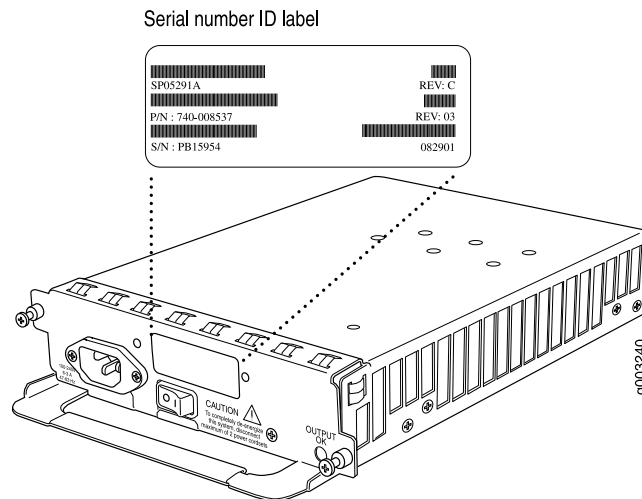
- [M7i PICs Description on page 16](#)
- [Maintaining the M7i FIC and FIC Cables and PICs and PIC Cables on page 74](#)
- [Troubleshooting the M7i FIC or PICs on page 84](#)
- [Replacing an M7i PIC on page 93](#)

- [Contacting Customer Support on page 195](#)

## Power Supply Serial Number ID Label

The serial number ID label on a power supply is located on the faceplate, as shown in [Figure 67 on page 194](#).

**Figure 67: Power Supply Serial Number ID Label**



### Related Documentation

- [M7i Power System Description on page 23](#)
- [Troubleshooting the M7i Power System When the LED on One M7i Power Supply Is Off on page 85](#)
- [Replacing an M7i AC Power Supply on page 111](#)
- [Replacing a DC Power Supply on page 116](#)
- [Contacting Customer Support on page 195](#)

## Routing Engine Serial Number ID Label

The serial number ID label for a Routing Engine is located on the left side near the midplane connector. Some Routing Engines might have more than one serial number. Contact your Juniper Networks support representative if you need assistance in determining which serial number to provide.

### Related Documentation

- [M7i Routing Engine Description on page 18](#)
- [Maintaining the M7i Routing Engine on page 76](#)
- [Replacing the M7i Routing Engine on page 101](#)
- [Contacting Customer Support on page 195](#)



## Contacting Customer Support

---

You can contact Juniper Networks Technical Assistance Center (JTAC) 24 hours a day, 7 days a week in one of the following ways:

- On the Web, using the Case Manager link at:

<http://www.juniper.net/support/>

- By telephone:

From the US and Canada: 1-888-314-JTAC

From all other locations: 1-408-745-9500

If contacting JTAC by phone, enter your 11-digit case number followed by the # key if this is an existing case, or press the \* key to be routed to the next available support engineer.

When requesting support from JTAC by telephone, be prepared to provide the following information:

- Your existing case number, if you have one
- Details of the failure or problem
- Type of activity being performed on the platform when the problem occurred
- Configuration data using one or more of the show commands

### Related Documentation

- [Displaying M7i Router Components and Serial Numbers on page 191](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 195](#)

## Returning a Hardware Component to Juniper Networks, Inc.

---

If a problem cannot be resolved by the JTAC technician, a Return Materials Authorization (RMA) is issued. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.



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

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

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) using the Case Manager link at <http://www.juniper.net/support/>

or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

To return a hardware component:

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

**Related  
Documentation**

- [Displaying M7i Router Components and Serial Numbers on page 191](#)
- [Contacting Customer Support on page 195](#)

---

## Tools and Parts Required to Remove Components from an M7i Router

---

To remove components from the router or the router from a rack, you need the following tools and parts:

- 2.5-mm flat-blade (–) screwdriver, for detaching alarm relay terminal block
- 7/16-in. (11 mm) nut driver
- Blank panels to cover empty slots
- Electrostatic bag or antistatic mat, for each component
- Electrostatic discharge (ESD) grounding wrist strap
- Flat-blade (–) screwdriver
- Mechanical lift, if available
- Phillips (+) screwdrivers, numbers 1 and 2
- Rubber safety cap for fiber-optic interfaces or cable
- Wire cutters

**Related  
Documentation**

- [Contacting Customer Support on page 195](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 195](#)
- [Packing the M7i Router for Shipment on page 197](#)

- [Guidelines for Packing M7i Components for Shipment on page 198](#)

## Packing the M7i Router for Shipment

---

To pack the router for shipment:

1. Retrieve the shipping crate and packing materials in which the router was originally shipped. If you do not have these materials, contact your Juniper Networks representative about approved packaging materials.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Power off the router. See [“Powering Off the M7i Router” on page 64](#).
4. Disconnect power from the router:
  - Unplug the power cord from each power supply. See [“Removing an M7i AC Power Cord” on page 115](#)



**NOTE:** When multiple AC power supplies are installed in the chassis, each AC power cord (one for each power supply) must be unplugged to disconnect power completely from the router.

- See [“Removing an M7i DC Power Cable” on page 120](#).



**NOTE:** All DC power cables must be disconnected to disconnect power completely from the router.

5. Remove the cables that connect to all external devices. For instructions, see [“Replacing the Routing Engine Interface Port Cables” on page 103](#) and [“Removing an M7i PIC” on page 93](#).
6. Remove all Field Replaceable Units (FRUs) from the router.
7. Remove the router from the rack:
  - If you are using a mechanical lift, place the lift platform under the router, unscrew and remove the mounting screws from the rack, and move the router to the shipping crate.
  - If you are not using a mechanical lift
    - If the router weight is fully supported by a shelf or another router, unscrew and remove the mounting screws from the rack. Then, move it to the shipping crate.
    - If the router weight is not fully supported by a shelf or another router, one person should grasp the router while another person unscrews and removes the mounting screws from the rack. You can then move the router to the shipping crate.

8. Place the router in the shipping crate or onto the pallet. If on a pallet, bolt the router to the pallet.
9. Cover the router with an ESD bag and place the packing foam on top of and around the router.
10. Replace the accessory box on top of the packing foam.
11. Securely tape the box closed or place the crate cover over the router.
12. Write the RMA number on the exterior of the box to ensure proper tracking.

**Related Documentation**

- [Contacting Customer Support on page 195](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 195](#)
- [Tools and Parts Required to Remove Components from an M7i Router on page 196](#)
- [Guidelines for Packing M7i Components for Shipment on page 198](#)

## Guidelines for Packing M7i Components for Shipment

---

To pack and ship individual components:

- When you return components, make sure they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in electrostatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.



.....  
**CAUTION: Do not stack any of the router components.**  
.....

**Related Documentation**

- [Contacting Customer Support on page 195](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 195](#)
- [Tools and Parts Required to Remove Components from an M7i Router on page 196](#)
- [Packing the M7i Router for Shipment on page 197](#)

PART 5

# Index

- [Index on page 201](#)



# Index

## Symbols

#, comments in configuration statements.....	xx
( ), in syntax descriptions.....	xx
< >, in syntax descriptions.....	xx
[ ], in configuration statements.....	xx
{ }, in configuration statements.....	xx
(pipe), in syntax descriptions.....	xx

## A

AC power cord	
connection instructions	
during initial installation.....	61
for maintenance or replacement.....	115
disconnection instructions.....	115
specifications.....	168
AC power supply	
cord See AC power cord	
description (hardware and function).....	24, 170
installation instructions.....	113
LED.....	25
maintenance.....	76
removal instructions.....	112
specifications.....	24, 170
troubleshooting.....	85
accessory box	
parts list.....	44
Adaptive Services Module	
description (hardware and function).....	12
agency approvals.....	157
air filter	
routine inspection of.....	73
tools required.....	90
airflow	
path through chassis.....	26
required clearance around chassis for.....	40
alarm	
LEDs (red and yellow) on FIC.....	16
messages, list of.....	80
alarms	
handling by Routing Engine.....	32
altitude, acceptable range.....	165

antistatic mat, using.....	132
application-specific integrated circuit See ASIC.....	3
approvals, agency.....	157
architecture	
overview.....	29
Packet Forwarding Engine.....	30
Routing Engine.....	31
ASIC	
as key element of router design.....	3
on CFEB.....	8
on CFEB-E.....	8
on PIC.....	16
role in forwarding.....	30
ATM	
analyzer, use of.....	74
PIC, wavelength range supported.....	179
attenuation in fiber-optic cable.....	179
auxiliary port (for Routing Engine management)	
cable	
connector pinouts (DB-9).....	186
replacement instructions.....	104
specifications.....	183
description.....	20
tools required.....	90

## B

battery	
environmental compliance.....	161
lithium.....	161
battery handling warning.....	143
braces, in configuration statements.....	xx
brackets	
angle, in syntax descriptions.....	xx
square, in configuration statements.....	xx

## C

cable	
auxiliary or console port (for Routing Engine management)	
connecting during initial installation.....	56
replacing for maintenance.....	104
tools required.....	90
DC power	
connecting .....	61
disconnecting for maintenance.....	120

Ethernet port (for Routing Engine management)	
connecting during initial installation.....	56
replacing for maintenance.....	103
tools required.....	90
fiber-optic	
cleaning instructions for transceivers.....	74
maintenance.....	74
multimode and single-mode.....	179
transmission distance, maximum.....	179
FIC	
connecting during initial installation.....	58
connecting during maintenance.....	97
disconnecting.....	96
specifications.....	177
grounding See grounding cable	
PIC	
connecting during initial installation.....	58
connecting during maintenance.....	97
disconnecting.....	96
maintenance.....	74
specifications.....	177
tools required.....	90
power See AC power cord; power cables	
tools required.....	90
cable management system See installation	
description.....	27
fiber-optic cable, use with.....	74
cables	
fiber-optic	
attenuation.....	179
dispersion.....	179
Canada Class A notice.....	159
Canada electronic emission Class A notice.....	159
carton See shipping carton.....	43
case number, for JTAC.....	195
center-mounting See rack.....	38
CFEB	
ASICs on.....	8
components.....	8
description (hardware and function).....	8
downgrade instructions.....	92
installation instructions	
for maintenance or replacement.....	92
LEDs.....	14
maintenance.....	73
offline button.....	8
removal instructions	
for maintenance or replacement.....	91
serial number.....	192
status, checking.....	73
tools required.....	90
troubleshooting.....	84
upgrade instructions.....	92
CFEB-E	
ASICs on.....	8
components.....	8
description (hardware and function).....	8
downgrade instructions.....	92
installation instructions	
for maintenance or replacement.....	92
LEDs.....	14
maintenance.....	73
offline button.....	8
removal instructions	
for maintenance or replacement.....	91
serial number.....	192
tools required.....	90
troubleshooting.....	84
upgrade instructions.....	92
chassis	
airflow path through.....	26
alarm messages See alarm, messages.....	80
description.....	6
grounding points.....	6
checklist	
site preparation.....	37
chromatic dispersion in fiber-optic cable.....	179
Class A electronic emission notice	
Canada.....	159
European Community.....	159
United States.....	160
cleaning instructions	
fiber-optic transceivers.....	74
clearance, around rack.....	40
CLI	
command	
to display chassis alarm messages.....	80
to display FIC status.....	74
to display PIC status.....	74
to display power supply status.....	76
to display Routing Engine status.....	76
to display serial number.....	191
commands	
show chassis alarms.....	80
show chassis cfeb.....	73
show chassis environment .....	76



- show chassis fpc
    - for PIC status.....74
  - show chassis hardware.....191
  - show chassis routing-engine.....76
  - comments, in configuration statements.....xx
  - Compact Forwarding Engine Board See CFEB.....8
  - CompactFlash card
    - configuration.....107
    - install instructions.....106
    - removal instructions.....106
  - compliance
    - Declaration of Conformity.....159
    - EMC requirements.....159, 160, 161
    - general standards.....157
  - components
    - hot-pluggable See field-replaceable units.....89
    - hot-removable and hot-insertable See
      - field-replaceable units.....89
    - overview.....5
    - packing for shipment.....198
    - Routing Engine.....21
  - configuration
    - CompactFlash card.....107
    - files, storage by Routing Engine.....32
    - Junos OS.....67
  - console port (for Routing Engine management)
    - cable
      - connector pinouts (DB-9).....186
      - replacement instructions.....104
      - specifications.....183
    - description.....20
    - tools required.....90
  - control packets, handling of.....8
  - conventions
    - notice icons.....xix
    - text and syntax.....xx
  - cooling system
    - redundancy.....26
  - copper conductors warning (DC power).....154
  - craft interface
    - routine inspection of.....73
  - crate See shipping carton.....43
  - curly braces, in configuration statements.....xx
  - customer support.....xxi
    - contacting.....195
    - contacting JTAC.....xxi
- D**
- data flow, through Packet Forwarding Engine.....30
  - DB-9 cable connector pinouts (auxiliary and console ports).....186
  - DC power
    - copper conductors warning.....154
    - disconnection warning.....150
    - grounding equipment warning.....148
    - grounding requirements warning.....149
    - power supplies disconnection warning.....150
    - removal warning.....155
    - wiring terminations warning.....156
  - DC power cables
    - disconnection instructions.....120
  - DC power supplies
    - multiple disconnection warning.....150
  - DC power supply
    - description (hardware and function).....25, 174
    - installation instructions.....118
    - LED.....25
    - maintenance.....76
    - removal instructions.....117
    - specifications.....25, 174
    - troubleshooting.....85
  - DC powercables
    - connection instructions.....61
  - Declaration of Conformity.....159
  - dispersion in fiber-optic cable.....179
  - documentation
    - comments on.....xxi
  - downgrade instructions
    - CFEB.....92
    - CFEB-E.....92
- E**
- E1 PIC
    - pinouts for RJ-48 cable.....186
  - earthquakes
    - site preparation for.....38
    - tested toleration for seismic.....165
  - EIA rack standards.....38
  - electrical specifications See specifications
  - electricity
    - safety warnings.....148
  - electronic emission Class A notice
    - Canada.....159
    - European Community.....159
    - United States.....160
  - electrostatic
    - discharge See ESD.....6

electrostatic bag	
using to store components.....	132
EMC (electromagnetic compatibility)	
compliance with requirements.....	161
EMC (EMI)	
compliance with requirements.....	159
standards.....	157
Enhanced Compact Forwarding Engine Board See	
CFEB-E.....	8
environmental specifications.....	165
ESD	
points on chassis.....	6
preventing damage to components by.....	132
Ethernet port (for Routing Engine management)	
cable	
replacement instructions.....	103
specifications.....	183
description.....	20
tools required.....	90
ETSI rack standards.....	38
European Community Class A notice.....	159
exception packets, handling of.....	8
<b>F</b>	
fan tray	
installation instructions	
for maintenance or replacement.....	123
maintenance.....	77
removal instructions	
for maintenance or replacement.....	122
tools required.....	90
troubleshooting.....	86
fiber-optic	
power budget calculation.....	180
fiber-optic cable See cable, fiber-optic	
fiber-optic cable See cable, fiber-optic.....	177
FIC	
cable	
installation instructions.....	97
removal instructions.....	96
specifications.....	177
description (hardware and function).....	15
LEDs	
alarm (red and yellow).....	16
maintenance.....	74
status, checking.....	74
troubleshooting.....	84
fire safety specifications.....	133
Flexible PIC Concentrator.....	18
font conventions.....	xx
FPC.....	18
front-mounting See rack.....	38
<b>G</b>	
grounding (electrical) specifications.....	171
grounding cables	
lugs.....	171
specifications.....	171
grounding equipment warning.....	148
grounding requirements warning.....	149
guidelines	
safety .....	129
guidelines See specifications.....	37
<b>H</b>	
hardware components	
CFEB.....	8
CFEB-E.....	8
FPC.....	18
midplane.....	7
PIC.....	17
power requirements.....	167
Routing Engine.....	18
higher-order mode loss (HOL).....	179
hot-pluggable components See field-replaceable	
units.....	89
humidity (relative), acceptable.....	165
<b>I</b>	
immunity standards.....	157
install instructions	
CompactFlash card.....	106
SDRAM module.....	108
installation instructions	
AC power cord	
during initial installation.....	61
for maintenance or replacement.....	115
AC power supply.....	113
cable, auxiliary or console port (for Routing	
Engine management)	
during initial installation.....	56
for maintenance or replacement.....	104
cable, Ethernet port (for Routing Engine	
management)	
during initial installation.....	56
for maintenance or replacement.....	103

- cable, FIC
  - during initial installation.....58
  - for maintenance or replacement.....97
- cable, PIC
  - during initial installation.....58
  - for maintenance or replacement.....97
- CFEB
  - for maintenance or replacement.....92
- CFEB-E
  - for maintenance or replacement.....92
- chassis.....49
  - tools required.....49
- DC power supply.....118
- fan tray
  - for maintenance or replacement.....123
- PC card.....111
- PC card flash disk.....110
- PIC.....94
- Routing Engine
  - for maintenance or replacement.....102
- SFP.....100
- SFP, FIC
  - during initial installation.....57
- SSD storage drive.....104
- installation warning.....135
- installing
  - overview.....41
  - parts received, verifying.....44
  - unpacking the router.....43
- instructions
  - calculation
    - power requirements.....167
  - cleaning
    - fiber-optic transceivers.....74
  - maintenance *See* maintenance guidelines
    - AC power supply.....76
    - cables, fiber-optic.....74
    - cables, PIC.....74
    - CFEB.....73
    - DC power supply.....76
    - fan tray.....77
    - FIC.....74
    - PIC.....74
    - Routing Engine.....76
  - site preparation.....37
  - unpacking the router.....43
- integrated ASIC
  - role in forwarding.....30
- interface
  - network *See* FIC.....177
  - network *See* PIC or specific PIC name.....177
- J**
- jewelry removal warning.....144
- Junos OS
  - configuration.....67
  - modularity and scalability.....32
  - role in system architecture.....31
- L**
- LEDs
  - AC power supply.....25
  - alarm (red and yellow on craft interface)
    - troubleshooting use.....79
  - alarm (red and yellow on FIC)
    - description.....16
  - CFEB.....14
  - CFEB-E.....14
  - DC power supply.....25
  - PIC.....17
  - Routing Engine.....18
- lightning activity warning.....145
- link loss, calculating.....181
- lithium battery compliance.....161
- load sharing (power supplies).....23
- lugs for grounding cable.....171
- M**
- maintenance guidelines
  - AC power supply.....76
  - cable
    - DC power and grounding.....76
    - fiber-optic.....74
    - PIC.....74
  - CFEB.....73
  - CFEB-E.....73
  - DC power supply.....76
  - fan tray.....77
  - FIC.....74
  - overview.....73
  - PIC.....74
  - Routing Engine.....76
- maintenance warnings.....143
- management
  - port, Ethernet *See* Ethernet port.....20
- manuals
  - comments on.....xxi

midplane		
description.....	7	
energy hazard warning.....	149	
modal dispersion in fiber-optic cable.....	179	
mode loss, higher-order.....	179	
multimode fiber-optic cable See cable, fiber-optic.....	179	
MultiServices Module		
description (hardware and function).....	13	
<b>N</b>		
NEBS standards.....	157	
network cable See cable, fiber-optic; cable, PIC		
network cable See cable, FIC and cable, fiber-optic.....	177	
network cable See cable, PIC and cable, fiber-optic.....	177	
networking interface		
FIC.....	16	
notice icons.....	xix	
notices		
Canada, Class A.....	159	
Declaration of Conformity.....	159	
European Community.....	159	
United States.....	160	
<b>O</b>		
offline button		
CFEB.....	8	
CFEB-E.....	8	
PIC.....	17	
online/offline button on Routing Engine.....	18	
open-frame rack See rack		
operating temperature warning.....	146	
<b>P</b>		
Packet Forwarding Engine		
architectural components.....	30	
ASICs, diagram of.....	30	
data flow through.....	30	
packing box See shipping carton.....	43	
parentheses, in syntax descriptions.....	xx	
PC card		
insertion instructions.....	111	
removal instructions.....	110	
PC card flash disk		
insertion instructions.....	110	
physical specifications.....	163	
PIC.....	16	
ASIC on.....	16	
ATM, wavelength range supported.....	179	
cable		
installation instructions.....	97	
removal instructions.....	96	
specifications.....	177	
tools required.....	90	
components.....	17	
description (hardware and function).....	16	
E1		
pinouts for RJ-48 cable.....	186	
installation instructions.....	94	
LEDs.....	17	
maintenance.....	74	
offline button.....	17	
online/offline.....	15	
removal instructions.....	93	
serial number.....	193	
SONET/SDH		
alarm messages.....	80	
wavelength range supported.....	179	
status, checking.....	74	
T1		
pinouts for RJ-48 cable.....	186	
tools required.....	90	
troubleshooting.....	84	
pinouts		
DB-9 cable connector ports (auxiliary/console).....	186	
RJ-45 Ethernet cable connector port.....	185	
RJ-48 cable.....	186	
port		
auxiliary See auxiliary port.....	20	
console on Routing Engine See console port.....	20	
Ethernet See Ethernet port.....	20	
power		
AC		
connection instructions during initial installation.....	61	
connection instructions for maintenance.....	115	
disconnection instructions.....	115	
budget calculation.....	180	
cables and cords See AC power cords; power and grounding cables		

DC	
connection instructions .....	61
disconnection instructions.....	120
margin calculation.....	181
requirements for hardware components.....	167
supply	
AC See AC power supply	
DC See DC power supply	
system	
load sharing.....	23
redundancy.....	23
specifications.....	167
power cables	
tools required.....	90
power disconnection warning (DC power).....	150
power supply	
serial number.....	194
tools required.....	90
procedures See instructions.....	167
product disposal warning.....	147
<b>Q</b>	
qualified personnel warning.....	130
<b>R</b>	
rack	
clearance around, required.....	40
securing to building.....	38
size and strength required.....	38
standards, EIA and ETSI.....	38
rack mounting warning.....	135
ramp warning.....	139
redundancy	
cooling system.....	26
power system.....	23
relative humidity, acceptable.....	165
removal instructions	
AC power cord.....	115
AC power supply.....	112
cable	
auxiliary or console port (for Routing Engine management).....	104
Ethernet port (for Routing Engine management).....	103
FIC.....	96
PIC.....	96
CFEB	
for maintenance or replacement.....	91
CFEB-E	
for maintenance or replacement.....	91
CompactFlash card.....	106
DC power cables.....	120
DC power supply.....	117
fan tray	
for maintenance or replacement.....	122
PC card.....	110
PIC.....	93
Routing Engine	
for maintenance or replacement.....	101
SDRAM module.....	108
SFP.....	98
replacement instructions See installation instructions, removal instructions.....	73
requirements See specifications.....	37
restricted access warning.....	130
RJ-45 cable connector pinouts.....	185
RJ-48 cable pinouts.....	186
router	
component overview.....	5
packing for shipment.....	197
parts list.....	44
Routing Engine	
alarm handling by.....	32
configuration files, storage.....	32
description.....	21
description (hardware and function).....	18
installation instructions	
for maintenance or replacement.....	102
LEDs.....	18
maintenance.....	76
management ports	
cable specifications.....	183
description.....	20
See also auxiliary port, console port, Ethernet port .....	20
tools required.....	90
management ports See auxiliary port, console port, Ethernet port.....	20
online/offline button.....	18
packet counting.....	32
removal instructions	
for maintenance or replacement.....	101
role in system architecture.....	31
routing	
table maintenance.....	32
serial number.....	194
status indicator lights.....	21

status, displaying.....	76
tools required.....	90
USB port.....	21
<b>S</b>	
safety guidelines	
general.....	129
safety information.....	130
<i>See also</i> warnings	
safety standards.....	157
SDRAM <i>See</i> DIMM module	
SDRAM module	
install instructions.....	108
removal instructions.....	108
seismic (earthquake).....	165
serial number	
CFEB.....	192
CFEB-E.....	192
in output from show chassis hardware	
command.....	191
PIC.....	193
power supply.....	194
Routing Engine.....	194
SFP	
FIC	
installing during initial router	
installation.....	57
installation instructions.....	100
removal instructions.....	98
shipping carton	
unpacking the router.....	43
shipping crate	
repacking.....	197
show chassis alarms command.....	80
show chassis cfeb command.....	73
show chassis environment command.....	76
show chassis fpc command	
for PIC status.....	74
show chassis hardware command.....	191
show chassis routing-engine command.....	76
signal dispersion.....	179
single-mode fiber-optic cable <i>See</i> cable,	
fiber-optic.....	179
site	
environmental specifications.....	165
preparation	
checklist.....	37
instructions.....	37
routine inspection of.....	73
small form-factor pluggable <i>See</i> SFP	
SONET/SDH	
analyzer, use of.....	74
PIC, wavelength range supported.....	179
specifications	
AC power cord.....	168
AC power supply.....	24, 170
cable	
FIC.....	177
grounding.....	171
PIC.....	177
Routing Engine management ports.....	183
clearance around rack.....	40
DC power supply.....	25, 174
electrical.....	168
grounding .....	171
environmental.....	165
fire safety.....	133
physical.....	163
power	
drawn by hardware components.....	167
system.....	167
rack	
connection to building structure.....	38
size and strength.....	38
thermal output.....	165
SSD storage drive	
removing.....	104
standards compliance.....	157
status indicator lights for Routing Engine.....	21
support, technical <i>See</i> technical support	
syntax conventions.....	xx
system	
architecture.....	29
description.....	3
<b>T</b>	
TI PIC	
pinouts for RJ-48 cable.....	186
technical support	
contacting JTAC.....	xxi
telco rack <i>See</i> rack	
temperature, acceptable range.....	165
thermal output.....	165
tolerances.....	165

tools required		
cable maintenance.....	90	
chassis		
installation.....	49	
returning for repair or replacement.....	196	
hardware components		
returning for repair or replacement.....	196	
Packet Forwarding Engine maintenance.....	90	
power system maintenance.....	90	
transmission distances, fiber-optic cable.....	179	
troubleshooting		
CFEB.....	84	
CFEB-E.....	84	
fan tray.....	86	
FIC.....	84	
LEDs		
FIC.....	79	
hardware components.....	80	
PIC.....	84	
power system.....	85	
<b>U</b>		
U (rack unit).....	38	
United States Class A notice.....	160	
unpacking the router		
tools required.....	43	
upgrade instructions		
CFEB.....	92	
CFEB-E.....	92	
<b>W</b>		
warnings		
battery handling.....	143	
copper conductors (DC power).....	154	
electrical.....	148	
grounding.....	149	
grounding equipment .....	148	
installation.....	135	
jewelry removal.....	144	
levels defined.....	127	
lightning activity.....	145	
maintenance and operational.....	143	
midplane energy hazard warning.....	149	
multiple power supplies disconnection.....	150	
operating temperature.....	146	
power disconnection.....	150	
power removal.....	155	
product disposal.....	147	
qualified personnel.....	130	
rack mounting.....	135	
ramp.....	139	
restricted access.....	130	
wiring terminations (DC power).....	156	
wavelength ranges supported by fiber-optic		
cable.....	179	
wiring, terminations warning (DC power).....	156	

