



E-series™ Routing Platforms

ERX™ Hardware Guide

Release 9.3.x

Juniper Networks, Inc.

1194 North Mathilda Avenue
Sunnyvale, California 94089
USA

408-745-2000

www.juniper.net

Part Number: 162-01999-00, Revision A00

Juniper Networks, the Juniper Networks logo, JUNOS, NetScreen, ScreenOS, and Steel-Belted Radius are registered trademarks of Juniper Networks, Inc. in the United States and other countries. JUNOS is a trademark 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.

E-series™ Routing Platforms ERX™ Hardware Guide, Release 9.3.x

Copyright © 2008, Juniper Networks, Inc.

All rights reserved. Printed in USA.

Writing: John Borelli, Helen Shaw

Editing: Ben Mann

Illustration: John Borelli

Cover Design: Edmonds Design

Revision History

17 October 2008—Revision 1

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

SOFTWARE LICENSE

The terms and conditions for using this software are described in the software license contained in the acknowledgment to your purchase order or, to the extent applicable, to any reseller agreement or end-user purchase agreement executed between you and Juniper Networks. By using this software, you indicate that you understand and agree to be bound by those terms and conditions.

Generally speaking, the software license restricts the manner in which you are permitted to use the software and may contain prohibitions against certain uses. The software license may state conditions under which the license is automatically terminated. You should consult the license for further details.

For complete product documentation, please see the Juniper Networks Web site at www.juniper.net/techpubs.

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 xiii

E-series and JUNOS ^e Documentation and Release Notes	xiii
Audience	xiii
E-series and JUNOS ^e Text and Syntax Conventions	xiii
Related E-series and JUNOS ^e Documentation	xv
Obtaining Documentation	xviii
Documentation Feedback	xix
Requesting Technical Support	xix

Part 1

Product Overview

Chapter 1

ERX Overview 3

Overview	3
ERX Routers	3
ERX-14xx Models	4
ERX-7xx Models	6
ERX-310 Router	7
ERX Modules	9
SRP Module	9
Module Details	11
SRP Module Redundancy	12
Nonvolatile Storage	12
SRP I/O Module	12
Module Details	12
Line Modules	13
Packet Classification	13
I/O Modules	14
Network Management Tools	14
CLI Management	14
SNMP MIB Management	14
NMC-RX Device Management System	14
Redundancy Features	14
SRP Modules	14
NVS Cards	15
Line Modules	16
Power	17
Fans	17

Part 2**Initial Installation**

Chapter 2**Unpacking and Inspecting ERX Routers****21**

Before You Begin	21
Unpacking ERX-14xx Models	21
Unpacking ERX-7xx Models and ERX-310 Routers	22
Inspecting Router Components and Accessories	22
If You Detect or Suspect Damage	23
Contacting Juniper Networks	23
The Next Step	23

Chapter 3**Installing ERX Routers****25**

Before You Begin	25
Freestanding Installation	25
Rack-Mounted Installation	26
Installation Guidelines	26
Safety Guidelines	27
Preparing the Equipment Racks	28
Installing the Router	29
The Next Step	29

Chapter 4**Installing Modules****31**

Overview	31
Slot Groups	32
Slot Groups for the ERX-1410 Router	32
Slot Groups for the ERX-7xx Models	33
Combinations of Line Modules In Slot Groups	33
OC48 Line Modules	34
GE-2 Line Modules	34
Managing Modules Using the Software	34
Hot-Swapping Modules	34
Protecting Modules and Slots	34
Order of Installation	36
Required Tools and Safety Items	36
Safety Guidelines	36
Installing SRP I/O and SRP Modules	37
Installing an SRP I/O Module	37
Installing an SRP Module	38
Installing Line and I/O Modules	39
Installing a Line Module or an I/O Module	40
Removing a Line Module, SRP Module, or SRP I/O Module	41
Installing Components for Line Module Redundancy	42
Installing the Line Modules	43
Installing the Redundancy Midplane	43
Installing the I/O Modules	45
Verifying the Installation	45

	Configuring Line Module Redundancy	46
	The Next Step	46
Chapter 5	Cabling ERX Routers	47
	Cabling Overview	47
	Required Tools, Wires, and Cables	48
	Cabling the SRP I/O Module	49
	External Timing Ports	50
	Management Ports	52
	Connecting to the Network	52
	Connecting to a Console Terminal	52
	Cabling the Router for Power	53
	Task 1: Turn Off All Router Power	55
	Task 2: Connect the Grounding Cables	55
	Task 3: Connect the Power Cables	56
	ERX-7xx Models, ERX-14xx Models, ERX-310 Router (DC Model)	56
	ERX-310 Router (AC Model)	57
	Cabling I/O Modules	58
	BNC Connectors	58
	HSSI Connectors	58
	RJ-45 Connectors	59
	RJ-48C Connectors	59
	LC Duplex Connectors	60
	SC Duplex Connectors	60
	SMB Connectors	61
	X.21/V.35 Connectors	62
	Redundant Ports	63
	The Next Step	63
Chapter 6	Powering Up ERX Routers	65
	Before You Power Up the System	65
	Powering Up	65
	Initialization Sequence	66
	Status LEDs	66
	Powering Down	67
	The Next Step	67
Chapter 7	Accessing ERX Routers	69
	Setting Up Management Access	69
	Console Port Setup	69
	Using HyperTerminal	70
	Connecting Directly to the Router	70
	Assigning an IP Address	71
	Telnet Setup	72

SNMP	73
The Next Step	73

Part 3 Hardware Maintenance, Replacement, and Troubleshooting Procedures

Chapter 8 Maintaining ERX Routers 77

Required Tools and Items	77
Storing Modules and Components	78
Cleaning the System	78
Upgrading from Release 5.1.1 or Lower-Numbered Releases to Release 6.x.x or Higher-Numbered Releases	78
Upgrading NVS Cards on SRP Modules	79
Upgrading a System That Contains One SRP Module	79
Upgrading a System That Contains Two SRP Modules	80
Replacing an NVS Card	81
Upgrading Memory on SRP Modules	82
Displaying the Memory Installed	83
Removing SODIMMs	83
Adding New SODIMMs	83
Verifying the Upgrade	85
Replacing SFPs on I/O Modules	85
Removing SFPs	85
Installing SFPs	86
Verifying the Installation	88
Replacing Fan Trays	88
Removing the Fan Tray	90
Installing the Fan Tray	90
Installing a ERX-14xx Model Air Filter	91
Installing a Cable-Management Bracket on ERX-7xx Models	92
Replacing a Power Input Module	93

Chapter 9 Troubleshooting 95

Diagnosing Problems	95
Initialization Sequence	95
Troubleshooting Power Failures	96
Understanding Status LEDs to Troubleshoot	96
LED Identification	96
LED Activity	100
Redundancy Status	103
Monitoring Temperatures of Modules	103
Resetting Line Modules and SRP Modules	104
Double-Bit Errors on SRP Modules	104
Detecting Double-Bit Errors	104
Fixing Double-Bit Errors	105

Part 4**Appendixes****Appendix A****System Specifications****109**

ERX-14xx Models Specifications	109
ERX-7xx Models Specifications	111
ERX-310 Router Specifications	113

Appendix B**Installation Guidelines and Requirements****117**

Your Preinstallation Responsibilities	117
Environmental Requirements	117
Regulatory Compliances	118
Safety Guidelines	118
ERX-310 Router Warnings (AC Model)	120
ERX-310 Power Cord Warnings (AC Model)	120
Power Cable Warning (Japanese)	121
Equipment Rack Requirements	121
Mechanical Requirements	122
Space Requirements	123
Proper Rack Installation	123
Cabling Recommendations	124
Product Reclamation and Recycling Program	125
Hardware Compliance	126
Federal Communications Commission (FCC) Statement	126
FCC Requirements for Consumer Products	126
Food and Drug Administration, Center for Devices and Radiological Health	127
Canadian Department Of Communications Radio Interference Regulations	127
Règlement sur le brouillage radioélectrique du ministère des communications	127
Industry Canada Notice CS-03	127
Avis CS-03 d'Industrie Canada	127
D.O.C. Explanatory Notes: Equipment Attachment Limitations	128
Notes explicatives du ministère des Communications: limites visant les accessoires	129
EC Declaration of Conformity	129
Voluntary Control Council for Interference (VCCI) Statement for Japan	129

Appendix C**Cable Pinouts****131**

SRP I/O Module	131
CT1 and CE1 I/O Modules	134

Appendix D	Contacting Customer Support and Returning Hardware	139
	Contacting Customer Support	139
	Return Procedure	139
	Locating Component Serial Numbers	140
	Information You Might Need to Supply to JTAC	141
	Tools and Parts Required	142
	Returning Products for Repair or Replacement	142
	Packing Instructions for Returning a Chassis	142
Appendix E	Declaration of Conformity	145
	Declaration of Conformity	145
Part 5	Index	
	Index	149

About the Documentation

- E-series and JUNOS^e Documentation and Release Notes on page xiii
- Audience on page xiii
- E-series and JUNOS^e Text and Syntax Conventions on page xiii
- Related E-series and JUNOS^e Documentation on page xv
- Obtaining Documentation on page xviii
- Documentation Feedback on page xix
- Requesting Technical Support on page xix

E-series and JUNOS^e Documentation and Release Notes

For a list of related E-series and JUNOS^e documentation, see
<http://www.juniper.net/techpubs/index.html>.

If the information in the latest *JUNOS^e Release Notes* differs from the information in the documentation, follow the *JUNOS^e Release Notes*.

To obtain the most current version of all Juniper Networks technical documentation, see the products documentation page on the Juniper Networks Web site at <http://www.juniper.net/>.

Audience

This guide is intended for experienced system and network specialists working with E-series routers in an Internet access environment.

E-series and JUNOS^e Text and Syntax Conventions

Table 1 on page xiv defines notice icons used in this documentation.

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 xiv defines text and syntax conventions that we use throughout the E-series and JUNOS documentation.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents commands and keywords in text.	<ul style="list-style-type: none"> ■ Issue the clock source command. ■ Specify the keyword exp-msg.
Bold text like this	Represents text that the user must type.	host1(config)# traffic class low-loss1
Fixed-width text like this	Represents information as displayed on your terminal's screen.	host1#show ip ospf 2 Routing Process OSPF 2 with Router ID 5.5.0.250 Router is an Area Border Router (ABR)
<i>Italic text like this</i>	<ul style="list-style-type: none"> ■ Emphasizes words. ■ Identifies variables. ■ Identifies chapter, appendix, and book names. 	<ul style="list-style-type: none"> ■ There are two levels of access: <i>user</i> and <i>privileged</i>. ■ <i>clusterId</i>, <i>ipAddress</i>. ■ <i>Appendix A, System Specifications</i>
Plus sign (+) linking key names	Indicates that you must press two or more keys simultaneously.	Press Ctrl + b.
Syntax Conventions in the Command Reference Guide		
Plain text like this	Represents keywords.	terminal length
<i>Italic text like this</i>	Represents variables.	<i>mask</i> , <i>accessListName</i>
(pipe symbol)	Represents a choice to select one keyword or variable to the left or to the right of this symbol. (The keyword or variable can be either optional or required.)	diagnostic line

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

Convention	Description	Examples
[] (brackets)	Represent optional keywords or variables.	[internal external]
[]* (brackets and asterisk)	Represent optional keywords or variables that can be entered more than once.	[level1 level2 l1]*
{ } (braces)	Represent required keywords or variables.	{ permit deny } { in out } { <i>clusterId</i> <i>ipAddress</i> }

Related E-series and JUNOS^e Documentation

Table 3 on page xv lists and describes the E-series and JUNOS^e document set.

Table 3: Juniper Networks E-series and JUNOS^e Technical Publications

Document	Description
E-series Hardware Documentation	
<i>E120 and E320 Quick Start Guide</i>	Shipped in the box with all new E120 and E320 routers. Provides the basic procedures to help you get the routers up and running quickly.
<i>E120 and E320 Hardware Guide</i>	<p>Provides the necessary procedures for getting the E120 routers and E320 routers operational, including information about:</p> <ul style="list-style-type: none"> ■ Installing the chassis and modules ■ Connecting cables ■ Powering up the routers ■ Configuring the routers for management access ■ Troubleshooting common issues <p>Describes switch router processor (SRP) modules, line modules, and I/O adapters (IOAs) available for the E120 and E320 routers.</p>
<i>E120 and E320 Module Guide</i>	<p>Provides detailed specifications for line modules and IOAs in E120 and E320 routers, and information about the compatibility of these modules with JUNOS^e software releases.</p> <p>Lists the layer 2 protocols, layer 3 protocols, and applications that line modules and their corresponding IOAs modules support.</p> <p>Provides module LED information.</p>
<i>E-series Installation Quick Start poster or ERX Quick Start Guide</i>	Shipped in the box with all new ERX routers. Provides the basic procedures to help you get an ERX router up and running quickly.

Table 3: Juniper Networks E-series and JUNOS® Technical Publications *(continued)*

Document	Description
<i>ERX Hardware Guide</i>	<p>Provides the necessary procedures for getting ERX-14xx models, ERX-7xx models, and ERX-310 routers operational, including information about:</p> <ul style="list-style-type: none"> ■ Installing the chassis and modules ■ Connecting cables ■ Powering up the routers ■ Configuring the routers for management access ■ Troubleshooting common issues <p>Describes switch router processor (SRP) modules, line modules, and I/O modules available for the ERX routers.</p>
<i>ERX Module Guide</i>	<p>Provides detailed specifications for line modules and I/O modules in ERX-14xx models, ERX-7xx models, and ERX-310 routers, and information about the compatibility of these modules with JUNOS® software releases.</p> <p>Lists the layer 2 protocols, layer 3 protocols, and applications that line modules and their corresponding I/O modules support.</p> <p>Provides module LED information.</p>
<i>ERX End-of-Life Module Guide</i>	<p>Provides an overview and description of ERX modules that are end-of-life (EOL) and can no longer be ordered for the following routers:</p> <ul style="list-style-type: none"> ■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
JUNOS® Software Guides	
<i>JUNOS® System Basics Configuration Guide</i>	<p>Provides information about:</p> <ul style="list-style-type: none"> ■ Planning and configuring your network ■ Using the command-line interface (CLI) ■ Installing JUNOS® software ■ Configuring the Simple Network Management Protocol (SNMP) ■ Managing the router and its modules, including the use of high availability (HA) for SRP redundancy ■ Configuring and running a unified in-service software upgrade (ISSU) ■ Configuring passwords and security ■ Configuring the router clock ■ Configuring virtual routers
<i>JUNOS® Physical Layer Configuration Guide</i>	Explains how to configure, test, and monitor physical layer interfaces.
<i>JUNOS® Link Layer Configuration Guide</i>	Explains how to configure and monitor static and dynamic link layer interfaces.
<i>JUNOS® IP, IPv6, and IGP Configuration Guide</i>	Explains how to configure and monitor IP, IPv6 and Neighbor Discovery, and interior gateway protocols (RIP, OSPF, and IS-IS).

Table 3: Juniper Networks E-series and JUNOS Technical Publications *(continued)*

Document	Description
<i>JUNOS IP Services Configuration Guide</i>	<p>Explains how to configure and monitor IP routing services. Topics include:</p> <ul style="list-style-type: none"> ■ Routing policies ■ Firewalls ■ Network Address Translation (NAT) ■ J-Flow statistics ■ Bidirectional forwarding detection (BFD) ■ Internet Protocol Security (IPSec) ■ Access Node Control Protocol (ANCP), also known as Layer 2 Control (L2C) ■ Digital certificates ■ IP tunnels ■ Virtual Router Redundancy Protocol (VRRP) ■ Mobile IP home agent
<i>JUNOS Multicast Routing Configuration Guide</i>	<p>Explains how to configure and monitor IP multicast routing and IPv6 multicast routing. Topics include:</p> <ul style="list-style-type: none"> ■ Internet Group Management Protocol (IGMP) ■ Protocol Independent Multicast (PIM) ■ Distance Vector Multicast Routing Protocol (DVMRP) ■ Multicast Listener Discovery (MLD)
<i>JUNOS BGP and MPLS Configuration Guide</i>	<p>Explains how to configure and monitor:</p> <ul style="list-style-type: none"> ■ Border Gateway Protocol (BGP) routing ■ Multiprotocol Label Switching (MPLS) and related applications ■ Layer 2 services over MPLS ■ Virtual private LAN service (VPLS) ■ Layer 2 virtual private networks (L2VPNs)
<i>JUNOS Policy Management Configuration Guide</i>	<p>Explains how to configure, manage, and monitor customized policy rules for packet classification, forwarding, filtering, and flow rates. Also describes the packet mirroring feature, which uses secure policies.</p>
<i>JUNOS Quality of Service Configuration Guide</i>	<p>Explains how to configure quality of service (QoS) features to queue, schedule, and monitor traffic flow. These features include:</p> <ul style="list-style-type: none"> ■ Traffic classes and traffic-class groups ■ Drop, queue, QoS, and scheduler profiles ■ QoS parameters ■ Statistics

Table 3: Juniper Networks E-series and JUNOS Technical Publications *(continued)*

Document	Description
<i>JUNOS Broadband Access Configuration Guide</i>	Explains how to configure and monitor a remote access environment, which can include the following features: <ul style="list-style-type: none"> ■ Authentication, authorization, and accounting (AAA) ■ Dynamic Host Configuration Protocol (DHCP) ■ Remote Authentication Dial-In User Service (RADIUS) ■ Terminal Access Controller Access Control System (TACACS +) ■ Layer 2 Tunneling Protocol (L2TP) ■ Subscriber management
<i>JUNOS System Event Logging Reference Guide</i>	Describes the JUNOS system logging feature and describes how to use the CLI to monitor your system's log configuration and system events.
<i>JUNOS Command Reference Guide A to M</i>	Together constitute the <i>JUNOS Command Reference Guide</i> . Contain important information about commands implemented in the system software. Use to look up: <ul style="list-style-type: none"> ■ Descriptions of commands and command parameters ■ Command syntax ■ A command's related mode ■ Starting with JUNOS Release 7.1.0, a history of when a command, its keywords, and its variables were introduced or added <p>Use with the JUNOS configuration guides.</p>
<i>JUNOS Command Reference Guide N to Z</i>	
<i>JUNOS Glossary</i>	Provides definitions for terms used in JUNOS technical documentation.
Release Notes	
<i>JUNOS Release Notes</i>	Provide the latest information about features, changes, known problems, resolved problems, and system maximum values. If the information in the <i>Release Notes</i> differs from the information found in the documentation set, follow the <i>Release Notes</i> . <p>Release notes are included on the corresponding software CD and are available on the Web.</p>

Obtaining Documentation

To obtain the most current version of all Juniper Networks technical documentation, see the products documentation page on the Juniper Networks Web site at <http://www.juniper.net/>.

To order a documentation CD, which contains this guide, contact your sales representative.

Copies of the Management Information Bases (MIBs) available in a software release are included on the software CDs and at <http://www.juniper.net/>.

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation to better meet your needs. 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

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/customers/support/downloads/710059.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 located at <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](http://www.juniper.net/support/requesting%20support.html)

Part 1

Product Overview

- ERX Overview on page 3

Chapter 1

ERX Overview

This chapter provides introductory information about the ERX routers. It contains the following sections:

- Overview on page 3
- ERX Routers on page 3
- ERX Modules on page 9
- Network Management Tools on page 14
- Redundancy Features on page 14

Overview

ERX routers are modular, carrier-class networking devices that deliver performance, reliability, and service differentiation to both business and consumer Internet users. The ERX-7xx and ERX-14xx models offer high port density, low power consumption, and fully redundant Internet access routing and edge aggregation. The ERX-310 router supports the same services, but with smaller capacity and scaling capabilities. ERX routers offer the complete edge solution for IP-optimized carriers.

ERX Routers

Five models of ERX routers are available:

- ERX-1440 router
- ERX-1410 router
- ERX-710 router
- ERX-705 router
- ERX-310 router

All models use the same software. However, the specific model determines the:

- Combination of line modules supported
- Conditions for line rate performance of line modules
- Type, capacity, and number of SRP modules used

ERX-14xx Models



NOTE: In the E-series documentation, the term ERX-14xx models refers to both the ERX-1440 router and the ERX-1410 router. The terms ERX-1440 router and ERX-1410 router refer to the specific models. See Figure 1 on page 5 and Figure 2 on page 5.

The ERX-1440 router manages an extremely high volume of network traffic, and uses a 40-Gbps switch route processor (SRP) module, either the SRP-40G or SRP-40G + module. (The SRP-40G + module obsoletes the SRP-40G module; however, the software continues to support both modules.) In this model, all line modules operate at full wire speed simultaneously.

The ERX-1410 router manages high levels of network traffic, and uses the 10-Gbps SRP module (SRP-10G). You can configure the ERX-1410 router to enable the line modules either to operate at full line rate performance or to allow line modules to operate at a rate dependent on the resources available. The former option restricts the allowed combinations of line modules. For information on configuring performance of line modules, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.



NOTE: The 10-Gbps SRP module used in the ERX-310 router is different from the 10-Gbps SRP module used in the ERX-1410 router. See “SRP Module” on page 9 for more information.

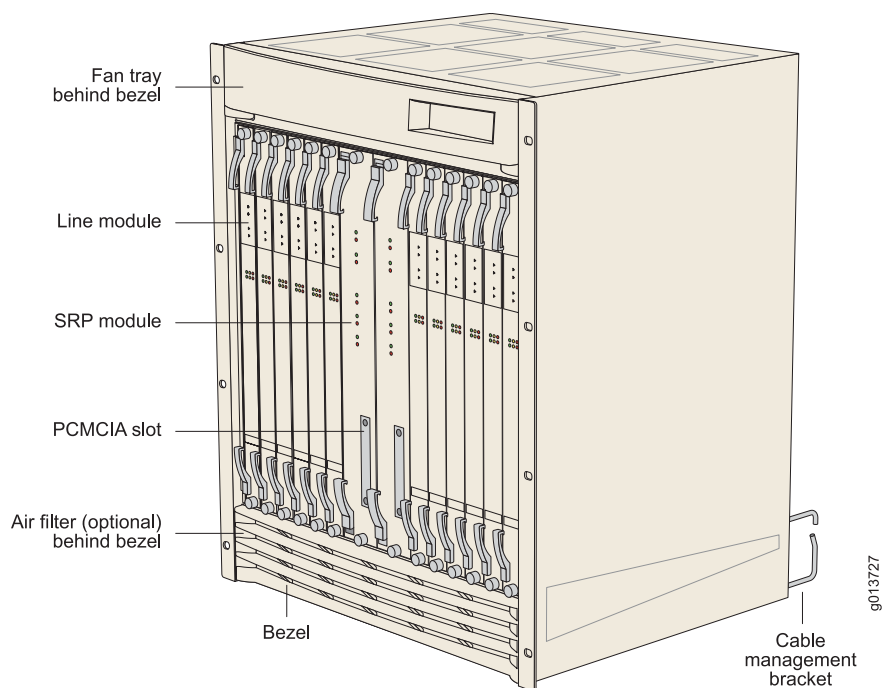
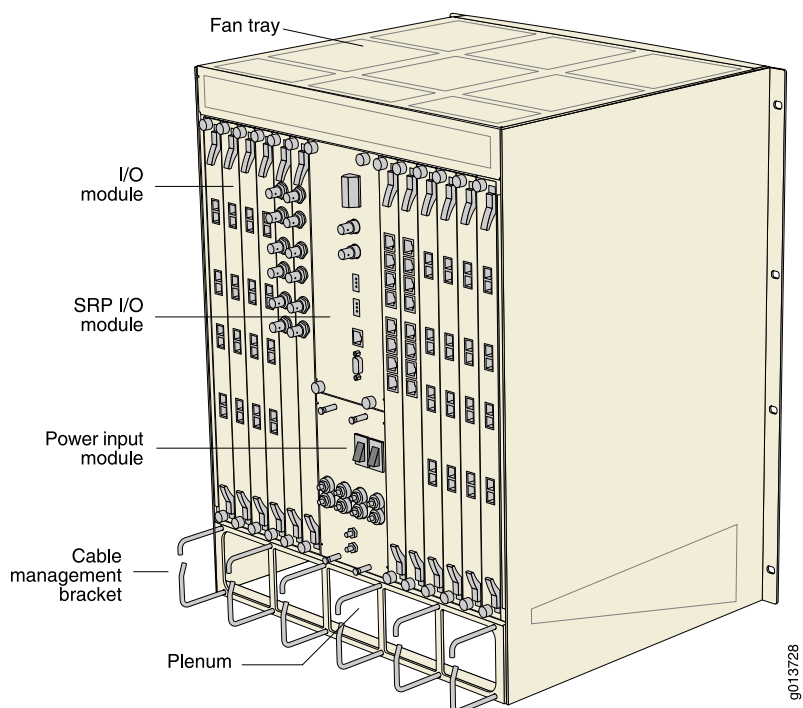
Externally, the ERX-1440 chassis is the same as the ERX-1410 chassis. (See Figure 1 on page 5 and Figure 2 on page 5.) Both routers contain 14 vertical slots to accommodate modules.

Internally, the ERX-1440 chassis differs from the ERX-1410 chassis, and includes a special midplane for the 40-Gbps SRP module.

Installation procedures and operating procedures are identical for both systems. All ERX-7xx and ERX-14xx models use the same SRP I/O module, but different power input modules are used.



NOTE: The router may look different from the routers shown in the figures in this chapter, depending on the line modules in the slots.

Figure 1: ERX-14xx Models, Front View**Figure 2: ERX-14xx Models, Rear View**

ERX-7xx Models



NOTE: In the E-series documentation, the term ERX-7xx models refers to both the ERX-705 router and the ERX-710 router. The terms ERX-705 router and ERX-710 router refer to the specific models. See Figure 3 on page 6 and Figure 4 on page 7.

The ERX-7xx models are robust, high-density routers with less capacity than the ERX-14xx models. The ERX-7xx models use either the SRP-10G module or the SRP-5G module.

You can configure the ERX-7xx models to enable the line modules (LM) to operate either at full line rate performance or at a rate dependent on the resources available. For information about configuring performance of line modules, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.



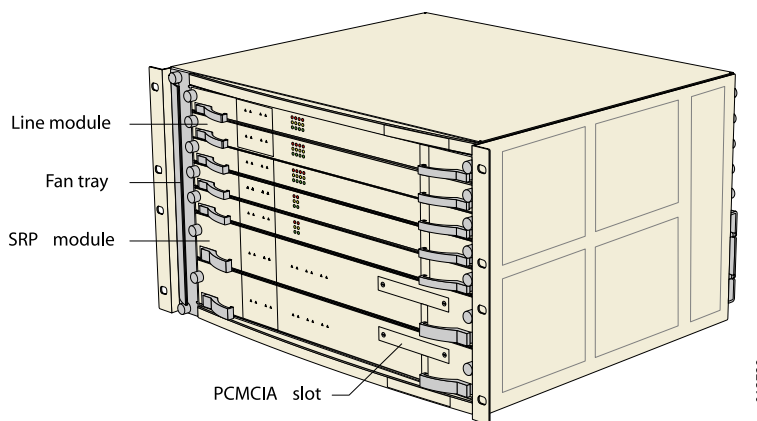
NOTE: The 10-Gbps SRP module used in the ERX-310 router is different from the 10-Gbps SRP module used in the ERX-710 router. See “SRP Module” on page 9 for more information.

The ERX-705 chassis is the same as the ERX-710 chassis. (See Figure 3 on page 6 and Figure 4 on page 7.) The chassis contains seven slots to accommodate modules. Installation procedures and operating procedures are identical for both systems. All ERX-7xx and ERX-14xx models use the same SRP I/O module, but different power input modules are used.

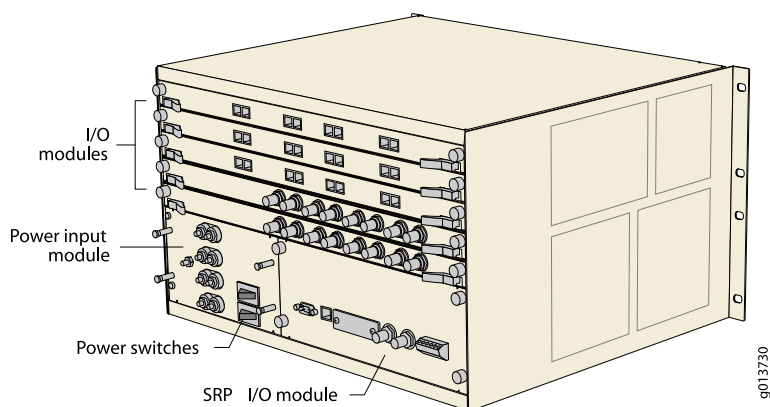


NOTE: The router may look different from the routers shown in the figures in this chapter, depending on the line modules in the slots.

Figure 3: ERX-7xx Models, Front View



9013729

Figure 4: ERX-7xx Models, Rear View

ERX-310 Router

The ERX-310 router is a low-end platform that supports all of the same services as the ERX-7xx and ERX-14xx models, but with smaller capacity and scaling capabilities. Like the ERX-7xx and ERX-14xx models, the ERX-310 router uses the same software architecture, providing a single IP entry point into the network with the same IP-based protocols and services that are available on other ERX routers. The ERX-310 router is designed to be used as a small distributed POP router as well as a high-end CPE router.

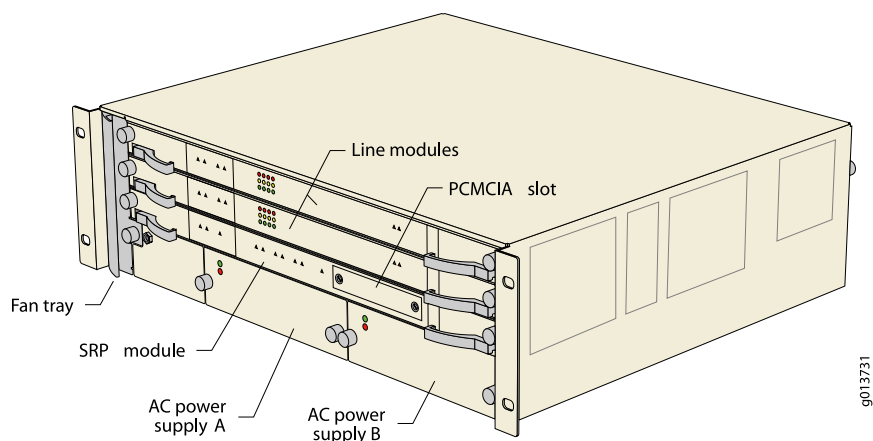
The ERX-310 router is a three-slot chassis with a midplane architecture. One slot supports one nonredundant 10-Gbps SRP module, while the other two slots support line modules. The router supports existing E-series ASIC-based line modules (except the OC48/STM16 line module), as well as a select number of combination cards. The combination cards provide a fixed combination of interfaces on the I/O module so that a single slot can support multiple interfaces (ATM OC3 and GE, for example).



NOTE: The 10-Gbps SRP module used in the ERX-310 router is different from the 10-Gbps SRP module used in the ERX-7xx and ERX-14xx models. See “SRP Module” on page 9 for more information.

The ERX-310 router is available in either redundant AC- or DC-powered models.

Figure 5: ERX-310 Router, Front View (AC Model)



NOTE: The DC model has blank filler panels in power supply slots.

Figure 6: ERX-310 Router, Rear View (AC Model)

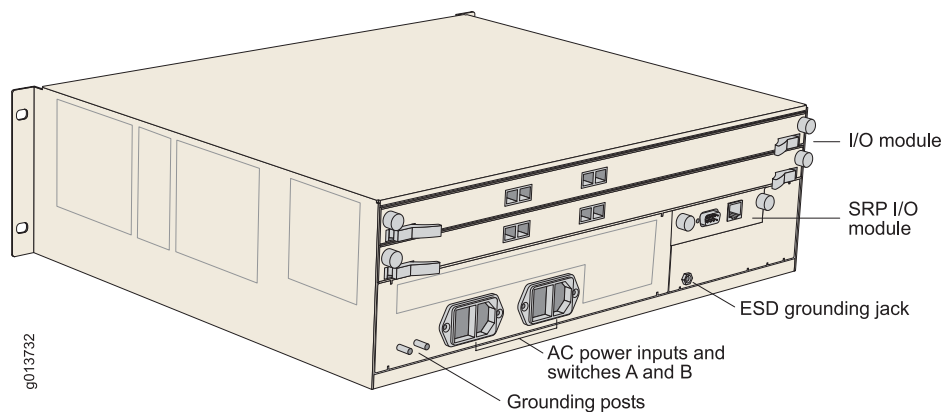
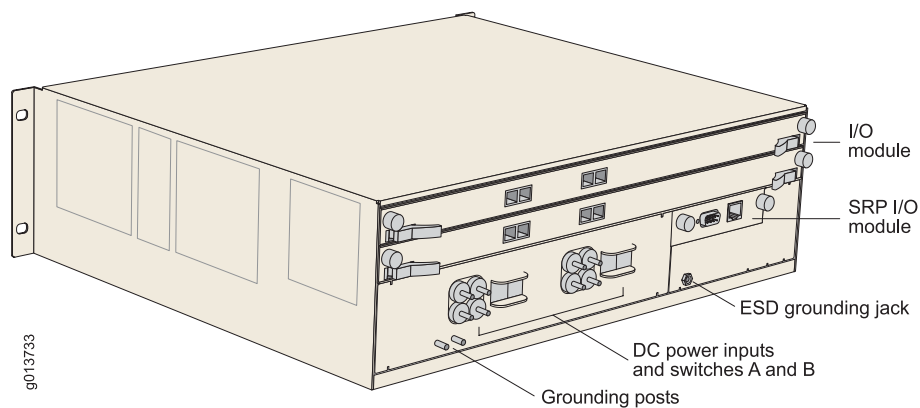


Figure 7: ERX-310 Router, Rear View (DC Model)



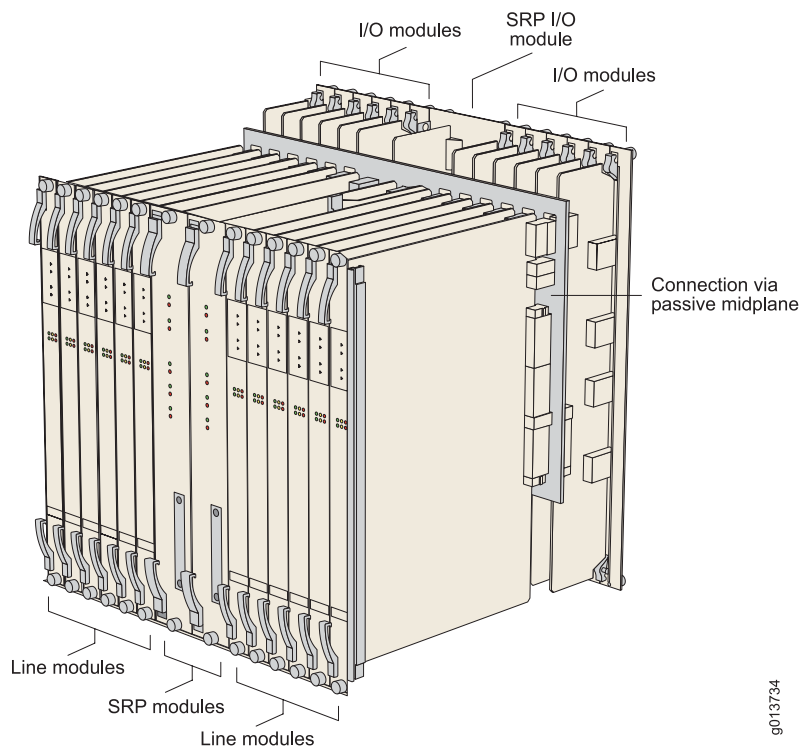
ERX Modules

Each system supports an SRP module and a selection of line modules. You can use any line module for *access* or *uplink*. Access line modules receive traffic from low-speed circuits, and the system routes the traffic onto higher-speed uplink line modules and then to the core of the network.

Each module connects to a corresponding I/O module via a passive midplane. See Figure 8 on page 9.

The front panel of each module contains a collection of status LEDs (light-emitting diodes). For information about how to interpret the LEDs, see “Troubleshooting” on page 95.

Figure 8: Modules in ERX-14xx Models



g013734



NOTE: Some line modules require a minimum amount of memory to be used with JUNOS Release 5.3.0 or a higher-numbered release. See the *ERX Module Guide* for line module specifications.

SRP Module

Switch route processor (SRP) modules perform system management, routing table calculations and maintenance, forwarding table computations, statistics processing, configuration storage, and other control plane functions. Each SRP module is a

PowerPC-based system with its own memory, nonvolatile disk storage, and power supply. (See Figure 9 on page 10 and Figure 10 on page 11.)

Figure 9: SRP Module for ERX-7xx and ERX-14xx Models

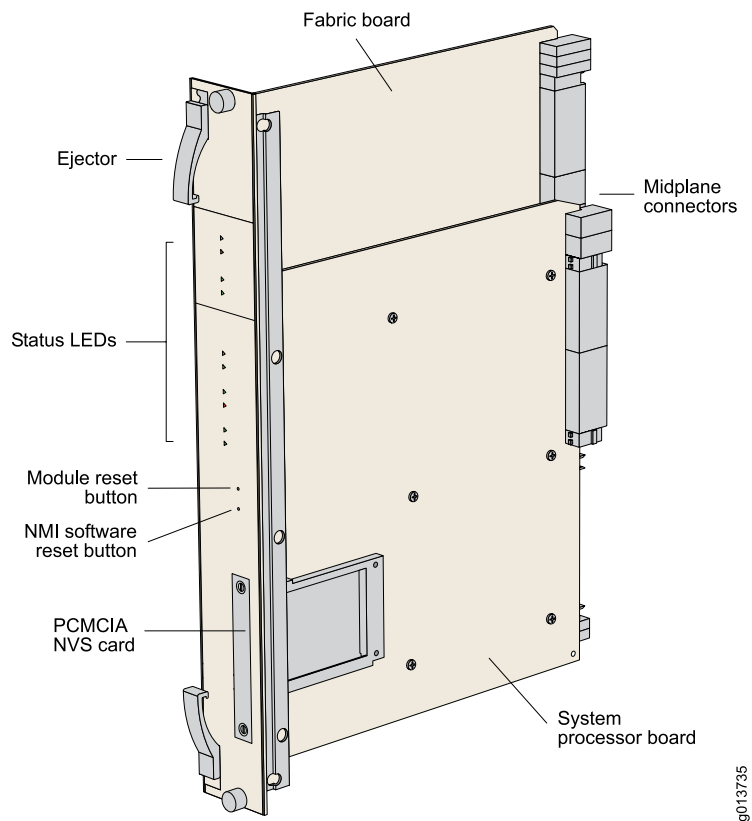
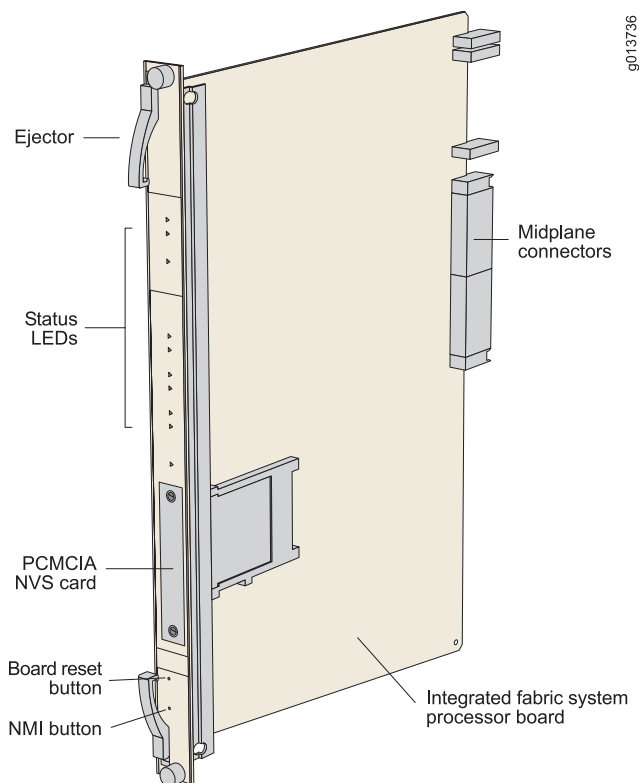


Figure 10: SRP Module for ERX-310 router

Module Details

ERX-7xx and ERX-14xx models use up to two redundant SRP modules operating in an active/standby configuration. ERX-310 routers use only one SRP module. An SRP module must be present for any system to boot.

SRP modules ranging from 5 Gbps to 40 Gbps can be used in ERX-7xx and ERX-14xx models. Only a 10-Gbps SRP module (SRP-SE10G) can be used in ERX-310 routers. See the *ERX Module Guide* for complete information.



NOTE: Because of different physical dimensions and switch fabric capabilities, SRP modules are not interchangeable between systems. For example, the 10-Gbps SRP module used in ERX-7xx and ERX-14xx models cannot be used in the ERX-310 router, and vice versa.



CAUTION: Do not remove the SRP module while the system is running.



NOTE: Some SRP modules require a minimum amount of memory to be used with JUNOS Release 5.3.0 or a higher-numbered release. See the *ERX Module Guide* for module specifications.

For details about installing SRP modules, see “Installing Modules” on page 31.

SRP Module Redundancy

SRP module redundancy is available only for ERX-7xx and ERX-14xx models. See “Redundancy Features” on page 14

Nonvolatile Storage

The PCMCIA slot on the front of the SRP module holds a Type II PCMCIA nonvolatile storage (NVS) card. (See Figure 9 on page 10 and Figure 10 on page 11.) This card is loaded with the system's software and configuration files. The PCMCIA card is factory installed.



CAUTION: Although you can remove PCMCIA NVS (Flash) cards from a running router, we recommend that you do not do so. If you remove the card while data is being written to or copied from the NVS card, data can be lost or corrupted. Therefore, we strongly recommend that you shut down the router before removing a PCMCIA NVS card.

SRP I/O Module

The SRP I/O module is a single corresponding input/output module that interfaces with the SRP modules through the system's midplane. The same SRP I/O module works with all SRP modules, but is router specific. The I/O module used in ERX-7xx and ERX-14xx models cannot be used in the ERX-310 router, and vice versa. See Figure 2 on page 5, Figure 4 on page 7, and Figure 6 on page 8 for locations.

Module Details

The SRP I/O module provides standard craft management interfaces, including:

- 10/100Base-T—The port enables access to the ERX router for Ethernet management functions via CLI or SNMP, for example.
- RS-232—The port provides a serial connection for monitoring the system's hardware configuration through a PC (running terminal emulation software) or ASCII terminal. Allows direct CLI access.
- Alarm contacts—The contacts provide for remote indication of critical, major, and minor router alarms (ERX-7xx and ERX-14xx models only; currently not implemented)
- External timing inputs—The inputs provide a method of ensuring that the clock timing used by the router remains synchronized with the network's system clock.

BNC connectors and wire wraps are available for ERX-7xx and ERX-14xx models only.

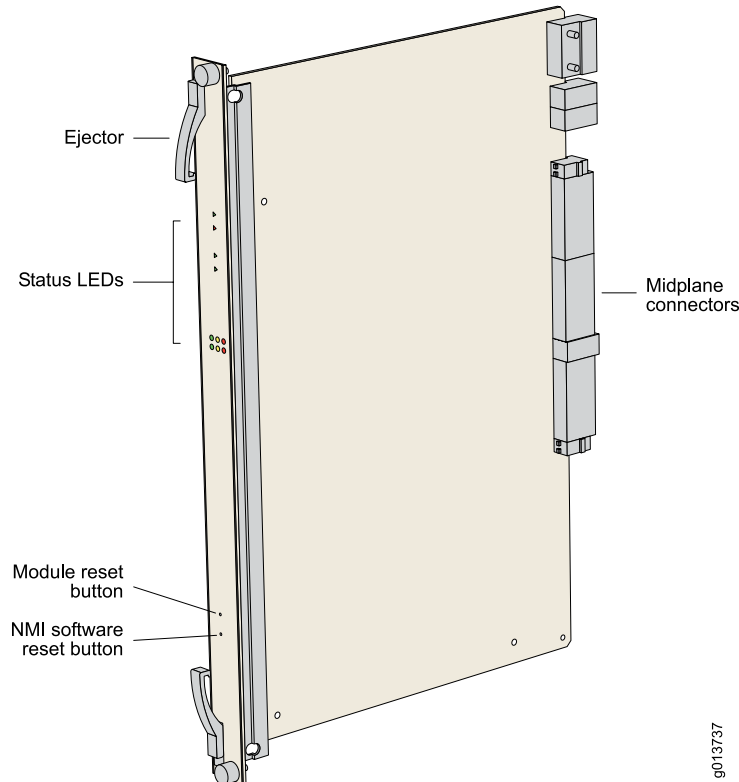
For details about installing the SRP I/O module, see “Installing Modules” on page 31.

Line Modules

Line modules (LM) process data from different types of network connections. For information about available line modules and which SRP modules support specific line modules, see the *ERX Module Guide*.

Figure 11 on page 13 shows a representative line module. For details about installing line modules, see “Installing Modules” on page 31.

Figure 11: Representative Line Module



Packet Classification

Most line modules support packet classification on ingress; some non-ASIC line modules do not. A classification engine on the line module matches specific fields (such as source and destination IP address, source and destination port, and protocol), the ingress IP interface, layer 2 fields, or some combination of these against user-configured filters at wire speed.

I/O Modules

Most line modules have a corresponding input/output (I/O) module that provides the physical interconnection to the network. Insert each I/O module into the back of the system, directly behind its corresponding line module.

For information about which line modules pair with which I/O modules, see the *ERX Module Guide*. See Figure 2 on page 5, Figure 4 on page 7, and Figure 6 on page 8 for locations. For details about installing I/O modules, see “Installing Modules” on page 31.

Network Management Tools

You can use different management tools to configure the system to meet the specific networking requirements.

CLI Management

The CLI provides fully developed and automated configuration and status functionality through a local RS-232 port, Telnet, or SSH via any reachable network. For a full discussion of the CLI, see *JUNOS System Basics Configuration Guide, Chapter 2, Command-Line Interface*.

SNMP MIB Management

The system offers a complete SNMP interface for configuration, status, and alarm reporting. The system supports both Standard and Enterprise MIBs (Management Information Bases). The Juniper Networks E-series Enterprise MIB is ASN.1 notated for easy importing into third-party SNMP management applications. For more information, see *JUNOS System Basics Configuration Guide, Chapter 4, Configuring SNMP*.

NMC-RX Device Management System

The NMC-RX application provides a global method of managing all routers, line modules, and ports through a graphical user interface.

Redundancy Features

This section describes system redundancy features.

SRP Modules



NOTE: This section applies to ERX-7xx and ERX-14xx models only. ERX-310 routers contain one SRP module and therefore do not offer SRP module redundancy.

ERX-7xx and ERX-14xx models use a 1:1 redundancy scheme for the SRP module. When two SRP modules of the same type are installed in the chassis, one acts as a

primary (active) and the second as a redundant (standby) module. Both SRP modules share a single SRP I/O module located in the rear of the chassis.

If the standby SRP module detects that the primary SRP module is not active (and high-availability mode is not enabled), it reboots the system and takes control. If high-availability mode has been enabled, automatic switchover occurs with near hitless failover. If you upgrade software, you must copy the software to the redundant SRP and reboot it. For information about configuring and managing SRP module redundancy, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.

After you install two SRP modules, the modules negotiate for the primary role. A number of factors determine which module becomes the primary; however, preference is given to the module in the lower-numbered slot. The SRP modules record their latest roles and retain them the next time you switch on the system. For information about installing SRP modules, see “Installing Modules” on page 31.

NVS Cards

If you have two SRP modules installed in a system, you can use NVS cards of different capacities on the SRP modules. The effective capacity of the higher-capacity NVS card will equal that of the lower-capacity NVS card. For information about installing NVS cards, see “Installing Modules” on page 31.

When you install new NVS cards or SRP modules, you must issue the **synchronize** command to match the file system of the NVS card on the redundant SRP module with the file system of the NVS card on the primary SRP module. (The NVS card on the redundant SRP module will hereafter be referred to as the redundant NVS card; the NVS card on the primary SRP module will hereafter be referred to as the primary NVS card.)

If the capacity of the primary NVS card is equal to or smaller than that of the redundant NVS card, the system copies all the files from the primary NVS card to the redundant NVS card. However, if the capacity of the primary NVS card exceeds that of the redundant NVS card, the system creates an invisible synchronization reserve file on the primary NVS card, provided that there is enough space for the file.

The purpose of the synchronization file is to prevent the creation of data that cannot fit on the redundant NVS card. The file contains no useful data, and is not visible when you view the files in NVS. The size of the file is equal to the difference in capacities of the two NVS cards. For example, if the primary NVS card has a capacity of 224 MB and the redundant NVS card has a capacity of 220 MB, the size of the synchronization file is 4 MB, and only 220 MB of space is available on the primary NVS card.

If the primary NVS card does not have enough space to create the synchronization reserve file, the **synchronize** command fails, and a warning message is displayed on the console. To resolve this issue, either delete unwanted files from the primary NVS card or replace the redundant NVS card with a higher-capacity NVS card.

Line Modules



NOTE: This section applies to ERX-7xx and ERX-14xx models only. ERX-310 routers do not offer line module redundancy.

ERX-7xx and ERX-14xx models support line module redundancy for several line modules. For details about which line modules support redundancy, see the *ERX Module Guide*. In this scheme, an extra line module in a group of identical line modules provides redundancy in case of line module failure. To use this feature, you need a:

- Spare line module
- Redundancy midplane
- Redundancy I/O module

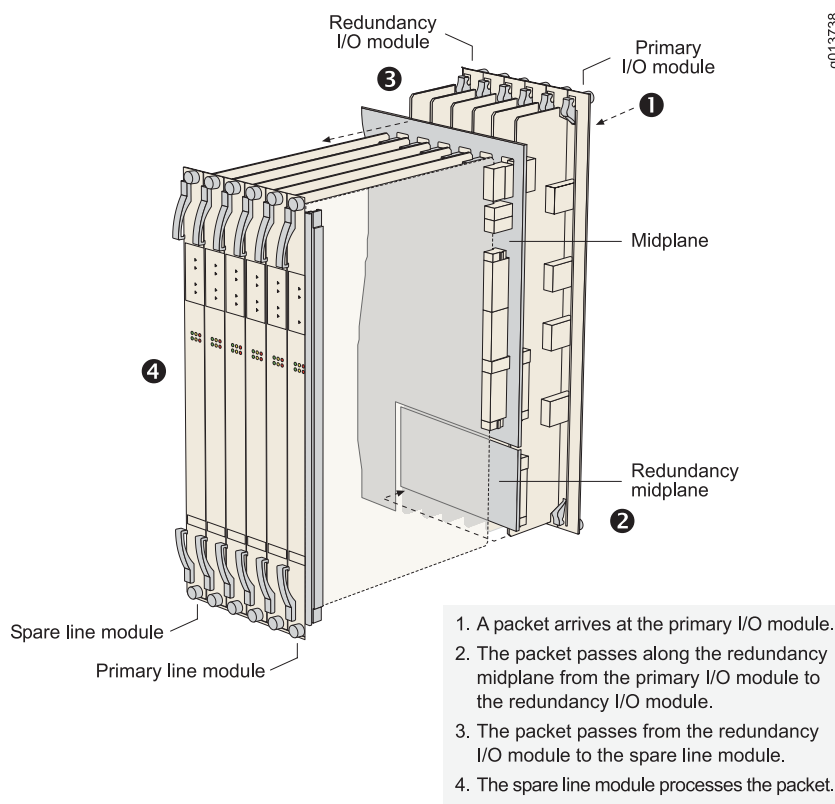
A redundancy midplane can cover 3–6 slots. It provides additional connectivity that enables the spare line module to take control of the I/O module associated with any failed line module in the redundancy group. The spare I/O module provides connectivity from the spare line module to the redundancy midplane.

The process by which the system switches to the spare line module is called *switchover*. When switchover occurs, the system:

1. Breaks the connection between the primary I/O module and the primary line module.
2. Connects the primary I/O module to the spare line module via the redundancy midplane and redundancy I/O module.

Protocol processing then takes place on the spare line module.

Figure 12 on page 17 shows the data flow when a spare line module becomes active.

Figure 12: Data Flow When a Spare Line Module Is Active

For information about installing modules for line module redundancy, see “Installing Modules” on page 31. For information about configuring and managing SRP module redundancy, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.

Power

All E-series routers provide a power architecture that distributes redundant –48 VDC feeds through the router to each line module, SRP module, and fan module where DC-to-DC converters provide local conversion to the required secondary voltages.

The ERX-310 router is available with either DC or AC power inputs. The AC-powered version can be configured with one or two hot-swappable power supplies for optional redundancy. (See Figure 5 on page 8 and Figure 6 on page 8.) The power supplies convert AC power to internal –48 V redundant DC feeds that are then distributed through the router.

Fans

Forced air-cooling keeps the temperature of the E-series modules and components within normal operating limits. In ERX-14xx models, six cooling fans are located in a tray at the top of the router (Figure 1 on page 5). In ERX-7xx models, four cooling fans are located in a tray on one side of the router (Figure 3 on page 6). In the

ERX-310 router, two cooling fans are located in a tray on one side of the router (Figure 5 on page 8).

The system monitors the temperature of each module. If the temperature of a module exceeds the maximum limit, the system immediately goes into thermal protection mode and the modules are powered off. The ERX system controller enters a low power mode, keeps the modules in a power-off condition, and does not respond to any management interface commands. For information about troubleshooting high operating temperatures, see “Troubleshooting” on page 95.

In ERX-7xx and ERX-14xx models, the fan tray has two redundant converters that power the fans (for the ERX-14xx models, a –24 V, 50 W converter; for the ERX-7xx models, a –12 V, 15 W converter). If one converter fails, the other takes over. The ERX-310 router does not have redundant converters.

For all E-series routers, the system software reports an alarm if any of the fans or converters fail.

Part 2

Initial Installation

- Unpacking and Inspecting ERX Routers on page 21
- Installing ERX Routers on page 25
- Installing Modules on page 31
- Cabling ERX Routers on page 47
- Powering Up ERX Routers on page 65
- Accessing ERX Routers on page 69

Chapter 2

Unpacking and Inspecting ERX Routers

This chapter reviews shipping contents and unpacking procedures for ERX routers. It contains the following sections:

- Before You Begin on page 21
- Unpacking ERX-14xx Models on page 21
- Unpacking ERX-7xx Models and ERX-310 Routers on page 22
- Inspecting Router Components and Accessories on page 22
- If You Detect or Suspect Damage on page 23
- Contacting Juniper Networks on page 23
- The Next Step on page 23

Before You Begin

Before you begin unpacking the router, be sure you have the following tools:

- A No. 2 Phillips screwdriver
- A utility knife
- A mechanical lift, or at least two people to assist in lifting

Unpacking ERX-14xx Models

ERX-14xx models come boxed, bolted, and strapped to a skid. For your convenience, we recommend that you unpack the router in the location where you want to install it.



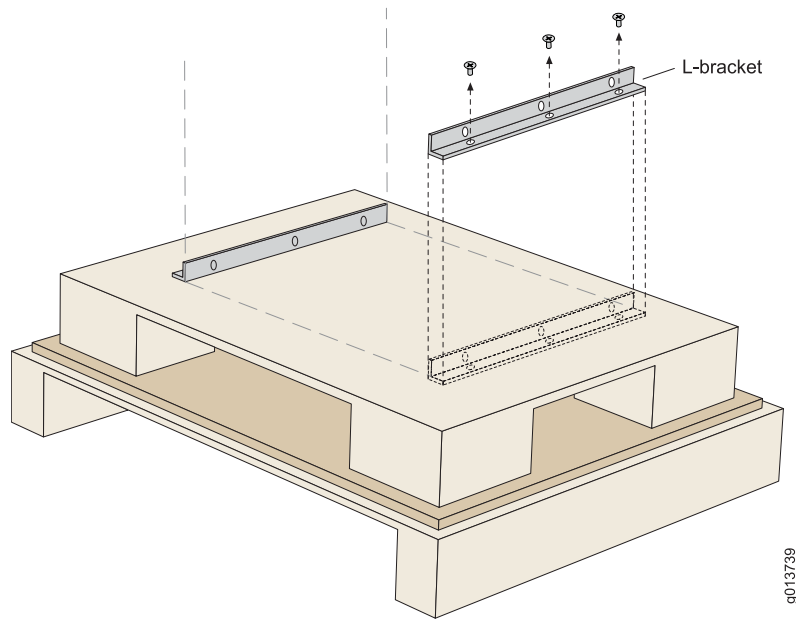
WARNING: Three people are required to install the router in a rack: two to lift the system into position and one to screw it to the rack.

To unpack ERX-14xx models:

1. Cut the two straps that secure the carton to the skid, open the carton from the top, and remove the box of accessories that sits on top of the router.
2. Unlock the four plastic clips that hold the box to the skid by squeezing them in their center and pulling out, and then lift the carton off the router.

3. Remove the three screws that attach each of the two L-brackets to the router.
4. To avoid scratching the router when removing it from the skid, detach one of the L-brackets from the skid by removing the three screws. See Figure 13 on page 22.

Figure 13: Removing an L-Bracket



Unpacking ERX-7xx Models and ERX-310 Routers

ERX-7xx models and ERX-310 routers are shipped boxed, but not attached to a skid. For your convenience, we recommend that you unpack the router in the location where you want to install it.

To unpack an ERX-7xx model or an ERX-310 router:

1. Open the carton from the top.
2. Remove the box of accessories that sits on top of the system.
3. Remove the router from the box.



WARNING: Three people are required to install the router in a rack: two to lift the system into position and one to screw it to the rack.

Inspecting Router Components and Accessories

After you remove the equipment from the shipping containers:

- Confirm the contents of each container.
- Inspect all external surfaces and external connectors for visible signs of damage.
- Inspect all accessories shipped with each unit.
- Document any damage noted during your inspection.
- Confirm that the router has the correct number and type of modules for your ordered configuration.

If You Detect or Suspect Damage

If you detect or suspect damage to any equipment:

- Contact the shipper responsible for delivery, and formally report the damage.
- Contact your Juniper Networks sales representative or reseller.

Contacting Juniper Networks

Please contact Juniper Networks at 1-888-314-JTAC (from the United States, Canada, or Mexico) or 408-745-9500 (from elsewhere), or contact your sales representative if you have any questions or concerns. See “Contacting Customer Support and Returning Hardware” on page 139 for complete contact information.

The Next Step

- To familiarize yourself with the electrical, environmental, and other guidelines and requirements for installing ERX routers, turn to “Installation Guidelines and Requirements” on page 117.
- If you are familiar with these guidelines and requirements, turn to “Installing ERX Routers” on page 25.

Chapter 3

Installing ERX Routers

This chapter describes how to install ERX routers in a rack. It contains the following sections:

- Before You Begin on page 25
- Freestanding Installation on page 25
- Rack-Mounted Installation on page 26
- The Next Step on page 29

Before You Begin

Before installing E-series routers, be sure you:

- Have a plan for installing the routers that takes into consideration future expansion of your system.
- Have the tools and accessories needed to complete the installation.
- Read and understand the clearance requirements for the front and back of the chassis for cable routing and other unit access. See “Environmental Requirements” on page 117 for more information.
- Read and understand the clearance requirements for the chassis to ensure adequate ventilation.
- Prepare the equipment racks by measuring and marking space for each router and plenum you plan to install.

Freestanding Installation

When installing the system on a table top or in any other freestanding mode, be sure to leave enough space around the system for adequate ventilation. Position the router with easy access to the connections that it needs for power, local communications, and remote communications.

See “Installation Guidelines and Requirements” on page 117, and “System Specifications” on page 109, for more information.



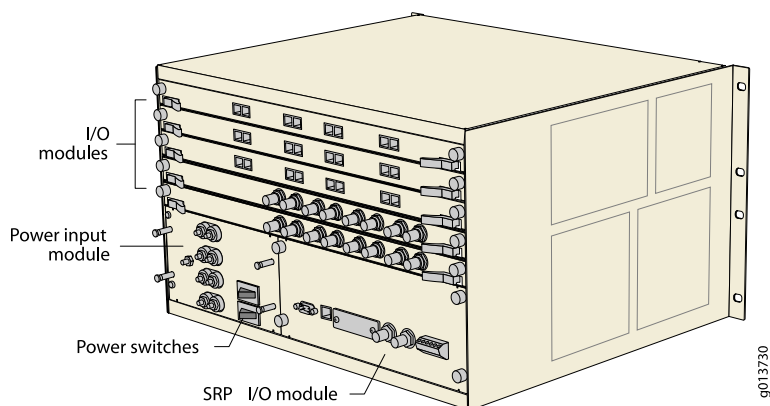
WARNING: Two people are required to lift an E-series router.



CAUTION: To prevent electrostatic damage to the system and its components, make sure persons handling the router wear an antistatic device.

Connectors are located on the I/O modules and the power input module. These modules are installed from the rear of the router. (See Figure 14 on page 26.) See “Cabling ERX Routers” on page 47 for cabling installation procedures.

Figure 14: ERX-7xx Models, Rear View



Rack-Mounted Installation

We recommend that you use a standard EIA distribution rack. See “Equipment Rack Requirements” on page 121 for detailed rack information.

Installation Guidelines

Before installing the systems in a rack, consider the following guidelines and refer to Figure 15 on page 27:

- You can install up to 3 ERX-14xx models, 6 ERX-7xx models, or 14 ERX-310 routers in a single 7-ft. (2.1 m) rack.

Installing multiple systems in a single rack enables you to maximize your available space.

- You can install an ERX-14xx model, an ERX-7xx model, and an ERX-310 router together in the same rack. (See Figure 15 on page 27.)

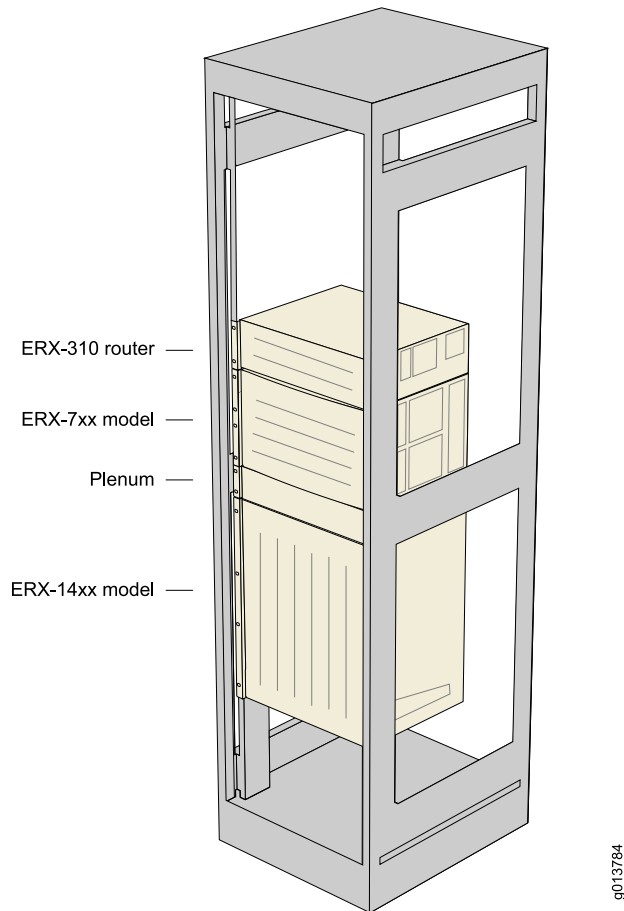


CAUTION: If you install an ERX-7xx model or ERX-310 router directly above an ERX-14xx model in the same rack, you must install a plenum between the ERX-7xx model or ERX-310 router and the ERX-14xx model so that the air can circulate between the systems. (See Figure 53 on page 124.) This plenum is available from Juniper Networks.

If you install an ERX-14xx model above an ERX-7xx model or ERX-310 router, there is no need to install a plenum between the units because the ERX-7xx models and ERX-310 routers vent air out the side of the chassis.

- Install heavier systems, such as an ERX-14xx model, on the bottom of the rack. Mount lighter systems, such as the ERX-310 router, higher in the rack.

Figure 15: ERX Routers Installed in Recommended Order



Safety Guidelines

Observe the following safety guidelines when mounting the router in a rack.



WARNING: Install equipment in the rack from the bottom upward. This helps to maintain the stability of the rack and reduces the chance of the rack tipping over.



WARNING: Three people are required to install the router in a rack: two to lift the system into position and one to screw it to the rack.



CAUTION: Evaluate the overall loading of the branch circuit before you install any equipment into a rack.



WARNING: Connect the router or rack to ground (earth), and ensure that a reliable grounding path is maintained in the rack.



WARNING: Do not work on the system or connect or disconnect cables during lightning activity.



WARNING: Be sure circuit breakers for the power source are in the OFF position before attaching power cables.



WARNING: Before servicing the router, turn off the power.



WARNING: Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. Metal objects heat up when connected to power and ground and can cause serious burns or become welded to the terminals.



WARNING: Do not insert any metal object, such as a screwdriver, into an open slot or the backplane. Doing so can cause electric shock and serious burns.



WARNING: The ERX-310 router AC model has more than one power-supply cord. Disconnect two power cords *before* servicing to avoid electric shock.

Preparing the Equipment Racks

Following your installation plan, use a tape measure and marking pen to measure and mark space on each equipment rack for each router component. For horizontal spacing, follow Network Equipment Building System (NEBS) requirements. If you choose not to install a plenum, be sure to include 2 U of space between each chassis for proper exhaust. A plenum, however, is highly recommended.

Installing the Router

To complete the installation of the router in a rack, you need:

- A Phillips screwdriver
- Depending on the router, up to eight 10-32 x 3/8 Phillips screws (provided with the router) for each router to be installed



WARNING: Three people are required to install the router in a rack: two to lift the system into position and one to screw it to the rack.



CAUTION: Make sure all persons handling a router wear an antistatic device.

To install the router in the rack:

1. With one person standing on the left side of the router and another standing on the right side, lift the router into the rack.
2. Position the router in its designated location in the equipment rack. Make sure the holes of the mounting brackets align evenly with the holes of the equipment rack on both sides.
3. Starting at the bottom, have the third person secure the router in the equipment rack by using the 10-32 x 3/8 Phillips screws.
4. Connect the necessary cables. (See “Cabling ERX Routers” on page 47 for instructions on installing the cables.)

Figure 15 on page 27 illustrates a distribution rack with one ERX-310 router, one ERX-7xx model, and one ERX-14xx model installed.

The Next Step

After you finish installing the router:

- If you need to install any modules, see “Installing Modules” on page 31.
- If the router was delivered with the modules already installed, see “Cabling ERX Routers” on page 47 for instructions on connecting cables.

Chapter 4

Installing Modules

This chapter describes how to install and remove E-series modules. For information about managing installed modules, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.

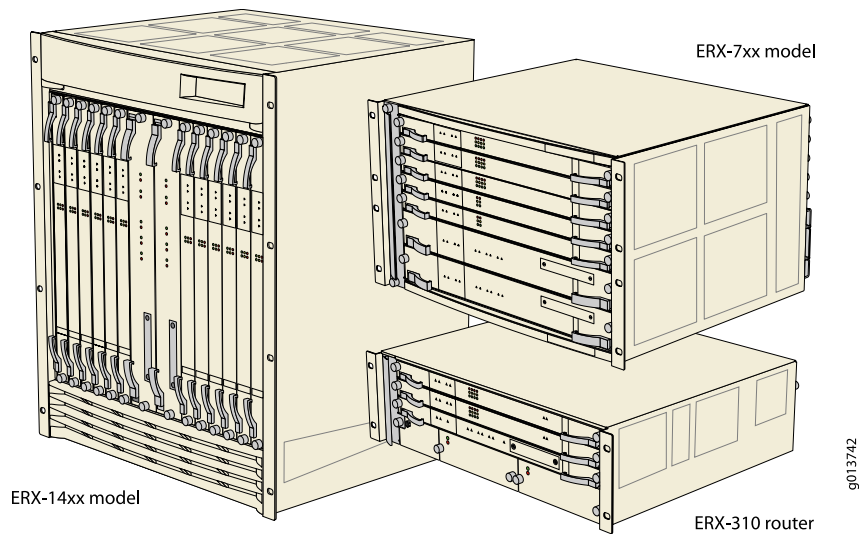
This chapter contains the following sections:

- Overview on page 31
- Safety Guidelines on page 36
- Installing SRP I/O and SRP Modules on page 37
- Installing Line and I/O Modules on page 39
- Removing a Line Module, SRP Module, or SRP I/O Module on page 41
- Installing Components for Line Module Redundancy on page 42
- Configuring Line Module Redundancy on page 46
- The Next Step on page 46

Overview

Line module slots are located in the front of each ERX chassis, while I/O module slots are located in the rear. See “ERX Overview” on page 3 for front and rear views of ERX routers.

In ERX-14xx models, modules mount vertically in a chassis with 14 slots. In ERX-7xx models and ERX-310 routers, modules mount horizontally in a chassis with 7 slots and 3 slots, respectively. See Figure 16 on page 32.

Figure 16: Orientation of Line Modules in ERX Routers

For details about available line modules and compatibility between line modules and SRP modules, see the *ERX Module Guide*.

Slot Groups

The slots in the ERX-1410 router and ERX-7xx models are divided into groups. The number of groups and number of slots per group depend on the system.

There are no slot groups in the ERX-1440 router or the ERX-310 router. In the ERX-310 router, slot 0 contains the SRP module and slots 1 and 2 each contain a line module.

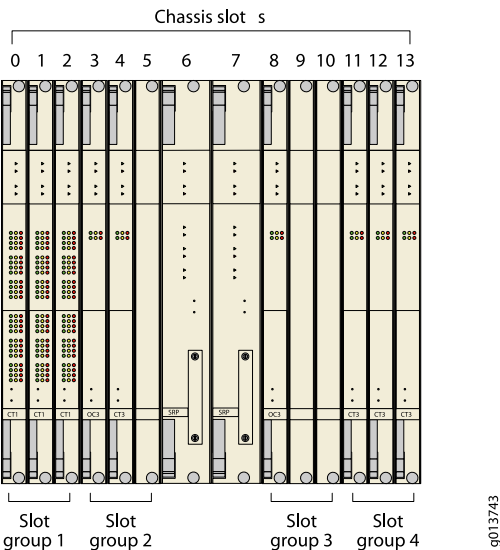
Slot Groups for the ERX-1410 Router

A slot group in the ERX-1410 router comprises three adjacent chassis slots. The groups for the ERX-1410 router consist of the following slots (Figure 17 on page 33):

- Slot group 1—Slots 0 through 2
- Slot group 2—Slots 3 through 5
- Slot group 3—Slots 8 through 10
- Slot group 4—Slots 11 through 13

Slots 6 and 7 are reserved for the SRP modules.

Figure 17: ERX-1410 Slot Groups



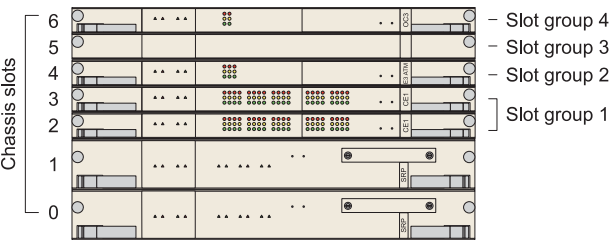
Slot Groups for the ERX-7xx Models

A slot group in an ERX-7xx model comprises one slot or two adjacent slots. The groups for an ERX-7xx model consist of the following slots (Figure 18 on page 33):

- Slot group 1—Slots 2 and 3
- Slot group 2—Slot 4
- Slot group 3—Slot 5
- Slot group 4—Slot 6

Slots 0 and 1 are reserved for the SRP modules.

Figure 18: ERX-7xx Model Slot Groups



Combinations of Line Modules In Slot Groups

For information about combinations of line modules in slot groups, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.

OC48 Line Modules

The ERX-1440 router with the SRP-40G + SRP module supports OC48 line modules. Other ERX routers do not support OC48 line modules.

An OC48 line module spans two slots in an ERX-1440 router. You can install this line module only in slots 2–3 and slots 4–5. Other slots in the system do not support this line module.

The corresponding OC48 Frame APS I/O module spans only one slot. Install the I/O module in the lower of the slots (either slot 2 or slot 4) that the line module spans.

GE-2 Line Modules

The ERX-1440 router with the SRP-40G + SRP module supports GE-2 line modules in all slots; however, full bandwidth is delivered only when the line module is in slot 2 or slot 4. The line module can be used with other SRP modules, but maximum line performance will not be achieved.

The ERX-310 router with the SRP-SE10G SRP module supports GE-2 line modules in both slots (1 and 2). Maximum line performance is achieved in either slot.

Other ERX routers do not support GE-2 line modules.

Managing Modules Using the Software

For information about software procedures associated with replacing and managing modules, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.

Hot-Swapping Modules

All ERX routers support hot-swapping of modules. Hot-swapping enables you to add or remove a module without powering down the system.

Protecting Modules and Slots

Each ERX chassis has an ESD (electrostatic discharge) grounding jack. See Table 4 on page 35 for locations. To prevent damage from electrostatic discharge, connect an antistatic wrist strap to the jack when handling components.

Figure 19: Connecting the Wrist Strap to the ERX-310 Router (Rear)

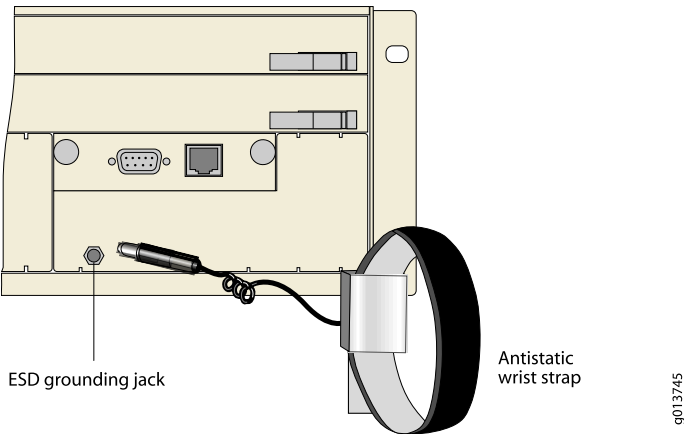


Table 4: Grounding Jack Locations

E-series Router	Location
ERX-14xx models	Front: inside front bezel in lower-left corner
	Rear: upper-right corner
ERX-7xx models	Rear: lower-right corner
ERX-310 router	Front: lower-left corner
	Rear: lower-right corner

To protect the modules and slots when installing modules, observe the following guidelines:

CAUTION: When handling modules, use an antistatic wrist strap connected to the router's ESD grounding jack. This action helps to protect the module from damage by electrostatic discharge.

CAUTION: Always handle the module by its edges. Do not touch the components, pins, leads, or solder connections.

CAUTION: If you meet strong resistance when attempting to seat the module using the ejectors, remove it from the chassis and confirm that the slot is designed to hold the module. Then verify, if applicable, that the module matches its corresponding module (I/O module or line module). Also, be sure that you have aligned the top and bottom edges in the correct matching tracks.



CAUTION: Be sure to cover every empty slot with a blank filler panel to protect the system from dust or other foreign substances and to ensure proper system cooling.



CAUTION: Do not discard the antistatic bag. When a module is not in use, store it in an antistatic bag.

Order of Installation

Before you attempt to install or replace a line module (inserted in the front of the chassis), make sure the corresponding I/O module (inserted in the rear of the chassis) is already in place. The slot diagnostics run when a line module is installed in a chassis slot. If the corresponding I/O module is not present, the diagnostics fail, and you need to remove and reinsert the module.

Required Tools and Safety Items

You need the following tools to install a line module:

- A Phillips screwdriver
- An ESD wrist strap

Safety Guidelines

Before and during the installation process, observe the following precautions:



WARNING: Do not work on the system or connect or disconnect cables during lightning activity.



WARNING: Be sure circuit breakers for the power source are in the OFF position before attaching power cables.



WARNING: Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. Metal objects heat up when connected to power and ground and can cause serious burns or become welded to the terminals.



WARNING: Do not insert any metal object, such as a screwdriver, into an open slot or the backplane. Doing so can cause electric shock and serious burns.



WARNING: Never attempt to repair parts of modules yourself. Only trained customer service personnel are authorized to service parts. Call Juniper Networks Customer Service to make arrangements to return defective modules for repair.

Installing SRP I/O and SRP Modules

You must install SRP modules in specific slots in each router. See Table 5 on page 37 for SRP module slot assignments.

Table 5: SRP Module Slot Assignments

Router	Slot
ERX-14xx models	6 and 7
ERX-7xx models	0 and 1
ERX-310 router	0



NOTE: Because of different physical dimensions and switch fabric capabilities, SRP modules are not interchangeable between systems. For example, the 10-Gbps SRP module used in ERX-7xx and ERX-14xx models cannot be used in an ERX-310 router, and vice versa.



NOTE: Install the SRP I/O module before you install the SRP module; otherwise, the system diagnostics will fail.

Installing an SRP I/O Module

To install an SRP I/O module:

1. Ground yourself by using an antistatic wrist strap or other device and connect it to the ESD grounding jack on the chassis.
2. With a Phillips screwdriver, loosen the captive screws that secure the blank filler panel covering the empty chassis slot, if present, and remove the filler panel.
3. Remove the SRP I/O module from its antistatic bag, being careful not to touch module components, pins, leads, or solder connections.
4. Slide the module into the chassis by placing it between the guides of the selected slot and pushing the module until it stops.



NOTE: See the figures in “ERX Overview” on page 3 for module locations.

5. Tighten the module's captive screws using a Phillips screwdriver. Turn both screws several times before tightening them completely to allow the module to sit correctly.

Installing an SRP Module

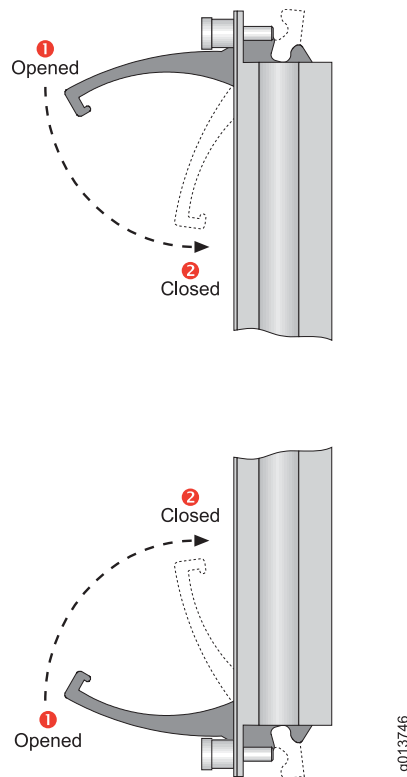
To install an SRP module:

1. Ground yourself by using an antistatic wrist strap or other device and connect it to the ESD grounding jack on the chassis.



NOTE: See the figures in “ERX Overview” on page 3 for module locations.

2. Choose the slot in which you want to install the module.
 - ERX-14xx models—Slot 6 or 7
 - ERX-7xx models—Slot 0 or 1
 - ERX-310 router—Slot 0
3. With a Phillips screwdriver, loosen the captive screws that secure the blank filler panel covering the empty chassis slot, if present, and remove the filler panel.
4. Remove the SRP module from its antistatic bag, being careful not to touch module components, pins, leads, or solder connections.
5. Verify that the ejectors are in the open position, as shown in Figure 20 on page 39.

Figure 20: Ejectors in the Open Position

6. Slide the module into the chassis by placing it between the guides of the selected slot and pushing the module until it stops.

The module stops sliding when the ejectors make contact with the front of the chassis.



CAUTION: If you meet strong resistance when attempting to seat the module using the ejectors, remove it from the chassis and confirm that the slot is designed to hold the module. Then verify, if applicable, that the module matches its corresponding module (I/O module or line module). Also, be sure that you have aligned the top and bottom edges in the correct matching tracks.

7. Insert the module into the backplane by simultaneously depressing both ejectors (as shown in Figure 20 on page 39) and exerting forward pressure on the module.
8. Tighten the module's captive screws using a Phillips screwdriver. Alternately turn each screw several times before tightening them completely to allow the module to sit correctly.

Installing Line and I/O Modules

This section describes the procedures for installing line and I/O modules.



NOTE: Install the I/O module before you install the corresponding line module; otherwise, the diagnostics fail and the line module's status is listed as inactive when you issue the **show version** command. If this occurs, remove and reinsert the line module.

Installing a Line Module or an I/O Module

To install a module:

1. Ground yourself by using an antistatic wrist strap or other device and connect it to the ESD grounding jack on the chassis.
2. Choose the slot where you want to insert the module.



NOTE: Line modules are in the front of the system and I/O modules are in the back of the system.

Table 6: Module Slot Assignments

Router	Module Slot
ERX-1440 router	<ul style="list-style-type: none"> ■ Install modules other than the OC48 modules in slots 0–5 and slots 8–13 ■ Install the OC48 line module in slots 2–3 and slots 4–5 ■ Install the corresponding I/O module only in the lower of the two slots (either slot 2 or slot 4) that the line module spans
ERX-1410 router	Install modules in slots 0–5 and slots 8–13
ERX-7xx models	Install modules in slots 2–6
ERX-310 router	Install modules in slots 1–2

3. With a Phillips screwdriver, loosen the screws that secure the blank filler panel covering the empty chassis slot, if present, and remove the filler panel.
4. Remove the module from its antistatic bag, being careful not to touch module components, pins, leads, or solder connections.
5. Verify that the ejectors are in the open position, as shown in Figure 20 on page 39.
6. Guide the module into the chassis by placing it between the guides of the selected slot and pushing the module until it stops.

The module stops sliding when the ejectors make contact with the front of the chassis.



CAUTION: If you meet strong resistance when attempting to seat the module using the ejectors, remove it from the chassis and confirm that the slot is designed to hold the module. Then verify, if applicable, that the module matches its corresponding module (I/O module or line module). Also, be sure that you have aligned the top and bottom edges in the correct matching tracks.

7. Insert the module into the midplane by simultaneously depressing both ejectors (as shown in Figure 20 on page 39) and exerting forward pressure on the module.
8. Tighten the module's captive screws using a Phillips screwdriver. Alternately turn each screw several times before tightening them completely to allow the module to sit correctly.

Removing a Line Module, SRP Module, or SRP I/O Module



NOTE: We recommend that you issue the **slot disable** command from the CLI before removing a line module or I/O module.



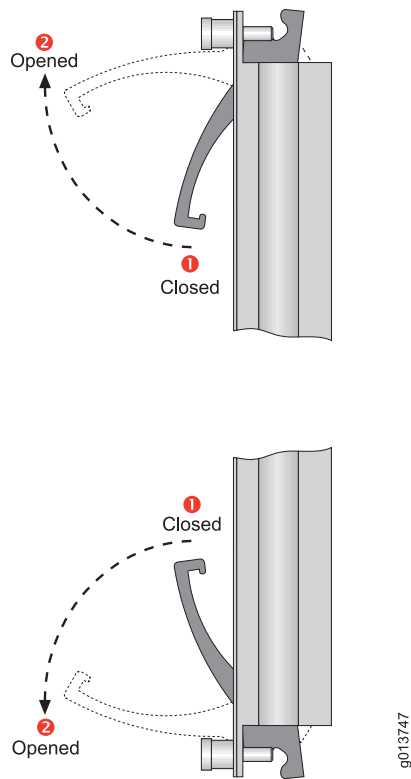
CAUTION: If you do not use the **halt** command before removing or powering down an SRP, the system's NVS card can become corrupted.

To remove a line module, SRP module, or SRP I/O module:

1. For SRP modules and SRP I/O modules, issue the appropriate **halt** command (**halt**, **halt primary-srp**, or **halt standby-srp**).

See *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules* for information about the **halt** commands.

2. Ground yourself by using an antistatic wrist strap or other device and connect it to the ESD grounding jack on the chassis.
3. Use a screwdriver to loosen the thumb screws located at the top and bottom of the module panel.
4. If the module has ejector handles, pull them to the open position, as shown in Figure 21 on page 42.

Figure 21: Ejectors in the Closed Position

5. Carefully slide the module out of the chassis.
6. Place the module in its antistatic bag, being careful not to touch module components, pins, leads, or solder connections.
7. Cover the empty chassis slot with a blank filler panel, and tighten the filler panel's captive screws using a Phillips screwdriver. Turn both screws several times before tightening them completely.

If you remove an I/O module and not the corresponding line module, the line module reboots. Its status becomes inactive when you issue the **show version** command.

If you remove a line module and do not delete the corresponding configuration, the status of the line module is listed as not present when you issue the **show version** command.

Installing Components for Line Module Redundancy

A spare line module provides redundancy for a group of identical line modules for ERX-7xx and ERX-14xx models only.



NOTE: The ERX-310 router does not support line module redundancy.

For line module redundancy to operate, you must install:

- The line modules, including the spare line module
- The redundancy midplane
- The I/O modules, including the spare I/O module

For more information, see “Redundancy Features” on page 14.



WARNING: Do not insert any metal object, such as a screwdriver, or place your hand into an open slot or the backplane when the router is on. Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. These actions can prevent electric shock and serious burns.



CAUTION: When handling modules, use an antistatic wrist strap connected to the router's ESD grounding jack, and hold modules by their edges. Do not touch the components, pins, leads, or solder connections. These actions help to protect modules from damage by electrostatic discharge.

Installing the Line Modules

To install the line modules in a redundancy group:

1. Install the spare line module in the lowest-numbered slot of the redundancy group.
2. Install the other line modules in the remaining slots. (See “Installing Line and I/O Modules” on page 39.)

Installing the Redundancy Midplane

To install the redundancy midplane in a redundancy group:



CAUTION: If you do not use the **halt** command before removing or powering down an SRP, the system's NVS card can become corrupted.

1. Enter the **halt** command.

See *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules* for information about the **halt** command.

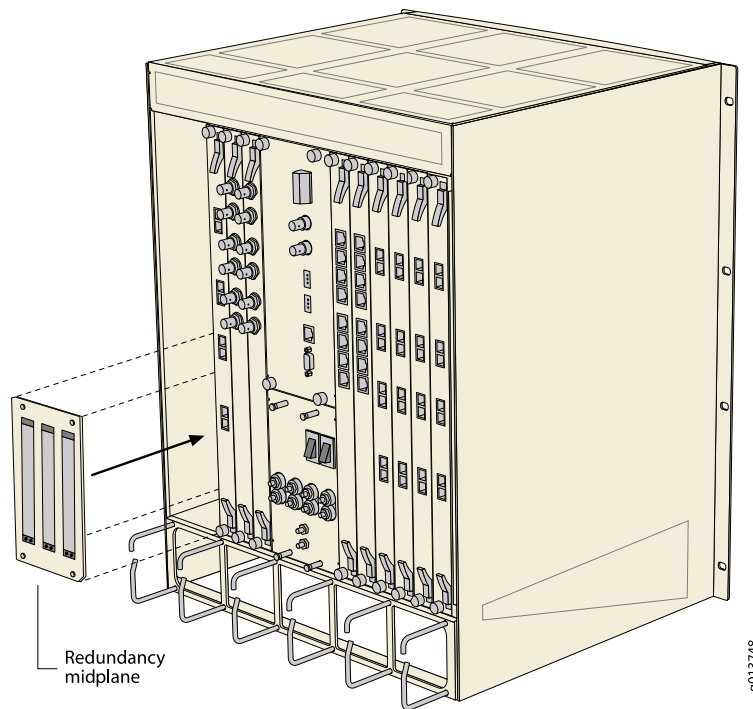


WARNING: Turn off the router before you install the redundancy midplane. Working inside the router when it is on can lead to electric shock and serious burns.

2. Turn off the power switches located on the power input module in the rear of the system (Figure 22 on page 45).
3. Remove the I/O modules from the slots that the redundancy midplane will span.
4. Place the redundancy midplane in the chassis so that it rests against the guides below the chassis midplane (Figure 22 on page 45).
5. Align the screw holes in the redundancy midplane with the screw holes in the guides so that the midplane covers the slots for the redundancy group.
6. Using a Phillips screwdriver and the screws provided, loosely attach, but do not tighten, the redundancy midplane to the guides.
7. Carefully insert an I/O module in one slot to ensure that the redundancy midplane is aligned correctly; then tighten the screws.



CAUTION: A misaligned redundancy midplane can result in bent pins on the backplane and midplane and poor contact between the I/O modules and the redundancy midplane.

Figure 22: Installing a Redundancy Midplane

Installing the I/O Modules

To install the I/O modules in a redundancy group:

1. Install the redundancy I/O module in the lowest-numbered slot of the redundancy group.



CAUTION: When setting up a redundancy group with line modules, be sure to install the redundancy I/O module in the lowest-numbered slot of the redundancy group. It is possible to install the redundancy I/O module in other slots; however, doing so can damage other I/O modules connected to the redundancy midplane.

2. Install the corresponding I/O module for the line module of each slot in the redundancy group. (See “Installing a Line Module or an I/O Module” on page 40.)
3. Cable each module to provide a path to the remote interface. (See “Cabling ERX Routers” on page 47.)

Verifying the Installation

To verify that the installation is complete:

1. After you have cabled the system for power, as described in “Cabling ERX Routers” on page 47, turn on the power switches.

The system reboots.

2. Issue the **show redundancy** command, and verify that the display shows the redundancy hardware.

Configuring Line Module Redundancy

For information about configuring line module redundancy, see *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*.

The Next Step

After you install the modules, you can connect cables to the system. See “Cabling ERX Routers” on page 47.

Chapter 5

Cabling ERX Routers

This chapter describes how to cable an ERX router. Before you cable the router, ensure that you have completed all installation instructions identified in previous chapters.

This chapter contains the following sections:

- Cabling Overview on page 47
- Required Tools, Wires, and Cables on page 48
- Cabling the SRP I/O Module on page 49
- Cabling the Router for Power on page 53
- Cabling I/O Modules on page 58
- The Next Step on page 63

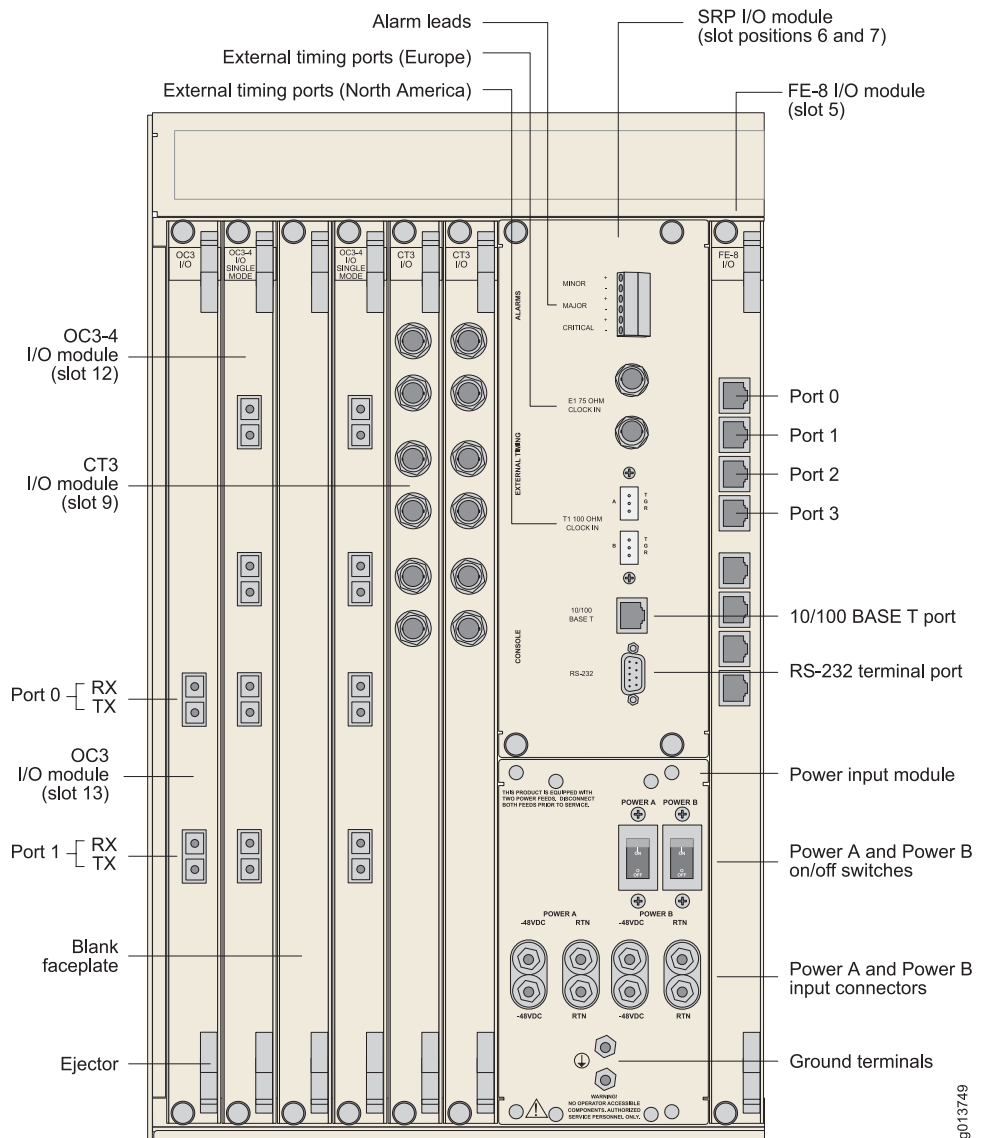
Cabling Overview

Cabling an ERX router requires the following main tasks:

1. Familiarize yourself with the module ports, and ensure that you have the cables and wires needed to complete each cabling procedure. (See Figure 23 on page 48.)
2. Read and understand all safety warnings. (See “Installation Guidelines and Requirements” on page 117.)
3. (Optional) Connect timing ports.
4. Connect the SRP I/O module to the network and to a management console.
5. Connect grounding wires to the router chassis.
6. Connect the power cables from the power source to the power input module.
7. Connect the line I/O modules to their appropriate network interface.



NOTE: We recommend that you use shielded cables where appropriate.

Figure 23: ERX Ports and Connectors (ERX-14xx Model Shown)

g013749

Required Tools, Wires, and Cables

Cabling your system takes only a few minutes. You need the following items and those listed in Table 7 on page 49 for proper installation:

- 1/8-inch flathead screwdriver
- 3/8-inch wrench or 3/8-inch nut-driver
- No. 2 Phillips screwdriver
- Ground wires—We recommend a minimum of 10-AWG ground wire.

- #10 (ERX-7xx and ERX-14xx models) or #8 (ERX-310 router) kep nut to connect the ground (earth) wire to the ground terminal.
- Power input module wiring—We recommend a minimum of 8-AWG wire for ERX-14xx models, 12-AWG wire for ERX-7xx models, and 14-AWG wire for ERX-310 routers (DC model) with a dual stud terminal lug with 5/8-inch spacing. For the ERX-310 router AC model, use a standard IEC power cord.

Consider the distance from the connection point and the configuration of the system when determining the size of wire used.

See “System Specifications” on page 109 for more information on router specifications.

Table 7: Required Cables

Connection	Port and Cable Used
Management connection between SRP I/O module and the LAN	One 10/100Base-T Ethernet management port with an RJ-45 connector
Management connection between SRP I/O module and a management console	One RS-232 port with a DB-9 connector for VT100 management access
Direct connections to I/O modules	See the <i>ERX Module Guide</i> for specific I/O module connector information



NOTE: If you plan to use a cable-management bracket (ERX-7xx and ERX-14xx models only), install it before you begin cabling your router. Cable-management brackets are helpful to keep network interface cables untangled and orderly and to prevent cables from hindering access to other slots. See “Installing a Cable-Management Bracket on ERX-7xx Models” on page 92.

Cabling the SRP I/O Module

Before powering up the router, you must set up a management console. The console enables you to communicate with your system during the power-up process and to manage your system using the command-line interface (CLI).

When connecting a console directly to the SRP I/O module, use a cable appropriate for your terminal connector. The cable must have a female DB-9 connector to attach to the RS-232 port on the SRP I/O module. See Figure 24 on page 51 and Figure 25 on page 52.

The console port is considered a data terminal equipment interface (DTE). Direct connection to a terminal or PC (which also have DTE interfaces) requires a crossover cable.



NOTE: The alarm function on the SRP I/O module is currently not implemented.

Only ERX-7xx and ERX-14xx models have external timing ports and alarm leads located on the SRP I/O module. All ERX routers have console ports located on the SRP I/O module. See Table 8 on page 50 for details on each component.

Table 8: SRP I/O Ports

Port	Description
Alarm leads (<i>ERX-7xx and ERX-14xx models only</i>)	Six terminal blocks for external alarm contacts; use a minimum 26-AWG for each (currently not implemented)
External timing ports (<i>ERX-7xx and ERX-14xx models only</i>)	<ul style="list-style-type: none"> ■ Two 3-pin wire-wrap posts for US external clock sources; primary (A) and secondary (B) ■ Two BNC connectors for E1 clock sources; primary (A) and secondary (B)
Management console ports	<ul style="list-style-type: none"> ■ One 10/100Base-T Ethernet management port with an RJ-45 connector ■ One RS-232 console port with a DB-9 connector for VT100 management access

External Timing Ports



NOTE: This section applies to ERX-7xx and ERX-14xx models only. The ERX-310 router does not support external timing.

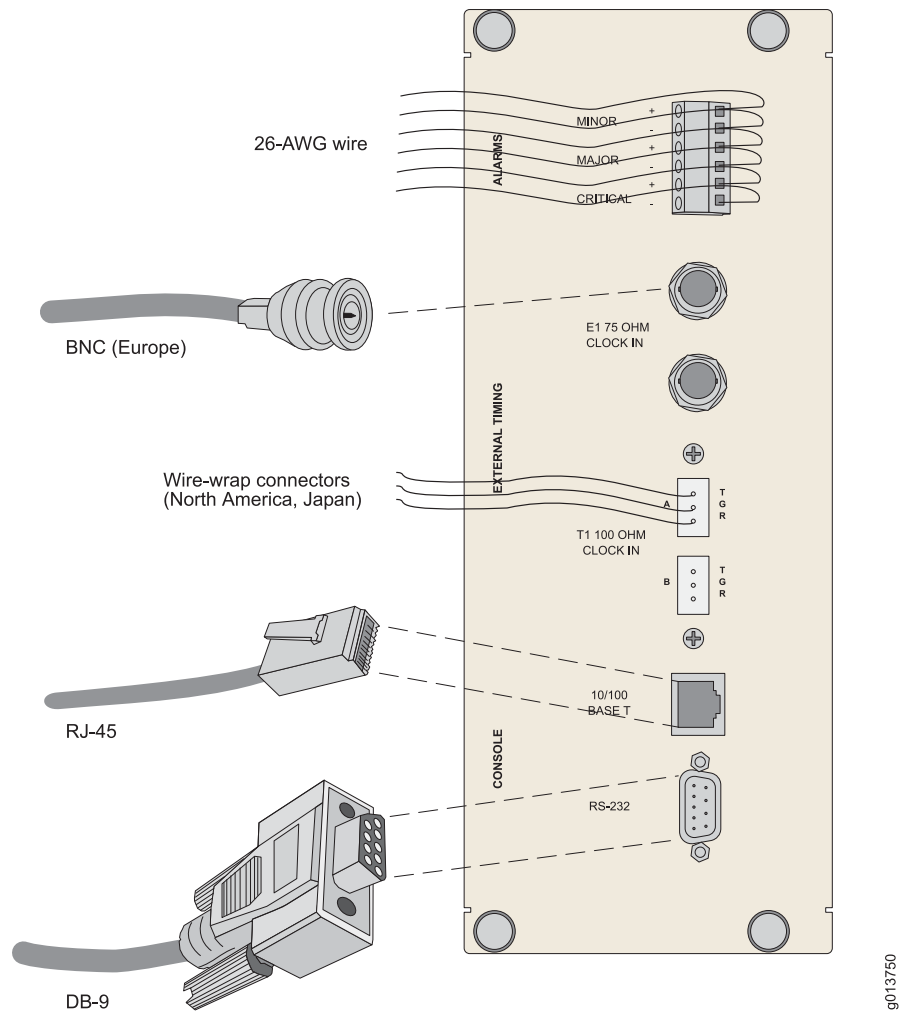
The SRP I/O module has two input ports for external clock sources. These ports provide a way to ensure that the router system clock remains synchronized with the network's system clock. The primary clock is labeled A; the secondary, redundant clock is labeled B.

Use the connectors appropriate for your locale (European or North American standard):

- European—Two 75-ohm E1 2.048-Mbps inputs with BNC connectors
- North American—Two 100-ohm T1 inputs with three pin wire-wrap connectors. Pins are labeled T (tip), G (ground), and R (ring). We recommend using 26-AWG wire minimum.



NOTE: Use shielded cables to connect the external clock sources to the clock source input ports.

Figure 24: SRP I/O Module for ERX-14xx Models

To connect the clock source input ports:

- Depending on the connector type, complete one of the following tasks:
 - E1: Attach the BNC connector to Clock A's external timing port.
 - T1: Wrap the tip wire on pin marked T of Clock A's external timing port, the ground wire on G pin, and the ring wire on R pin.



NOTE: You can use a wire-wrap gun to attach wires to pins.

- Attach the opposite end of the external timing cable or wires to your network's clock source A.
- Repeat Steps 1 and 2 for the Clock B connections.

Management Ports



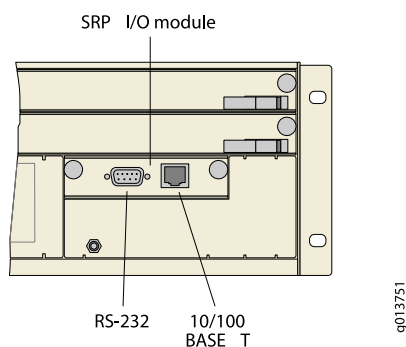
NOTE: This section applies to all ERX routers.

The Console section of the SRP I/O module has two ports for management access. (See Figure 24 on page 51 and Figure 25 on page 52.)

- The 10/100Base-T Ethernet port accepts an RJ-45 (male) connector, providing an out-of-band connection for LAN access through a Telnet session or SNMP.
- The RS-232 port accepts a DB-9 (female) connector for direct CLI access from a console terminal.

The console port is considered a data terminal equipment interface (DTE). Direct connection to a terminal or PC (which also have DTE interfaces) requires a crossover cable.

Figure 25: SRP I/O Module for the ERX-310 Router



See “Accessing ERX Routers” on page 69 for more information about management access.

Connecting to the Network

To connect the router to the network:

1. Insert an Ethernet cable (RJ-45) connector into the 10/100Base-T (RJ-45) port on the SRP I/O module until it clicks into place.
2. Connect the other end of the cable to the appropriate Ethernet network for an out-of-band connection.

Connecting to a Console Terminal

When you connect a console directly to the router SRP I/O module, use a cable appropriate for your terminal connector. The cable must have a female DB-9 connector to attach to the RS-232 port on the SRP I/O module.

To connect the console to the SRP I/O module:

1. Insert the female DB-9 connector into the RS-232 port, and tighten the screws.
2. Connect the other end of the cable to your terminal's serial port (VT100/ANSI).

Cabling the Router for Power

After you have correctly cabled the modules and I/O modules, you must attach grounding and electrical wires before you attempt system power-up. Three main tasks are involved:

1. Switch all router power switches to OFF.



CAUTION: Switches may have inadvertently flipped to ON during shipping and installation.

2. Connect the grounding wires to the chassis.



WARNING: Always connect the grounding wires first (before connecting the power cables) and disconnect them last when installing or servicing the router.

3. Connect the power cables (AC or DC) to the power input modules.

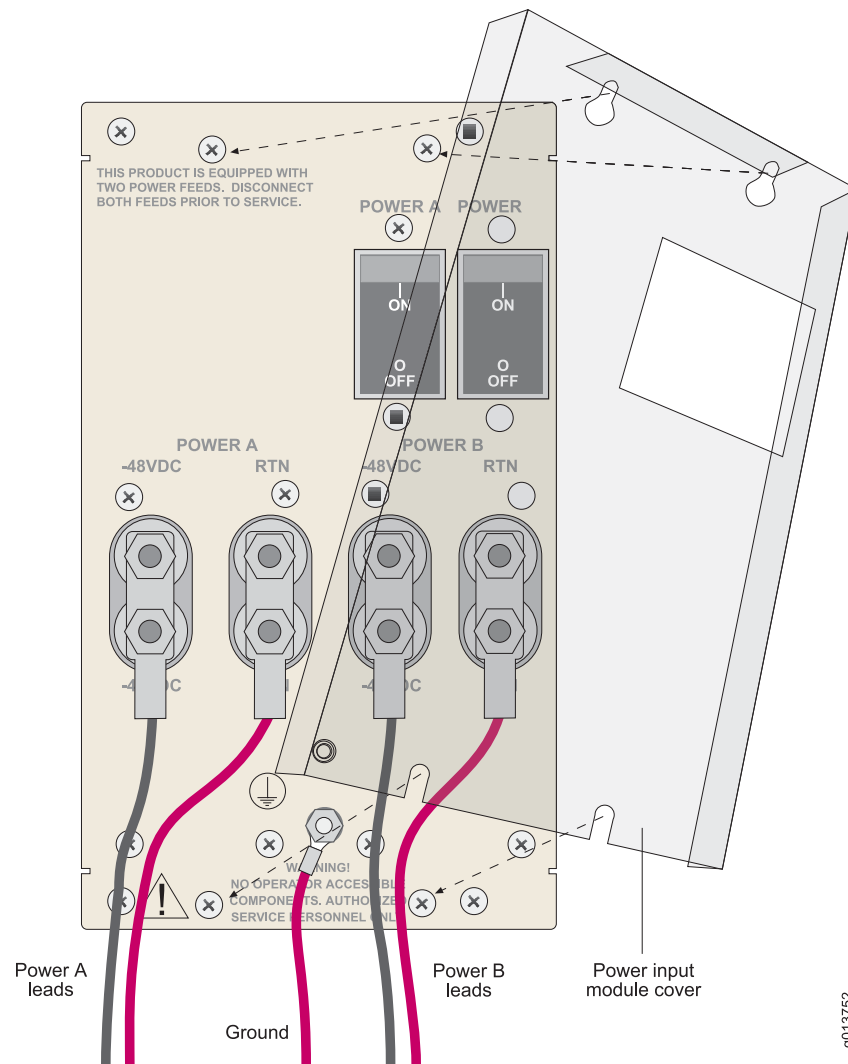
See “System Specifications” on page 109 for the power requirements for ERX routers. Table 9 on page 53 identifies the power input module cabling requirements, and Figure 26 on page 55 shows the main components of a power input module.

Table 9: Power Input Module Cables and Wires Needed

Cable/Wire	From	To
ERX-14xx models		
One 10-AWG ground wire	Power input module ground terminal	Termination ground
Two 8-AWG wire leads	Power input module Power A –48 VDC and RTN leads	Appropriate leads on power source No.1
Two 8-AWG wire leads	Power input module Power B –48 VDC and RTN leads	Appropriate leads on power source No.2
ERX-7xx models		
One 10-AWG ground wire	Power input module ground terminal	Termination ground
Two 12-AWG wire leads	Power input module Power A –48 VDC and RTN leads	Appropriate leads on power source No.1
Two 12-AWG wire leads	Power input module Power B –48 VDC and RTN leads	Appropriate leads on power source No.2
ERX-310 router		

Table 9: Power Input Module Cables and Wires Needed *(continued)*

Cable/Wire	From	To
One 10-AWG ground wire	Power input module ground terminal	Termination ground
Two 14-AWG wire leads (<i>DC model only</i>)	Power input module Power A –48 VDC and RTN leads	Appropriate leads on power source No.1
Two 14-AWG wire leads (<i>DC model only</i>)	Power input module Power B –48 VDC and RTN leads	Appropriate leads on power source No.2
One AC power cord (<i>AC model only</i>)	Power input module AC power IEC receptacle	Appropriate AC power supply

Figure 26: Power Input Module for ERX-14xx Models**Task 1: Turn Off All Router Power**

Before starting, you must switch all router power switches to OFF.

To turn off the router, push each power switch to the OFF position.

Task 2: Connect the Grounding Cables

All ERX routers have two grounding studs located in the rear of the chassis, near the power inputs. Each stud provides grounding for a single power unit.

To ground each power unit:

1. Locate the grounding studs on the router (Figure 26 on page 55 and Figure 27 on page 57).
2. Remove the nuts and locking washers from the grounding studs.



NOTE: We recommend a minimum of 10-AWG ground wire with a ring style terminal.

3. Place the grounding cable lead on one of the grounding studs and tighten the nuts to secure the connection.
4. Connect the other end of the ground cable to the appropriate ground termination lead.
5. Repeat Steps 3–4 for the remaining grounding stud.



NOTE: When grounding an ERX router, leave a service loop in the grounding cable to ensure that the grounding cable is the last cable to disconnect from the shelf if strain is placed on the electrical cables.

Task 3: Connect the Power Cables

To connect power cables to the router, follow these steps. Refer to Figure 26 on page 55, Figure 27 on page 57, and Figure 28 on page 58 as needed.

ERX-7xx Models, ERX-14xx Models, ERX-310 Router (DC Model)



WARNING: Before you begin this procedure, ensure that all power switches are in the OFF position.

1. Be sure you have completed Task 1 and Task 2 in the previous sections.
2. If applicable, loosen the screws from the clear power input module cover and remove it.



WARNING: Be sure the power source is turned off, the router is turned off, and proper grounding wires are attached before continuing with this procedure.



WARNING: The wiring color code of the power cables depends on the color coding of the DC power source installed at your site. Color code standards for DC wiring do not exist. To ensure that the correct polarity is connected to the router power units, confirm the connection of the power cables to the + (positive) and – (negative) leads at the power source.

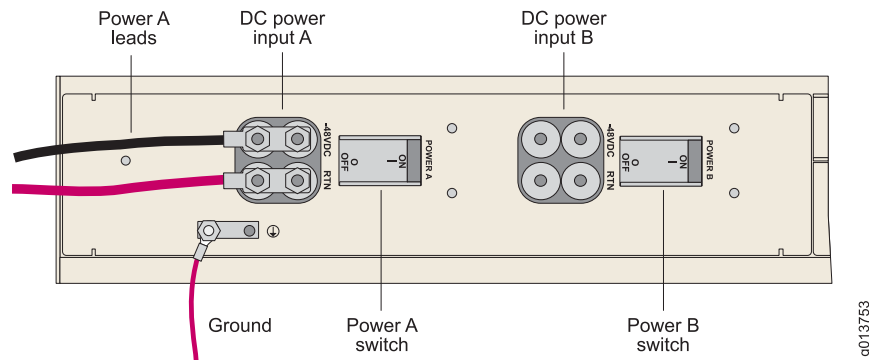
3. Remove the nuts and locking washers from the posts for the power input (A or B) using a small insulated adjustable wrench.
4. Place one negative (neutral) cable lead on the post labeled -48 VDC.
5. Replace the locking washers and nuts, and tighten the nuts to secure the connection.
6. Place the other cable lead on the post labeled RTN.
7. Replace the locking washer and nut, and tighten the nut to secure the connection.
8. Attach the opposite end of Power A's wire leads to the appropriate leads on your power source.



NOTE: To provide redundancy, do not terminate Power A and Power B leads at the same power source.

9. Place the clear plastic guard over the terminal posts, and secure it in place by tightening the four screws.
10. Repeat Steps 1–9 for each power input module in your configuration.

Figure 27: ERX-310 Router, Rear View (DC Model)



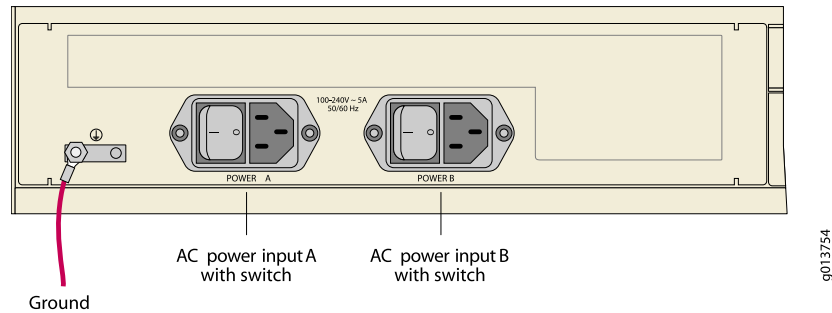
ERX-310 Router (AC Model)

1. Insert the power cord into the AC power IEC receptacle. (See Figure 28 on page 58.)
2. Insert the other end of the power cord into an appropriate AC power source.



NOTE: To provide redundancy, do not terminate Power A and Power B leads at the same power source.

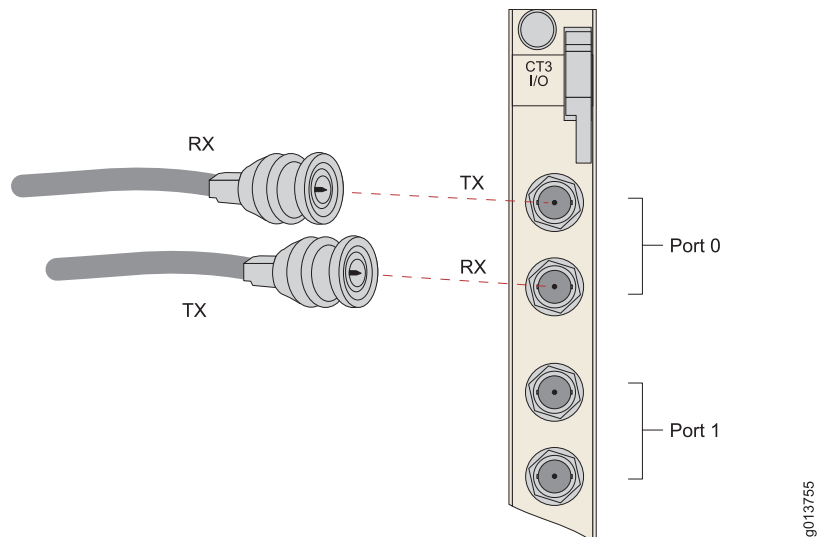
3. Repeat Steps 1–2 for the other power input module, if needed.

Figure 28: ERX-310 Router, Rear View (AC model)

Cabling I/O Modules

This section illustrates the common connector types used with ERX I/O modules. For information about the connectors on the different line modules, see the *ERX Module Guide*.

BNC Connectors

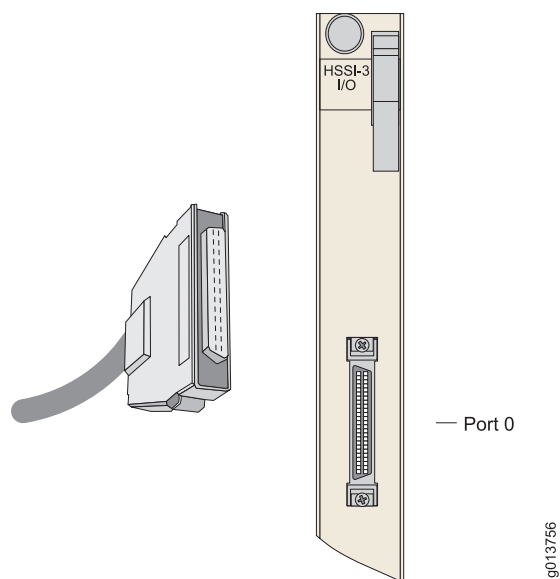
Figure 29: I/O Module with BNCs

HSSI Connectors

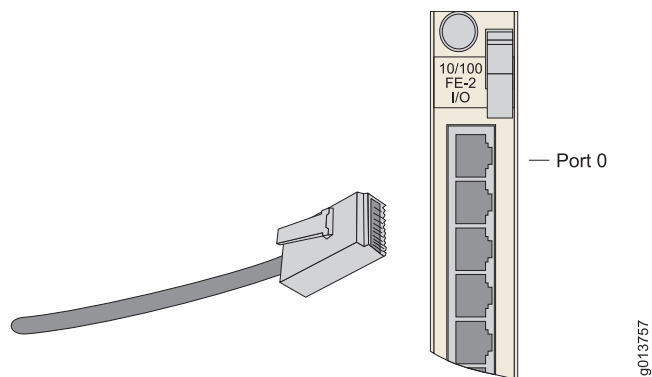
The HSSI I/O module uses a standard 50-pin HSSI connector.



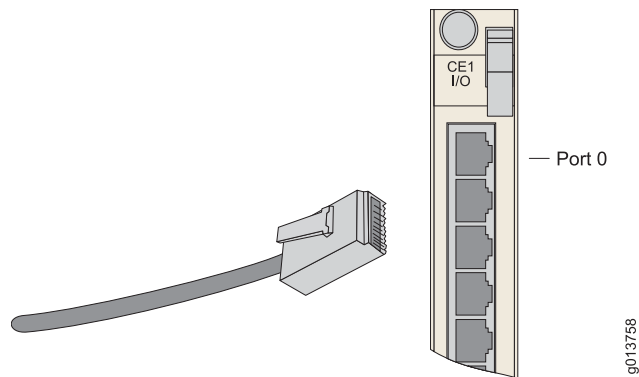
CAUTION: Do not terminate HSSI connections with SCSI connectors. Although SCSI connectors look very similar to HSSI connectors, using SCSI connectors on HSSI connections can lead to data loss.

Figure 30: HSSI I/O Module with 50-Pin HSSI Connector**RJ-45 Connectors**

When inserting an RJ-45 connector, be sure it clicks into the port.

Figure 31: I/O Module with RJ-45 Connector**RJ-48C Connectors**

When inserting an RJ-48C connector, be sure it clicks into the port.

Figure 32: I/O Module with RJ-48C Connectors

LC Duplex Connectors

In accordance with EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001), multimode I/O modules with LC connectors are defined as follows:

CLASS 1 LED PRODUCT.

In accordance with EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001), single-mode I/O modules with LC connectors are defined as follows:

CLASS 1 LASER PRODUCT.



WARNING: Do not look directly into LC-style fiber connectors. The fiber-optic laser used in single-mode fiber (SMF) meets the regulatory requirements for casual exposure to the eye; however, looking directly into a laser can cause eye damage.



WARNING: IEC 825, Class 1 laser fiber connectors are for connection only to Class 1 laser devices.

SC Duplex Connectors

In accordance with EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001), multimode I/O modules with SC connectors are defined as follows:

CLASS 1 LED PRODUCT.

In accordance with EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001), single-mode I/O modules with SC connectors are defined as follows:

CLASS 1 LASER PRODUCT.



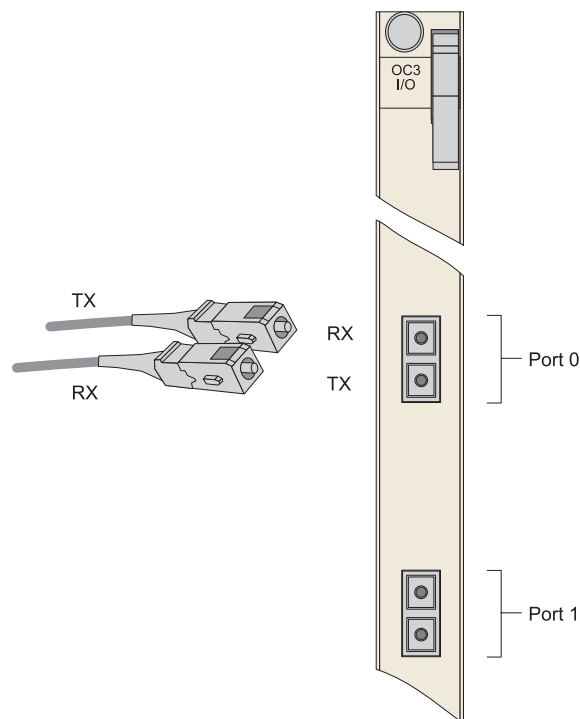
WARNING: Do not look directly into SC-style fiber connectors. The fiber-optic laser used in single-mode fiber (SMF) meets the regulatory requirements for casual exposure to the eye; however, looking directly into a laser can cause eye damage.



WARNING: IEC 825, Class 1 laser fiber connectors are for connection only to Class 1 laser devices.

SC duplex connectors have the same basic shape as LC duplex connectors, but are slightly larger. See Figure 33 on page 61.

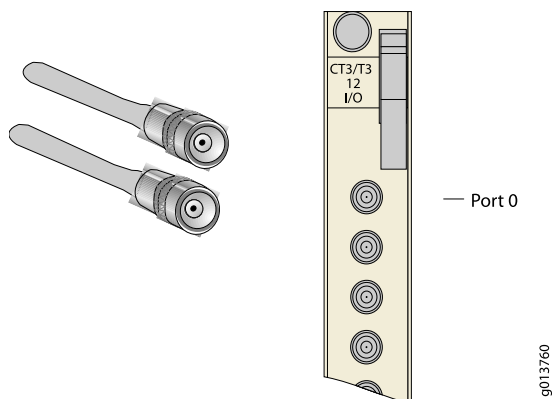
Figure 33: I/O Module with SC Full Duplex Connectors



g013759

SMB Connectors

To cable I/O modules with SMB connectors, pull back the metal sheath on the connector, insert the connector into the selected port, and release the metal sheath.

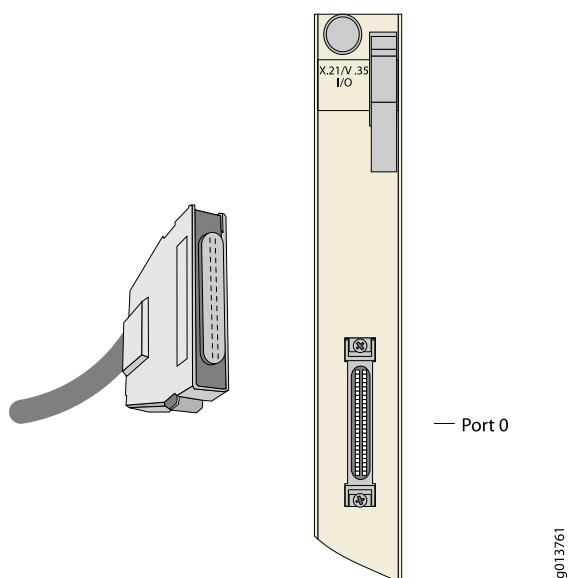
Figure 34: I/O Module with SMB Connectors

X.21/V.35 Connectors

Four cables are available for the X.21/V.35 I/O modules:

- X.21 DCE cable (terminated with 8 female X.21 connectors)
- X.21 DTE cable (terminated with 8 male X.21 connectors)
- V.35 DCE cable (terminated with 8 female V.35 connectors)
- V.35 DTE cable (terminated with 8 male V.35 connectors)

Each 200-pin proprietary socket on the I/O module provides connections to 8 V.35 or X.21 ports. The remote end of the cable is terminated with either 8 X.21 connectors or 8 V.35 connectors. The cable you attach to the port on the I/O module determines whether the connection is X.21 or V.35 and DCE or DTE.

Figure 35: X.21/V.35 Module with 50-Pin X.21/V.35 Connector

Redundant Ports

Some modules have redundant ports. See the *ERX Module Guide* for specifications. Cabling both ports provides a redundant path to the module.



CAUTION: For port redundancy to operate correctly on a GE I/O module that supports SFPs, both the primary and redundant ports on an E-series GE I/O module must use the same type of SFP.

The Next Step

See “Powering Up ERX Routers” on page 65.

Chapter 6

Powering Up ERX Routers

This chapter describes how to power up an ERX router and determine whether it has booted properly. It contains the following sections:

- Before You Power Up the System on page 65
- Powering Up on page 65
- Status LEDs on page 66
- Powering Down on page 67
- The Next Step on page 67

Before You Power Up the System

Before powering up the system, make sure you complete the following tasks. See the appropriate chapters in this guide for information about these tasks.



WARNING: Be sure the power source is turned off and the system is turned off before you perform the installation tasks.

- Installing SRP I/O and SRP Modules on page 37
- Installing Line and I/O Modules on page 39
- Cabling the SRP I/O Module on page 49
- Cabling the Router for Power on page 53
- Cabling I/O Modules on page 58

Powering Up

For specifications on the electrical requirements for the system, see “System Specifications” on page 109. For details on the power consumed by the different ERX modules, see the *ERX Module Guide*.



NOTE: In this procedure, we assume that the system is already connected to a power source. See “Cabling ERX Routers” on page 47.



CAUTION: Evaluate the overall loading of the branch circuit before you install any equipment into a rack.

To power up the system:

1. Verify that the power source is operational and turned on.
2. Inspect all grounding and power connections to the router chassis.
3. Confirm that all connections are secure.
4. Switch the power switches to ON.
5. Monitor the LEDs on the front of the SRP modules to verify that the system is booting properly. See Table 12 on page 101 in “Troubleshooting” on page 95 for LED status explanations.

When the prompt appears on the system console, the system is in User Exec mode and is ready to be configured:

```
host1>
```

6. Enter the **enable** command to access Privileged Exec mode:

```
host1>enable
host1#
```

In Privileged Exec mode you can begin to configure the system. See *JUNOS System Basics Configuration Guide, Chapter 2, Command-Line Interface* for more information.

Initialization Sequence

Each line module is initialized independently. As a result, the CLI on the SRP module can become available before the line modules have completed initialization. Commands relating to a line module might fail if the module has not completed initialization. You can use the **show version** command to display line module status. Do not enter commands for a line module until its state is listed as online.

Status LEDs

Upon initial power-up, the components of the router run boot code, go through a series of self diagnostic tests, and synchronize with each other.

When the tests are complete, use the LEDs on each module to determine the status of the router. Observe the line module and SRP module LEDs in the front, and the I/O line module and SRP I/O module LEDs in the rear.

See “Troubleshooting” on page 95 for information on the system's LEDs.

Powering Down

If you need to power down or remove the SRP module, first enter the **halt** command to temporarily suspend the system's operation. See *JUNOS System Basics Configuration Guide, Chapter 5, Managing the System* for more information.



CAUTION: If you do not use the **halt** command before removing or powering down an SRP module, the system's NVS card might become corrupted.

If you shut down the system improperly, it runs an investigation of the file allocation table (FAT) the next time it reboots.

The Next Step

If you have problems powering up the system, see “Troubleshooting” on page 95 for help.

If the system boots properly, see “Accessing ERX Routers” on page 69.

Chapter 7

Accessing ERX Routers

This chapter discusses how to access the system to manage it. Managing your router includes both configuring and monitoring it. For basic information on the management of the system, see *JUNOS System Basics Configuration Guide, Chapter 5, Managing the System*.

This chapter contains the following sections:

- Setting Up Management Access on page 69
- Console Port Setup on page 69
- Telnet Setup on page 72
- SNMP on page 73
- The Next Step on page 73

Setting Up Management Access

Before you power up the system, you must set up a management console. (See “Connecting to a Console Terminal” on page 52.) You use the console to communicate with the system during the power-up process, set an IP address, and manage the system using the command-line interface (CLI).

You can manage and monitor the router through either of these methods:

- Console terminal—Connect a console (PC, Macintosh, or UNIX workstation) directly to the system's RS-232 serial port.
- Remote console—Connect the 10/100Base-T port on the SRP I/O module to an Ethernet network, and run Telnet from a remote console.

For initial access to the system, you need to physically connect your console directly to the system's RS-232 port. Through this connection you can use the CLI to set an IP address on the system. After you configure the IP address, you can access the system remotely (for example, via Telnet).

Console Port Setup

You can connect a console terminal (PC, Macintosh, or UNIX workstation) directly to the SRP I/O module via the RS-232 terminal port. When you connect a console directly to the system, you can configure the system without an IP address.

To communicate with the system, you must have a terminal emulation program running on your PC or Macintosh. You can use any terminal emulation program, such as HyperTerminal. A UNIX workstation can use the emulator TIP.

Using HyperTerminal

If your console uses a version of Microsoft Windows (such as Windows 95 or Windows NT 4.0) that supports the HyperTerminal application, you can access the system via HyperTerminal.

1. Click the Start button and select Programs, Accessories, and HyperTerminal.
2. In the HyperTerminal window, select HyperTerminal.
3. In the Connection Description window, enter a name for your router (for example, erx1400) in the Name field.
4. Select any icon to represent your terminal emulation, and click OK.
5. In the Connect To dialog box, in the Connect using field, select the appropriate COM port to use (for example, COM1), and click OK.
6. In the COM1 Properties window, select the following settings:
 - Bits per second: 9600
 - Data bits: 8
 - Parity: None
 - Stop bits: 1
 - Flow control: Xon/Xoff
7. Click OK.

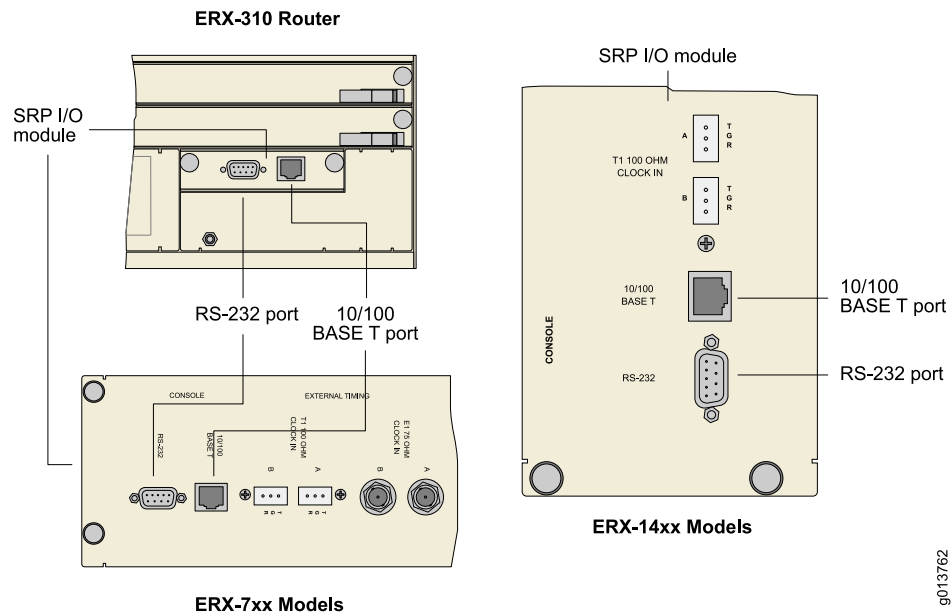
Connecting Directly to the Router

When you connect a console directly to the system, use a cable appropriate for your terminal connector. The cable must have a female DB-9 connector to attach to the RS-232 port on the system.

The console port is considered a data terminal equipment interface (DTE). Direct connection to a terminal or PC (which also have DTE interfaces) requires a crossover cable.

To connect a console directly to the system:

1. Connect the female DB-9 connector to the RS-232 port on the system's SRP I/O module. See Figure 36 on page 71.

Figure 36: Management Ports for ERX Routers

9013762

2. Connect the crossover adapter connector to your PC's serial port.
3. Power up the system.

When you power up the system, the CLI appears on your console's screen. The system is now in User Exec mode, and you can begin configuration. For more information on using the CLI and configuring the system, see the *JUNOS System Basics Configuration Guide*.



NOTE: Direct access through the RS-232 serial port enables you to monitor the system while it boots.

Assigning an IP Address

When your console is ready to communicate with the system, power up the system. (See “Powering Up ERX Routers” on page 65.) Then set an IP address for the system. The system powers up in User Exec mode. To assign an IP address:

1. Enter the **enable** command at the User Exec prompt.

```
host1>enable
host1#
```

The system is now in Privileged Exec mode.

2. Set an IP address on the Ethernet interface:
 - Substitute the slot number where the SRP module is located for the *slotnumber* variable. For redundant SRP modules, specify the lowest slot number of the two (for example *0/0* or *6/0*).

- Use an IP address valid for the system.

```
host1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#interface FastEthernet slotnumber/0
host1(config-if)#ip address 10.10.7.3 255.255.255.0
```

3. Continue to configure the system's parameters as needed.

After you have assigned an IP address to the system, you can communicate remotely by running Telnet over an Ethernet network. See “Telnet Setup” on page 72.

Telnet Setup

After you have configured an IP address for the system, you can run Telnet from a host to access the system through its Ethernet port. To connect the Ethernet port to the network:

1. Connect an Ethernet cable (RJ-45) to the system's 10/100Base-T (RJ-45) port on the SRP I/O module.
2. Connect the other end of the cable to the appropriate Ethernet network for an out-of-band connection.

Before you can access the system with Telnet, you must either configure a password for Telnet access or disable the password requirement from the management console. In the following example, you disable the password.

1. Enter the **enable** command.

```
host1>enable
host1#
```

The system is now in Privileged Exec mode.

2. Enter the **configure** command.

```
host1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#
```

The system is now in Global Configuration mode.

3. Enter the **line** command.

```
host1(config)#line vty 0 4
host1(config-line)#
```

The system is now in Line Configuration mode.

4. Disable the password.

```
host1(config-line)#no login
```



NOTE: In this example, you disabled the password requirement, but you can choose to set a password instead. See *JUNOS System Basics Configuration Guide, Chapter 8, Passwords and Security* for information on setting a password.

5. Run Telnet from a host on the same Ethernet network as the system.
6. Enter the IP address of the system to open the Telnet session.

The User Exec prompt appears when the Telnet session to the system is established.

```
host1>
```

7. Enter the **enable** command.

```
host1>enable
host1#
```

The system is now in Privileged Exec mode.

8. Enter the **configure** command.

```
host1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#
```

The system is now in Global Configuration mode, from which you can configure the system. See *JUNOS System Basics Configuration Guide, Chapter 2, Command-Line Interface*.



CAUTION: Do not change the IP address for the Ethernet interface that you are using to communicate with the system. If you change the address, you will lose the Telnet session.

SNMP

The system supports Simple Network Management Protocol (SNMP), a standard management protocol for IP networks. You can configure the system as an SNMP agent.

As an SNMP agent, the system provides access to management information that it maintains. See *JUNOS System Basics Configuration Guide, Chapter 4, Configuring SNMP* for information on SNMP. See *JUNOS Command Reference Guide A to M* and *JUNOS Command Reference Guide N to Z* for the commands that are available for configuring the system as an SNMP agent.

The Next Step

See “Maintaining ERX Routers” on page 77.

Part 3

Hardware Maintenance, Replacement, and Troubleshooting Procedures

- Maintaining ERX Routers on page 77
- Troubleshooting on page 95

Chapter 8

Maintaining ERX Routers

This chapter lists the tools, items, and steps needed for installing and uninstalling ERX router components. Other maintenance procedures must be performed by an authorized Juniper Networks technician.

This chapter contains the following sections:

- Required Tools and Items on page 77
- Storing Modules and Components on page 78
- Cleaning the System on page 78
- Upgrading from Release 5.1.1 or Lower-Numbered Releases to Release 6.x.x or Higher-Numbered Releases on page 78
- Upgrading NVS Cards on SRP Modules on page 79
- Replacing an NVS Card on page 81
- Upgrading Memory on SRP Modules on page 82
- Replacing SFPs on I/O Modules on page 85
- Replacing Fan Trays on page 88
- Installing a ERX-14xx Model Air Filter on page 91
- Installing a Cable-Management Bracket on ERX-7xx Models on page 92
- Replacing a Power Input Module on page 93

Required Tools and Items

You will need the following tools and other items to replace ERX router components:

- Flathead and Phillips screwdrivers
- Insulated adjustable wrench
- Antistatic wrist strap
- Antistatic bags (or other protective packaging to hold components)
- Plastic boots or other protective cover for fiber-optic SC and LC connectors

Storing Modules and Components

Retain the packaging in which a module or component was shipped, and use this packaging to store the item. Modules are shipped in antistatic bags and protective packaging. Components, such as transceivers and nonvolatile storage (NVS) cards, are shipped in antistatic plastic containers within an antistatic padded box.



CAUTION: Failure to store electronic modules and components correctly can lead to damage of these items.

Follow these guidelines for storing modules and components:

- Store each module in a separate antistatic bag.
- Store components in an antistatic plastic container. Some of these containers can accommodate several components in separate compartments.
- Do not store multiple modules or components in an antistatic bag or container where they can touch other items.
- (Optional) Store the item in its antistatic bag or container within the protective packaging or padded box that the item was shipped in.

Cleaning the System

Dust is attracted to the side of the system on which the air intake vent is located. Clean this side of the system with a dry cloth every few weeks to prevent excessive accumulation of dust. This cleaning helps to maintain the efficiency of the cooling system and prevent damage to electronic components.



WARNING: Do not insert any metal object, such as a screwdriver, or place your hand into an open slot or the backplane when the router is on. Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. These actions prevent electric shock and serious burns.



CAUTION: When cleaning the system, wear an antistatic wrist strap connected to the system's ESD grounding jack. This action helps to protect modules from damage by electrostatic discharge.

Upgrading from Release 5.1.1 or Lower-Numbered Releases to Release 6.x.x or Higher-Numbered Releases

Release 5.1.1 or lower-numbered releases support application images only up to 172 MB. To install larger application images for Release 6.0.0 and higher-numbered releases, you must first install Release 5.1.2 (or a higher-numbered 5.x.x release). This enables the system to support application images greater than 172 MB. For

example, you cannot go from Release 5.1.1 to Release 7.2.0 without first upgrading to Release 5.1.2. See the following table for compatibility of releases.

JUNOS Release	Highest Release Able to Load	Cannot Load	Maximum Application Image
5.1.1 or lower-numbered release	5.3.5p0-2 or the highest-numbered 5.x.x release	6.x.x or higher-numbered release	~ 172 MB
5.1.2 or higher-numbered release	No limitation	Not applicable	~ 234 MB
7.2.0 or higher-numbered release	No limitation	Not applicable	~ 256 MB

Your software upgrades may be available remotely through Telnet or FTP, or may be delivered on a new NVS card. Depending on how you access the software updates, there are two different procedures to follow. For more detailed information on installing software, and about NVS cards and SRP modules, see:

- *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules*
- Upgrading NVS Cards on SRP Modules on page 79

Upgrading NVS Cards on SRP Modules

This section describes how to install higher-capacity NVS cards on SRP modules. The procedure you use depends on the number of SRP modules in the system. A new NVS card already contains the software release you ordered.



NOTE: The new NVS card must contain the same software release that you are running on the system.

Upgrading a System That Contains One SRP Module

If the system contains only one SRP module, you must power down the system before you upgrade the NVS card.



CAUTION: If you do not use the **halt** command before removing or powering down an SRP module, the system's NVS card can become corrupted.

To upgrade the NVS card on a system that contains one SRP module:

1. Enter the **halt** command.

See *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules* for information about the **halt** command.



WARNING: Do not insert any metal object, such as a screwdriver, or place your hand into an open slot or the backplane when the router is on. Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. These actions prevent electric shock and serious burns.



CAUTION: When handling modules, use an antistatic wrist strap connected to the router's ESD grounding jack. This action helps to protect the module from damage by electrostatic discharge.

-
2. Connect the antistatic wrist strap to the ESD grounding jack on the router.
 3. Power down the system.
 4. Remove the SRP module.
 5. Replace the NVS card on the SRP module. (See “Replacing an NVS Card” on page 81.)
 6. Power up the system. (See “Powering Up ERX Routers” on page 65.)

Upgrading a System That Contains Two SRP Modules

In a system that contains two SRP modules, you can upgrade the NVS cards on the SRP modules without powering down the system.



WARNING: Do not insert any metal object, such as a screwdriver, or place your hand into an open slot or the backplane when the router is on. Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. These actions prevent electric shock and serious burns.



CAUTION: When handling modules, use an antistatic wrist strap connected to the router's ESD grounding jack. This action helps to protect the module from damage by electrostatic discharge.

To upgrade the NVS cards on the SRP modules in a system that contains two SRP modules:

1. Connect the antistatic wrist strap to the ESD grounding jack on your router.
2. Halt the redundant SRP module.

host1#halt standby-srp

3. Remove the redundant SRP module from the chassis.
4. Replace the NVS card on this SRP module. (See “Replacing an NVS Card” on page 81.)
5. Reinsert the SRP module into the chassis.
6. When this SRP module is available, synchronize the SRP modules.

host1#synchronize

7. When the SRP modules are synchronized, reboot the SRP module that you upgraded.

host1#reload slot 7

8. When this SRP module is available, synchronize the SRP modules.

host1#synchronize

9. When the SRP modules are synchronized, force the redundant SRP module to take over from the primary SRP module.

host1#srp switch

10. Halt the redundant (former primary) SRP module.

host1#halt standby-srp

11. Immediately remove the former primary SRP module.
12. Repeat Steps 4–8 for the former primary SRP module.

Replacing an NVS Card

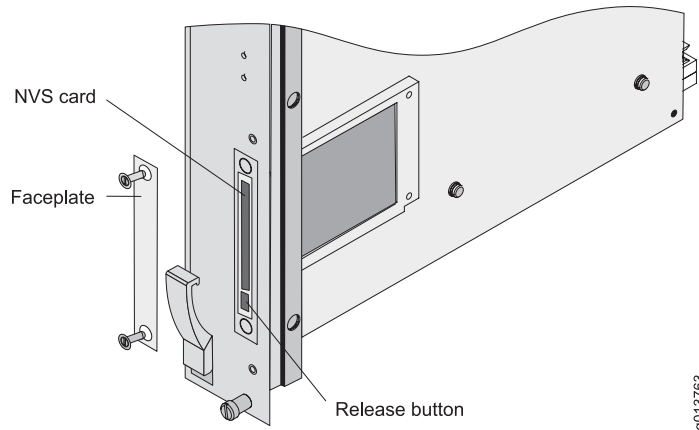
To replace an NVS card on an SRP module:



CAUTION: Before you insert or remove an NVS card from a running SRP module, we strongly recommend that you halt the SRP module or shut down the router. Failure to do this can result in file corruption in one or both cards. See *JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules* for information about the **halt** command.

1. Obtain an antistatic container for the NVS card you plan to remove. (See “Storing Modules and Components” on page 78.)
2. Be sure you have halted the SRP module using the **halt** command.
3. With a small flathead screwdriver, remove the faceplate from the NVS card slot on the SRP module. (See Figure 37 on page 82.)
4. Use the screwdriver to depress the release button next to the NVS card. (See Figure 37 on page 82.)

This action releases the NVS card.

Figure 37: NVS Card Slot on SRP Module

5. Remove the NVS card and place it in the antistatic container.
6. Insert the new NVS card into the slot, and push it until it clicks into place.
7. Replace the faceplate on the NVS card slot.

Upgrading Memory on SRP Modules

This section describes how to upgrade memory on SRP modules. JUNOS software releases 3.0.x and higher require at least 512 MB of memory on each SRP module, while releases 5.3.x and higher require at least 1 GB of memory. See the *ERX Module Guide* for more information.



NOTE: The ERX-310 SRP module contains two small outline dual inline memory module (SODIMM) banks that use 256-MB memory, and currently is not upgradeable.

Four main steps are involved in upgrading memory on SRP modules:

1. Display how much memory is currently installed on the SRP module.
2. Remove the SRP module and the SODIMMs.
3. Add the new SODIMMs to the SRP module.
4. Reinstall the SRP module and verify the upgrade.

See the following sections for information on each step.



WARNING: Do not insert any metal object, such as a screwdriver, or place your hand into an open slot or the backplane when the router is on. Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. These actions prevent electric shock and serious burns.



CAUTION: When handling modules, use an antistatic wrist strap connected to the router's ESD grounding jack, and hold modules by their edges. Do not touch the components, pins, leads, or solder connections. These actions help to protect modules from damage by electrostatic discharge.

Displaying the Memory Installed

Before you install the new memory, issue the **show hardware** command to see how much memory is installed. Each ERX-7xx and ERX-14xx model SRP module usually has at least 256 MB of memory. You need one upgrade kit for each SRP module in the system.

Depending on the upgrade you are performing, the kit contains a specific number of SODIMMs.

Removing SODIMMs

After removing the SRP module from the router, you might have to remove lower-memory SODIMMs to upgrade to a higher-capacity SRP module. The SODIMM sockets are close to the NVS card and have a cream-colored ceramic connector at one edge. Some or all of the sockets might already contain SODIMMs.

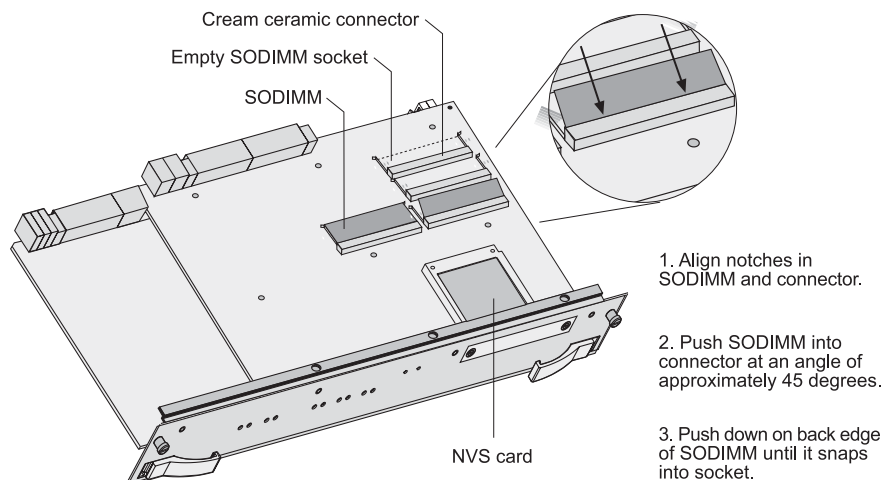
1. Push down on the back edge of a SODIMM to release it from the socket. (See Figure 38 on page 84.)
2. Gently pull the SODIMM up and out to disconnect it from the connectors and remove it from the socket.

Adding New SODIMMs

To add new SODIMMs:

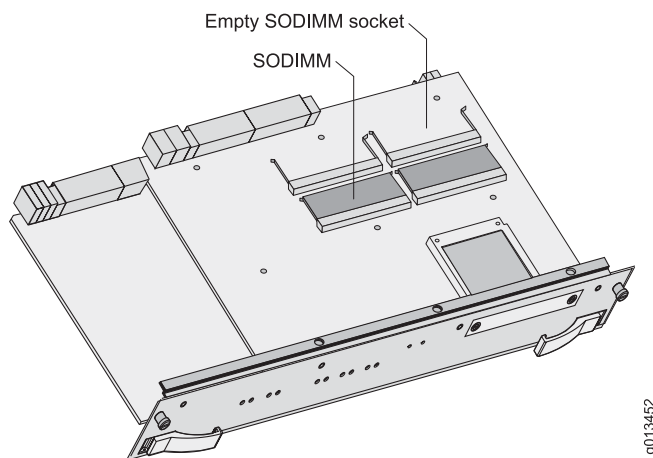
1. Locate the four SODIMM sockets on the SRP module. (See Figure 38 on page 84 and Figure 39 on page 84.) See the previous section to learn how to remove SODIMMs.

Figure 38: SODIMM Sockets on the SRP-5 and SRP-10 Module



g013451

Figure 39: SODIMM Sockets on the SRP-40 Module



g013452

2. Insert a SODIMM from the upgrade kit at an angle of approximately 45 degrees into an empty ceramic connector, so that the notch in the long gold edge of the SODIMM aligns with the notch in the connector.

The notch on the long gold edge is no longer visible when the SODIMM is pressed in far enough.

3. Press the top surface downward into the socket until the socket spring snaps into place and holds it.

4. Repeat Steps 2–3 with the other SODIMM.
5. Repeat Steps 1–4 for the other SRP module, if present.

Verifying the Upgrade

To verify that the upgrade is complete:

1. Place the SRP modules in the chassis.

The SRP modules reboot.

2. Close the ejector handles and tighten the thumbscrews.
3. Issue the **show hardware** command, and verify that the display indicates that the correct amount of memory is present.

Replacing SFPs on I/O Modules

This section describes how to replace small form-factor pluggable transceivers (SFPs) on modules that support these devices. A range of SFPs that support different optical modes (multimode and single mode) and cabling distances is available. You can replace the SFPs without disabling the interfaces or removing the module from the system.



WARNING: Do not insert any metal object, such as a screwdriver, or place your hand into an open slot or the backplane when the router is on. Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. These actions prevent electric shock and serious burns.



CAUTION: When handling electronic components, use an antistatic wrist strap connected to the system's ESD grounding jack, and hold components by their edges. Do not touch, pins, leads, or solder connections. Store components in antistatic bags. These actions help to protect modules from damage by electrostatic discharge.

Removing SFPs

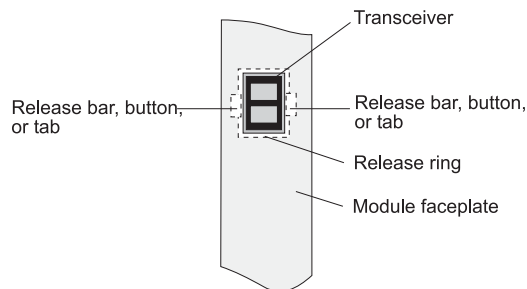
To remove the SFPs:

1. Obtain an antistatic container for the SFPs you plan to remove. (See “Storing Modules and Components” on page 78.)
2. Put the antistatic wrist strap on your wrist, and connect the strap to the ESD grounding jack on the system.
3. Disconnect the cables from one of the SFPs on the module.
4. Identify the release mechanism for the SFP.

Different SFPs use different release mechanisms. (See Figure 40 on page 86.) Possible release mechanisms include:

- A button that you press inward
- A ring that you press inward
- A bar that you pull sideways, then outward
- A tab that you pull sideways, then outward

Figure 40: Possible Release Mechanisms on the SFP



9013435

5. Release the SFP and pull it out of the slot.
6. Place the SFP in an antistatic bag.
7. If you are using the redundant port on the GE I/O module, repeat Steps 3–6 for the other SFP.



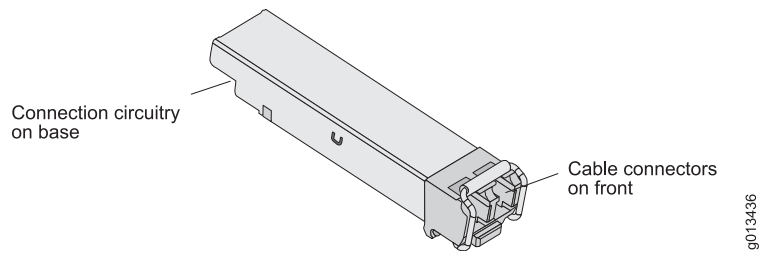
CAUTION: For port redundancy to operate correctly, both the primary and redundant ports on a GE I/O module must use the same type of SFP.

Installing SFPs

To install SFPs:

1. Put the antistatic wrist strap on your wrist, and connect the strap to the ESD grounding jack on your system.
2. Identify the following items on the SFP, as shown in Figure 41 on page 87:
 - The connection circuitry on the base
 - The cable connectors on the front

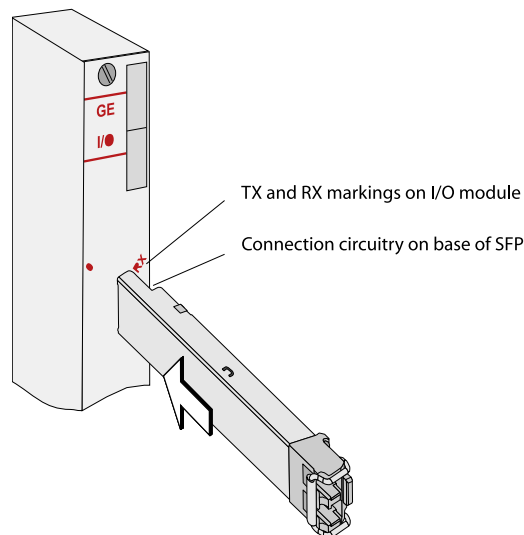
The cable connectors are protected by a dust cover.

Figure 41: Example of SFP

CAUTION: Be sure to position the SFP correctly before you install it.

3. Hold the SFP so that:
 - The connection circuitry is adjacent to the TX and RX markings on the module's faceplate.
 - The front will be visible when you install the SFP.

For the correct orientation, see Figure 42 on page 87.

Figure 42: Installing an SFP on a GE I/O Module

4. Insert the SFP into the I/O module until it clicks into place.
If the SFP does not slide smoothly into the I/O module, make sure that the orientation of the SFP is correct.
5. Gently pull the SFP to confirm that it is inserted correctly.
If the SFP comes out of the slot when you pull it, repeat Step 4.

6. Remove the dust cover that protects the ports.
7. Connect the new cables to the SFP.

If you are using the redundant port on the GE I/O module, repeat Steps 2–7 for the other port.

Verifying the Installation

After you have replaced the SFPs and connected the cables, issue the **show interface gigabitEthernet** command for each interface to make sure that the interface is operational (up).

- Field descriptions
 - `gigabitEthernet interfaceSpecifier`—Status of the hardware on this interface
 - Up—Hardware is operational
 - Down—Hardware is not operational
 - Administrative status—Operational state that you configured for this interface
 - Up—Interface is enabled
 - Down—Interface is disabled
- Example

```
host1:vr2#show interfaces gigabitEthernet2/0
gigabitEthernet2/0 is Up, Administrative status is Up
```

Replacing Fan Trays

A tray of cooling fans provides forced air cooling for components in the ERX routers. The fan trays are hot-swappable; you can replace them without powering down the system. However, if you do not replace the fan tray within approximately 2 minutes, the system enters thermal protection mode. For information about thermal protection mode, see “Monitoring Temperatures of Modules” on page 103.

You can monitor fan status by observing the LEDs on the SRP module or on the fan tray behind the faceplate. For complete LED information, see “Understanding Status LEDs to Troubleshoot” on page 96.



NOTE: On the SRP module, when the LED alternates between OK and FAIL in 10-second intervals, a non-critical fan failure exists. Noncritical warnings are not indicated on the fan tray LEDs; if the red FAN FAIL LED is illuminated, either a critical or non-critical failure exists.



CAUTION: If the red FAN FAIL LED on the SRP module is illuminated and none of the fans are spinning when you remove the fan tray, power down the system until a new fan tray is available. Operating an ERX router with inadequate air circulation can damage the modules.



CAUTION: Do not use the fan tray handle to carry the fan tray assembly. Use the handle only to pull the tray out of the chassis.

Figure 43: Fan Tray in ERX-14xx Models

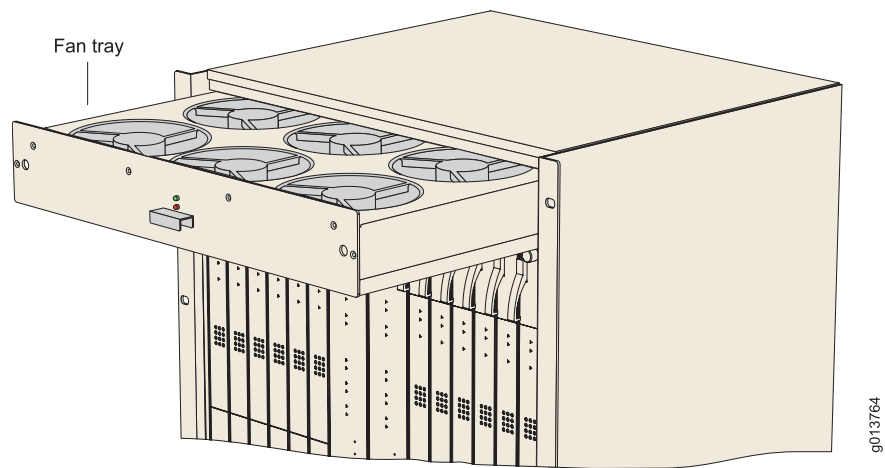


Figure 44: Fan Tray in ERX-7xx Models

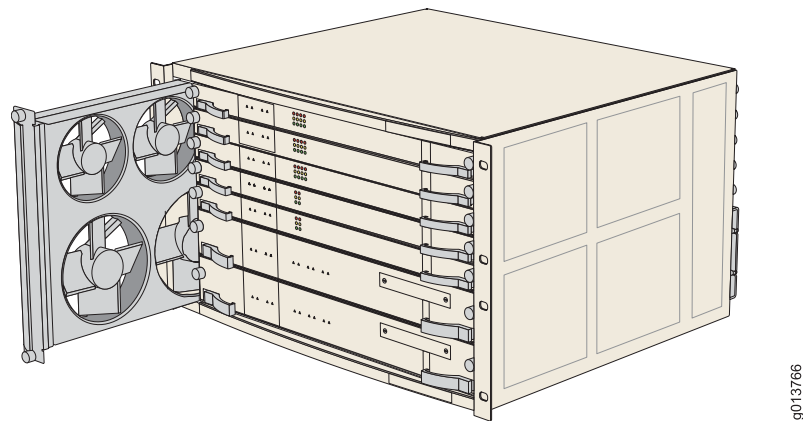
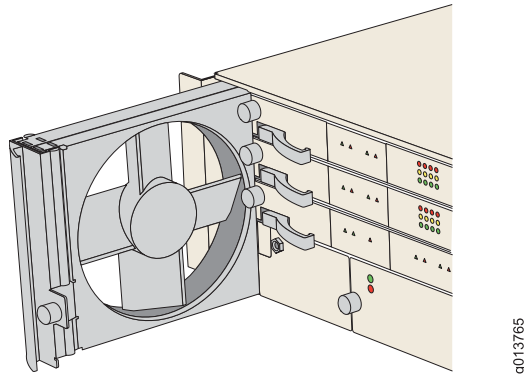


Figure 45: Fan Tray in ERX-310 Router

Removing the Fan Tray

To remove the fan tray:

1. (ERX-14xx models only) Place a flathead screwdriver in the groove where the top bezel meets the chassis on the top of the system, and lever the top bezel off the front of the system.
2. With an appropriate screwdriver, loosen the captive screws located at the corners of the fan tray.



WARNING: Do not place your fingers near the fans when removing the fan tray. The blades might still be moving.

3. Pull the fan tray halfway out of the shelf.



WARNING: Slowly slide the fan tray out of the chassis. The tray does not have stops to prevent it from sliding all the way out.

4. Pull the tray out of the chassis.

Installing the Fan Tray

To install the fan tray:



CAUTION: Do not use the fan tray handle to carry the fan tray assembly. Use the handle only to push the tray into the chassis.

1. Hold the tray horizontally (ERX-14xx models) or vertically (ERX-7xx models and ERX-310 routers) or so that the captive screws point toward you and you can read text on the labels.
2. Place the bottom corners of the tray housing in the plastic shelf guides of the fan tray compartment; push toward the back of the chassis halfway, and stop.
3. Push the fan tray toward the back of the shelf until it stops.

An electrical connector on the back of the fan tray pairs with an electrical connector at the back of the shelf.

4. With an appropriate screwdriver, tighten the captive screws.

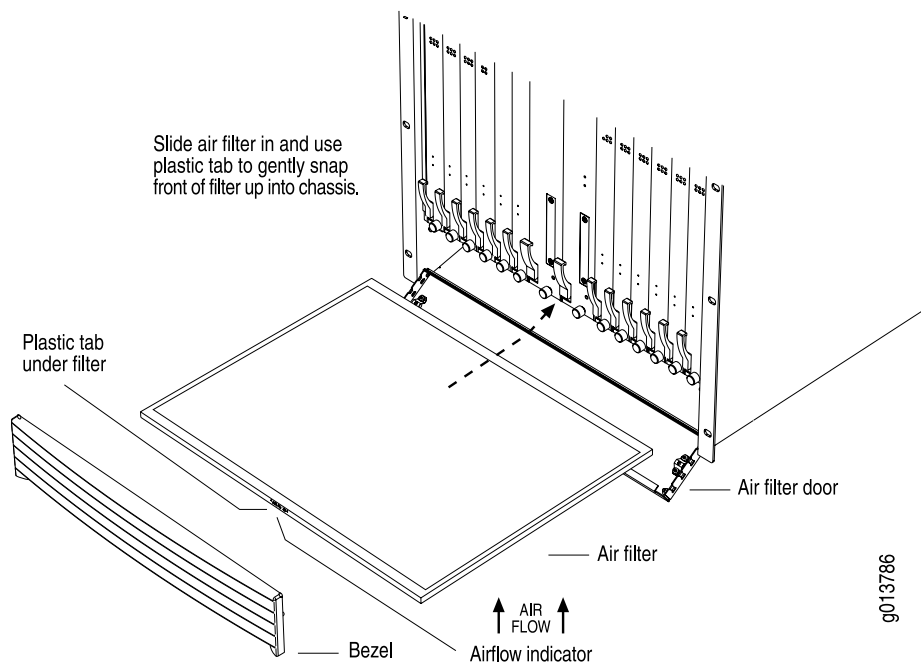
Alternate between screws when tightening them to ensure that the electrical connectors at the back of the tray fit tightly.

5. (ERX-14xx model only) Push the top bezel back on the front of the system.

Installing a ERX-14xx Model Air Filter

Air filters are hot-swappable; you do not have to power down the system to replace the filter. The filter is located behind the fan tray bezel located at the bottom of the front of the system. Remove the bezel to access the air filter. See Figure 46 on page 91.

Figure 46: Installing an Air Filter into an ERX-14xx Router



To install an air filter:

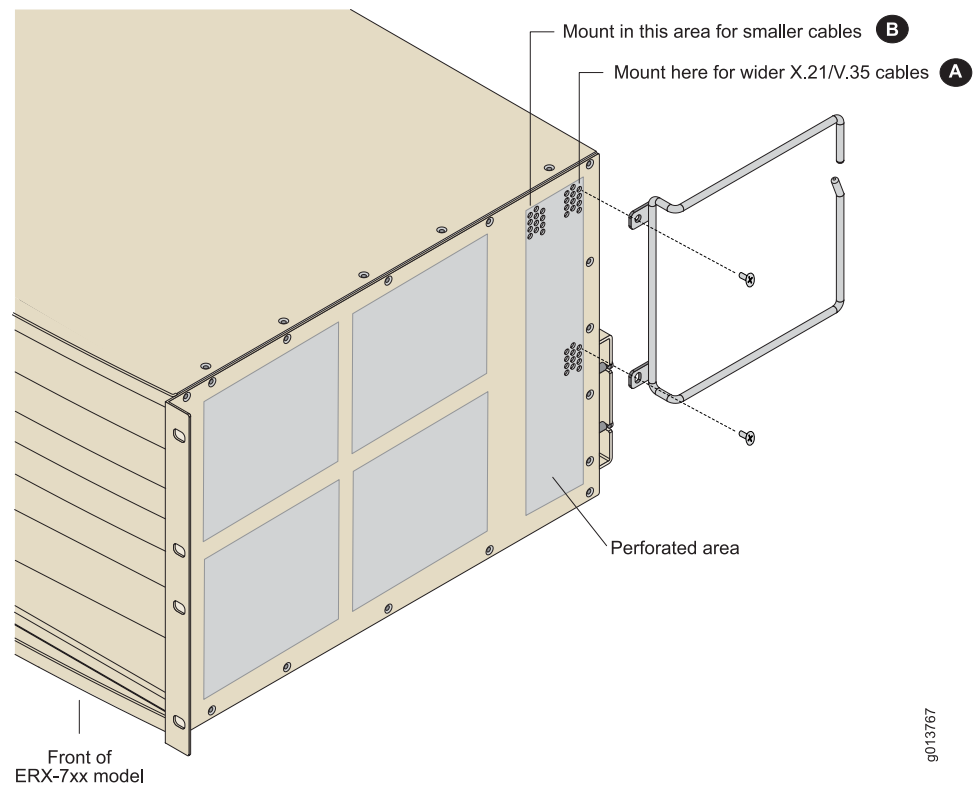
1. Ground yourself by using an antistatic wrist strap or other device and connect it to one of the ESD grounding jacks.
2. Remove the front bezel by grabbing the edges and pulling straight out toward you.
3. Unscrew the two captive screws on the air filter door and swing the door down to open it.
4. Remove the old air filter (if present).
5. Insert the new filter. Be sure the side with the plastic tab is toward you, the tab is on the bottom, and the mesh side is facing up.
6. After pushing the filter all the way in, pull down on the plastic tab and then gently snap front of filter up into the chassis.
7. Close the door, tighten the captive screws, and snap the bezel on.

Installing a Cable-Management Bracket on ERX-7xx Models

You can install a cable-management bracket to accommodate cables of different sizes on ERX-7xx models. See Figure 47 on page 93.

- For wider X.21/V.35 cables, mount the bracket in the last row of perforation holes in the chassis so that the bracket allows for maximum spacing (A).
- For smaller cables, mount the bracket closer to the front of the chassis (B).

Use two (2) #10 self-tapping screws to secure the bracket.

Figure 47: Attaching a Cable Management Bracket

Replacing a Power Input Module

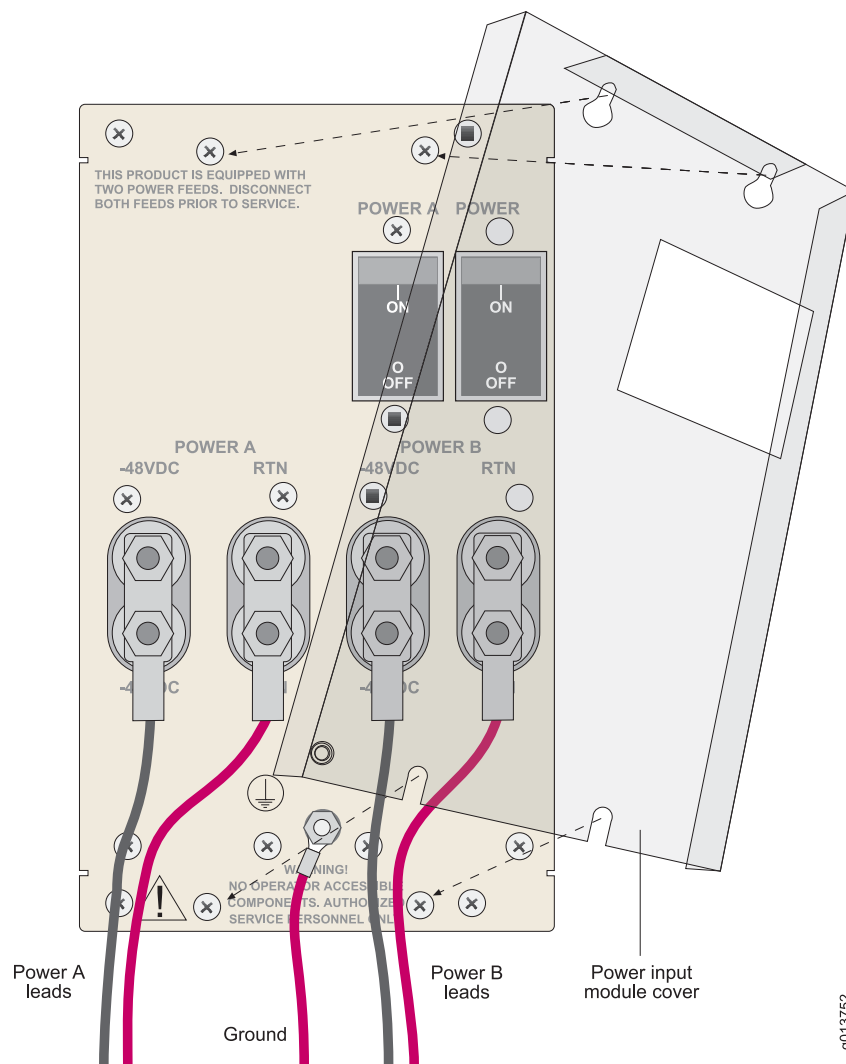
To replace a power input module (PIM):

1. Power down the router. See “Powering Down” on page 67.
2. Remove the clear plastic guard covering the PIM.



WARNING: Be sure the power source is turned off and all power switches are in the OFF position.

3. Disconnect the power cables and grounding cables. See Figure 48 on page 94.
4. With an appropriate screwdriver, loosen the screws located at the corners of the PIM.
5. Using two hands, pull the PIM out of the chassis.
6. Install the new PIM and tighten the screws.
7. Reconnect the power cables and grounding cables. See “Cabling the Router for Power” on page 53
8. Replace the clear plastic guard.
9. Power up the router. See “Powering Up ERX Routers” on page 65.

Figure 48: Power Input Module for ERX-14xx Models

Chapter 9

Troubleshooting

This chapter explains how you can troubleshoot a specific problem, such as abnormal LED activity or no system power, when you power up the router. It contains the following sections:

- Diagnosing Problems on page 95
- Troubleshooting Power Failures on page 96
- Understanding Status LEDs to Troubleshoot on page 96
- Monitoring Temperatures of Modules on page 103
- Resetting Line Modules and SRP Modules on page 104
- Double-Bit Errors on SRP Modules on page 104

Diagnosing Problems

When you first encounter a system problem:

1. Make sure power connections are securely attached.
2. Observe the system's LEDs carefully.
3. Make sure cable connections on the system modules are securely attached.

If a problem is beyond the scope of this chapter, see “Contacting Customer Support and Returning Hardware” on page 139 for further instructions.



NOTE: Running the **show version** and **show hardware** commands is often a good first step when trying to troubleshoot a problem.

Initialization Sequence

Each line module is initialized independently. As a result, the command-line interface (CLI) on the SRP module can become available before the line modules have completed initialization. Commands relating to a line module might fail if the module has not completed initialization. Use the **show version** command to display line module status. Do not enter commands for a line module until its state is listed as online.

Troubleshooting Power Failures

The system's distributed power system is designed to consume low levels of power and dissipate low levels of heat. See “System Specifications” on page 109 for specifications of power consumption and heat dissipation. If you suspect a power problem, see Table 10 on page 96.

Table 10: Causes of Power Failures

Symptom	Possible Problems	Actions
System does not power up.	<ul style="list-style-type: none"> ■ System is not receiving power. ■ Module's power supply has malfunctioned. ■ Power source cannot handle system load. 	<p>The following actions apply to all of the possible problems:</p> <ol style="list-style-type: none"> 1. Verify that all power connections are correct. 2. Verify that the power supply is delivering the correct voltage, current, and wattage to the system. See “System Specifications” on page 109. 3. If the system still does not operate, contact Juniper Networks Customer Service.
System shuts down.	<ul style="list-style-type: none"> ■ Temperature is too high. ■ Power is lost. 	<p>The following actions apply to all of the possible problems:</p> <ol style="list-style-type: none"> 1. Verify that power connections are properly attached. 2. Verify that system is receiving power. 3. Look to see whether or not the LEDs are lit. 4. Run diagnostics on SRP and line modules. 5. If system does not reset, contact Juniper Networks Customer Service.

Understanding Status LEDs to Troubleshoot

Module LEDs can show you the current status of a module and alert you to a problem with the module or one of its ports. We recommend you familiarize yourself with LED activity so that you can easily detect and correct a module-related problem with minimal or no system downtime.

LED Identification

The system's modules have two sets of status LEDs. The top set indicates overall router and module status. The bottom set indicates module-specific status, such as port status (line modules) or fan status (SRP module).

The number next to the port status LED on a line module corresponds to the number of the port on the I/O module. Some line modules have more port status LEDs than the number of ports on the I/O module. In these cases, only the LEDs for the corresponding ports on the I/O modules are active.

For example, an OCx/STMx line module can pair with either an OC3-4 or an OC12/STM4 I/O module. Consequently, the line module has four port status LEDs

for OC3/STM1 operation. However, only the top set of port status LEDs is active during OC12/STM4 operation.

Table 11 on page 97 presents the functions of the module LEDs and port status LEDs.

Table 11: LED Identification and Activity Descriptions

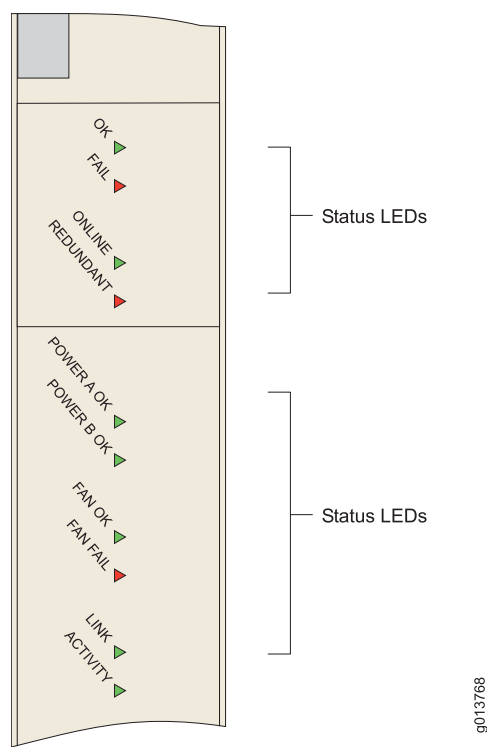
LED Location	LED Label	LED Indicator	LED Color	OFF to ON	ON to OFF
All modules	OK	Module status	Green	Self-test passed	Failure detected
	FAIL	Module status	Red	Failure detected	Diagnostic test running
	ONLINE	Module status	Green	Module online	Module offline
All modules	REDUNDANT	Redundancy	Green	See “Redundancy Status” on page 103.	
		NOTE: The REDUNDANT LED on the cOCx/STMx, FE-8, GE/FE, HSSI, OCx/STMx, and X.21/V.35 line modules is nonfunctional.			
SRP module	POWER A OK	Power	Green	Power online on source A	Power off
	POWER B OK	Power	Green	Power online on source B	Power off
	FAN OK	Fan	Green	Fan online	Critical fan failure
	FAN FAIL	Fan	Red	Critical fan failure	Fan online
		NOTE: When the LED alternates between OK and FAIL at 10-second intervals, a noncritical fan failure exists.			
	LINK	Ethernet	Green	Ethernet link up	Ethernet link down
	ACTIVITY	Ethernet	Green	Blinks when Ethernet traffic on link	No Ethernet traffic on link
Ethernet line modules	LINK	Ethernet	Green	Ethernet link up	Ethernet link down
	ACTIVITY	Ethernet	Green	Blinks when Ethernet traffic on link	No Ethernet traffic on link

Table 11: LED Identification and Activity Descriptions *(continued)*

LED Location	LED Label	LED Indicator	LED Color	OFF to ON	ON to OFF
HSSI line module	SYNC	Port status	Green	If the port is configured as DTE, the LED lights when both the DCE and the clock source are available. If the port is configured as DCE, the LED lights when the DTE is available.	If the port is configured as DTE, the LED goes out when either the DCE or the clock source becomes unavailable. If the port is configured as DCE, the LED goes out when the DTE becomes unavailable.
	YEL ALM	NOTE: This LED is not functional on the HSSI line module.			
	RED ALM	Port status	Red	If the port is configured as DTE, the LED lights when either the DCE or the clock source becomes unavailable. If the port is configured as DCE, the LED lights when the DTE becomes unavailable.	If the port is configured as DTE, the LED goes out when both the DCE and the clock source are available. If the port is configured as DCE, the LED goes out when the DTE is available.
X.21/V.35 line module	ACTIVE	Port status	Green	Port configured	Port not configured
	LOOPBK	Port status	Yellow	Port in local loopback or remote loopback, depending on the type of connection.	Port not in loopback
	ERROR	Port status	Red	Port is enabled or comes online	Port is disabled or goes offline
	V.35	Port status	Green	V.35 cable connected	V.35 cable disconnected
	X.21	Port status	Green	X.21 cable connected	X.21 cable disconnected
	DCE	Port status	Green	DCE cable connected	DCE cable disconnected
	DTE	Port status	Green	DTE cable connected	DTE cable disconnected
Other line modules	SYNC	Port status	Green	In frame	Not in frame
	YEL ALM	Port status	Yellow	Far-end receive failure (FERF) exists	No FERF present
	RED ALM	Port status	Red	Loss of sync/frame	In frame

The following figures show a representative module for each of the three variations:

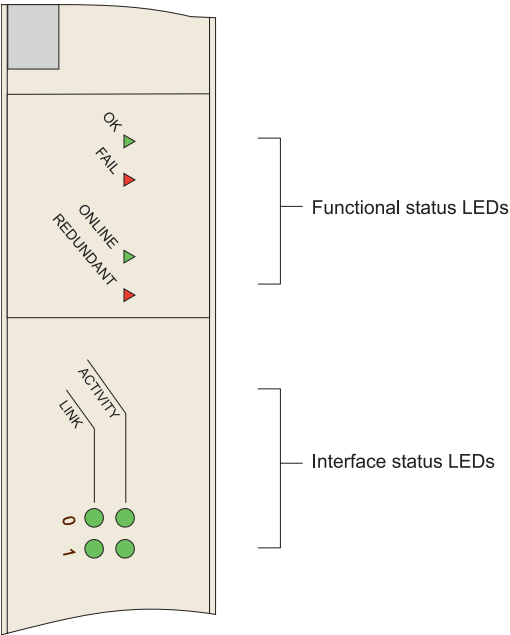
- SRP module (Figure 49 on page 99)
- Ethernet line module (Figure 50 on page 100)
- Other line modules (Figure 51 on page 100)

Figure 49: SRP Module LEDs

NOTE: The primary SRP module illuminates the REDUNDANT LED only when the SRP module detects a secondary or standby SRP module online. The standby SRP module monitors an activity signal from the primary SRP module to determine its state; it does not shadow the operations of the primary SRP module.

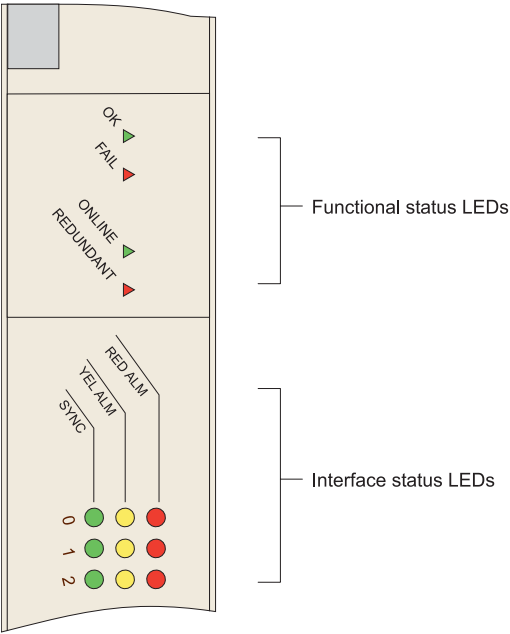
If the standby SRP module detects that the primary SRP module is not active (and high-availability mode is not enabled), it reboots the system and takes control. If high-availability mode has been enabled, automatic switchover occurs with near hitless failover. (ERX-7xx and ERX-14xx models only)

Figure 50: FE2 Module LEDs



g013769

Figure 51: E3 and T3 Module LEDs



g013770

LED Activity

When the system boots, it runs a series of tests for each module installed in the system, and the LEDs display various configurations. See Table 12 on page 101 and Table 13 on page 101 to understand normal and abnormal LED activity.



NOTE: When you reboot the system after installing a new version of the software, the line modules appear to boot twice.

Table 12: Normal Activity of Functional Status LEDs During Booting

OK	FAIL	ONLINE	Status Process
off	on (off for GE-2 LM and GE-HDE LM)	off	1. Module is in the power-up restart state; the FAIL LED stays on briefly.
off	on	off	2. Module is initializing, and diagnostic tests are running; the FAIL LED stays on briefly.
on	off	off	3. Module passed the diagnostics; the system boots.
on	off	on	4. Module is now up and running.

If the system detects an error during booting, the FAIL LED lights. Some failure conditions can cause the module not to boot. In this case, the LEDs might all be off. The system then resets the module.

If the operational software detects an error, the FAIL LED lights. Some errors can cause a module reset. Crash information is displayed at the console at the next reboot.

Table 13: Troubleshooting Abnormal LED Activity on Modules

Diagnostic Signs	Possible Problems	Actions
<ul style="list-style-type: none"> ■ POWER A OK LED is not lit ■ POWER B OK LED is not lit 	<ul style="list-style-type: none"> ■ System is not receiving power from Power A. ■ System is not receiving power from Power B. 	<ol style="list-style-type: none"> 1. Make sure Power A and Power B terminal connections are securely attached. 2. Verify that power switches are on. 3. Make sure connections to power sources are securely attached. 4. If system still does not operate, contact Juniper Networks Customer Service.
FAIL LED lights	<ul style="list-style-type: none"> ■ The line module and I/O module are incompatible. ■ A hardware failure, such as a failed module. 	<ol style="list-style-type: none"> 1. Make sure that the line modules and I/O modules are compatible; replace if necessary. 2. If you replaced the I/O module only, issue the reload slot slot_number command. 3. If you replaced the line module or if there was a hardware failure, the system is supposed to automatically reset the module. 4. If the condition persists, contact Juniper Networks Customer Service.

Table 13: Troubleshooting Abnormal LED Activity on Modules *(continued)*

Diagnostic Signs	Possible Problems	Actions
<ul style="list-style-type: none"> ■ FAN OK LED does not light ■ FAN FAIL LED lights 	<ul style="list-style-type: none"> ■ Fan is not working properly or has slowed down. ■ Fan needs replacement. 	Contact Juniper Networks Customer Service; the system must be serviced.
LINK LED is not lit	<ul style="list-style-type: none"> ■ Ethernet connection is down. 	<ol style="list-style-type: none"> 1. Make sure that Ethernet cables are properly connected to both the Ethernet port and the appropriate network device. 2. Contact Juniper Networks Customer Service.
RED ALM is lit	<ul style="list-style-type: none"> ■ System does not recognize a port connection. ■ Cabling is not connected properly. ■ Cable is faulty. ■ Clocking problem exists. 	<ol style="list-style-type: none"> 1. Make sure that all cables are firmly plugged into the ports and the attached network device. 2. Verify that cables are clean. 3. Test for faulty cables. 4. Verify clock source and configuration. 5. Reset system. <p>NOTE: Problem is corrected when normal LED activity occurs.</p>
YEL ALM is lit NOTE: This LED is not functional on the HSSI line module.	<ul style="list-style-type: none"> ■ Far end receive failure (FERF) exists. 	<ol style="list-style-type: none"> 1. Correct FERF problem. 2. Reset system. <p>NOTE: Problem is corrected when normal LED activity occurs.</p>
<ul style="list-style-type: none"> ■ System does not boot. ■ Modules held offline. ■ FAIL LED lights. 	<ul style="list-style-type: none"> ■ A slot group is overloaded. 	<ol style="list-style-type: none"> 1. Issue the show version command to display module status. 2. Review section on proper slot group configuration in “Installing Modules” on page 31. 3. Reconfigure system with correct slot group configuration. 4. Reset system.
No LED indications or obvious signs.	<ul style="list-style-type: none"> ■ System temperature is too high. ■ Vents are blocked. ■ Fans are not operating. 	<ol style="list-style-type: none"> 1. Look at your console for a message indicating the problem. If you have the system log set to a severity of WARNING or higher, a Warning message indicates the failure. 2. Issue the show environment command to display the temperatures. If the temperature is too high, power down the system. 3. Regulate temperature. 4. Reset system.

Redundancy Status

You can determine the redundancy state of line modules by examining the ONLINE and REDUNDANT status LEDs (ERX-7xx and ERX-14xx models only). See Table 14 on page 103.



NOTE: The REDUNDANT LED on the cOCx/STMx, FE-8, GE/FE, HSSI, and OCx/STMx modules is nonfunctional.

Table 14: Redundancy Status of a Line Module

ONLINE LED	REDUNDANT LED	State of the Line Module
Off	Off	Module is booting or is an inactive primary line module.
On	Off	Module is active, but no standby module is available.
Off	On	Module is in standby state.
On	On	Module is active, and a standby module is available.

Monitoring Temperatures of Modules

You can view the temperature of each module by issuing the **show environment all** and **show environment table** commands. In addition, the system generates detailed log messages if the temperature of a module is outside normal operating limits.

For example, if the temperature of any forwarding controller exceeds 212°F (100°C), a message appears on the console and the event is added to the system log. If you receive this message, report it to your customer service representative.

If the temperature of any module exceeds the upper temperature limit, the system immediately goes into thermal protection mode. After the system has entered thermal protection mode, you must resolve the cause of the high temperature quickly.

Table 15: Troubleshooting High-Temperature Conditions

Cause of High Operating Temperature	Symptoms	Resolution
Air vents to system are blocked	Space around system does not meet specifications. (See “System Specifications” on page 109.)	Increase space around system.
Ambient temperature exceeds specifications	Ambient temperature exceeds specifications. (See “System Specifications” on page 109.)	Provide extra cooling or heating in the room where the system is located.

Table 15: Troubleshooting High-Temperature Conditions *(continued)*

Cause of High Operating Temperature	Symptoms	Resolution
Cooling fan failure	<ul style="list-style-type: none"> ■ FAN OK LED on SRP module is not illuminated. ■ FAN FAIL LED on SRP module is illuminated. 	Replace fan tray. (See “Maintaining ERX Routers” on page 77.)
Module failure	FAIL LED on module is illuminated.	Replace module. (See “Installing Modules” on page 31.)

When you have resolved the cause of the high temperature, you must power cycle the system to reset the modules.

Resetting Line Modules and SRP Modules

Two recessed buttons on line modules and SRP modules provide the mechanisms for resetting. You can use the NMI software reset button to reset the software on the module and the module reset button to reset the module. See Figure 9 on page 10.

If a line module fails to respond for an extended time, that module might have a software problem. You can depress the NMI software reset button with a paper clip to suspend the current software task. Depending on the situation, this action might also reset the software on the module.

If depressing the NMI software reset button fails to correct the issue with the line module, depress the module reset button to reboot the line module.

The buttons work in the same way for the SRP module. Depressing the module reset button on an SRP module is equivalent to rebooting the router and causes all the line modules to reboot.

Double-Bit Errors on SRP Modules

SRP modules include error checking and correction (ECC) to protect their SDRAM. ECC provides error detection of single-bit and double-bit errors and correction of single-bit errors for the SDRAM as follows:

- If ECC detects a single-bit error, it automatically corrects the error, and operation continues.
- If ECC detects a double-bit error, it logs the error, stops the main processor on the controller, and takes the SRP module offline.

Detecting Double-Bit Errors

The following message appears on the console if ECC detects a double-bit error:

```

ALERT 05/10/2000 13:10:33 os: failed: ECC DOUBLE BIT ERROR OCCURRED
  Address = 0xe95db10
  Data (Upper 32Bits) = 0xe95db20
  Data (Lower 32Bits) = 0x55d06c
  ECC Data Bits = 0x2b
  ECC 1Bit Error Counter = 0x0
  *** YOU MUST PERFORM A HARD RESET TO CONTINUE ***
ALERT 05/10/2000 13:10:34 os: PROCESSOR EXCEPTION: 0x200n

```

If ECC detects a double-bit error in a system that contains a redundant SRP module, the redundant module becomes active and the system continues to operate. However, you must still troubleshoot the SRP module with the double-bit error. When ECC detects a double-bit error in a system that does not contain a redundant SRP module, you must troubleshoot the SRP module immediately. See “Fixing Double-Bit Errors” on page 105.

Fixing Double-Bit Errors

To fix a double-bit error:

1. Remove the second SRP module, if there is one.
2. Reboot the system with the module reset button on the primary SRP module. (See Figure 9 on page 10.)

These actions attempt to correct a transient double-bit error. However, if the console displays a memory test failure for the SRP module after you reboot, or if the FAIL LED on the SRP module stays on during rebooting, the SDRAM is permanently damaged and needs replacing. In this event, call Juniper Networks Customer Service to arrange for repair.

Part 4

Appendixes

- System Specifications on page 109
- Installation Guidelines and Requirements on page 117
- Cable Pinouts on page 131
- Contacting Customer Support and Returning Hardware on page 139
- Declaration of Conformity on page 145

Appendix A

System Specifications

This appendix lists the system specifications, requirements, and certifications for ERX routers.

- ERX-14xx Models Specifications on page 109
- ERX-7xx Models Specifications on page 111
- ERX-310 Router Specifications on page 113

ERX-14xx Models Specifications

Table 16: ERX-14xx Models Specifications

Category	Specification
Weight	Weights are approximate.
Chassis only	42 lb (18.9 kg)
Chassis fully configured	88 lb (39.6 kg)
Dimensions	22.75 (H) x 19 (W) x 16 (D) inches; 57.78 x 48.26 x 40.64 cm
Environmental Requirements	NEBS GR-63-CORE compliant
Ambient operating temperature	<ul style="list-style-type: none">■ Long term: 41° to 104° F (5° to 40° C)■ Short term: 23° to 122° F (–5° to 50° C)
Ambient operating humidity	<ul style="list-style-type: none">■ Long term: 5 % to 85 % (noncondensing)■ Short term: 5 % to 95 % (noncondensing)
Ambient storage temperature	–40° to 158° F (–40° ° to + 70° C), 95 % relative humidity
Ambient storage humidity	5 % to 95 % (noncondensing)
Heat Dissipation	2400 W, 8190 BTU/hour maximum
DC Input	
Voltage	–40 to –72 VDC
NOTE: If the voltage rises above –40 VDC, the system powers off. The system does not power on again until the input voltage reaches –43 +/– 0.5 VDC.	

Table 16: ERX-14xx Models Specifications *(continued)*

Category	Specification
Current	50 A @ –48 VDC
Power	2400 W maximum
Redundancy (input power)	2 independent line feeds
Space Requirements	<ul style="list-style-type: none"> ■ 3 feet (90 cm) behind router or rack ■ No space requirements for sides of units or rack ■ Do not block air vents on top, front, or back of the router
Airflow	<ul style="list-style-type: none"> ■ An integral air plenum directs router's exhaust air below the router and out the back. See Figure 53 on page 124.
NEBS Certification	<ul style="list-style-type: none"> ■ SR-3580 (FD-15): Network Equipment Building System (NEBS) Criteria Levels, Issue 1, November 1995 ■ GR-63–CORE: Network Equipment Building System (NEBS) Requirements: Physical Protection, Issue 2, April 2002 ■ GR-1089 (LSSGR, FD-15): Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment, Issue 2, Revision 1, February 1999
Safety Agency Certification	<ul style="list-style-type: none"> ■ AS/NZS 60950:2000 Safety of Information Technology Equipment ■ CAN/CSA-C22.2, No. 60950-1–03, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements ■ EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001) ■ EN60950-1:2001, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements ■ IEC 60950-1(2001-10) Ed. 1.0 Information Technology Equipment - Safety - Part 1: General Requirements ■ Low Voltage Directive (73/23/EEC) ■ UL 60950-1, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements
Electromagnetic Emissions Agency Certification	<ul style="list-style-type: none"> ■ AS/NZS 3548:1995 (CISPR 22 Class A) ■ EMC Directive (89/336/EEC) ■ EN55022 Class A (CISPR-22 Class A) ■ EN55024, Annex C for WAN Equipment Performance Criteria A, B, and C ■ ETSI 300-386, Telecommunication Network Equipment; ElectroMagnetic Compatibility (EMC) requirements ■ FCC Part 15 Class A ■ IECS-003 Issue 3 Class A ■ VCCI (Voluntary Control Council for Interference by Information Technology Equipment)

Table 16: ERX-14xx Models Specifications (continued)

Category	Specification
Telecommunications Certification	<ul style="list-style-type: none"> ■ ACA TS 016-1997 ■ CTR13 – Commission Decision of 9 July 1997 on a common technical regulation for attachment requirements for terminal equipment interface for connection to 2048 kbit/s digital structured ONP leased lines: 97/521/EC – OJ No. L215 Vol. 40, August 1997 ■ CTR24 – Commission Decision of 9 September 1997 on a common technical regulation for attachment requirements for terminal equipment interface for connection to 34 Mbit/s digital unstructured and structured leased lines: 97/639/EC – OJ No. L271 Vol. 40, 3 October 1997 ■ FCC PART 68 ■ IECS-003 Issue 3 Class A ■ PD7024 – Essential requirements for terminal equipment intended for connection to unstructured digital leased circuits of the public telecommunications network using a CCITT recommendation G,703 interface at a rate of 2048 kbit/s with a 75 ohm unbalanced presentation, 1994 ■ RTTE Directive (1999/5/EEC)

ERX-7xx Models Specifications

Table 17: ERX-7xx Models Specifications

Category	Specification
Weight	Weights are approximate.
Chassis only	22 lb (9.9 kg)
Chassis fully configured	46 lb (20.7 kg)
Dimensions	10.5 (H) x 19 (W) x 16 (D) inches; 26.67 x 48.26 x 40.64 cm
Environmental Requirements	NEBS GR-63-CORE compliant
Ambient operating temperature	<ul style="list-style-type: none"> ■ Long term: 41° to 104° F (5° to 40° C) ■ Short term: 23° to 122° F (–5° to 50° °C)
Ambient operating humidity	<ul style="list-style-type: none"> ■ Long term: 5 % to 85 % (noncondensing) ■ Short term: 5 % to 95 % (noncondensing)
Ambient storage temperature	–40° to 158° F (–40° to + 70° C), 95 % relative humidity
Ambient storage humidity	5 % to 95 % (noncondensing)
Heat Dissipation	1400 W, 4780 BTU/hour maximum
DC Input	
Voltage	–40 to –72 VDC
<p>NOTE: If the voltage rises above –40 VDC, the system powers off. The system does not power on again until the input voltage reaches –43 +/– 0.5 VDC.</p>	

Table 17: ERX-7xx Models Specifications (continued)

Category	Specification
Current	30 A @ -48 VDC
Power	1400 W maximum
Redundancy (input power)	2 independent line feeds
Space Requirements	<ul style="list-style-type: none"> ■ 3 feet (90 cm) behind router or rack ■ Do not block air vents on sides of the router. ■ Do not place equipment that exhausts hot air to left on the right of the router. ■ Be aware that router exhausts hot air from its left side.
Airflow	<ul style="list-style-type: none"> ■ Airflow direction is in through the right side and out through the left side. See Figure 53 on page 124.
NEBS Certification	<ul style="list-style-type: none"> ■ SR-3580 (FD-15): Network Equipment Building System (NEBS) Criteria Levels, Issue 1, November 1995 ■ GR-63-CORE: Network Equipment Building System (NEBS) Requirements: Physical Protection, Issue 2, April 2002 ■ GR-1089 (LSSGR, FD-15): Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment, Issue 2, Revision 1, February 1999
Safety Agency Certification	<ul style="list-style-type: none"> ■ AS/NZS 60950:2000 Safety of Information Technology Equipment ■ CAN/CSA-C22.2, No. 60950-1-03, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements ■ EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001) ■ EN60950-1:2001, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements ■ IEC 60950-1(2001-10) Ed. 1.0 Information Technology Equipment - Safety - Part 1: General Requirements ■ Low Voltage Directive (73/23/EEC) ■ UL 60950-1, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements
Electromagnetic Emissions Agency Certification	<ul style="list-style-type: none"> ■ AS/NZS 3548:1995 (CISPR 22 Class A) ■ EMC Directive (89/336/EEC) ■ EN55022 Class A (CISPR-22 Class A) ■ EN55024, Annex C for WAN Equipment Performance Criteria A, B, and C ■ ETSI 300-386, Telecommunication Network Equipment; ElectroMagnetic Compatibility (EMC) requirements ■ FCC Part 15 Class A ■ IECS-003 Issue 3 Class A ■ VCCI (Voluntary Control Council for Interference by Information Technology Equipment)

Table 17: ERX-7xx Models Specifications (continued)

Category	Specification
Telecommunications Certification	<ul style="list-style-type: none"> ■ ACA TS 016-1997 ■ CTR13 – Commission Decision of 9 July 1997 on a common technical regulation for attachment requirements for terminal equipment interface for connection to 2048 kbit/s digital structured ONP leased lines: 97/521/EC – OJ No. L215 Vol. 40, August 1997 ■ CTR24 – Commission Decision of 9 September 1997 on a common technical regulation for attachment requirements for terminal equipment interface for connection to 34 Mbit/s digital unstructured and structured leased lines: 97/639/EC – OJ No. L271 Vol. 40, 3 October 1997 ■ FCC PART 68 ■ IECS-003 Issue 3 Class A ■ PD7024 – Essential requirements for terminal equipment intended for connection to unstructured digital leased circuits of the public telecommunications network using a CCITT recommendation G.703 interface at a rate of 2048 kbit/s with a 75 ohm unbalanced presentation, 1994 ■ RTTE Directive (1999/5/EEC)

ERX-310 Router Specifications

Table 18: ERX-310 Router Specifications

Category	Specification
Weight: DC model	Weights are approximate.
Chassis only	25.5 lb (11.57 kg)
Chassis, fully configured	36 lb (16.33 kg)
Weight: AC model	Weights are approximate.
Chassis with single power supply	27.5 lb (12.47 kg)
Chassis with dual power supply	31.5 lb (14.29 kg)
Chassis with single power supply, fully configured	38 lb (17.24 kg)
Chassis with dual power supply, fully configured	42 lb (19.05 kg)
Dimensions	5.2 (H) x 19 (W) x 16 (D) inches; 13.21 x 48.26 x 40.64 cm
Environmental Requirements	NEBS GR-63-CORE compliant
Ambient operating temperature	<ul style="list-style-type: none"> ■ Long term: 41° to 104° F (5° to 40° C) ■ Short term: 23° to 122° F (–5° to 50° C)
Ambient operating humidity	<ul style="list-style-type: none"> ■ Long term: 5 % to 85 % (noncondensing) ■ Short term: 5 % to 95 % (noncondensing)

Table 18: ERX-310 Router Specifications *(continued)*

Category	Specification
Ambient storage temperature	–40° to 158° F (–40° to +70° C), 95 % relative humidity
Ambient storage humidity	5 % to 95 % (noncondensing)
Heat Dissipation	500 W, 1706 BTU/hour maximum
DC Input	
Voltage	–40 to –72 VDC NOTE: If the voltage rises above –40 VDC, the system powers off. The system does not power on again until the input voltage reaches –43 +/– 0.5 VDC.
Current	9 A @ –48 VDC
Power	500 W maximum
Redundancy (input power)	2 independent line feeds
AC Input	
Power required	90-265 VAC @ ~ 5 A
AC line frequency	50-60 Hz
Power	500 W
Space Requirements	<ul style="list-style-type: none"> ■ 3 feet (90 cm) behind router or rack ■ Do not block air vents on sides of the router. ■ Do not place equipment that exhausts hot air to left on the right of the router. ■ Be aware that router exhausts hot air from its left side.
Airflow	<ul style="list-style-type: none"> ■ Airflow direction is in through the right side and out through the left side. See Figure 53 on page 124.
NEBS Certification	<ul style="list-style-type: none"> ■ SR-3580 (FD-15): Network Equipment Building System (NEBS) Criteria Levels, Issue 1, November 1995 ■ GR-63–CORE: Network Equipment Building System (NEBS) Requirements: Physical Protection, Issue 2, April 2002 ■ GR-1089 (LSSGR, FD-15): Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment, Issue 2, Revision 1, February 1999

Table 18: ERX-310 Router Specifications (continued)

Category	Specification
Safety Agency Certification	<ul style="list-style-type: none"> ■ AS/NZS 60950:2000 Safety of Information Technology Equipment ■ CAN/CSA-C22.2, No. 60950-1-03, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements ■ EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001) ■ EN60950-1:2001, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements ■ IEC 60950-1(2001-10) Ed. 1.0 Information Technology Equipment - Safety - Part 1: General Requirements ■ Low Voltage Directive (73/23/EEC) ■ UL 60950-1, First Edition, Information Technology Equipment - Safety - Part 1: General Requirements
Electromagnetic Emissions Agency Certification	<ul style="list-style-type: none"> ■ AS/NZS 3548:1995 (CISPR 22 Class A) ■ EMC Directive (89/336/EEC) ■ EN55022 Class A (CISPR-22 Class A) ■ EN55024, Annex C for WAN Equipment Performance Criteria A, B, and C ■ ETSI 300-386, Telecommunication Network Equipment; ElectroMagnetic Compatibility (EMC) requirements ■ FCC Part 15 Class A ■ IECS-003 Issue 3 Class A ■ VCCI (Voluntary Control Council for Interference by Information Technology Equipment)
Telecommunications Certification	<ul style="list-style-type: none"> ■ ACA TS 016-1997 ■ CTR13 – Commission Decision of 9 July 1997 on a common technical regulation for attachment requirements for terminal equipment interface for connection to 2048 kbit/s digital structured ONP leased lines: 97/521/EC – OJ No. L215 Vol. 40, August 1997 ■ CTR24 – Commission Decision of 9 September 1997 on a common technical regulation for attachment requirements for terminal equipment interface for connection to 34 Mbit/s digital unstructured and structured leased lines: 97/639/EC – OJ No. L271 Vol. 40, 3 October 1997 ■ FCC PART 68 ■ IECS-003 Issue 3 Class A ■ PD7024 – Essential requirements for terminal equipment intended for connection to unstructured digital leased circuits of the public telecommunications network using a CCITT recommendation G,703 interface at a rate of 2048 kbit/s with a 75 ohm unbalanced presentation, 1994 ■ RTTE Directive (1999/5/EEC)

Appendix B

Installation Guidelines and Requirements

This chapter reviews preinstallation considerations such as electrical, environmental, and safety compliances for ERX routers. For complete system specifications, see “System Specifications” on page 109.

This chapter contains the following sections:

- Your Preinstallation Responsibilities on page 117
- Environmental Requirements on page 117
- Regulatory Compliances on page 118
- Safety Guidelines on page 118
- Equipment Rack Requirements on page 121
- Cabling Recommendations on page 124
- Product Reclamation and Recycling Program on page 125
- Hardware Compliance on page 126

Your Preinstallation Responsibilities

Complete the following tasks before installing the system:

- Verify that the electrical supply meets all AC and DC power requirements. See “System Specifications” on page 109.
- Verify that the site meets all environment specifications. See “Environmental Requirements” on page 117 and “System Specifications” on page 109.
- Verify that the cables you plan to use meet the specifications, and review the cabling recommendations. See “Cabling Recommendations” on page 124.
- Verify the operation of all telephone circuits, digital services, and T1 facilities required for installation.
- Ensure that all IP environment requirements are met, such as IP addresses, subnet masks, and any specific routing protocol information.

Environmental Requirements

See “System Specifications” on page 109 for complete environmental specifications.

Choose a location for the router that is dry, relatively dust free, well ventilated, and air conditioned. If you install equipment in a rack, be sure that the floor is capable of supporting the combined weight of the rack and the installed equipment. Place the router in a location with sufficient access to power and network cables.

Like other network devices, the router generates a significant amount of heat. You must provide a balanced environment so that the router performs properly and safely. See “System Specifications” on page 109 for acceptable ranges of temperature and humidity.

Be sure to allow enough space around the router for adequate ventilation. Inadequate ventilation can cause the system to overheat.



CAUTION: Do not block the air vents on the routers. Otherwise, the router might overheat.

Regulatory Compliances

See “System Specifications” on page 109, for a complete list of regulatory compliance requirements, including safety, EMC, and telecommunications.

Safety Guidelines

For your safety, before installing the system, review all safety warnings in this section.



WARNING: The recommended maximum ambient temperature is 50° C (122° F). For safe operation, take into consideration the internal temperature of the rack.



WARNING: Install equipment in the rack from the bottom upward. Doing this helps maintain the stability of the rack and reduces the chance of the rack tipping over.



WARNING: Do not insert any metal object, such as a screwdriver, into an open slot or the backplane. Doing so might cause electric shock and serious burns.



WARNING: Three people are required to install the router in a rack: two to lift the system into position and one to screw it to the rack.



WARNING: Connect the router or rack to ground (earth), and ensure that a reliable grounding path is maintained in the rack.



WARNING: Do not work on the system or connect or disconnect cables during lightning activity.



WARNING: Be sure circuit breakers for the power source are in the OFF position before attaching power cables.



WARNING: Before servicing the router, turn off the power.



WARNING: Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. Metal objects heat up when connected to power and ground and can cause serious burns or become welded to the terminals.



CAUTION: Evaluate the overall loading of the branch circuit before you install any equipment into a rack.

ERX-310 Router Warnings (AC Model)

The following warnings apply only to the ERX-310 router.

ERX-310 Power Cord Warnings (AC Model)



WARNING: This unit has more than one power-supply cord. Disconnect 2 power cords BEFORE servicing to avoid electric shock.

Denne enhed har mere end een strømfordelingsledning. Fjern ledning(er) nummer 2 FØR eftersyn for at undgå elektrisk stød.

Waarschuwing! Dit apparaat heeft meerdere netsnoeren. Vermijd elektrische schok! Verwijder 2 netsnoeren ALVORENS onderhoud te verrichten.

Tässä laitteessa on useampi kuin yksi verkkojohto. Irrottakaa 2 verkkojohtoa ENNEN huoltoa sähköiskujen välttämiseksi.

Attention: Cet appareil comporte plus d'un cordon d'alimentation. Afin de prévenir les chocs électriques, débrancher les 2 (donner le nombre de cordons) cordons d'alimentation AVANT le dépannage.

Dieses Gerät hat mehrere Stromversorgungskabel. Klemmen Sie 2 Stromkabel VOR der Wartung ab, um einen elektrischen Schlag zu vermeiden.

L'unità ha più di un cavo di alimentazione. Scollegare 2 cavi di alimentazione PRIMA di usarla, onde evitare scosse elettriche.

Denne enheten har mer enn en nett-tilkobling. 2 nettkabler må frakobles FØR service for å unngå elektrisk støt.

Este equipamento tem mais do que um cabo de alimentação. Para que se evitem choques, desligar 2 cabos, ANTES de servir o equipamento.

Esta unidad tiene más de un cable de toma de corriente. Desconecte 2 cables ANTES de darle mantenimiento a la unidad, para evitar descargas eléctricas.

Denna enhet har fler än en nätanslutningskabel. Koppla bort 2 nätanslutningskablar INNAN du påbörjar service.

Power Cable Warning (Japanese)



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

注意

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

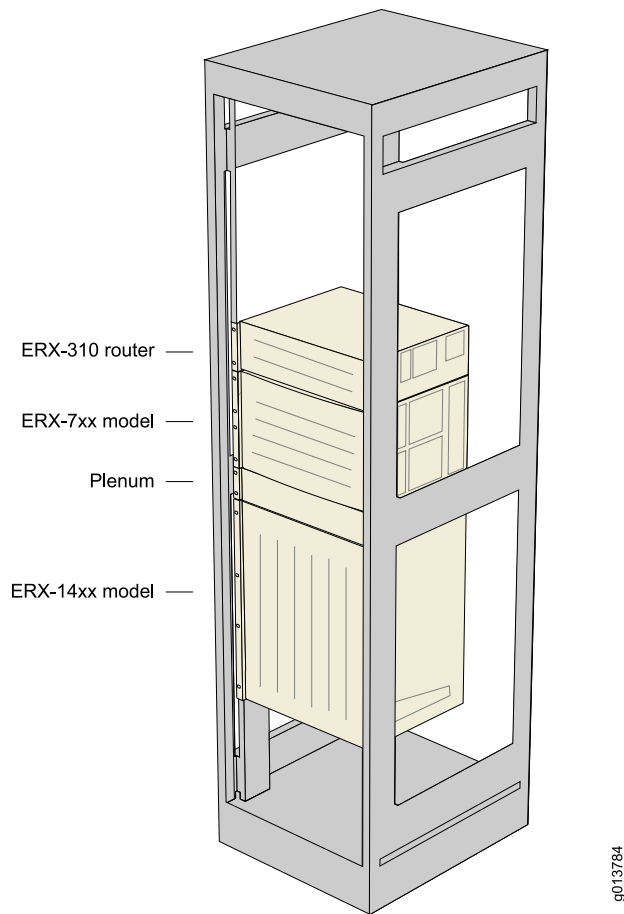
g017253

Equipment Rack Requirements

When allocating equipment rack space, consider the following:

- Type of equipment racks recommended for ERX routers
- Number of equipment racks required to hold your current router configuration
- Future expansion

Make sure your distribution rack meet basic mechanical and space requirements and complies with conventional standards. In the United States, use EIA-310-D Cabinets, Racks, Panels, and Associated Equipment, September 1992.

Figure 52: ERX Routers Installed in a Rack

Mechanical Requirements

Follow these mechanical requirements for your rack:

- Select from the following rack options:
 - Two-post rack—A freestanding enclosed cabinet with two mounting posts in the front
 - Telco-type rack—Two adjacent mounting posts that you must secure to the floor or an overhead structure
 - Four-post rack—A freestanding open rack, either open or closed
- The rack must have at least two mounting posts.
- The distance between the mounting holes in the two posts must be 18.31 inches \pm .063 inch, as specified in the EIA-310-D.
- Do not use an enclosed rack for ERX-7xx models or the ERX-310 router. It does not provide adequate ventilation.

- A fully loaded rack with three ERX-14xx models must structurally support 300 pounds (136 kilograms).
- Optional mounting kits are available for 19-inch and 23-inch rack mounting (mid-chassis and front-chassis mounting). Contact your Juniper Networks sales representative for more information.

Space Requirements

If you use an enclosed rack for an ERX-14xx model, ensure that there is a minimum of 3 inches of clearance between the inner side wall and the router. This clearance space ensures adequate air flow.

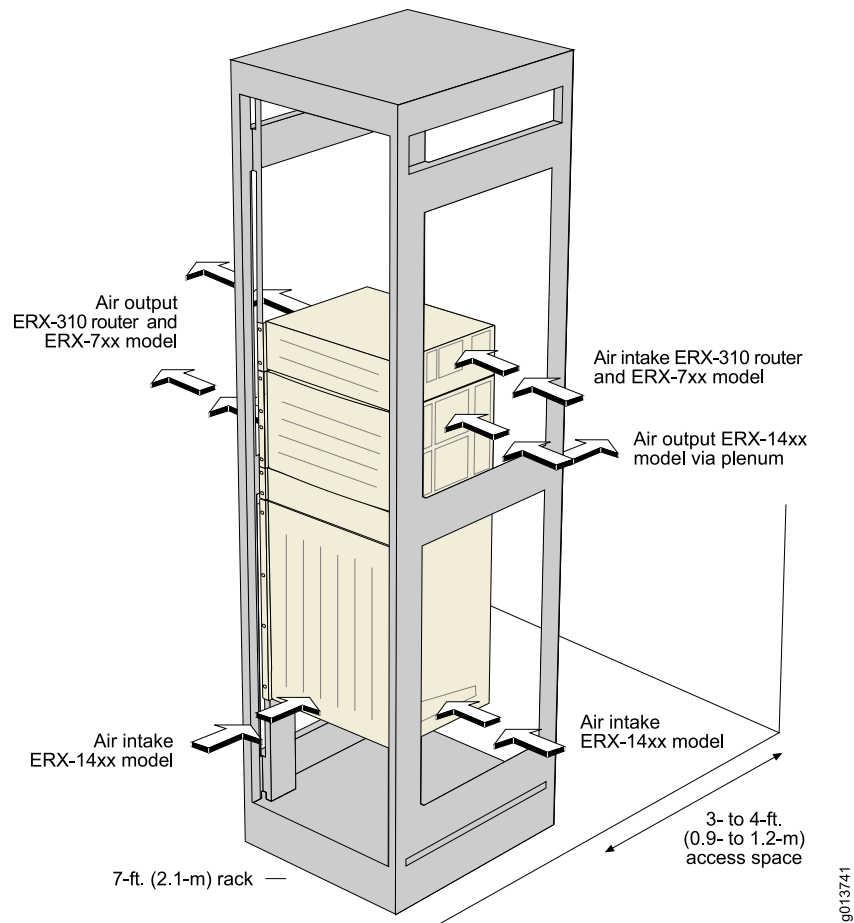
Proper Rack Installation

To confirm proper equipment rack installation, verify the following:

- Racks are installed and electrically grounded according to manufacturer instructions.
- Equipment racks are anchored to the floor and, when possible, anchored to the ceiling as well.
- Equipment rack installations comply with applicable local, state, and national codes.



CAUTION: To maintain airflow requirements, a plenum must be installed above ERX-14xx models before any other piece of equipment is installed above the router.

Figure 53: Airflow for ERX Routers

Cabling Recommendations

Comply with the following recommendations:

- Use only shielded cables.
- Ensure that cable distance and rate limits meet IEEE-recommended maximum speeds and distances for signaling purposes. For information about attenuation and power loss in optical fiber cables see:
 - ANSI T1.646a-1997 Telecommunications – Broadband ISDN - Physical Layer Specification for User-Network Interfaces Including DS1/ATM (1997)
 - ANSI T1.646-1995 Telecommunications – Broadband ISDN - Physical Layer Specification for User-Network Interfaces Including DS1/ATM (1995)
- Ensure that power cables deliver sufficient power to the system.
- Attach laser fiber connectors only to Class 1 laser devices in accordance with IEC 825-1, Safety of Laser Products - Part 1.
- Route cables so that they do not restrict ventilation or airflow.

- Route cables so that modules and field-replaceable units are easily accessible.
- Route cables in a logical direction to prevent loss of connectivity to other equipment in the rack, associated equipment in adjacent racks, or to the backbone network.
- Consider using cable-management brackets to keep network cables untangled and orderly and to prevent cables from hindering access to other slots.
- For specifications on cables for line modules, see the *ERX Module Guide*.

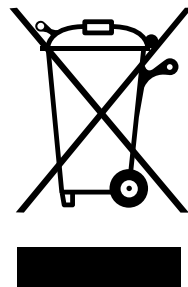
You may want to consult the document GR-63 (LSSGR, FD-15): Network Equipment Building System (NEBS) Requirements: Physical Protection, Issue 1, October 1995 for additional cable recommendations.

Product Reclamation and Recycling Program

Juniper Networks is committed to environmentally responsible behavior. As part of this commitment, we continually work to comply with environmental standards such as the European Union's *Waste Electrical and Electronic Equipment (WEEE) Directive* and *Restriction of Hazardous Substances (RoHS) Directive*.

These directives and other similar regulations from countries outside the European Union regulate electronic waste management and the reduction or elimination of specific hazardous materials in electronic products. The WEEE Directive requires electrical and electronics manufacturers to provide mechanisms for the recycling and reuse of their products. The RoHS Directive restricts the use of certain substances that are commonly found in electronic products today. Restricted substances include heavy metals, including lead, and polybrominated materials. The RoHS Directive, with some exemptions, applies to all electrical and electronic equipment.

In accordance with Article 11(2) of Directive 2002/96/EC (WEEE), products put on the market after 13 August 2005 are marked with the following symbol or include it in their documentation: a crossed-out wheeled waste bin with a bar beneath.



Juniper Networks provides recycling support for our equipment worldwide to comply with the WEEE Directive. For recycling information, go to <http://www.juniper.net/environmental>, and indicate the type of Juniper Networks equipment that you wish to dispose of and the country where it is currently located, or contact your Juniper Networks account representative.

Products returned through our reclamation process are recycled, recovered, or disposed of in a responsible manner. Our packaging is designed to be recycled and should be handled in accordance with your local recycling policies.

Hardware Compliance

The router meets the following hardware compliance requirements.

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This equipment is designed for use with properly shielded and terminated cables. Refer to the installation sections of this manual before operation.

Reference: CFR 47, Part 15J, Sect 15.105 April 18, 1989

Caution: Changes or Modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Requirements for Consumer Products

This equipment complies with FCC rules, Part 68. On the back side of this equipment is a label that contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN) for this equipment. If requested, provide this information to your telephone company.

If this equipment causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.

If you experience trouble with this equipment, please contact the manufacturer for warranty/repair information. The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

Food and Drug Administration, Center for Devices and Radiological Health

This equipment complies with 21 CFR 1040.10 and 1040.11 for the safe use of lasers.

Canadian Department Of Communications Radio Interference Regulations

This Class B (or Class A, if so indicated on the registration label) digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

Règlement sur le brouillage radioélectrique du ministère des communications

Cet appareil numérique de la Classe B (ou Classe A, si ainsi indiqué sur l'étiquette d'enregistrement) respecte toutes les exigences du Règlement sur le Matériel Brouilleur du Canada.

Industry Canada Notice CS-03

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operation and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the user's satisfaction. Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

Notice: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

Avis CS-03 d'Industrie Canada

L'étiquette du ministère des Communications du Canada indique que l'appareillage est certifié, c'est-à-dire qu'il respecte certaines exigences de sécurité et de fonctionnement visant les réseaux de télécommunications. Le ministère ne garantit pas que l'appareillage fonctionnera à la satisfaction de l'utilisateur. Avant d'installer

l'appareillage, s'assurer qu'il peut être branché aux installations du service de télécommunications local. L'appareillage doit aussi être raccordé selon des méthodes acceptées. Le client doit toutefois prendre note qu'une telle installation n'assure pas un service parfait en tout temps.

Les réparations de l'appareillage certifié devraient être confiées à un service d'entretien canadien désigné par le fournisseur. En cas de réparation ou de modification effectuées par l'utilisateur ou de mauvais fonctionnement de l'appareillage, le service de télécommunications peut demander le débranchement de l'appareillage.

Pour leur propre sécurité, les utilisateurs devraient s'assurer que les mises à la terre des lignes de distribution d'électricité, des lignes téléphoniques et de la tuyauterie métallique interne sont raccordées ensemble. Cette mesure de sécurité est particulièrement importante en milieu rural.

Attention: Les utilisateurs ne doivent pas procéder à ces raccordements eux-mêmes mais doivent plutôt faire appel aux pouvoirs de réglementation en cause ou à un électricien, selon le cas.

Avis: Veuillez prendre note que pour tout appareillage supportant des lignes de type “loopstart,” l'indice d'équivalence de la sonnerie (IES) assigné à chaque dispositif terminal indique le nombre maximal de terminaux qui peuvent être raccordés à une interface. La terminaison d'une interface téléphonique peut consister en une combinaison de quelques dispositifs, à la seule condition que la somme d'indices d'équivalence de la sonnerie de tous les dispositifs n'excède pas 5. Le REN figure sur l'étiquette “FCC Rules Part 68” située sur le support du module ou à l'arrière de l'unité.

D.O.C. Explanatory Notes: Equipment Attachment Limitations

The Canadian Department of Communications label identifies certified equipment. This certification meets certain telecommunication network protective, operational and safety requirements. The department does not guarantee the equipment will operate to the users satisfaction.

Before installing the equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above condition may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electrical inspection authority, or electrician, as appropriate.

Notes explicatives du ministère des Communications: limites visant les accessoires

L'étiquette du ministère des Communications du Canada indique que l'appareillage est certifié, c'est-à-dire qu'il respecte certaines exigences de sécurité et de fonctionnement visant les réseaux de télécommunications. Le ministère ne garantit pas que l'appareillage fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer l'appareillage, s'assurer qu'il peut être branché aux installations du service de télécommunications local. L'appareillage doit aussi être raccordé selon des méthodes acceptées. Dans certains cas, le câblage interne du service de télécommunications utilisé pour une ligne individuelle peut être allongé au moyen d'un connecteur certifié (prolongateur téléphonique). Le client doit toutefois prendre note qu'une telle installation n'assure pas un service parfait en tout temps.

Les réparations de l'appareillage certifié devraient être confiées à un service d'entretien canadien désigné par le fournisseur. En cas de réparation ou de modification effectuées par l'utilisateur ou de mauvais fonctionnement de l'appareillage, le service de télécommunications peut demander le débranchement de l'appareillage.

Pour leur propre sécurité, les utilisateurs devraient s'assurer que les mises à la terre des lignes de distribution d'électricité, des lignes téléphoniques et de la tuyauterie métallique interne sont raccordées ensemble. Cette mesure de sécurité est particulièrement importante en milieu rural.

Attention: Les utilisateurs ne doivent pas procéder à ces raccordements eux-mêmes mais doivent plutôt faire appel aux pouvoirs de réglementation en cause ou à un électricien, selon le cas.

EC Declaration of Conformity

The EC Declaration of Conformity is available in “Declaration of Conformity” on page 145.

Voluntary Control Council for Interference (VCCI) Statement for Japan

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用する
と電波妨害を引き起こすことがあります。この場合には使用者が適切な対策
を講ずるよう要求されることがあります。 VCCI-A

The preceding translates as:

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

Appendix C

Cable Pinouts

This appendix lists the cables and connector pinout assignments for the cables used with the ERX-7xx models and ERX-14xx models. It contains the following sections:

- SRP I/O Module on page 131
- CT1 and CE1 I/O Modules on page 134

SRP I/O Module

The SRP I/O module provides two management ports. You can connect a console directly to the RS-232 serial port using a shielded straight-through cable with a female DB-9 connector on one end and a male DB-25 with a crossover adapter on the DB-25 end. This port is called the serial port, the RS-232 port, or the console serial port. Figure 54 on page 131 shows the location of the serial port and the sequence of the pins in the RS-232 connector.

The console port is considered a data terminal equipment interface (DTE). Direct connection to a terminal or PC (which also have DTE interfaces) requires a crossover cable.

Figure 54: SRP I/O Module Serial Port

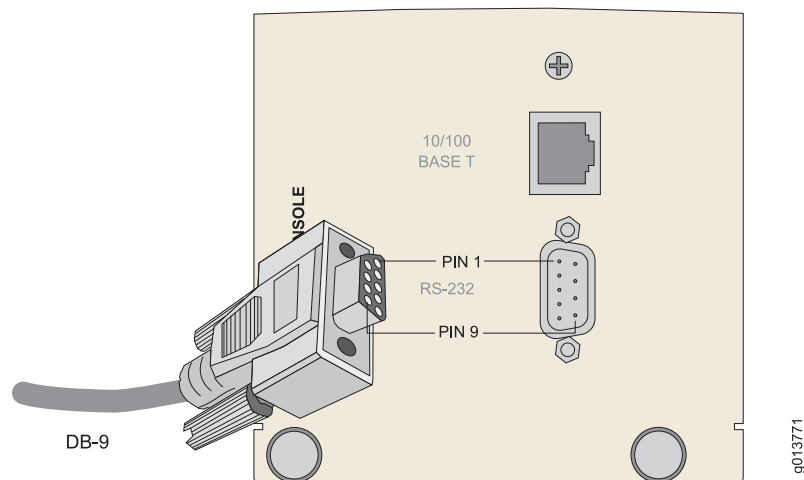


Table 19 on page 132 lists the pinout for the serial cable's RS-232 connector.

Table 19: SRP I/O Module—RS-232 Serial Connector Pinout

Pin	Signal
1	DCD
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RNG

After you have configured an IP address on the system, you can connect using a host running Telnet over the 10/100Base-T Ethernet port on the SRP I/O module. The router ships with a straight-through cable having a male RJ-45 Ethernet connector on each end. Figure 55 on page 132 shows the location of the Ethernet port and the sequence of the pins in the RJ-45 connector.

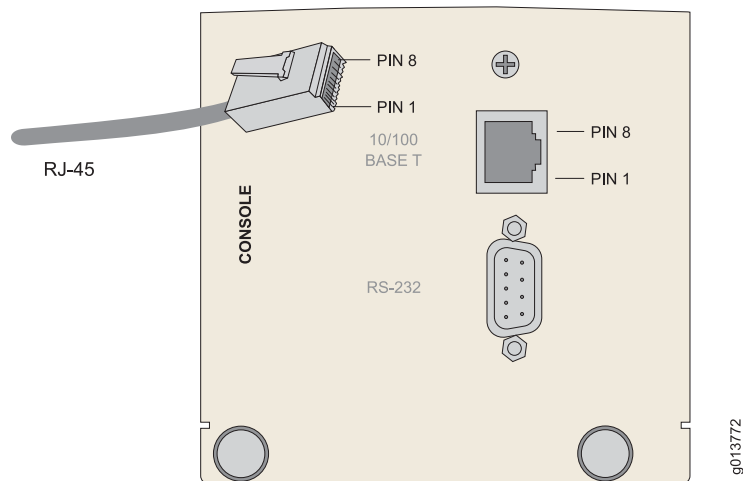
Figure 55: SRP I/O Module Ethernet Port

Table 20 on page 133 lists the pinouts for the Ethernet cable's RJ-45 connector.

Table 20: SRP I/O Module—RJ-45 Connector Pinout

Pin	Signal
1	TX +
2	TX –
3	RX +
4	no connect
5	no connect
6	RX –
7	no connect
8	no connect

To facilitate connecting the system to a terminal, the system is shipped with one of each of the following cable adapters:

- DB-9 female to RJ-45 female crossover null modem adapter
- DB-9 female to RJ-45 female straight-through adapter

Table 21 on page 133 lists the pinouts for the crossover adapter.

Table 21: DB-9—RJ-45 Crossover Adapter Pinout

DB-9 Pin	Signal	RJ-45 Pin
1	DCD	1
2	RXD	3
3	TXD	2
4	DTR	6
5	GND	5
6	DSR	4
7	RTS	8
8	CTS	7
9	RNG	no connect

Table 22 on page 134 lists the pinout for the straight-through adapter.

Table 22: DB-9—RJ-45 Straight-Through Adapter Pinout

DB-9 Pin	RS-232 Signal Name	RJ-45 Pin	Ethernet Signal Name
1	DCD	1	TX +
2	RXD	2	TX –
3	TXD	3	RX +
4	DTR	4	no connect
5	GND (signal)	5	no connect
6	DSR	6	RX –
7	RTS	7	no connect
8	CTS	8	no connect
9	RNG	no connect	none

CT1 and CE1 I/O Modules

CT1 I/O modules have 24 RJ-48C female connectors. CE1 I/O modules have either 20 RJ-48C female connectors or two 25-pair female Telco connectors. Figure 56 on page 134 shows the location of the ports on a CT1 I/O module and the sequence of the pins in the RJ-48C connector. CE1 I/O modules equipped with RJ-48C connectors have the same configuration as CT1 I/O modules equipped with RJ-48C connectors.

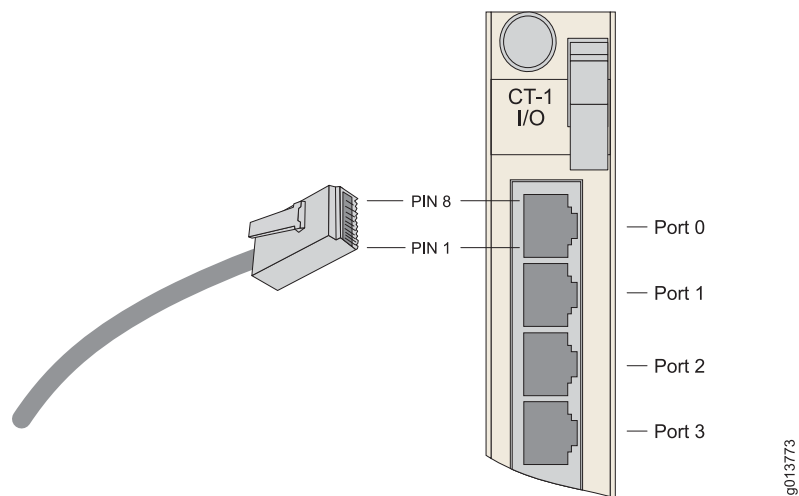
Figure 56: CT1 I/O Module Ports

Table 23 on page 135 lists the pinout for the CT1/CE1 connector.

Table 23: CT1/CE1 I/O Module—RJ-48C Connector Pinout

Pin	Signal
1	RX Ring
2	RX Tip
3	no connect
4	TX Ring
5	TX Tip
6	no connect
7	no connect
8	no connect

For CE1 I/O modules with Telco connectors, the other ends of the cables are attached to a balun panel that splits the signals from two Telco connectors to 20 pairs of BNC connectors. We supply the Telco cables if you purchase a balun panel.

Figure 57 on page 135 shows the location of the Telco connectors on a CE1 I/O module and the sequence of the pins in the connectors.

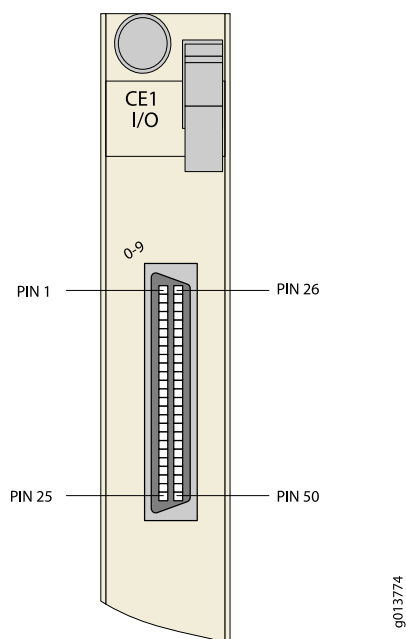
Figure 57: CE1 I/O Module with Telco Connectors

Figure 58 on page 136 shows the location of the 20 pairs of BNC connectors on a balun panel. The cables from the CE1 I/O module are plugged into the two 50-pin Telco connectors on the other side of the panel.

Figure 58: Twenty-Port Balun Panel

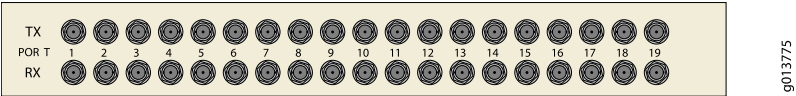


Table 24 on page 136 and Table 25 on page 137 list the pinouts for the Telco connectors on each cable.

Table 24: Pinout of 50-Pin Telco Connector to Ports 0–9

Pin	Signal	Pin	Signal
1	Port 0 RX TIP	26	Port 0 RX RING
2	Port 0 TX TIP	27	Port 0 TX RING
3	Port 1 RX TIP	28	Port 1 RX RING
4	Port 1 TX TIP	29	Port 1 TX RING
5	Port 2 RX TIP	30	Port 2 RX RING
6	Port 2 TX TIP	31	Port 2 TX RING
7	Port 3 RX TIP	32	Port 3 RX RING
8	Port 3 TX TIP	33	Port 3 TX RING
9	Port 4 RX TIP	34	Port 4 RX RING
10	Port 4 TX TIP	35	Port 4 TX RING
11	Port 5 RX TIP	36	Port 5 RX RING
12	Port 5 TX TIP	37	Port 5 TX RING
13	Port 6 RX TIP	38	Port 6 RX RING
14	Port 6 TX TIP	39	Port 6 TX RING
15	Port 7 RX TIP	40	Port 7 RX RING
16	Port 7 TX TIP	41	Port 7 TX RING
17	Port 8 RX TIP	42	Port 8 RX RING
18	Port 8 TX TIP	43	Port 8 TX RING
19	Port 9 RX TIP	44	Port 9 RX RING
20	Port 9 TX TIP	45	Port 9 TX RING
21	no connect	46	no connect
22	no connect	47	no connect

Table 24: Pinout of 50-Pin Telco Connector to Ports 0–9 *(continued)*

Pin	Signal	Pin	Signal
23	no connect	48	no connect
24	no connect	49	no connect
25	no connect	50	no connect

Table 25: Pinout of 50-Pin Telco Connector to Ports 10–19

Pin	Signal	Pin	Signal
1	Port 10 RX TIP	26	Port 10 RX RING
2	Port 10 TX TIP	27	Port 10 TX RING
3	Port 11 RX TIP	28	Port 11 RX RING
4	Port 11 TX TIP	29	Port 11 TX RING
5	Port 12 RX TIP	30	Port 12 RX RING
6	Port 12 TX TIP	31	Port 12 TX RING
7	Port 13 RX TIP	32	Port 13 RX RING
8	Port 13 TX TIP	33	Port 13 TX RING
9	Port 14 RX TIP	34	Port 14 RX RING
10	Port 14 TX TIP	35	Port 14 TX RING
11	Port 15 RX TIP	36	Port 15 RX RING
12	Port 15 TX TIP	37	Port 15 TX RING
13	Port 16 RX TIP	38	Port 16 RX RING
14	Port 16 TX TIP	39	Port 16 TX RING
15	Port 17 RX TIP	40	Port 17 RX RING
16	Port 17 TX TIP	41	Port 17 TX RING
17	Port 18 RX TIP	42	Port 18 RX RING
18	Port 18 TX TIP	43	Port 18 TX RING
19	Port 19 RX TIP	44	Port 19 RX RING
20	Port 19 TX TIP	45	Port 19 TX RING
21	no connect	46	no connect

Table 25: Pinout of 50-Pin Telco Connector to Ports 10–19 *(continued)*

Pin	Signal	Pin	Signal
22	no connect	47	no connect
23	no connect	48	no connect
24	no connect	49	no connect
25	no connect	50	no connect

Appendix D

Contacting Customer Support and Returning Hardware

See the Juniper Networks Web site for complete customer service information:
<http://www.juniper.net/support/guidelines.html>

This appendix contains the following sections:

- Contacting Customer Support on page 139
- Return Procedure on page 139
- Locating Component Serial Numbers on page 140
- Information You Might Need to Supply to JTAC on page 141
- Tools and Parts Required on page 142
- Returning Products for Repair or Replacement on page 142

Contacting Customer Support

For your convenience, we provide multiple options for requesting and receiving technical support from the Juniper Networks Technical Assistance Center (JTAC):

- By the Web using Juniper Networks, Inc. Case Manager:

<https://www.juniper.net/cm/index.jsp>

- By telephone:

From the US, Canada, and Mexico at 1-888-314-JTAC

From all other locations at 408-745-9500

Return Procedure

When you need to return a component, follow this procedure:

1. Determine the part number and serial number of the component. For instructions, see “Locating Component Serial Numbers” on page 140.
2. Obtain a Return Materials Authorization (RMA) number from the Juniper Networks Technical Assistance Center (JTAC). See “Information You Might Need to Supply to JTAC” on page 141.

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
- The shipping address for the replacement component, including contact name and phone number
- Description of the failure

The support representative validates your request and issues an RMA number for return of the component.

3. Pack the routing node or component for shipment, performing the procedure described in “Returning Products for Repair or Replacement” on page 142.

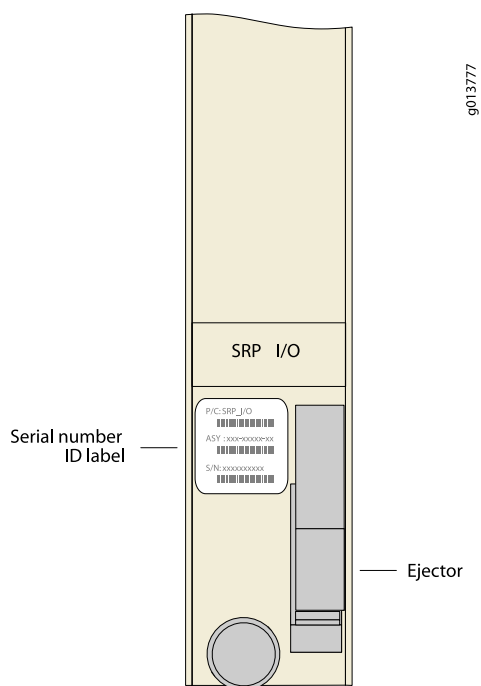
Locating Component Serial Numbers

Before contacting Juniper Networks to request a Return Materials Authorization (RMA), you must find the serial number on the chassis or component. To list all the chassis modules and their serial numbers, enter the following command:

```
host1#show hardware
```

You can also find the serial numbers on the modules. ID stickers are usually applied near the ejector. See Figure 59 on page 141.

Fan trays are not listed in the **show hardware** command output. ERX-7xx model and ERX-14xx model fan trays have stickers on the faceplate. For the ERX-310 router, you must remove the fan tray to view the serial number ID sticker.

Figure 59: Representative Module Serial Number ID Label

Information You Might Need to Supply to JTAC

When requesting technical support from the JTAC by phone, be prepared to provide the following information:

- Priority level
- Indication of what activity was being performed on the router when the problem occurred
- Problem detail and configuration data, obtained by these commands:
 - **show version**
 - **show hardware**
 - **show environment**
 - **show configuration**

When a new request for technical support is submitted, the JTAC engineer:

1. Opens a case and assigns a number
2. Begins troubleshooting, diagnostics, and problem replication (if appropriate)
3. Provides you with periodic updates on problem status and escalates the problem as appropriate according to escalation management guidelines
4. Closes the case when you agree that the problem has been resolved

Tools and Parts Required

To remove components from the chassis or the chassis from a rack prior to returning the chassis or components for repair or replacement, you need the following tools and parts:

- Mechanical lift, if available
- 3/8-inch nut driver or 3/8-inch wrench
- Blank filler panels
- Electrostatic bag or antistatic mat
- Electrostatic discharge (ESD) grounding wrist strap
- Flat-blade (—) screwdriver
- Phillips (+) screwdrivers, numbers 1 and 2
- Plastic boots or other protective cover for fiber-optic SC and LC connectors
- Wire cutters

Returning Products for Repair or Replacement

In the event of a hardware failure, please contact Juniper Networks to obtain a Return Material Authorization (RMA) number. This number is necessary to ensure proper tracking and handling of returned material at the factory. Do not return any hardware until you have received an RMA. Juniper Networks reserves the right to refuse shipments that do not have an RMA. Refused shipments will be returned to the shipper via collect freight.

See the customer support Web page for complete repair and return policies and procedures.

Packing Instructions for Returning a Chassis

If possible, use the original shipping crate, pallet, and packing materials in which the chassis was originally shipped. If these materials are unavailable, use comparable shipping material, or contact your Juniper Networks representative for information on approved packaging material.

To pack the chassis for shipment, follow these steps:

1. Ground yourself by using an antistatic wrist strap or other device and connect it to the ESD grounding jack on the chassis.
2. Issue the proper shutdown commands to halt your system.
3. Switch all power switches to the OFF position.
4. Remove all cables from the chassis.
5. Remove all major components from the chassis, including line modules, I/O modules, fan trays, and cable management systems.
6. Remove the chassis from the rack and bolt it to the shipping pallet.

7. Cover the chassis with an ESD bag and place packing foam on top of and around the chassis.
8. Place the crate cover over the chassis and fasten the cover to the pallet.

Appendix E

Declaration of Conformity

- Declaration of Conformity on page 145

Declaration of Conformity

Declaration of Conformity according to ISO/IEC Guide 22 and EN4514	
Manufacturer's Name:	Juniper Networks, Inc.
Manufacturer's Address:	Juniper Networks, Inc. 10 Technology Park Drive Westford, Massachusetts 01886 USA
Declares, that the product(s)	
Product Name:	Edge Switching Router
Model Number(s):	ERX-310, ERX-700, ERX-705, ERX-1400, ERX-1440
Product Options:	All Modules
Conforms to the following Product Specifications:	
Safety:	IEC 60950-1(2001-10) Ed. 1.0 Information technology equipment - Safety - Part 1: General requirements EN60950:2000, 3rd Edition, Safety of Information Technology Equipment EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001)
EMC:	EN55022 Class A (CISPR-22 Class A) EN55024, Annex C for WAN Equipment Performance Criteria A, B, and C ETSI 300-386, Telecommunication Network Equipment; ElectroMagnetic Compatibility (EMC) requirements
Supplementary Information:	The products herewith comply with the requirements of the Low Voltage Directive (73/23/EEC), the EMC Directive (89/336/EEC), and the RTTE Directive (1999/5/EEC), and carry the CE markings accordingly. Products were tested in a typical configuration.

Declaration of Conformity according to ISO/IEC Guide 22 and EN4514	
	<p>Westford, MA, May 01, 2003</p> <p>David H. Schilling</p> <p>Regulatory Affairs</p>

Part 5

Index

- Index on page 149

Index

Symbols

10-Gbps SRP module.....	11
10/100Base-T port.....	50, 52, 70
-48 VDC.....	17

A

access line modules.....	9
access, management.....	14, 69
setting up console.....	69, 71
SNMP.....	14, 73
Telnet setup.....	72
accessing fan tray.....	88
agency certification.....	109, 111, 113
air filter	
replacing.....	91
airflow.....	117
rack-mounted installation and.....	26
specifications.....	109, 111, 113
alarm ports.....	50
amperage.....	109, 111, 113
antistatic bags and containers.....	78
assembly numbers, locating.....	140
assigning an IP address.....	71

B

BNC connector.....	51, 58
booting	
LED activity.....	100

C

cable-management bracket.....	49
installing.....	92
cables	
failure.....	101
I/O modules.....	58
pinouts.....	131
power input module.....	53
recommendations.....	124
redundant port.....	63
required.....	49
SRP I/O modules.....	49, 52

cabling

ERX routers.....	47
HSSI connectors.....	58
RJ-45 connectors.....	59
SC duplex connectors.....	60, 61
SRP I/O modules.....	49, 52
X.21/V.35 connectors.....	62
Case Manager.....	139
certifications.....	110, 111, 112, 113, 114, 115
circulation, air.....	26
classification, packet.....	13
cleaning.....	78
CLI (command-line interface).....	14
clock source input ports.....	51
clocking problems.....	101
color code, power cable.....	56
combinations of line modules.....	33
command-line interface.....	14
compliance	
product reclamation and recycling.....	125
requirements.....	126, 127, 128, 129
components	
returning.....	78
storing.....	78
configuring cables.....	47, 124
configuring management access.....	69
configuring Telnet.....	72
connecting console to router.....	70
connectors, pinouts.....	131
console	
for management access.....	69, 71
ports	
RS-232.....	50, 52
consumption, power.....	109, 111, 113
conventions	
notice icons.....	xiii
text and syntax.....	xiv
current (electrical) requirements.....	109, 111, 113
customer support.....	xix, 139
contacting JTAC.....	xix

D

DB-9 connector.....	49, 131, 133, 134
DC power.....	56, 114
detecting double-bit error.....	104

Device Management System, NMC-RX.....	14
diagnosing problems.....	95
diagnostic LEDs.....	96
dimensions of ERX routers.....	109, 111, 113
dissipation, heat.....	109, 111, 113
distribution rack.....	121
documentation set	
comments on.....	xix
double-bit errors	
detecting.....	104
troubleshooting.....	105

E

E-series routers	
assigning IP address to.....	71
cabling.....	47
cabling recommendations.....	124
dimensions.....	109, 111, 113
electrical requirements.....	109, 111, 113
hardware.....	14
installing.....	21, 25
installing components.....	77
installing modules.....	31
lifting.....	21, 22
maintenance.....	77
management access.....	14, 69
models.....	3
modules.....	9
power requirements.....	109, 111, 113
powering down.....	67
powering up.....	65
safety guidelines.....	27, 118, 120
site planning.....	117
slot groups and identification.....	32
space requirements.....	26
troubleshooting.....	95, 96
EIA distribution rack.....	26
ejectors, module.....	39
electrical requirements.....	109, 111, 113
electronic equipment, recycling.....	125
environmental requirements.....	117
ERX-1440 router.....	4
ERX-14xx models.....	4
fan tray.....	17
front view.....	5
rear view.....	5
ERX-310 router	
fan tray.....	17
front view.....	8
power cord warnings.....	120
rear view (AC model).....	8
rear view (DC model).....	8
ERX-705 router.....	6

ERX-7xx models.....	6
fan tray.....	17
front view.....	6
rear view.....	7
slot identification and grouping.....	33
ESD (electrostatic discharge)	26
ESD grounding jack, chassis.....	34
Ethernet link.....	101
external timing ports.....	50

F

failure, fan.....	103
failures.....	101
FAN FAIL LED.....	88
FAN OK LED.....	88
fan tray.....	17
hot-swapping.....	88
fans	
failure.....	88, 103
installing.....	90
location.....	17
redundancy.....	17
removing.....	90
status.....	88
far-end receive failure.....	101
FERF (far end receive failure).....	101
filler panel.....	36
filter, air.....	91
Flash cards.....	12
flow, air.....	26

G

grounding jack, ESD.....	34
--------------------------	----

H

halt command.....	41, 79
hardware	
cable configuration.....	47, 124
reclamation and recycling.....	125
redundancy features.....	14
repairing and replacing.....	37
hazardous materials, reclamation and recycling.....	125
heat dissipation.....	109, 111, 113, 117
high-availability mode.....	99
hot-swapping	
fan trays.....	88
modules.....	34
HSSI connectors, cabling.....	58
humidity requirements.....	109, 111, 113
HyperTerminal.....	70

I

I/O modules.....	14
cables.....	58
installing.....	39
installing redundancy.....	45
OC48 Frame APS.....	34
removing.....	41
SFPs.....	85
SRP.....	49
installing ERX routers.....	21, 25
site planning.....	117
installing modules.....	
I/O modules.....	39
line modules.....	39
order of installation.....	36
slot groups and module arrangements.....	32
SRP I/O modules.....	37
SRP modules.....	37
installing NVS cards.....	79, 81
installing redundancy I/O modules.....	45
installing redundancy midplane.....	43
installing SFPs.....	86
installing spare line modules.....	43
IP address, assigning.....	71

J

JTAC, contacting.....	139
-----------------------	-----

L

lead in equipment, reclamation and recycling.....	125
LEDs.....	96
abnormal activity.....	101
fans.....	88
line modules.....	9
normal activity.....	100
redundancy status.....	103
SRP modules.....	9, 99
lifting router.....	22
line modules.....	13
access.....	9
combinations.....	4
installing.....	39
installing spare.....	43
LEDs.....	9, 96
OC48.....	34
performance rate.....	4
redundancy.....	42, 103
removing.....	41
slot groups.....	32
uplink.....	9
location, for ERX routers.....	117

M

maintenance, system.....	77
management access.....	14, 69
setting up console.....	69, 71
SNMP.....	14, 73
Telnet setup.....	72
Management Information Bases.....	14
management port.....	
10/100Base-T.....	50, 52
managing modules.....	34
manuals.....	
comments on.....	xix
mechanical requirements for distribution rack.....	122
memory, upgrading.....	82
MIBs (Management Information Bases).....	14
midplane.....	9
redundancy.....	43
models.....	
ERX router.....	3
module reset button.....	104
modules.....	
failure.....	101
hot-swapping.....	34
installing.....	31, 37
order of installation.....	36
managing.....	34
removing.....	41
repairing and replacing.....	37
replacing.....	34
self-testing.....	96
storing.....	78
types of.....	9
monitoring LEDs.....	96
monitoring temperature.....	103
mounting kits.....	122
mounting posts for rack.....	122

N

network management.....	14, 69
setting up console.....	69, 71
SNMP.....	14, 73
Telnet setup.....	72
NMC-RX Device Management System.....	14
notice icons.....	xiii
NVS cards.....	12
installing.....	79, 81
storing.....	78

O

OC48 modules.....	34
ONLINE LED.....	103
order of module installation.....	36

P

packaging, recycling.....	126
packet classification.....	13
packing instructions.....	142
PCMCIA slot, SRP modules.....	12
performance rate, line modules.....	4
PIM	
replacing.....	93
pinouts, router cables and connectors.....	131
planning site for installation.....	117
plenum.....	26
ports	
alarm.....	50
external timing.....	50
management.....	50
redundancy.....	34, 46
status LEDs.....	96
power	
cabling power input module.....	53
consumption	
system.....	109, 111, 113
dissipation.....	109, 111, 113
failures.....	96, 101
redundancy.....	57
source A.....	101
source B.....	101
specifications.....	109, 111, 113
power cord warnings.....	120
power input module	
cabling.....	53
replacing.....	93
power requirements.....	109, 111, 113
power switches.....	53, 65
powering down router.....	67
powering up router.....	65
preinstallation responsibilities.....	117
preparing site for installation.....	117
primary SRP module.....	14
problems.....	101
product numbers, locating.....	140

Q

QoS, packet classification for.....	13
-------------------------------------	----

R

rack, distribution.....	26
reclamation and recycling.....	125
recycling Juniper Networks equipment.....	125
redundancy	
line module status.....	103
midplane.....	14
SRP modules.....	12
status.....	103

redundancy features (hardware).....	14
fans.....	17
line modules.....	42
ports.....	34, 46
SRP modules.....	14
redundancy midplane.....	16
installing.....	43
REDUNDANT LED.....	103
release mechanisms for SFPs.....	85
removing components.....	77
removing modules.....	41
removing SFPs.....	85
repacking components.....	142
repairing hardware components.....	37
replacing components.....	77
replacing modules.....	34
replacing NVS cards.....	79, 81
replacing SFPs.....	85, 86
reset button, module.....	104
Restriction of Hazardous Substances (RoHS) Directive,	
recycling equipment.....	125
Return Materials Authorization.....	139
returning product.....	139
RJ-45 connectors, cabling.....	59
RMA.....	139
RoHS (Restriction of Hazardous Substances) Directive,	
recycling equipment.....	125
RS-232 port.....	50, 52, 69, 70

S

safety	
agency certification.....	109, 111, 113
guidelines.....	27, 118, 120
SC duplex connectors, cabling.....	60, 61
self-testing, modules.....	96
serial numbers, locating.....	140
SFPs (small form-factor pluggable transceivers).....	85
installing.....	86
removing.....	85
storing.....	78
show configuration command.....	141
show environment command.....	103, 141
show hardware command.....	141
show version command.....	39, 141
show interface gigabitEthernet command.....	88
site planning.....	117
size	
of ERX routers.....	109, 111, 113
of rack.....	123
slot disable command.....	41
slot groups.....	32
ERX-1410 router.....	32
ERX-7xx models.....	33
overloading.....	101
small form-factor pluggable transceivers.....	85

SMB connectors.....61
 SNMP for management access.....14, 73
 SODIMMs.....83
 software
 configuration.....12
 upgrading.....78
 space requirements.....26, 109, 111, 113, 117
 spare line modules, installing.....43
 specifications
 airflow.....109, 111, 113
 dimensions.....109, 111, 113
 distribution rack.....121
 electrical.....109, 111, 113
 heat dissipation.....109, 111, 113
 space.....109, 111, 113
 weight.....109, 111, 113
 SRP I/O modules.....12
 cabling.....49, 52
 installing.....37
 removing.....41
 SRP modules.....9
 errors on.....104
 installing.....38
 LEDs on.....9, 99
 models.....6
 PCMCIA slot.....12
 powering down.....67
 redundancy.....12, 14
 removing.....41, 67
 standby SRP module.....14
 starting ERX routers.....65
 status, redundancy.....103
 storing, modules and components.....78
 support, technical *See* technical support
 switches, power.....53, 65
 switching on router.....65
 switchover to spare line module.....16
 synchronize command.....15
 system maintenance.....77

T

technical support.....139
 contacting JTAC.....xix
 Telnet connection to router.....72
 temperature
 excessive.....101, 103
 monitoring.....103
 requirements.....101, 117
 text and syntax conventions.....xiv
 thermal protection mode.....17, 88, 103
 timing inputs, external.....13, 50
 tools needed.....21, 36, 48, 77, 142
 troubleshooting.....95, 96
 booting.....101
 cables.....101

clocking.....101
 double-bit errors.....105
 Ethernet link.....101
 fans.....96, 103
 FERF.....101
 LED activity for.....96
 modules.....96, 101
 power failure.....96, 101
 safety guidelines.....118, 120

U

uninstalling modules.....41
 upgrading software.....78
 uplink line modules.....9

V

ventilation.....26
 voltage requirements.....109, 111, 114

W

warnings, safety.....36
 Waste Electrical and Electronic Equipment (WEEE)
 Directive, recycling equipment.....125
 WEEE (Waste Electrical and Electronic Equipment)
 Directive, recycling equipment.....125
 weight
 of ERX routers.....109, 111, 113
 of rack.....117, 122
 wrist strap, antistatic.....34

X

X.21/V.35 connectors, cabling.....62

