

M40e Multiservice Edge Router

Hardware Guide



Published: 2010-10-28

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.

M40e Multiservice Edge Router Hardware Guide

Copyright © 2010, Juniper Networks, Inc.
All rights reserved. Printed in USA.

Writing: Charissa Fleischer, Elizabeth Gardner, Jerry Isaac, Tony Mauro, Sheila Nolte
Editing: Stella Hackell
Illustration: Faith Bradford
Cover Design: Edmonds Design

Revision History

August 2010—Corporate rebranding.
August 2009—Updated product names and revised sections into modular topics for easier customer access.
14 May 2007—Corrected the DC system current rating and cable lug specification. Updated the DC input voltage operating range, the nominal AC input voltage, AC input voltage range, and AC maximum power output.
30 March 2007—Added pinouts for the BITS input connectors. Updated clearance requirements. Corrected manual titles in references.
20 October 2006— Added European Community EMC Declaration of Conformity.
28 June 2006—Corrected FPC throughput information. Added how much torque to apply when securing the cables to the DC power supplies.
30 May 2006—Added power cable warning in Japanese. Added lithium battery statement. Deleted statements about converting a DC-powered router to AC power.
26 September 2005—Added new FPCs and FPC handling and storage procedures.
25 February 2005—Corrected DC power illustration and replacement procedure.
12 November 2004—Added general updates and revised fuse replacement procedure.
30 June 2003—Corrected and added component information.
18 October 2002—Incorporated updated technical information.
10 April 2002—Updated power information.
14 January 2002—Initial release.

The information in this document is current as of the date listed in the revision history.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. The 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

READ THIS END USER LICENSE AGREEMENT ("AGREEMENT") BEFORE DOWNLOADING, INSTALLING, OR USING THE SOFTWARE. BY DOWNLOADING, INSTALLING, OR USING THE SOFTWARE OR OTHERWISE EXPRESSING YOUR AGREEMENT TO THE TERMS CONTAINED HEREIN, YOU (AS CUSTOMER OR IF YOU ARE NOT THE CUSTOMER, AS A REPRESENTATIVE/AGENT AUTHORIZED TO BIND THE CUSTOMER) CONSENT TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT OR CANNOT AGREE TO THE TERMS CONTAINED HEREIN, THEN (A) DO NOT DOWNLOAD, INSTALL, OR USE THE SOFTWARE, AND (B) YOU MAY CONTACT JUNIPER NETWORKS REGARDING LICENSE TERMS.

1. **The Parties.** The parties to this Agreement are (i) Juniper Networks, Inc. (if the Customer's principal office is located in the Americas) or Juniper Networks (Cayman) Limited (if the Customer's principal office is located outside the Americas) (such applicable entity being referred to herein as "Juniper"), and (ii) the person or organization that originally purchased from Juniper or an authorized Juniper reseller the applicable license(s) for use of the Software ("Customer") (collectively, the "Parties").

2. **The Software.** In this Agreement, "Software" means the program modules and features of the Juniper or Juniper-supplied software, for which Customer has paid the applicable license or support fees to Juniper or an authorized Juniper reseller, or which was embedded by Juniper in equipment which Customer purchased from Juniper or an authorized Juniper reseller. "Software" also includes updates, upgrades and new releases of such software. "Embedded Software" means Software which Juniper has embedded in or loaded onto the Juniper equipment and any updates, upgrades, additions or replacements which are subsequently embedded in or loaded onto the equipment.

3. **License Grant.** Subject to payment of the applicable fees and the limitations and restrictions set forth herein, Juniper grants to Customer a non-exclusive and non-transferable license, without right to sublicense, to use the Software, in executable form only, subject to the following use restrictions:

- a. Customer shall use Embedded Software solely as embedded in, and for execution on, Juniper equipment originally purchased by Customer from Juniper or an authorized Juniper reseller.
- b. Customer shall use the Software on a single hardware chassis having a single processing unit, or as many chassis or processing units for which Customer has paid the applicable license fees; provided, however, with respect to the Steel-Belted Radius or Odyssey Access Client software only, Customer shall use such Software on a single computer containing a single physical random access memory space and containing any number of processors. Use of the Steel-Belted Radius or IMS AAA software on multiple computers or virtual machines (e.g., Solaris zones) requires multiple licenses, regardless of whether such computers or virtualizations are physically contained on a single chassis.
- c. Product purchase documents, paper or electronic user documentation, and/or the particular licenses purchased by Customer may specify limits to Customer's use of the Software. Such limits may restrict use to a maximum number of seats, registered endpoints, concurrent users, sessions, calls, connections, subscribers, clusters, nodes, realms, devices, links, ports or transactions, or require the purchase of separate licenses to use particular features, functionalities, services, applications, operations, or capabilities, or provide throughput, performance, configuration, bandwidth, interface, processing, temporal, or geographical limits. In addition, such limits may restrict the use of the Software to managing certain kinds of networks or require the Software to be used only in conjunction with other specific Software. Customer's use of the Software shall be subject to all such limitations and purchase of all applicable licenses.
- d. For any trial copy of the Software, Customer's right to use the Software expires 30 days after download, installation or use of the Software. Customer may operate the Software after the 30-day trial period only if Customer pays for a license to do so. Customer may not extend or create an additional trial period by re-installing the Software after the 30-day trial period.
- e. The Global Enterprise Edition of the Steel-Belted Radius software may be used by Customer only to manage access to Customer's enterprise network. Specifically, service provider customers are expressly prohibited from using the Global Enterprise Edition of the Steel-Belted Radius software to support any commercial network access services.

The foregoing license is not transferable or assignable by Customer. No license is granted herein to any user who did not originally purchase the applicable license(s) for the Software from Juniper or an authorized Juniper reseller.

4. **Use Prohibitions.** Notwithstanding the foregoing, the license provided herein does not permit the Customer to, and Customer agrees not to and shall not: (a) modify, unbundle, reverse engineer, or create derivative works based on the Software; (b) make unauthorized copies of the Software (except as necessary for backup purposes); (c) rent, sell, transfer, or grant any rights in and to any copy of the Software, in any form, to any third party; (d) remove any proprietary notices, labels, or marks on or in any copy of the Software or any product in which the Software is embedded; (e) distribute any copy of the Software to any third party, including as may be embedded in Juniper equipment sold in the secondhand market; (f) use any 'locked' or key-restricted feature, function, service, application, operation, or capability without first purchasing the applicable license(s) and obtaining a valid key from Juniper, even if such feature, function, service, application, operation, or capability is enabled without a key; (g) distribute any key for the Software provided by Juniper to any third party; (h) use the

Software in any manner that extends or is broader than the uses purchased by Customer from Juniper or an authorized Juniper reseller; (i) use Embedded Software on non-Juniper equipment; (j) use Embedded Software (or make it available for use) on Juniper equipment that the Customer did not originally purchase from Juniper or an authorized Juniper reseller; (k) disclose the results of testing or benchmarking of the Software to any third party without the prior written consent of Juniper; or (l) use the Software in any manner other than as expressly provided herein.

5. **Audit.** Customer shall maintain accurate records as necessary to verify compliance with this Agreement. Upon request by Juniper, Customer shall furnish such records to Juniper and certify its compliance with this Agreement.

6. **Confidentiality.** The Parties agree that aspects of the Software and associated documentation are the confidential property of Juniper. As such, Customer shall exercise all reasonable commercial efforts to maintain the Software and associated documentation in confidence, which at a minimum includes restricting access to the Software to Customer employees and contractors having a need to use the Software for Customer's internal business purposes.

7. **Ownership.** Juniper and Juniper's licensors, respectively, retain ownership of all right, title, and interest (including copyright) in and to the Software, associated documentation, and all copies of the Software. Nothing in this Agreement constitutes a transfer or conveyance of any right, title, or interest in the Software or associated documentation, or a sale of the Software, associated documentation, or copies of the Software.

8. **Warranty, Limitation of Liability, Disclaimer of Warranty.** The warranty applicable to the Software shall be as set forth in the warranty statement that accompanies the Software (the "Warranty Statement"). Nothing in this Agreement shall give rise to any obligation to support the Software. Support services may be purchased separately. Any such support shall be governed by a separate, written support services agreement. TO THE MAXIMUM EXTENT PERMITTED BY LAW, JUNIPER SHALL NOT BE LIABLE FOR ANY LOST PROFITS, LOSS OF DATA, OR COSTS OR PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, OR FOR ANY SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THIS AGREEMENT, THE SOFTWARE, OR ANY JUNIPER OR JUNIPER-SUPPLIED SOFTWARE. IN NO EVENT SHALL JUNIPER BE LIABLE FOR DAMAGES ARISING FROM UNAUTHORIZED OR IMPROPER USE OF ANY JUNIPER OR JUNIPER-SUPPLIED SOFTWARE. EXCEPT AS EXPRESSLY PROVIDED IN THE WARRANTY STATEMENT TO THE EXTENT PERMITTED BY LAW, JUNIPER DISCLAIMS ANY AND ALL WARRANTIES IN AND TO THE SOFTWARE (WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE), INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NONINFRINGEMENT. IN NO EVENT DOES JUNIPER WARRANT THAT THE SOFTWARE, OR ANY EQUIPMENT OR NETWORK RUNNING THE SOFTWARE, WILL OPERATE WITHOUT ERROR OR INTERRUPTION, OR WILL BE FREE OF VULNERABILITY TO INTRUSION OR ATTACK. In no event shall Juniper's or its suppliers' or licensors' liability to Customer, whether in contract, tort (including negligence), breach of warranty, or otherwise, exceed the price paid by Customer for the Software that gave rise to the claim, or if the Software is embedded in another Juniper product, the price paid by Customer for such other product. Customer acknowledges and agrees that Juniper has set its prices and entered into this Agreement in reliance upon the disclaimers of warranty and the limitations of liability set forth herein, that the same reflect an allocation of risk between the Parties (including the risk that a contract remedy may fail of its essential purpose and cause consequential loss), and that the same form an essential basis of the bargain between the Parties.

9. **Termination.** Any breach of this Agreement or failure by Customer to pay any applicable fees due shall result in automatic termination of the license granted herein. Upon such termination, Customer shall destroy or return to Juniper all copies of the Software and related documentation in Customer's possession or control.

10. **Taxes.** All license fees payable under this agreement are exclusive of tax. Customer shall be responsible for paying Taxes arising from the purchase of the license, or importation or use of the Software. If applicable, valid exemption documentation for each taxing jurisdiction shall be provided to Juniper prior to invoicing, and Customer shall promptly notify Juniper if their exemption is revoked or modified. All payments made by Customer shall be net of any applicable withholding tax. Customer will provide reasonable assistance to Juniper in connection with such withholding taxes by promptly: providing Juniper with valid tax receipts and other required documentation showing Customer's payment of any withholding taxes; completing appropriate applications that would reduce the amount of withholding tax to be paid; and notifying and assisting Juniper in any audit or tax proceeding related to transactions hereunder. Customer shall comply with all applicable tax laws and regulations, and Customer will promptly pay or reimburse Juniper for all costs and damages related to any liability incurred by Juniper as a result of Customer's non-compliance or delay with its responsibilities herein. Customer's obligations under this Section shall survive termination or expiration of this Agreement.

11. **Export.** Customer agrees to comply with all applicable export laws and restrictions and regulations of any United States and any applicable foreign agency or authority, and not to export or re-export the Software or any direct product thereof in violation of any such restrictions, laws or regulations, or without all necessary approvals. Customer shall be liable for any such violations. The version of the Software supplied to Customer may contain encryption or other capabilities restricting Customer's ability to export the Software without an export license.

12. **Commercial Computer Software.** The Software is "commercial computer software" and is provided with restricted rights. Use, duplication, or disclosure by the United States government is subject to restrictions set forth in this Agreement and as provided in DFARS 227.7201 through 227.7202-4, FAR 12.212, FAR 27.405(b)(2), FAR 52.227-19, or FAR 52.227-14 (ALT III) as applicable.

13. **Interface Information.** To the extent required by applicable law, and at Customer's written request, Juniper shall provide Customer with the interface information needed to achieve interoperability between the Software and another independently created program, on payment of applicable fee, if any. Customer shall observe strict obligations of confidentiality with respect to such information and shall use such information in compliance with any applicable terms and conditions upon which Juniper makes such information available.

14. **Third Party Software.** Any licensor of Juniper whose software is embedded in the Software and any supplier of Juniper whose products or technology are embedded in (or services are accessed by) the Software shall be a third party beneficiary with respect to this Agreement, and such licensor or vendor shall have the right to enforce this Agreement in its own name as if it were Juniper. In addition, certain third party software may be provided with the Software and is subject to the accompanying license(s), if any, of its respective owner(s). To the extent portions of the Software are distributed under and subject to open source licenses obligating Juniper to make the source code for such portions publicly available (such as the GNU General Public License ("GPL") or the GNU Library General Public License ("LGPL")), Juniper will make such source code portions (including Juniper modifications, as appropriate) available upon request for a period of up to three years from the date of distribution. Such request can be made in writing to Juniper Networks, Inc., 1194 N. Mathilda Ave., Sunnyvale, CA 94089, ATTN: General Counsel. You may obtain a copy of the GPL at <http://www.gnu.org/licenses/gpl.html>, and a copy of the LGPL at <http://www.gnu.org/licenses/lgpl.html>.

15. **Miscellaneous.** This Agreement shall be governed by the laws of the State of California without reference to its conflicts of laws principles. The provisions of the U.N. Convention for the International Sale of Goods shall not apply to this Agreement. For any disputes arising under this Agreement, the Parties hereby consent to the personal and exclusive jurisdiction of, and venue in, the state and federal courts within Santa Clara County, California. This Agreement constitutes the entire and sole agreement between Juniper and the Customer with respect to the Software, and supersedes all prior and contemporaneous agreements relating to the Software, whether oral or written (including any inconsistent terms contained in a purchase order), except that the terms of a separate written agreement executed by an authorized Juniper representative and Customer shall govern to the extent such terms are inconsistent or conflict with terms contained herein. No modification to this Agreement nor any waiver of any rights hereunder shall be effective unless expressly assented to in writing by the party to be charged. If any portion of this Agreement is held invalid, the Parties agree that such invalidity shall not affect the validity of the remainder of this Agreement. This Agreement and associated documentation has been written in the English language, and the Parties agree that the English version will govern. (For Canada: Les parties aux présentes confirment leur volonté que cette convention de même que tous les documents y compris tout avis qui s'y rattache, soient rédigés en langue anglaise. (Translation: The parties confirm that this Agreement and all related documentation is and will be in the English language)).

Table of Contents

	About the Documentation	xxiii
	Junos OS Documentation and Release Notes	xxiii
	Objectives	xxiii
	Audience	xxiv
	Documentation Conventions	xxiv
	Documentation Feedback	xxv
	Requesting Technical Support	xxvi
	Self-Help Online Tools and Resources	xxvi
	Opening a Case with JTAC	xxvii
Part 1	Overview of the M40e Multiservice Edge Router	
Chapter 1	Overview of the M40e Router	3
	M40e System Description	3
	M40e System Redundancy	4
Chapter 2	M40e Hardware Components	7
	M40e Chassis Description	8
	M40e Midplane Description	11
	M40e PICs Description	12
	M40e PIC Slots	13
	M40e PIC Components	13
	M40e Flexible PIC Concentrators (FPCs) Description	13
	M40e FPC Function	14
	M40e FPC Slots	14
	M40e FPC Components	15
	Identifying M40e FPCs	16
	M40e FPCs Supported	17
	M40e Packet Forwarding Engine Clock Generators (PCGs) Description	18
	M40e PCG LEDs	19
	M40e Switching and Forwarding Module (SFM) Description	20
	SFM Slots	21
	SFM Redundancy	21
	SFM Function	21
	SFM Components	22
	M40e SFM LEDs	23
	M40e Host Module Description	23
	M40e Routing Engine Description	26
	M40e Routing Engine 333	27
	M40e Routing Engine 333 LEDs	29
	M40e Routing Engine 600	29

	M40e Routing Engine 600 LEDs	31
	M40e Miscellaneous Control Subsystem (MCS) Description	31
	M40e MCS LEDs	33
	M40e Craft Interface Description	34
	M40e Craft Interface Alarm LEDs and Controls	35
	M40e Craft Interface LCD Description	36
	LCD Idle Mode	36
	LCD Alarm Mode	37
	Host Module LEDs on the M40e Craft Interface	37
	FPC LEDs and Controls on the M40e Craft Interface	38
	M40e Connector Interface Panel (CIP) Description	39
	Routing Engine Management Ports	40
	BITS Input Ports	41
	Alarm Relay Contacts	41
	M40e Power System Description	42
	AC Power Supply	44
	DC Power Supply	45
	Circuit Breaker Box on a DC-Powered Router	47
	Fuses	47
	M40e Cooling System Description	48
	Cooling System Components	48
	Airflow Through the Chassis	48
	M40e Cable Management System Description	49
Chapter 3	Junos OS Overview	51
	M40e Junos OS Overview	51
	M40e Routing Engine Software Components	52
	Routing Protocol Process	52
	IPv4 Routing Protocols	52
	IPv6 Routing Protocols	54
	Routing and Forwarding Tables	54
	Routing Policy	55
	VPNs	56
	Interface Process	56
	Chassis Process	57
	SNMP and MIB II Processes	57
	Management Process	57
	Routing Engine Kernel	57
	Tools for Accessing and Configuring the M40e Software	57
	Tools for Monitoring the M40e Software	58
	M40e Software Upgrades	58
Chapter 4	M40e System Architecture Overview	59
	M40e System Architecture Overview	59
	M40e Packet Forwarding Engine Architecture	60
	Packet Forwarding Engine Components	60
	Data Flow Through the Packet Forwarding Engine	60
	M40e Routing Engine Architecture	61
	Routing Engine Functions	62

Part 2	Setting Up the M40e Router	
Chapter 5	Preparing the Site for M40e Router Installation	67
	M40e Site Preparation Checklist	67
	M40e Rack Requirements	68
	M40e Rack Size and Strength	69
	Spacing of the M40e Mounting Holes	70
	M40e Connection to Building Structure	71
	M40e Clearance Requirements for Airflow and Hardware Maintenance	71
Chapter 6	Unpacking the M40e Router	73
	Tools and Parts Required to Unpack the M40e Router	73
	Unpacking the M40e Router	73
	Verifying the M40e Parts Received	75
Chapter 7	Installing the M40e Router Mounting Hardware	77
	Rack-Mounting M40e Hardware Description	77
	Installing the M40e Mounting Hardware for a Four-Post Rack	78
	Installing Cage Nuts, If Needed	78
	Installing the Mounting Shelf in a Four-Post Rack or Cabinet	78
	Removing the Center-Mounting Brackets	78
	Installing the M40e Mounting Hardware for an Open-Frame Rack	78
	Installing Cage Nuts, If Needed	79
	Installing the Mounting Shelf in an Open-Frame Rack	79
	Removing the Center-Mounting Brackets	79
Chapter 8	Installing the M40e Router Using a Mechanical Lift	81
	Tools and Parts Required to Install the M40e Router Using a Mechanical Lift	81
	Installing the M40e Router Using a Mechanical Lift	81
Chapter 9	Installing the M40e Router Without a Mechanical Lift	83
	Tools and Parts Required to Install the M40e Router Without a Lift	83
	Removing Components from the Chassis Before Installing the M40e Router	
	Without a Lift	83
	Removing the Power Supplies	85
	Removing the Rear Component Cover	85
	Removing the SFMs	86
	Removing the MCSs	87
	Removing the PCGs	88
	Removing the Routing Engines	89
	Removing the Rear Upper Impeller Assembly	90
	Removing the Rear Lower Impeller Assembly	91
	Removing the Fan Tray	91
	Removing the FPCs	92
	Removing the Front Impeller Assembly	94
	Installing the M40e Chassis into the Rack	95
	Reinstalling the M40e Components into the Chassis	97
	Reinstalling the Front Impeller Assembly	98
	Reinstalling the FPCs	99
	Reinstalling the Fan Tray	100
	Reinstalling the Rear Lower Impeller Assembly	101

	Reinstalling the Rear Upper Impeller Assembly	102
	Reinstalling the Routing Engines	102
	Reinstalling the PCGs	103
	Reinstalling the MCSs	104
	Reinstalling the SFMs	105
	Reinstalling the Rear Component Cover	106
	Reinstalling the Power Supplies	106
Chapter 10	Grounding the M40e Router	109
	Connecting the M40e Grounding Cable	109
Chapter 11	Connecting the M40e Router to External Devices	111
	Tools and Parts Required to Connect the M40e Management Devices	111
	Connecting the M40e Router to Management and Alarm Devices	111
	Connecting the M40e Router to a Management Console or Auxiliary Device	113
	Connecting the M40e Router to a Network for Out-of-Band Management	114
	Connecting the M40e Router to an External Alarm-Reporting Device	115
	Connecting the M40e PIC Cables	116
Chapter 12	Providing Power to the M40e Router	119
	Connecting AC Power to the M40e Router	119
	Connecting DC Power to the M40e Router	120
Chapter 13	Configuring Junos OS	123
	Initially Configuring the M40e Router	123
Part 3	Hardware Maintenance, Troubleshooting, and Replacement Procedures	
Chapter 14	Maintaining M40e Router Hardware Components	129
	Routine Maintenance Procedures for the M40e Router	129
	Maintaining the M40e Air Filter	130
	Maintaining the M40e Fan Tray and Impellers	130
	Maintaining the M40e Host Module Components	131
	Maintaining M40e FPCs	132
	Holding and Storing M40e FPCs	133
	Holding an M40e FPC Overview	133
	Holding an M40e FPC Vertically	136
	Holding an M40e FPC Horizontally	137
	Storing an M40e FPC	138
	Maintaining M40e PICs and PIC Cables	139
	Maintaining the M40e PCGs	141
	Maintaining M40e SFMs	141
	Maintaining M40e Power Supplies	142

Chapter 15	Troubleshooting M40e Hardware Components	145
	Overview of Troubleshooting Resources for the M40e Router	145
	M40e Router Troubleshooting Resources	145
	M40e Router LED Overview	146
	Craft Interface LEDs	146
	Hardware Components LEDs	147
	M40e Chassis and Interface Alarm Messages	147
	Using Blown Fuse Indicators to Troubleshoot the M40e Router	149
	Troubleshooting the Cooling System on the M40e Router	150
	Troubleshooting FPCs on the M40e Router	152
	Troubleshooting PICs on the M40e Router	153
	Troubleshooting the M40e Power System When All LEDs on Both Supplies Are Off	155
	Troubleshooting the M40e Power System When All LEDs on One Supply Are Off or LED States Are Not Correct	155
Chapter 16	Replacing M40e Hardware Components	157
	M40e Field-Replaceable Units (FRUs)	157
	Tools and Parts Required to Replace M40e Hardware Components	158
	Replacing the CIP on the M40e Router	160
	Removing the M40e CIP	160
	Installing the M40e CIP	161
	Replacing Connections to the M40e Routing Engine Interface Ports	163
	Replacing the M40e Management Ethernet Cable	163
	Replacing the M40e Console or Auxiliary Cable	166
	Replacing Alarm Relay Wires on the M40e Router	167
	Replacing the M40e Cooling System Components	167
	Replacing the Fan Tray on an M40e Router	168
	Removing the Fan Tray on an M40e Router	168
	Installing the M40e Fan Tray	169
	Replacing the M40e Air Filter	170
	Removing the M40e Air Filter	170
	Installing the M40e Air Filter	171
	Replacing the M40e Front Impeller Assembly	172
	Removing the M40e Front Impeller Assembly	172
	Removing the M40e Craft Interface from the Front Impeller Assembly	173
	Installing the M40e Craft Interface on the Front Impeller Assembly	174
	Installing the M40e Front Impeller Assembly	175
	Replacing the M40e Rear Lower Impeller Assembly	175
	Removing the M40e Rear Lower Impeller Assembly	176
	Installing the M40e Rear Lower Impeller Assembly	176

Replacing the M40e Rear Upper Impeller Assembly	177
Removing the M40e Rear Upper Impeller Assembly	178
Installing the M40e Rear Upper Impeller Assembly	178
Replacing the M40e Host Module Components	179
Replacing an MCS in an M40e Router	179
Removing an MCS from an M40e Router	180
Installing an MCS in an M40e Router	181
Removing and Inserting the PC Card in an M40e Router	182
Removing the M40e PC Card	183
Inserting the M40e PC Card	184
Replacing a DIMM Module in M40e Routing Engines	185
Removing a M40e DIMM Module	185
Installing a M40e DIMM Module	186
Replacing a Routing Engine in an M40e Router	186
Removing a Routing Engine from an M40e Router	187
Installing a Routing Engine in an M40e Router	189
Replacing the M40e Packet Forwarding Engine Components	190
Replacing an FPC in an M40e Router	191
Removing an FPC in an M40e Router	191
Installing an FPC in an M40e Router	193
Replacing a PCG in an M40e Router	196
Removing a PCG in an M40e Router	196
Installing a PCG in an M40e Router	197
Replacing a PIC in an M40e Router	198
Removing a PIC in an M40e Router	199
Installing a PIC in an M40e Router	201
Replacing PIC Cables in an M40e Router	203
Removing a PIC Cable from an M40e Router	203
Installing a PIC Cable in an M40e Router	204
Replacing an SFM in an M40e Router	206
Removing an SFM in an M40e Router	206
Installing an SFM in an M40e Router	207
Replacing an SFP in an M40e PIC	208
Removing an SFP from an M40e PIC	208
Installing an SFP in an M40e PIC	210
Replacing M40e Power System Components	211
Replacing an M40e AC Power Supply	211
Removing an M40e AC Power Supply	212
Installing an M40e AC Power Supply	213
Replacing an AC Power Cord on an M40e Power Supply	215
Replacing an M40e DC Power Supply	215
Removing an M40e DC Power Supply	216
Installing an M40e DC Power Supply	217
Replacing the Circuit Breaker Box on a DC-Powered M40e Router	218
Removing the Circuit Breaker Box from a DC-Powered M40e Router	219
Installing the Circuit Breaker Box in a DC-Powered M40e Router	220
Replacing a Fuse on an M40e Router	222

Part 4

Appendixes

Appendix A

Safety and Regulatory Compliance Information for the M40e Router . . . 227

Definition of Safety Warning Levels 227

Safety Guidelines and Warnings for the M40e Router 229

M40e General Safety Guidelines and Warnings 229

General Safety Guidelines and Warnings for M Series, MX Series, and
T Series Routers 229Qualified Personnel Warning for M Series, MX Series, and T Series
Routers 230Restricted Access Area Warning for M Series, MX Series, and T Series
Routers 231Preventing Electrostatic Discharge Damage to an M Series, MX Series,
or T Series Router 232

Fire Safety Requirements for the M40e Router 233

Fire Safety Requirements for M Series, MX Series, and T Series
Routers 233

M40e Router Installation Safety Guidelines and Warnings 234

M40e Chassis Lifting Guidelines 235

Installation Instructions Power Warning for M Series, MX Series, and T
Series Routers 235Rack-Mounting Requirements and Warnings for M Series, MX Series,
and T Series Routers 236

Ramp Warning for M Series, MX Series, and T Series Routers 240

Laser and LED Safety Guidelines and Warnings for the M40e Router 240

General Laser Safety Guidelines for M Series and T Series Routers . . . 240

Class 1 Laser Product Warning for M Series, MX Series, and T Series
Routers 241Class 1 LED Product Warning for M Series, MX Series, and T Series
Routers 242

Laser Beam Warning for M Series, MX Series, and T Series Routers . . . 242

Radiation from Open Port Apertures Warning for M Series, MX Series,
and T Series Routers 243Maintenance and Operational Safety Guidelines and Warnings for the M40e
Router 244Battery Handling Warning for M Series, MX Series, and T Series
Routers 244Jewelry Removal Warning for M Series, MX Series, and T Series
Routers 245Lightning Activity Warning for M Series, MX Series, and T Series
Routers 247Operating Temperature Warning for M Series, MX Series, and T Series
Routers 248Product Disposal Warning for M Series, MX Series, and T Series
Routers 249

	Electrical Safety Guidelines and Warnings for the M40e Router	250
	In Case of an Electrical Accident	250
	General Electrical Safety Guidelines and Warnings Electrical Codes for the M40e Router	250
	M40e AC Power Electrical Safety Guidelines and Warnings	256
	M40e DC Power Electrical Safety Guidelines and Warnings	256
	Agency Approvals and Compliance Statements for the M40e Router	264
	Agency Approvals for M40e Routers	264
	Compliance Statements for NEBS for M Series, MX Series, and T Series Routers	266
	Compliance Statements for EMC Requirements for the M40e Router	266
	Canada	266
	European Community	266
	Declaration of Conformity	267
	Japan	267
	United States	267
	Compliance Statements for Environmental Requirements for M Series, MX Series, and T Series Routers	268
	Compliance Statements for Acoustic Noise for the M40e Router	268
Appendix B	M40e Router Physical Specifications	269
	M40e Router Physical Specifications	269
Appendix C	M40e Router Environmental Specifications	271
	M40e Router Environmental Specifications	271
Appendix D	Power Guidelines, Requirements, and Specifications for the M40e Router	273
	Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers	273
	M40e Router Power Requirements	274
	M40e Chassis Grounding Specifications	276
	M40e AC Power, Connection, and Power Cord Specifications	277
	M40e DC Power, Connection, and Cable Specifications	279
	M40e DC Power Distribution	280
Appendix E	Cable and Wire Guidelines and Specifications for the M40e Router	283
	Fiber-Optic Specifications and Guidelines for the M40e Router	283
	Fiber-Optic and Network Cable Specifications for the M40e Router	283
	Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M40e Router	284
	Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers	284
	Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers	285
	Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers	286
	Routing Engine Interface Cable and Wire Specifications for the M40e Router	288

Appendix F	M40e Cable Connector Pinouts	289
	RJ-45 Connector Pinouts for the M40e Routing Engine MGMT Port	289
	DB-9 Connector Pinouts for the M40e Routing Engine AUX/MODEM and CONSOLE Ports	290
	RJ-48 Cable Pinouts for E1 and T1 PICs on the M40e Router	290
	DB-9 Connector Pinouts for the M40e CIP BITS Input Ports	293
	M40e X.21 and V.35 Cable Pinouts for EIA-530 PIC	294
	M40e Fast Ethernet PIC 48-port Cable Pinouts	296
Appendix G	Contacting Customer Support and Returning M40e Hardware	299
	Locating M40e Component Serial Numbers	299
	Displaying M40e Router Components and Serial Numbers	299
	M40e AC Power Supply Serial Number ID Label	300
	M40e CIP Serial Number ID Label	301
	M40e Craft Interface Serial Number ID Label	302
	M40e DC Power Supply Serial Number ID Label	303
	M40e FPC Serial Number ID Label	303
	M40e MCS Serial Number ID Label	304
	M40e PCG Serial Number ID Label	305
	M40e PIC Serial Number ID Label	305
	M40e Routing Engine Serial Number ID Label	306
	M40e SFM Serial Number ID Label	306
	Contacting Customer Support	307
	Returning a Hardware Component to Juniper Networks, Inc.	308
	Tools and Parts Required to Remove Components from an M40e Router	309
	Packing the M40e Router for Shipment	309
	Packing M40e Components for Shipment	310
Part 5	Index	
	Index	315

List of Figures

Part 1

Chapter 2

Overview of the M40e Multiservice Edge Router

M40e Hardware Components 7

Figure 1: Front of M40e Chassis	9
Figure 2: Rear of M40e Chassis with Component Cover in Place	10
Figure 3: Rear of M40e Chassis with Component Cover Removed	10
Figure 4: M40e Midplane	12
Figure 5: Front of M40e Chassis with Four-PIC FPC Installed in Slot FPC0	15
Figure 6: M40e FPC	16
Figure 7: M40e Enhanced Plus FPCs	17
Figure 8: M40e Packet Forwarding Engine Clock Generator	19
Figure 9: M40e and M160 Router PCG Location	19
Figure 10: M40e Packet Forwarding Engine Clock Generator	20
Figure 11: M40e Switching and Forwarding Module	20
Figure 12: M40e Switching and Forwarding Module	23
Figure 13: M40e and M160 Router Host Module Location	25
Figure 14: M40e and M160 Router Redundant Host Modules	26
Figure 15: M40e Router Routing Engine Location	27
Figure 16: M40e Routing Engine 333	29
Figure 17: M40e Routing Engine 600	31
Figure 18: M40e Miscellaneous Control Subsystem	31
Figure 19: M40e and M160 Router MCS Location	33
Figure 20: M40e Miscellaneous Control Subsystem	33
Figure 21: M40e Craft Interface	34
Figure 22: LCD in Idle Mode	36
Figure 23: M40e LCD in Alarm Mode	37
Figure 24: Connector Interface Panel	39
Figure 25: M40e and M160 Router CIP Location	40
Figure 26: M40e Routing Engine Interface Ports for Host Module 0	41
Figure 27: M40e Alarm Relay Contacts and BITS Input Ports	42
Figure 28: M40e Router Power Supplies	43
Figure 29: M40e AC Power Supply	44
Figure 30: M40e DC Power Supply	46
Figure 31: M40e Circuit Breaker Box	47
Figure 32: Airflow Through the M40e Chassis	49
Figure 33: M40e Cable Management System	49

Chapter 4

M40e System Architecture Overview 59

Figure 34: System Architecture	59
Figure 35: Packet Forwarding Engine Components and Data Flow	61
Figure 36: M40e Routing Engine Architecture	62

	Figure 37: Control Packet Handling for Routing and Forwarding Table Updates	63
Part 2	Setting Up the M40e Router	
Chapter 5	Preparing the Site for M40e Router Installation	67
	Figure 38: Typical Open-Frame Rack	70
	Figure 39: M40e Chassis Dimensions and Clearance Requirements	72
Chapter 6	Unpacking the M40e Router	73
	Figure 40: Unpacking the Router	75
Chapter 9	Installing the M40e Router Without a Mechanical Lift	83
	Figure 41: Removing a M40e Power Supply	85
	Figure 42: Removing an M40e SFM	87
	Figure 43: Removing an M40e MCS	88
	Figure 44: Removing a M40e PCG	89
	Figure 45: Removing a M40e Routing Engine	90
	Figure 46: Removing the M40e Rear Upper Impeller Assembly	90
	Figure 47: Removing the M40e Rear Lower Impeller Assembly	91
	Figure 48: Removing the M40e Fan Tray	92
	Figure 49: Removing an M40e FPC	94
	Figure 50: Removing the M40e Front Impeller Assembly	95
	Figure 51: Attaching the Lifting Handle	96
	Figure 52: Installing the Chassis in a Rack	97
	Figure 53: Reinstalling the M40e Front Impeller Assembly	99
	Figure 54: Reinstalling an M40e FPC	100
	Figure 55: Reinstalling the Fan Tray	101
	Figure 56: Reinstalling the Rear Lower Impeller Assembly	101
	Figure 57: Reinstalling the Rear Upper Impeller Assembly	102
	Figure 58: Reinstalling a Routing Engine	103
	Figure 59: Reinstalling a PCG	104
	Figure 60: Reinstalling an MCS	105
	Figure 61: Reinstalling an SFM	106
	Figure 62: Reinstalling a Power Supply	107
Chapter 10	Grounding the M40e Router	109
	Figure 63: Connecting the M40e Grounding Cable	110
Chapter 11	Connecting the M40e Router to External Devices	111
	Figure 64: Routing Engine Management Ports and Alarm Relay Contacts	112
	Figure 65: Console and Auxiliary Serial Port Connector	113
	Figure 66: Routing Engine Management Ports and Alarm Relay Contacts	114
	Figure 67: Routing Engine Ethernet Cable Connector	115
	Figure 68: Routing Engine Management Ports and Alarm Relay Contacts	115
	Figure 69: Attaching Cable to an M40e PIC	117
Chapter 12	Providing Power to the M40e Router	119
	Figure 70: Connecting DC Power Cables	122

Part 3	Hardware Maintenance, Troubleshooting, and Replacement Procedures	
Chapter 14	Maintaining M40e Router Hardware Components	129
	Figure 71: Do Not Grasp the Connector Edge	134
	Figure 72: Do Not Carry an FPC with Only One Hand	135
	Figure 73: Do Not Rest the FPC on an Edge	136
	Figure 74: Holding an FPC Vertically	137
	Figure 75: Holding an FPC Horizontally	138
	Figure 76: Do Not Stack FPCs	139
Chapter 15	Troubleshooting M40e Hardware Components	145
	Figure 77: Fuse Locations in the Fuse Box	150
Chapter 16	Replacing M40e Hardware Components	157
	Figure 78: Removing the M40e CIP	161
	Figure 79: Installing the M40e CIP	162
	Figure 80: Routing Engine Interface Ports and Alarm Relay Contacts	164
	Figure 81: Ethernet Cable Connectors	165
	Figure 82: Routing Engine Interface Ports and Alarm Relay Contacts	166
	Figure 83: Removing the Fan Tray	169
	Figure 84: Installing the Fan Tray	170
	Figure 85: Removing the Air Filter	171
	Figure 86: Installing the Air Filter	171
	Figure 87: Removing the Front Impeller Assembly	173
	Figure 88: Removing the Screws Along the Top Front Edge of the Front Impeller Assembly	174
	Figure 89: Removing the Craft Interface	174
	Figure 90: Installing the M40e Front Impeller Assembly	175
	Figure 91: Removing the Rear Lower Impeller Assembly	176
	Figure 92: Installing the Rear Lower Impeller Assembly	177
	Figure 93: Removing the Rear Upper Impeller Assembly	178
	Figure 94: Installing the Rear Upper Impeller Assembly	179
	Figure 95: Rear of M40e Chassis with Component Cover Removed	180
	Figure 96: Removing an MCS from an M40e Router	181
	Figure 97: Installing an MCS in an M40e Router	182
	Figure 98: Removing the PC Card	184
	Figure 99: Inserting the PC Card	185
	Figure 100: Installing the DIMM Module	186
	Figure 101: Rear of M40e Chassis with Component Cover Removed	187
	Figure 102: Removing a Routing Engine from an M40e Router	189
	Figure 103: Installing a Routing Engine in an M40e Router	190
	Figure 104: Removing an FPC from an M40e Router	193
	Figure 105: Installing an FPC in an M40e Router	195
	Figure 106: Connecting Fiber-Optic Cable to a PIC in an M40e Router	196
	Figure 107: Removing a PCG	197
	Figure 108: Installing a PCG	198
	Figure 109: Removing a PIC from an M40e Router	200
	Figure 110: Installing a PIC from an M40e Router	202
	Figure 111: Connecting Fiber-Optic Cable to a PIC in an M40e Router	203

Figure 112: Connecting Fiber-Optic Cable to a PIC	205
Figure 113: Removing an SFM	207
Figure 114: Installing an SFM	208
Figure 115: Small Form-Factor Pluggable (SFP)	209
Figure 116: Small Form-Factor Pluggable (SFP)	211
Figure 117: Removing an AC Power Supply	213
Figure 118: Rear of AC Power Supply Showing Midplane Connectors	213
Figure 119: Installing an AC Power Supply	214
Figure 120: Removing a DC Power Supply	217
Figure 121: Rear of DC Power Supply Showing Midplane Connectors	217
Figure 122: Installing a DC Power Supply	218
Figure 123: Removing the Circuit Breaker Box	220
Figure 124: Installing the Circuit Breaker Box	222
Figure 125: Fuse Locations in the Fuse Box	223

Part 4

Appendixes

Appendix A	Safety and Regulatory Compliance Information for the M40e Router . . .	227
	Figure 126: Placing a Component into an Electrostatic Bag	233
	Figure 127: M40e Declaration of Conformity	267
Appendix D	Power Guidelines, Requirements, and Specifications for the M40e Router	273
	Figure 128: M40e DC Power and Grounding Cable Lug	277
	Figure 129: AC Plug Types	279
	Figure 130: M40e DC Power and Grounding Cable Connections	281
Appendix F	M40e Cable Connector Pinouts	289
	Figure 131: EIA-530 PIC	294
	Figure 132: Fast Ethernet 48-port PIC	296
	Figure 133: VHDCI to RJ-21 Cable	297
Appendix G	Contacting Customer Support and Returning M40e Hardware	299
	Figure 134: Serial Number ID Label	300
	Figure 135: AC Power Supply Serial Number ID Label	301
	Figure 136: CIP Serial Number ID Label	302
	Figure 137: Craft Interface Serial Number ID Label	302
	Figure 138: DC Power Supply Serial Number ID Label	303
	Figure 139: FPC Serial Number ID Label	304
	Figure 140: MCS Serial Number ID Label	304
	Figure 141: PCG Serial Number ID Label	305
	Figure 142: PIC Serial Number ID Label	305
	Figure 143: Routing Engine Serial Number ID Label	306
	Figure 144: SFM Serial Number ID Label	307

List of Tables

	About the Documentation	xxiii
	Table 1: Notice Icons	xxiv
	Table 2: Text and Syntax Conventions	xxiv
Part 1	Overview of the M40e Multiservice Edge Router	
Chapter 2	M40e Hardware Components	7
	Table 3: FPCs Supported by the M40e Router	17
	Table 4: States for M40e PCG LEDs	20
	Table 5: States for M40e SFM LEDs	23
	Table 6: States for M40e MCS LEDs	34
	Table 7: Alarm LEDs and Alarm Cutoff/Lamp Test Button	36
	Table 8: States for M40e Host Module LEDs	38
	Table 9: States for M40e FPC LEDs	38
	Table 10: States for M40e AC Power Supply LED	44
	Table 11: Electrical Specifications for AC Power Supply	45
	Table 12: States for M40e DC Power Supply LEDs	46
	Table 13: M40e Electrical Specifications for DC Power Supply	46
Part 2	Setting Up the M40e Router	
Chapter 5	Preparing the Site for M40e Router Installation	67
	Table 14: Site Preparation Checklist	67
	Table 15: Spacing of Holes on M40e Front Support Post and Center-Mounting Bracket	70
Chapter 6	Unpacking the M40e Router	73
	Table 16: Generic Inventory of Router Components Installed in Chassis	75
Chapter 9	Installing the M40e Router Without a Mechanical Lift	83
	Table 17: M40e FPC Removal Checklist	92
Part 3	Hardware Maintenance, Troubleshooting, and Replacement Procedures	
Chapter 15	Troubleshooting M40e Hardware Components	145
	Table 18: M40e Chassis Alarm Messages	148
	Table 19: M40e SONET/SDH Interface Alarm Messages	148
	Table 20: SONET/SDH Interface Alarm Messages	154
Chapter 16	Replacing M40e Hardware Components	157
	Table 21: M40e Field-Replaceable Units	158

	Table 22: Tools and Parts Required to Replace M40e Hardware Components	158
	Table 23: M40e Fuse Specifications	224
Part 4	Appendixes	
Appendix B	M40e Router Physical Specifications	269
	Table 24: M40e Chassis Physical Specifications	269
	Table 25: M40e Component Weights	269
Appendix C	M40e Router Environmental Specifications	271
	Table 26: M40e Router Environmental Tolerances	271
Appendix D	Power Guidelines, Requirements, and Specifications for the M40e Router	273
	Table 27: M40e Power System Electrical Specifications	274
	Table 28: M40e Component Power Requirements	275
	Table 29: M40e AC Power Cord Specifications	278
	Table 30: Power Cable Specifications	279
Appendix E	Cable and Wire Guidelines and Specifications for the M40e Router	283
	Table 31: Estimated Values for Factors Causing Link Loss	286
	Table 32: M40e Routing Engine Interface Cable and Wire Specifications	288
Appendix F	M40e Cable Connector Pinouts	289
	Table 33: RJ-45 Connector Pinout	289
	Table 34: DB-9 Connector Pinout	290
	Table 35: RJ-48 Connector to RJ-48 Connector (Straight) Pinout for the Router	291
	Table 36: RJ-48 Connector to RJ-48 Connector (Crossover) Pinout for the Router	291
	Table 37: RJ-48 Connector to DB-15 Connector (Straight) Pinout for the Router	292
	Table 38: RJ-48 Connector to DB-15 Connector (Crossover) Pinout for the Router	292
	Table 39: DB-9 Connector Pinout for the M40e Router	293
	Table 40: DB-25 Connector to V.35 Connector Pinout for the M40e Router	294
	Table 41: DB-25 Connector to DB-15 (X.21) Connector Pinout for the M40e Router	295
	Table 42: RJ-21 Pin Assignments for the M40e Router	297

About the Documentation

- Junos OS Documentation and Release Notes on page xxiii
- Objectives on page xxiii
- Audience on page xxiv
- Documentation Conventions on page xxiv
- Documentation Feedback on page xxv
- Requesting Technical Support on page xxvi

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/>.

Objectives

This documentation describes hardware components, installation, basic configuration, and basic troubleshooting procedures for the Juniper Networks M40e Multiservice Edge Router. It explains how to prepare your site for router installation, unpack and install the hardware, power on the router, perform initial software configuration, and perform routine maintenance. After completing the installation and basic configuration procedures covered in this documentation, see the Junos OS configuration guides for information about further Junos OS configuration.



NOTE: For additional information about Juniper Networks routers and the Physical Interface Cards (PICs) they support—either corrections to or information that might have been omitted from this guide—see the hardware release notes at <http://www.juniper.net/>.

Audience

This documentation is designed for network administrators who are installing and maintaining a Juniper Networks router or preparing a site for router installation. To use the documentation, you need a broad understanding of networks in general, the Internet in particular, networking principles, and network configuration. Any detailed discussion of these concepts is beyond the scope of this hardware documentation.

Documentation Conventions

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

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the configure command: user@host> configure
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> show chassis alarms No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces important new terms. Identifies book names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos System Basics Configuration Guide</i> RFC 1997, <i>BGP Communities Attribute</i>

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

Convention	Description	Examples
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i>
Text like this	Represents names of configuration statements, commands, files, and directories; IP addresses; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level. The console port is labeled CONSOLE.
< > (angle brackets)	Enclose optional keywords or variables.	stub <default-metric <i>metric</i> >;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast <i>(string1 string2 string3)</i>
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Enclose a variable for which you can substitute one or more values.	community name members [<i>community-ids</i>]
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.	
J-Web GUI Conventions		
Bold text like this	Represents J-Web graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> In the Logical Interfaces box, select All Interfaces. To cancel the configuration, click Cancel.
> (bold right angle bracket)	Separates levels in a hierarchy of J-Web selections.	In the configuration editor hierarchy, select Protocols>Ospf .

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can send your comments to 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 M40e Multiservice Edge Router

- Overview of the M40e Router on page 3
- M40e Hardware Components on page 7
- Junos OS Overview on page 51
- M40e System Architecture Overview on page 59

CHAPTER 1

Overview of the M40e Router

- M40e System Description on page 3
- M40e System Redundancy on page 4

M40e System Description

The M40e Multiservice Edge Router is a complete routing system that provides SONET/SDH, ATM, Ethernet, and channelized interfaces for large networks and network applications, such as those supported by Internet service providers (ISPs).

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 40 million packets per second (Mpps) for all packet sizes. The router's maximum aggregate throughput is 3.2 gigabits per second (Gbps) full duplex per FPC. Inserting a combination of PICs with an aggregate higher than the maximum throughput is supported, but constitutes oversubscription of the FPC.

The router accommodates up to eight Flexible PIC Concentrators (FPCs), which can each be configured with a variety of network media types, altogether providing up to 32 OC12/STM4, 32 Gigabit Ethernet, or eight OC48/STM16 ports per system. The router height of 35 in. (89 cm) enables stacked installation of two M40e systems in a single floor-to-ceiling rack, for increased port density per unit of floor space.

Related Documentation

- M40e System Redundancy on page 4
- M40e Router Physical Specifications on page 269
- M40e Router Power Requirements on page 274
- M40e System Architecture Overview on page 59

M40e System Redundancy

The M40e Multiservice Edge Router is designed so that no single point of failure can cause the entire system to fail. The following hardware components contribute to system redundancy:

- **Cooling system**—When the temperature inside the router is below the acceptable maximum, the cooling system's components function at less than full speed. If the temperature becomes excessive—for example, because a cooling system component is removed—the MCS automatically increases the speed of the remaining components to reduce the temperature. The cooling system can function at the higher speed indefinitely. For more information, see “M40e Cooling System Description” on page 48.
- **FPC**—Each FPC has two I/O Manager ASICs, one that interacts with the active SFM and the other in standby mode. If two SFMs are installed and the active one stops functioning, the standby I/O Manager ASIC automatically becomes active when the standby SFM boots and becomes the active SFM. For more information, see “M40e Flexible PIC Concentrators (FPCs) Description” on page 13.
- **Host module (Routing Engine and MCS functioning together)**—The router can have one or two host modules. If two host modules are installed, one (the master) is active and the other is in standby mode. If the master host module (or either of its components) is removed from the chassis, the standby host module becomes active. The Routing Engine and MCS must reside in adjacent slots and be fully operational for the host module to function. For more information, see “M40e Host Module Description” on page 23.
- **PCG**—The router has two PCGs. Both PCGs send their clock signals to the other Packet Forwarding Engine components, along with a signal that indicates which clock is the master. If one PCG fails, the other PCG becomes the master system clock. For more information, see “M40e Packet Forwarding Engine Clock Generators (PCGs) Description” on page 18.
- **Power supply**—The router has two load-sharing, fully redundant power supplies to distribute either AC or DC power to the other components. If one power supply fails, the second power supply can provide full power to the router's components indefinitely. For more information, see “M40e Power System Description” on page 42.
- **SFM**—The router can have one or two SFMs. If two SFMs are installed, one is active and the other is in standby mode. If the active SFM fails or is removed from the chassis, the standby SFM automatically boots and becomes the active SFM. For more information, see “M40e Switching and Forwarding Module (SFM) Description” on page 20.

In the base configuration, the router has one host module and SFM, and multiple PCGs, power supplies, and cooling system components.

- Related Documentation**
- M40e Router Physical Specifications on page 269
 - M40e Router Power Requirements on page 274
 - M40e System Description on page 3
 - M40e System Architecture Overview on page 59

CHAPTER 2

M40e Hardware Components

- M40e Chassis Description on page 8
- M40e Midplane Description on page 11
- M40e PICs Description on page 12
- M40e Flexible PIC Concentrators (FPCs) Description on page 13
- M40e FPCs Supported on page 17
- M40e Packet Forwarding Engine Clock Generators (PCGs) Description on page 18
- M40e PCG LEDs on page 19
- M40e Switching and Forwarding Module (SFM) Description on page 20
- M40e SFM LEDs on page 23
- M40e Host Module Description on page 23
- M40e Routing Engine Description on page 26
- M40e Routing Engine 333 on page 27
- M40e Routing Engine 333 LEDs on page 29
- M40e Routing Engine 600 on page 29
- M40e Routing Engine 600 LEDs on page 31
- M40e Miscellaneous Control Subsystem (MCS) Description on page 31
- M40e MCS LEDs on page 33
- M40e Craft Interface Description on page 34
- M40e Craft Interface Alarm LEDs and Controls on page 35
- M40e Craft Interface LCD Description on page 36
- Host Module LEDs on the M40e Craft Interface on page 37
- FPC LEDs and Controls on the M40e Craft Interface on page 38
- M40e Connector Interface Panel (CIP) Description on page 39
- M40e Power System Description on page 42
- M40e Cooling System Description on page 48
- M40e Cable Management System Description on page 49

M40e Chassis Description

The M40e Multiservice Edge 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 29 in. (73.6 cm) deep. The chassis height of 35 in. (89 cm) enables stacked installation of two M40e routers in a single floor-to-ceiling rack. For more information, see “M40e Rack Size and Strength” on page 69.

The two front support posts and center-mounting brackets (one on each side) extend the chassis width to 19 in. (48.3 cm).

The chassis includes the following electrical safety components:

- Two electrostatic discharge (ESD) points (banana plug receptacles), one front and one rear, as shown in Figure 1 on page 9 and Figure 2 on page 10
- Two internally threaded grounding points, as shown in Figure 2 on page 10

Figure 1 on page 9, Figure 2 on page 10, and Figure 3 on page 10 show three views of the router chassis.

For chassis serial number information, see “Displaying M40e Router Components and Serial Numbers” on page 299.

Figure 1: Front of M40e Chassis

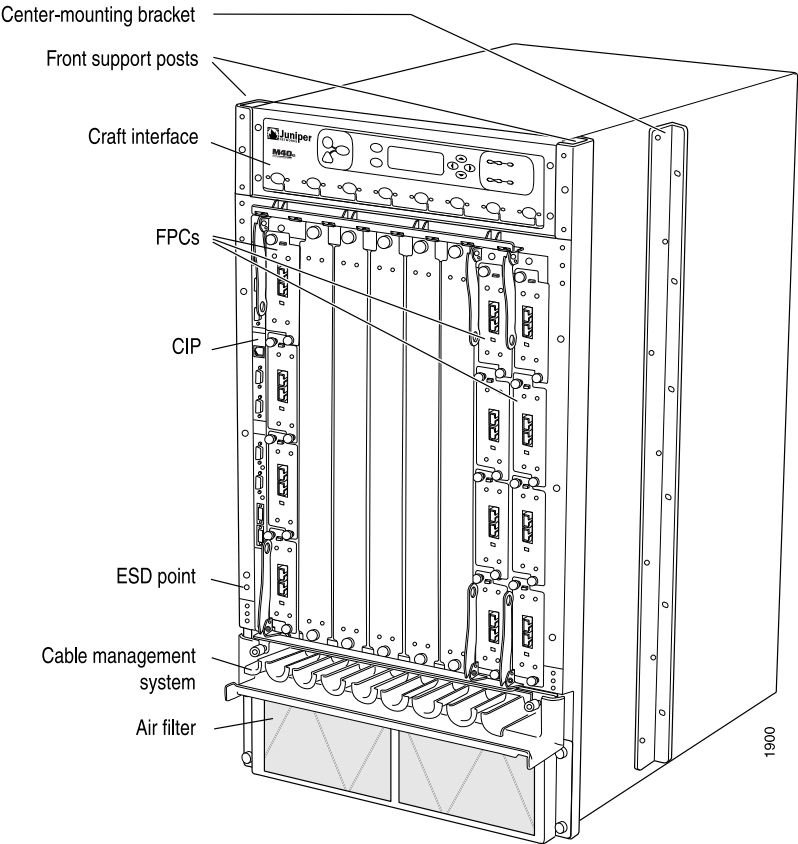


Figure 2: Rear of M40e Chassis with Component Cover in Place

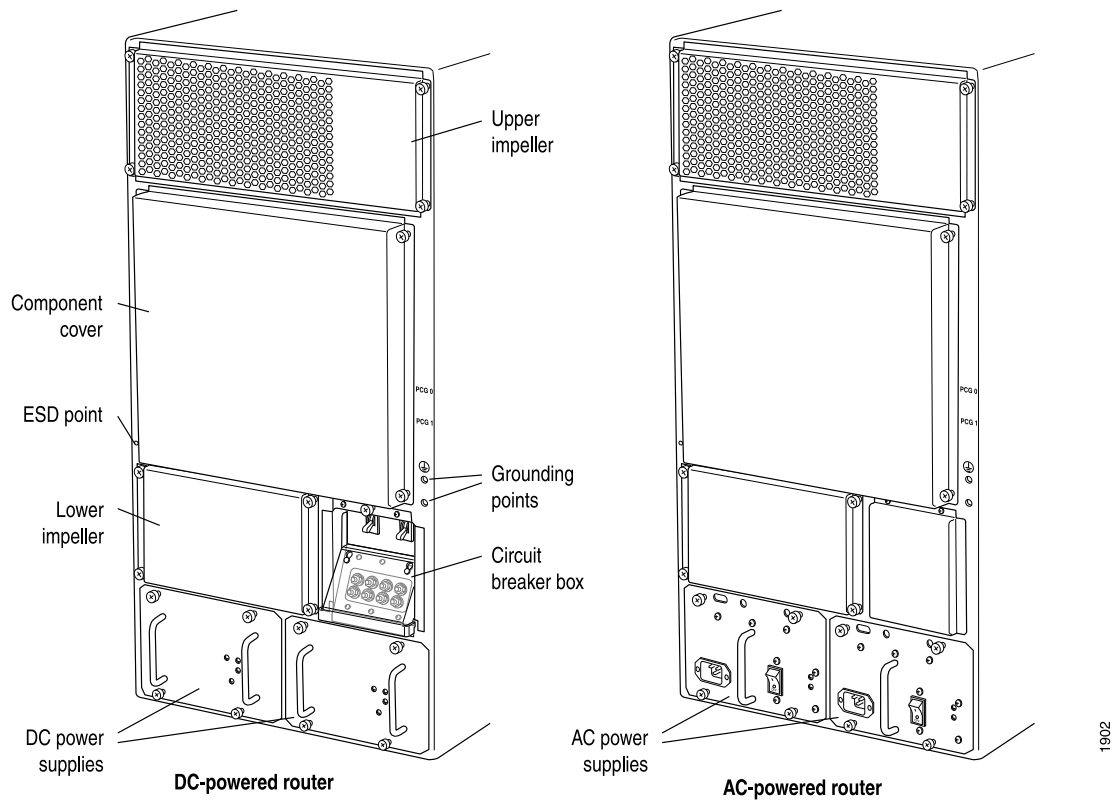
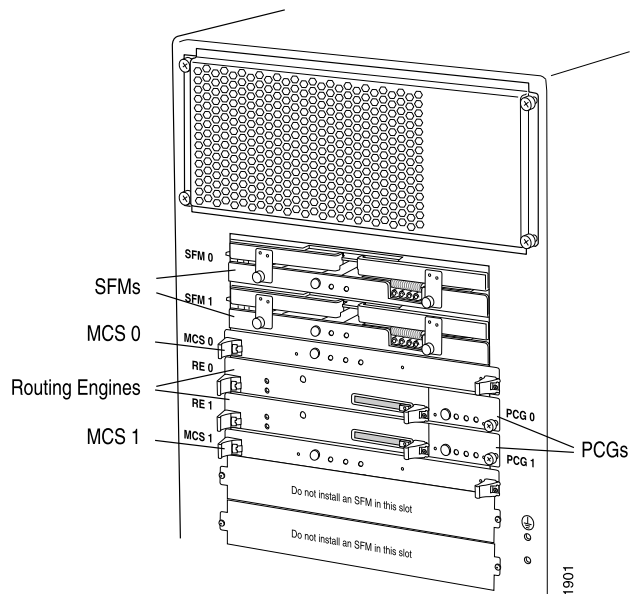


Figure 3: Rear of M40e Chassis with Component Cover Removed





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



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

For further safety information, see “General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers” on page 229.

**Related
Documentation**

- M40e Router Physical Specifications on page 269
- Installing the M40e Chassis into the Rack on page 95
- M40e Chassis Lifting Guidelines on page 235

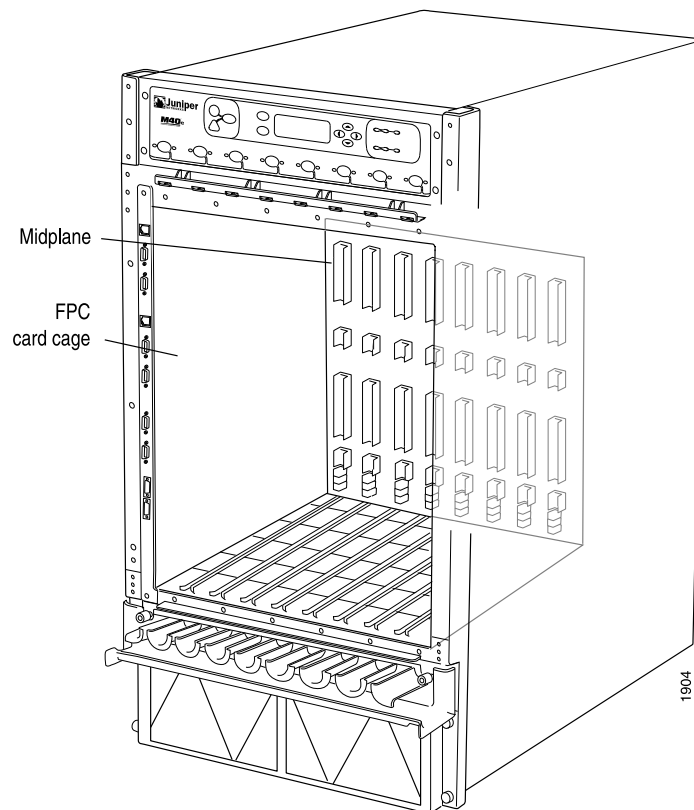
M40e Midplane Description

The midplane is a panel located in the center of the chassis, running from side to side and forming the rear of the FPC card cage (see Figure 4 on page 12). All router components other than PICs 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 functions:

- Transfer of packets—The midplane accepts an incoming packet after it is processed by an FPC, and transmits it to an SFM. The SFM performs switching and forwarding functions and transfers outgoing packets back across the midplane to the FPCs 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 4: M40e Midplane



For chassis serial number information, see "Displaying M40e Router Components and Serial Numbers" on page 299.

**Related
Documentation**

- M40e Router Physical Specifications on page 269
- M40e System Description on page 3
- M40e PIC Overview

M40e PICs Description

PICs physically connect the M40e Multiservice Edge Router to network media. They are housed in Flexible PIC Concentrators (FPCs).

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 FPCs 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, IP Services, and SONET/SDH interfaces.

Some PICs accept small form-factor pluggables (SFPs), which are fiber-optic transceivers that can be removed from the PIC. Various SFPs have different reach characteristics. You can mix them in a single PIC and change the combination dynamically. SFPs are hot-removable and hot-insertable. ,

M40e PIC Slots

The number of ports on a PIC depends on the type of PIC. You can install up to four PICs in each Type 1 FPC and one PIC in each Type 2 FPC. 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.

PICs installed on Type 1 FPCs and Type 2 FPCs are hot-removable and hot-insertable.

M40e PIC Components

Most PICs supported on the M40e Multiservice Edge Router have the following components:

- One or more cable connector ports—Accept a network media connector.
- LEDs—Indicate PIC 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. See each PIC description for more information about the LEDs.
- Offline button—Prepares the PIC for removal from the FPC when pressed.
 - Type 1 PICs—The offline button for each PIC is next to it on the FPC.
 - Type 2 PICs—The offline button is on the PIC faceplate.

Related Documentation

- M40e Flexible PIC Concentrators (FPCs) Description on page 13
- M40e PICs Supported.
- End-of-Life PICs Supported (M40e Router)
- M40e Field-Replaceable Units (FRUs) on page 157
- Replacing an SFP in an M40e PIC on page 208
- Connecting the M40e PIC Cables on page 116
- Troubleshooting PICs on the M40e Router on page 153
- Replacing a PIC in an M40e Router on page 198

M40e Flexible PIC Concentrators (FPCs) Description

FPCs are hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. When you remove or install an FPC, packet forwarding halts for about 200 ms while the Packet Forwarding Engine adjusts to the change in the amount of memory available in the pool located on and shared by all FPCs. When you install an FPC into a functioning router, the Routing Engine downloads the FPC software, the FPC runs its diagnostics, and the PICs housed on the FPC are enabled. Forwarding continues

uninterrupted during this process. For FPC replacement instructions, see “Replacing an FPC in an M40e Router” on page 191.

- M40e FPC Function on page 14
- M40e FPC Slots on page 14
- M40e FPC Components on page 15
- Identifying M40e FPCs on page 16

M40e FPC Function

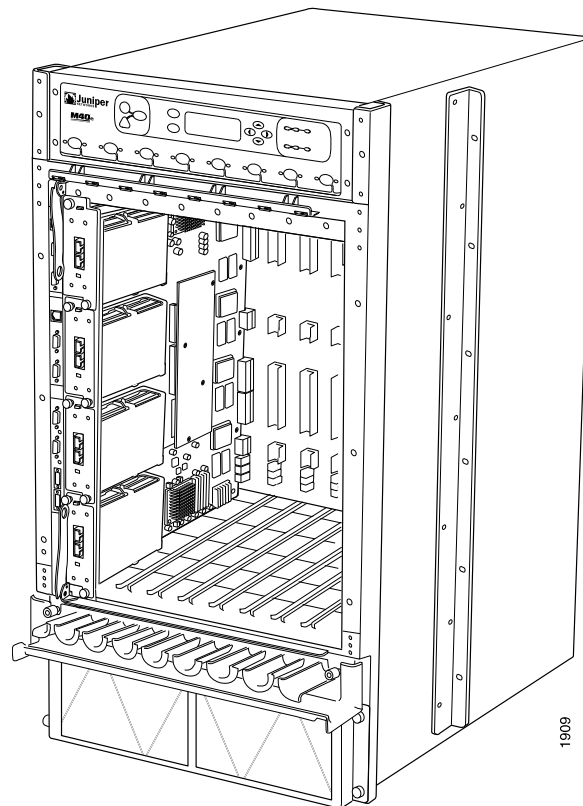
Flexible PIC Concentrators (FPCs) house the PICs that connect the router to network media (for information about PICs, see “M40e PICs Description” on page 12). The main function of an FPC is to connect the PICs installed in it to the other router components. An I/O Manager ASIC on the FPC divides each incoming data packet into 64-byte cells and passes the cells through the midplane to the SFM, where another ASIC decides how to distribute them among the memory buffers located on and shared by all installed FPCs. After the SFM decides how to forward a packet, an I/O Manager ASIC on the FPC reassembles the corresponding data cells back into network-packet form and passes the packet to the appropriate PIC for transmission to the network. For more information, see “M40e Packet Forwarding Engine Architecture” on page 60.

M40e FPC Slots

Up to eight FPCs install vertically into the midplane from the front of the chassis. The FPC slots are numbered from **FPC0** to **FPC7**, left to right. Each FPC accommodates either one or up to four PICs, depending on the type of FPC and PIC. The PIC slots in each FPC are numbered from **0** (zero) through **3**, top to bottom. An FPC can be installed into any FPC slot, regardless of the PICs it contains, and any combination of slots can be used. If a slot is empty, you must install a blank FPC panel to shield it, so that cooling air can circulate properly throughout the card cage.

Figure 5 on page 15, which shows a chassis with an FPC in slot **FPC0**, omits the blank FPC panels to show the position of the FPC in the card cage.

Figure 5: Front of M40e Chassis with Four-PIC FPC Installed in Slot FPC0



M40e FPC Components

An FPC has the components:

- FPC card carrier—Houses the ASICs, connectors, and processor subsystem.
- Two I/O Manager ASICs—Parse Layer 2 and Layer 3 data and perform encapsulation and segmentation. One I/O Manager ASIC is active, interacting with the active SFM, while the other is in standby mode, prepared to interact with the standby SFM if it is installed and becomes active. The active I/O Manager ASIC divides incoming packets into 64-byte data cells for easier processing, and reassembles the cells for each packet after the forwarding decision is made for it.
- Two Packet Director ASICs—Transfer packets between the PICs and the active I/O Manager ASIC: one directs incoming packets from the PICs to the active I/O Manager ASIC, while the second directs outgoing packets from the I/O Manager ASIC to the PICs.
- Four identical synchronous DRAM (SDRAM) dual inline memory modules (DIMMs)—Form the memory pool shared with the other FPCs installed in the router.
- Parity-protected synchronous SRAM (SSRAM)—Stores data structures used by the I/O Manager ASICs.
- Processor subsystem—Manages packet handling in the FPC and communication with the SFM. It is a PowerPC 603e-based CPU with parity-protected DRAM.

- EEPROM—Stores the serial number and revision level of the FPC.
- Two LEDs—Indicate FPC status. The LED labeled **OK** is green and the one labeled **FAIL** is red. The LEDs for each FPC are located on the router craft interface. For more information, see “FPC LEDs and Controls on the M40e Craft Interface” on page 38.
- Offline button—Prepares the FPC for removal from the router when pressed. Like the LEDs, an offline button is located on the craft interface. For more information, see “FPC LEDs and Controls on the M40e Craft Interface” on page 38.
- Four PIC offline buttons (on Type 1 FPCs only)—Prepare each corresponding PIC for removal from the FPC.
- Ejector levers—Control the locking system that secures the FPC in the card cage.



NOTE: For specific information about FPC components (for example, the amount of memory available), issue the `show chassis fpc` command.

Identifying M40e FPCs

Figure 6 on page 16 shows the standard M40e FPC.

Figure 6: M40e FPC

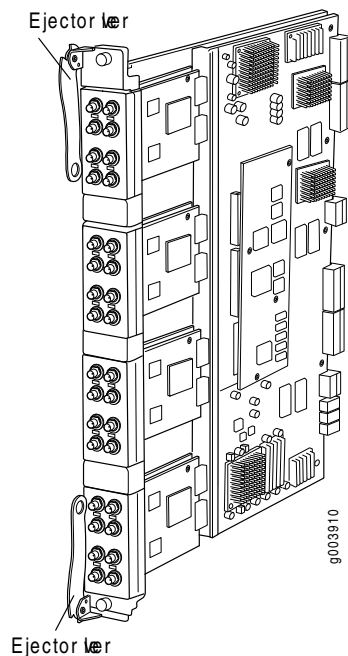
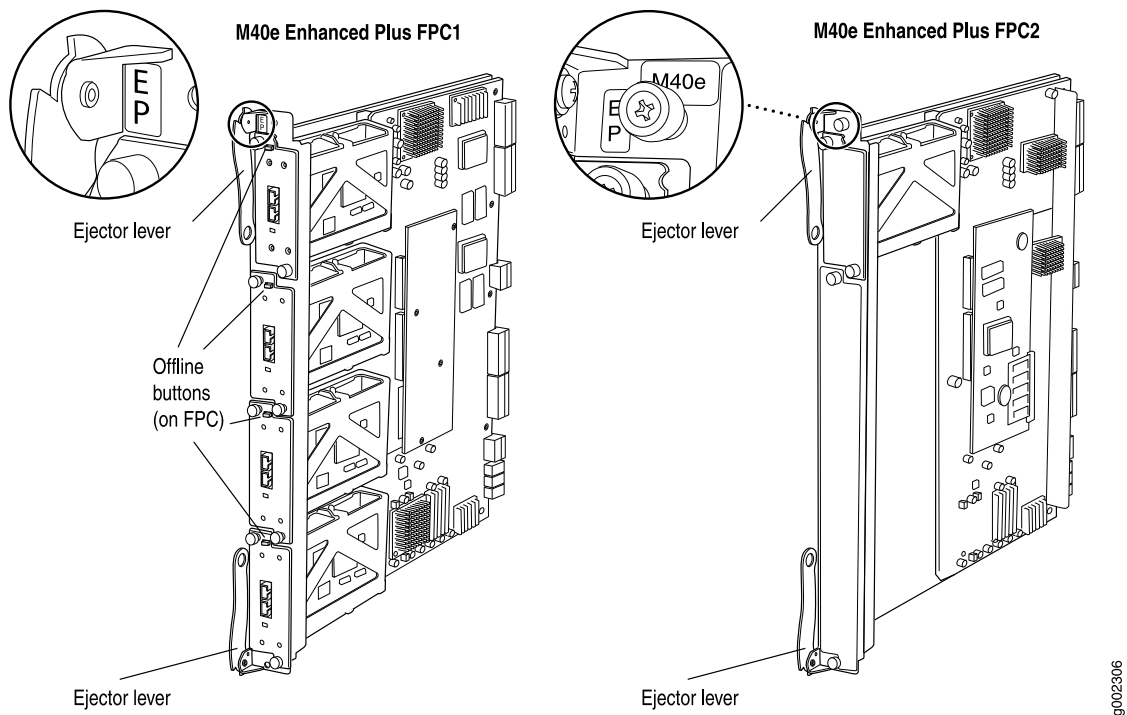


Figure 7 on page 17 shows the Enhanced Plus FPC1 and Enhanced Plus FPC2 supported by the M40e router.

Figure 7: M40e Enhanced Plus FPCs



- Related Documentation**
- Holding an M40e FPC Overview on page 133
 - Installing an FPC in an M40e Router on page 193
 - Troubleshooting FPCs on the M40e Router on page 152

M40e FPCs Supported

The M40e router supports the FPCs listed in Table 3 on page 17.



NOTE: Inserting a combination of PICs with an aggregate throughput higher than the maximum throughput per FPC is supported but constitutes oversubscription of the FPC.

Table 3: FPCs Supported by the M40e Router

FPC Type	FPC Name	FPC Model Number	Maximum Number of PICs Supported	Maximum Throughput per FPC (full duplex)	First Junos OS Release
1	FPC	M40e-FPC	4	3.2 Gbps	5.2
1	Enhanced Plus FPC1	M40e-FPC1-EP	4	3.2 Gbps	7.2

Table 3: FPCs Supported by the M40e Router (*continued*)

FPC Type	FPC Name	FPC Model Number	Maximum Number of PICs Supported	Maximum Throughput per FPC (full duplex)	First Junos OS Release
2	Enhanced Plus FPC2	M40e-FPC2-EP	1	3.2 Gbps	7.3

- Related Documentation**
- Holding an M40e FPC Overview on page 133
 - Installing an FPC in an M40e Router on page 193
 - Troubleshooting FPCs on the M40e Router on page 152

M40e Packet Forwarding Engine Clock Generators (PCGs) Description

The M40e Multiservice Edge Router has two Packet Forwarding Engine Clock Generators (PCGs) installed in the slots at the rear of the chassis that are labeled **PCG 0** and **PCG 1**, as shown in “M40e Chassis Description” on page 8. The PCGs generate a 125-MHz clock signal used to gate packet processing. During startup, the active Routing Engine determines which PCG is master and which is backup, and the MCS relays the decision to the PCGs and to the modules and ASICs in the Packet Forwarding Engine that use the clock signal. The modules and ASICs then use only the signal from the master source.

PCGs are hot-pluggable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. Removal or failure of the backup PCG does not affect router function. When the master PCG fails or is removed from the chassis, however, the Packet Forwarding Engine resets so that the components start using the signal from the other PCG (which becomes the master). The Packet Forwarding Engine cannot accept incoming packets until each PFE component, including the SFM and FPCs, resets to recognize the new master PCG. This can result in traffic halting for several minutes.

For PCG replacement instructions, see “Replacing a PCG in an M40e Router” on page 196.

Each PCG (shown in Figure 8 on page 19) has the components:

- Signal generator—Provides a 125-MHz system clock signal.
- EEPROM—Stores the serial number and revision level of the PCG.
- Three LEDs—Indicate PCG status. There is a blue one labeled **MASTER**, a green one labeled **OK**, and a yellow one labeled **FAIL**. “M40e PCG LEDs” on page 19 describes the LED states.
- Offline button—Prepares the PCG for removal from the router when pressed.

Figure 8: M40e Packet Forwarding Engine Clock Generator

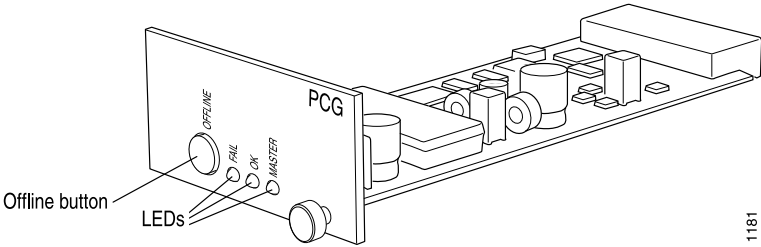
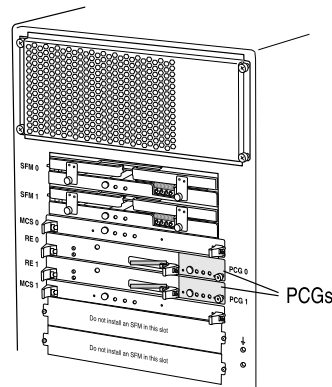


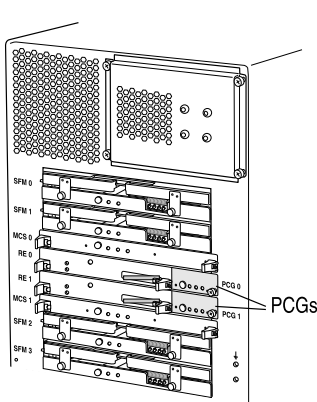
Figure 9 on page 19 shows the location of the PCGs on the M40e and M160 router chassis.

Figure 9: M40e and M160 Router PCG Location

M40e router rear



M160 router rear



Related Documentation

- Installing a PCG in an M40e Router on page 197
- M40e PCG LEDs on page 19
- M40e Packet Forwarding Engine Architecture on page 60

M40e PCG LEDs

Three LEDs indicate PCG status. There is a blue one labeled **MASTER**, a green one labeled **OK**, and an yellow one labeled **FAIL**. Table 4 on page 20 describes the LED states.

Figure 10: M40e Packet Forwarding Engine Clock Generator

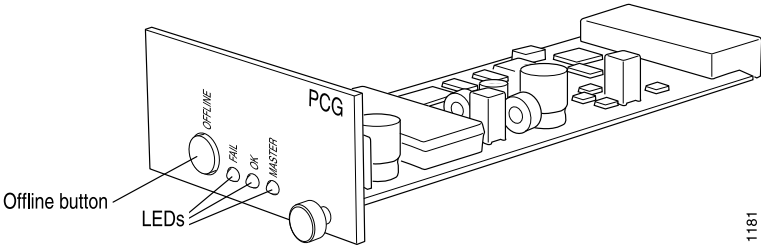


Table 4: States for M40e PCG LEDs

Label	Color	State	Description
MASTER	Blue	On steadily	PCG is master.
OK	Green	On steadily	PCG is functioning normally.
		Blinking	PCG is starting up.
FAIL	Yellow	On steadily	PCG has failed.

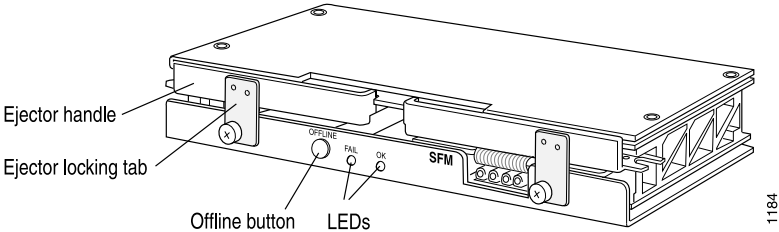
Related Documentation

- Installing a PCG in an M40e Router on page 197
- M40e Packet Forwarding Engine Clock Generators (PCGs) Description on page 18
- M40e Packet Forwarding Engine Architecture on page 60

M40e Switching and Forwarding Module (SFM) Description

The Switching and Forwarding Module (SFM) performs route lookup, filtering, and switching on incoming data packets, then directs outbound packets to the appropriate FPC for transmission to the network. It can process 40 million packets per second (Mpps).

Figure 11: M40e Switching and Forwarding Module



- SFM Slots on page 21
- SFM Redundancy on page 21
- SFM Function on page 21
- SFM Components on page 22

SFM Slots

One or two SFMs can be installed into the midplane from the rear of the chassis, as shown in “M40e Chassis Description” on page 8. Only one SFM is active at a time, with the optional second SFM in standby mode. By default, the SFM in slot **SFM 0** is active. To modify the default, include the appropriate **sfm** statement at the **[edit chassis redundancy]** hierarchy level of the configuration, as described in the section about SFM redundancy in the *Junos OS System Basics Configuration Guide*.

SFM Redundancy

SFM s are hot-pluggable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. Removing the standby SFM has no effect on router function. If the active SFM fails or is removed from the chassis, the effect depends on how many SFMs are installed:

- One SFM—Forwarding halts until the SFM is replaced and functioning again. It takes approximately one minute for the replaced SFM to boot and become active; reading in router configuration information can take additional time, depending on the complexity of the configuration.
- Two redundant SFMs—The effect depends on which release of the Junos OS is running on the router:
 - With Junos OS Release 5.4 and later, the standby SFM assumes forwarding functions in less than one second.
 - With Junos OS Release 5.3 and earlier, forwarding halts while the standby SFM boots and becomes active, which takes approximately one minute; synchronizing router configuration information can take additional time, depending on the complexity of the configuration.

SFM Function

The SFM communicates with the Routing Engine using a dedicated 100-Mbps Fast Ethernet link. The link transfers:

- Routing table data from the Routing Engine to the forwarding table in the Internet Processor II ASIC.
- Routing link-state updates and other packets destined for the router that have been received through the router interfaces from the SFM to the Routing Engine.

The ASICs and other components on the SFM provide the functions:

- Route lookups—The Internet Processor II ASIC on each SFM performs route lookups using the forwarding table stored in SSRAM.
- Management of shared memory on the FPCs—One Distributed Buffer Manager ASIC receives the 64-byte data cells into which the active I/O Manager ASIC on each FPC divides incoming packets, and uniformly allocates them throughout the shared memory buffers located on the FPCs.

- Transfer of outgoing data packets—The second Distributed Buffer Manager ASIC passes notification of the forwarding decision for each packet to an I/O Manager ASIC so that data cells for the outgoing packet can be reassembled for transmission to the network.
- Transfer of exception and control packets—The Internet Processor II ASIC passes exception packets to the microprocessor on the SFM, which processes almost all of them. The SFM sends any remaining exception packets to the Routing Engine for further processing. When the SFM detects an error originating in the Packet Forwarding Engine, it sends it to the Routing Engine using system logging (syslog) messages.

SFM Components

Each SFM is a two-board system, as shown in Figure 11 on page 20. It has the components:

- Two Distributed Buffer Manager ASICs—Process incoming and outgoing packets: one distributes data cells (which the I/O Manager ASIC on each FPC derives from incoming packets) to the shared memory buffers on the FPCs, while the second forwards notification of routing decisions to the I/O Manager ASICs.
- One Internet Processor II ASIC—Performs route lookups and makes routing decisions.
- Parity-protected SSRAM—Stores the forwarding table.
- Processor subsystem—Manages SFM functions and handles exception packets. The processor has the components:
 - One PowerPC 603e processor
 - Parity-protected Level 2 cache
 - Parity-protected DRAM
- EEPROM—Stores the serial number and revision level.
- Offline button—Prepares the SFM for removal from the router when pressed.
- Two LEDs—Indicate SFM status. There is a green one labeled **OK** and an yellow one labeled **FAIL**. “M40e SFM LEDs” on page 23 describes the LED states.
- Ejector handles and locking tabs—Control the locking system that secures the SFM in the chassis.



NOTE: For specific information about SFM components (for example, the amount of SSRAM and DRAM), issue the `show chassis sfm detail` command.

Related Documentation

- M40e SFM LEDs on page 23
- Replacing an SFM in an M40e Router on page 206.
- M40e Chassis Description on page 8

M40e SFM LEDs

Two LEDs indicate SFM status. There is a green one labeled **OK** and an yellow one labeled **FAIL**. Table 5 on page 23 describes the LED states.

Figure 12: M40e Switching and Forwarding Module

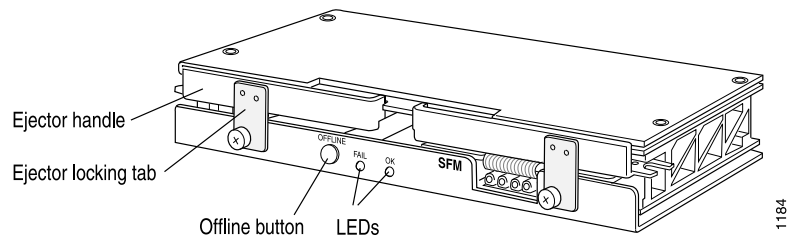


Table 5: States for M40e SFM LEDs

Label	Color	State	Description
OK	Green	On steadily	SFM is functioning normally.
		Blinking	SFM is starting up.
FAIL	Yellow	On steadily	SFM has failed.

Related Documentation

- M40e Switching and Forwarding Module (SFM) Description on page 20
- Installing an SFM in an M40e Router on page 207
- M40e Chassis Description on page 8

M40e Host Module Description

The host module constructs routing tables, performs system management functions, and generates the SONET/SDH clock signal for SONET/SDH interfaces. It consists of a paired Routing Engine and Miscellaneous Control Subsystem (MCS).

For a host module to function, both of its components—Routing Engine and MCS—must be installed and operational. One or two host modules can be installed into the midplane from the rear of the chassis, as shown in “M40e Chassis Description” on page 8. The Routing Engine slot labeled **RE 0** is below the MCS slot labeled **MCS 0** and the **RE 1** slot is above the **MCS 1** slot.

If two host modules are installed, both are powered on, but only one is active (the master); the second host module is in standby mode and performs no functions. By default, the master host module is the one with components installed in the **RE 0** and **MCS 0** slots. To change the default master Routing Engine, include the appropriate **[edit chassis redundancy routing-engine]** statement in the configuration, as described in the section about Routing Engine redundancy in the *Junos OS System Basics Configuration Guide*.

The host module components are hot-pluggable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. Removal or failure of one or both components in the standby host module does not affect router function. Removal or failure of one or both components in the master host module affects forwarding and routing based on the high availability configuration:

- Dual Routing Engines without any high availability features enabled—Traffic is interrupted while the Packet Forwarding Engine is reinitialized. All kernel and forwarding processes are restarted. When the switchover to the new master Routing Engine is complete, routing convergence takes place and traffic is resumed.
- Graceful Routing Engine switchover (GRES) is enabled—Graceful Routing Engine switchover preserves interface and kernel information. Traffic is not interrupted. However, graceful Routing Engine switchover does not preserve the control plane. Neighboring routers detect that the router has restarted and react to the event in a manner prescribed by individual routing protocol specifications. To preserve routing without interruption during a switchover, graceful Routing Engine switchover must be combined with nonstop active routing.
- Nonstop active routing is enabled (graceful Routing Engine switchover must be configured for nonstop active routing to be enabled)—Nonstop active routing supports Routing Engine switchover without alerting peer nodes that a change has occurred. Nonstop active routing uses the same infrastructure as graceful Routing Engine switchover to preserve interface and kernel information. However, nonstop active routing also preserves routing information and protocol sessions by running the routing protocol process (rpd) on both Routing Engines. In addition, nonstop active routing preserves TCP connections maintained in the kernel.
- Graceful restart is configured—Graceful restart provides extensions to routing protocols so that neighboring helper routers restore routing information to a restarting router. These extensions signal neighboring routers about the graceful restart and prevent the neighbors from reacting to the router restart and from propagating the change in state to the network during the graceful restart period. Neighbors provide the routing information that enables the restarting router to stop and restart routing protocols without causing network reconvergence. Neighbors are required to support graceful restart. The routing protocol process (rpd) restarts. A graceful restart interval is required. For certain protocols, a significant change in the network can cause graceful restart to stop.

If you do not configure graceful Routing Engine switchover, graceful restart, or nonstop active routing, you can configure automatic Routing Engine mastership failover. For information about configuring automatic mastership failover, see the *Junos OS System Basics Configuration Guide*.



NOTE: Router performance might change if the backup Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to each Routing Engine.



NOTE: For information about configuring graceful Routing Engine switchover, graceful restart, and nonstop active routing, see the *Junos OS High Availability Configuration Guide*.

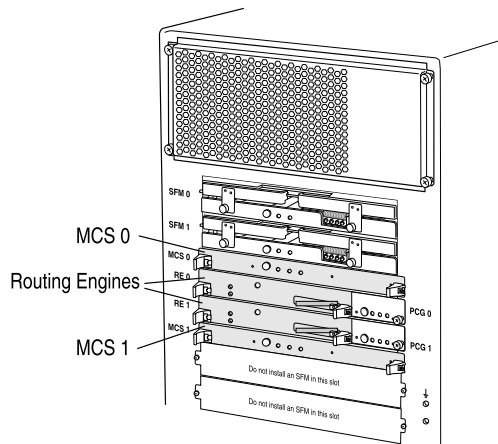


NOTE: The first supported release for graceful Routing Engine switchover and nonstop active routing on the M40e router is Junos OS Release 5.7 and Junos OS Release 8.4, respectively. However, for graceful Routing Engine switchover we recommend Junos OS Release 7.0 or later. Graceful restart software requirements are dependent on the routing protocols configured on the router. For the minimum software requirements for graceful restart, see the *Junos OS High Availability Configuration Guide*.

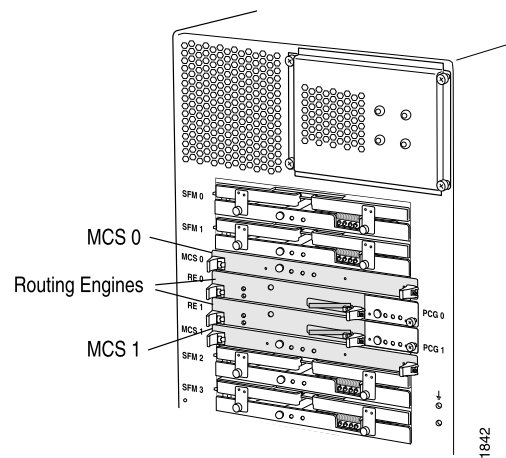
For host module replacement instructions, see “Replacing an MCS in an M40e Router” on page 179 and “Replacing a Routing Engine in an M40e Router” on page 186.

Figure 13: M40e and M160 Router Host Module Location

M40e router rear

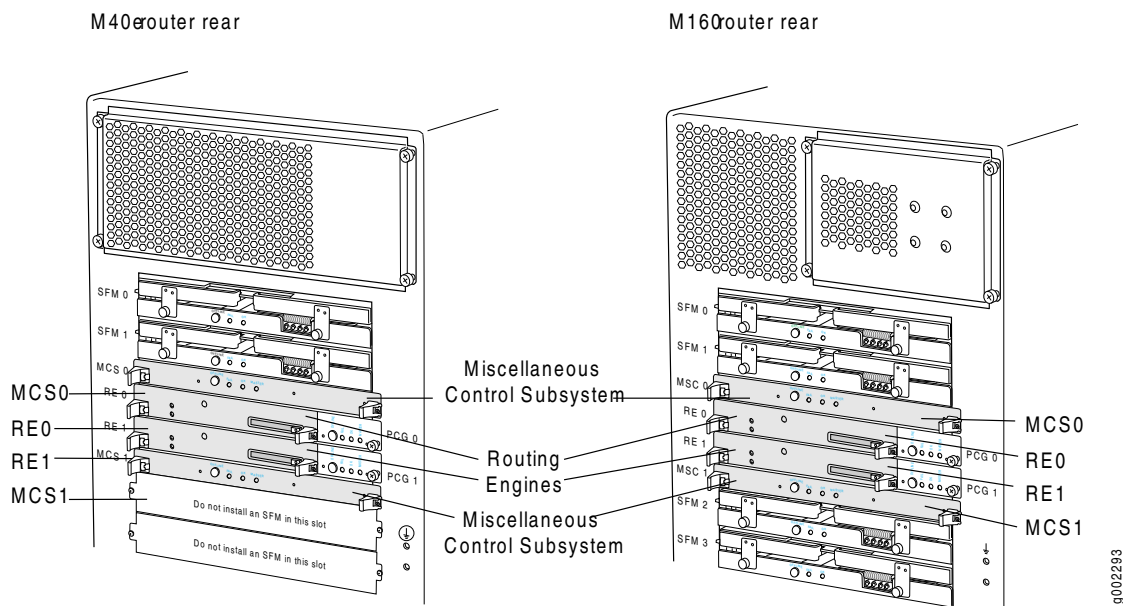


M160 router rear



On M40e and M160 routers, the host module consists of a paired Routing Engine and MCS. One pair functions as master, while the other stands by as a backup should the master Routing Engine fail. (See “Replacing an MCS in an M40e Router” on page 179 and “Replacing a Routing Engine in an M40e Router” on page 186.)

Figure 14: M40e and M160 Router Redundant Host Modules



- Related Documentation**
- M40e System Architecture Overview on page 59
 - Host Module LEDs on the M40e Craft Interface on page 37

M40e Routing Engine Description

The Routing Engine runs the 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.

For a description of the Routing Engine's role in router architecture, see "M40e Routing Engine Architecture" on page 61.

One or two host modules (paired Routing Engine and MCS) can be installed into the midplane from the rear of the chassis, as shown in "M40e Chassis Description" on page 8. If two host modules are installed, the Routing Engines together determine which is the master and which is in standby mode (and so performs no functions). By default, the Routing Engine in the slot labeled **RE0** is the master. The master Routing Engine also determines which of the two PCGs is the master.



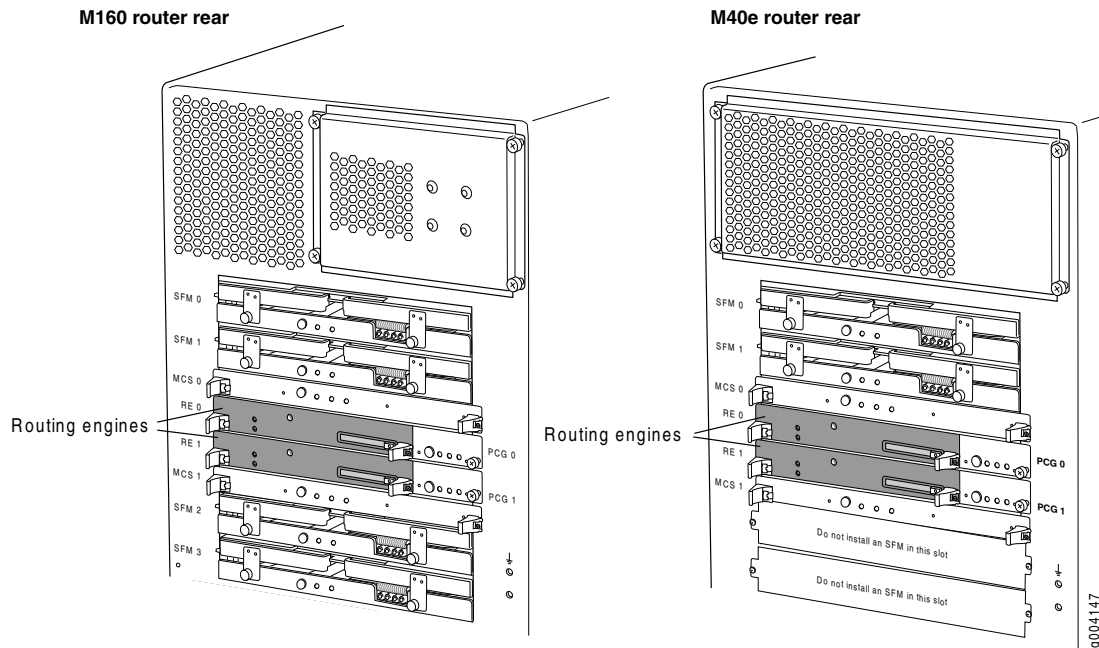
NOTE: If two Routing Engines are installed, they must both be the same hardware model.

The Routing Engine is hot-pluggable, as described in "M40e Field-Replaceable Units (FRUs)" on page 157. For information about the effect of removing a Routing Engine, see

"M40e Host Module Description" on page 23. For replacement instructions, see "Replacing a Routing Engine in an M40e Router" on page 186.

Figure 15 on page 27 shows the Routing Engine location on the M40e router.

Figure 15: M40e Router Routing Engine Location



- Related Documentation**
- Installing a Routing Engine in an M40e Router on page 189
 -
 -
 - M40e Routing Engine Software Components on page 52

M40e Routing Engine 333

The Routing Engine (shown in Figure 16 on page 29) is a two-board system with the following components:

- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- CompactFlash card—Provides primary storage for software images, configuration files, and microcode. The drive is a fixed CompactFlash card and is inaccessible from outside the router.
- Hard disk—Provides secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.

- PC Card slot—Accepts a removable PC Card, which stores software images for system upgrades.
- LED—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.
- Interfaces for out-of-band management access—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the Connector Interface Panel (CIP).

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

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



NOTE: The appearance and position of electronic components or the PC Card slot on your Routing Engine might differ from Figure 16 on page 29 and other figures in the documentation that depict the Routing Engine. These differences do not affect Routing Engine installation and removal or functionality.



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

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

The boot sequence for the router:

- PC Card
- CompactFlash card
- Hard disk



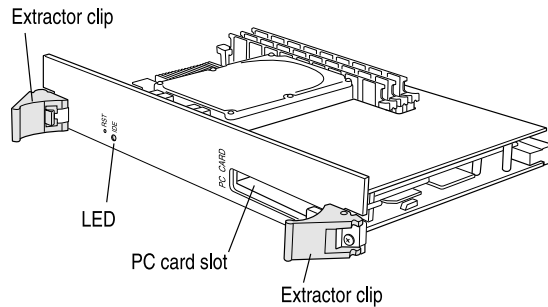
NOTE: If the router boots from an alternate boot device, a yellow alarm lights the LED on the router's craft interface.



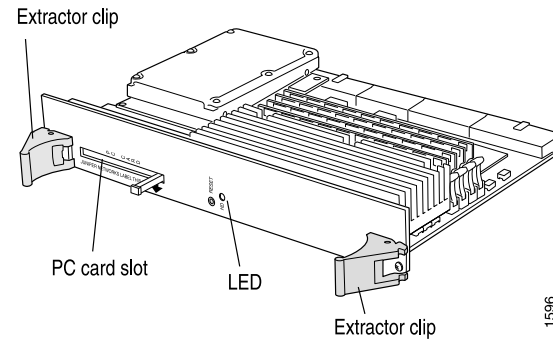
NOTE: If two Routing Engines are installed, they must both be the same hardware model.

Figure 16: M40e Routing Engine 333

Routing Engine 333



Routing Engine 600



M40e Routing Engine 333 LEDs

The **IDE** LED Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.



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

M40e Routing Engine 600

The Routing Engine (shown in Figure 17 on page 31) is a two-board system with the following components:

- **CPU**—Runs Junos OS to maintain the router's routing tables and routing protocols.
- **DRAM**—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- **CompactFlash card**—Provides primary storage for software images, configuration files, and microcode. The drive is a fixed CompactFlash card and is inaccessible from outside the router.
- **Hard disk**—Provides secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.
- **PC Card slot**—Accepts a removable PC Card, which stores software images for system upgrades.
- **LED**—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.
- **Interfaces for out-of-band management access**—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the Connector Interface Panel (CIP).

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

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



NOTE: The appearance and position of electronic components or the PC Card slot on your Routing Engine might differ from Figure 17 on page 31 and other figures in the documentation that depict the Routing Engine. These differences do not affect Routing Engine installation and removal or functionality.



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

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

The boot sequence for the router:

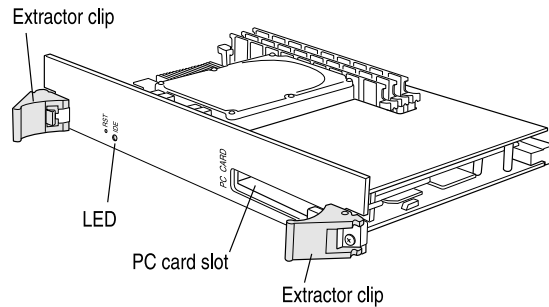
- PC Card
- CompactFlash card
- Hard disk



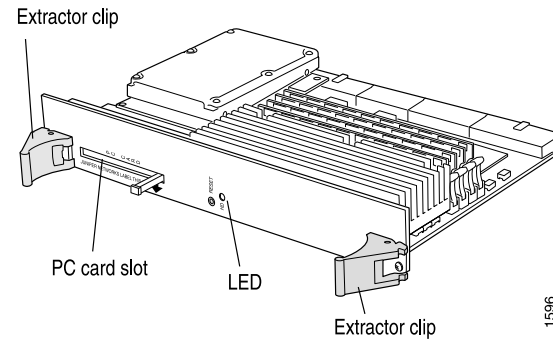
NOTE: If the router boots from an alternate boot device, a yellow alarm lights the LED on the router's craft interface.

Figure 17: M40e Routing Engine 600

Routing Engine 333



Routing Engine 600



M40e Routing Engine 600 LEDs

The **HD** LED indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.



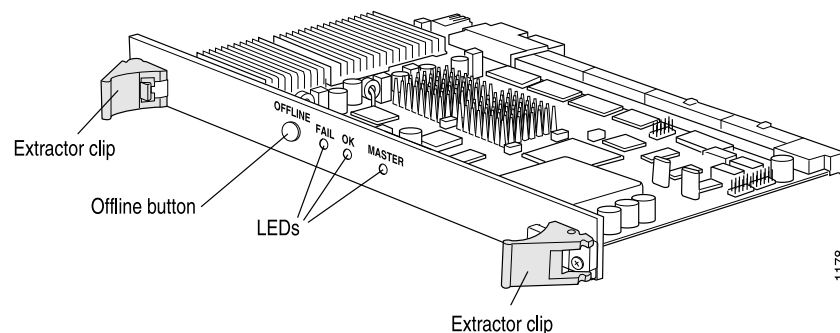
NOTE: The LEDs that report host module status (including Routing Engine status) are on the craft interface rather than the Routing Engine faceplate.

M40e Miscellaneous Control Subsystem (MCS) Description

The Miscellaneous Control Subsystem (MCS) works with its companion Routing Engine to provide control and monitoring functions for router components. It also generates a clock signal for the SONET/SDH interfaces on the router.

One or two host modules (paired MCS and Routing Engine) can be installed into the midplane from the rear of the chassis, as shown in "M40e Chassis Description" on page 8. Only one host module is active at a time, with the optional second host module in standby mode. For more information about host module interdependence and redundancy, see "M40e Host Module Description" on page 23.

Figure 18: M40e Miscellaneous Control Subsystem



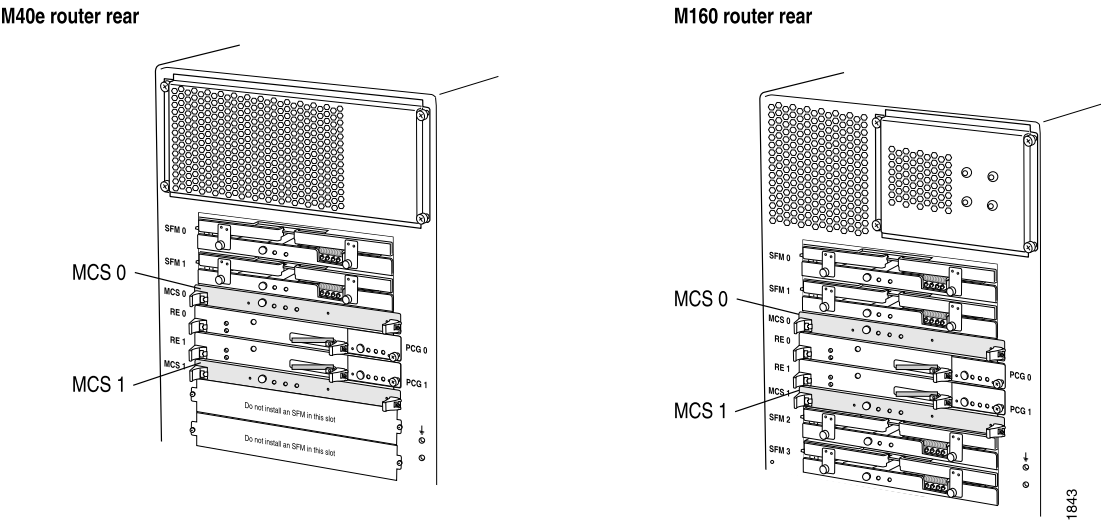
Each MCS (shown in Figure 18 on page 31) has the following components:

- PCI interface—Connects the MCS to the Routing Engine.
- 100-Mbps Ethernet switch—Carries signals and monitoring data between router components.
- 19.44-MHz stratum 3 reference clock—Generates clock signal for SONET/SDH PICs.
- I²C controller—Monitors the status of router components.
- Three LEDs—Indicate MCS status. There is a blue one labeled **MASTER**, a green one labeled **OK**, and an yellow one labeled **FAIL**. “M40e MCS LEDs” on page 33 describes the LED states.
- Offline button—Prepares the MCS for removal from the router when pressed.
- Extractor clips—Control the locking system that secures the MCS in the chassis.

The MCS, in conjunction with the routing software, performs the functions:

- Monitoring and control of router components—The MCS collects statistics from all sensors in the system. When it detects a failure or alarm condition, it sends a signal to the Routing Engine, which generates control messages or sets an alarm. The MCS also relays control messages from the Routing Engine to the router components.
- Controlling component power-up and power-down—The MCS controls the power-up sequence of router components as they start, and powers down components when their offline buttons are pressed.
- Signaling of mastership—In a router with more than one host module, the MCS signals to all router components which host module is the master and which is the standby. It relays the mastership signal for the two PCGs as well.
- Providing SONET/SDH clock source—The MCS generates a 19.44-MHz SONET/SDH clock signal, along with a signal that indicates which MCS is the master SONET/SDH clock generator (if two MCSs are installed).
- Clock monitoring—The MCS monitors the PCG system clock and its SONET/SDH clock to verify that they are providing the expected signal. It generates an alarm if a clock signal is incorrect.
- Control of FPC resets—If the MCS detects errors in an FPC, it attempts to reset the FPC. After three unsuccessful reset attempts, the MCS takes the FPC offline and informs the Routing Engine. Other FPCs are unaffected, and system operation continues.

Figure 19: M40e and M160 Router MCS Location



- Related Documentation**
- M40e MCS LEDs on page 33
 - M40e Chassis Description on page 8
 - Installing an MCS in an M40e Router on page 181

M40e MCS LEDs

Three LEDs indicate MCS status. There is a blue one labeled **MASTER**, a green one labeled **OK**, and a yellow one labeled **FAIL**. Table 6 on page 34 describes the LED states.

Figure 20: M40e Miscellaneous Control Subsystem

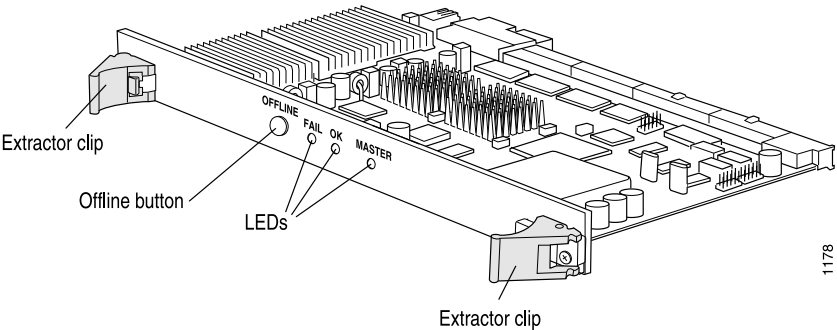


Table 6: States for M40e MCS LEDs

Label	Color	State	Description
MASTER	Blue	On steadily	MCS is master.
OK	Green	On steadily	MCS is functioning normally.
		Blinking	MCS is starting up.
FAIL	Yellow	On steadily	MCS has failed.

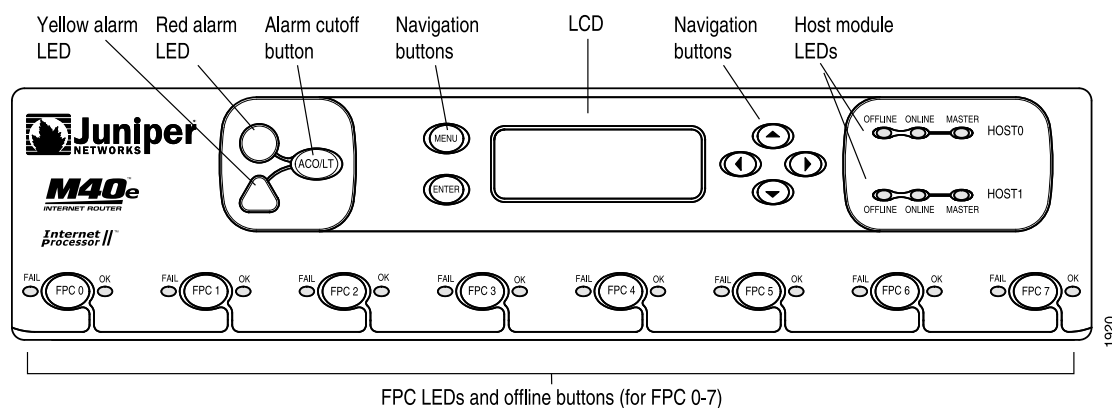
Related Documentation

- M40e Miscellaneous Control Subsystem (MCS) Description on page 31
- M40e Chassis Description on page 8
- Installing an MCS in an M40e Router on page 181

M40e Craft Interface Description

The craft interface provides status and troubleshooting information at a glance and has buttons for deactivating alarms and preparing FPCs for removal. The craft interface is located on the front of the chassis above the FPC card cage, as shown in “M40e Chassis Description” on page 8. It includes the elements shown in Figure 21 on page 34.

Figure 21: M40e Craft Interface





NOTE: The LEDs for some router components are located on the component faceplate, rather than on the craft interface. For information about those LEDs, see:

- [M40e Packet Forwarding Engine Clock Generators \(PCGs\) Description on page 18](#)
- [M40e Switching and Forwarding Module \(SFM\) Description on page 20](#)
- [M40e Miscellaneous Control Subsystem \(MCS\) Description on page 31](#)
- [M40e Power System Description on page 42](#)

Related Documentation

- [M40e Craft Interface Alarm LEDs and Controls on page 35](#)
- [M40e Craft Interface LCD Description on page 36](#)
- [M40e Chassis Description on page 8](#)

M40e Craft Interface Alarm LEDs and Controls




Two large alarm LEDs are located at the upper left of the craft interface (see “M40e Craft Interface Description” on page 34). The circular red LED lights to indicate a critical condition that can result in a system shutdown. The triangular yellow LED lights to indicate a less severe condition that requires monitoring or maintenance. Both LEDs can be lit simultaneously.

A condition that causes an LED to light also activates the corresponding alarm relay contact on the connector interface panel (CIP), as described in “M40e Connector Interface Panel (CIP) Description” on page 39. The LCD on the craft interface reports the cause of the alarm, as described in “M40e Craft Interface LCD Description” on page 36.

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

Table 7 on page 36 describes the alarm LEDs and alarm cutoff button in more detail.

Table 7: Alarm LEDs and Alarm Cutoff/Lamp Test Button

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

Related Documentation

- M40e PIC Overview
- Host Module LEDs on the M40e Craft Interface on page 37
- M40e Chassis Description on page 8

M40e Craft Interface LCD Description

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

- LCD Idle Mode on page 36
- LCD Alarm Mode on page 37

LCD Idle Mode

During normal operation, the LCD operates in idle mode and reports current status information, as shown in Figure 22 on page 36.

Figure 22: LCD in Idle Mode



1263

The lines in the display report the following information:

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

Up days + hours:minutes

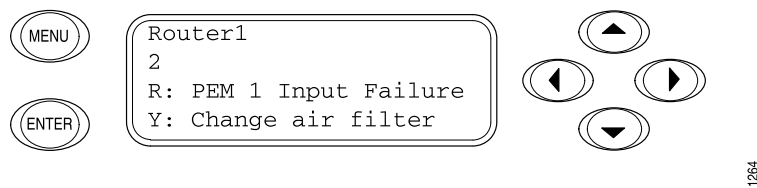
- Third and fourth lines—Status messages, which rotate at 2-second intervals. Some conditions, such as removal or insertion of a system component, can interrupt the messages.

To add a message that alternates every 2 seconds with the default status messages, use the **set chassis display message** command. For more information, see the *Junos OS System Basics and Services Command Reference*.

LCD Alarm Mode

When a red or yellow alarm occurs, the LCD switches to alarm mode and reports about the alarm condition, as shown in Figure 23 on page 37.

Figure 23: M40e LCD in Alarm Mode



The lines in the display report the following information:

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

For a list of alarm messages that can appear on the LCD, see “M40e Chassis and Interface Alarm Messages” on page 147.

Related Documentation

- M40e Craft Interface Alarm LEDs and Controls on page 35
- M40e Craft Interface Description on page 34
- M40e Chassis Description on page 8

Host Module LEDs on the M40e Craft Interface

At the upper right corner of the craft interface (see “M40e Craft Interface Description” on page 34) are two sets of LEDs that indicate host module status: the set labeled **HOST0** reports the status of the Routing Engine in slot **RE 0** and MCS in slot **MCS 0**, and the set labeled **HOST1** reports the status of the Routing Engine in slot **RE 1** and the MCS in slot **MCS 1**. Each set includes three LEDs—a green one labeled **MASTER**, another green one labeled **ONLINE**, and a red one labeled **OFFLINE**. Table 8 on page 38 describes the LED states.

Table 8: States for M40e Host Module LEDs

Label	Color	State	Description
MASTER	Green	On steadily	Host module is functioning as master.
ONLINE	Green	On steadily	Host module components (Routing Engine and MCS) are installed and functioning normally.
		Blinking	Host module is starting up.
OFFLINE	Red	On steadily	One or both host module components are not installed or have failed.

- Related Documentation**
- M40e Craft Interface Alarm LEDs and Controls on page 35
 - M40e Craft Interface LCD Description on page 36
 - M40e Host Module Description on page 23

FPC LEDs and Controls on the M40e Craft Interface

The LEDs and offline button for each FPC are located directly above it on the craft interface, as shown in “M40e Craft Interface Description” on page 34. The red LED labeled **FAIL** and the green LED labeled **OK** indicate FPC status, as described in Table 9 on page 38.

The offline button, labeled with the FPC slot number (for example, **FPC2**), prepares the FPC for removal from the router when pressed.

Table 9: States for M40e FPC LEDs

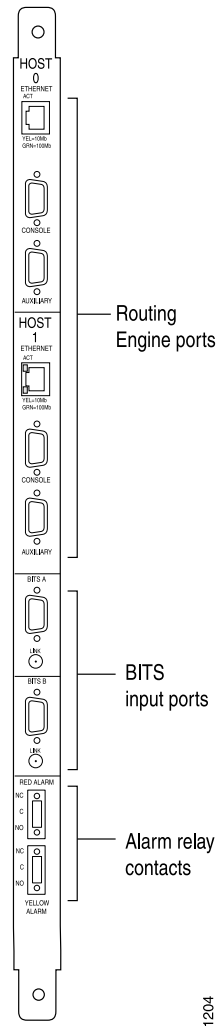
Label	Color	State	Description
OK	Green	On steadily	FPC is functioning normally.
		Blinking	FPC is starting up or going offline.
		Off	FPC is offline or not installed.
FAIL	Red	On steadily	FPC has failed.

- Related Documentation**
- M40e FPCs Supported on page 17
 - M40e Craft Interface Description on page 34
 - M40e Craft Interface LCD Description on page 36

M40e Connector Interface Panel (CIP) Description

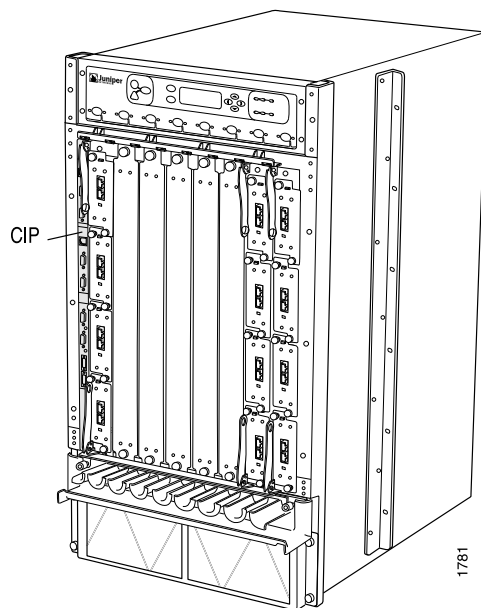
The Connector Interface Panel (CIP) is located at the left side of the FPC card cage, as shown in “M40e Chassis Description” on page 8. It houses Routing Engine management ports and alarm relay contacts, as shown in Figure 24 on page 39.

Figure 24: Connector Interface Panel



The CIP is located on the left side of the M40e and M160 router Flexible PIC Concentrator (FPC) card cage (see Figure 25 on page 40).

Figure 25: M40e and M160 Router CIP Location



The CIP is field-replaceable, but is not hot-removable, hot-insertable, or hot-pluggable. You must power down the router before removing or installing it.

- Routing Engine Management Ports on page 40
- BITS Input Ports on page 41
- Alarm Relay Contacts on page 41

Routing Engine Management Ports

On the upper half of the CIP are two sets of ports for connecting the Routing Engines to one or more external devices on which system administrators can issue Junos OS command-line interface (CLI) commands to manage the router. The set of ports labeled **HOST0** connects to the Routing Engine in the slot labeled **RE 0**, and the set labeled **HOST1** connects to the Routing Engine in the slot labeled **RE 1**.

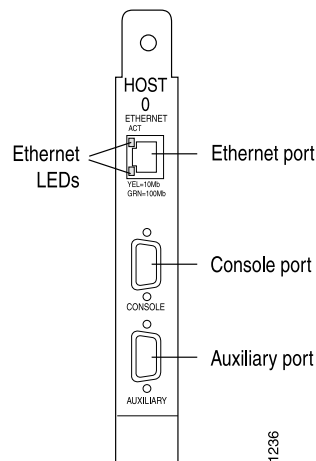
The ports with the indicated label in each set function as follows:

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

For information about the pinouts for the connectors, see “RJ-45 Connector Pinouts for the M40e Routing Engine MGMT Port” on page 289.

Figure 26 on page 41 shows the ports that connect to the Routing Engine installed in slot **RE 0**. The arrangement of ports for the Routing Engine installed in slot **RE 1** is the same.

Figure 26: M40e Routing Engine Interface Ports for Host Module 0



BITS Input Ports

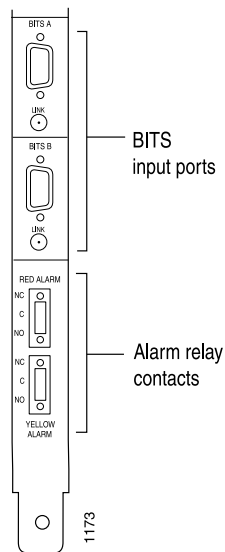
In the center of the CIP are two ports labeled **BITS A** and **BITS B** (see Figure 27 on page 42). Use two DB-9 connectors to connect external clock inputs for 19.44-MHz Stratum 3 reference clocks (supported in Junos OS Release 8.3 and later).

For information about the pinouts for the connectors, see “DB-9 Connector Pinouts for the M40e CIP BITS Input Ports” on page 293. For information about configuring an external synchronization interface, see the *Junos OS System Basics Configuration Guide*.

Alarm Relay Contacts

At the bottom of the CIP are two relay contacts for connecting the router to external alarm-reporting devices, the upper labeled **RED ALARM** and the lower **YELLOW ALARM** (see Figure 27 on page 42). A system condition that causes the red or yellow alarm LED to light on the craft interface also activates the corresponding alarm relay contact. For instructions for attaching a device to the alarm relay contacts, see “Replacing Alarm Relay Wires on the M40e Router” on page 167.

Figure 27: M40e Alarm Relay Contacts and BITS Input Ports



- Related Documentation**
- M40e Chassis Description on page 8
 - M40e Router Physical Specifications on page 269
 - M40e Router Power Requirements on page 274

M40e Power System Description

The M40e Multiservice Edge Router uses either AC or DC power. There are two load-sharing, pass-through power supplies located at the bottom rear of the chassis, as shown in “M40e Chassis Description” on page 8. The power supplies connect to the midplane, which distributes power to router components according to their individual voltage requirements. When the power supplies are installed and operational, they automatically share the electrical load. If a power supply stops functioning for any reason, the remaining power supplies instantly begin providing all the power the router needs for normal functioning and can provide full power indefinitely.



CAUTION: Mixing AC and DC power supplies is not supported and prevents the router from booting. If two power supplies are installed, they must either both be AC or both DC.

A circuit breaker box must be installed on a DC-powered router, whereas a circuit breaker is incorporated into each AC power supply.

Power supplies are hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. To avoid electrical injury, carefully follow the instructions in Disconnecting AC Power from the M40e Router and Disconnecting DC Power from the M40e Router.

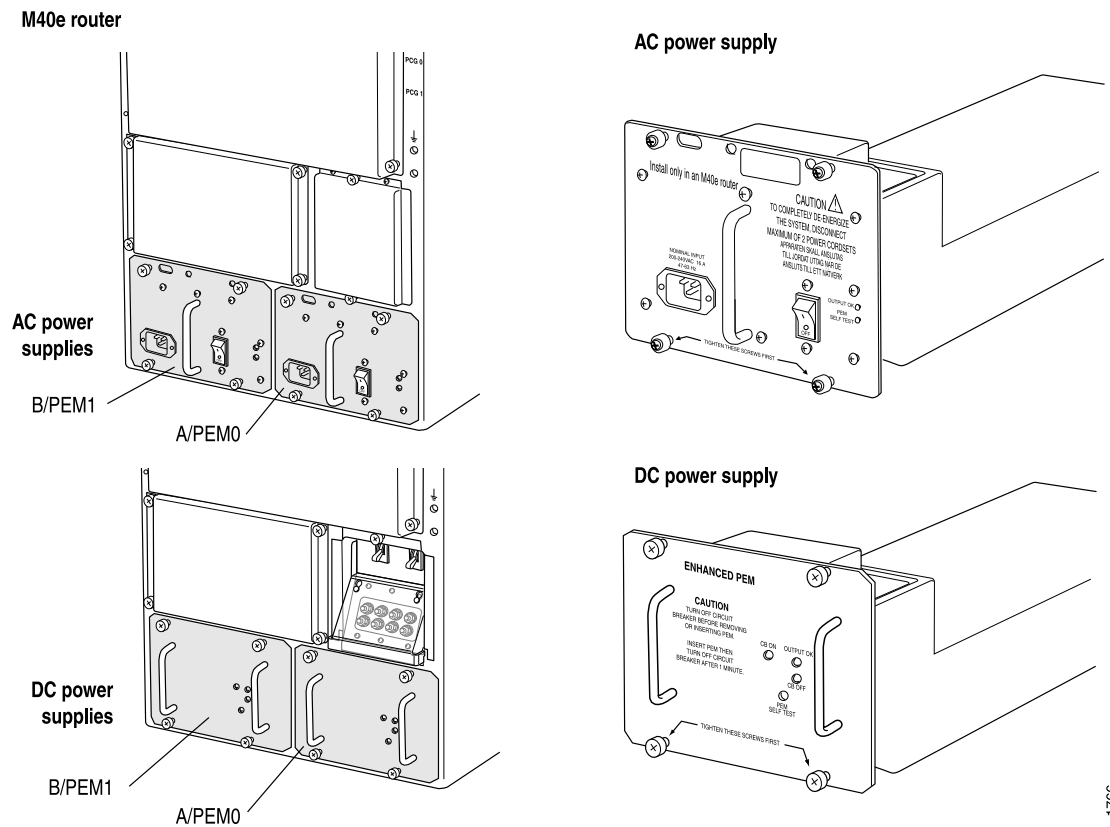


NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on. After powering on a power supply, wait at least 60 seconds before turning it off.

If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, see [Disconnecting AC Power from the M40e Router](#) or [Disconnecting DC Power from the M40e Router](#).

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

Figure 28: M40e Router Power Supplies



- AC Power Supply on page 44
- DC Power Supply on page 45
- Circuit Breaker Box on a DC-Powered Router on page 47
- Fuses on page 47

AC Power Supply

An AC-powered router has two load-sharing, pass-through AC power supplies, located at the bottom rear of the chassis, as shown in “M40e Chassis Description” on page 8.

Each AC power supply has the components (see Figure 29 on page 44):

- One LED—Indicates power supply status. It is green and labeled **OUTPUT OK**. Table 10 on page 44 describes the LED states.

In addition, power supply failure triggers the red alarm LED on the craft interface and the **RED ALARM** relay contact on the CIP. See “M40e Craft Interface Alarm LEDs and Controls” on page 35.

- Self-test button—Tests the power supply. Do not press this button; it is for use by qualified service personnel only.
- Internal fans—Cool the power supply.

Figure 29: M40e AC Power Supply

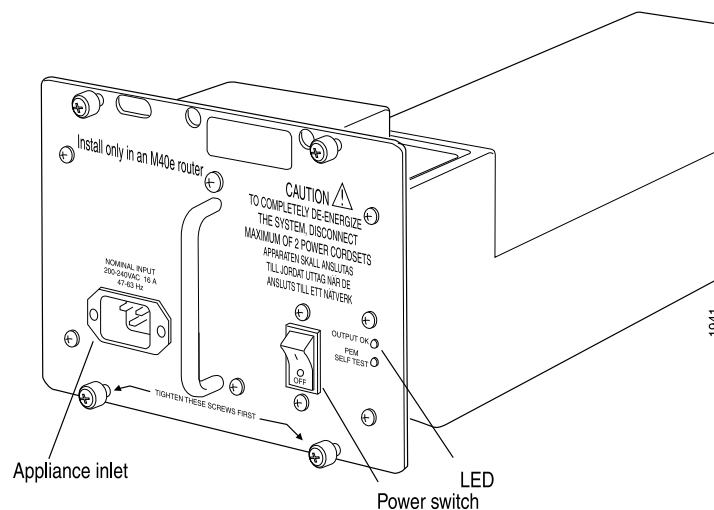


Table 10: States for M40e AC Power Supply LED

Label	Color	State	Description
OUTPUT OK	Green	On steadily	Power supply is inserted and is functioning normally.
		Blinking slowly	Power supply is not plugged in, or power switch is in off position (when other AC power supply is functioning).
		Blinking rapidly	Power supply is starting up.

Table 11 on page 45 lists electrical specifications for the AC power supply.

Table 11: Electrical Specifications for AC Power Supply

Description	Specification
Maximum power output	2900 W; isolated 3100 W; isolated
AC input voltage	Nominal: 200 VAC, 208 VAC, 220 VAC, 240 VAC Operating range: 180 to 264 VAC (2900 W) Operating range: 198 to 264 VAC (3100 W)
AC input line frequency	47 to 63 Hz
AC input current rating	15 A @ 200 V 13 A @ 240 V
Output voltages	+48 V @ 7.3 A (cooling system), +8 V @ 6 A (bias), –50 V @ 50 A isolated



NOTE: An AC-powered router can use only 220 VAC power (nominal range 200–240 VAC), not 110 VAC power (nominal range 100–120 VAC).

DC Power Supply

A DC-powered router has two load-sharing, pass-through DC power supplies, located at the bottom rear of the chassis, as shown in “M40e Chassis Description” on page 8.

Each DC power supply has the components (see Figure 30 on page 46):

- LEDs—Indicate power supply status. There is a green one labeled **CB ON**, a blue one labeled **OUTPUT OK**, and an yellow one labeled **CB OFF**. Table 12 on page 46 describes the LED states.

In addition, power supply failure triggers the red alarm LED on the craft interface and the **RED ALARM** relay contact on the CIP. See “M40e Craft Interface Alarm LEDs and Controls” on page 35.

- Self-test button—Tests the power supply. Do not press this button; it is for use by qualified service personnel only.

Figure 30: M40e DC Power Supply

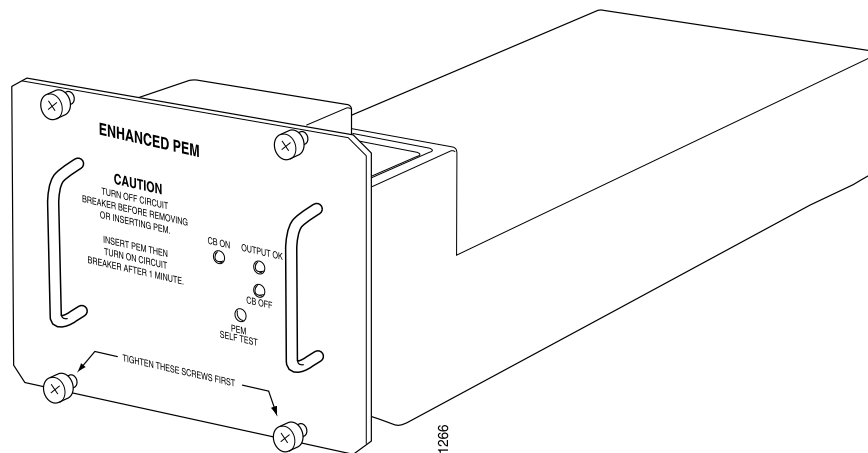


Table 12: States for M40e DC Power Supply LEDs

Label	Color	State	Description
CB ON	Green	On steadily	Power supply is inserted correctly and is receiving power. Circuit breaker is on.
OUTPUT OK	Blue	On steadily	Power supply is inserted and is functioning normally.
		Blinking	Power supply is not functioning, is starting up, or is not properly inserted, or airflow is not sufficient.
CB OFF	Yellow	On steadily	Power supply is functioning, but the circuit breaker is off.

Table 13 on page 46 lists electrical specifications for the DC power supply.

Table 13: M40e Electrical Specifications for DC Power Supply

Description	Specification
Maximum power output	3150 W; nonisolated
DC input voltage	<p>Nominal: -48 VDC, -60 VDC</p> <p>Operating range: -40.5 to -72 VDC</p> <p>NOTE: If the input voltage from the DC power source drops below -40.5 VDC, the platform automatically shuts down. During automatic shutdown, the circuit remains active. When the input voltage returns to -42.75 VDC, the platform automatically starts up again and the system returns to normal operation within 30 minutes. No operator intervention is required.</p>
DC input current rating	80 A @ -48 V
Output voltages	+48 V @ 8.3 A (cooling system), +8.3 V @ 6 A (bias), -48 V to -60 V @ 75 A

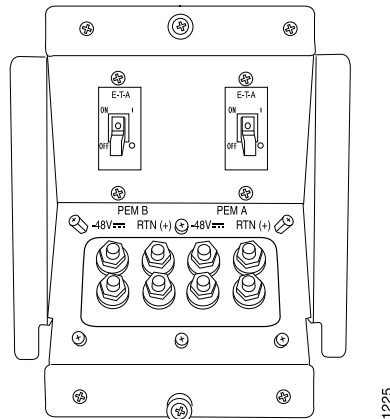
Circuit Breaker Box on a DC-Powered Router

On a DC-powered router, the circuit breaker box is located on the rear of the chassis, above the right power supply, as shown in “M40e Chassis Description” on page 8. (On an AC-powered router, the slot for the box is covered by a blank panel.)

The circuit breaker box houses two circuit breakers and sets of terminal studs, corresponding positionally to the two power supplies, as shown in Figure 31 on page 47. For proper router operation and power load sharing, connect a different external DC power source to each set of terminal studs.

In addition, a grounding cable attaches to separate grounding points located above the circuit breaker box, as shown in “M40e Chassis Description” on page 8. For more information, see “M40e Chassis Grounding Specifications” on page 276.

Figure 31: M40e Circuit Breaker Box



Fuses

The router uses fuses from the Cooper Bussman brand GMT series for the FPCs, MCSs, PCGs, and SFMs. The fuses are located in a fuse box on the rear of the midplane. When the fuse for a component blows, the component stops functioning even though it is installed correctly and the power supplies are providing power to the router. For more information, see “Using Blown Fuse Indicators to Troubleshoot the M40e Router” on page 149. For fuse replacement instructions, see “Replacing a Fuse on an M40e Router” on page 222.

Related Documentation

- M40e Router Power Requirements on page 274
- M40e System Description on page 3
- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251

M40e Cooling System Description

The cooling system includes a fan tray and several impellers that draw room air into the chassis to keep its internal temperature below a maximum acceptable level. When the temperature is below the maximum, the fans and impellers function at less than full speed. If the MCS detects that the temperature of a component has exceeded the acceptable maximum—for example, because an impeller is removed—it automatically increases the speed of the remaining impellers and fans to reduce the temperature. The fans and impellers can function at the higher speed indefinitely.

- Cooling System Components on page 48
- Airflow Through the Chassis on page 48

Cooling System Components

The cooling system has the following components. All are hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157.

- Air intake vent, air filter, and intake cover—Provide an opening for room air to enter the router. They are located at the bottom of the chassis front, below the cable management system, as shown in “M40e Chassis Description” on page 8. The air filter is removable and covers the air intake vent, preventing dust and other particles from entering the cooling system. For maintenance and replacement instructions, see “Maintaining the M40e Air Filter” on page 130. The nonremovable air intake cover is located behind the air filter and provides EMC shielding.



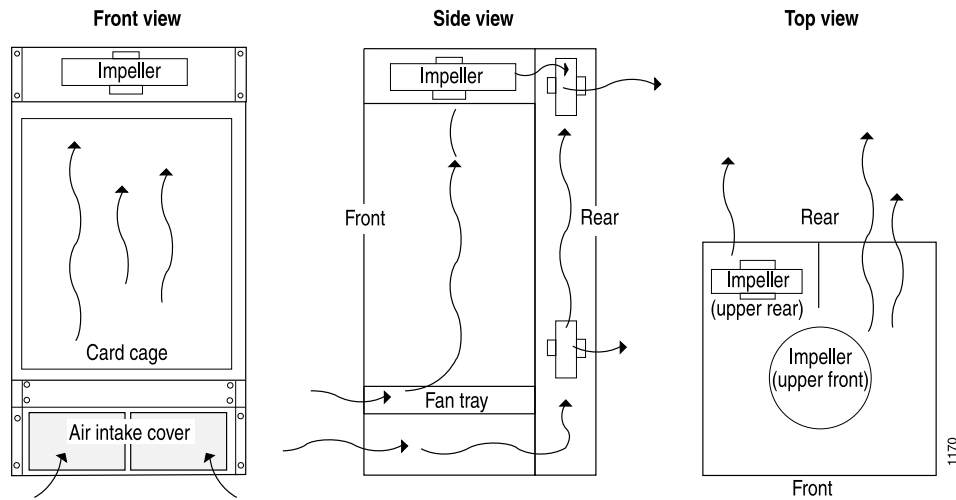
CAUTION: Do not remove the air filter for more than a few minutes while the router is operating. The fans and impellers are powerful enough to draw in foreign material, such as bits of wire, through the unfiltered air intake, which could damage router components.

- Front cooling subsystem—Cools the FPCs, PICs, and midplane. It includes a fan tray located behind the cable management system and a large, central impeller behind the craft interface. For replacement instructions, see “Replacing the Fan Tray on an M40e Router” on page 168 and “Replacing the M40e Front Impeller Assembly” on page 172.
- Rear cooling subsystem—Cools the SFMs, host module, PCGs, and power supplies. It includes one impeller located at the upper right of the chassis rear and another at the lower left, as shown in “M40e Chassis Description” on page 8. The upper and lower impellers are not interchangeable. For replacement instructions, see “Replacing the M40e Rear Lower Impeller Assembly” on page 175 and “Replacing the M40e Rear Upper Impeller Assembly” on page 177.

Airflow Through the Chassis

Figure 32 on page 49 shows airflow through the chassis and the location of the impellers and fan tray.

Figure 32: Airflow Through the M40e Chassis

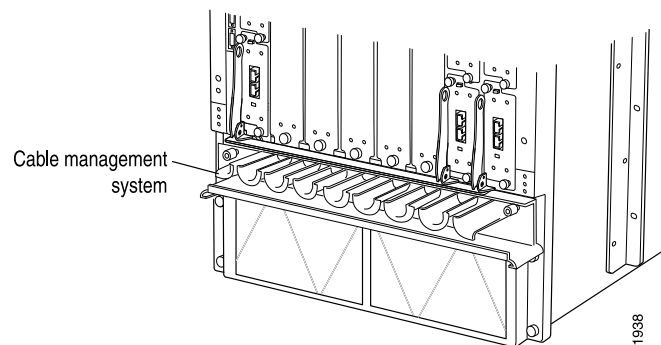
**Related Documentation**

- M40e Router Physical Specifications on page 269
- M40e System Architecture Overview on page 59
- Routine Maintenance Procedures for the M40e Router on page 129

M40e Cable Management System Description

The cable management system (see Figure 33 on page 49) consists of a row of nine semicircular plastic bobbins mounted on the front of the router below the FPC card cage. The PIC cables pass between the bobbins and into the tray, keeping the cables organized and securely in place. The curvature of the bobbins also helps maintain the proper bend radius for optical PIC cables.

Figure 33: M40e Cable Management System

**Related Documentation**

- M40e Chassis Description on page 8
- M40e Router Physical Specifications on page 269
- M40e PIC Overview

CHAPTER 3

Junos OS Overview

- M40e Junos OS Overview on page 51
- M40e Routing Engine Software Components on page 52
- Tools for Accessing and Configuring the M40e Software on page 57
- Tools for Monitoring the M40e Software on page 58
- M40e Software Upgrades on page 58

M40e Junos OS Overview

The Junos OS is especially designed for the large production networks typically supported by Internet Service Providers (ISPs). It incorporates Internet Protocol (IP) routing software and software for management of interfaces, networks, and the router chassis.

The Junos OS runs on the Routing Engine. The software consists of processes that support Internet routing protocols, control the router's interfaces and the router chassis itself, and provide an interface for system management. The processes run on top of a kernel that coordinates the communication among processes and has a direct link to the Packet Forwarding Engine software.

Use the Junos OS to configure the routing protocols that run on the router and the properties of router interfaces. After you have activated a software configuration, use the Junos OS to monitor the protocol traffic passing through the router and to troubleshoot protocol and network connectivity problems.

For additional information about the Junos OS, including its security features and a list of the industry standards it supports, see the *Junos OS System Basics Configuration Guide*. For complete information about configuring the software, including examples, see the Junos OS configuration guides.



NOTE: The router module supports Release 5.2 and later versions of the Junos OS.

Related Documentation

- M40e System Description on page 3
- M40e System Architecture Overview on page 59
- Initially Configuring the M40e Router on page 123

M40e Routing Engine Software Components

The Routing Engine software consists of several software processes that control router functions and a kernel that coordinates communication among the processes, as described in:

- Routing Protocol Process on page 52
- VPNs on page 56
- Interface Process on page 56
- Chassis Process on page 57
- SNMP and MIB II Processes on page 57
- Management Process on page 57
- Routing Engine Kernel on page 57

Routing Protocol Process

The Junos OS routing protocol process controls the routing protocols that run on the router. The routing protocol process starts all configured routing protocols and handles all routing messages. It consolidates the routing information learned from all routing protocols into common routing tables. From this routing information, the routing protocol process determines the active routes to network destinations and installs these routes into the Routing Engine's forwarding table. Finally, the routing protocol process implements the routing policies you specify, which determine how routing information is transferred between the routing protocols and the routing table.

This section discusses:

- IPv4 Routing Protocols on page 52
- IPv6 Routing Protocols on page 54
- Routing and Forwarding Tables on page 54
- Routing Policy on page 55

For complete information about routing concepts, see the Junos OS configuration guides.

IPv4 Routing Protocols

The Junos OS implements full IP routing functionality, providing support for IP version 4 (IPv4). The routing protocols are fully interoperable with existing IP routing protocols and provide the scale and control necessary for the Internet core. The software provides support for the following routing and traffic engineering protocols:

- Unicast routing protocols
 - BGP—Border Gateway Protocol, version 4, is an Exterior Gateway Protocol (EGP) that guarantees loop-free exchange of routing information between routing domains (also called autonomous systems). BGP, in conjunction with Junos routing policy, provides a system of administrative checks and balances that can be used to implement peering and transit agreements.
 - ICMP—Internet Control Message Protocol router discovery is a method that hosts can use to discover the addresses of operational routers on a subnet.
 - IS-IS—Intermediate System-to-Intermediate System is a link-state interior gateway protocol (IGP) for IP networks that uses the shortest-path-first algorithm (SPF algorithm, also called the Dijkstra algorithm) to determine routes.
 - OSPF—Open Shortest Path First, version 2, is an IGP developed for IP networks by the Internet Engineering Task Force (IETF). OSPF is a link-state protocol that makes routing decisions based on the SPF algorithm.
 - RIP—Routing Information Protocol, version 2, is an IGP for IP networks based on the Bellman-Ford algorithm. RIP is a distance-vector protocol. RIP dynamically routes packets between a subscriber and a service provider without the subscriber having to configure BGP or to participate in the service provider's IGP discovery process.
- Multicast routing protocols
 - DVMRP—Distance Vector Multicast Routing Protocol is a dense-mode (flood-and-prune) multicast routing protocol.
 - IGMP—Internet Group Management Protocol, versions 1 and 2, is used to manage membership in multicast groups.
 - MSDP—Multicast Source Discovery Protocol enables multiple PIM sparse mode domains to be joined. A rendezvous point (RP) in a PIM sparse mode domain has a peering relationship with an RP in another domain, thereby discovering multicast sources from other domains.
 - PIM sparse mode and dense mode—Protocol-Independent Multicast is a multicast routing protocol used to route traffic to multicast groups that might span wide-area and interdomain internetworks. In PIM sparse mode, routers explicitly join and leave multicast groups. PIM dense mode is a flood-and-prune protocol.
 - SAP/SDP—Session Announcement Protocol and Session Description Protocol handle conference session announcements.
- MPLS application protocols
 - LDP—Label Distribution Protocol provides a mechanism for distributing labels in nontraffic-engineered applications. LDP allows routers to establish label-switched paths (LSPs) through a network by mapping network-layer routing information directly to data-link layer switched paths. LSPs created by LDP can also traverse LSPs created by Resource Reservation Protocol (RSVP).

- **MPLS**—Multiprotocol Label Switching enables you to configure LSPs through a network either manually or dynamically. You can control how traffic traverses the network by directing it through particular paths, rather than relying on an IGP's least-cost algorithm to choose a path.
- **RSVP**—Resource Reservation Protocol, version 1, provides a mechanism for engineering network traffic patterns that is independent of the shortest path determined by a routing protocol. RSVP itself is not a routing protocol, but is designed to operate with current and future unicast and multicast routing protocols. Junos RSVP software supports dynamic signaling for MPLS LSPs.

IPv6 Routing Protocols

The Junos OS implements full IP routing functionality, providing support for IP version 6 (IPv6). The routing protocols are fully interoperable with existing IP routing protocols and provide the scale and control necessary for the Internet core. The software provides support for the following unicast routing protocols:

- **BGP**—Border Gateway Protocol, version 4, is an EGP that guarantees loop-free exchange of routing information between routing domains (also called autonomous systems). BGP, in conjunction with Junos routing policy, provides a system of administrative checks and balances that can be used to implement peering and transit agreements.
- **ICMP**—Internet Control Message Protocol router discovery is a method that hosts can use to discover the addresses of operational routers on a subnet.
- **IS-IS**—Intermediate System-to-Intermediate System is a link-state interior gateway protocol (IGP) for IP networks that uses the shortest-path-first algorithm (SPF algorithm, also called the Dijkstra algorithm) to determine routes.
- **OSPF**—Open Shortest Path First, version 3 (OSPFv3), supports version 6 of the Internet Protocol (IPv6). The fundamental mechanisms of OSPF such as flooding, Designated Router (DR) election, area based topologies and the Shortest Path First (SPF) calculations remain unchanged. Some differences exist either due to changes in protocol semantics between IPv4 and IPv6, or to handle the increased address size of IPv6.
- **RIP**—Routing Information Protocol, version 2, is an IGP for IP networks based on the Bellman-Ford algorithm. RIP is a distance-vector protocol. RIP dynamically routes packets between a subscriber and a service provider without the subscriber having to configure BGP or to participate in the service provider's IGP discovery process.

Routing and Forwarding Tables

The primary function of the Junos routing protocol process is maintaining routing tables and using the information in them to determine active routes to network destinations. It copies information about the active routes into the Routing Engine's forwarding table, which the Junos kernel copies to the Packet Forwarding Engine.

By default, the routing protocol process maintains the following routing tables and uses the information in each table to determine active routes to network destinations:

- **Unicast routing table**—Stores routing information for all unicast protocols running on the router, including BGP, IS-IS, OSPF, and RIP. You can also configure additional

routes, such as static routes, for inclusion in the routing table. The unicast routing protocols use the routes in this table when advertising routing information to their neighbors.

In the unicast routing table, the routing protocol process designates routes with the lowest preference values as active. By default, a route's preference value is simply a function of how the routing protocol process learned about the route. You can modify the default preference value by setting routing policies and configuring other software parameters. See “Routing Policy” on page 55.

- Multicast routing table (cache)—Stores routing information for all multicast protocols running on the router, including DVMRP and PIM. You can configure additional routes for inclusion in the routing table.

In the multicast routing table, the routing protocol process uses traffic flow and other parameters specified by the multicast routing protocol algorithms to select active routes.

- MPLS routing table—Stores MPLS label information.

For unicast routes, the routing protocol process determines active routes by choosing the most preferred route, which is the route with the lowest preference value. By default, the route's preference value is simply a function of how the routing protocol process learned about the route. You can modify the default preference value using routing policy and with software configuration parameters.

For multicast traffic, the routing protocol process determines active routes based on traffic flow and other parameters specified by the multicast routing protocol algorithms. The routing protocol process then installs one or more active routes to each network destination into the Routing Engine's forwarding table.

You can configure additional routing tables to meet your requirements, as described in the *Junos OS Routing Protocols Configuration Guide*.

Routing Policy

By default, all routing protocols place their routes into the routing table. When advertising routes, the routing protocols, by default, advertise only a limited set of routes from the routing table. Specifically, each routing protocol exports only the active routes that were learned by that protocol. In addition, IGPs (IS-IS, OSPF, and RIP) export the direct (interface) routes for the interfaces on which the protocol is explicitly configured.

For each routing table, you can affect the routes that a protocol places into the table and the routes from the table that the protocol advertises by defining one or more routing policies and then applying them to the specific routing protocol.

Routing policies applied when the routing protocol places routes into the routing table are called *import policies* because the routes are being imported into the routing table. Policies applied when the routing protocol is advertising routes that are in the routing table are called *export policies* because the routes are being exported from the routing table. In other words, the terms import and export are used with respect to the routing table.

Routing policy enables you to control (filter) which routes are imported into the routing table and which routes are exported from the routing table. Routing policy also allows you to set the information associated with a route as it is being imported into or exported from the routing table. Routing policies applied to imported routes control the routes used to determine active routes, whereas policies applied to exported routes control which routes a protocol advertises to its neighbors.

You implement routing policy by defining policies. A policy specifies the conditions to use to match a route and the action to perform on the route when a match occurs. For example, when a routing table imports routing information from a routing protocol, a routing policy might modify the route's preference, mark the route with a color to identify it for later manipulation, or prevent the route from even being installed in a routing table. When a routing table exports routes to a routing protocol, a policy might assign metric values, modify the BGP community information, tag the route with additional information, or prevent the route from being exported altogether. You also can define policies for redistributing the routes learned from one protocol into another protocol.

VPNs

The Junos OS supports several types of VPNs:

- Layer 2 VPNs—A Layer 2 VPN links a set of sites sharing common routing information, and whose connectivity is controlled by a collection of policies. A Layer 2 VPN is not aware of routes within a customer's network. It simply provides private links between a customer's sites over the service provider's existing public Internet backbone.
- Layer 3 VPNs—A Layer 3 VPN links a set of sites that share common routing information, and whose connectivity is controlled by a collection of policies. A Layer 3 VPN is aware of routes within a customer's network, requiring more configuration on the part of the service provider than a Layer 2 VPN. The sites that make up a Layer 3 VPN are connected over a service provider's existing public Internet backbone.
- Interprovider VPNs—An interprovider VPN supplies connectivity between two VPNs in separate autonomous systems (ASs). This functionality could be used by a VPN customer with connections to several various ISPs, or different connections to the same ISP in various geographic regions.
- Carrier-of-Carrier VPNs—Carrier-of-carrier VPNs allow a VPN service provider to supply VPN service to a customer who is also a service provider. The latter service provider supplies Internet or VPN service to an end customer.

Interface Process

The Junos interface process manages the physical interface devices and logical interfaces on the router. It implements the Junos OS command-line interface (CLI) commands and configuration statements that you use to specify interface properties such as location (FPC location in the FPC card cage and PIC location on an FPC), the interface type (such as SONET/SDH or ATM), encapsulation, and interface-specific properties. You can configure both interfaces that are currently active and interfaces that might be installed later.

The Junos interface process communicates with the interface process in the Packet Forwarding Engine through the Junos kernel, enabling the Junos OS to track the status and condition of router interfaces.

Chassis Process

The Junos chassis process allows you to configure and control the properties of the router, including conditions that trigger alarms and clock sources. The chassis process communicates directly with a chassis process in the Junos kernel.

SNMP and MIB II Processes

The Junos OS supports the Simple Network Management Protocol (SNMP), versions 1, 2, and 3, which provides a mechanism for monitoring the state of the router. This software is controlled by the Junos SNMP and Management Information Base (MIB) II processes, which consist of an SNMP master agent and a MIB II agent.

Management Process

The management process starts all the other Junos OS processes and the CLI when the router boots. It monitors the running Junos processes and makes all reasonable attempts to restart any process that terminates.

Routing Engine Kernel

The Routing Engine kernel provides the underlying infrastructure for all Junos OS processes. It also provides the link between the routing tables maintained by the routing protocol process and the forwarding table maintained by the Routing Engine. Additionally, it coordinates communication with the Packet Forwarding Engine, which primarily involves synchronizing the Packet Forwarding Engine's forwarding table with the master forwarding table maintained by the Routing Engine.

Related Documentation

- M40e Routing Engine Architecture on page 61
- M40e Routing Engine Description on page 26

Tools for Accessing and Configuring the M40e Software

The Junos OS CLI is the primary tool for accessing and controlling the Junos OS. You use it when accessing the router through the console or a connection to an out-of-band management network. The CLI includes commands for configuring router hardware, the Junos OS, and network connectivity.

The Junos OS CLI is a straightforward command interface. You type commands on a single line and enter the commands by pressing the Enter key. The CLI provides command help and command completion, as well as Emacs-style keyboard sequences for moving around on a command line and scrolling through a buffer that contains recently executed commands. For more information about the CLI, see the *Junos OS System Basics Configuration Guide*.

Related Documentation

- M40e System Description on page 3
- M40e System Architecture Overview on page 59

- Initially Configuring the M40e Router on page 123

Tools for Monitoring the M40e Software

In addition to commands for configuring router hardware and software, the CLI includes commands for monitoring and troubleshooting hardware, software, routing protocols, and network connectivity. CLI commands display information from routing tables, information specific to routing protocols, and information about network connectivity derived from the **ping** and **traceroute** utilities.

You can also use the Junos OS implementation of SNMP to monitor routers. The SNMP software consists of an SNMP master agent and a MIB II agent. It provides full support for MIB II SNMP version 1 traps and version 2 notifications, SNMP version 1 **Get** and **GetNext** requests, and version 2 **GetBulk** requests. For more information about SNMP, see the *Junos OS Network Management Configuration Guide*.

The software also supports tracing and logging operations, which you can use to track normal router operations, error conditions, and the packets that the router generates or forwards. Logging operations use a syslog-like mechanism to record systemwide, high-level events such as interfaces going up or down and user logins on the router. Tracing operations record more detailed information about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy actions.

Related Documentation

- M40e System Description on page 3
- M40e System Architecture Overview on page 59
- Initially Configuring the M40e Router on page 123

M40e Software Upgrades

The M40e MultiService Edge Router is delivered with the Junos OS preinstalled. To upgrade the software, you use CLI commands to copy a set of software images over the network to memory storage on the Routing Engine. The Junos OS set consists of several images provided in individual packages or as a bundle. You normally upgrade all packages simultaneously. For information about installing and upgrading Junos OS, see the *Junos OS Installation and Upgrade Guide*.

Related Documentation

- M40e System Description on page 3
- M40e System Architecture Overview on page 59
- Initially Configuring the M40e Router on page 123

CHAPTER 4

M40e System Architecture Overview

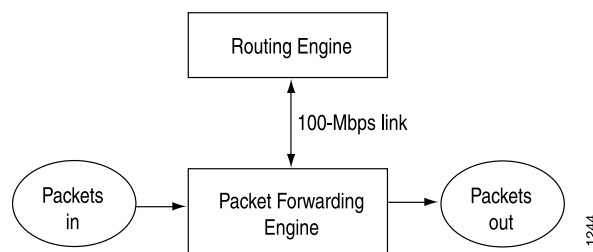
- M40e System Architecture Overview on page 59
- M40e Packet Forwarding Engine Architecture on page 60
- M40e Routing Engine Architecture on page 61

M40e System Architecture Overview

- 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 34 on page 59 illustrates the relationship between the Packet Forwarding Engine and the Routing Engine.

Figure 34: System Architecture



Related Documentation

- M40e System Redundancy on page 4
- M40e System Description on page 3
- M40e PIC Overview

M40e Packet Forwarding Engine Architecture

The Packet Forwarding Engine performs Layer 2 and Layer 3 packet switching.

- Packet Forwarding Engine Components on page 60
- Data Flow Through the Packet Forwarding Engine on page 60

Packet Forwarding Engine Components

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

The Packet Forwarding Engine architecture includes the 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.
- Flexible PIC Concentrators (FPCs)—House PICs and provide shared memory for processing incoming and outgoing packets. Each FPC hosts two I/O Manager ASICs, one active and one in standby mode. The active I/O Manager ASIC divides incoming data packets into memory blocks (cells) before passing them to the active SFM, and reassembles cells into data packets when the packets are ready for transmission. The FPC also hosts two Packet Director ASICs—one concentrates incoming packets to the active I/O Manager ASIC, and the other distributes outgoing packets to the appropriate PICs on the FPC.
- Switching and Forwarding Module (SFM)—Hosts an Internet Processor II ASIC, which makes forwarding decisions, and two Distributed Buffer Manager ASICs: one distributes data cells to the shared memory buffers on the FPCs and the other notifies the FPCs of forwarding decisions for outgoing packets.

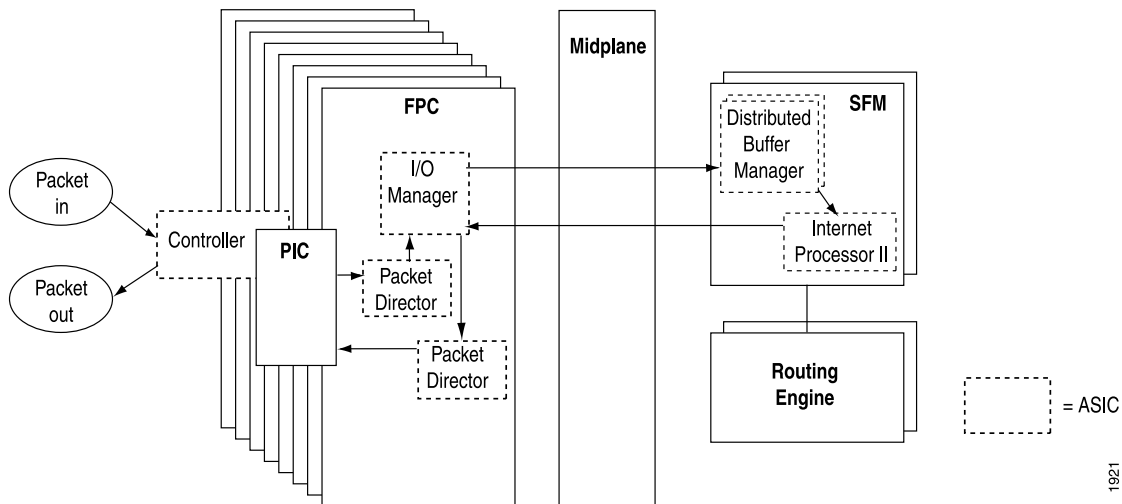
Data Flow Through the Packet Forwarding Engine

Use of ASICs promotes efficient movement of data packets through the system. Packets flow through the Packet Forwarding Engine in the sequence (see Figure 35 on page 61):

1. Packets arrive at an incoming PIC interface.
2. The PIC passes the packets to the FPC, where the Packet Director ASIC directs them to the active I/O Manager ASIC.
3. The I/O Manager ASIC processes the packet headers, divides the packets into 64-byte data cells, and passes the cells through the midplane to the SFM.
4. A Distributed Buffer Manager ASIC on the SFM distributes the data cells throughout the memory buffers located on and shared by all the FPCs.
5. The Internet Processor II ASIC on the SFM performs a route lookup for each packet and decides how to forward it.

6. The Internet Processor II ASIC notifies the second Distributed Buffer Manager ASIC (on the SFM) of the forwarding decision, and the Distributed Buffer Manager ASIC forwards the notification to the FPC that hosts the appropriate outbound interface.
7. The I/O Manager ASIC on the FPC reassembles data cells stored in shared memory into data packets as they are ready for transmission and passes them through the Packet Director ASIC to the outbound PIC.
8. The outbound PIC transmits the data packets.

Figure 35: Packet Forwarding Engine Components and Data Flow



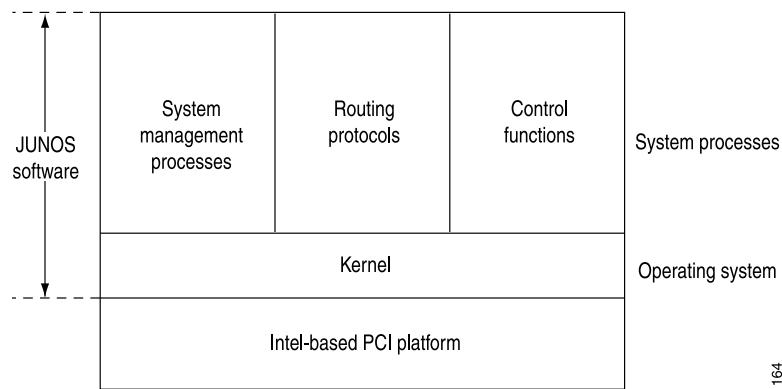
- Related Documentation**
- M40e PCG LEDs on page 19
 - M40e Packet Forwarding Engine Clock Generators (PCGs) Description on page 18
 - Installing a PCG in an M40e Router on page 197

M40e Routing Engine Architecture

The Routing Engine runs 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 36 on page 62).

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

Figure 36: M40e Routing Engine Architecture



- Routing Engine Functions on page 62

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 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.

63

Related Documentation

- Installing a Routing Engine in an M40e Router on page 189
- M40e Routing Engine Description on page 26



PART 2

Setting Up the M40e Router

- [Preparing the Site for M40e Router Installation on page 67](#)
- [Unpacking the M40e Router on page 73](#)
- [Installing the M40e Router Mounting Hardware on page 77](#)
- [Installing the M40e Router Using a Mechanical Lift on page 81](#)
- [Installing the M40e Router Without a Mechanical Lift on page 83](#)
- [Grounding the M40e Router on page 109](#)
- [Connecting the M40e Router to External Devices on page 111](#)
- [Providing Power to the M40e Router on page 119](#)
- [Configuring Junos OS on page 123](#)

CHAPTER 5

Preparing the Site for M40e Router Installation

- M40e Site Preparation Checklist on page 67
- M40e Rack Requirements on page 68
- M40e Clearance Requirements for Airflow and Hardware Maintenance on page 71

M40e Site Preparation Checklist

The checklist in Table 14 on page 67 summarizes the tasks you need to perform when preparing a site for router installation.

Table 14: Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Environment			
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	"M40e Router Environmental Specifications" on page 271		
Power			
Measure distance between external power sources and router installation site.	"M40e AC Power, Connection, and Power Cord Specifications" on page 277 "M40e DC Power, Connection, and Cable Specifications" on page 279		
Locate sites for connection of system grounding.	"M40e Chassis Grounding Specifications" on page 276		
Calculate the power consumption and requirements.	"M40e Router Power Requirements" on page 274		
Hardware Configuration			
Choose the configuration.			
Rack			

Table 14: Site Preparation Checklist (*continued*)

Item or Task	For More Information	Performed By	Date
Verify that your rack meets the minimum requirements for the installation of the router.	"M40e Rack Size and Strength" on page 69		
Plan rack location, including required space clearances.	"M40e Clearance Requirements for Airflow and Hardware Maintenance" on page 71		
If a rack is used, secure rack to floor and building structure.	"M40e Connection to Building Structure" on page 71		
Cables			
Acquire cables and connectors:	"Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers" on page 285		
<ul style="list-style-type: none"> Determine the number of cables needed based on your planned configuration. Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected. 	"Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers" on page 286		
Plan the cable routing and management.	"Maintaining M40e PICs and PIC Cables" on page 139		

- Related Documentation**
- M40e Chassis Description on page 8
 - M40e Router Physical Specifications on page 269
 - M40e Chassis Lifting Guidelines on page 235
 - General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229
 - M40e Router Environmental Specifications on page 271

M40e Rack Requirements

The M40e Multiservice Edge Router must be installed in a rack. Many types of racks are acceptable, including 4-post (telco) racks and open-frame racks. An example of a open-frame rack appears in "M40e Rack Size and Strength" on page 69.

The following sections describe rack requirements:

- M40e Rack Size and Strength on page 69
- Spacing of the M40e Mounting Holes on page 70
- M40e Connection to Building Structure on page 71

M40e Rack Size and Strength

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

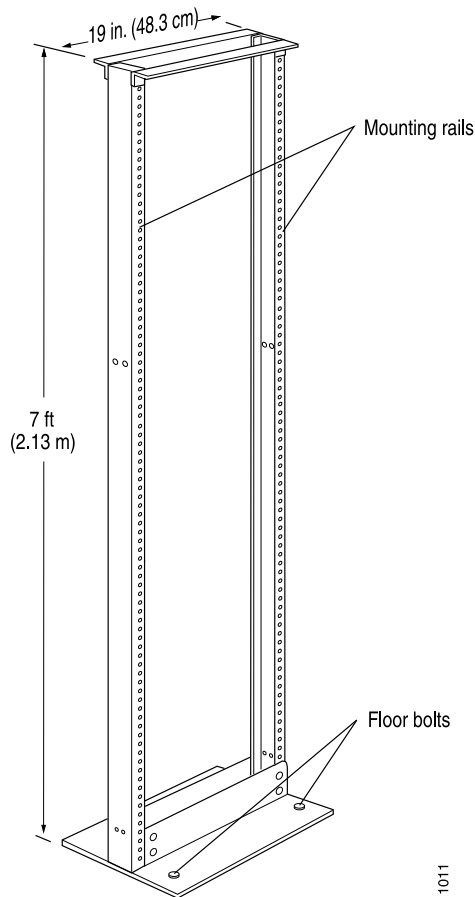
With the use of adapters, the router is designed to fit into a 600-mm-wide rack, as defined in the four-part *Equipment Engineering (EE); European telecommunications standard for equipment practice* (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards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

The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions: 35 in. (89 cm) high, 29 in. (73.6 cm) deep, and 17.5 in. (44.5 cm) wide. The outer edges of the front support posts and center-mounting brackets extend the width to 19 in. (48.3 cm). The spacing of rails and adjacent racks must also allow for the clearances around the router and rack that are specified in "M40e Clearance Requirements for Airflow and Hardware Maintenance" on page 71.

The chassis height of 35 in. (89 cm) is approximately 20 U. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Industry Association. You can stack two M40e routers in a rack that has at least 40 U (70 in. or 1.78 m) of usable vertical space.

The rack must be strong enough to support the weight of the fully configured router, up to approximately 360 lb (164 kg). If you stack two fully configured routers in one rack, it must be capable of supporting about 720 lb (328 kg).

Figure 38: Typical Open-Frame Rack



Related Documentation

- Rack-Mounting M40e Hardware Description on page 77
- M40e Site Preparation Checklist on page 67
- M40e Chassis Description on page 8
- M40e Router Physical Specifications on page 269

Spacing of the M40e Mounting Holes

Table 15 on page 70 specifies the spacing between mounting holes in the chassis's front support posts and center-mounting brackets. The mounting holes in a front-mount rack's rails must align with the holes in the front support posts, and the mounting holes in a center-mount rack's rails must align with the holes in the center-mounting brackets.

Table 15: Spacing of Holes on M40e Front Support Post and Center-Mounting Bracket

Router Mounting Rail	Hole Spacing
Front support post	4 U (7 in. or 17.78 cm)

Table 15: Spacing of Holes on M40e Front Support Post and Center-Mounting Bracket (*continued*)

Router Mounting Rail	Hole Spacing
Center-mounting bracket	3 U (5.25 in. or 13.33 cm)

Related Documentation

- M40e Site Preparation Checklist on page 67
- M40e Chassis Description on page 8
- M40e Router Physical Specifications on page 269

M40e Connection to Building Structure

Always secure the rack to the structure of the building. If your geographical area is subject to earthquakes, bolt the rack to the floor. For maximum stability, also secure the rack to ceiling brackets. For more information, see “Rack-Mounting Requirements and Warnings for M Series, MX Series, and T Series Routers” on page 236.

Related Documentation

- M40e Site Preparation Checklist on page 67
- M40e Chassis Description on page 8
- M40e Router Physical Specifications on page 269

M40e Clearance Requirements for Airflow and Hardware Maintenance

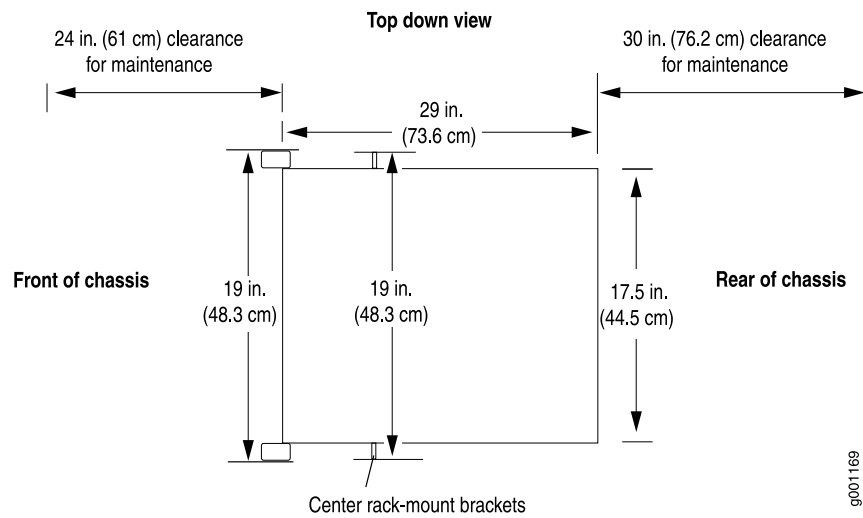
When planning the installation site, you must allow sufficient clearance around the rack (see Figure 39 on page 72):

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. “M40e Cooling System Description” on page 48 depicts the airflow in the router.



NOTE: If you mount the router in a cabinet, be sure that ventilation is sufficient to prevent overheating.

- For service personnel to remove and install hardware components, there must be adequate space at the front and back of the router. At least 24 in. (61 cm) is required both in front of and behind the router. NEBS GR-63 recommends that you allow at least 30 in. (72.6 cm) in front of the rack and 24 in. (61 cm) behind the rack.

Figure 39: M40e Chassis Dimensions and Clearance Requirements**Related Documentation**

- M40e Site Preparation Checklist on page 67
- M40e Chassis Description on page 8
- M40e Router Physical Specifications on page 269

CHAPTER 6

Unpacking the M40e Router

- Tools and Parts Required to Unpack the M40e Router on page 73
- Unpacking the M40e Router on page 73
- Verifying the M40e Parts Received on page 75

Tools and Parts Required to Unpack the M40e Router

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

- 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

- M40e Chassis Description on page 8
- M40e PIC Overview
- M40e Site Preparation Checklist on page 67
- General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229

Unpacking the M40e Router

The router is shipped in a wooden crate and bolted to the pallet that forms the bottom of the crate. The crate also contains an accessory box, the handle used during manual router installation, and the *M40e Multiservice Edge Router Quick Start*.

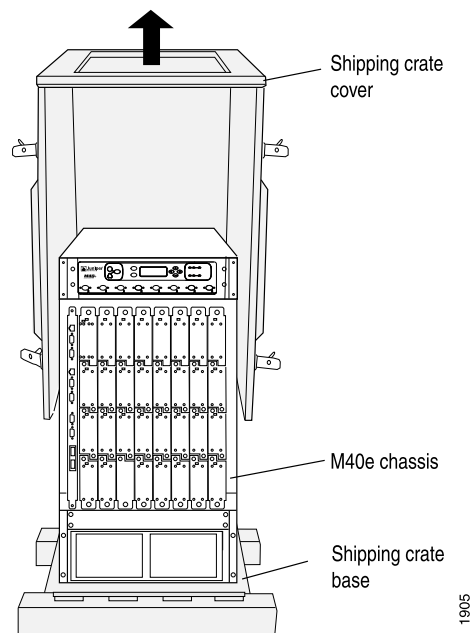


NOTE: The router is maximally protected inside the shipping crate. Do not unpack it until you are ready to begin installation.

To unpack the router:

1. Move the shipping crate to a staging area as close to the installation site as possible, but where you have enough room to remove the system components. While the chassis is bolted to the pallet, you can use a forklift or pallet jack to move it.
2. Position the crate so that the arrows are pointing up.
3. Twist open the locking tabs that secure the crate to the pallet and the front panel to the side panels.
4. Remove the front panel from the crate, then lift the top and sides off the pallet as a unit. See Figure 40 on page 75.
5. Remove the plastic cover, then the foam and Quick Start that are sitting on top of the chassis. The installation handle and accessory box are embedded in cutouts in the foam.
6. Open the accessory box and verify the contents against the parts inventory on the label attached to the box.
7. Verify the chassis components received against the packing list included with the router. A generic parts inventory appears in "Verifying the M40e Parts Received" on page 75.
8. Use a 1/2-in. open-end or socket wrench to loosen and remove the bolts on the brackets that attach the chassis to the pallet. If a 1/2-in. tool is not available, use an adjustable wrench rather than a fixed-size metric wrench.
9. Use a Phillips screwdriver to loosen the screws that secure the brackets to the sides of the chassis, and remove the brackets. Store the brackets, screws, and bolts inside the accessory box.
10. Save the shipping crate, packing materials, and pallet in case you later need to move or ship the router.

Figure 40: Unpacking the Router



- Related Documentation
- M40e Chassis Description on page 8
 - M40e PIC Overview
 - M40e Site Preparation Checklist on page 67
 - M40e Chassis Lifting Guidelines on page 235
 - General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229

Verifying the M40e 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 generic router contains the router chassis with installed components, listed in Table 16 on page 75.

Table 16: Generic Inventory of Router Components Installed in Chassis

Component	Quantity
Front impeller assembly with craft interface	1
FPC with one or more PICs installed	Up to 8
PIC	Up to 4 per Type 1 FPCs, 1 per Type 2 FPCs

Table 16: Generic Inventory of Router Components Installed in Chassis (*continued*)

Component	Quantity
CIP	1
Front fan tray with 4 fans and cable management system	1
Midplane	1
Rear upper impeller assembly	1
SFM	1 or 2
MCS	1 or 2
Routing Engine	1 or 2
PCG	2
Rear lower impeller assembly	1
Circuit breaker box (on DC-powered router only)	1
Power supply (AC or DC)	2
Center-mounting brackets	2
Blank panels for slots without components	Varies depending on router configuration

- Related Documentation**
- M40e Chassis Description on page 8
 - M40e PIC Overview
 - M40e Site Preparation Checklist on page 67

CHAPTER 7

Installing the M40e Router Mounting Hardware

- Rack-Mounting M40e Hardware Description on page 77
- Installing the M40e Mounting Hardware for a Four-Post Rack on page 78
- Installing the M40e Mounting Hardware for an Open-Frame Rack on page 78

Rack-Mounting M40e Hardware Description

Install the mounting hardware before you install the router. After you install the mounting hardware, proceed to “Installing the M40e Router Using a Mechanical Lift” on page 81 or “Installing the M40e Chassis into the Rack” on page 95, depending on your type of installation.

The mounting hardware required and the procedure for installing the mounting hardware depends on the type of rack.

The following mounting hardware is supplied with the M40e MultiService Edge Router:

- Mounting shelf—Required for all mounting options
- Front-mounting flanges on the chassis—Required for a four-post rack or cabinet, or for front-mounting in an open-frame rack
- Center-mounting brackets attached to the sides of the chassis—Required for center-mounting in an open-frame rack

“M40e Chassis Description” on page 8 shows the center-mounting brackets and the front-mounting flanges.

Related Documentation

- M40e Rack Size and Strength on page 69
- M40e Clearance Requirements for Airflow and Hardware Maintenance on page 71
- M40e Site Preparation Checklist on page 67
- Installing the M40e Mounting Hardware for a Four-Post Rack on page 78
- Installing the M40e Mounting Hardware for an Open-Frame Rack on page 78

Installing the M40e Mounting Hardware for a Four-Post Rack

To prepare to mount the router into a four-post rack or cabinet:

- Installing Cage Nuts, If Needed on page 78
- Installing the Mounting Shelf in a Four-Post Rack or Cabinet on page 78
- Removing the Center-Mounting Brackets on page 78

Installing Cage Nuts, If Needed

Install cage nuts, if needed:

1. On each front rack rail, install a cage nut 0.88 in. (2.2 cm) up from the bottom of a U division.
2. Insert a cage nut behind each hole where you plan to install the flanges of the mounting shelf.

Installing the Mounting Shelf in a Four-Post Rack or Cabinet

To install the mounting shelf:

1. On the front of each front rack rail, partially insert a mounting screw 0.88 in. (2.2 cm) up from the bottom of a U division.
2. Install the shelf on the front rack rails. Rest the bottom slot of each flange on one of the mounting screws.
3. Partially insert a mounting screw into the top hole in each flange of the shelf.
4. Tighten all the screws completely.

Removing the Center-Mounting Brackets

To remove the center-mounting brackets:

1. Loosen the screws at the top and bottom of each bracket.
2. Remove the brackets from both sides of the chassis.

Related Documentation

- M40e Chassis Description on page 8
- General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229
- M40e Clearance Requirements for Airflow and Hardware Maintenance on page 71
- M40e Site Preparation Checklist on page 67

Installing the M40e Mounting Hardware for an Open-Frame Rack

To prepare to mount the router into an open-frame rack, install the mounting shelf on the rack. Install cage nuts, if needed.

For open-frame racks, center-mounting the chassis is preferable to front-mounting because the more even distribution of weight provides greater stability. You use the center-mounting brackets to center-mount the chassis in an open-frame rack; you use the front-mounting flanges to front-mount the chassis in an open-frame rack.

- Installing Cage Nuts, If Needed on page 79
- Installing the Mounting Shelf in an Open-Frame Rack on page 79
- Removing the Center-Mounting Brackets on page 79

Installing Cage Nuts, If Needed

Install cage nuts, if needed:

1. On each front rack rail, install a cage nut 0.88 in. (2.2 cm) up from the bottom of a U division.
2. Insert a cage nut behind each hole where you plan to install the flanges of the mounting shelf.

Installing the Mounting Shelf in an Open-Frame Rack

To install the mounting shelf in an open-frame rack:

1. On the front of each front rack rail, partially insert a mounting screw 0.88 in. (2.2 cm) up from the bottom of a U division.
2. Install the shelf on the front rack rails. Rest the bottom slot of each flange on one of the mounting screws.
3. Partially insert a mounting screw into the top hole in each flange of the shelf.
4. Tighten all the screws completely.

Removing the Center-Mounting Brackets

If you plan to front-mount the router, remove the center-mounting brackets.

To remove the center-mounting brackets:

1. Loosen the screws at the top and bottom of each bracket.
2. Remove the brackets from both sides of the chassis.

Related Documentation

- M40e Chassis Description on page 8
- General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229
- M40e Clearance Requirements for Airflow and Hardware Maintenance on page 71
- M40e Site Preparation Checklist on page 67

CHAPTER 8

Installing the M40e Router Using a Mechanical Lift

- Tools and Parts Required to Install the M40e Router Using a Mechanical Lift on page 81
- Installing the M40e Router Using a Mechanical Lift on page 81

Tools and Parts Required to Install the M40e Router Using a Mechanical Lift

To install the chassis into a rack using a mechanical lift:

- Mechanical lift
- 5/32-in. Allen (hexagonal) wrench for tightening the mounting screws provided in the accessory box; do not substitute a metric-size wrench
- Phillips (+) screwdrivers, numbers 1 and 2, if removing center-mounting brackets or installing rear support shelf

Related Documentation

- M40e Chassis Description on page 8
- M40e Chassis Lifting Guidelines on page 235
- M40e Site Preparation Checklist on page 67
- Installing the M40e Router Using a Mechanical Lift on page 81

Installing the M40e Router Using a Mechanical Lift

Using a mechanical lift to maneuver the router into the rack is recommended because of the router's size and weight. The lift must be able to accommodate the router's weight—between 190 lb (86 kg) and about 360 lb (164 kg) depending on configuration—and must fit between the support posts of the rack.



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

First, perform the prerequisite procedures:

- Verify that the router site meets the requirements described in “M40e Site Preparation Checklist” on page 67.
- Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure. For details, see “M40e Rack Size and Strength” on page 69, “M40e Connection to Building Structure” on page 71, and “M40e Clearance Requirements for Airflow and Hardware Maintenance” on page 71.
- For details on mounting, see “Spacing of the M40e Mounting Holes” on page 70, “Installing the M40e Mounting Hardware for a Four-Post Rack” on page 78, and “Installing the M40e Mounting Hardware for an Open-Frame Rack” on page 78.
- Read the information in “M40e Chassis Lifting Guidelines” on page 235.
- Remove the router from the shipping carton, as described in “Unpacking the M40e Router” on page 73.

Then install the router:

1. If you are front-mounting the router, remove the center-mounting brackets from each side of the chassis. (Also, we recommend installing a shelf or other support for the rear of the chassis.)
2. Load the router onto the lift, making sure it rests securely on the lift platform.
3. Use the lift to position the router at the correct height in the rack.
4. Align the bottom hole in both front support posts or center-mounting brackets with a hole in each rack rail, making sure the chassis is level.
5. Install one of the mounting screws provided into each of the two aligned holes. Use a 5/32-in. Allen wrench to tighten the screws.
6. Moving up each post or bracket, install a screw in every mounting hole.
7. 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.
8. Move the lift away from the rack.
9. To continue the installation, proceed to “Connecting the M40e Router to Management and Alarm Devices” on page 111.

**Related
Documentation**

- M40e Chassis Description on page 8
- M40e Router Environmental Specifications on page 271
- M40e Router Physical Specifications on page 269

CHAPTER 9

Installing the M40e Router Without a Mechanical Lift

- Tools and Parts Required to Install the M40e Router Without a Lift on page 83
- Removing Components from the Chassis Before Installing the M40e Router Without a Lift on page 83
- Installing the M40e Chassis into the Rack on page 95
- Reinstalling the M40e Components into the Chassis on page 97

Tools and Parts Required to Install the M40e Router Without a Lift

To install the chassis without using a mechanical lift, you need:

- Phillips (+) screwdrivers, numbers 1 and 2
- Flat-blade screwdriver, approximately 1/4 in. (6 mm), for removing craft interface
- 5/32-in. Allen (hexagonal) wrench for tightening the mounting screws provided in the accessory box; do not substitute a metric-size wrench
- Electrostatic bags or antistatic mats, one for each electronic component removed
- Electrostatic discharge (ESD) grounding wrist strap

Related Documentation

- M40e Chassis Description on page 8
- M40e Chassis Lifting Guidelines on page 235
- M40e Site Preparation Checklist on page 67
- Installing the M40e Chassis into the Rack on page 95
- Removing Components from the Chassis Before Installing the M40e Router Without a Lift on page 83

Removing Components from the Chassis Before Installing the M40e Router Without a Lift

You can install the router into a rack either with or without the help of a mechanical lift. Because the router weighs between 190 lb (86 kg) and about 360 lb (164 kg) depending

on configuration, using a mechanical lift is recommended; for instructions, see “Installing the M40e Router Using a Mechanical Lift” on page 81.

If you do not use a mechanical lift, you must remove components from the chassis to reduce its weight before lifting it into the rack. The reduced chassis weight is approximately 115 lb (52 kg), so installing it safely still requires three people to lift and another person to insert the mounting screws.

To make the router light enough to install without a mechanical lift, you must remove most of the components.



.....
WARNING: The procedures in this section apply only to initial installation and assume that you have not yet connected power to the router. If power is connected, completely disconnect it before continuing. See [Disconnecting AC Power from the M40e Router](#) or [Disconnecting DC Power from the M40e Router](#).

Do not stack components on top of one another after removing them from the chassis. Place each one individually on a flat, stable surface, either on an antistatic mat or in an electrostatic bag.

Set the removed components far enough away from the installation site that they will not be in the way as you lift the chassis into the rack.



.....
NOTE: Do not remove the circuit breaker box (on a DC-powered router) or the Connector Interface Panel (CIP). This topic does not include instructions for removing these components.

.....
Perform the procedures described in the following sections to remove components from the chassis, first from the rear and then from the front:

- Removing the Power Supplies on page 85
- Removing the Rear Component Cover on page 85
- Removing the SFMs on page 86
- Removing the MCSs on page 87
- Removing the PCGs on page 88
- Removing the Routing Engines on page 89
- Removing the Rear Upper Impeller Assembly on page 90
- Removing the Rear Lower Impeller Assembly on page 91
- Removing the Fan Tray on page 91
- Removing the FPCs on page 92
- Removing the Front Impeller Assembly on page 94

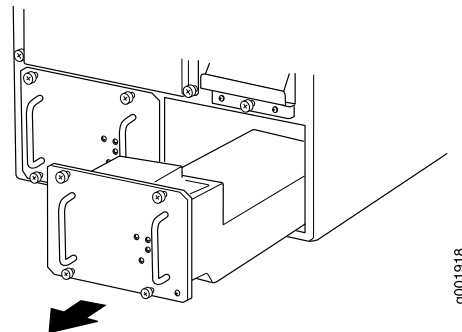
Removing the Power Supplies

The router has two power supplies (AC or DC) located at the bottom rear of the chassis, as shown in “M40e Chassis Description” on page 8. An AC power supply weighs approximately 15 lb (6.8 kg). A DC power supply weighs approximately 13 lb (5.9 kg).

To remove the power supplies (see Figure 41 on page 85, which shows a DC power supply):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Verify that the power switch for each power supply is in the **OFF (O)** position. On an AC-powered router, the switch for each power supply is on the power supply faceplate. On a DC-powered router, the switches are on the circuit breaker box.
3. Loosen the thumbscrew at each corner of the power supply faceplate, using a Phillips screwdriver if necessary.
4. Grasp the handle or handles on the power supply faceplate and pull firmly to slide the unit about halfway out of the chassis.
5. Place one hand under the power supply to support it, then slide it completely out of the chassis.
6. Repeat the procedure to remove the second power supply.

Figure 41: Removing a M40e Power Supply



Removing the Rear Component Cover

The rear component cover protects the SFMs, Routing Engines, MCSs, and PCGs, as shown in “M40e Chassis Description” on page 8. To remove it:

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Loosen the thumbscrew at each corner of the component cover, using a Phillips screwdriver if necessary.

3. Pull the cover straight off the chassis.



CAUTION: To maintain proper airflow and provide electromagnetic shielding, do not operate the router without the rear component cover in place.

Removing the SFMs

The router can have an SFM in each of the slots labeled **SFM 0** and **SFM 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. Each SFM weighs approximately 5 lb (2.3 kg).

To remove an SFM (see Figure 42 on page 87):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Loosen the thumbscrew on each ejector locking tab (shown in “M40e SFM LEDs” on page 23), using a Phillips screwdriver if necessary.
4. Pull the end of each ejector handle outward until it is nearly perpendicular to the SFM or CFEB-E faceplate.
5. Grasp the ejector handles and pull firmly to slide the SFM or CFEB-E about halfway out of the chassis.
6. Place one hand under the SFM 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.

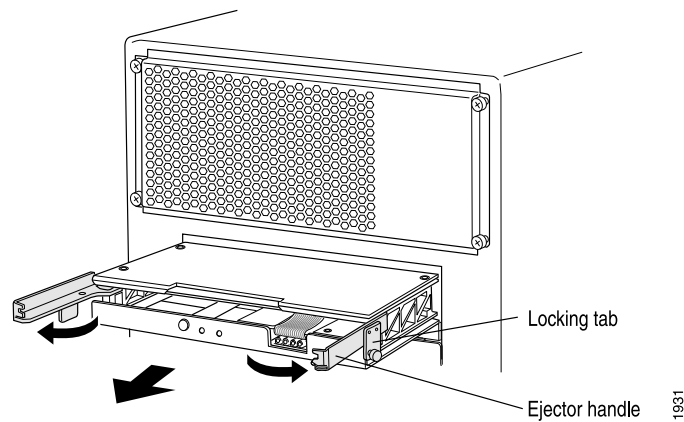


CAUTION: When an SFM or CFEB-E is out of the chassis, do not hold it by the ejector handles. They cannot support its weight.

Do not stack SFMs 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.

If a second SFM is installed, repeat the procedure to remove it.

Figure 42: Removing an M40e SFM



Removing the MCSs

The router can have an MCS in each of the slots labeled **MCS 0** and **MCS 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. Each MCS weighs approximately 2.5 lb (1 kg).

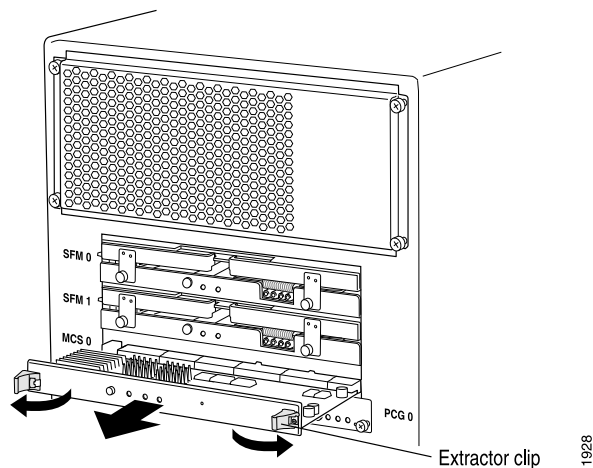
The MCS is hot-pluggable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. For a description of the effect of removing an MCS, see “M40e Host Module Description” on page 23.

To remove the MCSs (see Figure 43 on page 88):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Push the end of each extractor clip (located at each end of the MCS) outward.
4. Grasp the extractor clips and slide the MCS about halfway out of the chassis.
5. Place one hand under the MCS to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

If a second MCS is installed, repeat the procedure to remove it.

Figure 43: Removing an M40e MCS



Removing the PCGs

The router has two PCGs installed in the slots labeled **PCG 0** and **PCG 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. Each PCG weighs approximately 1 lb (0.5 kg).

To remove the PCGs (see Figure 44 on page 89):

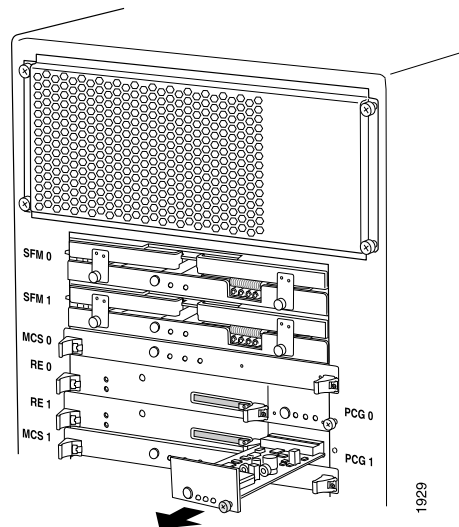
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Loosen the thumbscrew at the lower right corner of the PCG faceplate, using a Phillips screwdriver if necessary.
4. Grasp the thumbscrew and slide the PCG about halfway out of the chassis.



CAUTION: Be careful to slide the PCG straight out of the chassis to avoid bending any of the pins on the underside of the board.

5. Place one hand under the PCG to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.
6. Repeat the procedure to remove the second PCG.

Figure 44: Removing a M40e PCG



Removing the Routing Engines

The router can have a Routing Engine in each of the slots labeled **RE 0** and **RE 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. Each Routing Engine weighs approximately 1.5 lb (0.7 kg).

The routing engine is hot-pluggable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. For a description of the effect of removing a routing engine, see “M40e Host Module Description” on page 23.

To remove a Routing Engine (see Figure 45 on page 90):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Using your thumbs, push and hold the red tab on each extractor clip toward the outer edge of the unit. Push the ends of the extractor clips outward to unseat the Routing Engine from the chassis.
4. Grasp the extractor clips and slide the unit about halfway out of the chassis.

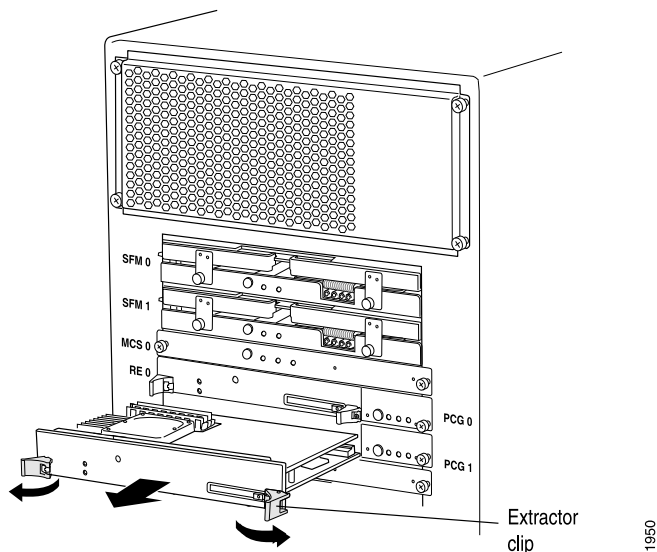


CAUTION: Slide the Routing Engine straight out of the chassis. Damage can result if the Routing Engine gets lodged because of uneven movement.

5. 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.

If a second Routing Engine is installed, repeat the procedure to remove it.

Figure 45: Removing a M40e Routing Engine



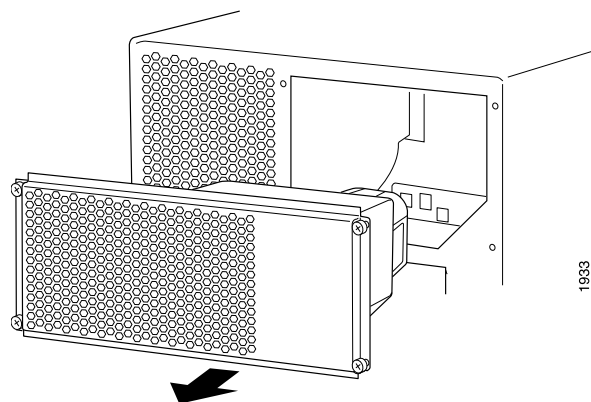
Removing the Rear Upper Impeller Assembly

The rear upper impeller assembly is located at the top of the chassis rear, as shown in “M40e Chassis Description” on page 8. The assembly weighs approximately 4 lb (1.8 kg).

To remove the rear upper impeller assembly (see Figure 46 on page 90):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Loosen the thumbscrew at each corner of the impeller cover, using a Phillips screwdriver if necessary.
3. Grasp the screws at opposite corners of the impeller cover and slide the assembly out of the chassis.

Figure 46: Removing the M40e Rear Upper Impeller Assembly



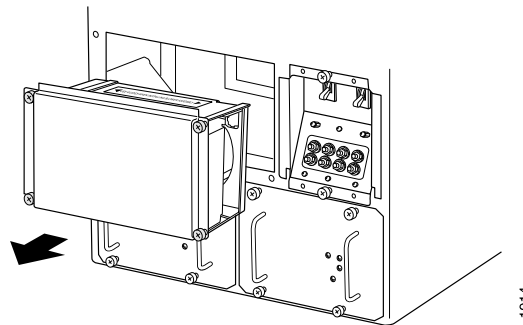
Removing the Rear Lower Impeller Assembly

The rear lower impeller assembly is located to the left of the circuit breaker box on the rear of the chassis, as shown in “M40e Chassis Description” on page 8. The assembly weighs approximately 5 lb (2.3 kg).

To remove the rear lower impeller assembly (see Figure 47 on page 91):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Loosen the thumbscrew at each corner of the impeller cover, using a Phillips screwdriver if necessary.
3. Grasp the screws at opposite corners of the impeller cover and slide the assembly out of the chassis.

Figure 47: Removing the M40e Rear Lower Impeller Assembly



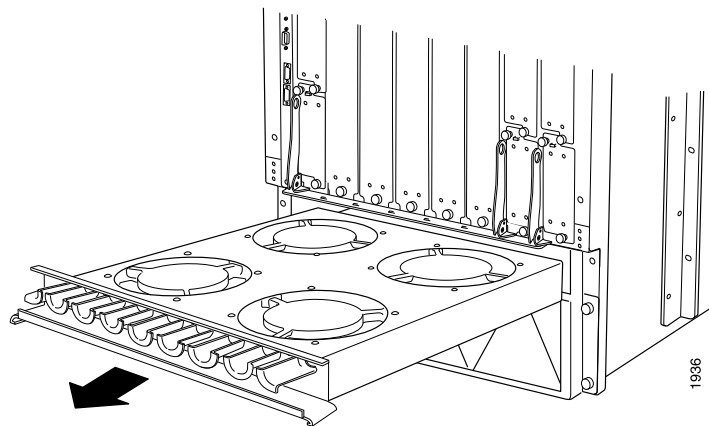
Removing the Fan Tray

The fan tray is located behind the cable management system on the front of the chassis, just above the air filter, as shown in “M40e Chassis Description” on page 8. The fan tray contains four fans and weighs approximately 13 lb (5.9 kg).

To remove the fan tray (see Figure 48 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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Loosen the thumbscrew at each end of the fan tray, using a Phillips screwdriver if necessary.
3. Grasp the sides of the fan tray and pull firmly to slide it out of the chassis.

Figure 48: Removing the M40e Fan Tray



Removing the FPCs

The router can have up to eight FPCs mounted vertically in the FPC card cage on the front of the chassis, as shown in “M40e Chassis Description” on page 8. An FPC that houses four PICs weighs about 15 lb (6.8 kg).



NOTE: To help you work systematically, remove FPCs starting at the left side of the card cage and working toward the right. You can remove FPCs in any order, however. As you remove each FPC, label it with its slot number and record the relevant information in the checklist in Table 17 on page 92.

Table 17: M40e FPC Removal Checklist

Slot	Media Types	Date Removed	Date Reinstalled
0			
1			
2			
3			
4			
5			
6			
7			

To remove the FPCs (see Figure 49 on page 94):

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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
3. Locate the FPC or blank panel located in the leftmost slot of the card cage on the front of the chassis. It is directly below the offline button on the craft interface that is labeled **FPC0**.
4. If the slot is covered by a blank panel, you can leave it in place. If the slot contains an FPC:
 - a. Loosen the thumbscrew at each end of the FPC, using a Phillips screwdriver if necessary.
 - b. Pull the ends of the ejector levers, which are adjacent to the thumbscrews, away from the face of the FPC until they are nearly perpendicular to it.
 - c. Grasp the top and bottom flanges of the card carrier and slide the FPC about halfway out of the card cage.
 - d. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.



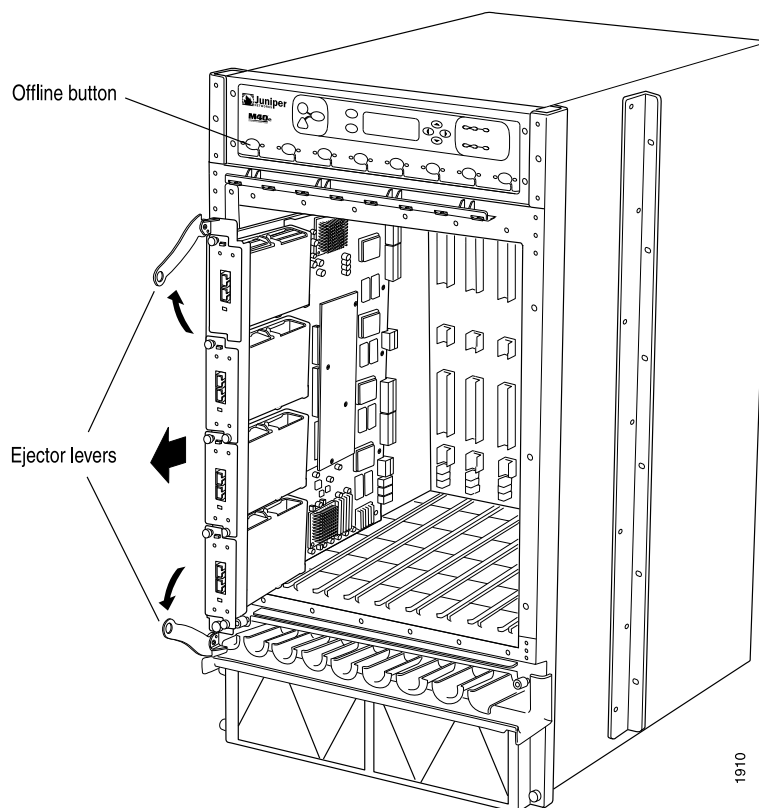
CAUTION: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 15 lb (6.8 kg)—as you slide the FPC out of the chassis.

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

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

5. Repeat Step 4 for each FPC card carrier or blank cover, proceeding from left to right.

Figure 49: Removing an M40e FPC



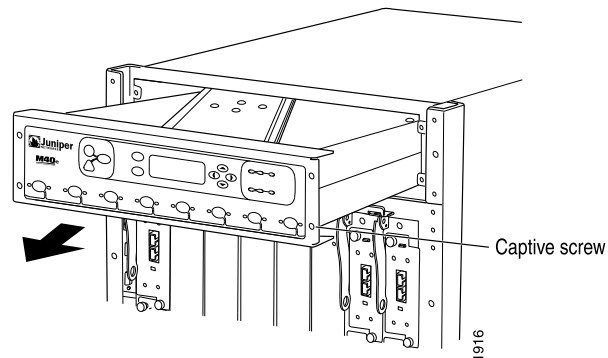
Removing the Front Impeller Assembly

The front impeller assembly, which includes the craft interface, is located at the front of the chassis above the FPC card cage, as shown in “M40e Chassis Description” on page 8. The assembly weighs approximately 14.5 lb (6.6 kg).

To remove the front impeller assembly (see Figure 50 on page 95):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Using a Phillips screwdriver, loosen the captive screw at each corner of the craft interface.
4. Insert a flat-blade screwdriver into the gap around the craft interface and gently pry the impeller assembly forward until you can grasp the sides of the assembly and slide it halfway out of the chassis.
5. Place one hand under the assembly to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

Figure 50: Removing the M40e Front Impeller Assembly



Related Documentation

- M40e Component Weights
- M40e Router Physical Specifications on page 269
- M40e System Architecture Overview on page 59
- Installing the M40e Chassis into the Rack on page 95
- Reinstalling the M40e Components into the Chassis on page 97

Installing the M40e Chassis into the Rack

Before installing the chassis:

- Verify that the router site meets the requirements described in “M40e Site Preparation Checklist” on page 67.
- Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure. For details, see “M40e Rack Size and Strength” on page 69.
- Read the information in “M40e Chassis Lifting Guidelines” on page 235.
- Remove the router from the shipping carton, as described in “Unpacking the M40e Router” on page 73.

After you have removed components as described in “Removing Components from the Chassis Before Installing the M40e Router Without a Lift” on page 83, the chassis is light enough for a team of installers to lift into the rack.

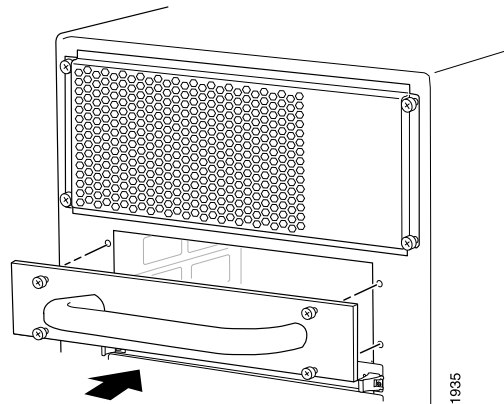


CAUTION: The reduced weight of the chassis is approximately 115 lb (52 kg). Installing it into the rack still requires three people to lift and an additional person to secure the mounting screws.

If you are installing multiple routers in a rack, install the lowest one first and proceed upward (see Figure 52 on page 97):

1. If you are front-mounting the router, remove the center-mounting brackets from each side of the chassis. (Also, we recommend installing a shelf or other support for the rear of the chassis.)
2. Attach the lifting handle to the rear of the chassis, screwing the thumbscrews at its corners into the holes located next to the SFM slots on the chassis (see Figure 51 on page 96). If you are installing the chassis in a lower rack space, use the set of holes adjacent to the slots labeled **SFM 0** and **SFM 1**. If you are installing the chassis in an upper rack space, use the set of holes adjacent to the slot covers labeled **Do not install an SFM in this slot.**

Figure 51: Attaching the Lifting Handle



3. Prepare to lift the router:
 - One person stands behind the chassis and grasps the lifting handle.
 - Two people stand on either side of the chassis. Each grasps the bar at the bottom of the FPC card cage with one hand and places the other hand under the chassis near the rear.
4. Lift the chassis and position it in the rack.

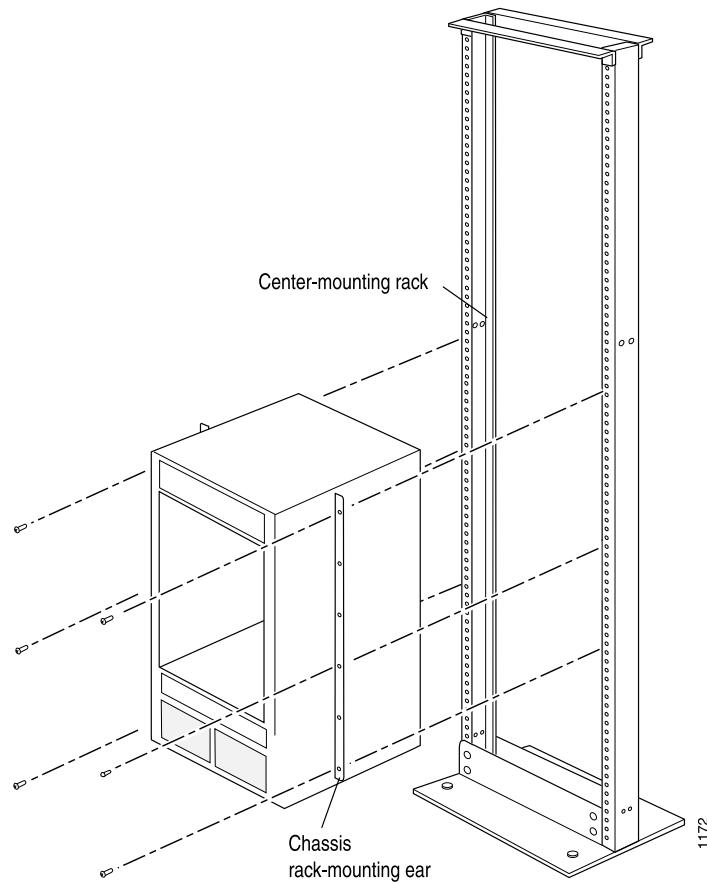


WARNING: To prevent injury, keep your back straight and lift with your legs, not your back. Avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

5. Align the bottom hole in both front support posts or center-mounting brackets with a hole in each rack rail, making sure the chassis is level.
6. Install one of the mounting screws provided into each of the two aligned holes. Use a 5/32-in. Allen wrench to tighten the screws.
7. Moving up each post or bracket, install a screw in every mounting hole.
8. 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.

9. Loosen the thumbscrews on the lifting handle and remove it from the chassis.
10. Proceed to the instructions in “Reinstalling the M40e Components into the Chassis” on page 97.

Figure 52: Installing the Chassis in a Rack



Related Documentation

- M40e Chassis Description on page 8
- M40e Router Physical Specifications on page 269
- General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229

Reinstalling the M40e Components into the Chassis

After you have mounted the chassis in the rack as described in “Installing the M40e Chassis into the Rack” on page 95, reinstall the router components into the chassis.



.....

WARNING: The procedures in this section apply only to initial installation and assume that you have not yet connected power to the router. If power is connected, completely disconnect it before continuing. See [Disconnecting AC Power from the M40e Router](#) or [Disconnecting DC Power from the M40e Router](#).

.....

Reinstall components into the chassis, first into the front and then into the rear:

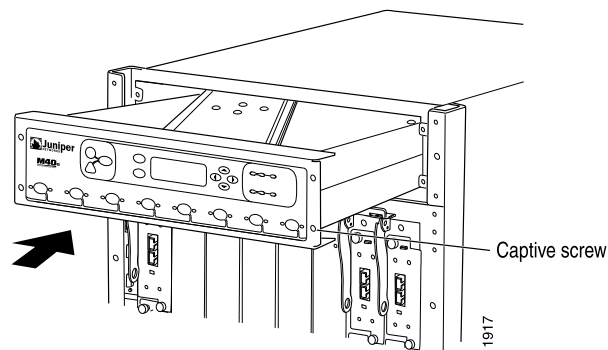
- Reinstalling the Front Impeller Assembly on page 98
- Reinstalling the FPCs on page 99
- Reinstalling the Fan Tray on page 100
- Reinstalling the Rear Lower Impeller Assembly on page 101
- Reinstalling the Rear Upper Impeller Assembly on page 102
- Reinstalling the Routing Engines on page 102
- Reinstalling the PCGs on page 103
- Reinstalling the MCSs on page 104
- Reinstalling the SFMs on page 105
- Reinstalling the Rear Component Cover on page 106
- Reinstalling the Power Supplies on page 106

Reinstalling the Front Impeller Assembly

The front impeller assembly, which includes the craft interface, is located at the top of the chassis front, as shown in “M40e Chassis Description” on page 8. To reinstall it (see Figure 53 on page 99):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Grasp the sides of the impeller assembly and align the rear of the assembly with the guides inside the chassis.
3. Slide the impeller assembly all the way into the chassis.
4. Using a Phillips screwdriver, tighten the captive screw at each corner of the craft interface.

Figure 53: Reinstalling the M40e Front Impeller Assembly



Reinstalling the FPCs

The FPCs install into the card cage at the front of the chassis, as shown in “M40e Chassis Description” on page 8.



NOTE: To help you work systematically, reinstall FPCs starting at the left side of the card cage and working toward the right. You can install FPCs in any order, however.

Be sure there is a blank panel over every empty slot. The blank panels must be in place during router operation to guarantee adequate circulation of cooling air.

To reinstall the FPCs (see Figure 54 on page 100):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Locate the leftmost slot in the FPC card cage on the front of the chassis. It is directly below the offline button on the craft interface that is labeled **FPC0**. Locate the FPC that you labeled **FPC0** during removal.
3. Verify that the ends of the ejector levers, which are located at each end of the FPC, are pushed outward, nearly perpendicular to the face of the FPC.
4. Grasp the front of the FPC with one hand and place the other hand under the FPC to support it.

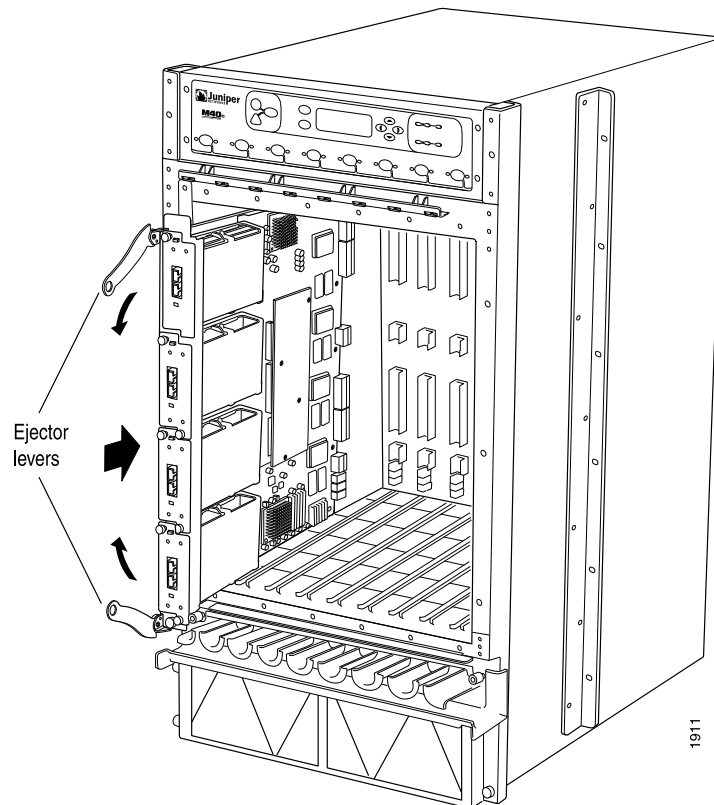


CAUTION: When the FPC is out of the chassis, do not hold it by the ejector levers, bus bars, or edge connectors. They cannot support its weight.

5. Align the rear bottom corners of the FPC with the guides at the bottom of the FPC slot. Slide the FPC into the card cage until it contacts the midplane.

6. Push the ends of the ejector levers inward until they are nearly flush with the face of the FPC.
7. Tighten the thumbscrew at each end of the FPC to seat the FPC securely in the chassis.
8. Repeat the procedure for each FPC, proceeding from left to right through the slots with offline buttons labeled **FPC1** through **FPC7** on the craft interface.

Figure 54: Reinstalling an M40e FPC

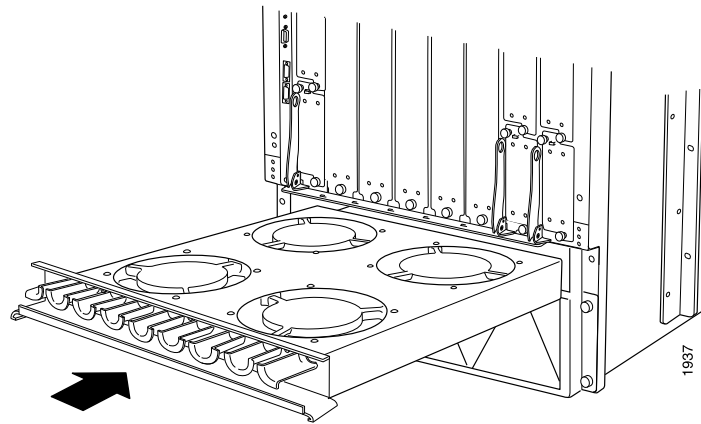


Reinstalling the Fan Tray

The fan tray, which includes the cable management system, is located on the front of the chassis, just above the air filter, as shown in “M40e Chassis Description” on page 8. To reinstall it (see Figure 55 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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
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.
4. Tighten the thumbscrew at each end of the cable management system.

Figure 55: Reinstalling the Fan Tray

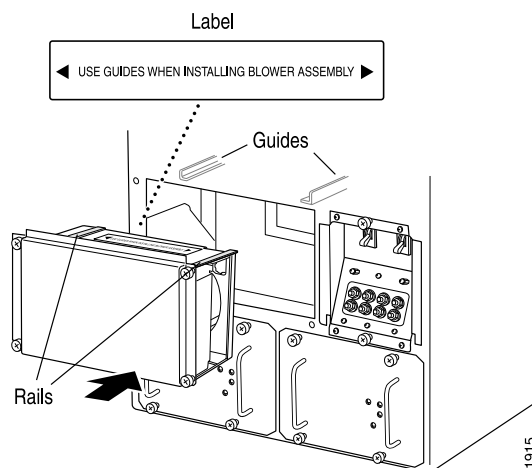


Reinstalling the Rear Lower Impeller Assembly

The rear lower impeller assembly is located to the left of the circuit breaker box on the rear of the chassis, as shown in “M40e Chassis Description” on page 8. To reinstall it (see Figure 56 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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Orient the impeller so that the label is on the top. Align the rails on the upper edges of the impeller assembly with the guides inside the chassis.
3. Push the impeller assembly up and to the right to start it into the chassis, then slide it all the way in.
4. Tighten the thumbscrew at each corner of the impeller cover.

Figure 56: Reinstalling the Rear Lower Impeller Assembly

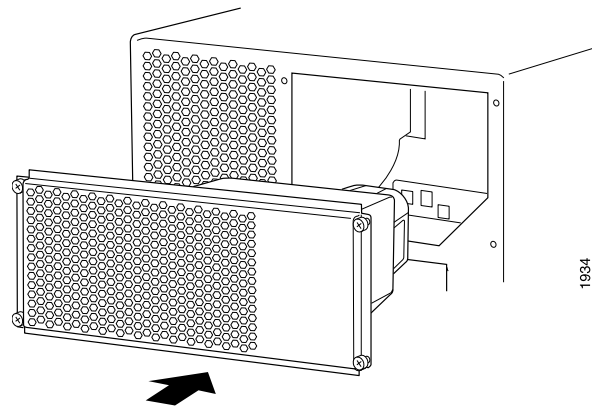


Reinstalling the Rear Upper Impeller Assembly

The rear upper impeller assembly is installed at the top of the chassis rear, as shown in “M40e Chassis Description” on page 8. To reinstall the assembly (see Figure 57 on page 102):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Slide the assembly all the way into the chassis.
3. Tighten the thumbscrew at each corner of the impeller cover.

Figure 57: Reinstalling the Rear Upper Impeller Assembly



Reinstalling the Routing Engines

The router can have a Routing Engine in each of the slots labeled **RE 0** and **RE 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8.



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

To reinstall a Routing Engine (see Figure 58 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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Verify that the extractor clip at each end of the Routing Engine is flipped toward the outer edge of the unit. If necessary, use your thumbs to push and hold the red tab on each extractor clip toward the outer edge, then push the ends of the extractor clips outward.

3. Place one hand under the Routing Engine to support it and grasp one of the extractor clips on the faceplate with the other hand.
4. Align the rear of the Routing Engine with the guide rails inside the chassis and slide it in completely.

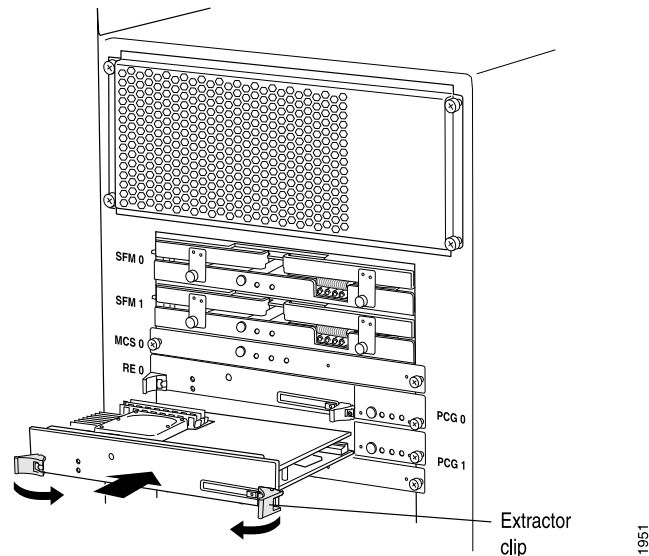


CAUTION: Align the Routing Engine carefully with the guide rails and push it in evenly. Damage can result if the Routing Engine gets lodged in the rails because of uneven movement.

5. Press the extractor clip at each end of the Routing Engine inward to seat the unit firmly in the chassis.

If there is a second Routing Engine, repeat the procedure to reinstall it.

Figure 58: Reinstalling a Routing Engine



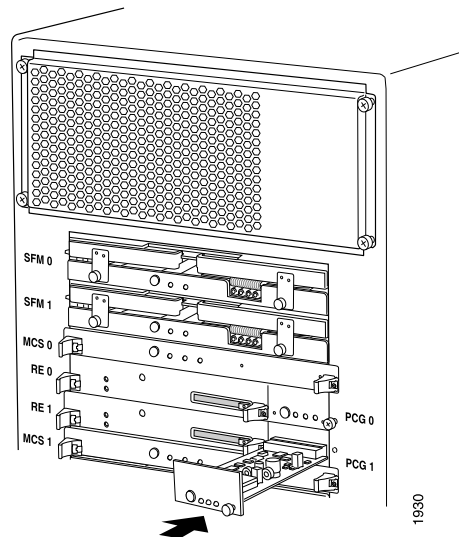
Reinstalling the PCGs

The router has two PCGs installed in the slots labeled **PCG 0** and **PCG 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. To reinstall the PCGs (see Figure 59 on page 104):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Place one hand under the PCG to support it and grasp the thumbscrew on the faceplate with the other hand.
3. Align the rear of the PCG with the guides inside the chassis and slide it in completely.

4. Tighten the thumbscrew on the faceplate to seat the PCG firmly in the chassis.
5. Repeat the procedure to reinstall the second PCG.

Figure 59: Reinstalling a PCG



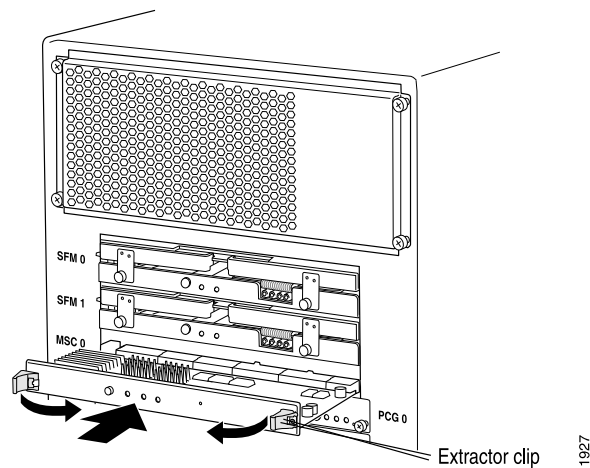
Reinstalling the MCSs

The router can have an MCS in each of the slots labeled **MCS 0** and **MCS 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. To reinstall an MCS (see Figure 60 on page 105):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Place one hand under the MCS to support it and grasp one of the extractor clips on the faceplate with the other hand.
3. Align the rear of the MCS with the guides inside the chassis and slide it in completely.
4. Press the extractor clip at each end of the MCS inward.

If there is a second MCS, repeat the procedure to reinstall it.

Figure 60: Reinstalling an MCS



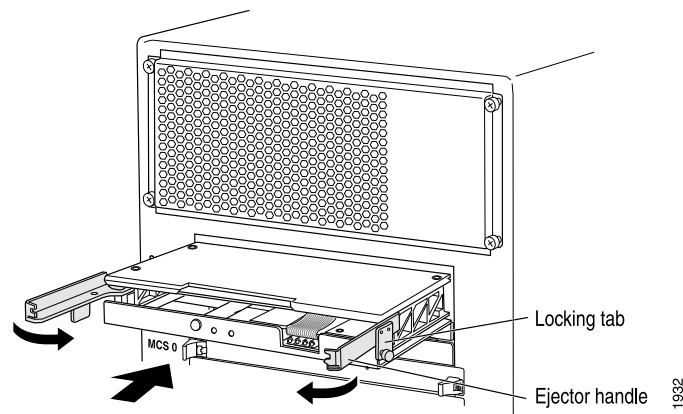
Reinstalling the SFMs

The router can have an SFM in each of the slots labeled **SFM 0** and **SFM 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. To reinstall an SFM (see Figure 61 on page 106):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Verify that the ends of the ejector handles are pulled outward to a position nearly perpendicular to the faceplate of the SFM or CFEB-E.
3. Place one hand under the SFM 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 SFM or CFEB-E with the guides inside the chassis and slide it in completely.
5. Press the ejector handle at each end of the SFM or CFEB-E inward.
6. Tighten the thumbscrew on each ejector locking tab (shown in “M40e SFM LEDs” on page 23) to seat the SFM or CFEB-E firmly in the chassis.

If there is a second SFM, repeat the procedure to reinstall it.

Figure 61: Reinstalling an SFM



Reinstalling the Rear Component Cover

The rear component cover protects the Routing Engines, PCGs, MCSs, and SFMs, as shown in “M40e Chassis Description” on page 8. To reinstall the rear component cover:

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Hold the component cover up to the rear of the chassis and align the flanges at the top and bottom with the top and bottom of the opening in the chassis.
3. Push the cover into place.
4. Tighten the thumbscrew at each corner of the cover.



CAUTION: To maintain proper airflow and provide electromagnetic shielding, do not operate the router without the rear component cover in place.

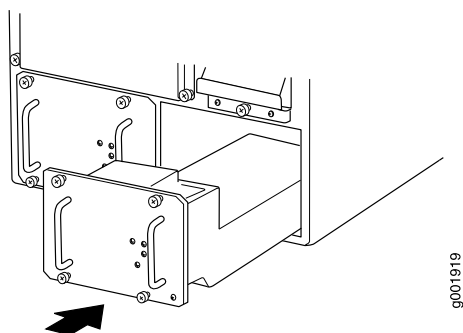
Reinstalling the Power Supplies

The two power supplies (AC or DC) are located at the bottom rear of the chassis, as shown in “M40e Chassis Description” on page 8. To reinstall the power supplies (see Figure 62 on page 107, which shows a DC power supply):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Verify that the power switch for each power supply is in the **OFF (O)** position. On an AC-powered router, the switch for each power supply is on the power supply faceplate. On a DC-powered router, the switches are on the circuit breaker box.

3. Place one hand under the power supply and grasp a handle on the faceplate with the other hand. Slide the power supply into the chassis until it contacts the midplane.
4. Starting with the bottom screws, tighten (but do not overtighten) the thumbscrew at each corner of the power supply faceplate.
5. Repeat the procedure to reinstall the second power supply.
6. To continue the installation, proceed to “Connecting the M40e Router to Management and Alarm Devices” on page 111.

Figure 62: Reinstalling a Power Supply



Related Documentation

- M40e Component Weights
- M40e Router Physical Specifications on page 269
- M40e System Architecture Overview on page 59
- Removing Components from the Chassis Before Installing the M40e Router Without a Lift on page 83
- Installing the M40e Chassis into the Rack on page 95

CHAPTER 10

Grounding the M40e Router

- Connecting the M40e Grounding Cable on page 109

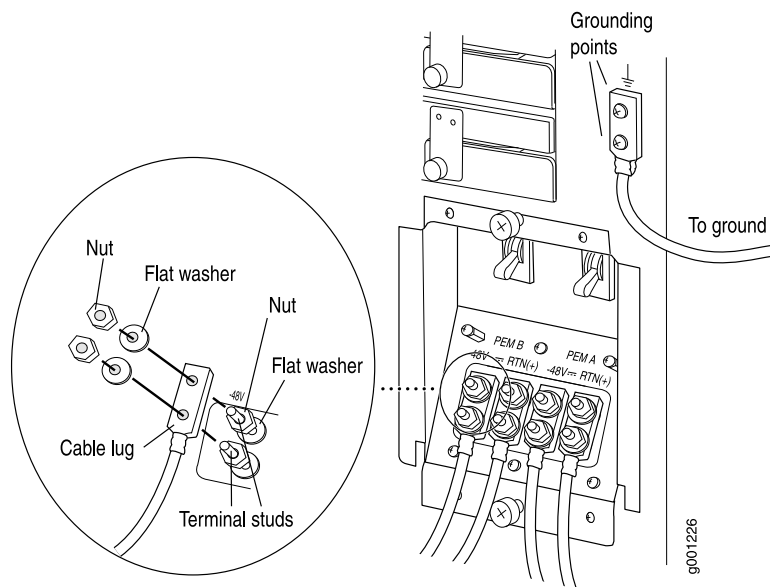
Connecting the M40e Grounding Cable

Ground the router by attaching a grounding cable to the chassis grounding points. The grounding cable is not supplied with the router. For cable specifications, see “M40e Chassis Grounding Specifications” on page 276.

To connect the grounding cable (see Figure 63 on page 110):

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. For each power supply, verify that the power switch on the circuit breaker box is in the **OFF (O)** position.
3. Make sure that grounding surfaces are clean and brought to a bright finish before grounding connections are made.
4. Connect the grounding cable to a proper earth ground.
5. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
6. 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.
7. Place the grounding cable lug over the grounding points. The grounding points are sized for 1/4-20 UNC screws.
8. Secure the grounding cable lug to the grounding points, first with the washers, then with the screws.
9. 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.

Figure 63: Connecting the M40e Grounding Cable



CHAPTER 11

Connecting the M40e Router to External Devices

- Tools and Parts Required to Connect the M40e Management Devices on page 111
- Connecting the M40e Router to Management and Alarm Devices on page 111
- Connecting the M40e PIC Cables on page 116

Tools and Parts Required to Connect the M40e Management Devices

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

- Phillips (+) screwdrivers, numbers 1 and 2
- 2.5-mm flat-blade (-) screwdriver
- 7/16-in. hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm), for tightening nuts to terminal studs on the circuit breaker box (on a DC-powered router)
- Wire cutters
- Electrostatic discharge (ESD) grounding wrist strap

Related Documentation

- M40e Chassis Description on page 8
- M40e Chassis Grounding Specifications on page 276
- Using the Command-Line Interface to Troubleshoot the M40e Router
- Connecting the M40e Router to Management and Alarm Devices on page 111
- Connecting the M40e PIC Cables on page 116

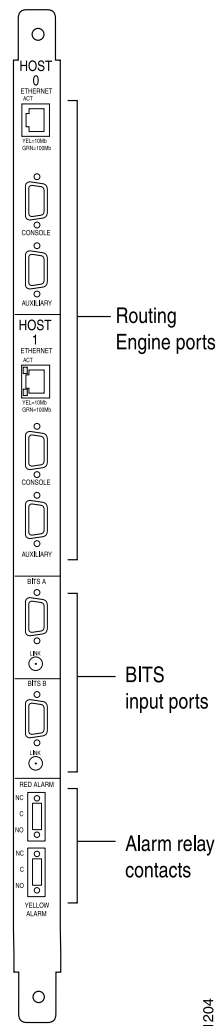
Connecting the M40e Router to Management and Alarm Devices

After installing the router into the rack as described in “Installing the M40e Router Using a Mechanical Lift” on page 81 or “Installing the M40e Chassis into the Rack” on page 95, complete the installation by connecting management and alarm devices, PICs, and power cables.

For management and service operations, you connect the Routing Engine to an external console or management network through ports on the Connector Interface Panel (CIP). You can also connect the router to external alarm-reporting devices through the alarm relay contacts on the CIP. (For more information, see “M40e Connector Interface Panel (CIP) Description” on page 39.)

After you have installed the router into the rack, attach one or more external devices to the ports on the CIP that connect to the Routing Engines for management and service operations (see Figure 64 on page 112). For specifications for the cable accepted by the Routing Engine management ports, see “Routing Engine Interface Cable and Wire Specifications for the M40e Router” on page 288.

Figure 64: Routing Engine Management Ports and Alarm Relay Contacts



To connect external devices to the Routing Engine management ports, perform the following procedures:

- Connecting the M40e Router to a Management Console or Auxiliary Device on page 113
- Connecting the M40e Router to a Network for Out-of-Band Management on page 114
- Connecting the M40e Router to an External Alarm-Reporting Device on page 115

Connecting the M40e Router to a Management Console or Auxiliary Device

To use a system console to configure and manage the Routing Engine, connect it to the appropriate **CONSOLE** port on the CIP. To use a laptop, modem, or other auxiliary device, connect it to the appropriate **AUXILIARY** port on the CIP. Both ports accept a cable with an RJ-45 connector. One RJ-45/DB-9 cable is provided with the router. To connect a device to the other port, you must supply another cable. For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M40e Router” on page 288.

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 65 on page 113) of the provided serial cable into the appropriate **CONSOLE** or **AUXILIARY** port. Figure 66 on page 114 shows the external device ports on the CIP. The ports labeled **HOST 0** connect to the Routing Engine in the upper Routing Engine slot (**RE 0**), and the ports labeled **HOST 1** connect to the Routing Engine in the lower Routing Engine slot (**RE 1**).
3. Using a 2.5-mm flat-blade screwdriver, tighten the screws on the connector.
4. Attach the other end of the cable to the console or auxiliary device.

Figure 65: Console and Auxiliary Serial Port Connector

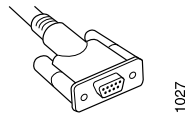
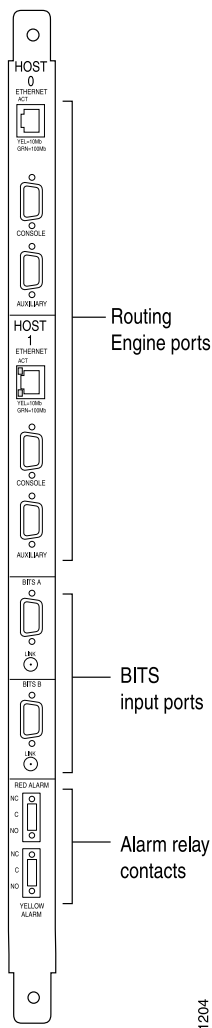


Figure 66: Routing Engine Management Ports and Alarm Relay Contacts



Connecting the M40e Router to a Network for Out-of-Band Management

To connect the Routing Engine to a network for out-of-band management, connect an Ethernet cable with RJ-45 connectors to the **ETHERNET** port on the CIP. One such cable is provided with the router. For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M40e Router” on page 288. To connect the Routing Engine to a network for out-of-band management:

1. Turn off the power to the management device.
2. Plug one end of the Ethernet cable (Figure 67 on page 115 shows the connector) into the appropriate **ETHERNET** port on the CIP. Figure 68 on page 115 shows the external device ports on the CIP. The ports labeled **HOST 0** connect to the Routing Engine in the upper Routing Engine slot (**RE 0**), and the ports labeled **HOST 1** connect to the Routing Engine in the lower Routing Engine slot (**RE 1**).
3. Plug the other end of the cable into the network device.

Figure 67: Routing Engine Ethernet Cable Connector

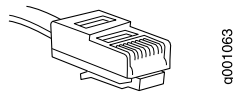
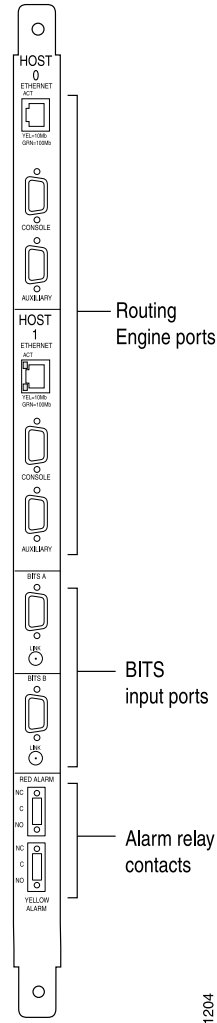


Figure 68: Routing Engine Management Ports and Alarm Relay Contacts



Connecting the M40e Router to an External Alarm-Reporting Device

To connect the router to external alarm-reporting devices, attach wires to the **RED ALARM** and **YELLOW ALARM** relay contacts on the CIP. A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 24-AWG and 12-AWG (0.20 and 3.33 mm²), which is not provided. Use the wire gauge appropriate for the external device you are connecting.

To connect an external device to an alarm relay contact:

1. Prepare the required length of wire with gauge between 24-AWG and 12-AWG (0.20 and 3.33 mm²).
2. While the terminal block is not plugged into the relay contact, use a 2.5-mm flat-blade screwdriver to loosen the small screws on its side. With the small screws on its side facing left, insert wires into the slots in the front of the block based on the wiring for the external device. Tighten the screws to secure the wire.
3. Orient the terminal block according to the labels to the left of the appropriate relay contact (**NC** means “normally closed, **C** means “common,” and **NO** means “normally open”).
4. Plug the terminal block into the relay contact and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.
5. Attach the other end of the wires to the external device.

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

**Related
Documentation**

- M40e Site Preparation Checklist on page 67
- M40e Router Power Requirements on page 274
- Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers on page 273

Connecting the M40e PIC Cables

After installing the router into the rack as described in “Installing the M40e Router Using a Mechanical Lift” on page 81 or “Installing the M40e Chassis into the Rack” on page 95, complete the installation by connecting management and alarm devices, PICs, and power cables.

Now connect PICs to the network by plugging in network cable. To connect cable to the PICs (see Figure 69 on page 117, which shows a fiber-optic PIC):

1. Have ready a length of the type of cable used by the PIC. For cable specifications, see the *M40e Multiservice Edge Router PIC Guide*.
2. If the PIC cable connector port is covered by a rubber safety plug, remove the plug.



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



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

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

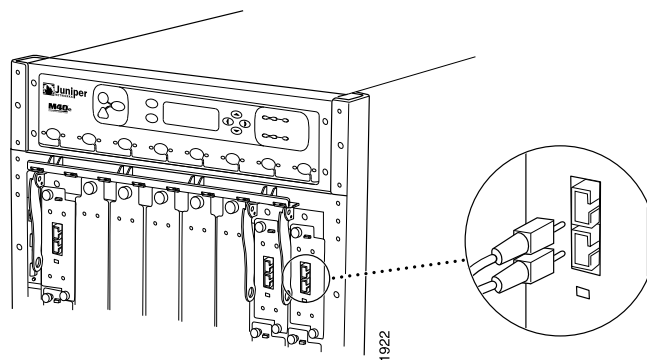


CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.



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

Figure 69: Attaching Cable to an M40e PIC



Related Documentation

- M40e Site Preparation Checklist on page 67
- Tools and Parts Required to Connect the M40e Management Devices on page 111
- Connecting the M40e Router to Management and Alarm Devices on page 111
- M40e Router Power Requirements on page 274
- Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers on page 273

Providing Power to the M40e Router

- Connecting AC Power to the M40e Router on page 119
- Connecting DC Power to the M40e Router on page 120

Connecting AC Power to the M40e Router

To connect AC power to 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, 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.



NOTE: The AC power source must supply 220 VAC power (nominal range 200–240 VAC), not 110 VAC power (nominal range 100–120 VAC).

3. Connect a management device to one of the ports on the Connector Interface Panel (CIP) (**AUXILIARY**, **CONSOLE**, or **ETHERNET**) for the Routing Engine that is configured to become the master. For more information on connecting management devices, see “Replacing Connections to the M40e Routing Engine Interface Ports” on page 163.
4. Turn on the management device.
5. Press the power switch on the faceplate of one power supply to the **ON** (|) position. Verify that the green **OUTPUT OK** LED eventually 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 system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, see [Disconnecting AC Power from the M40e Router](#) or [Disconnecting DC Power from the M40e Router](#).

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

-
6. Press the power switch on the other power supply to the **ON (I)** position and observe the LEDs on the power supply faceplate. They should light as described in the previous step.

If the LEDs are not lit in the appropriate pattern after 60 seconds, repeat the procedures in “Installing an M40e AC Power Supply” on page 213 and the previous steps in this procedure.



NOTE: When two power supplies are installed, at least one Routing Engine and one FPC must also be installed for both power supplies to power on. In the absence of this minimum load, only one power supply starts. (The router powers on and operates correctly with one power supply, but without the redundancy benefit of a second power supply.)

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

Related Documentation

- [M40e Power System Description](#) on page 42
- [M40e AC Power Electrical Safety Guidelines and Warnings](#) on page 256
- [M40e AC Power, Connection, and Power Cord Specifications](#) on page 277
- [Disconnecting AC Power from the M40e Router](#)

Connecting DC Power to the M40e Router

Connect DC power to the router by attaching power cables from external power sources to the terminal studs on the circuit breaker box. Power cables are not supplied with the router. For DC power cable specifications, see “M40e DC Power, Connection, and Cable Specifications” on page 279.



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



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

To connect DC power to the router (see Figure 70 on page 122):

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. For each power supply, verify that the power switch on the circuit breaker box is in the **OFF (O)** position.
3. Using a Phillips screwdriver, loosen and remove the screws securing the protective shield over the terminal studs on the circuit breaker box. Remove the cover.
4. Install one flat washer and one nut (in that order) on each power terminal stud:
 - If no washers and nuts are already installed, they should be in the accessory box.
 - If two pairs of nuts and washers are installed on the studs, use a 7/16-in. nut driver or wrench to loosen the outer nut on each stud. Remove the outer nuts and washers, leaving the inner nut and washer on each stud.



CAUTION: The inner washer and nut prevent direct contact between the power cable lug and the circuit breaker box, which can cause a short circuit.

5. Slide the power cable lugs onto the terminal studs. Install another washer and nut (in that order) on each terminal stud to secure each power cable lug.
 - a. Connect the positive (+) source cable lugs to the return terminals, which are labeled **RTN(+)**.
 - b. Connect the negative (–) source cable lugs to the input terminals, which are labeled **–48V**.

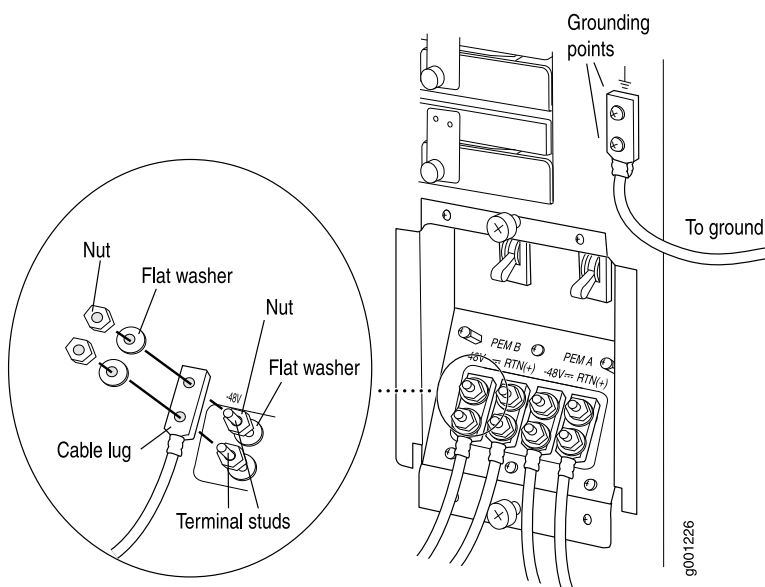
Using a 7/16-in. nut driver or wrench, tighten the nuts. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut.

6. Bend the power cables at a radius appropriate for the AWG being used and tie them together to ensure that the power cables do not obstruct any other components. To identify the minimum bend radius for each type of power cable types, see published

industry standards, such as the National Electrical Code (NEC) and Insulated Cable Engineers Association (ICEA). Do not bend a power cable beyond the specified minimum bend radius.

7. Verify that the source power cabling and the grounding cabling are correct, that they are not touching or blocking access to router components, and that they do not drape where people could trip on them.
8. Replace the protective shield over the terminal studs and use a Phillips screwdriver to tighten the screws.
9. Turn on the current from the power source so that voltage flows to the router.

Figure 70: Connecting DC Power Cables



Related Documentation

- DC Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 259
- M40e DC Power Electrical Safety Guidelines on page 257
- M40e DC Power Distribution on page 280
- Disconnecting DC Power from the M40e Router

Configuring Junos OS

- Initially Configuring the M40e Router on page 123

Initially Configuring the M40e Router

The M40e router is shipped with the Junos OS preinstalled and ready to be configured when the M40e router is powered on. There are three copies of the software: one on a CompactFlash card in the Routing Engine, one on a rotating hard disk in the Routing Engine, and one on a USB flash drive that can be inserted into the slot in the Routing Engine faceplate.

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

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

Gather the following information before configuring the router:

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

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

To configure the software:

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

3. Start the CLI.

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

4. Enter configuration mode.

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

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

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

6. Create a management console user account.

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

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

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

8. Configure the router's domain name.

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

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

```
[edit]
root@# set interfaces fpx0 unit 0 family inet address address/prefix-length
```

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

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

11. Configure the IP address of a DNS server.

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

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

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

or

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

or


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

or

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

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

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

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

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

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

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

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

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

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

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

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

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



NOTE: To reinstall 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, 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**

- M40e PIC Overview
- M40e Routing Engine Software Components on page 52
- M40e System Architecture Overview on page 59

PART 3

Hardware Maintenance, Troubleshooting, and Replacement Procedures

- Maintaining M40e Router Hardware Components on page 129
- Troubleshooting M40e Hardware Components on page 145
- Replacing M40e Hardware Components on page 157

CHAPTER 14

Maintaining M40e Router Hardware Components

- Routine Maintenance Procedures for the M40e Router on page 129
- Maintaining the M40e Air Filter on page 130
- Maintaining the M40e Fan Tray and Impellers on page 130
- Maintaining the M40e Host Module Components on page 131
- Maintaining M40e FPCs on page 132
- Holding and Storing M40e FPCs on page 133
- Maintaining M40e PICs and PIC Cables on page 139
- Maintaining the M40e PCGs on page 141
- Maintaining M40e SFMs on page 141
- Maintaining M40e Power Supplies on page 142

Routine Maintenance Procedures for the M40e Router

Purpose For optimum router performance, perform preventive maintenance procedures.

- Action**
- Inspect the installation site for moisture, loose wires or cables, and excessive dust. Make sure that airflow is unobstructed around the router and into the air intake vents.
 - Check the status-reporting devices on the craft interface: system alarms, LEDs, and LCD. See “M40e Craft Interface Description” on page 34.
 - Inspect the air filter at the bottom front of the router, replacing it every 6 months for optimum cooling system performance. Do not run the router for more than a few minutes without the air filters in place. For maintenance instructions, see “Maintaining the M40e Air Filter” on page 130.

- Related Documentation**
- M40e Chassis Description on page 8
 - M40e Router Physical Specifications on page 269
 - M40e System Architecture Overview on page 59

Maintaining the M40e Air Filter

Purpose Verify the condition of the air filter.

- Action**
- Check the air filter regularly for dust and debris.
 - Replace the air filter every 6 months. The air filter is hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. Take note of the following caution, however.



CAUTION: Do not operate the router for more than a few minutes when the air filter has been removed. The fans and impellers are powerful enough to draw in foreign material, such as bits of wire, through the unfiltered air intake, which could damage router components.

- Related Documentation**
- M40e Cooling System Description on page 48
 - Troubleshooting the Cooling System on the M40e Router on page 150
 - M40e Clearance Requirements for Airflow and Hardware Maintenance on page 71

Maintaining the M40e Fan Tray and Impellers

Purpose Verify the condition of the fan tray and impellers.

- Action** The fan tray is attached to the back of the cable management system and installs into the front of the chassis, as shown in “M40e Chassis Description” on page 8. There are also three separate, non-interchangeable impeller assemblies. The front impeller is located behind the craft interface (shown in “M40e Chassis Description” on page 8) and works together with the fan tray to cool the FPCs and midplane. The upper and lower impellers on the rear of the chassis (shown in “M40e Chassis Description” on page 8) work together to cool the components that install into the rear of the chassis.

To check the status of the impellers and the fans in the fan tray, issue the **show chassis environment** command. The output includes an entry for each impeller (which it refers to as a **Blower**) and for each fan in the fan tray:

```
user@host> show chassis environment
Class Item                Status    Measurement
...
Fans  Rear Bottom Blower      OK        Spinning at normal speed
      Rear Top Blower       OK        Spinning at normal speed
      Front Top Blower      OK        Spinning at normal speed
      Fan Tray Rear Left    OK        Spinning at normal speed
      Fan Tray Rear Right   OK        Spinning at normal speed
      Fan Tray Front Left   OK        Spinning at normal speed
      Fan Tray Front Right  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

- M40e Cooling System Description on page 48
- Troubleshooting the Cooling System on the M40e Router on page 150
- Replacing the Fan Tray on an M40e Router on page 168
- M40e Clearance Requirements for Airflow and Hardware Maintenance on page 71

Maintaining the M40e Host Module Components

Purpose Verify the condition of the host module components.

Action The router can have a Routing Engine in each of the slots labeled **RE 0** and **RE 1** and a Miscellaneous Control Subsystem (MCS) in each of the slots labeled **MCS 0** and **MCS 1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. Each paired Routing Engine and MCS function together as a host module. To maintain the host module, regularly:

- Check the LCD and the host module LEDs on the craft interface. The LCD reports host module status during normal operation and describes the cause of failures when they occur. The green LEDs labeled **ONLINE** and **MASTER** light steadily for the master host module when it is functioning normally. The **ONLINE** LED also lights for the standby host module if it is installed. For more information about the LEDs and LCD, see “M40e Craft Interface Alarm LEDs and Controls” on page 35 and “M40e Craft Interface LCD Description” on page 36.
- Issue the CLI **show chassis routing-engine** command to check the status of the Routing Engines. As shown in the sample output, the master Routing Engine is designated **Master** in the **Current state** field:

```
user@host> show chassis routing-engine

Routing Engine status:
Slot 0:
  Current state           Master
  Election priority       Master (default)
  Temperature             37 degrees C / 98 degrees F
  DRAM                   768 MB
  Memory utilization      18 percent
  CPU utilization:
    User                  0 percent
    Background            0 percent
    Kernel                2 percent
    Interrupt             0 percent
    Idle                  98 percent
  Model                  RE-2.0
  Serial ID               8b00000792898b01
  Start time             2003-04-29 16:09:49 PDT
  Uptime                 16 days, 3 hours, 6 minutes, 34 seconds
  Load averages:         1 minute 5 minute 15 minute
                        0.00      0.00      0.00

Routing Engine status:
Slot 1:
```

Current state	Backup
Election priority	Backup (default)
Temperature	36 degrees C / 96 degrees F
DRAM	768 MB
Memory utilization	16 percent
CPU utilization:	
User	0 percent
Background	0 percent
Kernel	0 percent
Interrupt	0 percent
Idle	100 percent
Model	RE-2.0
Serial ID	6d000007c8150801
Start time	2003-04-22 10:01:29 PDT
Uptime	16 days, 3 hours, 6 minutes, 34 seconds

- Issue the CLI **show chassis environment mcs** command to check the status of the MCSs. As shown in the sample output, the MCS that belongs to the master host module is designated **Master** in the **State** field:

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

```
MCS 0 status:
```

State	Online Master
Temperature	48 degrees C / 118 degrees F
Power:	
3.3 V	3299 mV
5.0 V	4971 mV
12.0 V	11770 mV
5.0 V bias	4989 mV
8.0 V bias	8246 mV
BUS Revision	12
FPGA Revision	13

```
MCS 1 status:
```

State	Online Standby
Temperature	51 degrees C / 123 degrees F
Power:	
3.3V	3316 mV
5.0 V	5001 mV
12.0 V	11775 mV
5.0 V bias	5001 mV
8.0 V bias	8249 mV
BUS Revision	12
FPGA Revision	13

For further description of the output from the commands, see the *Junos OS System Basics and Services Command Reference*.

Related Documentation

- M40e Host Module Description on page 23
- Host Module LEDs on the M40e Craft Interface on page 37

Maintaining M40e FPCs

Purpose Verify the condition of the FPCs.

Action The router can have up to eight Flexible PIC Concentrators (FPCs) mounted vertically in the FPC card cage at the front of the chassis, as shown in “M40e Chassis Description” on page 8. To maintain FPCs, regularly:

- Check the LCD on the craft interface and the LEDs on the craft interface directly above each FPC slot. The green LED labeled **OK** lights steadily when an FPC is functioning normally. For more information, see “FPC LEDs and Controls on the M40e Craft Interface” on page 38.
- Issue the CLI **show chassis fpc** command to check the status of installed FPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the FPC is functioning normally:

```
user@host> show chassis fpc
```

Slot	State	Temp (C)	CPU Utilization (%) Total	Interrupt	Memory DRAM (MB)	Utilization (%) Heap	Buffer
0	Online	37	4	0	32	2	40
1	Empty						
2	Offline	--	FPC not supported on platform --				
3	Empty						
4	Online	34	1	0	32	1	40
5	Online	35	4	0	32	2	40
6	Online	39	4	0	32	1	39
7	Empty						

Related Documentation

- FPC LEDs and Controls on the M40e Craft Interface on page 38
- M40e FPCs Supported on page 17
- Holding an M40e FPC Overview on page 133
- M40e Flexible PIC Concentrators (FPCs) Description on page 13

Holding and Storing M40e FPCs

- Holding an M40e FPC Overview on page 133
- Holding an M40e FPC Vertically on page 136
- Holding an M40e FPC Horizontally on page 137
- Storing an M40e FPC on page 138

Holding an M40e FPC Overview



CAUTION: To prevent damage when handling or carrying FPCs, observe the following precautions.

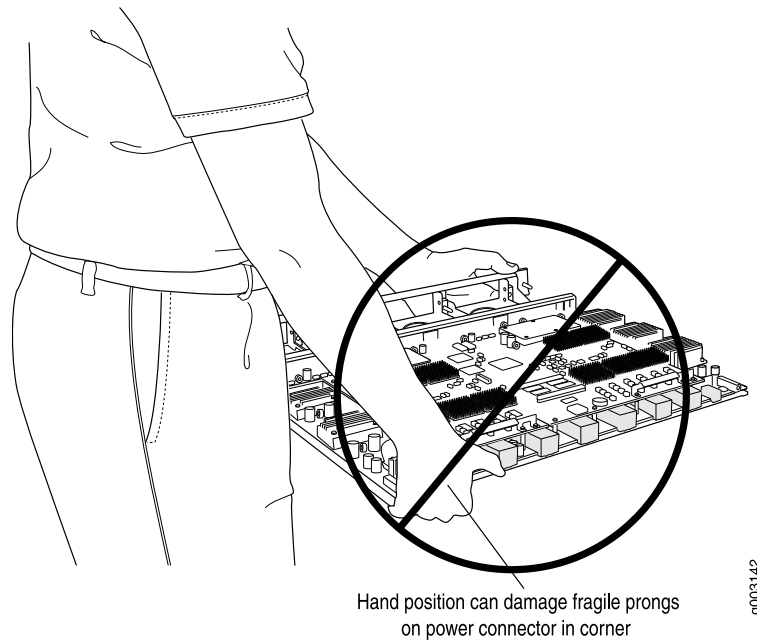


NOTE: An FPC configured with PICs installed can weigh as much as 15 lb (6.8 kg). Be prepared to accept the full weight of the FPC as you lift it.

As you carry the FPC, do not bump it against anything. FPC components are fragile.

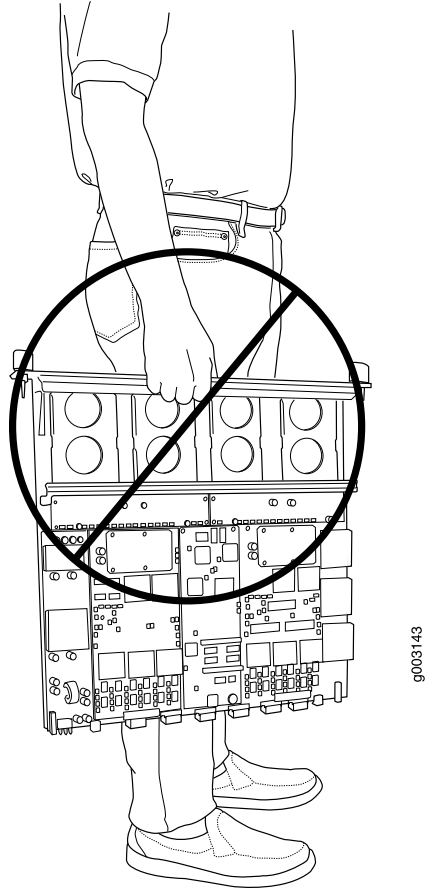
Do not grasp the FPC anywhere except places that this document indicates. In particular, never grasp the connector edge, especially at the power connector in the corner where the connector and bottom edges meet (see Figure 71 on page 134).

Figure 71: Do Not Grasp the Connector Edge



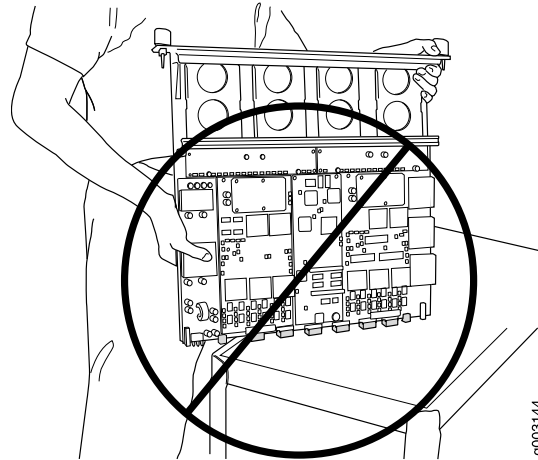
Do not carry the FPC by the faceplate with only one hand (see Figure 72 on page 135).

Figure 72: Do Not Carry an FPC with Only One Hand



Do not rest any edge of an FPC directly against a hard surface (see Figure 73 on page 136). If you must rest the FPC temporarily on an edge while changing its orientation between vertical and horizontal, use your hand as a cushion between the edge and the surface.

Figure 73: Do Not Rest the FPC on an Edge



Related Documentation

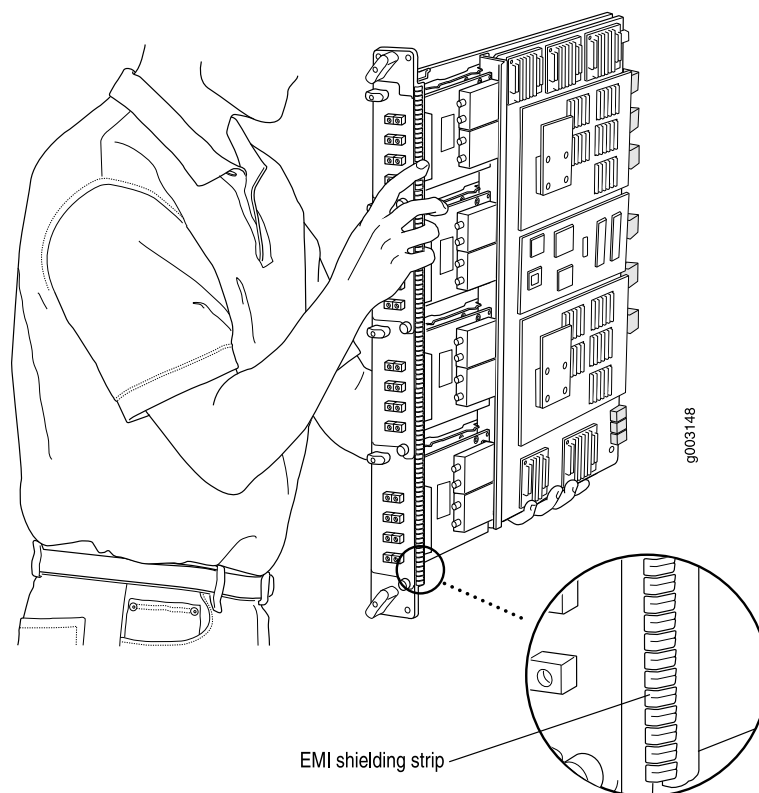
- FPC LEDs and Controls on the M40e Craft Interface on page 38
- M40e FPCs Supported on page 17
- Replacing an FPC in an M40e Router on page 191
- M40e Flexible PIC Concentrators (FPCs) Description on page 13

Holding an M40e FPC Vertically

You hold an FPC vertically when installing it into the chassis or an equipment rack. To hold an FPC vertically (see Figure 74 on page 137):

1. Orient the FPC so that the faceplate faces you.
2. Place one hand around the FPC faceplate about a quarter of the way down from the top edge. To avoid deforming the electromagnetic interference (EMI) shielding strip, do not press hard on it.
3. Place your other hand at the bottom edge of the FPC. If the FPC has heat sinks about midway between the faceplate and connector edge, place your other hand against the heat sinks.

Figure 74: Holding an FPC Vertically



Related Documentation

- FPC LEDs and Controls on the M40e Craft Interface on page 38
- M40e FPCs Supported on page 17
- Replacing an FPC in an M40e Router on page 191
- M40e Flexible PIC Concentrators (FPCs) Description on page 13
- Holding an M40e FPC Overview on page 133

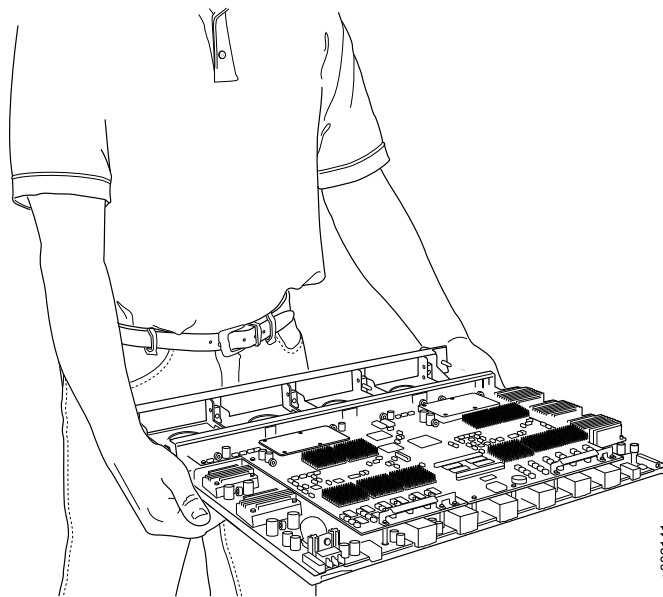
Holding an M40e FPC Horizontally

If the FPC is horizontal before you grasp it, place your left hand around the faceplate and your right hand along the bottom edge. To hold an FPC horizontally (see Figure 75 on page 138):

1. Orient the FPC so that the faceplate faces you.
2. Grasp the top edge with your left hand and the bottom edge with your right hand. If the FPC has heat sinks about midway between the faceplate and connector edge, place your right hand against the heat sinks.

You can rest the faceplate of the FPC against your body as you carry it.

Figure 75: Holding an FPC Horizontally



Related Documentation

- Holding an M40e FPC Overview on page 133
- FPC LEDs and Controls on the M40e Craft Interface on page 38
- M40e FPCs Supported on page 17
- Replacing an FPC in an M40e Router on page 191
- M40e Flexible PIC Concentrators (FPCs) Description on page 13

Storing an M40e FPC

When not installed in the routing platforms, FPCs must be either stored in the container in which a spare FPC is shipped or stored horizontally and component-side up on a flat, stable surface.

When you store an FPC on a horizontal surface or in the shipping container, always place it inside an antistatic bag. Because the FPC is heavy and because antistatic bags are fragile, inserting the FPC into the bag is easier with two people. To do this, one person holds the FPC in the horizontal position with the faceplate facing the body, and the other person slides the opening of the bag over the FPC connector edge. If you must insert the FPC into a bag by yourself, first lay the FPC horizontally on a flat, stable surface, component-side up. Orient the FPC with the faceplate facing you. Carefully insert the FPC connector edge into the opening of the bag, and pull the bag toward you to cover the FPC.

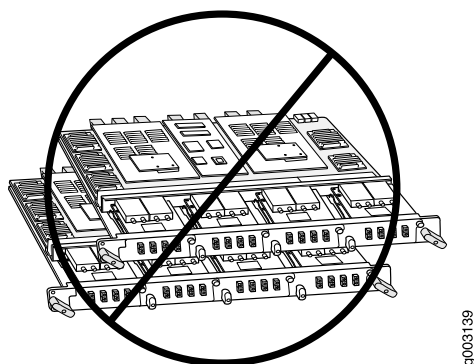


CAUTION: To prevent damage when storing FPCs, observe the following precautions:

- Never lay an FPC component-side down.

- Never stack an FPC under or on top of any other component (see Figure 76 on page 139).

Figure 76: Do Not Stack FPCs



Related Documentation

- FPC LEDs and Controls on the M40e Craft Interface on page 38
- M40e FPCs Supported on page 17
- Replacing an FPC in an M40e Router on page 191
- M40e Flexible PIC Concentrators (FPCs) Description on page 13

Maintaining M40e PICs and PIC Cables

Purpose Verify the condition of the PICs and PIC cables.

Action To maintain PICs and PIC cables:

- Check the LEDs on PIC faceplates. The meaning of the LED states differs for various PICs. For more information, see the *M40e Multiservice Edge Router PIC Guide*. If the FPC that houses the PIC detects a PIC failure, the FPC generates an alarm message to be sent to the Routing Engine.
- Issue the CLI **show chassis fpc pic-status** command. The PIC slots in an FPC are numbered from **0** through **3**, top to bottom:

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

```
Slot 0 Online
  PIC 0   4x OC-3 SONET, MM
  PIC 1   1x CSTM1, SMIR
  PIC 3   2x OC-3 ATM, MM
Slot 1 Online
  PIC 0   1x OC-12 SONET, MM
  PIC 1   1x OC-12 ATM, MM
  PIC 2   2x OC-3 ATM, MM
  PIC 3   2x OC-3 ATM, MM
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

- Use the cable management system (shown in “M40e Chassis Description” on page 8) to support cables and prevent cables from dislodging or developing stress points. Place excess cable out of the way in the cable management system. Do not allow fastened loops of cable to dangle from the connector or cable management system, because this stresses the cable at the fastening point. Putting fasteners on the loops helps to maintain their shape.
- Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them if necessary before connecting an interface.
- Label both ends of PIC cables to identify them.

The following guidelines apply specifically to fiber-optic cable:

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

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

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

**Related
Documentation**

- Installing a PIC in an M40e Router on page 201
- M40e PICs Description on page 12
- Replacing PIC Cables in an M40e Router on page 203
- Replacing a PIC in an M40e Router on page 198

Maintaining the M40e PCGs

- Purpose** For optimal performance, verify the condition of the Packet Forwarding Engine Clock Generators (PCGs).
- Action** The router has two PCGs installed in the slots labeled **PCG 0** and **PCG 1** on the rear of the chassis, as shown in “M40e Chassis Description” on page 8. To maintain the PCGs, regularly:
- Check the LEDs on the PCG faceplates. The green LED labeled **OK** lights steadily when the PCG is functioning normally. The blue LED labeled **MASTER** lights steadily on the master PCG. For more information, see “M40e PCG LEDs” on page 19.
 - Issue the CLI **show chassis environment pcg** command to check the status of the PCGs. As shown in the sample output, the master PCG is designated **Online - Master clock** and the standby PCG **Online - Standby**:

```
user@host> show chassis environment pcg

PCG 0 status:
State                Online - Master clock
Temperature           40 degrees C / 104 degrees F
Frequency:
  Setting             125.00 MHz
  Measurement         125.01 MHz
Power:
  3.3 V               3274 mV
  5.0 V bias          4974 mV
  8.0 V bias          8183 mV
BUS Revision         12
PCG 1 status:
State                Online - Standby
Temperature           40 degrees C / 104 degrees F
Frequency:
  Setting             125.00 MHz
  Measurement         125.03 MHz
Power:
  3.3 V               3267 mV
  5.0 V bias          4993 mV
  8.0 V bias          8190 mV
BUS Revision         12
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

- Related Documentation**
- M40e Packet Forwarding Engine Clock Generators (PCGs) Description on page 18
 - M40e Packet Forwarding Engine Architecture on page 60
 - Installing a PCG in an M40e Router on page 197
 - Replacing a PCG in an M40e Router on page 196

Maintaining M40e SFMs

- Purpose** For optimal performance, verify the condition of the SFMs.

Action The router can have a Switching and Forwarding Module (SFM) in each of the slots labeled **SFM0** and **SFM1** at the rear of the chassis, as shown in “M40e Chassis Description” on page 8. To maintain the SFMs, regularly:

- Check the LEDs on the SFM faceplates. The green LED labeled **OK** lights steadily on the active SFM when it is functioning normally. No LEDs are lit on the standby SFM. For more information, see “M40e SFM LEDs” on page 23.
- Issue the CLI **show chassis sfm** command to check the status of the SFMs. As shown in the sample output, when two SFMs are installed the active SFM is marked as **Online**, and the standby SFM as **Online - Standby**:

```
user@host> show chassis sfm
```

Slot	State	Temp (C)	CPU Utilization (%)	Memory Utilization (%)
			Total Interrupt	DRAM (MB) Heap Buffer
0	Online	39	3 0	64 16 46
1	Online - Standby	42	4 0	64 16 46

For more detailed output, add the **detail** option. The following example also specifies a slot number (1), which is optional:

```
user@host> show chassis sfm detail 1
```

```
Slot 1 information:
State                Online - Standby
SPP Temperature      42 degrees C / 107 degrees F
SPR Temperature      42 degrees C / 107 degrees F
Total CPU DRAM       64 MB
Total SSRAM          8 MB
Internet Processor II Version 1, Foundry IBM, Part number 9
```

For further description of the output from the commands, see the *Junos OS System Basics and Services Command Reference*.

- Related Documentation**
- Replacing an SFM in an M40e Router on page 206
 - M40e Switching and Forwarding Module (SFM) Description on page 20
 - Installing an SFM in an M40e Router on page 207

Maintaining M40e Power Supplies

Action To verify that the power system is functioning normally, regularly:

- Check the LEDs on the faceplate of both power supplies:
 - An AC power supply is functioning correctly when the green LED labeled **OUTPUT OK** is lit steadily.
 - A DC power supply is functioning correctly when the green LED labeled **CB ON** is lit steadily (indicating that the circuit breaker is switched on) and the blue LED labeled **OUTPUT OK** is lit steadily (indicating that the supply is receiving power from the DC source).

If these LEDs are blinking or other LEDs are lit, there could be an error condition. For a summary of LED states, see “M40e Power System Description” on page 42.

- Issue the following CLI command to check the status of the power supplies. The following example specifies a slot number (0), which is optional. As shown in the sample output, the value **Online** in the **State** column indicates that the power supply is operating normally:

```
user@host> show chassis environment pem 0

PEM 0 status:
  State           OnLine
  Temperature      OK
  DC input         OK
  DC Output        OK
  Load            Less than 40 percent
Voltage:
  48.0 V input     55059 mV
  48.0 V fan supply 50181 mV
  5.0 V bias       5032 mV
  8.0 V bias       8224 mV
```



NOTE: The messages in the craft interface LCD and the output from CLI **show** commands refer to the power supply on the right as **PEM 0** and the power supply on the left as **PEM 1**.

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 and the LCD on the craft interface. Power supply failure or removal triggers an alarm that causes one or both of the LEDs to light and an error message to appear on the LCD. You can display the associated error messages by issuing the CLI command:

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

For a list of possible alarm messages, see “M40e Chassis and Interface Alarm Messages” on page 147.

- 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**

- Installing an M40e AC Power Supply on page 213
- Installing an M40e DC Power Supply on page 217
- M40e Router Power Requirements on page 274

CHAPTER 15

Troubleshooting M40e Hardware Components

- Overview of Troubleshooting Resources for the M40e Router on page 145
- Troubleshooting the Cooling System on the M40e Router on page 150
- Troubleshooting FPCs on the M40e Router on page 152
- Troubleshooting PICs on the M40e Router on page 153
- Troubleshooting the M40e Power System When All LEDs on Both Supplies Are Off on page 155
- Troubleshooting the M40e Power System When All LEDs on One Supply Are Off or LED States Are Not Correct on page 155

Overview of Troubleshooting Resources for the M40e Router

- M40e Router Troubleshooting Resources on page 145
- M40e Router LED Overview on page 146
- M40e Chassis and Interface Alarm Messages on page 147
- Using Blown Fuse Indicators to Troubleshoot the M40e Router on page 149

M40e Router Troubleshooting Resources

To troubleshoot a router, you use the Junos OS command-line interface (CLI), LCD, alarms, devices connected to the alarm relay contacts on the TXP-CIP, and LEDs on both the components and craft interface.

- LEDs—When the Routing Engine detects an alarm condition, it lights the red or yellow alarm LED on the craft interface as appropriate. In addition, you can also use the component-specific LEDs on the craft interface and on the faceplate of a component to troubleshoot the routing matrix.

See “M40e Router LED Overview” on page 146

- LCD—When a red or yellow alarm occurs, the cause of the alarm messages is displayed on the craft interface LCD. Use the CLI to display more information about the alarm.
- Alarm devices connected to the alarm relay contact on the TXP-CIP—When a red or yellow alarm occurs, it trips the corresponding alarm relay contact on the TXP-CIP.

- **CLI**—The CLI is the primary tool for controlling and troubleshooting hardware, the Junos OS, routing protocols, and network connectivity. CLI commands display information from routing tables, information specific to routing protocols, and information about network connectivity derived from the ping and traceroute utilities. For information about using the CLI to troubleshoot the Junos OS, see the appropriate Junos OS configuration guide.
- **JTAC**—If you need assistance during troubleshooting, you can contact the Juniper Networks Technical Assistance Center (JTAC) by using the Web or by telephone. If you encounter software problems, or problems with hardware components not discussed here, contact JTAC.

**Related
Documentation**

- M40e Router LED Overview on page 146
- M40e Chassis and Interface Alarm Messages on page 147
- Contacting Customer Support on page 307

M40e Router LED Overview

- Craft Interface LEDs on page 146
- Hardware Components LEDs on page 147

Craft Interface LEDs

The craft interface provides status and troubleshooting information at a glance. It is located on the front of the chassis above the FPC card cage, as shown in “M40e Chassis Description” on page 8. The LEDs on the craft interface include:

- **Alarm**—The circular red alarm LED at the upper left of the craft interface indicates a critical condition that can result in a system shutdown. The triangular yellow alarm next to it indicates a less severe condition that requires monitoring or maintenance. Both alarms can occur simultaneously. When an alarm LED is lit, the LCD describes the cause of the alarm. For more information about the alarm LEDs, see “M40e Craft Interface Alarm LEDs and Controls” on page 35. For more information about the causes of alarms, see “M40e Chassis and Interface Alarm Messages” on page 147.
- **FPC**—For each of the FPC slots in the router, there are two LEDs and an offline button located on the craft interface directly above the slot. The green LED labeled **OK** and the red LED labeled **FAIL** indicate FPC status. For more information, see “FPC LEDs and Controls on the M40e Craft Interface” on page 38.
- **Host module**—Two sets of LEDs at the upper right corner of the craft interface indicate the status of the two host modules. Each set includes three LEDs—a green one labeled **MASTER**, another green one labeled **ONLINE**, and a red one labeled **OFFLINE**. For more information, see “Host Module LEDs on the M40e Craft Interface” on page 37.

Hardware Components LEDs

LEDs on the faceplates of the following hardware components report their status:

- AC power supply—A green LED labeled **OUTPUT OK**. For more information, see “M40e Power System Description” on page 42.
- DC power supply—A green LED labeled **CB ON**, a blue one labeled **OUTPUT OK**, and an yellow one labeled **CB OFF**. For more information, see “M40e Power System Description” on page 42.
- MCS—A blue LED labeled **MASTER**, a green one labeled **OK**, and an yellow one labeled **FAIL**. For more information, see “M40e MCS LEDs” on page 33.
- PCG—A blue LED labeled **MASTER**, a green one labeled **OK**, and an yellow one labeled **FAIL**. For more information, see “M40e PCG LEDs” on page 19.
- 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 *M40e Multiservice Edge Router PIC Guide*.
- SFM—A green LED labeled **OK** and a red one labeled **FAIL**. For more information, see “M40e SFM LEDs” on page 23.

Related Documentation

- Routine Maintenance Procedures for the M40e Router on page 129
- Contacting Customer Support on page 307

M40e Chassis and Interface Alarm Messages

When the Routing Engine detects an alarm condition, it lights the red or yellow alarm LED on the craft interface as appropriate, trips the corresponding contact on the CIP, and reports the cause of the alarm in the craft interface LCD. To view a more detailed description of the alarm cause, issue the **show chassis alarms** CLI command:

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

There are two classes of alarm messages:

- Chassis alarms—Indicate a problem with a chassis component such as the cooling system or power supplies, as described in Table 18 on page 148.
- Interface alarms—Indicate a problem with a specific network interface, as described in Table 19 on page 148.

In both Table 18 on page 148 and Table 19 on page 148, the text in the column labeled “LCD Message” appears in the LCD. The text in the column labeled “CLI Message” appears in the output from the **show chassis alarms** command.

Table 18: M40e Chassis Alarm Messages

Component	LCD Message	CLI Message
Fans and impellers	Fan Failure	RED ALARM - <i>fan name</i> Failure
	Fan Removed	YELLOW ALARM - <i>fan name</i> Removed
	Fans Missing	RED ALARM - Too many fans missing or failing
Temperature sensors	Temperature Warm	YELLOW ALARM - Temperature Warm
	Temperature Hot	RED ALARM - Temperature Hot
	Sensor Failure	RED ALARM - Temperature sensor failure
Power supplies	PEM <i>pem-ID</i> Removed	YELLOW ALARM - PEM <i>pem-ID</i> Removed
	PEM <i>pem-ID</i> High Temp	RED ALARM - PEM <i>pem-ID</i> High Temperature
	PEM <i>pem-ID</i> Output Fail	RED ALARM - PEM <i>pem-ID</i> Output Failure
	PEM <i>pem-ID</i> Input Fail	RED ALARM - PEM <i>pem-ID</i> Input Failure
SFM	SFM <i>sfm-number</i> Failure	RED ALARM - SFM <i>sfm-number</i> Failure (displayed only if no alternate SFM is housed in chassis)
	SFM <i>sfm-number</i> Removed	RED ALARM - SFM <i>sfm-number</i> Removed (displayed only if no alternate SFM is housed in chassis)
Host modules	Host <i>host-number</i> Failure	RED ALARM - Host <i>host-number</i> Failure
	Host <i>host-number</i> Removed	RED ALARM - Host <i>host-number</i> Removed
Craft interface	Craft Failure	YELLOW ALARM - Craft Failure

Table 19: M40e SONET/SDH Interface Alarm Messages

LCD Message	CLI Message
<i>interface-name</i> so-x/x/x BERR-SD	<i>interface-name</i> so-x/x/x - SONET bit error rate defect
<i>interface-name</i> so-x/x/x BERR-SF	<i>interface-name</i> so-x/x/x - SONET bit error rate fault
<i>interface-name</i> so-x/x/x LAIS	<i>interface-name</i> so-x/x/x - SONET line AIS
<i>interface-name</i> so-x/x/x LOF	<i>interface-name</i> so-x/x/x - SONET loss of frame
<i>interface-name</i> so-x/x/x LOL	<i>interface-name</i> so-x/x/x - SONET loss of light

Table 19: M40e SONET/SDH Interface Alarm Messages (*continued*)

LCD Message	CLI Message
<i>interface-name</i> so-x/x/x LOP	<i>interface-name</i> so-x/x/x - SONET loss of pointer
<i>interface-name</i> so-x/x/x LOS	<i>interface-name</i> so-x/x/x - SONET loss of signal
<i>interface-name</i> so-x/x/x LRDI	<i>interface-name</i> so-x/x/x - SONET line remote defect indicator
<i>interface-name</i> so-x/x/x PAIS	<i>interface-name</i> so-x/x/x - SONET path AIS
<i>interface-name</i> so-x/x/x PLL	<i>interface-name</i> so-x/x/x - SONET PLL lock
<i>interface-name</i> so-x/x/x PMIS	<i>interface-name</i> so-x/x/x - SONET path mismatch
<i>interface-name</i> so-x/x/x PRDI	<i>interface-name</i> so-x/x/x - SONET path remote defect indicator
<i>interface-name</i> so-x/x/x REI	<i>interface-name</i> so-x/x/x - SONET remote error indicator
<i>interface-name</i> so-x/x/x SEF	<i>interface-name</i> so-x/x/x - SONET severely errored frame
<i>interface-name</i> so-x/x/x UNEQ	<i>interface-name</i> so-x/x/x - SONET unequipped

Related Documentation

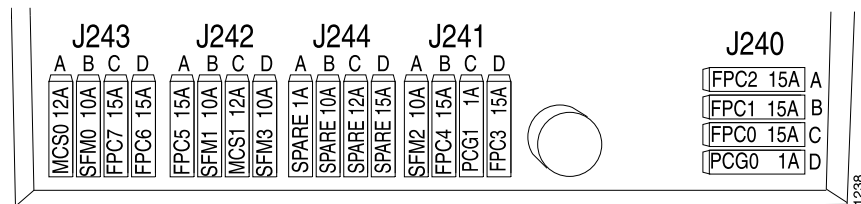
- Connecting the M40e Router to Management and Alarm Devices on page 111
- M40e Router LED Overview on page 146
- Using Blown Fuse Indicators to Troubleshoot the M40e Router on page 149
- Contacting Customer Support on page 307

Using Blown Fuse Indicators to Troubleshoot the M40e Router

The router uses fuses from the Cooper Bussman brand GMT series for the FPCs, MCSs, PCGs, and SFMs. They are located in a fuse box on the rear of the midplane. When the fuse for a component blows, the component stops functioning even though it is installed correctly and the power supplies are still providing power to the router.

Figure 77 on page 150 shows the location in the fuse box of the fuse for each component. The labels shown in the figure do not appear on the actual fuses (the clear cover on every fuse reads **BUSS GMT-X**), but a table on the surface of the midplane below the fuse box displays the same information.

Figure 77: Fuse Locations in the Fuse Box



When a fuse has blown but the power supplies are still delivering power to router, the yellow LED adjacent to the fuse lights. For vertically oriented fuses (in the groups labeled J241 through J244 in Figure 77 on page 150), the LED is located below the fuse; for horizontally oriented fuses (in the group labeled J240), it is to the left of the fuse.



NOTE: The LEDs are each about 0.1in. (2 mm) square. They might be difficult to see when not lit.

A blown fuse can cause a component to fail even though it is correctly installed and the power supplies are functioning. Check for a blown fuse in the following circumstances:

- The LED that indicates normal operation for the component fails to light.
- The appropriate CLI **show chassis environment** command indicates that the component is installed but is not receiving power.

Related Documentation

- Connecting the M40e Router to Management and Alarm Devices on page 111
- Replacing a Fuse on an M40e Router on page 222
- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251
- M40e Router LED Overview on page 146
- M40e Chassis and Interface Alarm Messages on page 147
- Contacting Customer Support on page 307

Troubleshooting the Cooling System on the M40e Router

Problem The cooling system is not functioning normally.

Solution The router's cooling system comprises separate front and rear subsystems:

The router's cooling system comprises separate front and rear subsystems:

- The front subsystem includes the fan tray located behind the cable management system and the impeller located behind the craft interface. They cool the FPCs, PICs, and midplane. See "M40e Chassis Description" on page 8.

- The rear subsystem include upper and lower impellers in the rear of the chassis. They cool the SFMs, host module, PCGs, and power supplies. See “M40e Chassis Description” on page 8.

The cooling system draws in room air through the air intake vent located at the front of the chassis below the cable management system. After entering the chassis, the air stream separates into separate flows for the front and rear subsystems, and the MCS monitors the temperature of each flow independently. For a graphic depiction of the airflow, see “M40e Cooling System Description” on page 48.

For the cooling system to function properly, the clearance around the chassis must be sufficient for unobstructed airflow. See “M40e Clearance Requirements for Airflow and Hardware Maintenance” on page 71.

During normal operation, the impellers and fans in the fan tray function at less than full speed. The MCS constantly monitors the temperatures detected by sensors on the midplane and router components, adjusting the speed of the fans and impellers as necessary. If the router temperature exceeds the acceptable maximum, the MCS turns off the power supplies. The following conditions automatically cause the fans and impellers to run at full speed and also trigger the indicated alarm:

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

For more information about impeller-related alarms, see “M40e Chassis and Interface Alarm Messages” on page 147.

To troubleshoot the fans and impellers, follow these guidelines:

- If the red alarm LED on the craft interface lights, check the LCD on the craft interface for the source of the problem. The display reports the number of alarm conditions and the source of each alarm, as described in “LCD Alarm Mode” on page 37. For a list of messages, see “M40e Chassis and Interface Alarm Messages” on page 147.
- Issue the following CLI command for more information about the source of an alarm condition:

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

- On a DC-powered router, if the blue LED labeled **OUTPUT OK** is blinking on the power supply faceplate, the airflow passing by the power supply might be insufficient. Place your hand near the exhaust vents at the rear of the chassis to determine whether the impellers are expelling air.

- If both power supplies have failed, the system temperature might have exceeded the threshold, causing the system to shut down. See “Troubleshooting the M40e Power System When All LEDs on Both Supplies Are Off” on page 155.
- If the LCD on the craft interface reports failure of only one impeller and the other impellers are functioning normally, the impeller is probably faulty and needs to be replaced. For replacement instructions, see “Replacing the M40e Front Impeller Assembly” on page 172, “Replacing the M40e Rear Lower Impeller Assembly” on page 175, or “Replacing the M40e Rear Upper Impeller Assembly” on page 177. For instructions about returning a faulty component to Juniper Networks, see “Contacting Customer Support” on page 307.

Related Documentation

- Replacing the Fan Tray on an M40e Router on page 168
- Removing Components from the Chassis Before Installing the M40e Router Without a Lift on page 83
- Routine Maintenance Procedures for the M40e Router on page 129

Troubleshooting FPCs on the M40e Router

Problem The FPCs are not functioning normally.

Solution As soon as an FPC is seated in an operating router, the Routing Engine downloads the FPC software to it. The FPC then runs diagnostics and enables the PICs housed on it. During this time, the green LED labeled **STATUS** above the FPC on the craft interface blinks. When the FPC is online and functioning normally, the **STATUS** LED lights steadily.

To troubleshoot the FPCs, follow these guidelines:

- If the red LED labeled **FAIL** above the FPC on the craft interface lights steadily, check the LCD on the craft interface for a message about the status of the FPC and the PICs housed in it.
- Make sure the FPC is properly seated in the midplane—use a Phillips screwdriver to check that the screws at the top and bottom of the card carrier are tight.
- To check the status of an FPC, issue the CLI command:

```
user@host> show chassis fpc
```

Slot	State	Temp (C)	CPU Utilization (%)	Memory (MB)	Utilization (%)
		Total	Interrupt	DRAM (MB)	Heap Buffer
0	Online	37	4	0	32 2 40
1	Empty				
2	Offline	-- FPC not supported on platform --			
3	Empty				
4	Online	34	1	0	32 1 40
5	Online	35	4	0	32 2 40
6	Online	39	4	0	32 1 39
7	Empty				

For more detailed output, add the **detail** option. The following example also specifies a slot number (**0**), which is optional:

```
user@host> show chassis fpc detail 0
```

```
Slot 0 information:
State                Online
Temperature          37 degrees C / 98 degrees F
Total CPU DRAM       32 MB
Total SRAM           4 MB
Total SDRAM          128 MB
I/O Manager ASIC information Version 3.0, Foundry IBM, Part number
0
I/O Manager ASIC information Version 3.0, Foundry IBM, Part number
0
Start time:          2003-03-31 20:54:30 PDT
Uptime:              25 days, 8 hours, 5 minutes, 32 seconds
```

For further description of the output from the commands, see the *Junos OS System Basics and Services Command Reference*.

Related Documentation

- M40e FPCs Supported on page 17
- Holding an M40e FPC Overview on page 133
- Installing an FPC in an M40e Router on page 193
- M320 Flexible PIC Concentrator (FPC) Description

Troubleshooting PICs on the M40e Router

Problem The PICS are not functioning normally.

Solution To troubleshoot the PICs:

1. Check the status of the LEDs located on the PIC faceplate. Many PICs have an LED labeled **STATUS** on their faceplate. Some PICs have additional LEDs, often one per port. For information about the LEDs on each PICs, see the *M40e Multiservice Edge Router PIC Guide*.
2. Issue the following CLI command to check the status of a PIC:

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

```
Slot 0  Online      DPC 40x 1GE R
PIC 0   Online      10x 1GE(LAN)
PIC 1   Online      10x 1GE(LAN)
PIC 2   Online      10x 1GE(LAN)
PIC 3   Online      10x 1GE(LAN)
Slot 1  Online      MX FPC Type 3
PIC 0   Online      1x OC-192 SONET
PIC 1   Online      1x OC-192 SONET
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

The PIC slots are numbered from **0** through **3**, top to bottom

3. If an LED is lit indicating a problem with the PIC, issue the **show chassis alarms** CLI command to view a more detailed description of the alarm cause:

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

For a list of messages that can appear in the output, see Table 20 on page 154.

4. If you are unable to correct the problem, replace the PIC with a spare. For instructions, see “Replacing a PIC in an M40e Router” on page 198. If the LEDs light correctly on the spare, the original PIC is faulty. Return it to Juniper Networks for replacement, as described in “Contacting Customer Support” on page 307.

Table 20: 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
<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**
- M40e PICs Description on page 12
 - M40e PICs Supported

Troubleshooting the M40e Power System When All LEDs on Both Supplies Are Off

Problem The following LED states indicate that a power supply is functioning correctly:

- On an AC power supply, the green LED labeled **OUTPUT OK** is lit steadily.
- On a DC power supply, both the green LED labeled **CB ON** and blue LED labeled **OUTPUT OK** are lit steadily and the yellow LED labeled **CB OFF** is not lit.

Solution If all LEDs are off on both 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 host module shuts down both power supplies. There is no power to the router, so the alarm LEDs on the craft interface are not lit and the LCD also goes blank.

Excessive system temperature is almost always caused by excessive environmental temperature. Correct the environmental temperature before powering on the router.

- Related Documentation**
- M40e Power System Description on page 42
 - M40e Router Power Requirements on page 274
 - M40e Router LED Overview on page 146

Troubleshooting the M40e Power System When All LEDs on One Supply Are Off or LED States Are Not Correct

Problem If either of the following conditions applies, perform the diagnostic procedure described following the list of conditions:

- The LEDs on one power supply are all off, but the LEDs on the other supply indicate that it is functioning properly.
- The LED states on one or both supplies indicate a problem:
 - On an AC power supply, the green LED labeled **OUTPUT OK** is blinking slowly.
 - On a DC power supply, the green LED labeled **CB ON** is not lit and the yellow LED labeled **CB OFF** is lit, or the blue LED labeled **OUTPUT OK** is blinking or is not lit.

Solution Perform the following steps to diagnose and correct the problem:

1. Check the red alarm LED on the craft interface:
 - If it is lit, read the message on the craft interface LCD. The display reports the number of alarm conditions and the source of each alarm, as described in “M40e Craft Interface LCD Description” on page 36. For a list of messages, see “M40e Chassis and Interface Alarm Messages” on page 147. Issue the following CLI command for more information about the cause of an alarm condition:

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



NOTE: The messages in the craft interface LCD and the output from CLI `show` commands refer to the power supply on the right as **PEM 0** and the power supply on the left as **PEM 1**.

A common cause of power supply shutdown is that the temperature of the power supply or another router component has exceed the maximum limit.

- If the red alarm LED is not lit, check that the power switch is in the **ON (|)** position. On an AC-powered router, the switch for each power supply is on the power supply faceplate. On a DC-powered router, the switches are on the circuit breaker box.
2. Replace the faulty power supply with a spare. For instructions, see “Replacing an M40e AC Power Supply” on page 211 and “Replacing an M40e DC Power Supply” on page 215. If the LEDs light 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 307.
 3. If the spare power supply also does not work, connect the router to a different power source. You might also try replacing the power cord or cable. For instructions, see Disconnecting and Connecting AC Power from the M40e Router or Disconnecting and Connecting DC Power on the M40e Router (you do not need to disconnect and reconnect the grounding cable on a DC-powered router).
 4. If you cannot determine the cause of the problem or need additional assistance, see “Contacting Customer Support” on page 307.

**Related
Documentation**

- M40e Power System Description on page 42
- M40e Router Power Requirements on page 274
- M40e Router LED Overview on page 146

Replacing M40e Hardware Components

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Replace M40e Hardware Components on page 158
- Replacing the CIP on the M40e Router on page 160
- Replacing Connections to the M40e Routing Engine Interface Ports on page 163
- Replacing the M40e Cooling System Components on page 167
- Replacing the M40e Host Module Components on page 179
- Replacing the M40e Packet Forwarding Engine Components on page 190
- Replacing M40e Power System Components on page 211

M40e 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 off the router or disrupting the routing functions.
- Hot-pluggable FRUs—You can remove and replace these components without powering down the router, but the routing functions of the system are interrupted when the component is removed.
- FRUs that require powering off the router—You must power off the router before removing these components.

Table 21 on page 158 lists the FRUs for the M40e router.

Table 21: M40e Field-Replaceable Units

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs	FRUs That Require Powering Down the Router
Air filter	Miscellaneous Control Subsystem (MCS)	Circuit breaker box (on DC-powered router only)
Fan tray (located behind the cable management system)	Packet Forwarding Engine Clock Generator (PCG)	Connector Interface Panel (CIP)
Flexible PIC Concentrator (FPC)	Routing Engine	
Physical Interface Card (PIC)	Switching and Forwarding Module (SFM)	
Power supply (AC or DC)		
Small form-factor pluggable (SFP)		

Related Documentation

- M40e Chassis Description on page 8
- Routine Maintenance Procedures for the M40e Router on page 129
- M40e System Description on page 3

Tools and Parts Required to Replace M40e Hardware Components

To replace hardware components, you need the tools and parts listed in Table 22 on page 158.

Table 22: Tools and Parts Required to Replace M40e Hardware Components

Tool or part	Components
Electrostatic bag or antistatic mat	CIP Craft interface FPC Front impeller assembly MCS PIC PCG Routing Engine SFM
Electrostatic discharge (ESD) grounding wrist strap	All

Table 22: Tools and Parts Required to Replace M40e Hardware Components (*continued*)

Tool or part	Components
Flat-blade (–) screwdriver, 2.5 mm	Alarm relay contacts on CIP
Flat-blade screwdriver, approximately 1/4 in. (6 mm)	Craft interface Front impeller assembly
Phillips (+) screwdrivers, numbers 1 and 2	Air filter CIP Circuit breaker box Craft interface DC power cables (to remove protective shield over circuit breaker box) Fan tray Fuse (to remove rear lower impeller assembly) Impeller assembly PCG PIC Power supply (AC or DC) Routing Engine SFM
7/16-in. hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm)	Circuit breaker box (to remove or install power cables) DC power cables
Wire cutters	Alarm relay contacts on CIP
Rubber safety cap	Fiber-optic PIC or PIC cable

Related Documentation

- M40e Chassis Description on page 8
- Routine Maintenance Procedures for the M40e Router on page 129
- M40e System Description on page 3

Replacing the CIP on the M40e Router

The CIP is located to the left side of the FPC card cage, as shown in “M40e Chassis Description” on page 8. It houses the Routing Engine interface ports, which accept connections to external management and alarm-reporting devices.

The CIP is field-replaceable, but you must power off the router before removing or installing it. It weighs about 6.5 lb (3 kg). The cables and wire that connect to the Routing Engine interface ports are hot-removable and hot-insertable.

- Removing the M40e CIP on page 160
- Installing the M40e CIP on page 161

Removing the M40e CIP

To remove the CIP (see Figure 78 on page 161):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. On the console or other management device connected to the master Routing Engine, enter CLI operational mode and issue the following command to shut down the router software. (If two Routing Engines are installed, also issue the command on the backup Routing Engine.)

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

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

For more information about the command, see the *Junos System Basics and Services Command Reference*.



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

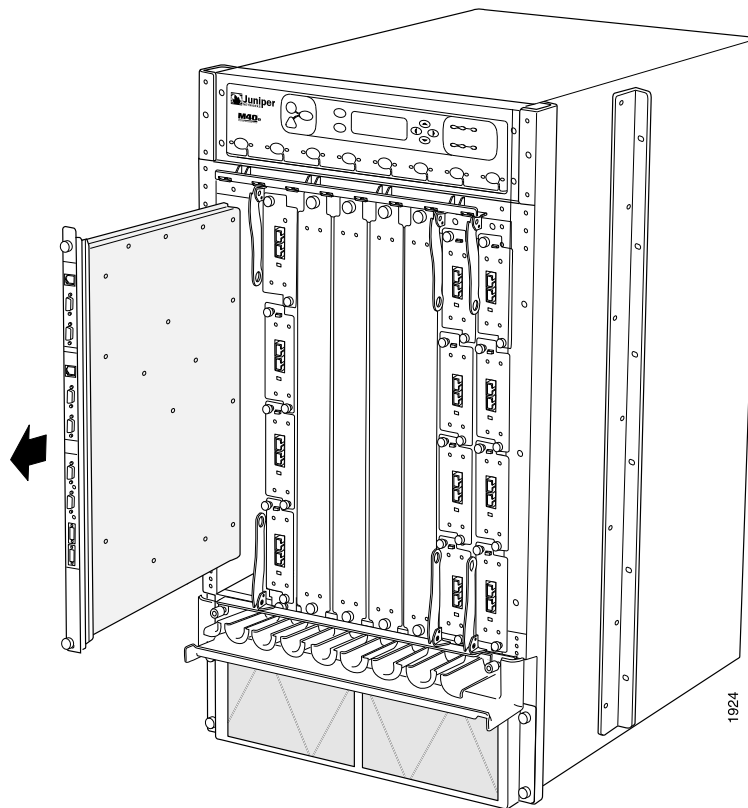
3. Press the power switch for both power supplies to the **OFF (0)** position. On an AC-powered router, the switch for each power supply is on the power supply faceplate. On a DC-powered router, the switches are on the circuit breaker box.
4. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
5. Disconnect any external devices connected to the CIP. For instructions, see “Replacing the M40e Management Ethernet Cable” on page 163, “Replacing the M40e Console or Auxiliary Cable” on page 166, and “Replacing Alarm Relay Wires on the M40e Router” on page 167.

6. Using a Phillips screwdriver, loosen and remove the screw at each end of the CIP faceplate.
7. Grasp the CIP and slide it out of the chassis. Place it in the electrostatic bag or on the antistatic mat.



CAUTION: Be sure to slide the CIP straight within the slot to avoid damaging the connector pins on the front of the midplane.

Figure 78: Removing the M40e CIP



Installing the M40e CIP

To install the CIP (see Figure 79 on page 162):

1. Verify that the router is powered down.
2. Carefully insert the rear of the CIP into the guides at the top and bottom of the CIP slot, which is located to the left of the FPC card cage.



NOTE: The components on the CIP are on the left side of the board, unlike the components of an FPC, which are on the right side. Verify that the components are on the left before inserting the CIP.

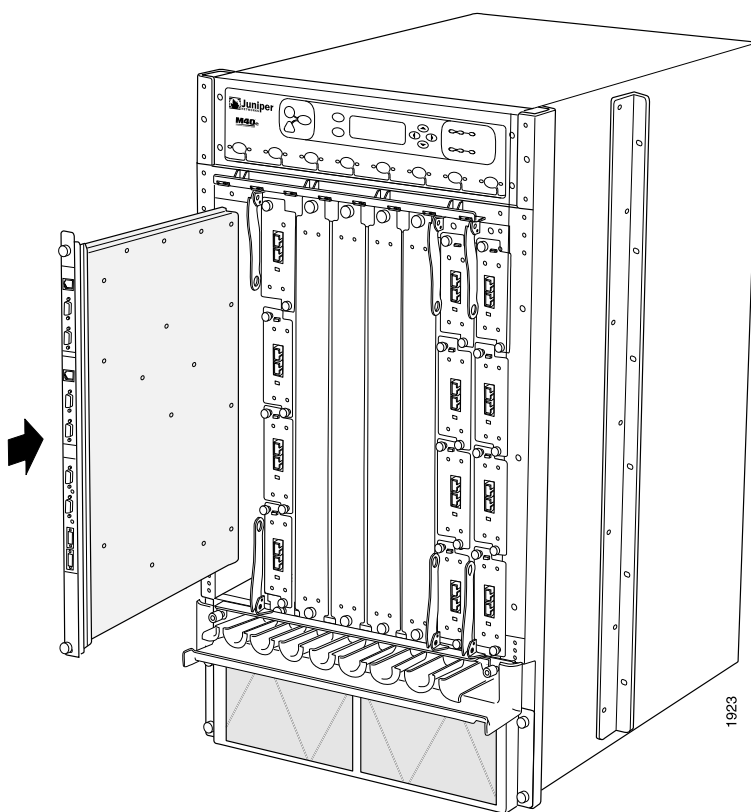
3. Slide the CIP into the chassis until it contacts the midplane.



CAUTION: Be sure to slide the CIP straight within the slot to avoid damaging the connector pins on the front of the midplane.

4. Using a Phillips screwdriver, tighten the screw at each end of the CIP faceplate.
5. Reattach an external management device to one of the Routing Engine ports on the CIP (**AUXILIARY**, **CONSOLE**, or **ETHERNET**). Also reattach alarm relay contacts if desired. For instructions, see “Replacing the M40e Management Ethernet Cable” on page 163, “Replacing the M40e Console or Auxiliary Cable” on page 166, and “Replacing Alarm Relay Wires on the M40e Router” on page 167.
6. Power on the router and verify correct startup by performing the procedures in “Connecting AC Power to the M40e Router” on page 119 for AC power or “Connecting DC Power to the M40e Router” on page 120 for DC power.

Figure 79: Installing the M40e CIP



- Related Documentation**
- M40e Field-Replaceable Units (FRUs) on page 157
 - Tools and Parts Required to Remove Components from an M40e Router on page 309
 - M40e CIP Serial Number ID Label on page 301
 - M40e Connector Interface Panel (CIP) Description on page 39
 - M40e Chassis Description on page 8

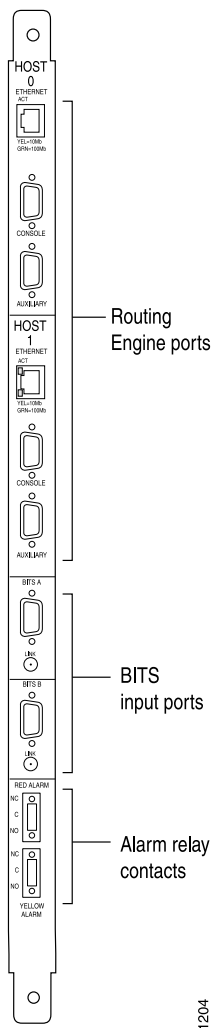
Replacing Connections to the M40e Routing Engine Interface Ports

- Replacing the M40e Management Ethernet Cable on page 163
- Replacing the M40e Console or Auxiliary Cable on page 166
- Replacing Alarm Relay Wires on the M40e Router on page 167

Replacing the M40e Management Ethernet Cable

The ports on the CIP connect the Routing Engine to external management devices (see Figure 80 on page 164).

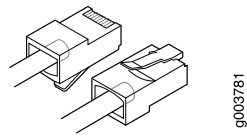
Figure 80: Routing Engine Interface Ports and Alarm Relay Contacts



For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M40e Router” on page 288. To replace the management Ethernet Cable:

1. Press the tab on the connector and pull the connector straight out of the **ETHERNET** port. Figure 81 on page 165 shows the connector.
2. Disconnect the cable from the network device.
3. Plug one end of the replacement cable into the appropriate **ETHERNET** port. Figure 80 on page 164 shows the external device ports on the CIP. The ports labeled **HOST 0** connect to the Routing Engine in the upper Routing Engine slot (**RE 0**), and the ports labeled **HOST 1** connect to the Routing Engine in the lower Routing Engine slot (**RE 1**).
4. Plug the other end of the cable into the network device.

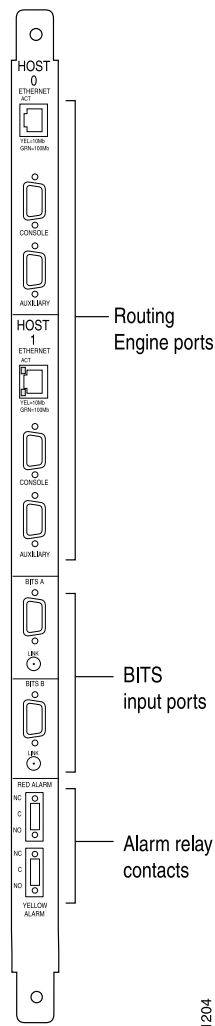
Figure 81: Ethernet Cable Connectors



Replacing the M40e Console or Auxiliary Cable

To use a system console to configure and manage the Routing Engine, connect it to the appropriate **CONSOLE** port on the CIP. To use a laptop, modem, or other auxiliary device, connect it to the appropriate **AUXILIARY** port on the CIP. Both ports accept a cable with an RJ-45 connector. One RJ-45/DB-9 cable is provided with the router. To connect a device to the other port, you must supply another cable. For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M40e Router” on page 288.

Figure 82: Routing Engine Interface Ports and Alarm Relay Contacts



To connect a management console or auxiliary device:

1. Plug one end of the replacement cable into the appropriate **CONSOLE** or **AUXILIARY** port. Figure 82 on page 166 shows the external device ports on the CIP. The ports labeled **HOST 0** connect to the Routing Engine in the upper Routing Engine slot (**RE 0**), and the ports labeled **HOST 1** connect to the Routing Engine in the lower Routing Engine slot (**RE 1**).

2. Plug the the other end of the cable into the device's serial port.

Replacing Alarm Relay Wires on the M40e Router

To connect the router to external alarm-reporting devices, attach wires to the **RED ALARM** and **YELLOW ALARM** relay contacts on the CIP. A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 24-AWG and 12-AWG (0.20 and 3.33 mm²), which is not provided. Use the wire gauge appropriate for the external device you are connecting.

To replace the wires connecting to an alarm-reporting device:

1. Disconnect the existing wire at the external device.
2. Prepare the required length of replacement wire with gauge between 24-AWG and 12-AWG (0.20 and 3.33 mm²).
3. Using a 2.5-mm flat-blade screwdriver, loosen the small screws on the face of the terminal block and remove the block from the relay contact.
4. Using the 2.5-mm flat-blade screwdriver, loosen the small screws on the side of the terminal block. Remove existing wires from the slots in the front of the block and insert replacement wires. Tighten the screws to secure the wire.
5. Orient the terminal block according to the labels to the left of the appropriate relay contact (**NC** means "normally closed," **C** means "common," and **NO** means "normally open").
6. Plug the terminal block into the relay contact and use a 2.5 mm flat-blade screwdriver to tighten the screws on the face of the block.
7. Attach the other end of the wires to the external device.

Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Connecting the M40e Router to a Management Console or Auxiliary Device on page 113
- M40e Routing Engine Description on page 26
- M40e Chassis Description on page 8

Replacing the M40e Cooling System Components

- Replacing the Fan Tray on an M40e Router on page 168
- Replacing the M40e Air Filter on page 170
- Replacing the M40e Front Impeller Assembly on page 172

- Replacing the M40e Rear Lower Impeller Assembly on page 175
- Replacing the M40e Rear Upper Impeller Assembly on page 177

Replacing the Fan Tray on an M40e Router

- Removing the Fan Tray on an M40e Router on page 168
- Installing the M40e Fan Tray on page 169

Removing the Fan Tray on an M40e Router

The fan tray is located behind the cable management system on the front of the chassis, as shown in “M40e Chassis Description” on page 8. It weighs approximately 13 lb (5.9 kg).

To remove the fan tray (see Figure 83 on page 169):

1. Unwrap any PIC cables from the spools on the cable management system and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable management system and tray, and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.



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

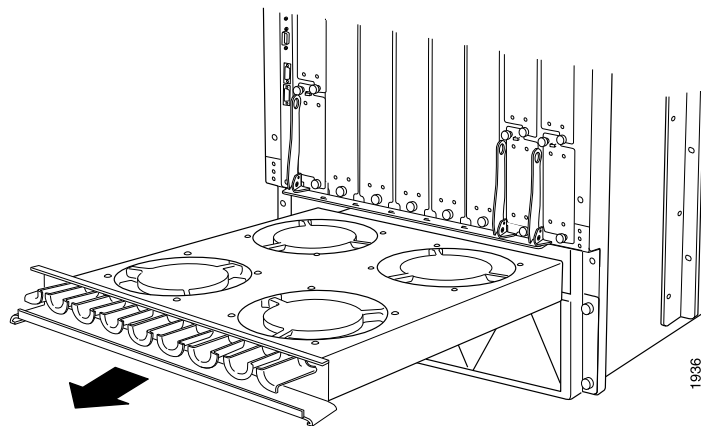
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Loosen the thumbscrew at each end of the fan tray, using a Phillips screwdriver if necessary.
4. Grasp the sides of the fan tray and pull firmly to slide it halfway out of the chassis.



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

5. Place one hand under the fan tray to support it and slide the tray completely out of the chassis after the fans stop spinning.

Figure 83: Removing the Fan Tray



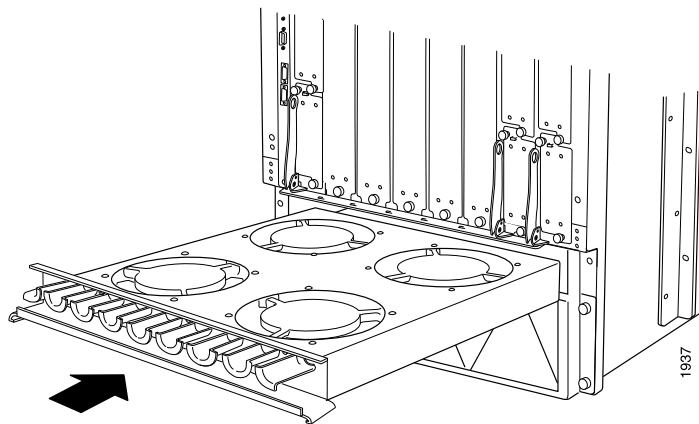
Installing the M40e Fan Tray

To install the fan tray (see Figure 84 on page 170):



CAUTION: When sliding the fan tray into the chassis, take care not to catch and pinch any dangling PIC cables with the edges of the tray. Also 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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
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.
4. Tighten the thumbscrew at each end of the cable management system.
5. Rearrange the PIC cables in the cable management system. For more information about proper cable arrangement, see "Maintaining M40e PICs and PIC Cables" on page 139.

Figure 84: Installing the Fan Tray**Related Documentation**

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- M40e Cooling System Description on page 48
- Troubleshooting the Cooling System on the M40e Router on page 150
- M40e Clearance Requirements for Airflow and Hardware Maintenance on page 71

Replacing the M40e Air Filter

The air filter is located at the front of the chassis, below the FPC card cage and cable management system (see “Removing the M40e Air Filter” on page 170).

To replace the air filter:

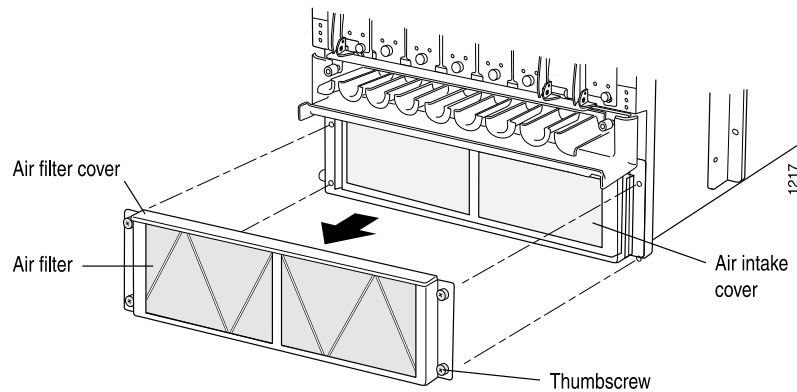
- Removing the M40e Air Filter on page 170
- Installing the M40e Air Filter on page 171

Removing the M40e Air Filter

To remove the air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Loosen the thumbscrew at each corner of the air filter cover.
3. Grasp the edges of the air filter and pull it away from the front of the chassis.
4. Inspect the filter for dust, dirt, and holes. If needed, replace it.

Figure 85: Removing the Air Filter

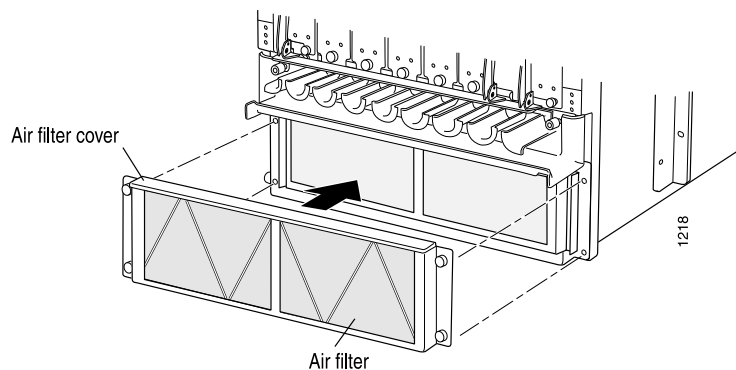


Installing the M40e Air Filter

To install the air filter (see Figure 86 on page 171):

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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
2. Grasp the sides of the air filter and push it firmly into place over the air intake vent.
3. Tighten the thumbscrew at each corner of the air filter cover.

Figure 86: Installing the Air Filter



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Maintaining the M40e Air Filter on page 130
- M40e Cooling System Description on page 48
- Troubleshooting the Cooling System on the M40e Router on page 150
- M40e Clearance Requirements for Airflow and Hardware Maintenance on page 71

Replacing the M40e Front Impeller Assembly

The front impeller assembly, which includes the craft interface, is located at the front of the chassis above the FPC card cage, as shown in “M40e Chassis Description” on page 8. The assembly weighs approximately 14.5 lb (6.6 kg). The assembly is hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157.

The craft interface is attached to the front of the front impeller assembly. If you are removing the front impeller assembly to replace it and the replacement assembly does not have a craft interface already installed on it, you must transfer the craft interface from the removed assembly to the replacement assembly.

If the replacement front impeller assembly already has a craft interface on it, perform only the procedures in “Replacing the M40e Front Impeller Assembly” on page 172.

- Removing the M40e Front Impeller Assembly on page 172
- Removing the M40e Craft Interface from the Front Impeller Assembly on page 173
- Installing the M40e Craft Interface on the Front Impeller Assembly on page 174
- Installing the M40e Front Impeller Assembly on page 175

Removing the M40e Front Impeller Assembly

To remove the front impeller assembly (see Figure 87 on page 173):

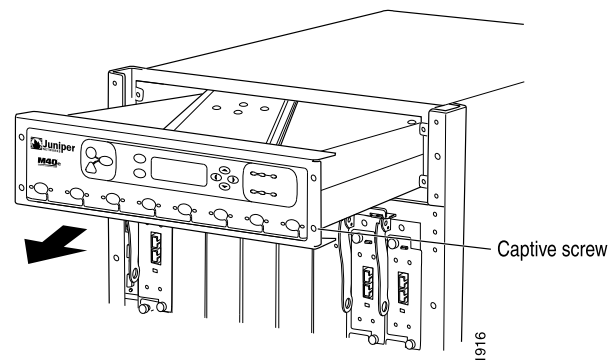
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Using a Phillips screwdriver, loosen the captive screw at each corner of the craft interface.
4. Insert a flat-blade screwdriver into the gap around the craft interface and gently pry the impeller assembly forward until you can grasp the sides of the assembly and slide it halfway out of the chassis.



CAUTION: To avoid injury, as you slide the assembly out of the chassis do not touch any part of the impeller behind the front panel—the impeller might still be spinning.

5. Place one hand under the assembly to support it. When the impeller is no longer spinning, slide the assembly completely out of the chassis and place it on the antistatic mat or in the electrostatic bag.
6. If you are replacing the front impeller assembly and the replacement assembly has a craft interface panel installed on it, proceed to “Installing the M40e Front Impeller Assembly” on page 175. Otherwise, proceed to “Removing the M40e Craft Interface from the Front Impeller Assembly” on page 173.

Figure 87: Removing the Front Impeller Assembly



Removing the M40e Craft Interface from the Front Impeller Assembly

If you are replacing the front impeller assembly and the replacement assembly does not have a craft interface panel on the front, you must transfer the craft interface from the removed assembly to the replacement assembly. To remove the craft interface from the removed impeller assembly:

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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
2. Place the removed and replacement impeller assemblies top side up on antistatic mats.
3. If not immediately transferring the craft interface panel to the replacement assembly, place an antistatic mat or electrostatic bag on a flat, stable surface to receive it.
4. Using a Phillips screwdriver, remove the screws from the three semicircular metal tabs on the back of the craft interface that secure it to the impeller assembly (see Figure 88 on page 174). Save the screws.
5. Grasp the ends of the craft interface, pull upward to release the hooks on the back of it from the windows on the front of the impeller assembly, then pull it toward you to free the craft interface completely (see Figure 89 on page 174). If not immediately transferring it to a replacement impeller assembly, place it in the electrostatic bag or on the antistatic mat.

Figure 88: Removing the Screws Along the Top Front Edge of the Front Impeller Assembly

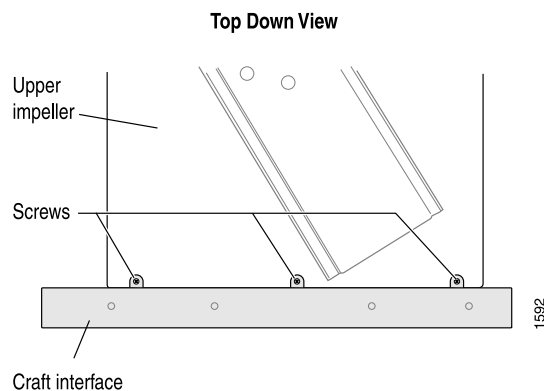
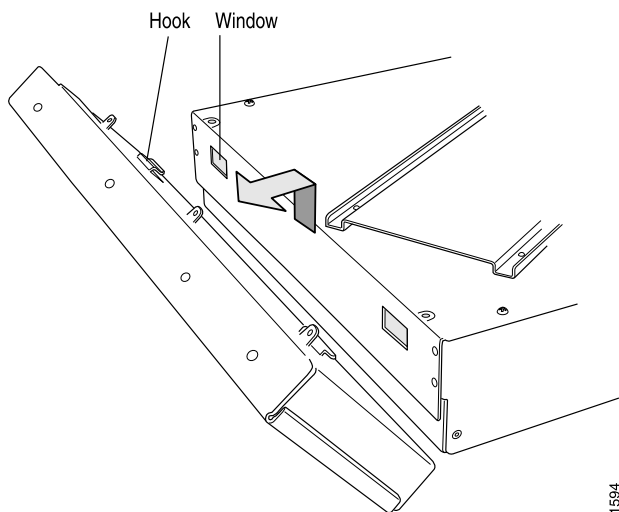


Figure 89: Removing the Craft Interface



Installing the M40e Craft Interface on the Front Impeller Assembly

To attach the craft interface to the front impeller assembly:

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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
2. Place the replacement impeller assembly top side up on an antistatic mat on a flat, stable surface.
3. Attach the craft interface to the front of the impeller assembly, making sure that the hooks on the back of the craft interface clip securely into the windows on the front of the impeller assembly (see "Removing the M40e Craft Interface from the Front Impeller Assembly" on page 173).

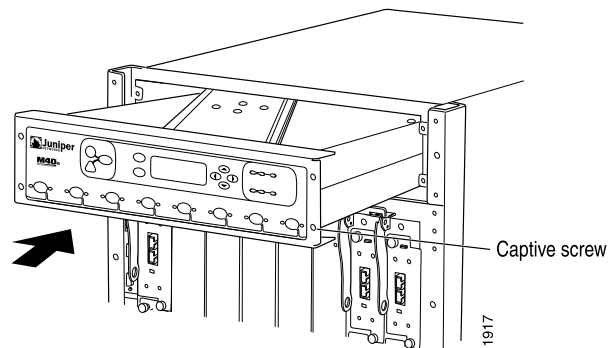
4. Align the holes in the three semicircular metal tabs on the back of the craft interface with the corresponding holes in the top of the impeller assembly.
5. Insert the screws you saved when removing the craft interface into the three holes and tighten using a Phillips screwdriver (see “Removing the M40e Craft Interface from the Front Impeller Assembly” on page 173).

Installing the M40e Front Impeller Assembly

To install the front impeller assembly (see Figure 90 on page 175):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Grasp the sides of the impeller assembly and align the rear of the assembly with the guides inside the chassis.
3. Slide the impeller assembly all the way into the chassis.
4. Using a Phillips screwdriver, tighten the captive screw at each corner of the craft interface.

Figure 90: Installing the M40e Front Impeller Assembly



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Maintaining the M40e Fan Tray and Impellers on page 130
- M40e Craft Interface Description on page 34
- M40e Craft Interface Alarm LEDs and Controls on page 35

Replacing the M40e Rear Lower Impeller Assembly

The rear lower impeller assembly is located at the lower left of the rear of the chassis, above the left power supply, as shown in “M40e Chassis Description” on page 8. It weighs about 4 lb (1.8 kg).

The assembly is hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157.

- Removing the M40e Rear Lower Impeller Assembly on page 176
- Installing the M40e Rear Lower Impeller Assembly on page 176

Removing the M40e Rear Lower Impeller Assembly

To remove the rear lower impeller assembly (see Figure 91 on page 176):

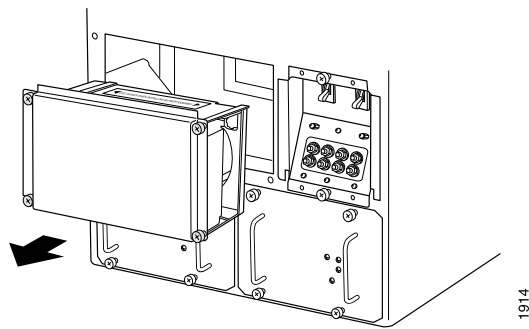
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Loosen the thumbscrew at each corner of the impeller cover, using a Phillips screwdriver if necessary.
3. Grasp the thumbscrews at opposite corners of the impeller cover and slide the assembly halfway out of the chassis.



CAUTION: To avoid injury, as you slide the assembly out of the chassis do not touch any part of the impeller behind the front panel—the impeller might still be spinning.

4. When the impeller is no longer spinning, slide the assembly completely out of the chassis.

Figure 91: Removing the Rear Lower Impeller Assembly



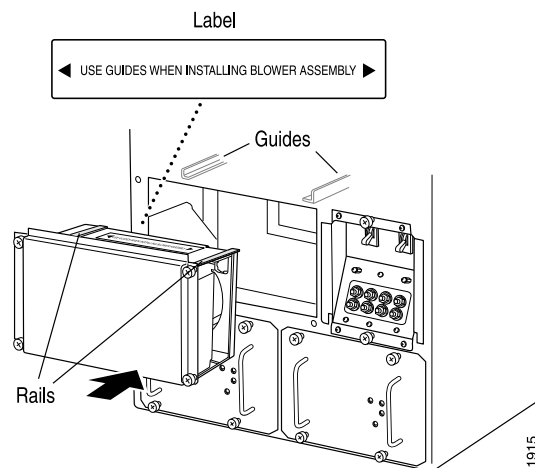
Installing the M40e Rear Lower Impeller Assembly

To install the rear lower impeller assembly (see Figure 92 on page 177):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Orient the impeller so that the label is on the top. Align the rails on the upper edges of the impeller assembly with the guides inside the chassis.

3. Push the impeller assembly up and to the right to start it into the chassis, then slide it all the way in.
4. Tighten the thumbscrew at each corner of the impeller cover.

Figure 92: Installing the Rear Lower Impeller Assembly



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Maintaining the M40e Fan Tray and Impellers on page 130
- M40e Craft Interface Description on page 34
- M40e Craft Interface Alarm LEDs and Controls on page 35

Replacing the M40e Rear Upper Impeller Assembly

The rear upper impeller assembly is located at the upper left of the rear of the chassis, as shown in “M40e Chassis Description” on page 8. It weighs about 4 lb (1.8 kg).

The assembly is hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157.

- Removing the M40e Rear Upper Impeller Assembly on page 178
- Installing the M40e Rear Upper Impeller Assembly on page 178

Removing the M40e Rear Upper Impeller Assembly

To remove the rear upper impeller assembly (see Figure 93 on page 178):

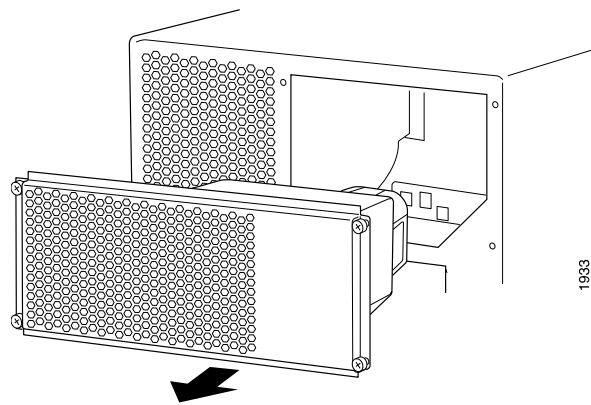
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
2. Loosen the thumbscrew at each corner of the impeller cover, using a Phillips screwdriver if necessary.
3. Grasp the thumbscrews at opposite corners of the impeller cover and slide the assembly halfway out of the chassis.



CAUTION: To avoid injury, as you slide the assembly out of the chassis do not touch any part of the impeller behind the front panel—the impeller might still be spinning.

4. When the impeller is no longer spinning, slide the assembly completely out of the chassis.

Figure 93: Removing the Rear Upper Impeller Assembly

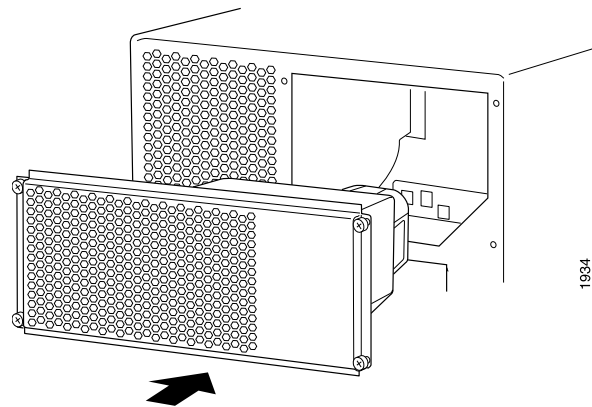


Installing the M40e Rear Upper Impeller Assembly

To install the rear upper impeller assembly (see Figure 94 on page 179):

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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
2. Slide the assembly all the way into the chassis.
3. Tighten the thumbscrew at each corner of the impeller cover.

Figure 94: Installing the Rear Upper Impeller Assembly



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Maintaining the M40e Fan Tray and Impellers on page 130
- M40e Craft Interface Description on page 34
- M40e Craft Interface Alarm LEDs and Controls on page 35

Replacing the M40e Host Module Components

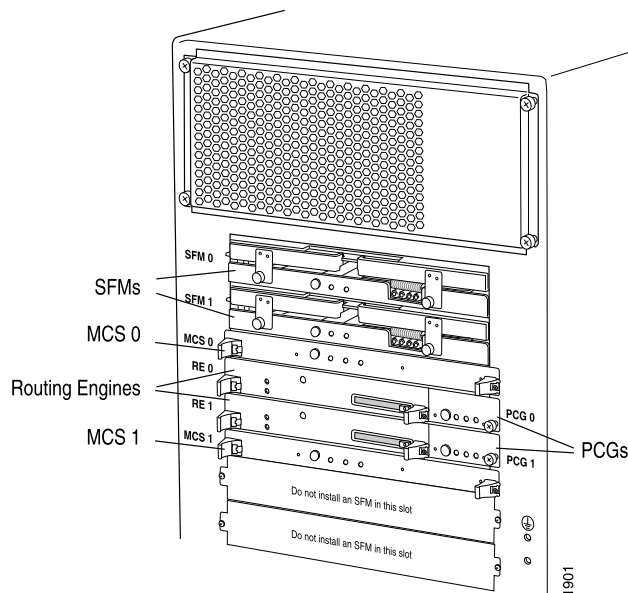
- Replacing an MCS in an M40e Router on page 179
- Removing and Inserting the PC Card in an M40e Router on page 182
- Replacing a DIMM Module in M40e Routing Engines on page 185
- Replacing a Routing Engine in an M40e Router on page 186

Replacing an MCS in an M40e Router

The router can have an MCS in each of the slots labeled **MCS0** and **MCS1** at the rear of the chassis, as shown in Figure 95 on page 180. Each MCS weighs approximately 2.5 lb (1 kg).

The MCSs are hot-pluggable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. For a description of the effect of removing an MCS, see “M40e Host Module Description” on page 23. To replace an MCS:

Figure 95: Rear of M40e Chassis with Component Cover Removed



- Removing an MCS from an M40e Router on page 180
- Installing an MCS in an M40e Router on page 181

Removing an MCS from an M40e Router

To remove an MCS from an M40e router:

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Remove the rear component cover by loosening the thumbscrew at each corner of the cover and pulling it straight off the chassis. For complete instructions, see "Removing Components from the Chassis Before Installing the M40e Router Without a Lift" on page 83.
4. If two host modules are installed, use one of the following two methods to determine which is functioning as master:
 - Note which of the green host module **MASTER** LEDs is lit on the craft interface.
 - The master Routing Engine is designated **Master** in the **Current state** field when you issue the command:

```
user@host> show chassis routing-engine
```

```
Routing Engine status:      Slot 0:      Current state
Master ...
```

5. If the component you are removing belongs to the master host module and a second host module is installed, switch mastership to the standby host module by issuing the CLI command:

```
user@host> request chassis routing-engine master switch
```


6. To halt the router:

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

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

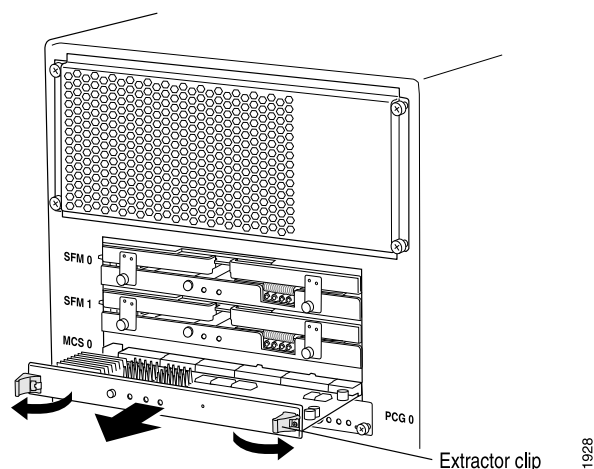
For more information about the command, see the *Junos OS System Basics and Services Command Reference*.



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

7. Push the end of each extractor clip (located at each end of the MCS) outward.
8. Grasp the extractor clips and slide the MCS about halfway out of the chassis.
9. Place one hand under the MCS to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

Figure 96: Removing an MCS from an M40e Router



Installing an MCS in an M40e Router

To install an MCS in an M40e router:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Place one hand under the MCS to support it and grasp one of the extractor clips on the faceplate with the other hand.
3. Align the rear of the MCS with the guides inside the chassis and slide it in completely.
4. Press the extractor clip at each end of the MCS inward.
5. Verify that the green LED labeled **OK** on the MCS faceplate is lit. Also check the host module LEDs on the craft interface to verify that the green LED labeled **ONLINE** is lit.

for the host module to which the MCS belongs (“M40e Craft Interface Description” on page 34 shows the LEDs).

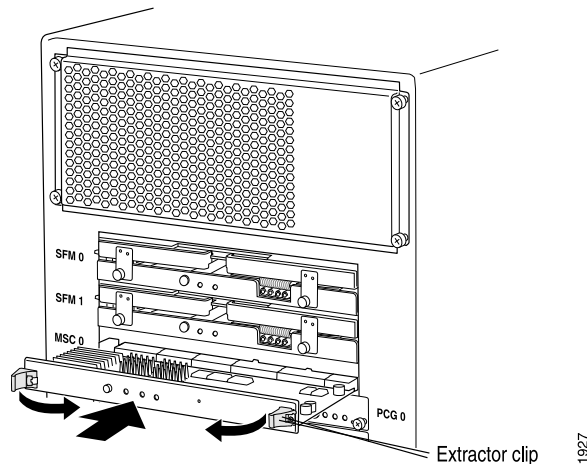
You can also verify correct MCS functioning by issuing the **show chassis environment mcs** command described in “Maintaining the M40e Host Module Components” on page 131.

6. Reinstall the rear component cover and tighten the thumbscrew at each corner to secure it to the chassis. For complete instructions, see “Reinstalling the M40e Components into the Chassis” on page 97.



CAUTION: To maintain proper airflow and provide electromagnetic shielding, do not operate the router without the rear component cover in place.

Figure 97: Installing an MCS in an M40e Router



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- M40e Chassis Description on page 8
- M40e MCS LEDs on page 33
- M40e Miscellaneous Control Subsystem (MCS) Description on page 31

Removing and Inserting the PC Card in an M40e Router

A 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). The router is shipped with a PC Card that contains Junos OS. The PC Card can be used to copy Junos OS from the PC Card onto the Routing Engine. You can also copy Junos OS from the Routing Engine onto a PC Card, for example, to create a backup copy of upgrade software that you have obtained from Juniper Networks. Instructions for copying software to a PC Card are available at the Juniper

Networks Support Web site (<http://www.juniper.net/support/>); after logging in, navigate to the Customer Support Center, then to the download page for Junos OS.



NOTE: The appearance and position of electronic components or the PC Card slot on your Routing Engine might differ from the figures in this section. These differences do not affect Routing Engine installation and removal or functionality.



NOTE: The software on a PC Card is loaded only onto the Routing Engine into which the PC Card is inserted. It is not automatically copied to the other Routing Engine.

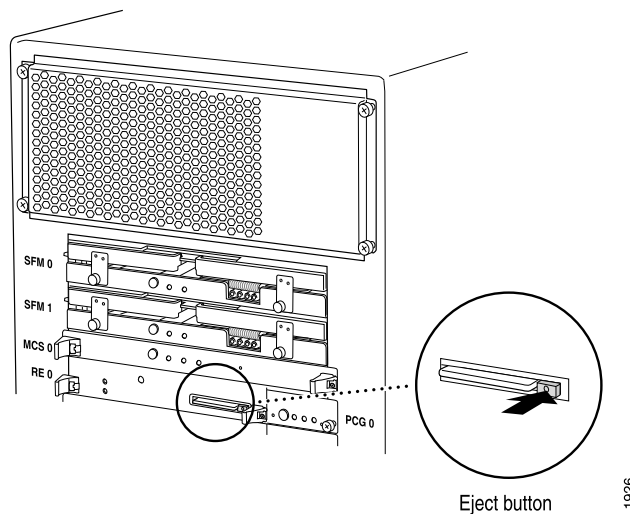
- Removing the M40e PC Card on page 183
- Inserting the M40e PC Card on page 184

Removing the M40e 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 98 on page 184):

1. Remove the rear component cover by loosening the thumbscrew at each corner of the cover and pulling it straight off the chassis. For complete instructions, see “Removing Components from the Chassis Before Installing the M40e Router Without a Lift” on page 83.
2. Press the eject button located next to the PC Card slot in the Routing Engine faceplate. Note that the PC Card slot might be located in a different position from that shown in Figure 98 on page 184.
3. When the PC Card pops partially out of the slot, grasp the card and pull it straight out of the slot.

Figure 98: Removing the PC Card



Inserting the M40e PC Card

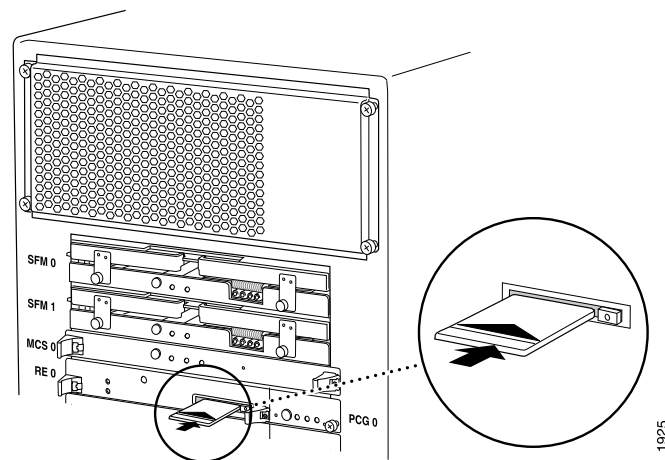
To insert the PC Card (see Figure 99 on page 185):

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. Note that the PC Card slot might be located in a different position from that shown in Figure 99 on page 185.
3. Reinstall the rear component cover and tighten the thumbscrew at each corner to secure it to the chassis. For complete instructions, see "Reinstalling the M40e Components into the Chassis" on page 97.



CAUTION: To maintain proper airflow and provide electromagnetic shielding, do not operate the router without the rear component cover in place.

Figure 99: Inserting the PC Card



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- M40e Routing Engine Description on page 26
- Routing Engine Interface Cable and Wire Specifications for the M40e Router on page 288

Replacing a DIMM Module in M40e Routing Engines

1. Removing a M40e DIMM Module on page 185
2. Installing a M40e DIMM Module on page 186

Removing a M40e DIMM Module

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

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Remove the Routing Engine.
4. Depending on which Routing Engine you are using, there are two different procedures for ejecting the DIMMs:
 - For Routing Engines with an ejector on one side of the DIMM, press the plastic ejector of the DIMM module. The edge of the module raises upward.
 - For Routing Engines with ejectors on each side of the DIMM, press the plastic ejectors on both sides of the DIMM module.
5. Grasp the DIMM module, being careful not to touch any electrical components on the module, and firmly pull it out of the slot on the Routing Engine.

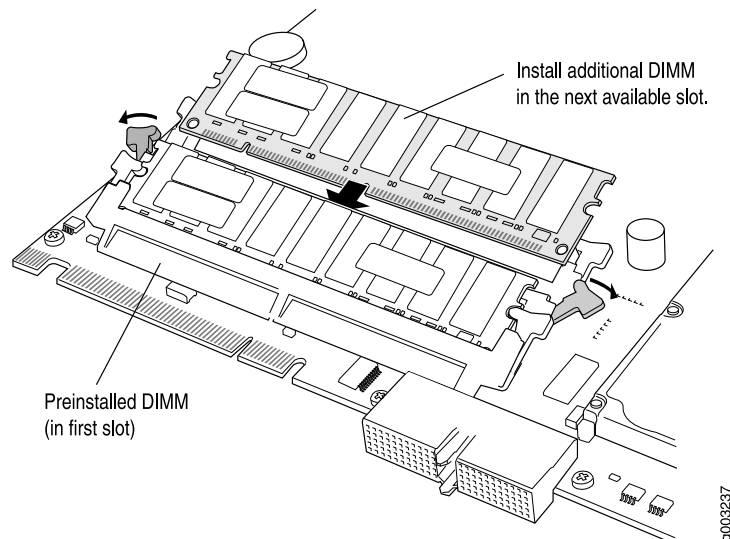
6. Place the DIMM module on the antistatic mat or in the electrostatic bag.
7. Push the plastic ejectors to close the empty DIMM module slot.

Installing a M40e DIMM Module

To insert a DIMM module into the Routing Engine:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the DIMM module from its electrostatic bag.
3. To open the empty DIMM slot, press the plastic ejectors open.
4. Grasp the DIMM module by the edges, being careful not to touch any electrical components.
5. Pressing firmly on both ends, push the module into the slot until the ejectors return completely to the closed position.
6. Install the Routing Engine.
7. You can view the the SDRAM configuration and verify the DIMM was installed correctly by issuing the **show chassis routing-engine** command.

Figure 100: Installing the DIMM Module



Related Documentation

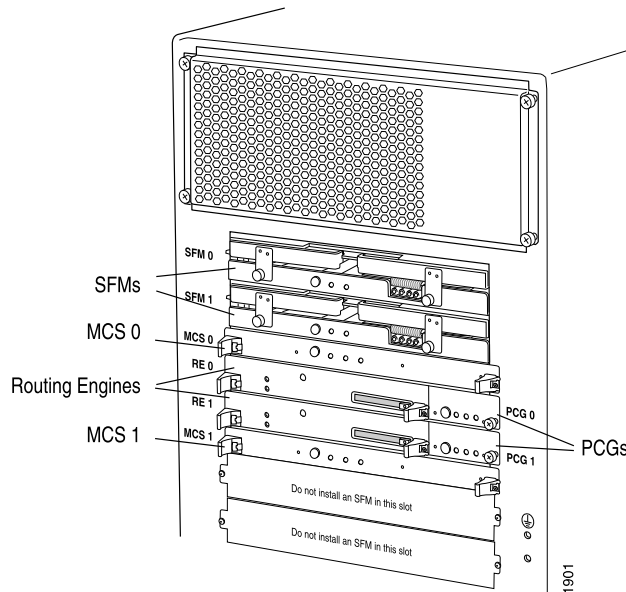
- M40e Routing Engine Description on page 26
- Replacing a Routing Engine in an M40e Router on page 186

Replacing a Routing Engine in an M40e Router

The router can have a Routing Engine in each of the slots labeled **RE0** and **RE1** at the rear of the chassis, as shown in Figure 101 on page 187. Each Routing Engine weighs approximately 1.5 lb (0.7 kg).

The Routing Engines are hot-pluggable. For a description of the effect of removing a Routing Engine, see “M40e Host Module Description” on page 23.

Figure 101: Rear of M40e Chassis with Component Cover Removed



- Removing a Routing Engine from an M40e Router on page 187
- Installing a Routing Engine in an M40e Router on page 189

Removing a Routing Engine from an M40e Router

To remove a Routing Engine from an M40e router:

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Remove the rear component cover by loosening the thumbscrew at each corner of the cover and pulling it straight off the chassis. For complete instructions, see “Removing Components from the Chassis Before Installing the M40e Router Without a Lift” on page 83.
4. If two host modules are installed, use one of the following two methods to determine which is functioning as master:
 - Note which of the green host module **MASTER** LEDs is lit on the craft interface.
 - The master Routing Engine is designated **Master** in the **Current state** field when you issue the command:

```
user@host> show chassis routing-engine
```

```
Routing Engine status:      Slot 0:      Current state
Master ...
```

5. If the component you are removing belongs to the master host module and a second host module is installed, switch mastership to the standby host module by issuing the CLI command:

```
user@host> request chassis routing-engine master switch
```

For more information about switching host module mastership, see “M40e Host Module Description” on page 23.

6. On the console or other management device connected to the Routing Engine you are removing, enter CLI operational mode and issue the following command. The command shuts down the Routing Engine cleanly, so its state information is preserved:

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

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

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.



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

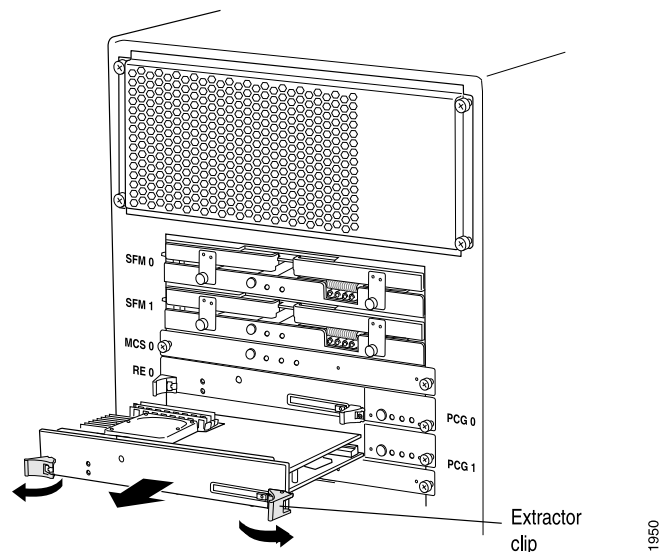
7. Using your thumbs, push and hold the red tab on each extractor clip toward the outer edge of the unit. Push the ends of the extractor clips outward to unseat the Routing Engine from the chassis.
8. Grasp the extractor clips and slide the unit about halfway out of the chassis.



CAUTION: Slide the Routing Engine straight out of the chassis. Damage can result if the Routing Engine gets lodged because of uneven movement.

9. 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 102: Removing a Routing Engine from an M40e Router



Installing a Routing Engine in an M40e Router

To install a Routing Engine in an M40e router:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that the extractor clip at each end of the Routing Engine is flipped toward the outer edge of the unit. If necessary, use your thumbs to push and hold the red tab on each extractor clip toward the outer edge, then push the ends of the extractor clips outward.
3. Place one hand under the Routing Engine to support it and grasp one of the extractor clips on the faceplate with the other hand.
4. Align the rear of the Routing Engine with the guide rails inside the chassis and slide it in completely.



CAUTION: Align the Routing Engine carefully with the guide rails and push it in evenly. Damage can result if the Routing Engine gets lodged in the rails because of uneven movement.

5. Press the extractor clip at each end of the Routing Engine inward to seat the unit firmly in the chassis.
6. Check the host module LEDs on the craft interface to verify that the green LED labeled **ONLINE** is lit for the host module to which the Routing Engine belongs ("M40e Craft Interface Description" on page 34 shows the LEDs).

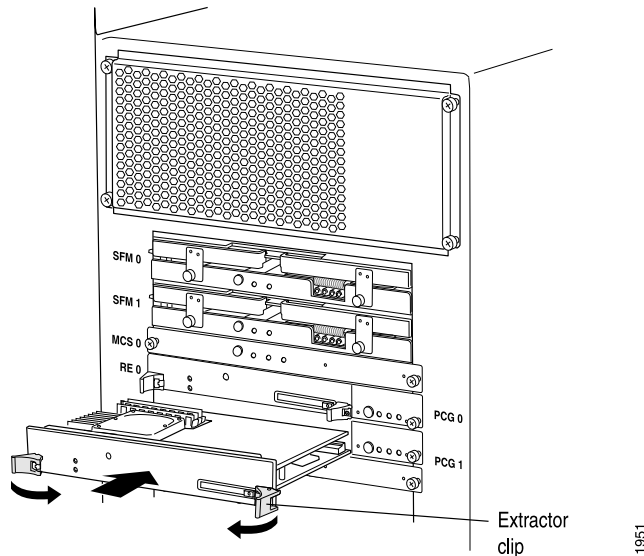
You can also verify correct Routing Engine functioning by issuing the **show chassis routing-engine** command described in “Maintaining the M40e Host Module Components” on page 131.

7. Reinstall the rear component cover and tighten the thumbscrew at each corner to secure it to the chassis. For complete instructions, see “Reinstalling the M40e Components into the Chassis” on page 97.



CAUTION: To maintain proper airflow and provide electromagnetic shielding, do not operate the router without the rear component cover in place.

Figure 103: Installing a Routing Engine in an M40e Router



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- M40e Routing Engine Description on page 26
- Routing Engine Interface Cable and Wire Specifications for the M40e Router on page 288

Replacing the M40e Packet Forwarding Engine Components

For instructions on replacing Packet Forwarding Engine components, see:

- Replacing an FPC in an M40e Router on page 191
- Replacing a PCG in an M40e Router on page 196
- Replacing a PIC in an M40e Router on page 198
- Replacing PIC Cables in an M40e Router on page 203

- Replacing an SFM in an M40e Router on page 206
- Replacing an SFP in an M40e PIC on page 208

Replacing an FPC in an M40e Router

FPCs are hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. When you remove an FPC, forwarding operations halt for about 200 ms while the Packet Forwarding Engine flushes the shared memory buffers on the remaining FPCs.

- Removing an FPC in an M40e Router on page 191
- Installing an FPC in an M40e Router on page 193

Removing an FPC in an M40e Router

To remove an FPC (see Figure 104 on page 193):

1. Place an antistatic mat on a flat, stable surface to receive the FPC. If you are removing PICs from the FPC, prepare an antistatic mat or electrostatic bag for each one. If any of the PICs on the FPC use 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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Label the cables connected to each PIC on the FPC so that you can later reconnect the cables to the correct PICs.
4. Use one of the following methods to take the FPC offline:
 - Press and hold the FPC offline button. The green **OK** LED next to the button begins to blink. Hold the button down until the LED goes out. The LEDs and offline button for each FPC are located directly above it on the craft interface.
 - Issue the CLI command:

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

For more information about the command, see the *Junos System Basics and Services Command Reference*.

5. Disconnect the cables from the PICs installed in the FPC. If a PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap. Arrange the disconnected cables in the cable management system, to prevent the cables from developing stress points.



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



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



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

6. If you are transferring any PICs to a different FPC, remove them while the FPC is still installed:
 - a. Unscrew the thumbscrews at the top and bottom of the PIC faceplate simultaneously and at about the same rate (unscrewing the two screws alternately or at very different rates can cause the PIC to become lodged in the FPC slot, making it difficult to turn the screws).
 - b. Slide the PIC out of the slot and immediately place it on an antistatic mat or in an electrostatic bag.
7. Loosen the thumbscrew at each end of the FPC, using a Phillips screwdriver if necessary.
8. Pull the ends of the ejector levers, which are adjacent to the thumbscrews, away from the face of the FPC until they are nearly perpendicular to it.
9. Grasp the top and bottom flanges of the card carrier and slide the FPC about halfway out of the card cage.
10. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.



CAUTION: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 15 lb (6.8 kg)—as you slide the FPC out of the chassis.

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

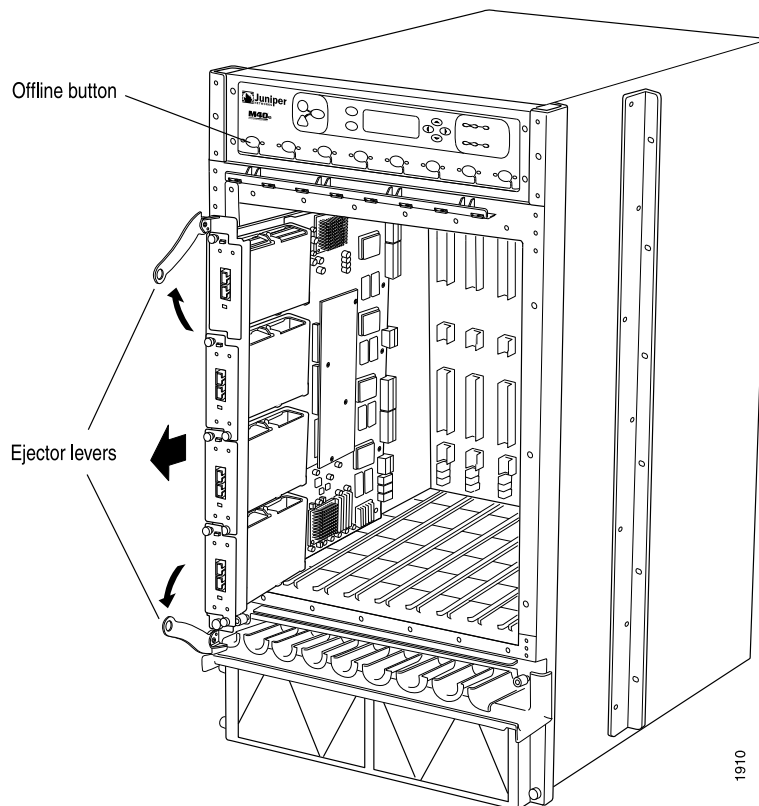
Do not stack FPCs on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

11. If you are not reinstalling a FPC into the emptied FPC slot within a short time, install a blank FPC panel over the slot to maintain proper airflow in the FPC card cage.



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

Figure 104: Removing an FPC from an M40e Router



Installing an FPC in an M40e Router

To install an FPC (see Figure 105 on page 195 and Figure 106 on page 196):

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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
2. Verify that the ends of the ejector levers, which are located at each end of the FPC, are pushed outward, nearly perpendicular to the face of the FPC.
3. Grasp the front of the FPC with one hand and place the other hand under the FPC to support it.



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

4. Align the rear bottom corners of the FPC with the guides at the bottom of the FPC slot. Slide the FPC into the card cage until it contacts the midplane.
5. Push the ends of the ejector levers inward until they are nearly flush with the face of the FPC.
6. Tighten the thumbscrew at each end of the FPC to seat the FPC securely in the chassis.
7. For each different PIC you install in the FPC:
 - a. 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.
 - b. Slide the PIC into a slot in the FPC, aligning the notches in the connector at the rear of the PIC with the notches in the FPC slot and then firmly pushing the PIC into place.



CAUTION: Insert the PIC straight into the FPC slot to avoid damaging the components on the bottom of the PIC.

- c. Tighten the thumbscrews at the ends of the PIC faceplate simultaneously and at about the same rate (tightening the two screws alternately or at very different rates can cause the PIC to become lodged in the FPC slot, making it difficult to turn the screws). Verify that the PIC is seated properly.
8. If any of the PICs on the FPC connect to fiber-optic cable, remove the rubber safety cap from each transceiver and cable.



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

9. Insert the appropriate cable into the cable connector ports on each PIC on the FPC. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.



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



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

10. Use one of the following methods to bring the FPC online:

- Press and hold the FPC offline button until the green **OK** LED next to the button lights steadily, in about 5 seconds. The LEDs and offline button for each FPC are located directly above it on the craft interface.
- Issue the CLI command:

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

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.



CAUTION: After the OK LED lights steadily, wait at least 30 seconds before removing the FPC again, removing an FPC from a different slot, or inserting an FPC in a different slot.

You can also verify correct FPC and PIC functioning by issuing the **show chassis fpc** and **show chassis fpc pic-status** commands described in “Maintaining M40e FPCs” on page 132 and “Maintaining M40e PICs and PIC Cables” on page 139.

Figure 105: Installing an FPC in an M40e Router

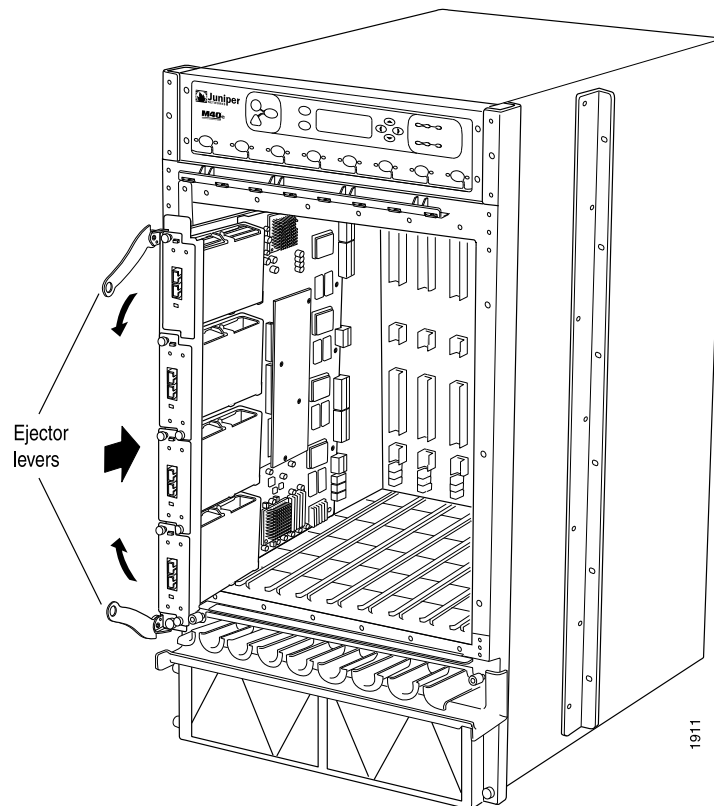
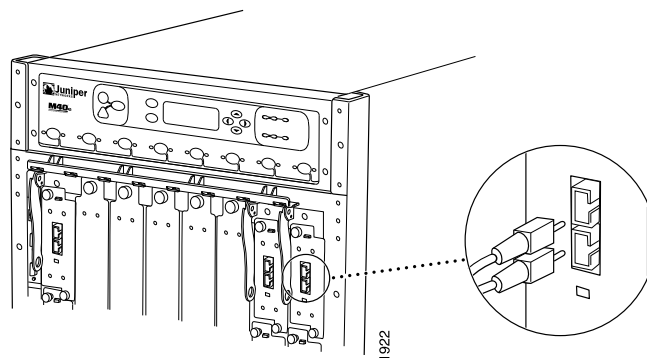


Figure 106: Connecting Fiber-Optic Cable to a PIC in an M40e Router**Related Documentation**

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- M40e Flexible PIC Concentrators (FPCs) Description on page 13
- Maintaining M40e FPCs on page 132
- Troubleshooting FPCs on the M40e Router on page 152

Replacing a PCG in an M40e Router

During normal operation, both PCGs generate a 125-MHz clock signal, but only one is designated as the master. The modules and ASICs in the Packet Forwarding Engine that use the clock signal to gate packet processing use only the signal from the master PCG. For information about determining which PCG is the master, see “Maintaining the M40e PCGs” on page 141.

PCGs are hot-pluggable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. Removal or failure of the backup PCG does not affect router function. If the master PCG fails or is removed from the chassis, however, the Packet Forwarding Engine resets so that the components start using the signal from the other PCG (which becomes the master). The Packet Forwarding Engine cannot accept incoming packets until each PFE component, including the SFM and FPCs, resets to recognize the new master PCG. This can result in traffic halting for several minutes.

- Removing a PCG in an M40e Router on page 196
- Installing a PCG in an M40e Router on page 197

Removing a PCG in an M40e Router

To remove a PCG (see Figure 107 on page 197):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.

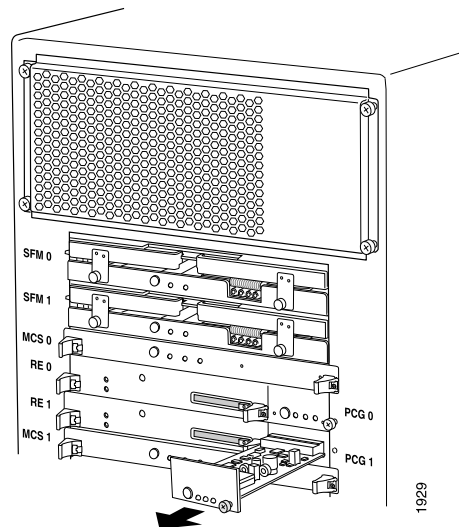
3. Remove the rear component cover by loosening the thumbscrew at each corner of the cover and pulling it straight off the chassis. For complete instructions, see “Reinstalling the M40e Components into the Chassis” on page 97.
4. Press and hold the offline button on the PCG faceplate until the yellow LED labeled **FAIL** lights, which takes about 3 seconds.
(Keep in mind that if you are removing the master PCG, forwarding halts while the Packet Forwarding Engine resets so that the components start using the clock signal from the other PCG, which becomes the master.)
5. Loosen the thumbscrew at the lower right corner of the PCG faceplate, using a Phillips screwdriver if necessary.
6. Grasp the thumbscrew and slide the PCG about halfway out of the chassis.



CAUTION: Be careful to slide the PCG straight out of the chassis to avoid bending any of the pins on the underside of the board.

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

Figure 107: Removing a PCG



Installing a PCG in an M40e Router

To install a PCG (see Figure 108 on page 198):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Place one hand under the PCG to support it and grasp the thumbscrew on the faceplate with the other hand.

3. Align the rear of the PCG with the guides inside the chassis and slide it in completely.
4. Tighten the thumbscrew on the faceplate to seat the PCG firmly in the chassis.
5. Verify that the green LED labeled **OK** lights steadily, which takes about 3 seconds.

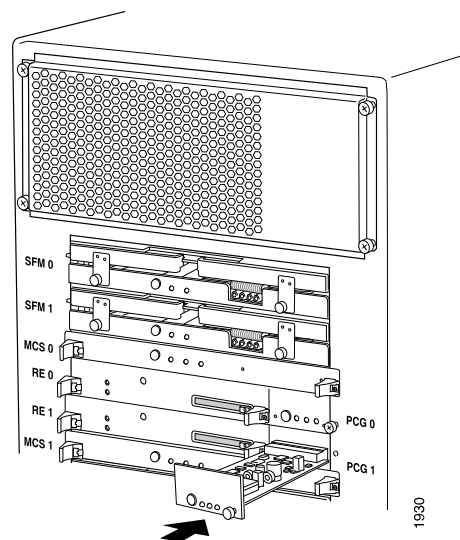
You can also verify correct PCG functioning by issuing the **show chassis environment pcg** command, as described in “Maintaining the M40e PCGs” on page 141.

6. Reinstall the rear component cover and tighten the thumbscrew at each corner to secure it to the chassis. For complete instructions, see “Reinstalling the M40e Components into the Chassis” on page 97.



CAUTION: To maintain proper airflow and provide electromagnetic shielding, do not operate the router without the rear component cover in place.

Figure 108: Installing a PCG



- Related Documentation**
- M40e Field-Replaceable Units (FRUs) on page 157
 - Tools and Parts Required to Remove Components from an M40e Router on page 309
 - M40e Packet Forwarding Engine Clock Generators (PCGs) Description on page 18
 - M40e PCG LEDs on page 19
 - Maintaining the M40e PCGs on page 141

Replacing a PIC in an M40e Router

PICs are housed in the FPCs installed in the front of the router, as shown in “M40e Chassis Description” on page 8. PICs are hot-removable and hot-insertable, as described in

"M40e Field-Replaceable Units (FRUs)" on page 157. Removing a PIC does not affect router function, except that the PIC no longer receives or transmits data.

- Removing a PIC in an M40e Router on page 199
- Installing a PIC in an M40e Router on page 201

Removing a PIC in an M40e Router

To remove a PIC (see Figure 109 on page 200):

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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
3. If the PIC has multiple cable connector ports, label the cable connected to each port, to make it easier to reconnect the cables correctly.
4. Use one of the following methods to take the PIC offline:
 - Press and hold the PIC offline button until its failure indicator LED lights, which usually takes about 5 seconds. The failure LED is usually red; for more information, see the *M40e Multiservice Edge Router PIC Guide*. For the PICs that install on an Type 1 FPCs, the offline button for each PIC is next to it on the FPC card carrier. For the PICs that install on an Type 2 FPCs, the offline button is on the PIC faceplate.
 - Issue the CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline
```

For more information about the command, see the *Junos System Basics and Services Command Reference*.

5. Disconnect the cables from the PIC. If the PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.



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



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

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

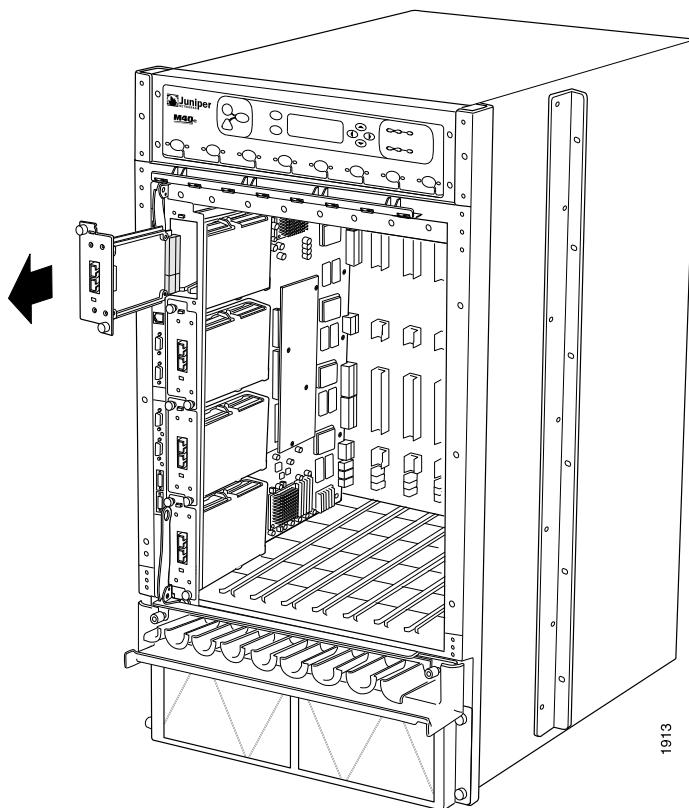
the cable management system. Placing fasteners on the loop helps to maintain its shape.



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

7. Unscrew the thumbscrews at the top and bottom of the PIC faceplate simultaneously and at about the same rate (unscrewing the two screws alternately or at very different rates can cause the PIC to become lodged in the FPC slot, making it difficult to turn the screws).
8. Slide the PIC out of the FPC card carrier and place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a PIC into the emptied PIC slot within a short time, install a blank PIC panel over the slot to maintain proper airflow in the FPC card cage.

Figure 109: Removing a PIC from an M40e Router



Installing a PIC in an M40e Router

To install a PIC (see Figure 110 on page 202 and Figure 111 on page 203):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. If the PIC uses fiber-optic cable, verify that there is a rubber safety cap over each transceiver on the faceplate. Install a cap if necessary.
3. Align the notches in the connector at the rear of the PIC with the notches in the PIC slot in the FPC and then slide the PIC in until it lodges firmly in the FPC.



CAUTION: Slide the PIC straight into the slot to avoid damaging the components on the bottom of the PIC.

4. Tighten the thumbscrews at the top and bottom of the PIC faceplate simultaneously and at about the same rate (tightening the two screws alternately or at very different rates can cause the PIC to become lodged in the FPC slot, making it difficult to turn the screws). Verify that the PIC is seated properly.
5. If the PIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.



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



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

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



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



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

8. Use one of the following methods to bring the PIC online:

- Press and hold the PIC offline button until the status LED on the PIC faceplate indicates normal functioning, which usually takes about 5 seconds. The LED is usually green; for more information, see the *M40e Multiservice Edge Router PIC Guide*. For the PICs that install on an Type 1 FPCs, the offline button for each PIC is next to it on the FPC card carrier. For the PICs that install on an Type 2 FPCs, the offline button is on the PIC faceplate.
- Issue the CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot online
```

For more information about the command, see the *Junos System Basics and Services Command Reference*.

The normal functioning status LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the **show chassis fpc pic-status** command described in "Maintaining M40e PICs and PIC Cables" on page 139.

Figure 110: Installing a PIC from an M40e Router

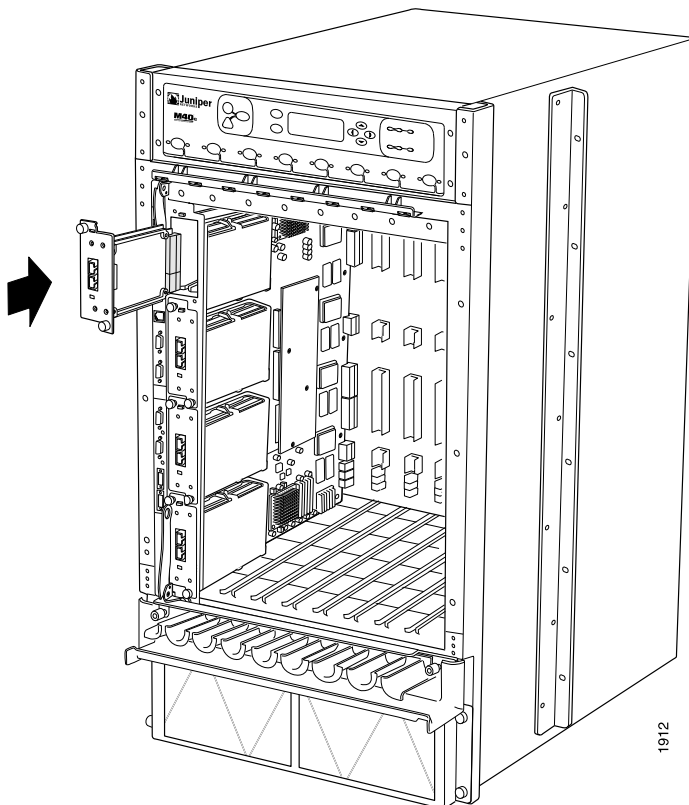
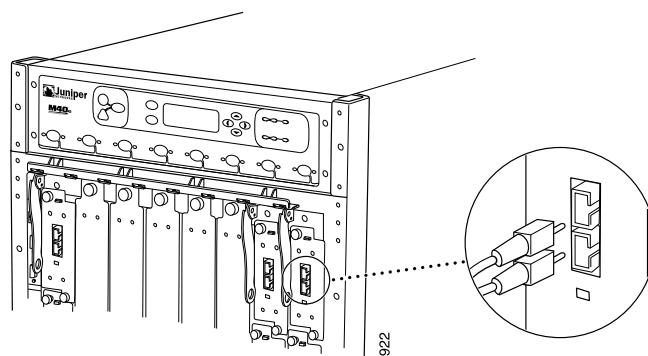


Figure 111: Connecting Fiber-Optic Cable to a PIC in an M40e Router



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- M40e PICs Description on page 12
- Troubleshooting PICs on the M40e Router on page 153

Replacing PIC Cables in an M40e Router

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

- Removing a PIC Cable from an M40e Router on page 203
- Installing a PIC Cable in an M40e Router on page 204

Removing a PIC Cable from an M40e Router

To remove a PIC cable:

1. If the PIC connects to fiber-optic cable, have ready a rubber safety cap for each cable and transceiver.
2. If removing all cables connected to the PIC, use one of the following methods to take the PIC offline:
 - Press its online/offline button. For a PIC installed in a Type 1 FPC, use a tool—such as a flat-blade screwdriver—to press the button slightly beneath the faceplate of the PIC. For a PIC installed in a Type 2 FPC, use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the PIC LED goes out (about 5 seconds).
 - Issue the CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline
```

For more information about the command, see the *Junos System Basics and Services Command Reference*.

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



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



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

4. Remove the cable from the cable management system and detach it from the destination port.

Installing a PIC Cable in an M40e Router

To install a PIC cable (see Figure 112 on page 205):

1. Have ready a length of the type of cable used by the PIC. For cable specifications, see the *M40e Multiservice Edge Router PIC Guide*.
2. If the PIC cable connector port is covered by a rubber safety plug, remove the plug.



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



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

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



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



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

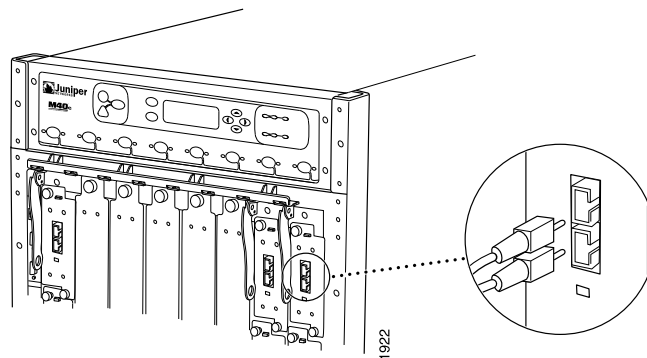
5. Insert the other end of the cable into the destination port.
6. Repeat the previous steps for any additional cables.
7. If the PIC is offline (its failure indicator LED is lit), use one of the following methods to bring the PIC online:
 - Press the PIC offline/online button until the PIC LED lights green. For a PIC installed in a Type 1 FPC, use a tool—such as a flat-blade screwdriver—to press the button slightly beneath the faceplate of the PIC. For a PIC installed in a Type 2 FPC, use a narrow-ended tool that fits inside the opening that leads to the button.
 - Issue the CLI command:

```
user@host>request chassis pic fpc-slot fpc-slot pic-slot pic-slot online
```

For more information about the command, see the *Junos System Basics and Services Command Reference*.

The normal functioning indicator LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the **show chassis fpc pic-status** command described in “Maintaining M40e PICs and PIC Cables” on page 139.

Figure 112: Connecting Fiber-Optic Cable to a PIC



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Maintaining M40e PICs and PIC Cables on page 139
- M40e PICs Description on page 12

Replacing an SFM in an M40e Router

One or two SFMs can be installed into the midplane from the rear of the chassis, as shown in “M40e Chassis Description” on page 8. Only one SFM is active at a time, with the optional second SFM in standby mode. By default, the SFM in slot **SFM 0** is active. To modify the default, include the appropriate **sfm** statement at the **[edit chassis redundancy]** hierarchy level of the configuration, as described in the section about SFM redundancy in the *Junos System Basics Configuration Guide*.

SFM s are hot-pluggable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. Removing the standby SFM has no effect on router function. If the active SFM fails or is removed from the chassis, the effect depends on how many SFMs are installed:

- If there is one SFM, forwarding halts until the SFM is replaced and functioning again. It takes approximately one minute for the replaced SFM to boot and become active; reading in router configuration information can take additional time, depending on the complexity of the configuration.
- If there are two SFMs, the effect depends on which release of the Junos OS is running on the router:
 - With Junos OS Release 5.4 and later, the standby SFM assumes forwarding functions in less than one second.
 - With Junos OS Release 5.3 and earlier, forwarding halts while the standby SFM boots and becomes active, which takes approximately 1 minute; synchronizing router configuration information can take additional time, depending on the complexity of the configuration.
- Removing an SFM in an M40e Router on page 206
- Installing an SFM in an M40e Router on page 207

Removing an SFM in an M40e Router

To remove an SFM (see Figure 113 on page 207):

1. Remove the rear component cover by loosening the thumbscrew at each corner of the cover and pulling it straight off the chassis. For complete instructions, see “Reinstalling the M40e Components into the Chassis” on page 97.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
4. If you are removing the active SFM or CFEB-E, press and hold the online/offline button on the faceplate until the yellow LED labeled **FAIL** lights, which takes about 5 seconds.

(The effect of removing the active SFM or CFEB-E depends on whether a second SFM or CFEB-E is installed.)

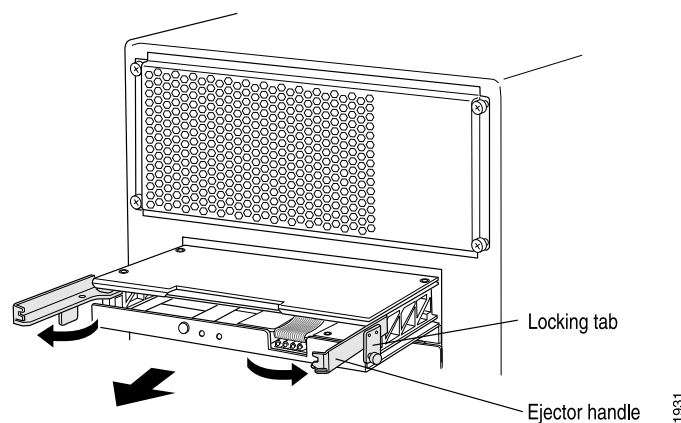
5. Loosen the thumbscrew on each ejector locking tab (shown in “M40e SFM LEDs” on page 23), using a Phillips screwdriver if necessary.
6. Pull the end of each ejector handle outward until it is nearly perpendicular to the SFM or CFEB-E faceplate.
7. Grasp the ejector handles and pull firmly to slide the SFM or CFEB-E about halfway out of the chassis.
8. Place one hand under the SFM 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 an SFM or CFEB-E is out of the chassis, do not hold it by the ejector handles. They cannot support its weight.

Do not stack SFMs 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 113: Removing an SFM



Installing an SFM in an M40e Router

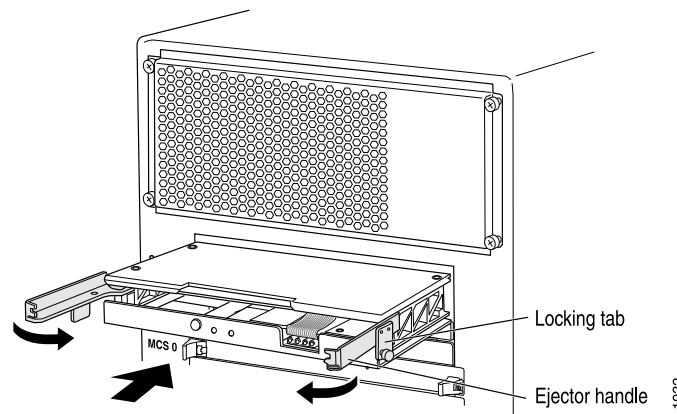
To install an SFM (see Figure 114 on page 208):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Verify that the ends of the ejector handles are pulled outward to a position nearly perpendicular to the faceplate of the SFM or CFEB-E.
3. Place one hand under the SFM 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 SFM or CFEB-E with the guides inside the chassis and slide it in completely.
5. Press the ejector handle at each end of the SFM or CFEB-E inward.

6. Tighten the thumbscrew on each ejector locking tab (shown in “M40e SFM LEDs” on page 23) to seat the SFM or CFEB-E firmly in the chassis.
7. Press the offline button on the SFM faceplate and hold it down until the green LED labeled **OK** lights steadily, in about 5 seconds.

You can also verify correct SFM functioning by issuing the **show chassis sfm** commands described in “Maintaining M40e SFMs” on page 141.

Figure 114: Installing an SFM



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Configuring SFM Redundancy on M40e and M160 Routers
- M40e Switching and Forwarding Module (SFM) Description on page 20
- M40e Chassis Description on page 8

Replacing an SFP in an M40e PIC

Small form-factor pluggables (SFPs) are optical transceivers that can be removed from a PIC. For more information, see “M40e PICs Description” on page 12. 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.

- Removing an SFP from an M40e PIC on page 208
- Installing an SFP in an M40e PIC on page 210

Removing an SFP from an M40e PIC

To remove an SFP (see Figure 115 on page 209):

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. For more information about ESD,

see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.

3. Label the cable connected to the SFP so that you can later reconnect it to the correct SFP.
4. Disconnect the cable from the SFP. Immediately cover the transceiver and the end of the cable with a rubber safety cap.



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



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

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



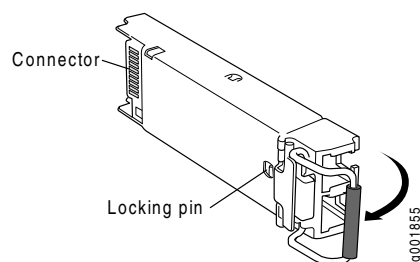
CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

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



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

Figure 115: Small Form-Factor Pluggable (SFP)



Installing an SFP in an M40e PIC

To install a replacement SFP (see Figure 116 on page 211):

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 are installed vertically in the chassis, and faces upward on platforms in which FPCs are installed 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.



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



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

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



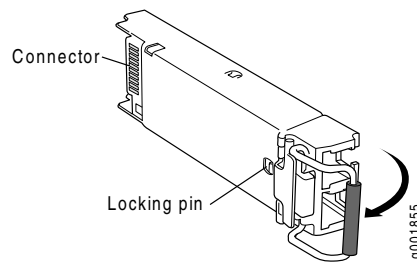
CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.



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

7. Verify that the status LEDs on the PIC faceplate indicate that the SFP is functioning correctly (there is an LED for each SFP port). For more information about the PIC LEDs, see the *M40e Multiservice Edge Router PIC Guide*. You can also verify PIC functioning by issuing the **show chassis fpc pic-status** command described in “Maintaining M40e PICs and PIC Cables” on page 139.

Figure 116: Small Form-Factor Pluggable (SFP)



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- M40e Chassis Description on page 8
- M40e PICs Description on page 12

Replacing M40e Power System Components

- Replacing an M40e AC Power Supply on page 211
- Replacing an AC Power Cord on an M40e Power Supply on page 215
- Replacing an M40e DC Power Supply on page 215
- Replacing the Circuit Breaker Box on a DC-Powered M40e Router on page 218
- Replacing a Fuse on an M40e Router on page 222

Replacing an M40e AC Power Supply

An AC-powered router has two load-sharing, redundant AC power supplies. Each power supply is hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. When one power supply fails or is powered down, the other power supply automatically assumes the entire electrical load for the router.

- Removing an M40e AC Power Supply on page 212
- Installing an M40e AC Power Supply on page 213

Removing an M40e AC Power Supply

The AC power supplies are located at the bottom rear of the chassis, as shown in Figure 2 on page 10. Each AC power supply weighs approximately 15 lb (6.8 kg).



CAUTION: Do not leave a power supply slot empty for more than 30 minutes while the router is operational. For proper airflow, the power supply must remain in the chassis, or a blank panel must be used in an empty slot.

To remove an AC power supply (see Figure 118 on page 213):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
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 or handles 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.



WARNING: Do not touch the power connectors on the rear of the power supply (see “Removing an M40e DC Power Supply” on page 216). They can contain dangerous voltages.

Figure 117: Removing an AC Power Supply

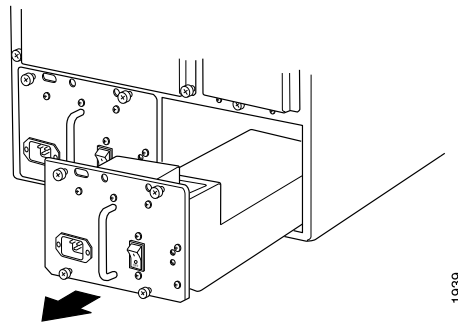
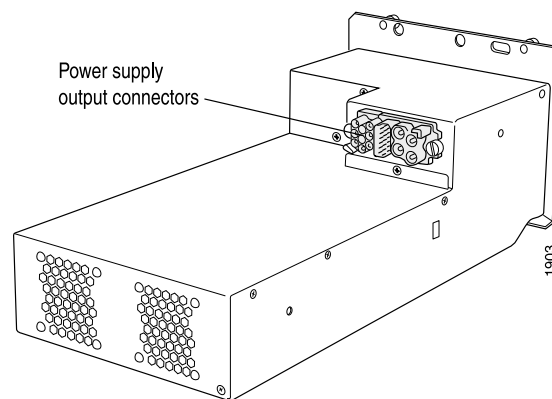


Figure 118: Rear of AC Power Supply Showing Midplane Connectors



Installing an M40e AC Power Supply

To install an AC power supply (see Figure 119 on page 214):

1. Verify that the power 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 “M40e AC Power, Connection, and Power Cord Specifications” on page 277).
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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
4. Place one hand under the power supply and grasp a 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 screws, tighten (but do not overtighten) the thumbscrew 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.



NOTE: The AC power source must supply 220 VAC power (nominal range 200–240 VAC), not 110 VAC power (nominal range 100–120 VAC).

7. Press the power switch on the faceplate to the **ON** (I) position. Verify that the green LED labeled **OUTPUT OK** on the faceplate blinks rapidly for a short time, then lights steadily.

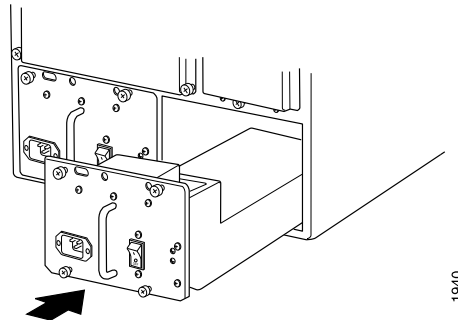


NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on. After powering on a power supply, wait at least 60 seconds before turning it off.

If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, see [Disconnecting AC Power from the M40e Router](#) or [Disconnecting DC Power from the M40e Router](#).

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

Figure 119: Installing an AC Power Supply



Related Documentation

- [M40e Field-Replaceable Units \(FRUs\)](#) on page 157
- [Tools and Parts Required to Remove Components from an M40e Router](#) on page 309
- [Connecting AC Power to the M40e Router](#) on page 119
- [M40e Power System Description](#) on page 42
- [M40e AC Power Electrical Safety Guidelines and Warnings](#) on page 256

Replacing an AC Power Cord on an M40e Power Supply

To replace the power cord for an AC power supply:

1. Locate a replacement power cord with the type of plug appropriate for your geographical location (see “M40e AC Power, Connection, and Power Cord Specifications” on page 277).
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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
3. Press the power switch on the power supply faceplate to the **OFF (O)** position.
4. Unplug the power cord from the appliance inlet on the faceplate and from the power source receptacle.
5. 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. Verify that the power cord does not block access to router components or drape where people could trip on it.



NOTE: The AC power source must supply 220 VAC power (nominal range 200–240 VAC), not 110 VAC power (nominal range 100–120 VAC).

6. Press the power switch on the power supply faceplate to the **ON (I)** position. Verify that the green **OUTPUT OK** LED eventually lights steadily.



NOTE: When two power supplies are installed, at least one Routing Engine and one FPC must also be installed for both power supplies to power on. In the absence of this minimum load, only one power supply starts. (The router powers on and operates correctly with one power supply, but without the redundancy benefit of a second power supply.)

Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Connecting AC Power to the M40e Router on page 119
- Disconnecting AC Power from the M40e Router
- M40e AC Power Electrical Safety Guidelines and Warnings on page 256

Replacing an M40e DC Power Supply

On a DC-powered router, the router has two load-sharing, redundant DC power supplies. Each power supply is hot-removable and hot-insertable, as described in “M40e Field-Replaceable Units (FRUs)” on page 157. When one power supply fails or is powered

down, the other power supply automatically assumes the entire electrical load for the router.

- Removing an M40e DC Power Supply on page 216
- Installing an M40e DC Power Supply on page 217

Removing an M40e DC Power Supply

The DC power supplies are located at the bottom rear of the chassis, as shown in “M40e Chassis Description” on page 8. Each DC power supply weighs approximately 13 lb (5.9 kg).



CAUTION: Do not leave a power supply slot empty for more than 30 minutes while the router is operational. For proper airflow, the power supply must remain in the chassis, or a blank panel must be used in an empty slot.

To remove a DC power supply (see Figure 120 on page 217):

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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
2. Press the power switch for the power supply (located on the circuit breaker box) 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. Loosen the thumbscrew at each corner of the power supply faceplate, using a Phillips screwdriver if necessary.
5. Grasp the handle or handles 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.



WARNING: Do not touch the power connectors on the rear of the power supply (see Figure 121 on page 217). They can contain dangerous voltages.

Figure 120: Removing a DC Power Supply

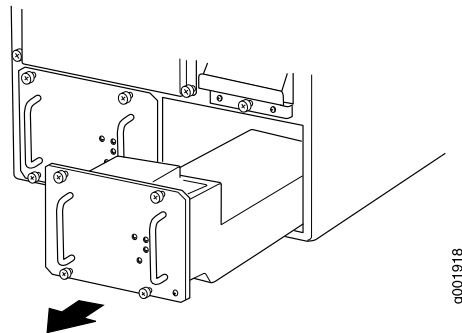
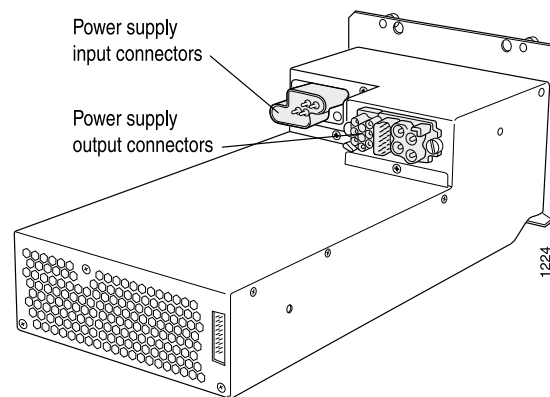


Figure 121: Rear of DC Power Supply Showing Midplane Connectors



Installing an M40e DC Power Supply

To install a DC power supply (see Figure 122 on page 218):

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 circuit breaker box) is in the **OFF (O)** position.
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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
4. Place one hand under the power supply and grasp a 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 screws, tighten (but do not overtighten) the thumbscrew at each corner of the power supply faceplate.
6. Press the switch on the corresponding circuit breaker to the **ON (I)** position. Verify that on the power supply faceplate the green LED labeled **CB ON** lights steadily, the blue LED labeled **OUTPUT OK** blinks momentarily, then lights steadily, and the yellow LED labeled **CB OFF** does not light.

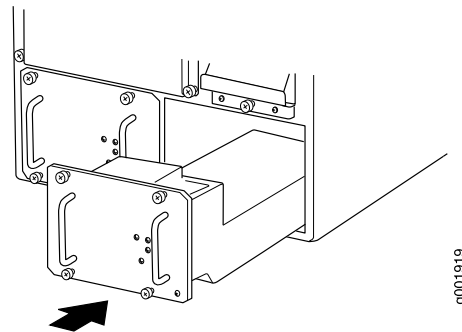


NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on. After powering on a power supply, wait at least 60 seconds before turning it off.

If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, see [Disconnecting AC Power from the M40e Router](#) or [Disconnecting DC Power from the M40e Router](#).

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

Figure 122: Installing a DC Power Supply



Related Documentation

- [M40e Field-Replaceable Units \(FRUs\)](#) on page 157
- [Tools and Parts Required to Remove Components from an M40e Router](#) on page 309
- [DC Power Disconnection Warning for M Series, MX Series, and T Series Routers](#) on page 259
- [M40e DC Power Electrical Safety Guidelines](#) on page 257
- [M40e DC Power Distribution](#) on page 280

Replacing the Circuit Breaker Box on a DC-Powered M40e Router

The circuit breaker box on a DC-powered router is field-replaceable, but you must power off the router before removing or replacing it.

- [Removing the Circuit Breaker Box from a DC-Powered M40e Router](#) on page 219
- [Installing the Circuit Breaker Box in a DC-Powered M40e Router](#) on page 220

Removing the Circuit Breaker Box from a DC-Powered M40e Router

The circuit breaker box on a DC-powered router is located on the rear of the chassis above the right power supply, as shown in “M40e Chassis Description” on page 8. It weighs about 6 lb (2.7 kg).



CAUTION: Do not remove the grounding lug from the grounding points on the chassis during this procedure.

To remove the circuit breaker box (see Figure 123 on page 220):

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

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

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

For more information about the command, see the *Junos System Basics and Services Command Reference*.



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

2. For each power supply, press the power switch on the circuit breaker box to the **OFF (O)** position.

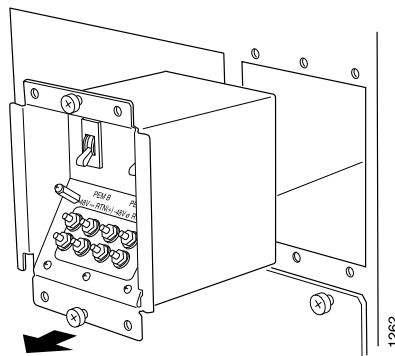


NOTE: If you are power cycling the power supply rather than shutting it off for a time, wait at least 60 seconds after turning it off before turning it back on. If you need to power it off again, wait for at least 60 seconds after powering it on.

3. Shut off the power flowing from both 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.
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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
5. Using a Phillips screwdriver, loosen and remove the screws securing the protective shield over the terminal studs on the circuit breaker box. Remove the cover.

6. Using a 7/16-in. nut driver or wrench, loosen the outer nut securing the cable lug to each terminal stud. Remove the outer nuts and washers, leaving the inner nut and washer on each stud.
7. Slide the cable lug off of each terminal stud. Leave the inner washer and nut on each stud.
8. Remove the rear lower impeller assembly by loosening the thumbscrew at each corner and pulling the impeller assembly straight out of the chassis. For complete instructions, see "Removing the M40e Rear Lower Impeller Assembly" on page 176.
9. Using a Phillips screwdriver, loosen and remove the screw at each corner of the circuit breaker box. Loosen the thumbscrews at the top and bottom edge of the box.
10. Pull the circuit breaker box straight out of the chassis.

Figure 123: Removing the Circuit Breaker Box



Installing the Circuit Breaker Box in a DC-Powered M40e Router

To install the circuit breaker box (see Figure 124 on page 222):

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. For each power supply, verify that the power switch on the circuit breaker box is in the **OFF (O)** position.
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. For more information about ESD, see “Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router” on page 232.
4. Align the guide pin on the back of the circuit breaker box with the opening in the chassis, then push the circuit breaker box straight in.
5. Tighten the thumbscrews at the top and bottom edge of the circuit breaker box. Using a Phillips screwdriver, tighten the screw at each corner of the box.
6. Slide the power cable lugs for both power sources onto the terminal studs on the circuit breaker box:

- Connect the positive (+) source cable lugs to the return terminals on the circuit breaker box, which are labeled **RTN(+)**.
 - Connect the negative (–) source cable lugs to the input terminals on the circuit breaker box, which are labeled **–48V**.
7. Slide a washer and then screw a nut onto each terminal stud (if the washers and nuts were not installed on the studs, they should be in the accessory box). Using a 7/16-in. nut driver or wrench, tighten the nuts.
 8. Replace the protective shield on the circuit breaker box and tighten the screws that secure it to the box.
 9. Replace the rear lower impeller assembly by lining up the rails with the guides inside the chassis, pushing the impeller straight in, and tightening the thumbscrew at each corner of the impeller cover. For complete instructions, see “Installing the M40e Rear Lower Impeller Assembly” on page 176.
 10. Apply voltage from the DC power sources to the power cables so the router receives power.
 11. Press the switches on the circuit breaker box to the **ON (I)** position.
 12. Confirm that the LEDs on the power supply faceplates indicate correct operation: the green **CB ON** LED lights steadily, the blue **OUTPUT OK** LED blinks briefly, then lights steadily, and the yellow **CB OFF** LED does not light.

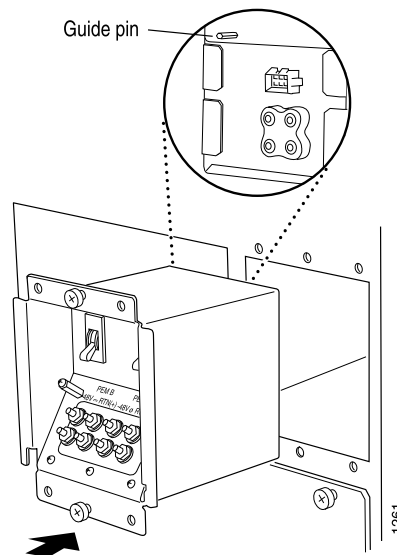


NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on. After powering on a power supply, wait at least 60 seconds before turning it off.

If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, see [Disconnecting AC Power from the M40e Router](#) or [Disconnecting DC Power from the M40e Router](#).

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

Figure 124: Installing the Circuit Breaker Box



Related Documentation

- M40e Field-Replaceable Units (FRUs) on page 157
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- DC Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 259
- M40e DC Power Electrical Safety Guidelines on page 257
- M40e DC Power Distribution on page 280

Replacing a Fuse on an M40e Router

To replace a fuse (see Figure 125 on page 223):



WARNING: You must power off the router before removing or installing a fuse.

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. For more information about ESD, see "Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router" on page 232.
2. Remove the rear lower impeller assembly by loosening the thumbscrew at each corner of the impeller cover and sliding the impeller assembly out of the chassis. For complete instructions, see "Removing the M40e Rear Lower Impeller Assembly" on page 176.
3. Determine which fuse has blown. The yellow LED next to the fuse lights and the indicator bulb becomes visible through the clear cover on the fuse.

4. Power off the router as described in Disconnecting AC Power from the M40e Router or Disconnecting DC Power from the M40e Router.
5. Grasp the blown fuse by the edges and rock it in its slot until it comes loose and disconnects. Rock up and down for a vertically oriented fuse (in the groups labeled **J241** through **J243** in Figure 125 on page 223) and side to side for a horizontally oriented fuse (in the group labeled **J240**). If the cover slips off the fuse, snap the cover back into place and begin again.



NOTE: We recommend you use an insulated fuse removal tool to remove fuses.

6. Remove the appropriate spare fuse from the group of fuses labeled **J244** in Figure 125 on page 223. (The labels shown in the figure do not appear on the actual fuses—the clear cover on every fuse reads **BUSS GMT-X**—but a table on the midplane below the fuse box displays the same information.) Verify that the spare has the same rating and color coding as the fuse it is replacing, as specified in Table 23 on page 224. To see the indicator bulb and printed rating, look at the fuse from the side.
7. For a vertically oriented fuse, orient the replacement fuse over the slot so that the text on the fuse cover (**BUSS GMT-X**) reads from bottom to top. For a horizontally oriented fuse, orient the replacement fuse over the slot so that the text on the fuse cover is upside down.
8. Press the new fuse into the slot.
9. Power on the router as described in “Connecting AC Power to the M40e Router” on page 119 for AC power or “Connecting DC Power to the M40e Router” on page 120 for DC power.
10. Verify that the yellow LED next to the replacement fuse is no longer lit.
11. Reinstall the rear lower impeller by sliding it back into the chassis and tightening the thumbscrew at each corner of the impeller cover. For complete instructions, see “Installing the M40e Rear Lower Impeller Assembly” on page 176.
12. Order new fuses from an electrical supply house to replace the spares in the **J244** group. The Cooper Bussman product number for each fuse is **GMT-X**, where **X** is the amperage rating. For example, product number **GMT-15** is a 15-A fuse, required for an FPC.

Figure 125: Fuse Locations in the Fuse Box

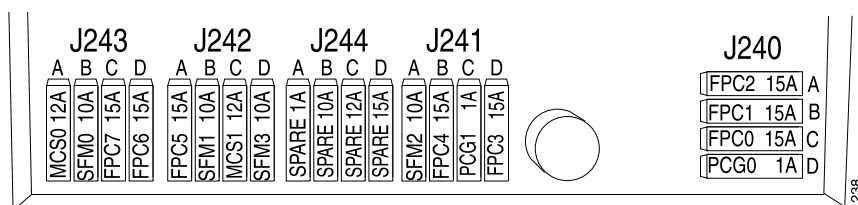


Table 23: M40e Fuse Specifications

Indicator Bulb Color	Component	Fuse Rating	Quantity	Locations
Red and blue	FPC	15 A	9	J240 A, B, and C
				J241 B and D
				J242 A
				J243 C and D
				J244 D (spare)
Yellow and green	MCS	12 A	3	J242 C
				J243 A
				J244 C (spare)
Red and white	SFM	10 A	5	J241 A
				J242 B and D
				J243 B
				J244 B (spare)
Gray	PCG	1 A	3	J240 D
				J241 C
				J244 A (spare)

- Related Documentation**
- M40e Field-Replaceable Units (FRUs) on page 157
 - Tools and Parts Required to Remove Components from an M40e Router on page 309
 - Using Blown Fuse Indicators to Troubleshoot the M40e Router on page 149
 - Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers on page 273
 - M40e Power System Description on page 42

PART 4

Appendixes

- Safety and Regulatory Compliance Information for the M40e Router on page 227
- M40e Router Physical Specifications on page 269
- M40e Router Environmental Specifications on page 271
- Power Guidelines, Requirements, and Specifications for the M40e Router on page 273
- Cable and Wire Guidelines and Specifications for the M40e Router on page 283
- M40e Cable Connector Pinouts on page 289
- Contacting Customer Support and Returning M40e Hardware on page 299

APPENDIX A

Safety and Regulatory Compliance Information for the M40e Router

- Definition of Safety Warning Levels on page 227
- Safety Guidelines and Warnings for the M40e Router on page 229
- Agency Approvals and Compliance Statements for the M40e Router on page 264

Definition of Safety Warning Levels

The M Series, MX Series, and T Series router 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 need to observe the specified guidelines to avoid minor injury or discomfort to you, or severe damage to the router.



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 Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229
- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251

Safety Guidelines and Warnings for the M40e Router

- M40e General Safety Guidelines and Warnings on page 229
- Fire Safety Requirements for the M40e Router on page 233
- M40e Router Installation Safety Guidelines and Warnings on page 234
- Laser and LED Safety Guidelines and Warnings for the M40e Router on page 240
- Maintenance and Operational Safety Guidelines and Warnings for the M40e Router on page 244
- Electrical Safety Guidelines and Warnings for the M40e Router on page 250

M40e General Safety Guidelines and Warnings

- General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229
- Qualified Personnel Warning for M Series, MX Series, and T Series Routers on page 230
- Restricted Access Area Warning for M Series, MX Series, and T Series Routers on page 231
- Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series Router on page 232

General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers

The general safety guidelines and warnings help ensure your safety and protect the router 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 router only when it is properly grounded.

- Replace fuses only with fuses of the same type and rating. (Applies only to the M320 and T320 routers.)
- 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 router chassis or onto any router component. Such an action could cause electrical shock or damage the router.
- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Such an action could cause electrical shock.
- The equipment is suitable for over voltage category CAT II per IEC 60664-1.

Related Documentation

- Definition of Safety Warning Levels on page 227
- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251

Qualified Personnel Warning for M Series, MX Series, and T Series Routers



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

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

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

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

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

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

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

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

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

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

- Related Documentation**
- Definition of Safety Warning Levels on page 227
 - General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229

Restricted Access Area Warning for M Series, MX Series, and T Series Routers



WARNING: The router 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**

- Definition of Safety Warning Levels on page 227
- General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229

Preventing Electrostatic Discharge Damage to an M Series, MX Series, or T Series 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.

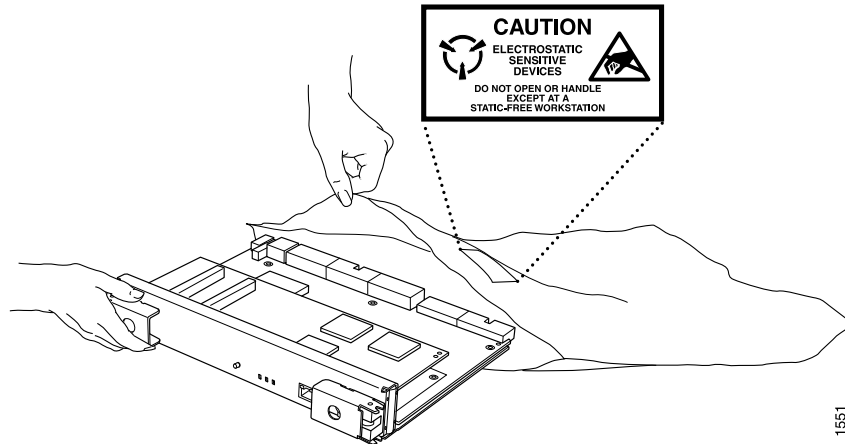


CAUTION: For safety, periodically check the resistance value of the ESD strap. The measurement should be in the range of 1 to 10 Mohms.

-
- 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 126

on page 233). If you are returning a component, place it in an electrostatic bag before packing it.

Figure 126: Placing a Component into an Electrostatic Bag



Related Documentation

- Definition of Safety Warning Levels on page 227
- General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229
- M40e AC Power Electrical Safety Guidelines and Warnings on page 256
- M40e DC Power Electrical Safety Guidelines on page 257

Fire Safety Requirements for the M40e Router

- Fire Safety Requirements for M Series, MX Series, and T Series Routers on page 233

Fire Safety Requirements for M Series, MX Series, and T Series Routers

- General Fire Safety Requirements on page 233
- Fire Suppression on page 234
- Fire Suppression Equipment on page 234

General Fire Safety Requirements

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

In addition, establish procedures to protect your equipment in the event of 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. For more information about fire extinguishers, see “Fire Suppression Equipment” on page 234.

Fire Suppression Equipment

Type C fire extinguishers, which use noncorrosive fire retardants such as carbon dioxide (CO₂) and Halotron, are most effective for suppressing electrical fires. Type C fire extinguishers displace the oxygen from the point of combustion to eliminate the fire. For extinguishing fire on or around equipment that draws air from the environment for cooling, use this type of inert oxygen displacement extinguisher instead of an extinguisher that leave residues on equipment.

Do not use multipurpose Type ABC chemical fire extinguishers (dry chemical fire extinguishers) near Juniper Networks equipment. 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 router. 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 M Series, MX Series, and T Series Routers
- General Safety Warnings for M Series, MX Series, and T Series Routers
- General Electrical Safety Warnings for M Series, MX Series, and T Series Routers
- DC Power Electrical Safety Warnings for M Series, MX Series, and T Series Routers

M40e Router Installation Safety Guidelines and Warnings

- M40e Chassis Lifting Guidelines on page 235
- Installation Instructions Power Warning for M Series, MX Series, and T Series Routers on page 235
- Rack-Mounting Requirements and Warnings for M Series, MX Series, and T Series Routers on page 236
- Ramp Warning for M Series, MX Series, and T Series Routers on page 240

M40e Chassis Lifting Guidelines

The weight of a fully configured chassis is about 360 lb (164 kg). Observe these guidelines for lifting and moving the router:

- Before moving the router, read the guidelines in “M40e Site Preparation Checklist” on page 67 to verify that the intended site meets the specified power, environmental, and clearance requirements.
- Do not attempt to lift a fully configured router by yourself. Using a mechanical lift to maneuver the router into a rack is recommended. If a lift cannot be used, a minimum of three people must lift the router, and you must remove components from the chassis before lifting.
- Before lifting or moving the router, disconnect all external cables.
- As when lifting any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

Related Documentation

- Installing the M40e Chassis into the Rack on page 95
- Installing the M40e Router Using a Mechanical Lift on page 81
- Removing Components from the Chassis Before Installing the M40e Router Without a Lift on page 83
- Installation Instructions Power Warning for M Series, MX Series, and T Series Routers on page 235
- Rack-Mounting Requirements and Warnings for M Series, MX Series, and T Series Routers on page 236
- Ramp Warning for M Series, MX Series, and T Series Routers on page 240

Installation Instructions Power Warning for M Series, MX Series, and T Series Routers



WARNING: Read the installation instructions before you connect the router to a power source.

Waarschuwing Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.

Varoit 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.

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.

Related Documentation

- M40e Chassis Lifting Guidelines on page 235
- Rack-Mounting Requirements and Warnings for M Series, MX Series, and T Series Routers on page 236
- Ramp Warning for M Series, MX Series, and T Series Routers on page 240

Rack-Mounting Requirements and Warnings for M Series, MX Series, and T Series Routers

Ensure that the equipment rack into which the router 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 router in a rack, take the following precautions to ensure that the system remains stable. The following directives help maintain your safety:

- The router must be installed into a rack that is secured to the building structure.
- The router should be mounted at the bottom of the rack if it is the only unit in the rack.
- When mounting the router 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 or servicing the router in the rack.

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 Juniper Networks 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 loukkaantumiset. Noudata seuraavia turvallisuusohjeita:

- Juniper Networks 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 Juniper Networks 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 Juniper Networks 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 Juniper Networks 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:

- Juniper Networks 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 Juniper Networks 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 Juniper Networks 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:

- Juniper Networks 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.

Related Documentation • M40e Chassis Lifting Guidelines on page 235

- Installation Instructions Power Warning for M Series, MX Series, and T Series Routers on page 235
- Ramp Warning for M Series, MX Series, and T Series Routers on page 240

Ramp Warning for M Series, MX Series, and T Series Routers



WARNING: When you install the router, 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 käyttää 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

- M40e Chassis Lifting Guidelines on page 235
- Installation Instructions Power Warning for M Series, MX Series, and T Series Routers on page 235
- Rack-Mounting M40e Hardware Description on page 77

Laser and LED Safety Guidelines and Warnings for the M40e Router

- General Laser Safety Guidelines for M Series and T Series Routers on page 240
- Class 1 Laser Product Warning for M Series, MX Series, and T Series Routers on page 241
- Class 1 LED Product Warning for M Series, MX Series, and T Series Routers on page 242
- Laser Beam Warning for M Series, MX Series, and T Series Routers on page 242
- Radiation from Open Port Apertures Warning for M Series, MX Series, and T Series Routers on page 243

General Laser Safety Guidelines for M Series and T Series Routers

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

- Class 1 Laser Product Warning for M Series, MX Series, and T Series Routers on page 241
- Class 1 LED Product Warning for M Series, MX Series, and T Series Routers on page 242
- Laser Beam Warning for M Series, MX Series, and T Series Routers on page 242
- Radiation from Open Port Apertures Warning for M Series, MX Series, and T Series Routers on page 243

Class 1 Laser Product Warning for M Series, MX Series, and T Series Routers



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.

Related Documentation

- General Laser Safety Guidelines for M Series and T Series Routers on page 240
- Class 1 LED Product Warning for M Series, MX Series, and T Series Routers on page 242
- Laser Beam Warning for M Series, MX Series, and T Series Routers on page 242

- Radiation from Open Port Apertures Warning for M Series, MX Series, and T Series Routers on page 243

Class 1 LED Product Warning for M Series, MX Series, and T Series Routers



WARNING: Class 1 LED product.

Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Attention Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Related Documentation

- General Laser Safety Guidelines for M Series and T Series Routers on page 240
- Class 1 Laser Product Warning for M Series, MX Series, and T Series Routers on page 241
- Laser Beam Warning for M Series, MX Series, and T Series Routers on page 242
- Radiation from Open Port Apertures Warning for M Series, MX Series, and T Series Routers on page 243

Laser Beam Warning for M Series, MX Series, and T Series Routers



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.

Related Documentation

- General Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229
- Class 1 Laser Product Warning for M Series, MX Series, and T Series Routers on page 241
- Class 1 LED Product Warning for M Series, MX Series, and T Series Routers on page 242
- Radiation from Open Port Apertures Warning for M Series, MX Series, and T Series Routers on page 243

Radiation from Open Port Apertures Warning for M Series, MX Series, and T Series Routers



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 Safety Guidelines and Warnings for M Series, MX Series, and T Series Routers on page 229
- Class 1 Laser Product Warning for M Series, MX Series, and T Series Routers on page 241
- Class 1 LED Product Warning for M Series, MX Series, and T Series Routers on page 242
- Laser Beam Warning for M Series, MX Series, and T Series Routers on page 242

Maintenance and Operational Safety Guidelines and Warnings for the M40e Router

- Battery Handling Warning for M Series, MX Series, and T Series Routers on page 244
- Jewelry Removal Warning for M Series, MX Series, and T Series Routers on page 245
- Lightning Activity Warning for M Series, MX Series, and T Series Routers on page 247
- Operating Temperature Warning for M Series, MX Series, and T Series Routers on page 248
- Product Disposal Warning for M Series, MX Series, and T Series Routers on page 249

Battery Handling Warning for M Series, MX Series, and T Series Routers



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 ontplofingsgevaar 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 weggegooid te worden.

Varoitus Räjähdyksen vaara, jos akku on vaihdettu väärään akkuun. Käytä vaihtamiseen ainoastaan saman- tai vastaavantyyppistä akkua, joka on valmistajan suosittelema. Hävitä käytetyt akut valmistajan ohjeiden mukaan.

Attention Danger d'explosion si la pile n'est pas remplacée correctement. Ne la remplacer que par une pile de type semblable ou équivalent, recommandée par le fabricant. Jeter les piles usagées conformément aux instructions du fabricant.

Warnung Bei Einsetzen einer falschen Batterie besteht Explosionsgefahr. Ersetzen Sie die Batterie nur durch den gleichen oder vom Hersteller empfohlenen Batterietyp. Entsorgen Sie die benutzten Batterien nach den Anweisungen des Herstellers.

Avvertenza Pericolo di esplosione se la batteria non è installata correttamente. Sostituire solo con una di tipo uguale o equivalente, consigliata dal produttore. Eliminare le batterie usate secondo le istruzioni del produttore.

Advarsel Det kan være fare for eksplosjon hvis batteriet skiftes på feil måte. Skift kun med samme eller tilsvarende type som er anbefalt av produsenten. Kasser brukte batterier i henhold til produsentens instruksjoner.

Aviso Existe perigo de explosão se a bateria for substituída incorrectamente. Substitua a bateria por uma bateria igual ou de um tipo equivalente recomendado pelo fabricante. Destrua as baterias usadas conforme as instruções do fabricante.

¡Atención! Existe peligro de explosión si la batería se reemplaza de manera incorrecta. Reemplazar la batería exclusivamente con el mismo tipo o el equivalente recomendado por el fabricante. Desechar las baterías gastadas según las instrucciones del fabricante.

Varning! Explosionsfara vid felaktigt batteribyte. Ersätt endast batteriet med samma batterityp som rekommenderas av tillverkaren eller motsvarande. Följ tillverkarens anvisningar vid kassering av använda batterier.

Related Documentation

- Jewelry Removal Warning for M Series, MX Series, and T Series Routers on page 245
- Lightning Activity Warning for M Series, MX Series, and T Series Routers on page 247
- Operating Temperature Warning for M Series, MX Series, and T Series Routers on page 248
- Product Disposal Warning for M Series, MX Series, and T Series Routers on page 249

Jewelry Removal Warning for M Series, MX Series, and T Series Routers



WARNING: Before working on equipment that is connected to power lines, remove jewelry, including rings, necklaces, and watches. Metal objects heat

up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

Waarschuwing Alvorens aan apparatuur te werken die met elektrische leidingen is verbonden, sieraden (inclusief ringen, kettingen en horloges) verwijderen. Metalen voorwerpen worden warm wanneer ze met stroom en aarde zijn verbonden, en kunnen ernstige brandwonden veroorzaken of het metalen voorwerp aan de aansluitklemmen lassen.

Varoitus Ennen kuin työskentelet voimavirtajohtoihin kytkettyjen laitteiden parissa, ota pois kaikki korut (sormukset, kaulakorut ja kellot mukaan lukien). Metalliesineet kuumenevat, kun ne ovat yhteydessä sähkövirran ja maan kanssa, ja ne voivat aiheuttaa vakavia palovammoja tai hitsata metalliesineet kiinni liitäntänapoihin.

Attention Avant d'accéder à cet équipement connecté aux lignes électriques, ôter tout bijou (anneaux, colliers et montres compris). Lorsqu'ils sont branchés à l'alimentation et reliés à la terre, les objets métalliques chauffent, ce qui peut provoquer des blessures graves ou souder l'objet métallique aux bornes.

Warnung Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzen sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.

Avvertenza Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

Advarsel Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.

Aviso Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

¡Atención! Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.

Varning! Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledning. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.

Related Documentation

- Battery Handling Warning for M Series, MX Series, and T Series Routers on page 244
- Lightning Activity Warning for M Series, MX Series, and T Series Routers on page 247
- Operating Temperature Warning for M Series, MX Series, and T Series Routers on page 248
- Product Disposal Warning for M Series, MX Series, and T Series Routers on page 249

Lightning Activity Warning for M Series, MX Series, and T Series Routers



WARNING: Do not work on the system or connect or disconnect cables during periods of lightning activity.

Waarschuwing Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.

Varoitus Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.

Attention Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.

Warnung Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.

Avvertenza Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.

Advarsel Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.

Aviso Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).

¡Atención! No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

Varning! Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

Related Documentation

- Battery Handling Warning for M Series, MX Series, and T Series Routers on page 244
- Jewelry Removal Warning for M Series, MX Series, and T Series Routers on page 245

- Operating Temperature Warning for M Series, MX Series, and T Series Routers on page 248
- Product Disposal Warning for M Series, MX Series, and T Series Routers on page 249

Operating Temperature Warning for M Series, MX Series, and T Series Routers



WARNING: To prevent the router 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 in. (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke router van de Juniper Networks 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 Juniper Networks 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 Juniper Networks 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 Juniper Networks router. Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104° F). Sørg for at klaringen rundt lufteåpningene er minst 15,2 cm (6 tommer) for å forhindre nedsatt luftsirkulasjon.

Aviso Para evitar o sobreaquecimento do encaminhador Juniper Networks 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 Juniper Networks 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 Juniper Networks 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.

Related Documentation

- Battery Handling Warning for M Series, MX Series, and T Series Routers on page 244
- Jewelry Removal Warning for M Series, MX Series, and T Series Routers on page 245
- Lightning Activity Warning for M Series, MX Series, and T Series Routers on page 247
- Product Disposal Warning for M Series, MX Series, and T Series Routers on page 249

Product Disposal Warning for M Series, MX Series, and T Series Routers



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**

- Battery Handling Warning for M Series, MX Series, and T Series Routers on page 244
- Jewelry Removal Warning for M Series, MX Series, and T Series Routers on page 245
- Lightning Activity Warning for M Series, MX Series, and T Series Routers on page 247
- Operating Temperature Warning for M Series, MX Series, and T Series Routers on page 248

Electrical Safety Guidelines and Warnings for the M40e Router

- In Case of an Electrical Accident on page 250
- General Electrical Safety Guidelines and Warnings Electrical Codes for the M40e Router on page 250
- M40e AC Power Electrical Safety Guidelines and Warnings on page 256
- M40e DC Power Electrical Safety Guidelines and Warnings on page 256

In Case of an Electrical Accident

If an electrical accident results in an injury, take the following actions in this order:

1. Use caution. Be aware of potentially hazardous conditions that could cause further injury.
2. Disconnect power from the router.
3. If possible, send another person to get medical aid. Otherwise, assess the condition of the victim, then call for help.

**Related
Documentation**

- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251
- M40e AC Power Electrical Safety Guidelines and Warnings on page 256
- M40e DC Power Electrical Safety Guidelines on page 257

General Electrical Safety Guidelines and Warnings Electrical Codes for the M40e Router

- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251
- Grounded Equipment Warning for M Series, MX Series, and T Series Routers on page 251
- Midplane Energy Hazard Warning for M Series, MX Series, and T Series Routers on page 252
- Multiple Power Supplies Disconnection Warning for M Series, MX Series, and T Series Routers on page 253

- Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 254
- TN Power Warning for M Series, MX Series, and T Series Routers on page 255

General Electrical Safety Guidelines and Warnings 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

- M40e Field-Replaceable Units (FRUs) on page 157
- Grounded Equipment Warning for M Series, MX Series, and T Series Routers on page 251
- Midplane Energy Hazard Warning for M Series, MX Series, and T Series Routers on page 252
- Multiple Power Supplies Disconnection Warning for M Series, MX Series, and T Series Routers on page 253
- Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 254
- TN Power Warning for M Series, MX Series, and T Series Routers on page 255

Grounded Equipment Warning for M Series, MX Series, and T Series Routers



WARNING: The router is intended to be grounded. Ensure that the router 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 jordnet ved normalt bruk.

Aviso Este equipamento deverá estar ligado à terra. Certifique-se que o host se encontra ligado à terra durante a sua utilização normal.

¡Atención! Este equipo debe conectarse a tierra. Asegurarse de que el equipo principal esté conectado a tierra durante el uso normal.

Varning! Denna utrustning är avsedd att jordas. Se till att värdenheten är jordad vid normal användning.

**Related
Documentation**

- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251
- Midplane Energy Hazard Warning for M Series, MX Series, and T Series Routers on page 252
- Multiple Power Supplies Disconnection Warning for M Series, MX Series, and T Series Routers on page 253
- Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 254
- TN Power Warning for M Series, MX Series, and T Series Routers on page 255

Midplane Energy Hazard Warning for M Series, MX Series, and T Series Routers



WARNING: High levels of electrical energy are distributed across the router midplane. Be careful not to contact the midplane connectors, or any component connected to the midplane, with any metallic object while servicing components installed in the router.

**Related
Documentation**

- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251

- Grounded Equipment Warning for M Series, MX Series, and T Series Routers on page 251
- Multiple Power Supplies Disconnection Warning for M Series, MX Series, and T Series Routers on page 253
- Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 254
- TN Power Warning for M Series, MX Series, and T Series Routers on page 255

Multiple Power Supplies Disconnection Warning for M Series, MX Series, and T Series Routers



WARNING: The router 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.

Related Documentation

- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251
- Grounded Equipment Warning for M Series, MX Series, and T Series Routers on page 251
- Midplane Energy Hazard Warning for M Series, MX Series, and T Series Routers on page 252
- Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 254
- TN Power Warning for M Series, MX Series, and T Series Routers on page 255

Power Disconnection Warning for M Series, MX Series, and T Series Routers



WARNING: Before working on the router or near power supplies, unplug the power cord from an AC router; switch off the power at the circuit breaker on a DC router.

Waarschuwing Voordat u aan een frame of in de nabijheid van voedingen werkt, dient u bij wisselstroom toestellen de stekker van het netsnoer uit het stopcontact te halen; voor gelijkstroom toestellen dient u de stroom uit te schakelen bij de stroomverbreker.

Varoitus Kytke irti vaihtovirtalaitteiden virtajohto ja katkaise tasavirtalaitteiden virta suojakytkimellä, ennen kuin teet mitään asennuspohjalle tai työskentelet virtalähteiden läheisyydessä.

Attention Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif; couper l'alimentation des unités en courant continu au niveau du disjoncteur.

Warnung Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw. schalten Sie bei Gleichstromeinheiten den Strom am Unterbrecher ab.

Avvertenza Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA; scollegare l'alimentazione all'interruttore automatico sulle unità CC.

Advarsel Før det utføres arbeid på kabinettet eller det arbeides i nærheten av strømforsyningsenheter, skal strømledningen trekkes ut p vekselstrømsenheter og strømmen kobles fra ved strømbryteren på likestrømsenheter.

Aviso Antes de trabalhar num chassis, ou antes de trabalhar perto de unidades de fornecimento de energia, desligue o cabo de alimentação nas unidades de corrente alternada; desligue a corrente no disjuntor nas unidades de corrente contínua.

¡Atención! Antes de manipular el chasis de un equipo o trabajar cerca de una fuente de alimentación, desenchufar el cable de alimentación en los equipos

de corriente alterna (CA); cortar la alimentación desde el interruptor automático en los equipos de corriente continua (CC).

Varning! Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden och för likströmsenheter bryta strömmen vid överspänningsskyddet.

Related Documentation

- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251
- Grounded Equipment Warning for M Series, MX Series, and T Series Routers on page 251
- Midplane Energy Hazard Warning for M Series, MX Series, and T Series Routers on page 252
- Multiple Power Supplies Disconnection Warning for M Series, MX Series, and T Series Routers on page 253
- TN Power Warning for M Series, MX Series, and T Series Routers on page 255

TN Power Warning for M Series, MX Series, and T Series Routers



WARNING: The router is designed to work with TN power systems.

Waarschuwing Het apparaat is ontworpen om te functioneren met TN energiesystemen.

Varoitus Koje on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.

Attention Ce dispositif a été conçu pour fonctionner avec des systèmes d'alimentation TN.

Warnung Das Gerät ist für die Verwendung mit TN-Stromsystemen ausgelegt.

Avvertenza Il dispositivo è stato progettato per l'uso con sistemi di alimentazione TN.

Advarsel Utstyret er utfomet til bruk med TN-strømsystemer.

Aviso O dispositivo foi criado para operar com sistemas de corrente TN.

¡Atención! El equipo está diseñado para trabajar con sistemas de alimentación tipo TN.

Varning! Enheten är konstruerad för användning tillsammans med elkraftssystem av TN-typ.

Related Documentation

- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251

- Grounded Equipment Warning for M Series, MX Series, and T Series Routers on page 251
- Midplane Energy Hazard Warning for M Series, MX Series, and T Series Routers on page 252
- Multiple Power Supplies Disconnection Warning for M Series, MX Series, and T Series Routers on page 253
- Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 254

M40e 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 20 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 250
- General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers on page 251
- M40e DC Power Electrical Safety Guidelines on page 257

M40e DC Power Electrical Safety Guidelines and Warnings

- M40e DC Power Electrical Safety Guidelines on page 257
- Copper Conductors Warning for M Series, MX Series, and T Series Routers on page 258
- DC Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 259

- DC Power Grounding Requirements and Warning for M Series, MX Series, and T Series Routers on page 260
- DC Power Wiring Sequence Warning for M Series, MX Series, and T Series Routers on page 261
- DC Power Wiring Terminations Warning for M Series, MX Series, and T Series Routers on page 263

M40e 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 54 A. We recommend that the 48 VDC facility DC source be equipped with a circuit breaker rated at 125% of the power provisioned for the input minimum, or as required by local code. Incorporate an easily accessible disconnect device into the facility wiring. In the United States and Canada, the –48 VDC facility should be equipped with a circuit breaker rated a minimum of 125% of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada. Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.



NOTE: The router is equipped with a circuit breaker box rated at 80 A, but even when maximally configured requires a maximum of 54 A @ 48 VDC.



NOTE: If the circuit breaker at the facility DC source is rated at less than 80 A, it (rather than the circuit breaker on the router) provides primary current fault protection.

- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 100 A.
- A DC-powered router that is equipped with a DC terminal block is intended only for installation in a restricted access location. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.



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

- Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.

- For personal safety, connect the green and yellow wire to safety (earth) ground at both the router and the supply side of the DC wiring.
- The marked input voltage of –48 VDC for a DC-powered router is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.
- Because the router is a positive ground system, you must connect the positive lead to the terminal labeled **RTN(+)**, the negative lead to the terminal labeled **–48V**, and the earth ground to the chassis grounding points.

Related Documentation

- Copper Conductors Warning for M Series, MX Series, and T Series Routers on page 258
- DC Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 259
- DC Power Grounding Requirements and Warning for M Series, MX Series, and T Series Routers on page 260
- DC Power Wiring Sequence Warning for M Series, MX Series, and T Series Routers on page 261
- DC Power Wiring Terminations Warning for M Series, MX Series, and T Series Routers on page 263

Copper Conductors Warning for M Series, MX Series, and T Series Routers



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.

Related Documentation

- M40e DC Power Electrical Safety Guidelines on page 257
- DC Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 259
- DC Power Grounding Requirements and Warning for M Series, MX Series, and T Series Routers on page 260

- DC Power Wiring Sequence Warning for M Series, MX Series, and T Series Routers on page 261
- DC Power Wiring Terminations Warning for M Series, MX Series, and T Series Routers on page 263

DC Power Disconnection Warning for M Series, MX Series, and T Series Routers



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

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 schakelaarhandel 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.

**Related
Documentation**

- M40e DC Power Electrical Safety Guidelines on page 257
- Copper Conductors Warning for M Series, MX Series, and T Series Routers on page 258
- DC Power Grounding Requirements and Warning for M Series, MX Series, and T Series Routers on page 260
- DC Power Wiring Sequence Warning for M Series, MX Series, and T Series Routers on page 261
- DC Power Wiring Terminations Warning for M Series, MX Series, and T Series Routers on page 263

DC Power Grounding Requirements and Warning for M Series, MX Series, and T Series Routers

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 you install the router, 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 Erdschluß muß bei der Installation der Einheit immer zuerst hergestellt und zuletzt abgetrennt werden.

Avvertenza In fase di installazione dell'unità, eseguire sempre per primo il collegamento a massa e disconnetterlo per ultimo.

Advarsel Når enheten installeres, må jordledningen alltid tilkobles først og frakobles sist.

Aviso Ao instalar a unidade, a ligação à terra deverá ser sempre a primeira a ser ligada, e a última a ser desligada.

¡Atención! Al instalar el equipo, conectar la tierra la primera y desconectarla la última.

Varning! Vid installation av enheten måste jordledningen alltid anslutas först och kopplas bort sist.

Related Documentation

- M40e DC Power Electrical Safety Guidelines on page 257
- Copper Conductors Warning for M Series, MX Series, and T Series Routers on page 258
- DC Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 259
- DC Power Wiring Sequence Warning for M Series, MX Series, and T Series Routers on page 261
- DC Power Wiring Terminations Warning for M Series, MX Series, and T Series Routers on page 263

DC Power Wiring Sequence Warning for M Series, MX Series, and T Series Routers



WARNING: Wire the DC power supply using the appropriate lugs. When you connect the power, the proper wiring sequence is ground to ground, +RTN to +RTN, then –48 V to –48 V. When disconnecting power, the proper wiring sequence is –48 V to –48 V, +RTN to +RTN, then ground to ground. Note that the ground wire should always be connected first and disconnected last.

Waarschuwing De juiste bedradingsvolgorde verbonden is aarde naar aarde, +RTN naar +RTN, en –48 V naar –48 V. De juiste bedradingsvolgorde losgemaakt is en –48 V naar –48 V, +RTN naar +RTN, aarde naar aarde.

Varoitus Oikea yhdistettävä kytkentäjäjestys on maajohto maajohtoon, +RTN varten +RTN, –48 V varten –48 V. Oikea irrotettava kytkentäjäjestys on –48 V varten –48 V, +RTN varten +RTN, maajohto maajohtoon.

Attention Câblez l'alimentation d'alimentation CC En utilisant les crochets appropriés à l'extrémité de câblage. En reliant la puissance, l'ordre approprié de câblage est rectifié pour rectifier, +RTN à +RTN, puis -48 V à -48 V. En débranchant la puissance, l'ordre approprié de câblage est -48 V à -48 V, +RTN à +RTN, a alors rectifié pour rectifier. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois.

Warnung Die Stromzufuhr ist nur mit geeigneten Ringösen an das DC Netzteil anzuschliessen. Die richtige Anschlusssequenz ist: Erdanschluss zu Erdanschluss, +RTN zu +RTN und dann -48V zu -48V. Die richtige Sequenz zum Abtrennen der Stromversorgung ist -48V zu -48V, +RTN zu +RTN und dann Erdanschluss zu Erdanschluss. Es ist zu beachten dass der Erdanschluss immer zuerst angeschlossen und als letztes abgetrennt wird.

Avvertenza Mostra la morsettiera dell'alimentatore CC. Cablare l'alimentatore CC usando i connettori adatti all'estremità del cablaggio, come illustrato. La corretta sequenza di cablaggio è da massa a massa, da positivo a positivo (da linea ad L) e da negativo a negativo (da neutro a N). Tenere presente che il filo di massa deve sempre venire collegato per primo e scollegato per ultimo.

Advarsel Riktig tilkoples tilkoplingssekvens er jord til jord, +RTN til +RTN, -48 V til -48 V. Riktig frakoples tilkoplingssekvens er -48 V til -48 V, +RTN til +RTN, jord til jord.

Aviso Ate con alambre la fuente de potencia cc Usando los terminales apropiados en el extremo del cableado. Al conectar potencia, la secuencia apropiada del cableado se muele para moler, +RTN a +RTN, entonces -48 V a -48 V. Al desconectar potencia, la secuencia apropiada del cableado es -48 V a -48 V, +RTN a +RTN, entonces molió para moler. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último.

Atenção! Wire a fonte de alimentação de DC Usando os talões apropriados na extremidade da fiação. Ao conectar a potência, a sequência apropriada da fiação é moída para moer, +RTN a +RTN, então -48 V a -48 V. Ao desconectar a potência, a sequência apropriada da fiação é -48 V a -48 V, +RTN a +RTN, moeu então para moer. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último.

Varning! Korrekt kopplingssekvens ar jord till jord, +RTN till +RTN, -48 V till -48 V. Korrekt kopplas kopplingssekvens ar -48 V till -48 V, +RTN till +RTN, jord till jord.

Related Documentation • M40e DC Power Electrical Safety Guidelines on page 257

- Copper Conductors Warning for M Series, MX Series, and T Series Routers on page 258
- DC Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 259
- DC Power Grounding Requirements and Warning for M Series, MX Series, and T Series Routers on page 260
- DC Power Wiring Terminations Warning for M Series, MX Series, and T Series Routers on page 263

DC Power Wiring Terminations Warning for M Series, MX Series, and T Series Routers



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 johdinliitääntä, esimerkiksi suljettua silmukkaa tai kourumaista liitääntä, 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. für einen geschlossenen Regelkreis oder gabelförmig, mit nach oben gerichteten Kabelschuhen 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 lederen.

Aviso Quando forem requeridas montagens de instalação eléctrica de cabo torcido, use terminações de cabo aprovadas, tais como, terminações de cabo em circuito fechado e planas com terminais de orelha voltados para cima. Estas terminações de cabo deverão ser do tamanho apropriado para os respectivos cabos, e deverão prender simultaneamente o isolamento e o fio condutor.

¡Atención! Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

Varning! När flertrådiga ledningar krävs måste godkända ledningskontakter användas, t.ex. kabelsko av 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**

- M40e DC Power Electrical Safety Guidelines on page 257
- Copper Conductors Warning for M Series, MX Series, and T Series Routers on page 258
- DC Power Disconnection Warning for M Series, MX Series, and T Series Routers on page 259
- DC Power Grounding Requirements and Warning for M Series, MX Series, and T Series Routers on page 260
- DC Power Wiring Sequence Warning for M Series, MX Series, and T Series Routers on page 261

Agency Approvals and Compliance Statements for the M40e Router

- Agency Approvals for M40e Routers on page 264
- Compliance Statements for NEBS for M Series, MX Series, and T Series Routers on page 266
- Compliance Statements for EMC Requirements for the M40e Router on page 266
- Compliance Statements for Environmental Requirements for M Series, MX Series, and T Series Routers on page 268
- Compliance Statements for Acoustic Noise for the M40e Router on page 268

Agency Approvals for M40e 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 A (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
 - 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
 - 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

- Compliance Statements for NEBS for M Series, MX Series, and T Series Routers on page 266
- Compliance Statements for EMC Requirements for the M40e Router on page 266
- Compliance Statements for Environmental Requirements for M Series, MX Series, and T Series Routers on page 268
- Compliance Statements for Acoustic Noise for the M40e Router on page 268

Compliance Statements for NEBS for M Series, MX Series, and T Series Routers

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (i.e. DC-I), as defined in GR-1089-CORE.

Related Documentation

- Agency Approvals for M40e Routers on page 264
- Compliance Statements for EMC Requirements for the M40e Router on page 266
- Compliance Statements for Environmental Requirements for M Series, MX Series, and T Series Routers on page 268
- Compliance Statements for Acoustic Noise for the M40e Router on page 268

Compliance Statements for EMC Requirements for the M40e Router

- Canada on page 266
- European Community on page 266
- Declaration of Conformity on page 267
- Japan on page 267
- United States on page 267

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.


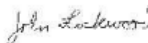
European Community

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

Figure 127 on page 267 shows the Declaration of Conformity for the router.

Figure 127: M40e Declaration of Conformity

	DOC 0008
Declaration of Conformity	
Juniper Networks, Inc. 1194 N. Mathilda Ave Sunnyvale, CA. 94089 USA	
declares that under our sole responsibility the product(s)	
Internet Router Model M71	
are in conformity with the provisions of the following EC Directives, including all amendments, and with national legislation implementing these directives:	
Low Voltage Directive 73/23/EEC EMC Directive 89/336/EEC	
and that the following harmonized standards have been applied	
EN 60950:1992+A1+A2+A3+A4+A11 EN 60825-1:1994+A11 EN 60825-2:1994	
EN 300 386 V1.3.1:2001 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

Japan

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用する
と電波妨害を引き起こすことがあります。この場合には使用者が適切な対策
を講ずるよう要求されることがあります。 VCCI-A

Translation from Japanese—This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. VCCI-A

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 M40e Routers on page 264
 - Compliance Statements for NEBS for M Series, MX Series, and T Series Routers on page 266
 - Compliance Statements for Environmental Requirements for M Series, MX Series, and T Series Routers on page 268
 - Compliance Statements for Acoustic Noise for the M40e Router on page 268

Compliance Statements for Environmental Requirements for M Series, MX Series, and T Series Routers

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**
- Agency Approvals for M40e Routers on page 264
 - Compliance Statements for NEBS for M Series, MX Series, and T Series Routers on page 266
 - Compliance Statements for EMC Requirements for the M40e Router on page 266
 - Compliance Statements for Acoustic Noise for the M40e Router on page 268

Compliance Statements for Acoustic Noise for the M40e 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 M40e Routers on page 264
 - Compliance Statements for NEBS for M Series, MX Series, and T Series Routers on page 266
 - Compliance Statements for EMC Requirements for the M40e Router on page 266
 - Compliance Statements for Environmental Requirements for M Series, MX Series, and T Series Routers on page 268

APPENDIX B

M40e Router Physical Specifications

- M40e Router Physical Specifications on page 269

M40e Router Physical Specifications

Table 24 on page 269 summarizes the physical specifications for the router chassis.

Table 24: M40e Chassis Physical Specifications

Description	Value
Chassis height	35 in. (89 cm)
Chassis width	17.5 in. (44.5 cm) for sides of chassis 19 in. (48.3 cm) with front support posts and center-mounting brackets
Chassis depth	29 in. (73.6 cm)
Weight, maximum configuration	360 lb (164 kg)
Weight, minimum configuration	190 lb (86 kg)
Thermal output	AC power: 9350 BTU/hour (2738 W) DC power: 8350 BTU/hour (2445 W)

Table 25 on page 269 lists the weight of the chassis and major components.

Table 25: M40e Component Weights

Component	Approximate Weight (lb)	Approximate Weight (kg)
AC power supply	15	6.8
Air filter	2	0.9

Table 25: M40e Component Weights (*continued*)

Component	Approximate Weight (lb)	Approximate Weight (kg)
Cable management system	1	0.5
Chassis (with midplane, CIP, and circuit breaker box or panel)	113.5	51.5
DC power supply	13	5.9
Fan tray	13	5.9
FPC with 4 installed PICs	15	6.8
Front impeller assembly with craft interface	14.5	6.6
MCS	2.5	1.1
PCG	0.75	0.34
Rear lower impeller assembly	5	2.3
Rear upper impeller assembly	4	1.8
Routing Engine	1.5	0.7
SFM	5	2.3

Related Documentation

- M40e PIC Overview
- M40e Chassis Description on page 8
- M40e System Architecture Overview on page 59

APPENDIX C

M40e Router Environmental Specifications

- M40e Router Environmental Specifications on page 271

M40e Router Environmental Specifications

Table 26 on page 271 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 M40e Router” on page 129.

Table 26: M40e 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
Maximum thermal output	AC power: 9350 BTU/hour (2738 W) DC power: 8350 BTU/hour (2445 W)



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 and Warnings for M Series, MX Series, and T Series Routers” on page 229.

**Related
Documentation**

- M40e Chassis Description on page 8
- Compliance Statements for EMC Requirements for the M40e Router on page 266
- M40e Router Physical Specifications on page 269

APPENDIX D

Power Guidelines, Requirements, and Specifications for the M40e Router

- Site Electrical Wiring Guidelines for M Series, MX Series, and T Series Routers on page 273
- M40e Router Power Requirements on page 274
- M40e Chassis Grounding Specifications on page 276
- M40e AC Power, Connection, and Power Cord Specifications on page 277
- M40e DC Power, Connection, and Cable Specifications on page 279
- M40e DC Power Distribution on page 280

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**
- M40e Router Power Requirements on page 274
 - M40e AC Power, Connection, and Power Cord Specifications on page 277
 - M40e DC Power, Connection, and Cable Specifications on page 279

M40e Router Power Requirements

The router uses either AC or DC power. There are two load-sharing, pass-through power supplies located at the bottom rear of the chassis, as shown in “M40e Chassis Description” on page 8. The power supplies connect to the midplane, which distributes power to router components according to their individual voltage requirements. When the power supplies are installed and operational, they automatically share the electrical load. If a power supply stops functioning for any reason, the remaining power supplies instantly begin providing all the power the router needs for normal functioning and can provide full power indefinitely.



CAUTION: Mixing AC and DC power supplies is not supported and prevents the router from booting. If two power supplies are installed, they must either both be AC or both DC.

A circuit breaker box must be installed on a DC-powered router, whereas a circuit breaker is incorporated into each AC power supply.

Table 27 on page 274 lists the AC and DC power system electrical specifications. Table 28 on page 275 lists the power requirements for various hardware components when the router is operating under typical voltage conditions. For PIC power requirements, see the *M40e Multiservice Edge Router PIC Guide*.

Table 27: M40e Power System Electrical Specifications

Item	Specification
AC input voltage	Operating range: 180 to 264 VAC
	Nominal: 200 VAC, 208 VAC, 220 VAC, 240 VAC
AC input line frequency	47 to 63 Hz
AC system current rating	15 A @ 200 VAC
	13 A @ 240 VAC

Table 27: M40e Power System Electrical Specifications (*continued*)

Item	Specification
DC input voltage	<p>Operating range: –40.5 to –72 VDC</p> <p>NOTE: If the input voltage from the DC power source drops below –40.5 VDC, the platform automatically shuts down. During automatic shutdown, the circuit remains active. When the input voltage returns to –42.75 VDC, the platform automatically starts up again and the system returns to normal operation within 30 minutes. No operator intervention is required.</p> <p>Nominal: –48 VDC, –60 VDC</p>
DC system current rating	54 A @ –48 VDC (nominal)
DC maximum system input power	2445 W

Table 28: M40e Component Power Requirements

Component	Power Requirement (Amps)
Base system (cooling system, power supplies, and craft interface)	7-10 A @ –48 V
Host module (Routing Engine and MCS)	1.3 A @ –48 V
M40e Type 1 and Type 2 FPCs	1.6 A @ –48 V
PCG	0.2 A @ –48 V
SFM	1.3 A @ –48 V

You can use the information in Table 28 on page 275 to calculate power consumption for various hardware configurations, input current from a different source voltage, and thermal output, as shown in the following examples for a DC-powered router. These examples use generalized values for PICs. For PIC power requirements, see the *M40e Multiservice Edge Router PIC Guide*.

- Power consumption for minimum configuration:

Base system + 1 FPC + 1 SFM + 1 host module + 2 PCGs + 4 PICs =

7 A + 1.6 A + 1.3 A + 1.3 A + 2(0.2 A) + 4(0.625 A) =

7 A + 1.6 A + 1.3 A + 1.3 A + 0.4 A + 2.5 A = 14.1 A @ 48 V = 677 W DC

- Power consumption for maximum configuration:

Base system + 8 FPCs + 4 SFMs + 2 host modules + 2 PCGs + 32 PICs =

10 A + 8(1.6 A) + 2(1.3 A) + 2(1.3 A) + 2(0.2 A) + 32(0.625 A) =

10 A + 12.8 A + 2.6 A + 2.6 A + 0.4 A + 20 A = 48.4 A @ 48 V = 2323 W DC

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

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

$$54 \times X = 48 \times 50.8 \text{ A}$$

$$X = 48 \times 50.8 \text{ A} / 54 = 45.2 \text{ A}$$

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

$$\text{Watts DC} / 85\% \text{ AC PEM efficiency} / 0.293 = \text{BTU/hr}$$

$$2323 / 0.85 / 0.293 = 9327 \text{ BTU/hr}$$

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

$$105\% \text{ of Watts DC} / 0.293 = \text{BTU/hr}$$

$$1.05 \times 2323 / 0.293 = 8325 \text{ BTU/hr}$$



NOTE: As indicated in the preceding list of calculations, even when maximally configured the router requires no more than 54 A of power.

If you plan to operate a maximally configured DC-powered router, we recommend that you provision at least 54 A @ 48 VDC and use a facility circuit breaker rated for 70 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 one power supply.

If you plan to operate a DC-powered router at less than the maximum configuration and do not provision a 70 A circuit breaker, we recommend that you provision a circuit breaker rated for at least 125% of the continuous current that the system draws at 48 V.

**Related
Documentation**

- M40e Power System Description on page 42
- Replacing an M40e AC Power Supply on page 211
- Replacing an M40e DC Power Supply on page 215
- M40e System Architecture Overview on page 59

M40e Chassis Grounding Specifications

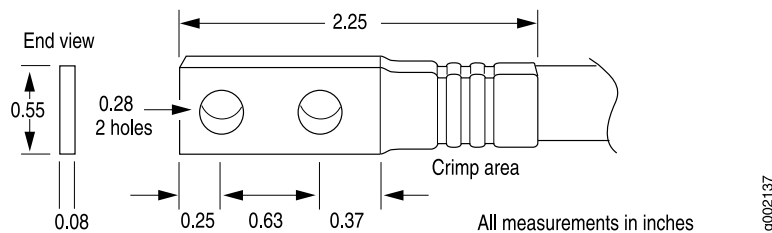
To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the router must be adequately grounded before power is connected. A pair of threaded inserts (PEM nuts) are provided on the right rear of the chassis for connecting the router to earth ground.



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

To ground AC-powered and DC-powered routers, connect a grounding cable to earth ground and then attach it to the chassis grounding points. The grounding points are spaced at 0.625-in. (15.86-mm) centers. The accessory box shipped with the router includes the cable lug that attaches to the grounding cable (see Figure 128 on page 277) and the UNC 1/4–20 screws (American) used to secure the grounding cable to the grounding points. (The cable lug shown in Figure 128 on page 277 is also used for the DC power cables.) The grounding cable must be able to handle up to 68 A.

Figure 128: M40e DC Power and Grounding Cable Lug



The grounding cable must be 6-AWG (13.3 mm²) wire, minimum, or as permitted by the local code.



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

Related Documentation

- M40e Chassis Description on page 8
- Removing Components from the Chassis Before Installing the M40e Router Without a Lift on page 83

M40e 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 C19 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.



NOTE: The AC power source must supply 220 VAC power (nominal range 200–240 VAC), not 110 VAC power (nominal range 100–120 VAC).



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



WARNING:

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

g017253

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



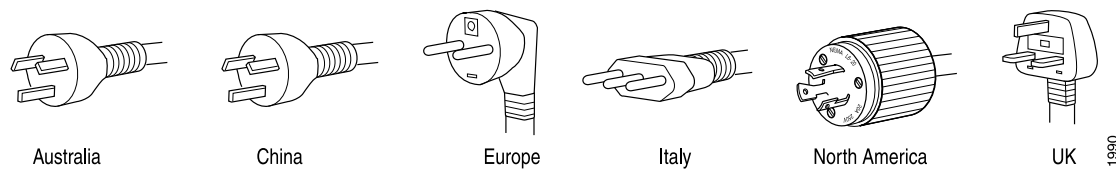
NOTE: In North America, AC power cords must not exceed 4.5 m (approximately 14.75 ft) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52, and Canadian Electrical Code (CEC) Section 4-010(3). The cords supplied with the router are in compliance.

Table 29 on page 278 provides specifications and Figure 129 on page 279 depicts the plug on the AC power cord provided for each country or region.

Table 29: M40e AC Power Cord Specifications

Country	Electrical Specification	Plug Type
Australia	240 VAC, 50 Hz AC	SAA/3
China	220 VAC, 50 Hz AC	CH2-16P
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	208 VAC, 60 Hz AC	NEMA L6-20P
United Kingdom	240 VAC, 50 Hz AC	BS89/13

Figure 129: 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

- M40e Power System Description on page 42
- Replacing an M40e AC Power Supply on page 211
- Replacing an AC Power Cord on an M40e Power Supply on page 215
- Connecting AC Power to the M40e Router on page 119

M40e DC Power, Connection, and Cable Specifications

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 terminal studs on the circuit breaker box.

The accessory box shipped with the router includes the cable lugs that attach to the terminal studs of the circuit breaker box. (The cable lug shown in “M40e Chassis Grounding Specifications” on page 276 is also used for the grounding the chassis.)



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

Table 30 on page 279 summarizes the specifications for the power cables, which you must supply.

Table 30: Power Cable Specifications

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



CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity. There is no standard color coding for DC power cables. The

color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on the circuit breaker box.



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

For other electrical safety information, see “General Electrical Safety Guidelines and Warnings Electrical Codes for M Series, MX Series, and T Series Routers” on page 251.



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

“M40e DC Power Distribution” on page 280 shows how to attach the power cables. The power cables attach to the 1/4–20 UNC terminal studs located on the circuit breaker box— the input set of studs is labeled **–48V** and the return set is labeled **RTN(+)**. The nuts and locking washers used to secure the power cable lugs on the terminal studs are preinstalled on the studs.

The tool for loosening or tightening the nuts on the terminal studs is a 7/16-in. hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm).

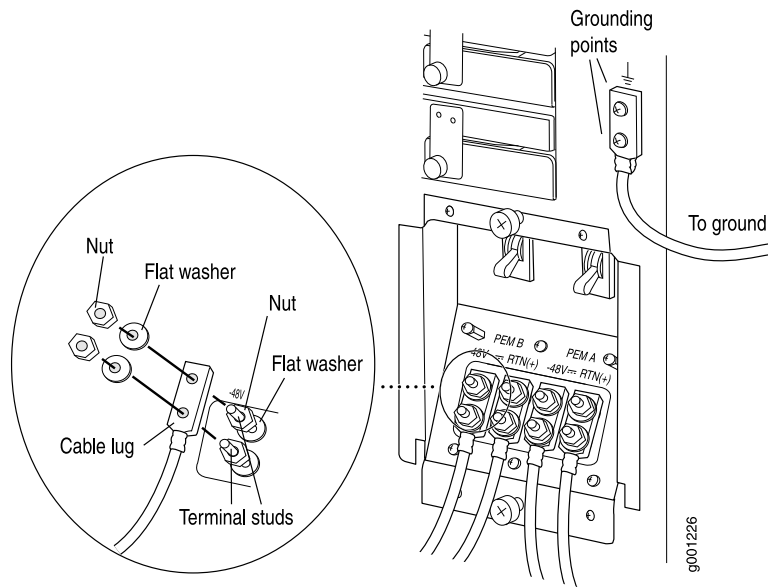
**Related
Documentation**

- Disconnecting and Connecting DC Power on the M40e Router
- Replacing an M40e DC Power Supply on page 215
- M40e DC Power Distribution on page 280

M40e DC Power Distribution

Most sites distribute DC power through a main conduit that leads to frame-mounted DC power distribution panels, one of which might be located at the top of the rack that houses the router. A pair of cables (one input and one return) connects each set of terminal studs to the power distribution panel.

Figure 130: M40e DC Power and Grounding Cable Connections



- Related Documentation**
- Disconnecting and Connecting DC Power on the M40e Router
 - Replacing an M40e DC Power Supply on page 215
 - Connecting DC Power to the M40e Router on page 120

APPENDIX E

Cable and Wire Guidelines and Specifications for the M40e Router

- Fiber-Optic Specifications and Guidelines for the M40e Router on page 283
- Routing Engine Interface Cable and Wire Specifications for the M40e Router on page 288

Fiber-Optic Specifications and Guidelines for the M40e Router

- Fiber-Optic and Network Cable Specifications for the M40e Router on page 283
- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M40e Router on page 284
- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 284
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 285
- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 286

Fiber-Optic and Network Cable Specifications for the M40e 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 *M40e Multiservice Edge Router PIC Guide*.

Related Documentation

- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M40e Router on page 284
- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 284
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 285
- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 286

Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M40e 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 *M40e 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 M40e Router on page 283
- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 284
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 285
- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 286

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 M40e Router on page 283
- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M40e Router on page 284
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 285
- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 286

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 M40e Router on page 283
- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M40e Router on page 284
- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 284
- Calculating Power Margin for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 286

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 31 on page 286 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 31: 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 31: 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 31 on page 286 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 31 on page 286 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 M40e Router on page 283
- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable for the M40e Router on page 284

- Attenuation and Dispersion in Fiber-Optic Cable on M Series, MX Series, and T Series Routers on page 284
- Calculating Power Budget for Fiber-Optic Cable for M Series, MX Series, and T Series Routers on page 285

Routing Engine Interface Cable and Wire Specifications for the M40e Router

For management and service operations, you connect the Routing Engine to an external console or management network. (For more information, see “M40e Routing Engine Description” on page 26.)

Table 32 on page 288 lists the specifications for the cables that connect to management ports and the wires that connect to the alarm relay contacts.

Table 32: M40e Routing Engine Interface Cable and Wire Specifications

Port	Cable Specification	Cable/Wire Supplied	Maximum Length	Router Receptacle
Routing Engine console or auxiliary interface	RS-232 (EIA-232) serial cable	One 6-ft (1.83-m) length with DB-9/DB-9 connectors	6 ft (1.83 m)	DB-9 male
Routing Engine Ethernet interface	Category 5 cable or equivalent suitable for 100Base-T operation	One 15-ft (4.57-m) length with RJ-45/RJ-45 connectors	328 ft (100 m)	RJ-45 autosensing
Alarm relay contacts	Wire with gauge between 24-AWG and 12-AWG (0.20 and 3.33 mm ²)	No	None	—

Related Documentation

- Replacing Connections to the M40e Routing Engine Interface Ports on page 163
- M40e Routing Engine Description on page 26

APPENDIX F

M40e Cable Connector Pinouts

- RJ-45 Connector Pinouts for the M40e Routing Engine MGMT Port on page 289
- DB-9 Connector Pinouts for the M40e Routing Engine AUX/MODEM and CONSOLE Ports on page 290
- RJ-48 Cable Pinouts for E1 and T1 PICs on the M40e Router on page 290
- DB-9 Connector Pinouts for the M40e CIP BITS Input Ports on page 293
- M40e X.21 and V.35 Cable Pinouts for EIA-530 PIC on page 294
- M40e Fast Ethernet PIC 48-port Cable Pinouts on page 296

RJ-45 Connector Pinouts for the M40e Routing Engine MGMT Port

The port on the CIP 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 33 on page 289 describes the RJ-45 connector pinout.

Table 33: 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**
- M40e Routing Engine Description on page 26
 - M40e Connector Interface Panel (CIP) Description on page 39

DB-9 Connector Pinouts for the M40e 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 34 on page 290 describes the DB-9 connector pinouts.

Table 34: 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**
- M40e Routing Engine Description on page 26
 - Replacing Connections to the M40e Routing Engine Interface Ports on page 163
 - M40e Routing Engine Software Components on page 52

RJ-48 Cable Pinouts for E1 and T1 PICs on the M40e Router

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 35 on page 291, Table 36 on page 291, Table 37 on page 292, and Table 38 on page 292 describe the RJ-48 connector pinouts.

Table 35: 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 36: 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
7	No connect	No connect
8	No connect	No connect

Table 37: 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 38: 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/–

Table 38: RJ-48 Connector to DB-15 Connector (Crossover) Pinout for the Router *(continued)*

RJ-48 Pin (on T1/E1 PIC) (Data numbering form)	DB-15 Pin (Data numbering form)	Signal
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

- Maintaining M40e PICs and PIC Cables on page 139
- Installing a PIC Cable in an M40e Router on page 204
- M40e PICs Description on page 12

DB-9 Connector Pinouts for the M40e CIP BITS Input Ports

The ports on the CIP labeled **BITS A** and **BITS B** are DB-9 receptacles that accept RS-232 (EIA-232) cables. For more information, see “M40e Connector Interface Panel (CIP) Description” on page 39. Table 39 on page 293 describes the DB-9 connector pinouts.

Table 39: DB-9 Connector Pinout for the M40e Router

Pin	Signal
1	-
2	BITS input TIP

Table 39: DB-9 Connector Pinout for the M40e Router (*continued*)

Pin	Signal
3	BITS input RING
4	-
5	BITS output TIP
6	-
7	-
8	-
9	BITS output RING

Related Documentation

- Replacing the CIP on the M40e Router on page 160
- M40e PIC Overview
- M40e Router Power Requirements on page 274

M40e X.21 and V.35 Cable Pinouts for EIA-530 PIC

The EIA-530 PIC accepts X.21 and V.35 cable connectors.

- A V.35 connection requires an DB-25 to V.35 cable and connects to a V.35 data terminal equipment (DTE) 34-pin Winchester type male cable (one per port). Table 40 on page 294 describes the V.35 cable pinouts.
- An X.21 connection requires an DB-25 to X.21 cable and connects to a X.21 DTE DB-15 male cable. Table 41 on page 295 describes the X.21 cable pinouts.

Figure 131: EIA-530 PIC

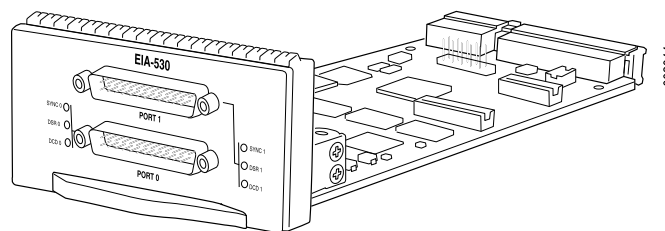


Table 40: DB-25 Connector to V.35 Connector Pinout for the M40e Router

DB-25 Pin	Signal	V.35 Pin	Description
2	TD	P	Transmit Data
14	TD	S	Transmit Data

Table 40: DB-25 Connector to V.35 Connector Pinout for the M40e Router (continued)

DB-25 Pin	Signal	V.35 Pin	Description
3	RD	R	Receive Data
16	RD	T	Receive Data
4	RTS	C	Ready To Send
5	CTS	D	Clear To Send
6	DSR	E	Data Set Ready
20	DTR	H	Data Terminal Ready
24	XTC	U	DTE Transmit Clock
11	XTC	W	DTE Transmit Clock
15	TC	Y	Transmit Clock
12	TC	AA	Transmit Clock
17	RC	V	Receive Clock
9	RC	X	Receive Clock
1	FGND	A	Protective Ground
7	GND	B	Signal Ground
8	DCD	F	Data Carrier Detect

Table 41: DB-25 Connector to DB-15 (X.21) Connector Pinout for the M40e Router

DB-25 Pin	Signal	DB-15 (X.21) Pin	Description
1	FGND	1	Protective Ground
7	GND	8	Signal Ground
2	T	2	Transmit Data
14	T	9	Transmit Data
3	R	4	Receive Data
16	R	11	Receive Data

Table 41: DB-25 Connector to DB-15 (X.21) Connector Pinout for the M40e Router *(continued)*

DB-25 Pin	Signal	DB-15 (X.21) Pin	Description
4	C	3	Request To Send
19	C	10	Request To Send
8	I	5	Data Carrier Detect
10	I	12	Data Carrier Detect
17	S	6	Receive Clock
9	S	13	Receive Clock

- Related Documentation**
- Maintaining M40e PICs and PIC Cables on page 139
 - Installing a PIC Cable in an M40e Router on page 204
 - M40e PICs Description on page 12

M40e Fast Ethernet PIC 48-port Cable Pinouts

The Fast Ethernet 48-port PIC has four VHDCI connector ports on its faceplate (see Figure 132 on page 296), each of which accepts one of the four RJ-21 cables supplied with the PIC (see Figure 133 on page 297). Each VHDCI connector port supports 12 Ethernet ports.

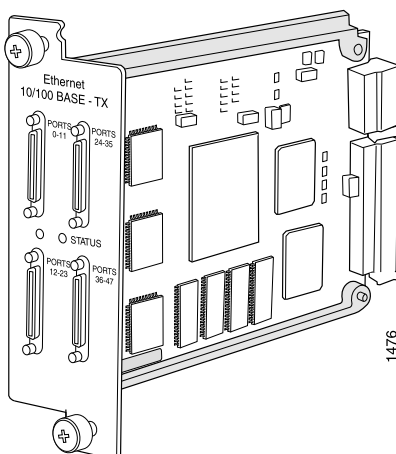
Figure 132: Fast Ethernet 48-port PIC

Figure 133: VHDCI to RJ-21 Cable

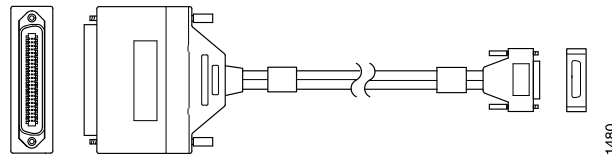


Table 42 on page 297 describes the RJ-21 cable pinouts.



NOTE: RJ-21 pin numbers 25 and 50 do not appear in the table because they are ground connectors.

Table 42: RJ-21 Pin Assignments for the M40e Router

Ethernet Port Numbers	RJ-21 Pin Assignment			
	TX -	TX +	RX -	RX +
0, 12, 24, 36	2	27	1	26
1, 13, 25, 37	4	29	3	28
2, 14, 26, 38	6	31	5	30
3, 15, 27, 39	8	33	7	32
4, 16, 28, 40	10	35	9	34
5, 17, 29, 41	12	37	11	36
6, 18, 30, 42	14	39	13	38
7, 19, 31, 43	16	41	15	40
8, 20, 32, 44	18	43	17	42
9, 21, 33, 45	20	45	19	44
10, 22, 34, 46	22	47	21	46
11, 23, 35, 47	24	49	23	48

- Related Documentation**
- M40e PIC Overview
 - M40e Router Power Requirements on page 274

APPENDIX G

Contacting Customer Support and Returning M40e Hardware

- Locating M40e Component Serial Numbers on page 299
- Contacting Customer Support on page 307
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Tools and Parts Required to Remove Components from an M40e Router on page 309
- Packing the M40e Router for Shipment on page 309
- Packing M40e Components for Shipment on page 310

Locating M40e Component Serial Numbers

- Displaying M40e Router Components and Serial Numbers on page 299
- M40e AC Power Supply Serial Number ID Label on page 300
- M40e CIP Serial Number ID Label on page 301
- M40e Craft Interface Serial Number ID Label on page 302
- M40e DC Power Supply Serial Number ID Label on page 303
- M40e FPC Serial Number ID Label on page 303
- M40e MCS Serial Number ID Label on page 304
- M40e PCG Serial Number ID Label on page 305
- M40e PIC Serial Number ID Label on page 305
- M40e Routing Engine Serial Number ID Label on page 306
- M40e SFM Serial Number ID Label on page 306

Displaying M40e 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 sample output is for a CFEB, the second sample output is for a CFEB-E):

```
user@host> show chassis hardware
Hardware inventory:
Item                Version  Part number  Serial number  Description
```

Chassis				M40e
Midplane	REV 01	710-005071	AX3672	
FPM CMB	REV 03	710-001642	AS9746	
FPM Display	REV 03	710-001647	BC0067	
CIP	REV 04	710-002649	BB4452	
PEM 0	Rev 01	740-003787	MC12384	Power Entry Module
PEM 1	Rev 01	740-003787	MC12396	Power Entry Module
PCG 0	REV 07	710-001568	AG1379	
PCG 1	REV 07	710-001568	AG1313	
Routing Engine 0			d8000007ca01	RE-2.0
Routing Engine 1				
MCS 0	REV 11	710-001226	AS4709	
SFM 0 SPP	REV 07	710-001228	AF2247	
SFM 0 SPR	REV 05	710-002189	AF1847	Internet Processor II
SFM 1 SPP	REV 07	710-001228	BE0175	
SFM 1 SPR	REV 05	710-002189	BE0201	Internet Processor II
FPC 1	REV 01	710-005078	BE0644	M40e-FPC Type 1
CPU	REV 01	710-004600	AN4272	
PIC 1	REV 03	750-004746	BC5190	2x CT3-NxDS0
PIC 2	REV 03	750-003034	HD2507	4x OC-3 SONET, SMIR
FPC 3	REV 01	710-005078	BE0665	M40e-FPC Type 1
CPU	REV 01	710-004600	AN4300	
PIC 0	REV 04	750-001895	HE0988	1x OC-12 SONET, MM
PIC 1	REV 04	750-001895	HE0821	1x OC-12 SONET, MM
PIC 2	REV 04	750-001895	HD8099	1x OC-12 SONET, MM
PIC 3	REV 04	750-001895	HE0806	1x OC-12 SONET, MM
FPC 6	REV 02	710-005197	BD9837	M40e-FPC Type 2
CPU	REV 01	710-004600	AM7420	
PIC 0	*** Hardware Not Supported ***			

Most components also have a small rectangular serial number ID label (see Figure 134 on page 300) attached to the component body.

Figure 134: Serial Number ID Label



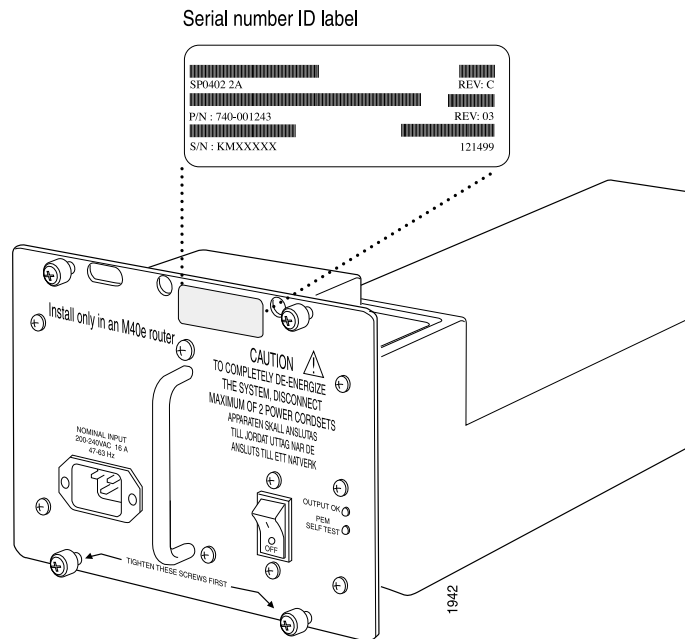
Related Documentation

- [Contacting Customer Support on page 307](#)

M40e AC Power Supply Serial Number ID Label

The serial number ID label on a AC power supply is located on the faceplate, as shown in Figure 135 on page 301.

Figure 135: AC Power Supply Serial Number ID Label



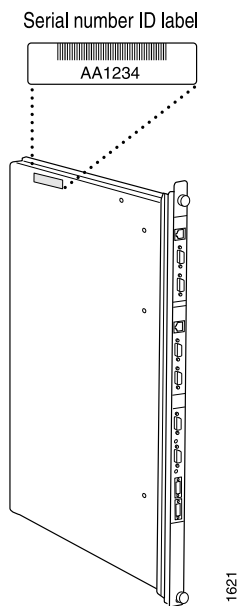
Related Documentation

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

M40e CIP Serial Number ID Label

The serial number ID label on the CIP is located at the top of the left side, as shown in Figure 136 on page 302.

Figure 136: CIP Serial Number ID Label

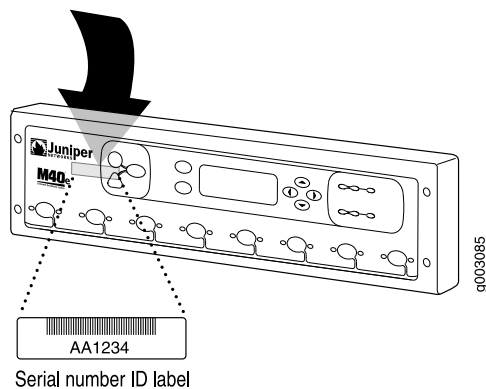

Related Documentation

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

M40e Craft Interface Serial Number ID Label

The serial number on the craft interface is located on the back of the panel, behind the alarm LEDs, as shown in Figure 137 on page 302.

Figure 137: Craft Interface Serial Number ID Label

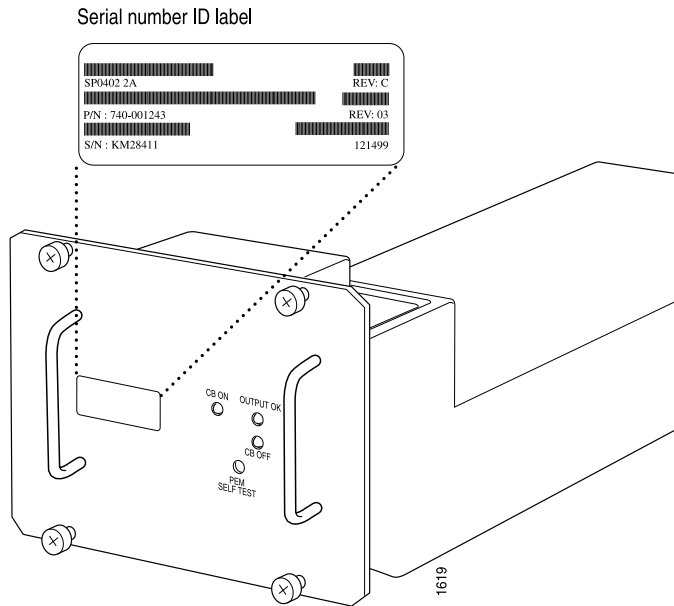

Related Documentation

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Contacting Customer Support on page 307

M40e DC Power Supply Serial Number ID Label

The serial number ID label on a DC power supply is located on the faceplate, as shown in Figure 138 on page 303.

Figure 138: DC Power Supply Serial Number ID Label



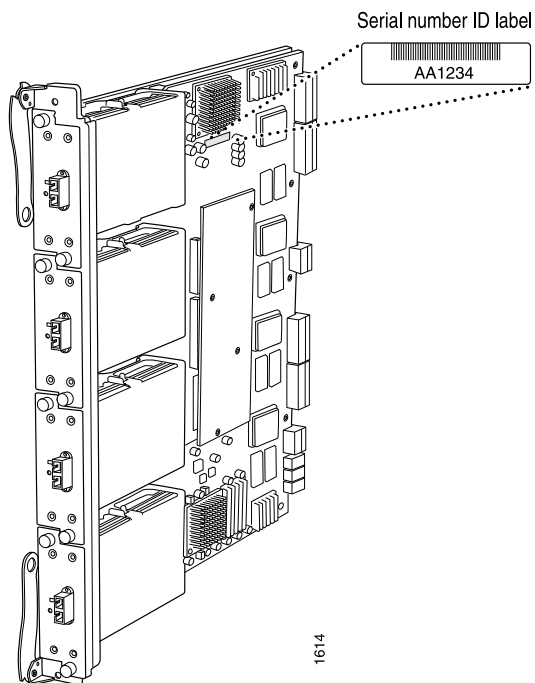
Related Documentation

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

M40e FPC Serial Number ID Label

The serial number ID label on an FPC is located on the right side, as shown in Figure 139 on page 304.

Figure 139: FPC Serial Number ID Label

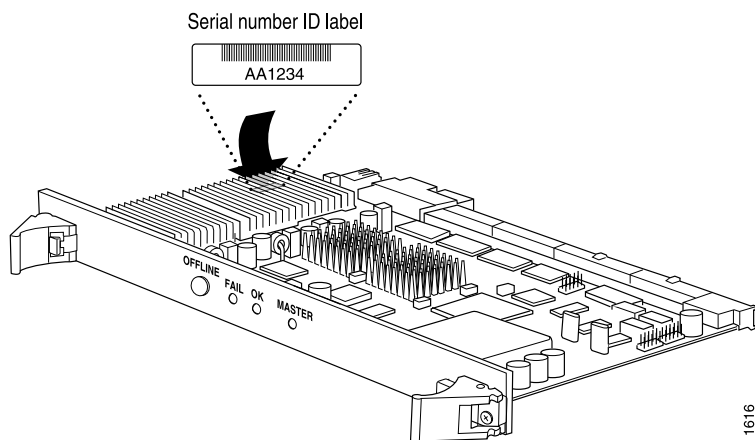
**Related Documentation**

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

M40e MCS Serial Number ID Label

The serial number on an MCS is located on the bottom at the left side, as shown in Figure 140 on page 304.

Figure 140: MCS Serial Number ID Label

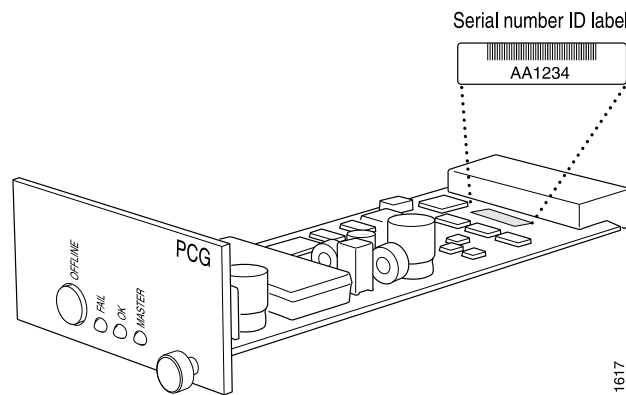


Related Documentation

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

M40e PCG Serial Number ID Label

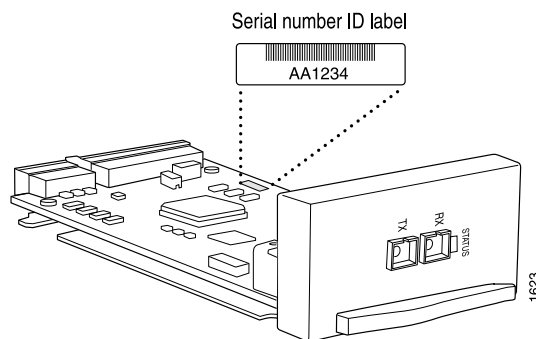
The serial number on a PCG is located on the top, close to the midplane connector, as shown in Figure 141 on page 305.

Figure 141: PCG Serial Number ID Label**Related Documentation**

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

M40e 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 142 on page 305.

Figure 142: PIC Serial Number ID Label

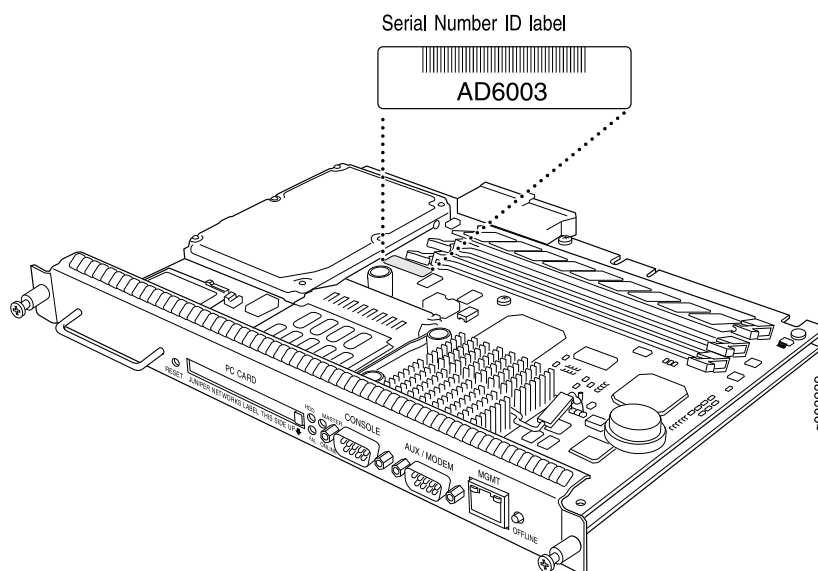
Related Documentation

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

M40e Routing Engine Serial Number ID Label

The serial number ID label on a Routing Engine is located on the left side, near the back, as shown in Figure 143 on page 306. 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.

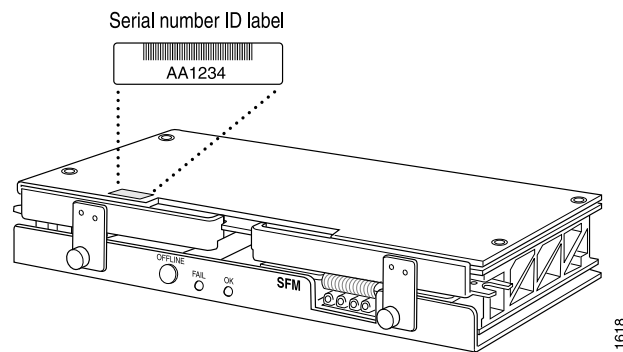
Figure 143: Routing Engine Serial Number ID Label

**Related Documentation**

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

M40e SFM Serial Number ID Label

The serial number ID label on an SFM is located on the left side of the top panel, as shown in Figure 144 on page 307.

Figure 144: SFM Serial Number ID Label**Related Documentation**

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Contacting Customer Support on page 307

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 router when the problem occurred
- Configuration data using one or more of the show commands

Related Documentation

- Displaying M40e Router Components and Serial Numbers on page 299
- Returning a Hardware Component to Juniper Networks, Inc. on page 308

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 via 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 router or component for shipment.

Related Documentation

- Packing the M40e Router for Shipment on page 309
- Displaying M40e Router Components and Serial Numbers on page 299
- Contacting Customer Support on page 307

Tools and Parts Required to Remove Components from an M40e 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 307
- Returning a Hardware Component to Juniper Networks, Inc. on page 308
- Packing the M40e Router for Shipment on page 309
- Packing M40e Components for Shipment on page 310

Packing the M40e 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. Shut down power to the router by pressing the power switch for all power supplies to the off (O) position. On an AC-powered router, the switch for each power supply is on the power supply faceplate. On a DC-powered router, the switches are on the circuit breaker box.
3. On the console or other management device connected to the master Routing Engine, enter CLI operational mode and issue the following command to shut down the router software. (If two Routing Engines are installed, also issue the command on the backup Routing Engine.)
4. Shut down power to the router by pressing the power switch for all power supplies to the off (O) position. On both AC and DC power supplies, the switch is located on the power supply faceplate.

5. Disconnect power from the router. For instructions, see [Disconnecting AC Power from the M40e Router](#) or [Disconnecting DC Power from the M40e Router](#).
6. Remove the cables that connect to all external devices. For instructions, see [“Replacing the M40e Management Ethernet Cable” on page 163](#), [“Replacing the M40e Console or Auxiliary Cable” on page 166](#), [“Replacing Alarm Relay Wires on the M40e Router” on page 167](#), and [“Removing a PIC Cable from an M40e Router” on page 203](#).
7. Remove all Field Replaceable Units (FRUs) from the router.
8. Remove the router from the rack:
 - If you are using a mechanical lift, place the lift platform under the router, unscrew and remove the mounting screws from the rack, and move the router to the shipping crate.
 - If you are not using a mechanical lift and the router weight is fully supported by a shelf or another router, unscrew and remove the mounting screws from the rack. Two people can then lift the router and move it to the shipping crate.
 - If you are not using a mechanical lift and the router weight is not fully supported by a shelf or another router, two people should grasp the router while a third person unscrews and removes the mounting screws from the rack. The two lifters can then move the router to the shipping crate.
9. Place the router in the shipping crate or onto the pallet. If on a pallet, bolt the router to the pallet.
10. Cover the router with an ESD bag and place the packing foam on top of and around the router.
11. Replace the accessory box on top of the packing foam.
12. Securely tape the box closed or place the crate cover over the router.
13. Write the RMA number on the exterior of the box to ensure proper tracking.

Related Documentation

- [Contacting Customer Support on page 307](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 308](#)
- [Tools and Parts Required to Remove Components from an M40e Router on page 309](#)
- [Packing M40e Components for Shipment on page 310](#)

Packing M40e 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 boards 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 307](#)
- [Returning a Hardware Component to Juniper Networks, Inc. on page 308](#)
- [Tools and Parts Required to Remove Components from an M40e Router on page 309](#)
- [Packing the M40e Router for Shipment on page 309](#)

PART 5

Index

- Index on page 315

Index

Symbols

#, comments in configuration statements.....	xxv
(), in syntax descriptions.....	xxv
< >, in syntax descriptions.....	xxv
[], in configuration statements.....	xxv
{ }, in configuration statements.....	xxv
(pipe), in syntax descriptions.....	xxv

A

AC power cord	
connection instructions	
for maintenance or replacement.....	119
replacement instructions.....	215
specifications.....	277
AC power supply	
connectors to midplane.....	212
cord See AC power cord	
description and specifications.....	44
installation instructions	
during initial installation.....	106
for maintenance or replacement.....	213
maintenance.....	142
removal instructions	
during initial installation.....	85
for maintenance or replacement.....	212
serial number.....	300
troubleshooting.....	155
weight.....	83
agency approvals.....	264
air filter	
description (hardware and function).....	48
installation instructions.....	171
maintenance.....	130
removal instructions.....	170
tools required.....	158
weight.....	83
air filters	
routine inspection of.....	129

airflow	
clearance required	71
path through chassis.....	48
alarm	
messages, list of.....	147
relay contacts	
description.....	41
tools required.....	158
alarm relay contacts	
connecting wires.....	115
replacing wire.....	167
wire specifications.....	288
alarms	
cutoff/lamp test button.....	35
handling by Routing Engine.....	62
LEDs (red and yellow) on craft interface.....	35
mode for LCD.....	37
altitude, acceptable range.....	271
antistatic mat, using.....	232
application-specific integrated circuit See ASIC	
approvals, agency.....	264
architecture	
overview.....	59
Packet Forwarding Engine.....	60
Routing Engine.....	61
ASIC	
as key element of router design.....	3
Distributed Buffer Manager	
component on SFM.....	20
role in forwarding.....	60
I/O Manager	
component on FPC.....	15
role in forwarding.....	60
Internet Processor II	
component on SFM.....	20
role in forwarding.....	60
on FPC.....	15
on PIC.....	12

on SFM.....	20	grounding See DC power and grounding cables	
Packet Director		PIC	
component on FPC.....	15	connecting during initial installation.....	116
role in forwarding.....	60	connecting during replacement.....	204
ATM		disconnecting.....	203
PIC, wavelength range supported.....	284	maintaining.....	139
ATM analyzer, use of.....	139	tools required.....	158
attenuation in fiber-optic cable.....	284	power See AC power cord; power cables	
auxiliary port (for Routing Engine management)		cable management system	
cable		description.....	49
connector pinouts (DB-9).....	290	fiber-optic cable, use with.....	139
tools required.....	158	weight.....	83
cable specifications.....	288	cables	
description.....	40	fiber-optic	
installing cable.....	113	attenuation.....	284
replacing cable	166	dispersion.....	284
B		Canada Class A notice.....	266
battery		Canada electronic emission Class A notice.....	266
environmental compliance.....	268	carton See shipping crate	
lithium.....	268	case number, for JTAC.....	307
BITS input port		center-mounting See rack	
cable		chassis	
connector pinouts (DB-9).....	293	airflow path through.....	48
BITS input ports on CIP.....	41	alarm messages See alarm, messages	
braces, in configuration statements.....	xxv	description.....	8
brackets		grounding points.....	8
angle, in syntax descriptions.....	xxv	process (software module in Routing Engine).....	57
square, in configuration statements.....	xxv	weight.....	83
C		checklist	
cable		FPC removal.....	92
auxiliary or console port (for Routing Engine management)		checklist for site preparation.....	67
connecting during initial installation.....	113	chromatic dispersion in fiber-optic cable.....	284
replacing.....	166	CIP	
tools required.....	158	alarm relay contacts See alarm relay contacts	
DC power and grounding		BITS input ports.....	41
connecting during maintenance.....	120	installation instructions.....	161
tools required.....	158	removal instructions.....	160
Ethernet port (for Routing Engine management)		Routing Engine management ports See auxiliary port, console port, Ethernet port	
connecting during initial installation.....	114	serial number.....	301
replacing.....	163	circuit breaker box	
tools required.....	158	description (hardware and function).....	47
fiber-optic		installation instructions.....	220
cleaning transceivers.....	139	removal instructions.....	219
multimode and single-mode.....	284	tools required.....	158
transmission distance, maximum.....	284	Class A electronic emission notice	
		Canada.....	266

- cleaning
 - fiber-optic transceivers.....139
 - cleaning fiber-optic cable.....139
 - clearance, requirements for airflow and maintenance.....71
 - CLI
 - command
 - to display chassis alarm messages.....147
 - to display FPC status.....132
 - to display MCS status.....131
 - to display PCG status.....141
 - to display PIC status.....139
 - to display power supply status.....142
 - to display Routing Engine status.....131
 - to display serial number.....299
 - to display/switch master host module.....23
 - tools provided in
 - for accessing and controlling software.....57
 - for monitoring software.....58
 - clock source, SONET/SDH.....31
 - command-line interface *See* CLI
 - commands
 - request chassis routing-engine master switch.....23
 - show chassis alarms.....147
 - show chassis environment mcs.....131
 - show chassis environment pcg.....141
 - show chassis environment pem.....142
 - show chassis fpc.....15, 132
 - show chassis fpc pic-status.....139
 - show chassis hardware.....299
 - show chassis routing-engine.....131
 - show chassis sfm.....141
 - comments, in configuration statements.....xxv
 - compliance
 - EMC requirements.....266
 - general standards.....264
 - components
 - hot-pluggable *See* field-replaceable units
 - hot-removable and hot-insertable *See* field-replaceable units
 - overview.....7
 - packing for shipment.....310
 - redundancy.....4
 - requiring power-down *See* field-replaceable units
 - software *See* Junos OS
 - configuration
 - files, storage by Routing Engine.....62
 - router.....123
 - Connector Interface Panel *See* CIP
 - console port (for Routing Engine management)
 - cable
 - connector pinouts (DB-9).....290
 - tools required.....158
 - cable specifications.....288
 - description.....40
 - installing cable.....113
 - replacing serial cable166
 - control packets, handling of.....20
 - conventions
 - notice icons.....xxiv
 - text and syntax.....xxiv
 - cooling system.....48
 - description (hardware and function).....48
 - maintenance.....130
 - redundancy.....48
 - See also* air filter, fan tray, front impeller assembly, rear lower impeller assembly, rear upper impeller assembly
 - craft interface
 - alarm cutoff/lamp test button.....35
 - description (hardware and function).....34
 - installation instructions.....174
 - LEDs
 - alarm (red and yellow).....35
 - FPC.....38
 - host module.....37
 - removal instructions.....173
 - routine inspection of.....129
 - serial number.....302
 - tools required.....158
 - crate *See* shipping crate
 - curly braces, in configuration statements.....xxv
 - customer support.....xxvi
 - contacting.....307
 - contacting JTAC.....xxvi
- D**
- data flow, through Packet Forwarding Engine.....60
 - DB-9 cable connector pinouts (auxiliary and console ports).....290
 - DB-9 cable connector pinouts (BITS input ports).....293

DC power and grounding cables		
connection instructions		
for maintenance or replacement.....	120	
lugs.....	279	
specifications.....	279	
tools required.....	158	
DC power supply		
cables See DC power and grounding cables		
connectors to midplane.....	216	
description and specifications.....	45	
grounding.....	279	
installation instructions		
during initial installation.....	106	
for maintenance or replacement.....	217	
maintenance.....	142	
removal instructions		
during initial installation.....	85	
for maintenance or replacement.....	216	
serial number.....	303	
tools required.....	158	
troubleshooting.....	155	
weight.....	83	
dispersion in fiber-optic cable.....	284	
Distributed Buffer Manager ASIC		
component on SFM.....	20	
role in forwarding.....	60	
documentation		
comments on.....	xxv	
E		
E1 PIC		
pinouts for RJ-48 cable.....	290	
earthquakes		
site preparation for.....	71	
tested toleration for seismic.....	271	
EIA rack standards.....	69	
EIA-530 PIC, pinouts for X.21 cable.....	294	
electrical specifications See specifications		
electronic emission Class A notice		
Canada.....	266	
electrostatic		
discharge See ESD		
electrostatic bag		
using to store components.....	232	
EMC (EMI)		
compliance with requirements.....	266	
standards.....	264	
environmental specifications.....	271	
ESD		
points on chassis.....	8	
preventing damage to components by.....	232	
Ethernet port (for Routing Engine management)		
cable		
installing.....	114	
replacing.....	163	
specifications.....	288	
tools required.....	158	
description.....	40	
ETSI rack standards.....	69	
exception packets, handling of.....	20	
F		
fan tray		
installation instructions		
during initial installation.....	100	
for maintenance or replacement.....	169	
maintenance.....	130	
removal instructions		
during initial installation.....	91	
for maintenance or replacement.....	168	
tools required.....	158	
troubleshooting.....	150	
weight.....	83	
Fast Ethernet 48-port PIC, pinouts for RJ-21		
cable.....	296	
fiber-optic		
power budget calculation.....	285	
fiber-optic cable See cable, fiber-optic		
field-replaceable units (FRUs).....	157	
fire safety specifications.....	233	
Flexible PIC Concentrator See FPC		
font conventions.....	xxiv	
forwarding tables.....	54	
FPC		
ASICs on.....	15	
blank panels.....	13	
components.....	15	
description (hardware and function).....	13	
installation instructions		
during initial installation.....	99	
for maintenance or replacement.....	193	
LEDs.....	38	
offline button.....	38	
removal instructions		
during initial installation.....	92	
for maintenance or replacement.....	191	
tools required.....	158	

- troubleshooting.....152
- types.....17
- weight.....83
- FPCs
 - maintenance.....132
 - status, checking.....132
- front impeller assembly
 - installation instructions
 - during initial installation.....98
 - for maintenance or replacement.....175
 - maintenance.....130
 - removal instructions
 - during initial installation.....94
 - for maintenance or replacement.....172
 - tools required.....158
 - troubleshooting.....150
 - weight.....83
- front-mounting *See* rack
- FRUs.....157
- fuses
 - description (hardware and function).....47
 - replacement of blown.....222
 - use in troubleshooting.....149
- G**
- grounding (electrical) specifications
 - AC-powered router.....276
 - DC-powered router.....276
- grounding cables
 - lugs.....276
- guidelines *See* specifications
- H**
- hardware components
 - FPC.....15
 - host module.....23
 - MCS.....33
 - midplane.....11
 - PCG.....18
 - PIC.....12
 - power requirements.....274
 - reinstallation of all during initial
 - installation.....97
 - removal of all during initial installation.....83
 - SFM.....20
 - weight.....83
- higher-order mode loss (HOL).....284
- host module.....23
 - description (hardware and function).....23
 - LEDs.....37
 - location on M40e and M160 routers.....25
 - maintenance.....131
 - mastership, checking and switching.....23
 - See also* MCS, Routing Engine
- hot-pluggable components *See* field-replaceable units
- hot-removable and hot-insertable components *See* field-replaceable units
- humidity (relative), acceptable.....271
- I**
- I/O Manager ASIC
 - on FPC.....15
 - role in forwarding.....60
- immunity standards.....264
- impeller assembly *See* front impeller assembly, rear
 - lower impeller assembly, rear upper impeller assembly
- installation instructions
 - AC power cord
 - for maintenance or replacement.....119
 - AC power supply
 - during initial installation.....106
 - for maintenance or replacement.....213
 - air filter.....171
 - alarm relay contact wires
 - tools required.....111
 - cable, auxiliary or console port (for Routing Engine management)
 - tools required.....111
 - cable, Ethernet port (for Routing Engine management)
 - tools required.....111
 - cable, PIC
 - during initial installation.....116
 - chassis using mechanical lift.....81
 - tools required.....81
 - chassis without mechanical lift.....83
 - tools required.....83
 - CIP.....161
 - circuit breaker box.....220
 - craft interface.....174
 - DC power and grounding cables
 - for maintenance or replacement.....120
 - tools required.....111

DC power supply		interface	
during initial installation.....	106	command-line See CLI	
for maintenance or replacement.....	217	process (software module in Routing Engine).....	56
fan tray		Internet Processor II ASIC	
during initial installation.....	100	component on SFM.....	20
for maintenance or replacement.....	169	role in forwarding.....	60
FPC			
during initial installation.....	99	J	
for maintenance or replacement.....	193	Japan VCCI notice See Japan voluntary control	
front impeller assembly		council for interference notice	
during initial installation.....	98	Japan voluntary control council for interference	
for maintenance or replacement.....	175	notice.....	267
fuses.....	222	Junos OS	
MCS		chassis process.....	57
during initial installation.....	104	CLI See CLI	
for maintenance or replacement.....	181	interface process.....	56
PC Card.....	184	kernel (Routing Engine).....	57
PCG		management process.....	57
during initial installation.....	103	MIB II process.....	57
for maintenance or replacement.....	197	modularity and scalability.....	62
PIC.....	201	overview.....	51
rear component cover.....	106	role in system architecture.....	61
rear lower impeller assembly		routing protocol process.....	52
during initial installation.....	101	SNMP process.....	57
for maintenance or replacement.....	176	tools	
rear upper impeller assembly		for accessing and configuring.....	57
during initial installation.....	102	for monitoring.....	58
for maintenance or replacement.....	178	upgrade of.....	58
router		VPNs.....	56
preparing for.....	73		
Routing Engine		K	
during initial installation.....	102	kernel (software in Routing Engine).....	57
for maintenance or replacement.....	189		
SFM		L	
during initial installation.....	105	LCD on craft interface	
for maintenance or replacement.....	207	alarm mode.....	37
instructions		idle mode.....	36
calculation		LEDs	
power requirements.....	274	AC power supply.....	44
installation See installation instructions		alarm (red and yellow on craft interface)	
maintenance		description.....	35
AC power supply.....	142	troubleshooting use.....	146
SFM.....	141	DC power supply.....	45
removal See removal instructions		FPC.....	38
site preparation.....	67	host module.....	37
unpacking the router.....	73	MCS.....	33
		PCG.....	19

PIC.....	12
SFM.....	23
lifting handle (for installation).....	95
link loss, calculating.....	286
lithium battery compliance.....	268
load sharing (power supplies).....	42
lugs for DC power and grounding cables.....	279
lugs for grounding cables.....	276

M

M40e router	
Routing Engine	
location.....	26
maintenance guidelines	
AC power supply.....	142
air filter.....	130
cooling system.....	130
DC power supply.....	142
fan tray.....	130
host module.....	131
impeller assemblies.....	130
MCS.....	131
overview.....	129
PCG.....	141
Routing Engine.....	131
SFM.....	141
management	
port, Ethernet See Ethernet port	
process (software module of Routing Engine).....	57
manuals	
comments on.....	xxv
MCS	
components.....	33
description (hardware and function).....	31
installation instructions	
during initial installation.....	104
for maintenance or replacement.....	181
LEDs.....	33
maintenance.....	131
offline button.....	33
removal instructions	
during initial installation.....	87
for maintenance or replacement.....	180
status, displaying.....	131
tools required.....	158
weight.....	83
MIB II process (software module in Routing Engine).....	57

midplane	
AC power supply connectors to.....	212
DC power supply connectors to.....	216
description.....	11
Miscellaneous Control Subsystem See MCS	
modal dispersion in fiber-optic cable.....	284
mode loss, higher-order.....	284
MPLS protocols.....	52
multicast routing protocols.....	52
multimode fiber-optic cable See cable,	
fiber-optic.....	284

N

NEBS standards.....	264
network cable See cable, fiber-optic; cable, PIC	
notice icons.....	xxiv
notices	
Canada, Class A.....	266
Japan voluntary control council for	
interference.....	267
voluntary control council for interference,	
Japan.....	267

O

offline button	
FPC.....	38
MCS.....	33
PCG.....	19
PIC.....	12
SFM.....	23

P

Packet Director ASIC	
component on FPC.....	15
role in forwarding.....	60
Packet Forwarding Engine	
architectural components.....	60
ASICs, diagram of.....	60
Clock Generator See PCG	
data flow through.....	60
packing crate See shipping crate	
parentheses, in syntax descriptions.....	xxv
PC Card	
insertion instructions.....	184
removal instructions.....	183
PCG	
components.....	18
description (hardware and function).....	18

installation instructions		pinouts	
during initial installation.....	103	DB-9 cable connector ports	
for maintenance or replacement.....	197	(auxiliary/console).....	290
LEDs.....	19	DB-9 cable connector ports (BITS input).....	293
maintenance.....	141	RJ-21 cable.....	296
offline button.....	19	RJ-45 Ethernet cable connector port.....	289
removal instructions		RJ-48 cable.....	290
during initial installation.....	88	V.35 cable.....	294
for maintenance or replacement.....	196	X.21 cable.....	294
serial number.....	305	policy, routing.....	55
status, checking.....	141	port	
tools required.....	158	auxiliary See auxiliary port	
weight.....	83	BITS input.....	41
physical specifications.....	269	console on CIP See console port	
PIC.....	12	Ethernet See Ethernet port	
ASIC on.....	12	power	
ATM, wavelength range supported.....	284	AC	
cable		connection instructions for	
tools required.....	158	maintenance.....	119
components.....	12	budget calculation.....	285
description (hardware and function).....	12	cables and cords See AC power cords; power	
E1		and grounding cables	
pinouts for RJ-48 cable.....	290	connecting DC	
EIA-530, pinouts for X.21 cable.....	294	for maintenance or replacement.....	120
Fast Ethernet 48-port, pinouts for RJ-21		margin calculation.....	286
cable.....	296	requirements for hardware components.....	274
installation instructions.....	201	supply	
LEDs.....	12	AC See AC power supply	
offline button.....	12	DC See DC power supply	
removal instructions.....	199	system	
serial number.....	305	load sharing.....	42
SONET/SDH		redundancy.....	42
alarm messages.....	147	specifications.....	273
clock source for.....	31	procedures See instructions	
wavelength range supported.....	284		
T1		R	
pinouts for RJ-48 cable.....	290	rack	
tools required.....	158	clearance required.....	71
troubleshooting.....	153	mounting hole spacing.....	70
PICs		securing to building.....	71
ATM, use of analyzer.....	139	size and strength required.....	69
maintenance.....	139	standards, EIA and ETSI.....	69
replacing cables.....	203	rack mounting	
SONET/SDH		brackets.....	77
analyzer, use of.....	139	front-mount flanges.....	77
status, checking.....	139	shelves.....	77
		spacer bars.....	77
		rack requirements.....	68

rear component cover		front impeller assembly	
installation instructions.....	106	during initial installation.....	94
removal instructions.....	85	for maintenance or replacement.....	172
rear lower impeller assembly		fuses.....	222
installation instructions		MCS	
during initial installation.....	101	during initial installation.....	87
for maintenance or replacement.....	176	for maintenance or replacement.....	180
maintenance.....	130	PC Card.....	183
removal instructions		PCG	
during initial installation.....	91	during initial installation.....	88
for maintenance or replacement.....	176	for maintenance or replacement.....	196
tools required.....	158	PIC.....	199
troubleshooting.....	150	rear component cover.....	85
weight.....	83	rear lower impeller assembly	
rear upper impeller assembly		during initial installation.....	91
installation instructions		for maintenance or replacement.....	176
during initial installation.....	102	rear upper impeller assembly	
for maintenance or replacement.....	178	during initial installation.....	90
maintenance.....	130	for maintenance or replacement.....	178
removal instructions		Routing Engine	
during initial installation.....	90	during initial installation.....	89
for maintenance or replacement.....	178	for maintenance or replacement.....	187
tools required.....	158	SFM	
troubleshooting.....	150	during initial installation.....	86
weight.....	83	for maintenance or replacement.....	206
redundancy		request chassis routing-engine master switch	
components.....	4	command.....	23
cooling system.....	48	requirements See specifications	
power system.....	42	RJ-21 cable pinouts.....	296
redundant power supplies		RJ-45 cable connector pinouts.....	289
M40e router.....	43	RJ-48 cable pinouts.....	290
relative humidity, acceptable.....	271	router	
removal instructions		component overview.....	7
AC power supply		configuration.....	123
during initial installation.....	85	packing for shipment.....	309
for maintenance or replacement.....	212	routing	
air filter.....	170	policy.....	55
CIP.....	160	protocol process (software module of Routing Engine).....	52
circuit breaker box.....	219	protocols	
craft interface.....	173	IPv4.....	52
DC power supply		IPv6.....	54
during initial installation.....	85	tables.....	54
for maintenance or replacement.....	216	Routing Engine	
fan tray		alarm handling by.....	62
during initial installation.....	91	chassis process.....	57
for maintenance or replacement.....	168	components	
FPC		software.....	52
during initial installation.....	92	configuration files, storage.....	62
for maintenance or replacement.....	191		

description (hardware and function).....	26	SFM	
installation instructions		ASICs on.....	20
during initial installation.....	102	components.....	20
for maintenance or replacement.....	189	description (hardware and function).....	20
interface process.....	56	installation instructions	
kernel.....	57	during initial installation.....	105
location		for maintenance or replacement.....	207
M40e router.....	26	LEDs.....	23
maintenance.....	131	maintenance.....	141
management ports.....	40	offline button.....	23
cable and wire specifications.....	288	removal instructions	
description.....	40	during initial installation.....	86
tools required.....	158	for maintenance or replacement.....	206
See also auxiliary port, console port,		serial number.....	306
Ethernet port		status, checking.....	141
management process.....	57	tools required.....	158
MIB II process.....	57	weight.....	83
packet counting.....	62	SFP	
removal instructions		installing.....	210
during initial installation.....	89	removing.....	208
for maintenance or replacement.....	187	shipping crate	
role in system architecture.....	61	repacking.....	309
routing		unpacking the router.....	73
protocol process.....	52	show chassis alarms command.....	147
table maintenance.....	62	show chassis environment mcs command.....	131
serial number.....	306	show chassis environment pcg command.....	141
SNMP process.....	57	show chassis environment pem command.....	142
status, displaying.....	131	show chassis fpc command.....	15, 132
tools required.....	158	show chassis fpc pic-status command.....	139
weight.....	83	show chassis hardware command.....	299
		show chassis routing-engine command.....	131
		show chassis sfm command.....	141
		signal dispersion.....	284
		Simple Network Management Protocol See SNMP	
		single-mode fiber-optic cable See cable,	
		fiber-optic.....	284
		site	
		environmental specifications.....	271
		preparation	
		instructions.....	67
		preparation checklist.....	67
		routine inspection.....	129
		small form-factor pluggable See SFP	
		SNMP	
		as tool for monitoring.....	58
		process (software module in Routing	
		Engine).....	57
		Software, Junos See Junos OS	

S

safety standards.....	264
seismic (earthquake).....	271
self-test button	
AC power supply.....	44
DC power supply.....	45
serial number	
AC power supply.....	300
CIP.....	301
craft interface.....	302
DC power supply.....	303
in output from show chassis hardware	
command.....	299
PCG.....	305
PIC.....	305
Routing Engine.....	306
SFM.....	306

-
- SONET/SDH
- PIC, wavelength range supported.....284
 - SONET/SDH analyzer, use of.....139
 - specifications
 - AC power cord.....277
 - AC power supply.....44
 - cable
 - DC power and grounding.....279
 - Routing Engine management ports.....288
 - clearance71
 - DC power supply.....45
 - electrical.....277, 279
 - environmental.....271
 - fire safety.....233
 - physical.....269
 - power
 - drawn by hardware components.....274
 - system.....273
 - rack
 - connection to building structure.....71
 - mounting hole spacing.....70
 - size and strength.....69
 - thermal output.....8, 271
 - wires to external alarm-reporting
 - devices.....288
 - standards compliance.....264
 - support, technical See technical support
 - Switching and Forwarding Module See SFM
 - syntax conventions.....xxiv
 - system
 - architecture.....59
 - description.....3
- T**
- T1 PIC
- pinouts for RJ-48 cable.....290
- tables, routing and forwarding.....54
- technical support
- contacting JTAC.....xxvi
- telco rack See rack
- temperature, acceptable range.....271
- thermal output.....8, 271
- tolerances.....271
- tools required
- chassis
 - installation using mechanical lift.....81
 - installation without mechanical lift.....83
 - returning for repair or replacement.....309
 - CIP maintenance.....158
 - hardware components
 - replacing on operational router.....158
 - returning for repair or replacement.....309
 - transmission distances, fiber-optic cable.....284
 - troubleshooting
 - cooling system.....150
 - FPC.....152
 - fuses.....149
 - LEDs
 - craft interface.....146
 - hardware components.....147
 - overview.....145
 - PIC.....153
 - power system.....155
- U**
- U (rack unit).....69
- unicast routing protocols
- IPv4.....52
 - IPv6.....54
- V**
- V.35 cable pinouts.....294
- VCCI notice See voluntary control council for interference notice
- voluntary control council for interference notice
- Japan.....267
- W**
- warnings
- general.....229
 - levels defined.....227
- wavelength ranges supported by fiber-optic cable.....284
- weight
- chassis.....83
 - hardware components.....83
- X**
- X.21 cable pinouts.....294

