



ERX Edge Routers Installation and User Guide

Release 4.0.x

Juniper
NETWORKS

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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.

Réglement 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'exécède 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 at the end of this manual.

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Appendix F Declaration of Conformity

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About This Guide

This *ERX Installation and User Guide* provides the information you need to install and start the ERX edge router.



Note: If the information in the *ERX Release Notes* differs from the information in this guide, follow the *ERX Release Notes*.

Your ERX system is shipped with the latest system software installed. If you need to install a future release or reinstall the system software, refer to the procedures in [Appendix E, Installing ERX System Software](#).

ERX Edge Routers

Four models of the ERX edge router are available:

- ERX-1440 system
- ERX-1410 system
- ERX-705 system
- ERX-700 system

All models use the same software. For information about the differences between the models, see [Chapter 1, ERX System Overview](#).

In the ERX documentation, the term ERX-1400 series refers to both the ERX-1440 system and the ERX-1410 system. Similarly, the term ERX-700 series refers to both the ERX-705 system and the ERX-700 system. The terms ERX-1440 system, ERX-1410 system, ERX-705 system, and ERX-700 system refer to the specific models.

Audience

This guide is intended for experienced system and network specialists who will configure a Juniper Networks ERX system in an Internet access environment.

Conventions

[Table 1](#), [Table 2](#), and [Table 3](#) list all the conventions used in the ERX documentation. [Table 1](#) defines notice icons. [Table 2](#) shows text conventions used throughout the book, except for command syntax. [Table 3](#) provides command syntax conventions used primarily in the *ERX Command Reference Guide*. For more information about command syntax, see *ERX System Basics Configuration Guide, Chapter 2, Command Line Interface*.

Table 1 Notice icons




Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates that you may risk losing data or damaging your hardware.
	Warning	Alerts you to the risk of personal injury.

Table 2 Text conventions (except for command syntax)

Convention	Description	Examples
Bold typeface	Represents commands and keywords in text.	<ul style="list-style-type: none"> Command example: Issue the clock source command. Keyword example: Specify the keyword exp-msg.
Bold Courier typeface	Represents text that the user must type.	user input
Key name in angle brackets	Indicates the name of a key on the keyboard.	Press <Enter>.
Key names linked with a plus sign (+) in angle brackets.	Indicates that you must press two or more keys simultaneously.	Press <Ctrl+B>.
Plain Courier typeface	Represents information as displayed on your terminal's screen.	<pre>host1#show ip ospf 2 Routing Process OSPF 2 with Router ID 5.5.0.250 Router is an Area Border Router (ABR)</pre>

Table 2 Text conventions (except for command syntax) (continued)

Convention	Description	Examples
<i>Italics</i>	<ul style="list-style-type: none"> Emphasize words. Identify variables. Identify 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>.

Table 3 Syntax conventions in *Command Reference Guide*

Convention	Description	Examples
Words in plain text	Represent keywords.	terminal length
Words in italics	Represent variables.	<i>mask</i> , <i>accessListName</i>
Words separated by the symbol	Represent a choice to select one keyword or variable to the left or right of this symbol. (The keyword or variable may be either optional or required.)	diagnostic line
Words enclosed in [brackets]	Represent optional keywords or variables.	[internal external]
Words enclosed in [brackets]*	Represent optional keywords or variables that can be entered more than once.	[level1 level2 l1]*
Words enclosed in { braces }	Represent required keywords or variables.	{ permit deny } { in out } { <i>clusterId</i> <i>ipAddress</i> }

Documentation

The *ERX Installation Quick Start* poster is shipped in the box with all new systems. This poster provides the basic procedures to help you get the system up and running quickly.

The document set contains the following books and online resources:

- *ERX Installation and User Guide* – Provides the necessary procedures for getting your system operational, including information on installing, cabling, powering up, configuring your system for management access, and general troubleshooting.
- *ERX System Basics Configuration Guide* – Describes planning and configuring your network, managing the system, passwords, and security, and configuring the system clock and virtual routers.
- *ERX Physical and Link Layers Configuration Guide* – Describes configuring physical and link layer interfaces.

- *ERX Routing Protocols Configuration Guide, Vol. 1* – Provides information about configuring routing policy and configuring IP, IP routing, and IP security.
- *ERX Routing Protocols Configuration Guide, Vol. 2* – Describes BGP Routing, MPLS, and related VPNs.
- *ERX Policy and QoS Configuration Guide* – Provides information about configuring policy management and quality of service (QoS).
- *ERX Broadband Access Configuration Guide* – Provides information about configuring remote access.
- *ERX Command Reference Guide* – Contains important information about all system commands implemented in the system software. Use to look up command descriptions, command syntax, a command's related mode, or a description of a command's parameters. It is intended to be used with the *ERX Configuration Guides*.
- *ERX Product Overview Guide* – Gives a thorough overview of the system from a software and hardware perspective. It provides illustrations and configuration examples that present the “big picture.”
- *ERX Release Notes* – Contains information about features, changes, known problems, and limitations. Provides final information that did not make it into the documentation.
- *ERX Online Documentation CD* – Provides an online version of this guide and the documents listed above. The online documents contain numerous links between guides, giving easy access to a vast amount of technical information.

Abbreviations

A complete list of abbreviations used in this document set, along with their spelled-out terms, is provided in the *ERX System Basics Configuration Guide, Appendix A, Abbreviations and Acronyms*.

Using the Online Documentation CD

To use the Online Documentation CD:

- 1** Place the Online Documentation CD in your CD drive.
- 2** Follow the instructions located on the inside cover of your CD jewel case to install Acrobat Reader.
- 3** From the *Documentation* folder on the CD, open the *CDtips.pdf* file for information on using Adobe Acrobat Reader.
- 4** From the *Documentation* folder on the CD, open the *Welcome.pdf* file for access to the documentation set.

Comments About the Documentation

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

- techpubs-comments@juniper.net

Along with your comments, be sure to indicate:

- Document name
- Document part number
- Page number

Contacting Customer Support

For technical support, contact Juniper Networks at support@juniper.net, or at 1-888-314-JTAC (within the United States) or 408-745-2121 (from outside the United States).

ERX System Overview

1

This chapter provides information about the system.

Topic	Page
The ERX System	1-1
Where the ERX System Fits In	1-6
ERX System Modules	1-7
Network Management Tools	1-11
Redundancy Features	1-11
The Next Step	1-15

The ERX System

The ERX edge routers are modular, carrier-class networking devices that deliver performance, reliability, and service differentiation to both business and consumer Internet users. The systems offer high port density, low power consumption, and fully redundant Internet access routing and edge aggregation. The ERX edge routers offer the complete edge solution for IP-optimized carriers.

Four models of the ERX edge router are available:

- ERX-1440 system
- ERX-1410 system
- ERX-705 system
- ERX-700 system

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

- The combination of line modules supported
- The conditions for line rate performance of line modules

ERX-1400 Series

In the ERX documentation, the term ERX-1400 series refers to both the ERX-1440 system and the ERX-1410 system. The terms ERX-1440 system and ERX-1410 system refer to the specific models.

The ERX-1440 system 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 system manages high levels of network traffic, and uses the 10-Gbps SRP module (SRP-10G). You can configure the ERX-1410 system 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 [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules](#).

Externally, the ERX-1440 chassis is the same as the ERX-1410 chassis (see [Figure 1-1](#) and [Figure 1-2](#)). Both systems contain fourteen vertical slots to accommodate modules and have the same power requirements. Installation procedures and operating procedures are identical for both systems. All ERX systems use the same SRP I/O modules.



Note: *The system may look different from the systems shown in the figures in this chapter, depending on the line modules in the slots.*

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

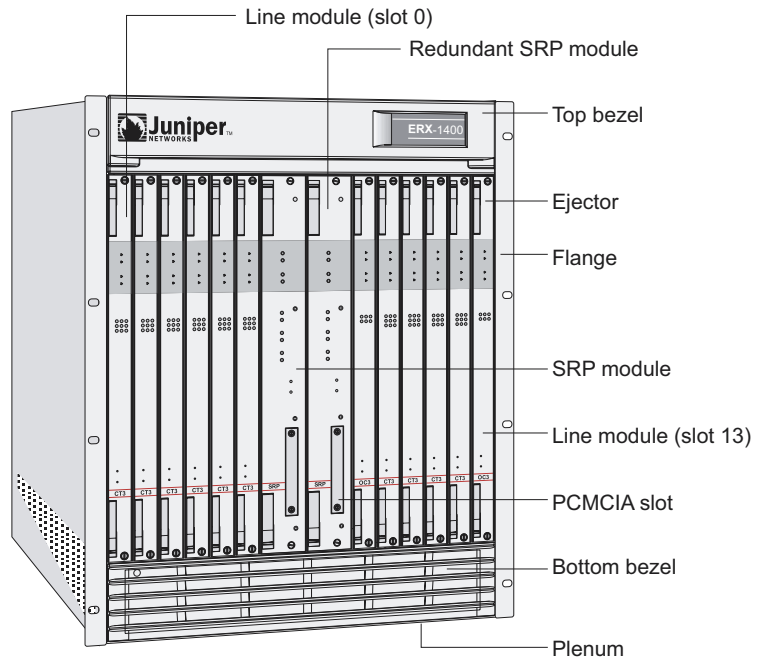


Figure 1-1 ERX-1400 series front view

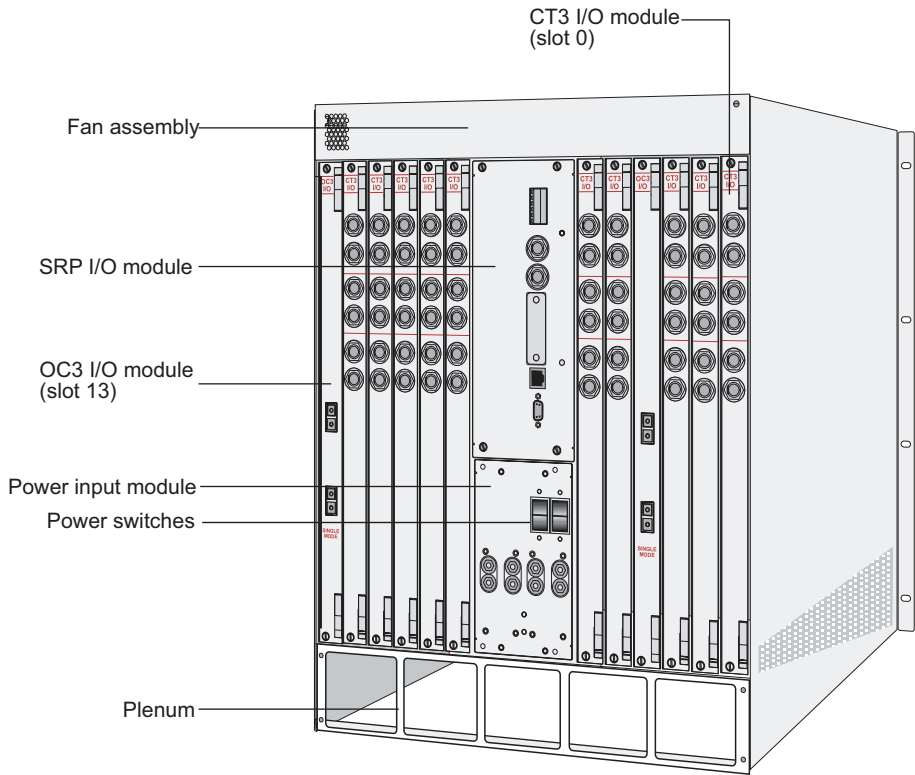


Figure 1-2 ERX-1400 series rear view

ERX-700 Series

In the ERX documentation, the term ERX-700 series refers to both the ERX-705 system and the ERX-700 system. The terms ERX-705 system and ERX-700 system refer to the specific models.

The ERX-705 system is a compact, high-performance model that manages low traffic density and uses a 5-Gbps SRP module, the SRP-5G+ module. The ERX-700 system is a robust, high-density system with less capacity than the ERX-1400 series. The ERX-700 system uses either the SRP-10G module or a 5-Gbps SRP module, the SRP-5G module. (Although the SRP-5G+ module obsoletes the SRP-5G module; the software continues to support both modules.)

You can configure the ERX-700 series to enable the line modules either to operate at full line rate performance or to operate at a rate dependent on the resources available. For information about configuring performance of line modules, see [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules](#).

The ERX-705 chassis is the same as the ERX-700 chassis (see [Figure 1-3](#) and [Figure 1-4](#)). The chassis contains seven slots to accommodate modules. Installation procedures and operating procedures are identical for both systems. All ERX systems use the same SRP I/O modules.



Note: The system may look different from the systems shown in the figures in this chapter, depending on the line modules in the slots.

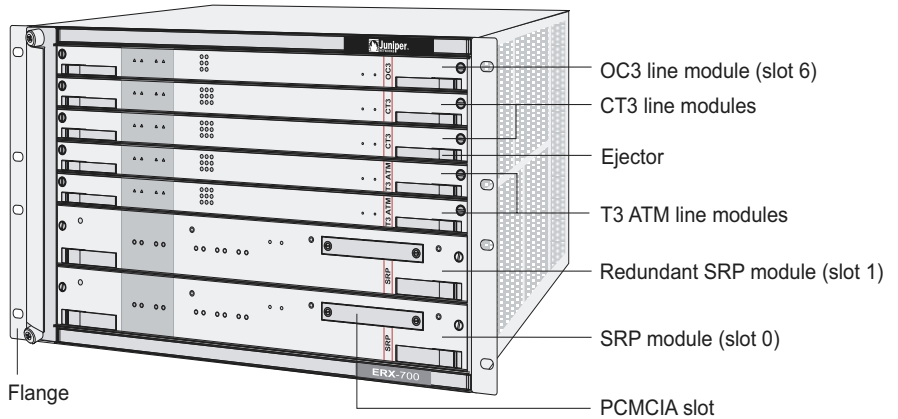


Figure 1-3 ERX-700 series front view

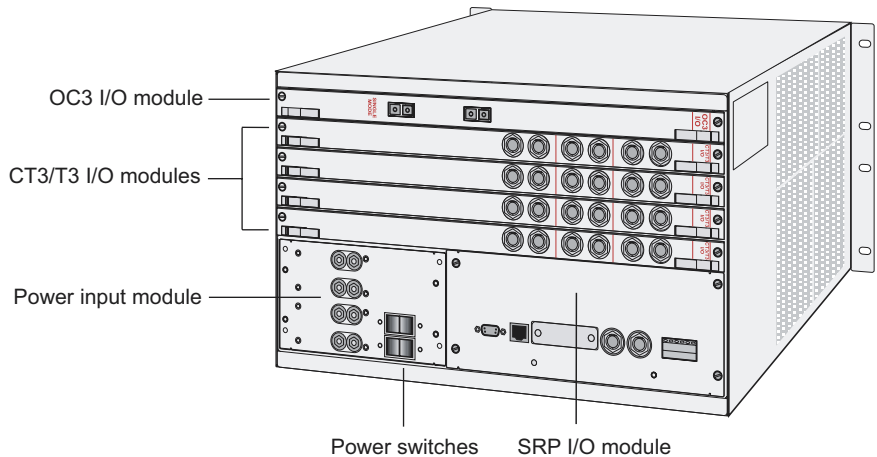


Figure 1-4 ERX-700 series rear view

Where the ERX System Fits In

Figure 1-5 and Figure 1-6 illustrate the position of the system as an edge router in an end-to-end Internet network. Communications with the system can take place over a variety of media. In Figure 1-5, the customers are businesses using T1/T3 communication lines. In Figure 1-6, the customers are using digital subscriber lines (DSLs) with a DSL access multiplexer (DSLAM).

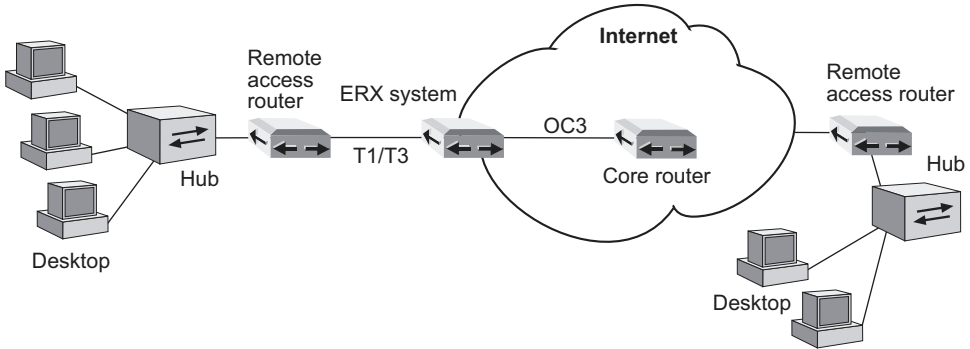


Figure 1-5 ERX system communicating over T1/T3 lines

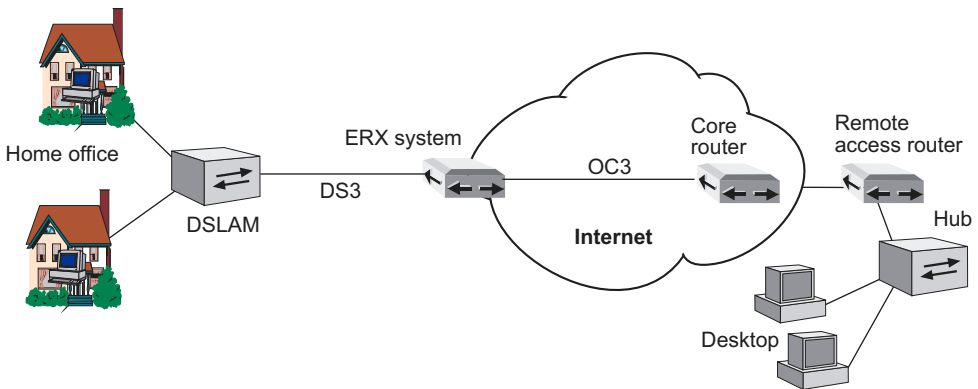


Figure 1-6 ERX system communicating over DSL lines

ERX System Modules

The 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 Internet.

Each module connects to a corresponding I/O module via a passive midplane. See [Figure 1-7](#).

The front panel of each system module contains a collection of status LEDs (light-emitting diodes). See [Figure 1-8](#). For information about how to interpret the LEDs, see [Chapter 8, Troubleshooting](#).

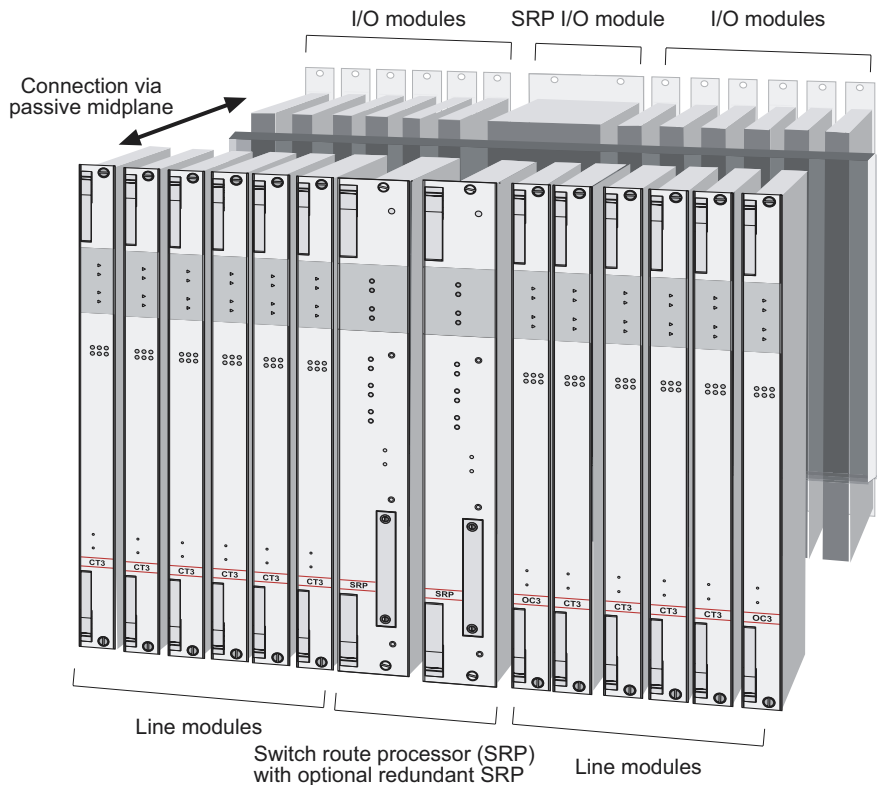


Figure 1-7 Modules in the ERX-1400 series

SRP Module

The SRP module (see [Figure 1-8](#)) is a two-board assembly; both boards connect to the system's midplane and to each other:

- The fabric board is a switch fabric server that queues packets for the line modules. The fabric server houses a flexible hardware queuing resource that empowers IP QoS for each physical and logical interface, providing weighted scheduling for preferential packet delivery.
- The system processor board is the dedicated processor that boots the system, manages diagnostics, and supports routing protocol processing.

An SRP module must be present for the system to boot. For details about installing SRP modules, see [Chapter 3, Installing ERX Modules](#). For specifications of SRP modules, see [Appendix B, Module Specifications](#).



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

You can install two SRP modules of the same type in the system. If you do, the first SRP module serves as the primary; the second as a redundant module, which enhances the system's reliability. See [Redundancy Features](#), later in this chapter.

Nonvolatile Storage

The PCMCIA slot on the front of the SRP module holds a Type II PCMCIA nonvolatile storage (NVS) card. This card retains the system's configuration and software. See [Figure 1-8](#). The PCMCIA card is factory installed.

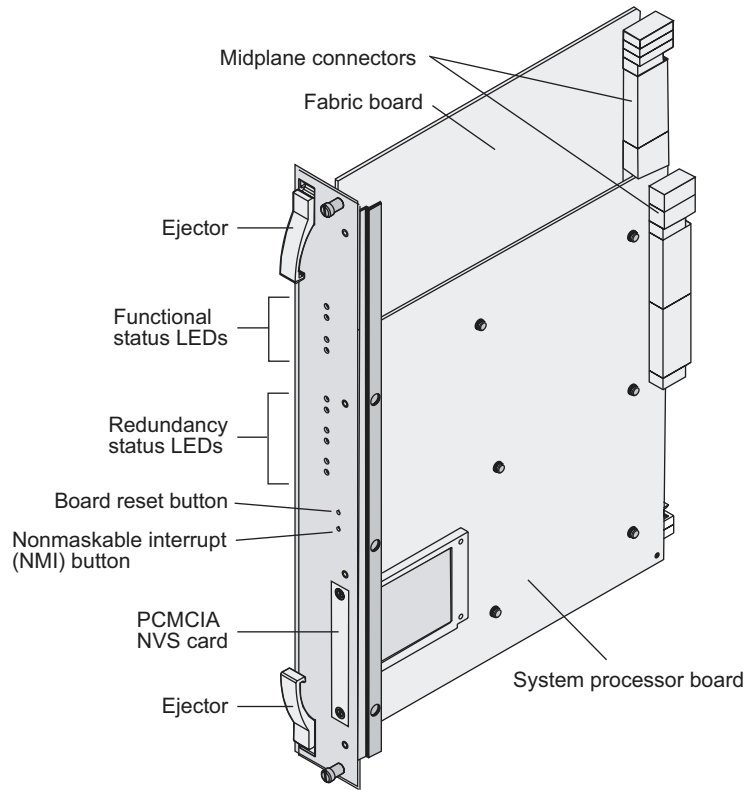


Figure 1-8 SRP module

SRP I/O Module

A single corresponding input/output module called the SRP I/O module interfaces with one or two SRP modules through the system's midplane. The same SRP I/O works with all models of the SRP module. This I/O module is two slots wide. See [Figure 1-2](#) and [Figure 1-4](#).

The SRP module provides standard craft management interfaces, including:

- 10/100Base-T – a port for Ethernet management
- RS-232 – a port for VT100 management access
- External timing inputs – ports for external timing sources

For details about installing the SRP I/O module, see [Chapter 3, Installing ERX Modules](#).

Line Modules

Line modules process data from different types of network connections. For information about the available line modules and which SRP modules support specific line modules, see [Appendix B, Module Specifications](#).

Figure 1-9 shows a representative line module. For details about installing line modules, see [Chapter 3, Installing ERX Modules](#).

Packet Classification

Each line module supports packet classification on ingress. 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.

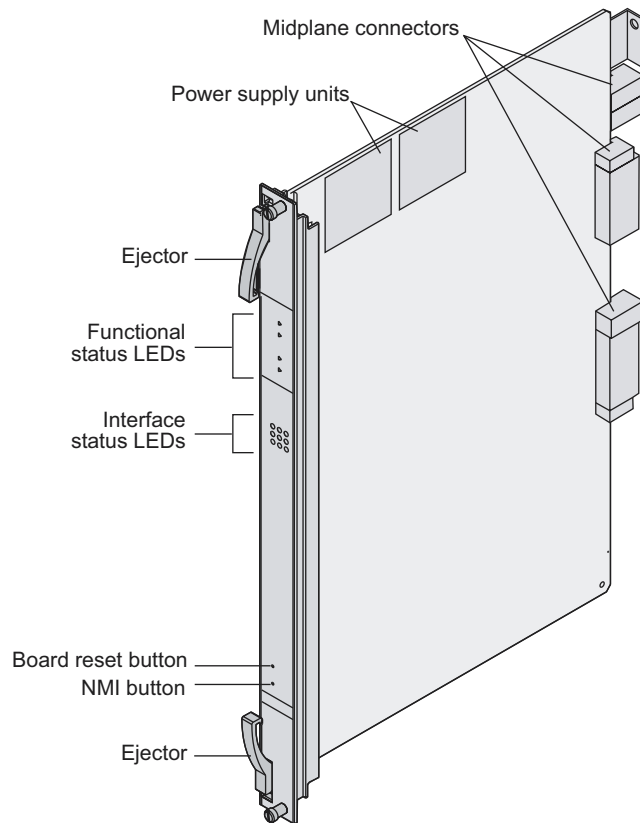


Figure 1-9 Representative line module

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 in the back of the system, directly behind its corresponding line module. For information about which line modules pair with which I/O modules, see [Appendix B, Module Specifications](#). For details about installing I/O modules, see [Chapter 3, Installing ERX Modules](#).

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, an Ethernet connection, or Telnet through any reachable network. For a full discussion of the CLI, see [ERX 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 ERX Enterprise MIB is ASN.1 notated for easy importing into third-party SNMP management applications. For more information, see [ERX System Basics Configuration Guide, Chapter 3, Configuring SNMP](#).

NMC-RX Device Management System

The NMX-RX application provides a global method of managing all edge routers, line modules, and ports.

Redundancy Features

The system has the following redundancy features:

SRP Modules

The SRP module uses a 1:1 redundancy scheme. When two SRP modules of the same type are installed in the system chassis, one acts as a primary and the second as a standby. Both SRP modules share a single

SRP I/O module located in the rear of the chassis. If the primary SRP fails, the redundant SRP module assumes control without rebooting or initializing itself. (As a consequence, 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 [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP 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 [Chapter 3, Installing ERX Modules](#).

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 [Chapter 3, Installing ERX Modules](#).

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 will not 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 there is not enough space on the primary NVS card to create the synchronization reserve file, the **synchronize** command fails, and you see a warning message 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

The ERX system supports line module redundancy for several line modules. For details about which line modules support redundancy, see [Appendix B, Module Specifications](#). In this scheme, an extra line access 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 may cover 2–6 slots. It provides additional connectivity that enables the spare line module to assume 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 1-10](#) shows the data flow when a spare line module becomes active.

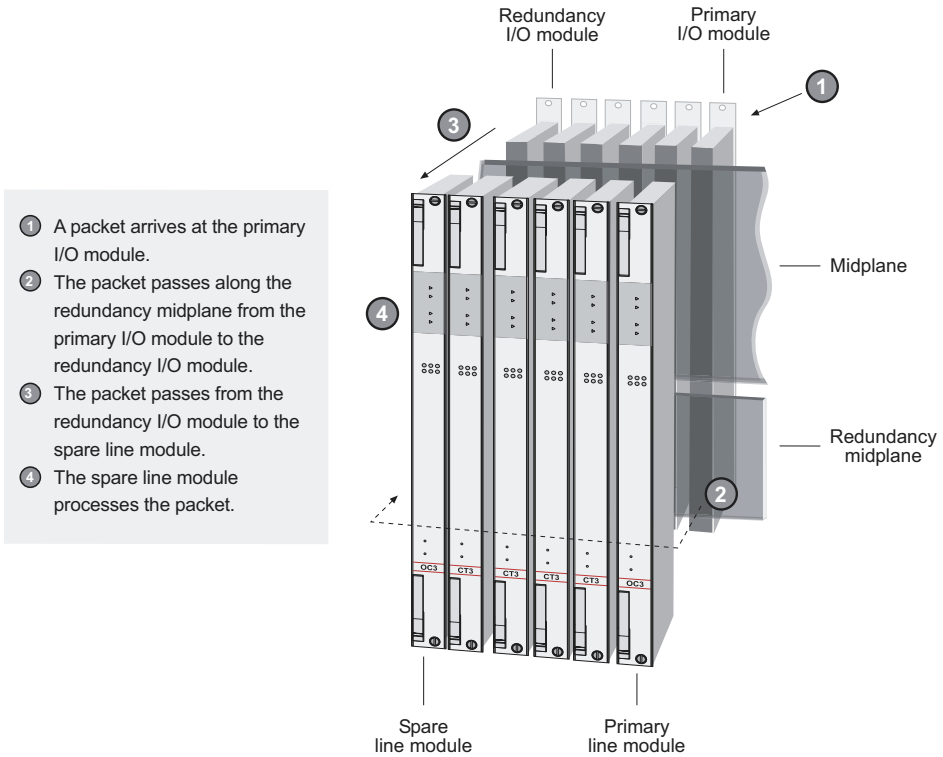


Figure 1-10 Data flow when a spare line module is active

For information about installing modules for line module redundancy, see [Chapter 3, Installing ERX Modules](#). For information about configuring and managing SRP module redundancy, see [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules](#), for more information.

Power

The system provides a power architecture that distributes redundant –48 VDC feeds through the system to each line module, SRP module, and fan module where DC-to-DC converters provide local conversion to the required secondary voltages. The system design prevents a failure of any one of the power components from causing any other component in the system to fail.

Fans

Forced air-cooling keeps the temperature of the ERX modules and components within normal operating limits. In the ERX-1400 series, six cooling fans are located in a tray at the top of the system (see [Figure 7-5](#)). In the ERX-700 series, four cooling fans are located in a tray on one side of the system (see [Figure 7-7](#)).

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. In this mode, the modules consume extremely low levels of power. For information about troubleshooting high operating temperatures, see [Chapter 8, Troubleshooting](#).

The fan tray has two redundant converters that power the fans (for the ERX-1400 series, a –24 V, 50 W converter; for the ERX-700 series, a –12 V, 15 W converter). If one converter fails, the other takes over. In addition, the system software reports an alarm if any of the fans overrotate or underrotate or if one of the converters fails.

The Next Step

Go to [Chapter 2, Installing the ERX System](#).

Installing the ERX System

2

This chapter provides procedures for installing the ERX-1400 series and the ERX-700 series either as freestanding devices or in a distribution rack.

Topic	Page
Before You Begin	2-1
Unpacking the ERX-1400 Series	2-1
Unpacking the ERX-700 Series	2-4
Freestanding Installation	2-5
Rack-Mounted Installation	2-6
The Next Step	2-10

Before You Begin

Before you begin unpacking the system, be sure you have the following items:

- A No. 2 Phillips screwdriver
- A utility knife

Unpacking the ERX-1400 Series

The ERX-1400 series come boxed, bolted, and strapped to a skid. See [Figure 2-1](#).

For your convenience, we recommend that you unpack the ERX system in the location where you want to install it.

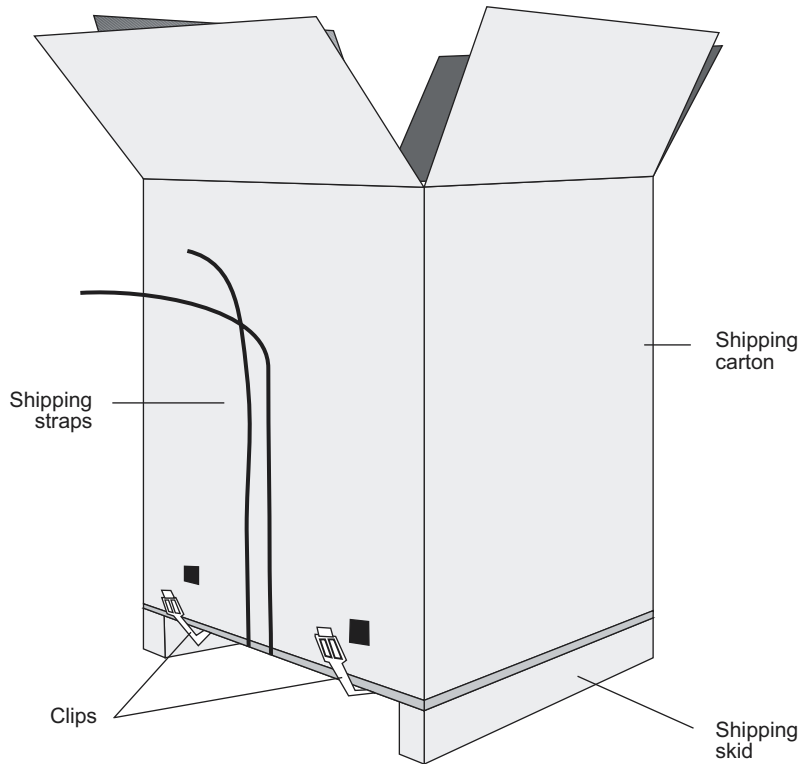


Figure 2-1 Packaged ERX-1400 series

To unpack the ERX-1400 series:

- 1** Cut the two straps that secure the carton to the skid. See [Figure 2-1](#).
- 2** Open the carton from the top.
- 3** Remove the box of accessories that sits on top of the router.
- 4** Unlock the four plastic clips that hold the box to the skid by squeezing them in their center and pulling out. See [Figure 2-1](#).
- 5** Lift the carton off the router. See [Figure 2-2](#).

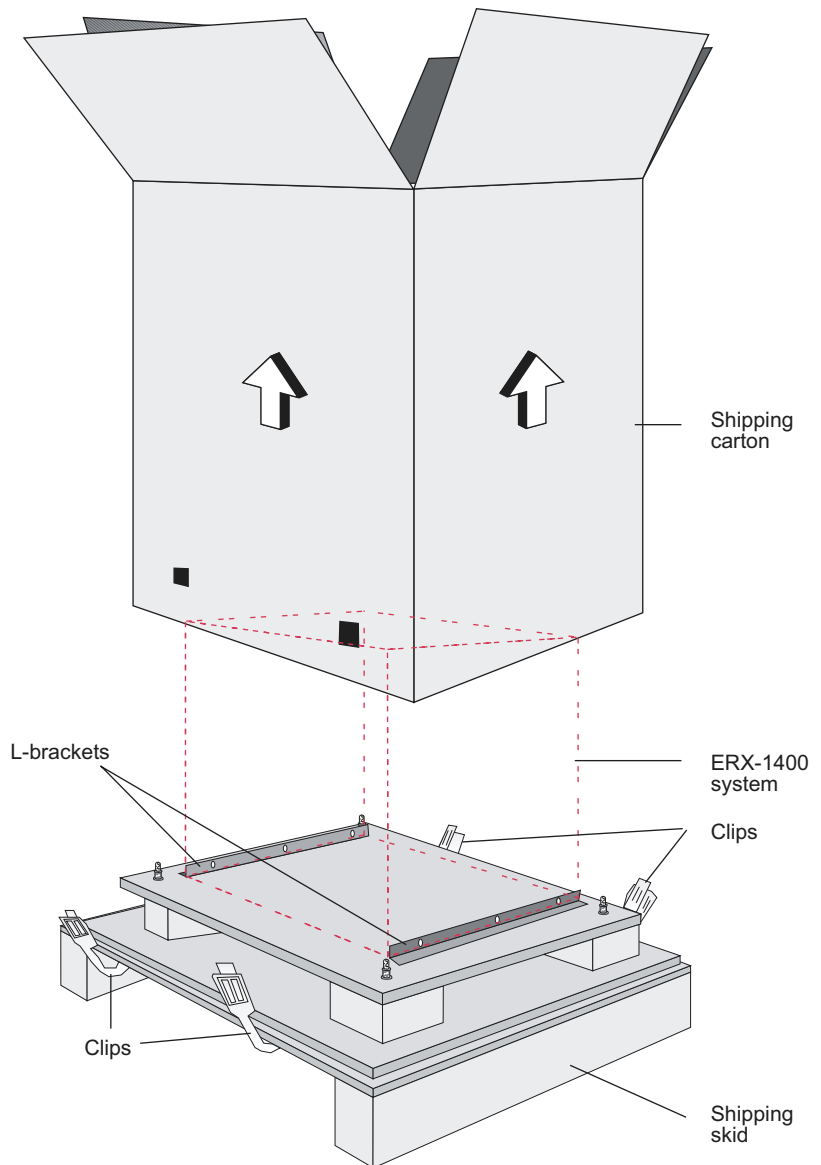


Figure 2-2 Lifting the carton off an ERX-1400 series

- 6** Use a Phillips screwdriver to remove the three screws (10-32 x 3/8 in) that attach each of the two L-brackets to the router.
- 7** To move the router more easily from the skid, unscrew one of the L-brackets from the skid by removing the three screws that attach it to the skid. See [Figure 2-3](#).

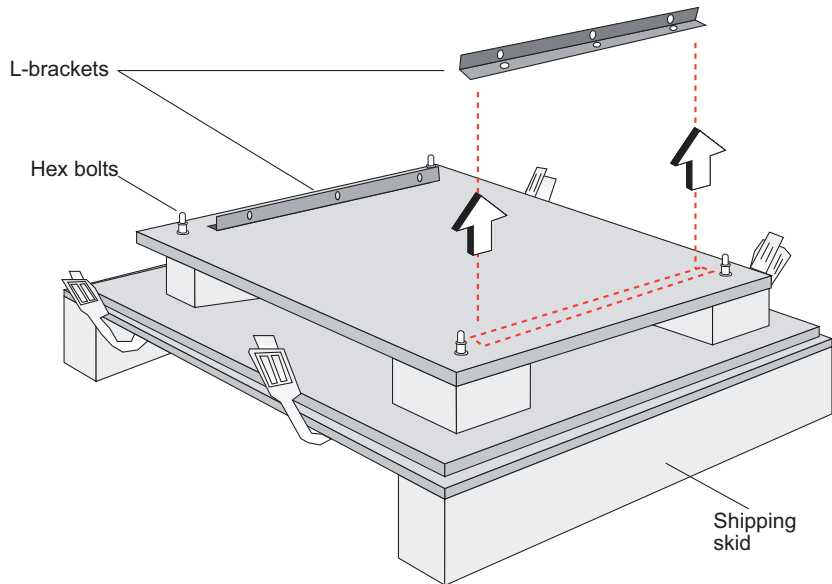


Figure 2-3 Removing an L-bracket

- 8 Depending on where you want to position the system, proceed to *Freestanding Installation* or *Rack-Mounted Installation*, later in this chapter.

Unpacking the ERX-700 Series

The ERX-700 series come boxed but not attached to a skid.

For your convenience, we recommend that you unpack the ERX system in the location where you want to install it.

To unpack the ERX-700 series:

- 1 Open the carton from the top.
- 2 Remove the box of accessories that sits on top of the system.
- 3 Before you remove the unit from its carton, proceed to *Freestanding Installation* or *Rack-Mounted Installation*, later in this chapter.

Freestanding Installation

This section provides instructions for installing the system on a table top or in any other freestanding mode. See [Appendix D, Preparing Your Site](#), for information about site requirements.

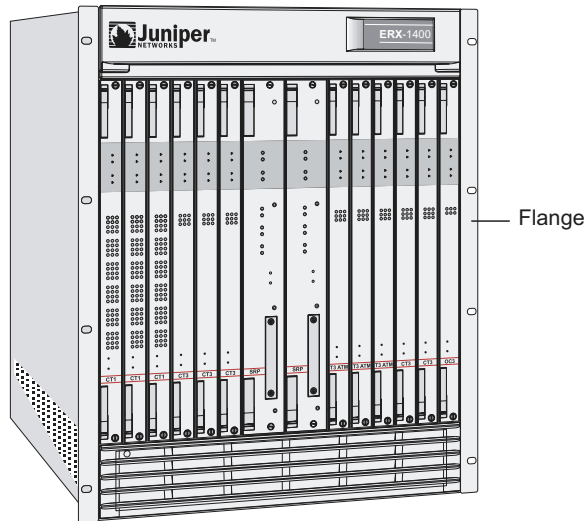


Figure 2-4 ERX-1400 series front view



Warning: Two people are required to lift an ERX system. The system is extremely heavy.

To install the system as a freestanding device:

- 1 One person should stand on the left side of the system, and the other should stand on the right side.
- 2 Grasp the lower back of the unit with one hand and the front flange (see [Figure 2-4](#)) with the other.
- 3 Bend your knees and carefully lift the unit into position.
- 4 Carry the system to the location where it will operate.



Caution: Leave enough space around the system for adequate ventilation. See [Appendix A, System Specifications](#), for details.

- 5 Position the router with easy access to the connections that it needs for power, local communications, and remote communications.



Note: Connectors are located on the I/O modules and the power input module. See [Figure 2-5](#). You install these modules from the rear of the router. See [Chapter 4, Cabling the ERX System](#), for cabling installation procedures.

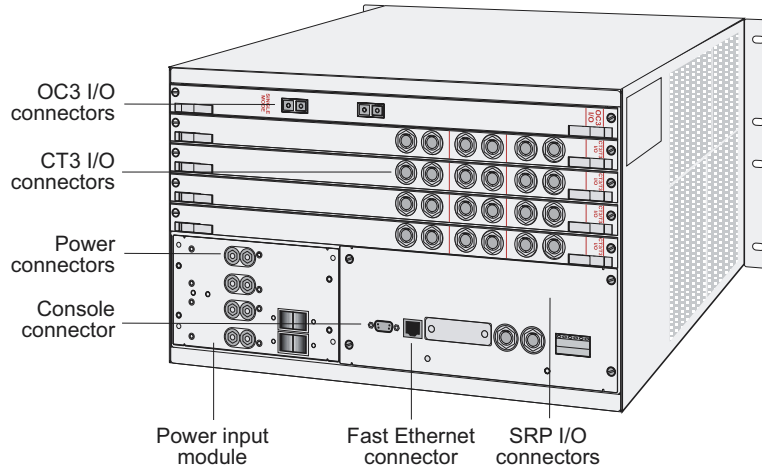


Figure 2-5 ERX-700 series rear view

Rack-Mounted Installation

We recommend that you use a standard EIA distribution rack. Refer to [Rack Requirements in Appendix D, Preparing Your Site](#), for detailed rack information. Before installing the systems in the rack, consider the following guidelines:

- You can install up to three ERX-1400 series systems in a single 84-inch rack.

Installing multiple systems in a single rack allows you to maximize your available space. An ERX-1400 series system has a plenum that allows air to circulate between systems.

- You can install an ERX-1400 series system and an ERX-700 series system together in the same rack.

If you install an ERX-700 series system above an ERX-1400 series system in the same rack, you must install a plenum between the ERX-700 series system and the ERX-1400 series system so that the air can circulate between the systems. See [Figure 2-6](#). This plenum is available from Juniper Networks.

If you install an ERX-1400 series system above an ERX-700 series system, there is no need to install a plenum between the units because the ERX-1400 series system has one at its base.

Safety Guidelines

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



Rack Installation Warning: Install equipment in the rack from the bottom upward. This will maintain the stability of the rack and reduce the chance of the rack's tipping over.



Heavy Equipment Warning: Three people are required to install the ERX system in a rack: two to lift the system into position and one to screw it to the rack. The system is extremely heavy.



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



Ground (Earth) Warning: Connect the ERX system or rack to ground (earth), and ensure that a reliable grounding path is maintained in the rack.



Lightning Activity Warning: Do not work on the system or connect or disconnect cables during lightning activity.



DC Power Disconnection Warning: Before powering on the ERX system, remove power from the DC circuit by deactivating the circuit breaker on the panel board that services the DC circuit.



Servicing Unit Warning: Before servicing the ERX system, turn off the power.



Jewelry Removal 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.



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

Installation

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

- A Phillips screwdriver
- Eight 10-32 x 3/8 Phillips screws (provided with the system) for each system to be installed



Warning: Three people are required to install the ERX system in a rack: two to lift the system into position and one to screw it to the rack. The system is extremely heavy.

To install the system in the rack:

- 1** On the rack, identify and mark the holes that you want to use for mounting the system.
- 2** One person should stand on the left side of the system, and another should stand on the right side.
- 3** Grasp the lower back of the unit with one hand and the lower front of the unit (see [Figure 2-4](#)) with the other hand.
- 4** Bend your knees and carefully lift the unit into position in the rack.
- 5** With the help of the third person, align the holes in the system's flanges with the holes in the rack, and hold the system in position.
- 6** Starting at the bottom, the third person should screw the flange on each side of the system into the four holes on each side of the rack.
- 7** Connect the necessary cables (see [Chapter 4, Cabling the ERX System](#), for instructions on installing the cables).

[Figure 2-6](#) illustrates a distribution rack with one ERX-1410 system and two ERX-700 systems installed.

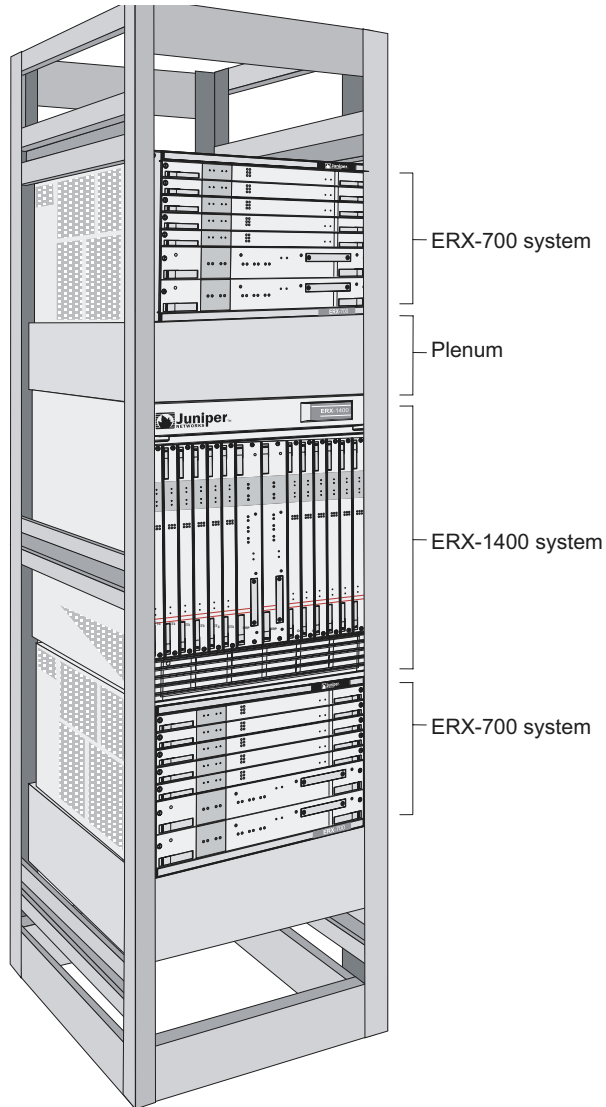


Figure 2-6 Rack with ERX-700 systems and an ERX-1410 system

The Next Step

After you finish installing the system:

- If the system was delivered with the modules already installed, go to [Chapter 4, *Cabling the ERX System*](#), for instructions on connecting cables.
- If you need to install any modules, go to [Chapter 3, *Installing ERX Modules*](#).

Installing ERX Modules

3

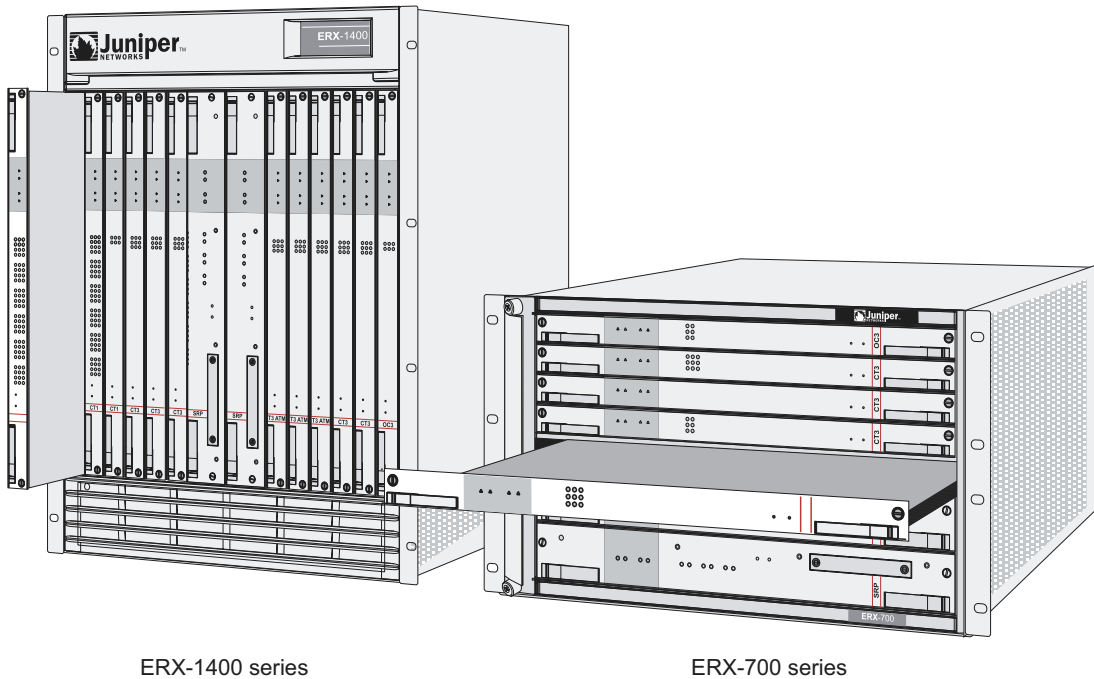
This chapter describes how to physically install and remove ERX modules. If the modules you want are already installed in the system, you can skip this chapter and go to [Chapter 4, Cabling the ERX System](#).

For information about managing installed modules, see [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules](#).

Topic	Page
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Overview

In the ERX-1400 series, modules mount vertically in a chassis with 14 slots, whereas in the ERX-700 series, modules mount horizontally in a chassis with 7 slots. See [Figure 3-1](#). For information about compatibility between lines modules and SRP modules, see [Table B-1](#) in [Appendix B, Module Specifications](#).



ERX-1400 series

ERX-700 series

Figure 3-1 Orientation of line modules in the ERX-700 series and ERX-1400 series

For details about available line modules, see [Appendix B, Module Specifications](#).

Slot Groups

The slots in the ERX-700 series' and the ERX-1410 system's chassis 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 system.

Slot Groups for the ERX-1410 System

A slot group in the ERX-1410 system comprises three adjacent chassis slots. The groups for the ERX-1410 system consist of the following slots ([Figure 3-2](#)):

- 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.

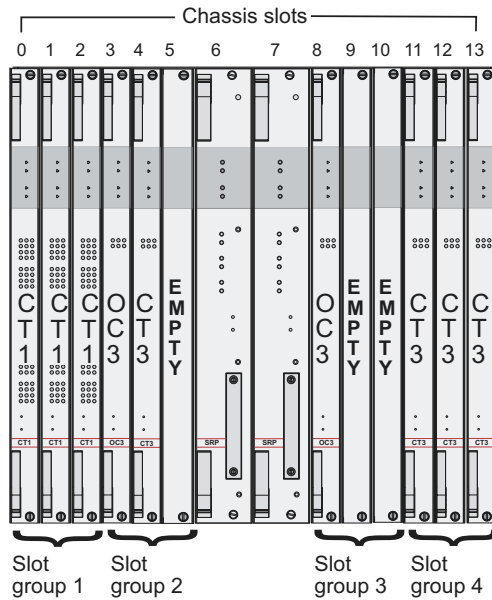


Figure 3-2 ERX-1400 slot groups

Slot Groups for the ERX-700 Series

A slot group in the ERX-700 series comprises one slot or two adjacent slots. The groups for the ERX-700 series consist of the following slots (Figure 3-3):

- 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.

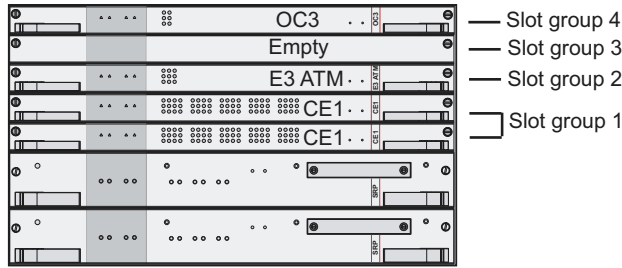


Figure 3-3 ERX-700 series slot groups

Combinations of Line Modules

For information about allowed combinations of line modules, see [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules](#).

Replacing and Managing Modules

For information about software procedures associated with replacing and managing modules, see [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules](#).

Hot-Swapping Modules

The ERX-700 series and ERX-1400 series support hot-swapping of modules. Hot-swapping allows you to add or remove a module without powering down the system.

Required Tools and Safety Items

You need the following tools to install a line module:

- A Phillips screwdriver
- An ESD (electrostatic discharge) wrist strap

Protecting Modules and Slots

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



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

On the ERX-1400 series, the grounding jacks are inside the front bezel in the lower-left area of the front of the chassis (Figure 3-4) and in the upper-right corner on the rear of the chassis. On the ERX-700 series, the grounding jack is in the lower-right corner on the rear of the chassis.



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



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

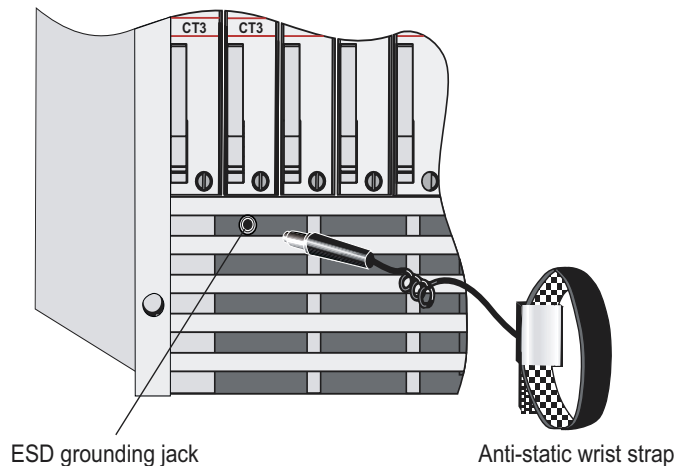


Figure 3-4 Connecting the wrist strap to the ERX-1400 series (front)

Order of Installation

Before you attempt to install or replace a module (inserted in the front of the chassis), the corresponding I/O module (inserted in the rear of the chassis) should already be in place. The system diagnostics run when a 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.

Safety Guidelines

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



Lightning Activity Warning: Do not work on the system or connect or disconnect cables during lightning activity.



DC Power Disconnection Warning: Before powering on the ERX system, remove power from the DC circuit by deactivating the circuit breaker on the panel board that services the DC circuit.



Jewelry Removal 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.



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



Repair 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. See [Appendix F, Customer Service](#).

Installing SRP I/O and SRP Modules

You should install SRP modules only in chassis slots 6 and 7 of the ERX-1400 series and slots 0 and 1 of the ERX-700 series.



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

Installing an SRP I/O Module

To install an SRP I/O module:

- 1 Connect the antistatic wrist strap to the ESD grounding jack on your ERX system.



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

- 2 With a Phillips screwdriver, loosen the top and bottom captive screws securing the blank faceplate covering the empty slot. See [Figure 3-5](#).
- 3 Remove the faceplate.

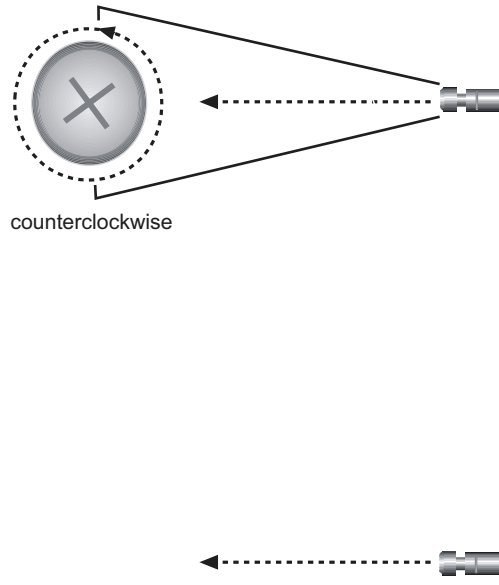


Figure 3-5 Removing the blank faceplate



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

- 4** Remove the SRP I/O module from its antistatic bag.
- 5** Position the module as follows:
 - For the ERX-1400 series, position the module vertically so that the labeling is upright.
 - For the ERX-700 series, position the module horizontally so that the alarm leads are to the right.
- 6** Position the module into the chassis by placing it between the guides of the selected slot, and slide the module until it stops.

Figure 3-6 shows how to install an SRP I/O module in the ERX-1400 series.

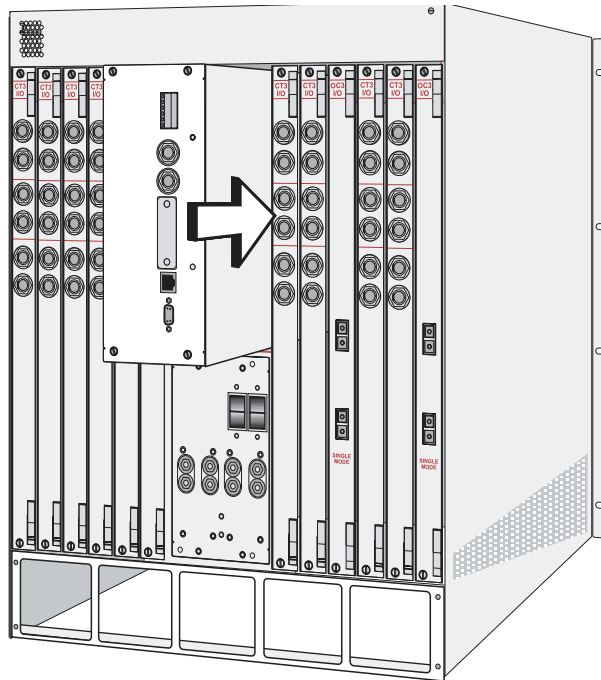


Figure 3-6 Installing an SRP I/O module in the ERX-1400 series

- 7 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 Connect the antistatic wrist strap to the ESD grounding jack on your ERX system.



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

- 2 Choose the chassis slot where you want to insert the module.
For the ERX-1400 series, use slot 6 or 7; for the ERX-700 series, use slot 0 or 1.
- 3 With a Phillips screwdriver, loosen the top and bottom screws that secure the blank faceplate covering the empty chassis slot.
- 4 Remove the faceplate.



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

- 5 Remove the SRP module from its antistatic bag.
- 6 Make sure that the ejectors are in position 1, as shown in [Figure 3-7](#).

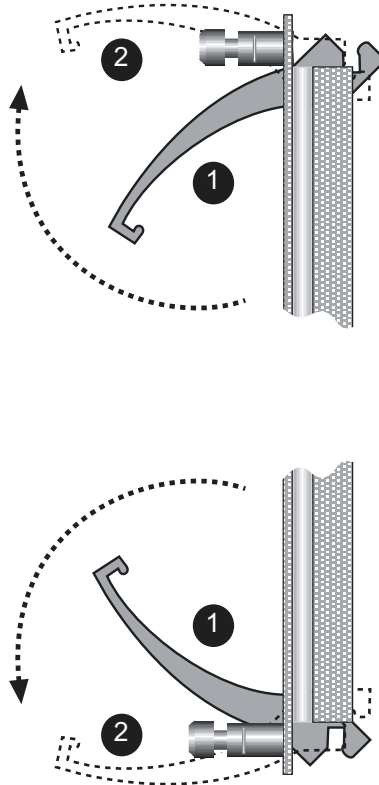


Figure 3-7 Positioning the ejectors

- 7 Position the module as follows:
 - For the ERX-1400 series, position the module vertically so that the labeling is upright.
 - For the ERX-700 series, position the module horizontally so that the labeling is to the right.
- 8 Position the module in the chassis by placing it between the guides of the selected slot, and slide the module until it stops.

The module stops sliding when the ejectors make contact with the front of the chassis. [Figure 3-8](#) shows how to install an SRP module in the ERX-1400 series.

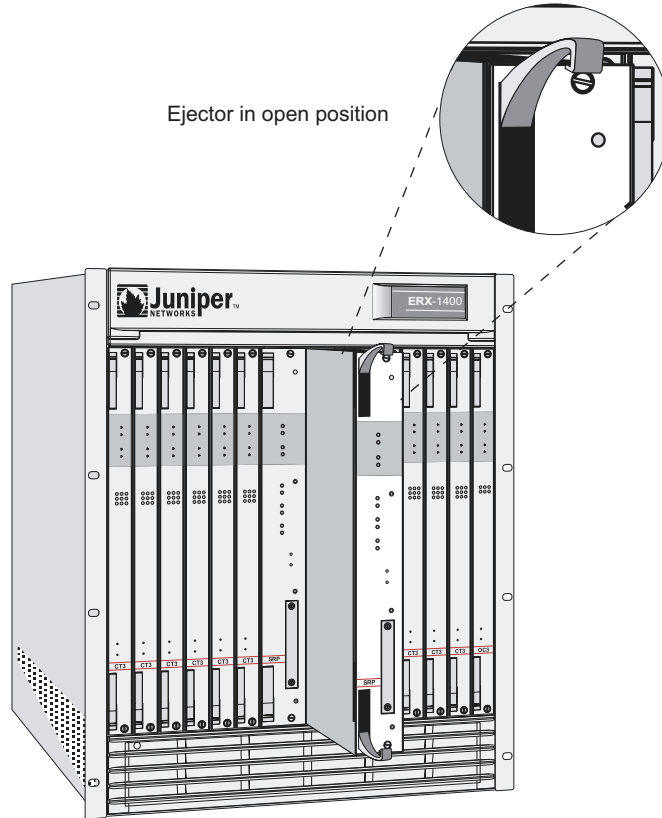


Figure 3-8 Installing an SRP module

- 9 Insert the module into the backplane by simultaneously depressing both ejectors (as shown in Figure 3-7) and exerting forward pressure on the module.
- 10 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 Line Modules and Their 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 ERX system diagnostics fail, and after the line module has tried to reboot, its status will be “inactive” when you issue a **show version** command.

Installing a Line or I/O Module

To install a module:

- 1 Connect the antistatic wrist strap to the ESD grounding jack on your ERX system.



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

- 2 Choose the slot where you want to insert the module.

For the ERX-1400 series, you can install line modules in slots 0 through 5 and slots 8 through 13; for the ERX-700 series you can choose slots 2 through 6.

- 3 With a Phillips screwdriver, loosen the top and bottom screws that secure the blank faceplate covering the empty chassis slot, as shown in [Figure 3-5](#).
- 4 Remove the faceplate.



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

- 5 Remove the module from its antistatic bag.
- 6 Make sure that the ejectors are in position 1, as shown in [Figure 3-7](#).
- 7 Position the module as follows:
 - For the ERX-1400 series, position the module vertically so that the labeling is upright.
 - For the ERX-700 series, position the module horizontally so that the labeling is to the right.
- 8 Guide the module into the chassis by placing it between the guides of the selected slot, and slide the module until it stops.

The module stops sliding when the ejectors make contact with the front of the chassis. [Figure 3-9](#) shows how to install an I/O module and a line module in the ERX-1400 series.

Removing a Module

To remove a module:



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

- 1 Enter the **halt** command.

See [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules](#) for information about the **halt** command.



Caution: When handling modules, use an antistatic wrist strap connected to the ERX system'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 your ERX system.
- 3 Use a screwdriver to loosen the thumb screws located at the top and bottom of the module panel, as shown in [Figure 3-5](#).
- 4 Raise the ejector handles located at the top and bottom of the module so that they are in position 2, as shown in [Figure 3-7](#).



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

- 5 Carefully slide the module out of the chassis, as shown in [Figure 3-9](#).
- 6 Place the module in its antistatic bag.
- 7 Cover the empty chassis slot with a blank faceplate. Tighten the faceplate's top and bottom captive screws using a Phillips screwdriver, as shown in [Figure 3-10](#). Turn both screws several times before tightening them completely.

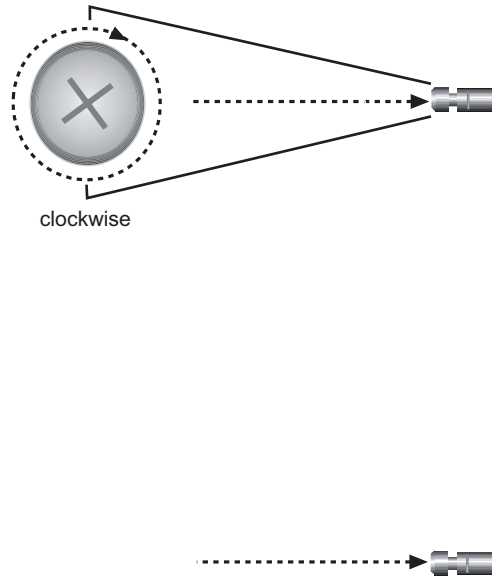


Figure 3-10 Installing the blank faceplate

If you remove an I/O module and not the corresponding line module, the line module reboots, and then its status will be “inactive” when you issue a **show version** command. If you remove a line module and do not delete the corresponding configuration, the status of the line module will be “not present” when you issue a **show version** command.

Installing Components for Line Module Redundancy

The ERX system allows a spare line module to provide redundancy for a group of identical line modules. 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 redundancy I/O module



Warning: Do not insert any metal object, such as a screwdriver, or place your hand into an open slot or the backplane when the ERX system 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 ERX system'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 Modules and Their I/O Modules](#), earlier in this chapter).

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 may become corrupted.

- 1 Enter the **halt** command.

See [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules](#) for information about the **halt** command.



Warning: Turn off the ERX system before you install the redundancy midplane. Working inside the ERX system 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 (see [Figure 3-11](#)).
- 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 (see [Figure 3-11](#)).
- 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.

- Carefully insert an I/O module in one slot to ensure that the redundancy midplane is aligned correctly; then tighten the screws.

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

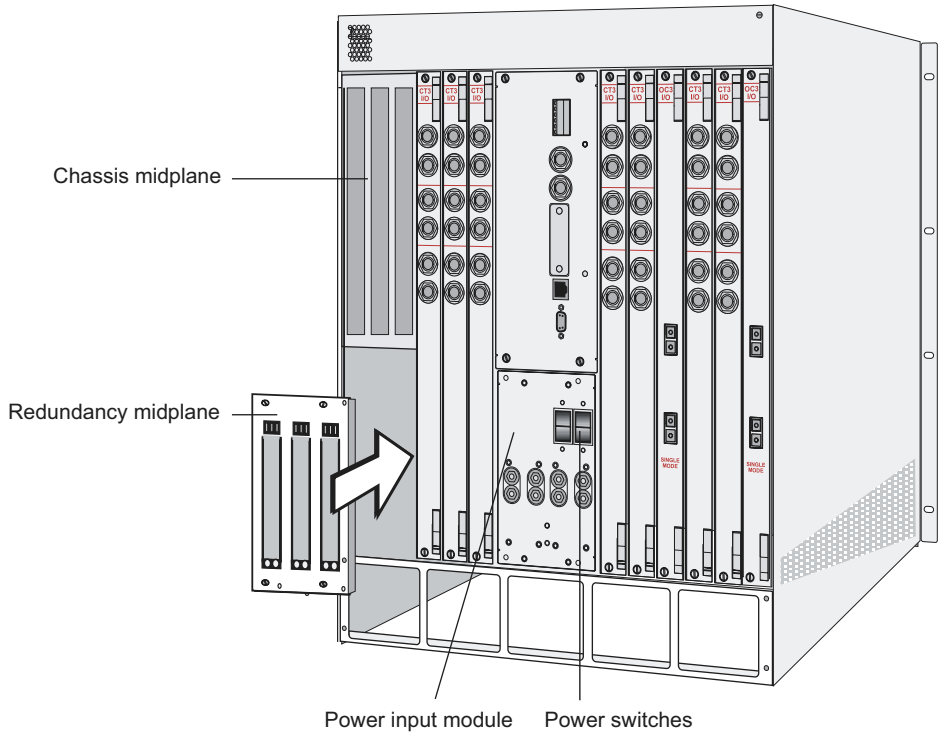


Figure 3-11 Installing a redundancy midplane

Installing the I/O Modules

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

- 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 may damage other I/O modules connected to the redundancy midplane.

- Install the corresponding I/O module for the line module of each slot in the redundancy group. (See [Installing a Line or I/O Module](#), earlier in this chapter.)

Verifying the Installation

To verify that the installation is complete:

- 1 Turn on the power switches.
The system will reboot.
- 2 Issue the **show redundancy** command, and verify that the display shows the redundancy hardware.

The Next Step

After you have installed the modules and are confident that they sit correctly in their respective chassis slots, you are ready to connect cables. For instructions on installing cables for your ERX system, see [Chapter 4, Cabling the ERX System](#).

4

Cabling the ERX System

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

Topic	Page
Before You Begin	4-1
Cabling Your ERX System	4-2
Safety Guidelines	4-3
Cabling the Power Input Module	4-4
Cabling the SRP I/O Module	4-7
Cabling I/O Modules	4-10
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Before You Begin

Before you cable the ERX system, read [Cabling Recommendations](#) in [Appendix D, Preparing Your Site](#).

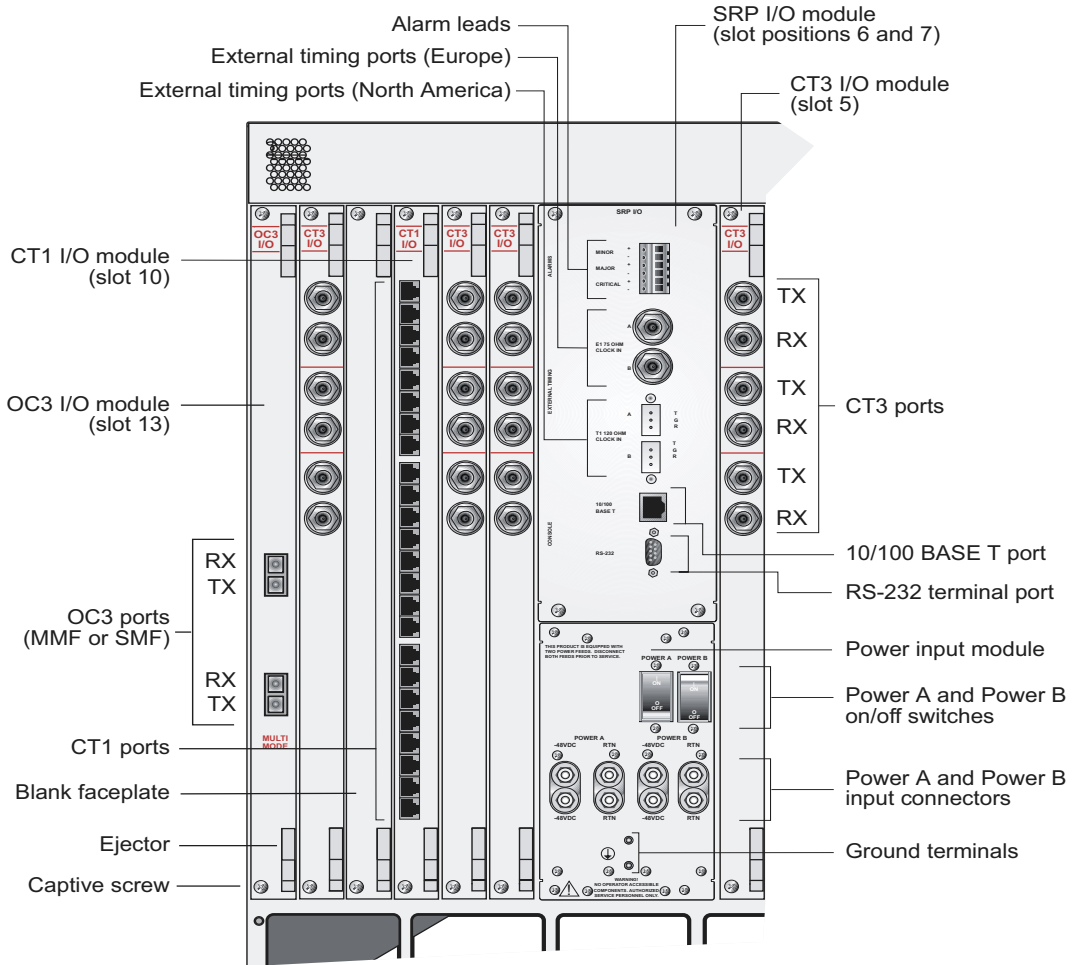
Cabling Your ERX System

Cabling the system takes only a few minutes. You need these items:

- A 1/8" flathead screwdriver – to connect the alarm leads
- A 3/8" wrench or 3/8" nut-driver – to loosen and tighten hex nuts on Power A and Power B leads
- A No. 2 Phillips screwdriver – to remove the power input module cover
- Two ground wires – we recommend a minimum of 10-AWG ground wire with a ring-style terminal.
- A #10 keph nut to connect the ground (earth) wire to the ground terminal.

We recommend that you use shielded cables where appropriate and perform the cabling tasks in this order:

- 1** Familiarize yourself with the module ports. See [Figure 4-1](#).
- 2** Ensure that you have the cables and wires needed to complete each cabling procedure.
- 3** Read and understand all safety warnings.
- 4** Connect the power cables from the power source to the power input module.
- 5** Connect cables to the SRP I/O module.
- 6** Connect cables to the line I/O modules.



ERX-1400 rear view

Figure 4-1 Cabling your ERX system

Safety Guidelines

Observe the following guidelines when cabling your ERX system.



Ground (Earth) Warning: Connect either the freestanding ERX system or the rack to ground (earth), and ensure that a reliable grounding path is maintained in the rack.



Lightning Activity Warning: Do not work on the system or connect or disconnect cables during lightning activity.



DC Power Disconnection Warning: Before powering on the ERX system, remove power from the DC circuit by deactivating the circuit breaker on the panel board that services the DC circuit.



Servicing Unit Warning: Before servicing the ERX system, turn off the power.



Jewelry Removal 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 weld the metal object to the terminals.



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



Note: If you plan on using a cable-management bracket, install it before you begin cabling your ERX system. Cable-management brackets are helpful to keep network interface cables untangled and orderly and to prevent cables from hindering access to other slots.

Cabling the Power Input Module

Input power is supplied to the system by two redundant and independent –48 VDC line feeds. If one line fails, the other can carry the full load of the system. See [Appendix A, System Specifications](#) for the power requirements for the ERX system.

[Table 4-1](#) identifies the power input module cabling requirements.

Table 4-1 Power input module cables/wires needed

Cable/Wire	From	To
One 10-AWG ground wire	Power input module ground terminal	Termination ground
Two 10-AWG wire leads	Power input module Power A –48 VDC and RTN leads	Appropriate leads on power source No. 1
Two 10-AWG wire leads	Power input module Power B –48 VDC and RTN leads	Appropriate leads on power source No. 2

Follow the procedure in this section to connect power cables to the system. Refer to [Figure 4-2](#) as needed.



Caution: Before you begin this procedure, ensure that both Power A and Power B switches are in the OFF position.

- 1 Loosen the four screws from the clear power input module cover.
- 2 Remove the cover by sliding it upward so that the screw heads line up with the holes in the cover.
- 3 Set the cover and screws aside for later use.
- 4 Connect the ground wire to the ground terminal on the lower portion of the power input module, and secure it with a #10 kep nut.



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

- 5 Connect the other end of the ground wire to the appropriate ground termination lead.



Warning: Be sure the power source is turned off and the ERX system is turned off before continuing with this procedure.

- 6 With the wrench or nut driver, loosen the 3/8" hex nuts from the bottom -48 VDC and RTN leads of Power A, and connect a 10-AWG wire to each.
- 7 With the wrench or nut driver, tighten the hex nuts on both leads.
- 8 Attach the opposite end of Power A's wire leads to the appropriate leads on your power source.



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

- 9 Repeat Steps 6–8 for Power B.
- 10 Reattach the clear power input module cover that you removed in step 1 by securing the four screws.

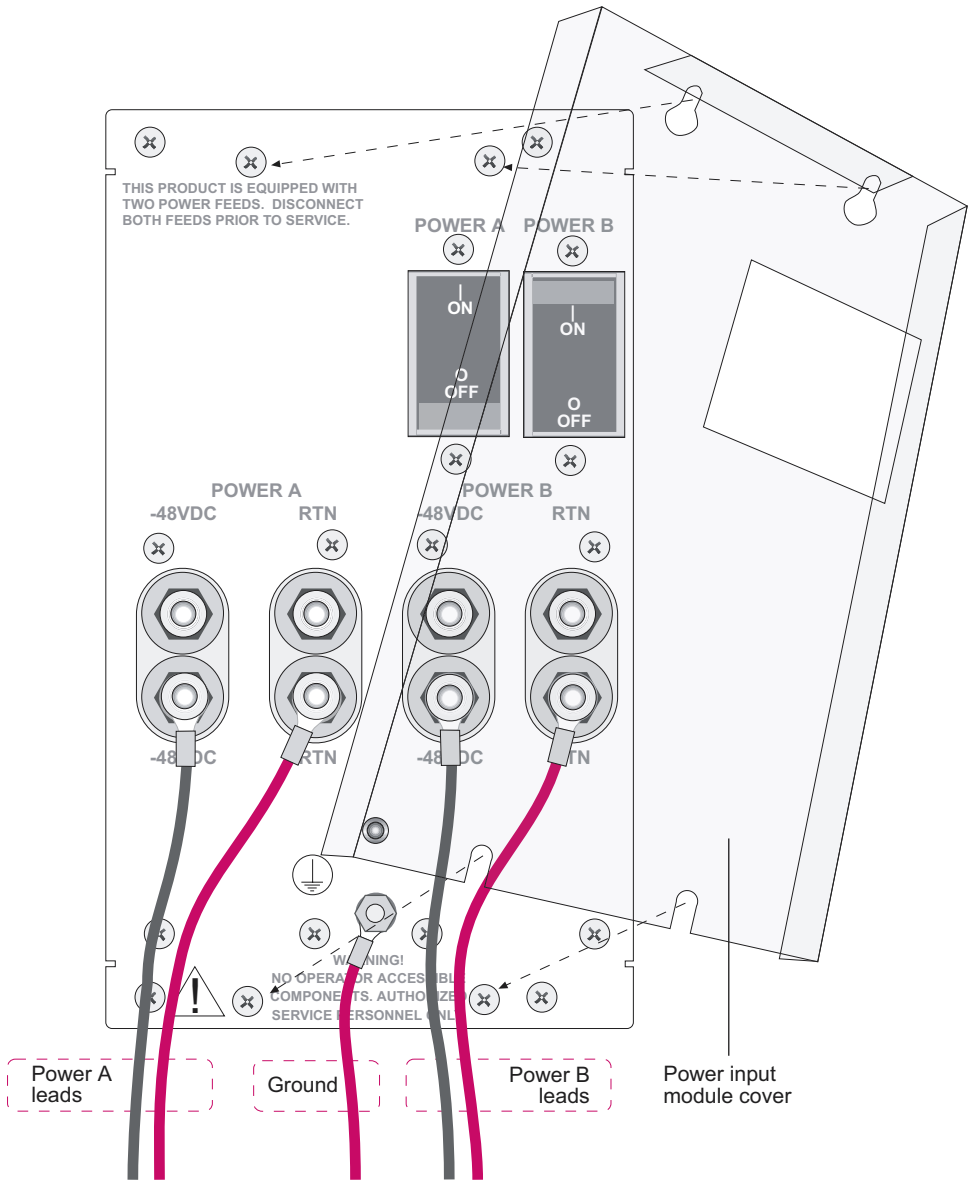


Figure 4-2 Power input module

Cabling the SRP I/O Module

The next step in cabling the system is to connect cables to your SRP I/O module. See [Figure 4-3](#).



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

Cable connections to your SRP I/O module are divided into two sections: external timing ports and console ports. [Table 4-2](#) shows the specifications for each section.

Table 4-2 SRP I/O ports

Port	Description
External Timing Ports	<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)
Console Ports	<ul style="list-style-type: none">One 10/100Base-T Ethernet management port with an RJ-48C connectorOne RS-232 port with a DB-9 connector for VT100 management access

External Timing Ports

Two external clock source input ports provide a method of ensuring that the system's clock timing remains synchronized with the network's system clock. The primary clock is labeled A; the secondary, redundant clock is labeled B. Use the connector type appropriate for your location:

- Two 75-ohm E1 2.048-Mbps inputs with BNC connectors
- 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.

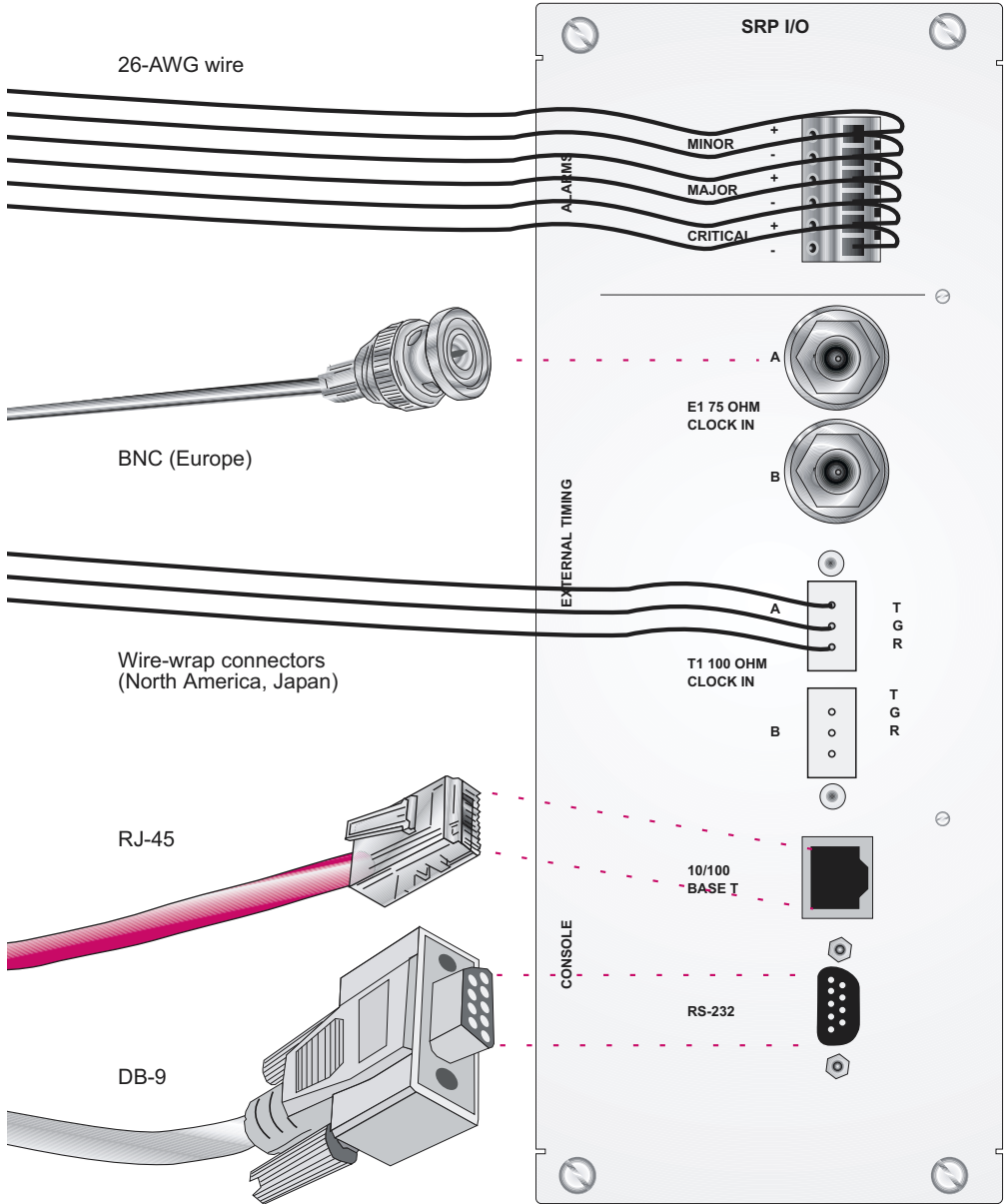


Figure 4-3 SRP I/O module

To connect the clock source input ports:

- 1** 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.

- 2** Attach the opposite end of the External Timing cable or wires into your network's clock source A.
- 3** Repeat steps 1 and 2 for the Clock B connections.

Console Ports

There are two ports located in the Console section (as shown in [Figure 4-3](#)) that allow management access.

- The 10/100Base-T Ethernet port accepts an RJ-45 (male) connector. This port provides an out-of-band connection. (We ship an Ethernet cable with the system.)
- The RS-232 port accepts a DB-9 (female) connector. This port allows direct CLI access.

Follow this procedure to connect the Console ports. Refer to [Figure 4-3](#) as needed.

- 1** Insert the male RJ-45 connector into the 10/100Base-T port until it clicks into place.
- 2** Attach the opposite end of the cable to your appropriate network device.
- 3** Insert the female DB-9 connector into the RS-232 port until it is secure.
- 4** Hand-tighten the DB-9 connector screws.
- 5** Attach the opposite end of the cable to your terminal (VT100/ANSI).

See [Chapter 5, Accessing the ERX System](#), for more information about management access.

Cabling I/O Modules

The following sections describe how to cable I/O modules with different types of connectors. For information about the connectors on the different line modules, see [Appendix B, Module Specifications](#).

Cabling BNC Connectors

To cable I/O modules with BNC connectors:

- 1 Insert the RX male BNC connector into the selected port.
- 2 Terminate the other end in the appropriate network interface, such as a multiplexer (MUX) device.
- 3 Repeat steps 1 and 2 for the TX connector.
- 4 Repeat steps 1–3 for all ports.

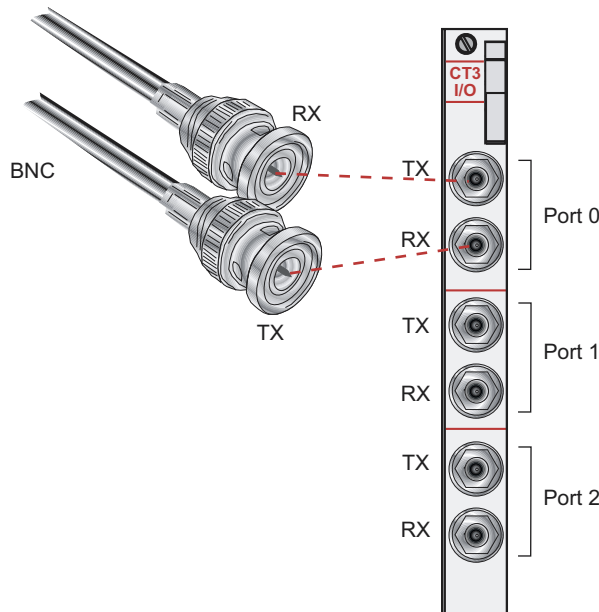


Figure 4-4 I/O module with BNCs

Cabling 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 may lead to data loss.

To cable I/O modules with HSSI connectors:

- 1 Insert the HSSI connector into the selected port.
- 2 Terminate the other end in the appropriate network connection.
- 3 Repeat steps 1 and 2 for the other ports.

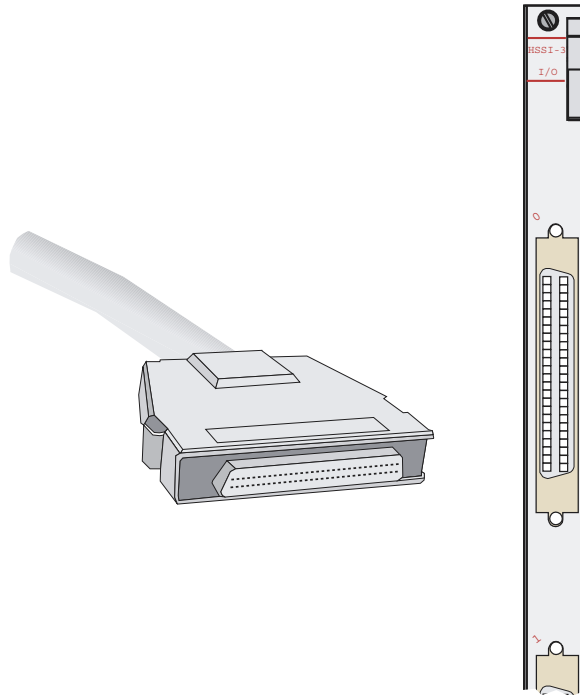


Figure 4-5 HSSI I/O module with 50-pin HSSI connector

Cabling RJ-45 Connectors

To cable I/O modules with RJ-45 connectors:

- 1 Insert the RJ-45 connector into the selected port.
- 2 Terminate the other end in the appropriate network connection.
- 3 Repeat steps 1 and 2 for the other ports.

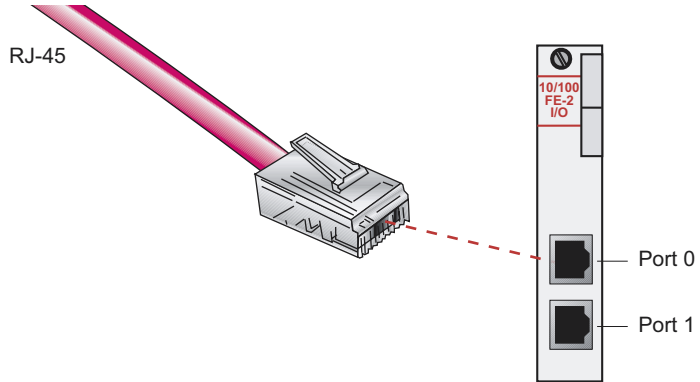


Figure 4-6 I/O module with RJ-45 connector

Cabling RJ-48C Connectors

To cable I/O modules with RJ-48C connectors:

- 1 Insert the RJ-48C connector into the selected port.
- 2 Terminate the other end in the appropriate network interface, such as a multiplexer (MUX) device.
- 3 Repeat steps 1 and 2 for all ports.

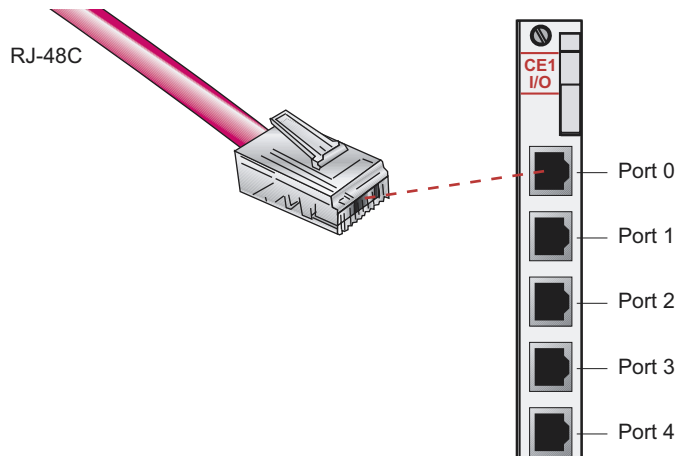


Figure 4-7 I/O module with RJ-48C connectors

Cabling 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.

To cable I/O modules with LC duplex connectors:



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.

- 1 Insert the TX male fiber connector into the selected port.
- 2 Terminate the other end in the appropriate network connection.
- 3 Repeat steps 1 and 2 for the RX fiber connector.
- 4 Repeat steps 1–3 for the remaining ports.

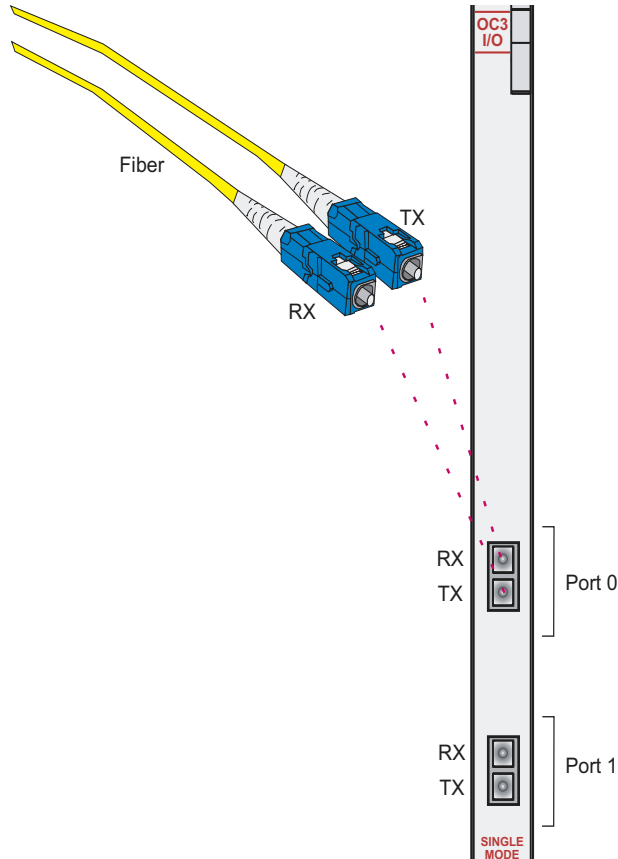


Figure 4-8 I/O module with LC full duplex connectors

Cabling 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.

To cable I/O modules with SC duplex connectors:



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.

- 1 Insert the TX male fiber connector into the selected port.
- 2 Terminate the other end in the appropriate network connection.
- 3 Repeat steps 1 and 2 for the RX fiber connector.
- 4 Repeat steps 1–3 for the remaining ports.

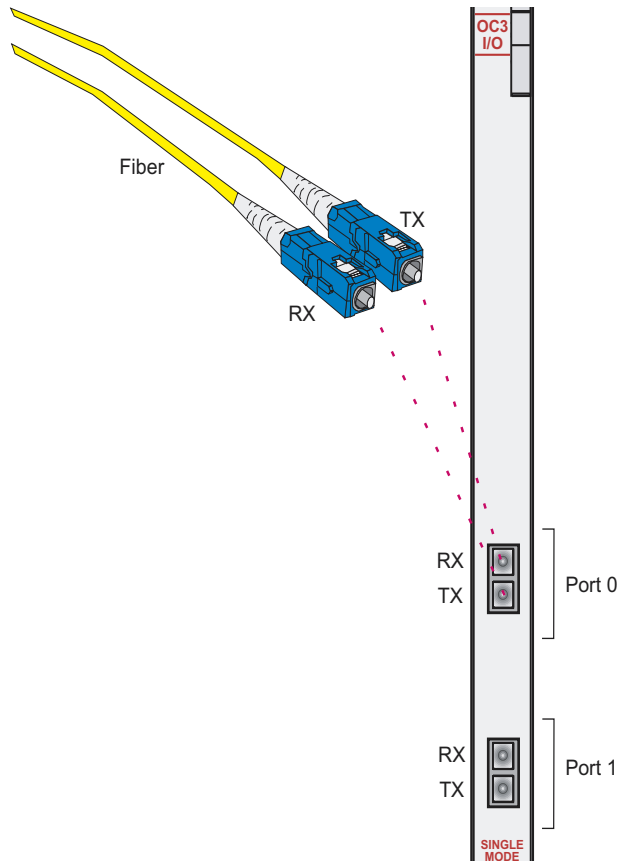


Figure 4-9 I/O module with SC full duplex connectors

Cabling SMB Connectors

To cable I/O modules with SMB connectors:

- 1 Pull back the metal sheath on the TX cable's SMB connector.
- 2 Insert the TX cable's SMB connector into the selected port.
- 3 Release the metal sheath on the TX cable's SMB connector.

- 4 Terminate the other end in the appropriate network connection.
- 5 Repeat steps 1–4 for the RX cable’s SMB connector.
- 6 Repeat steps 1–5 for the remaining ports.

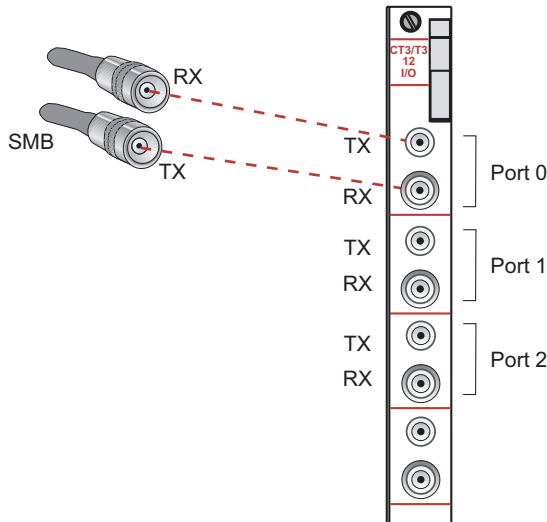


Figure 4-10 I/O module with SMB connectors

Cabling 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.

To cable I/O modules with X.21/V.35 connectors:

- 1 Insert the X.21/V.35 connector into the selected socket.
- 2 Terminate the other end in the appropriate network connection.
- 3 Repeat steps 1 and 2 for the other socket.

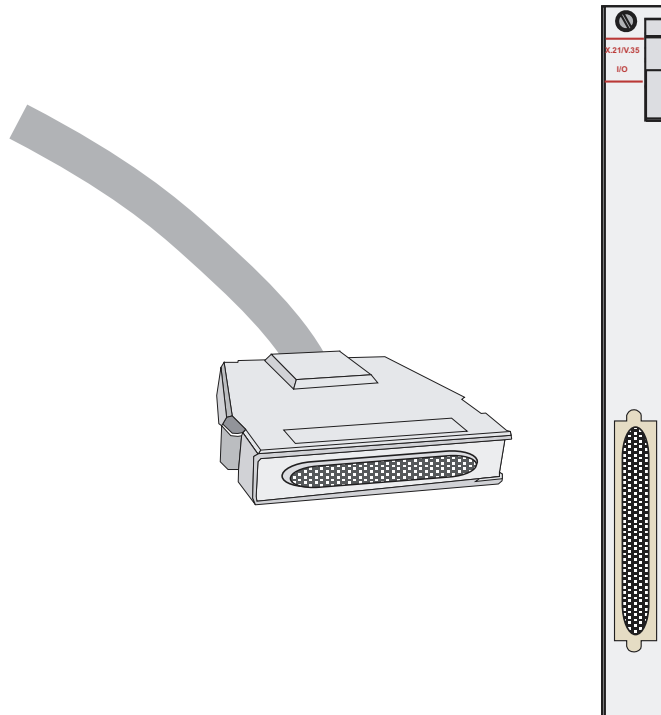


Figure 4-11 X.21/V.35 module with 50-pin X.21/V.35 connector

Cabling Redundant Ports

Some modules have redundant ports. See [Appendix B, Module Specifications](#) for specifications. Cabling both ports provides a redundant path to the ERX 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 ERX GE I/O module must use the same type of SFP.

The Next Step

After you have cabled the system, check that all connections go the right places and are secure. Then proceed as follows:

- If you need to set up a console to communicate with the system, go to [Chapter 5, Accessing the ERX System](#).
- If you have already set up your console, go to [Chapter 6, Powering Up the System](#).

5

Accessing the ERX System

This chapter provides information on the various ways you can 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 *ERX System Basics Configuration Guide, Chapter 4, Managing the System*.

Topic	Page
Setting Up Management Access	5-1
Console Port Setup	5-2
Telnet Setup	5-4
SNMP	5-6
The Next Step	5-6

Setting Up Management Access

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

You can manage and monitor the system by accessing it in the following ways:

- Connect a console (PC, Macintosh, or UNIX workstation) directly to the system's RS-232 serial port (DTE).
- Connect the system's 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. This connection allows you to use the CLI to set an IP address on the system. Once you configure the IP address, you can access the system remotely (for example, via Telnet).

Console Port Setup

You can connect a console (PC, Macintosh, or UNIX workstation) directly to the system via the RS-232 terminal port on the SRP I/O module. 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 screen, in the Connect using field, select the appropriate COM port to use (for example, COM1), and click OK.
- 6** In the COM1 Properties screen, 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 ERX System

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. 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 5-1](#).
- 2 Connect the crossover adapter connector to your PC's serial port.

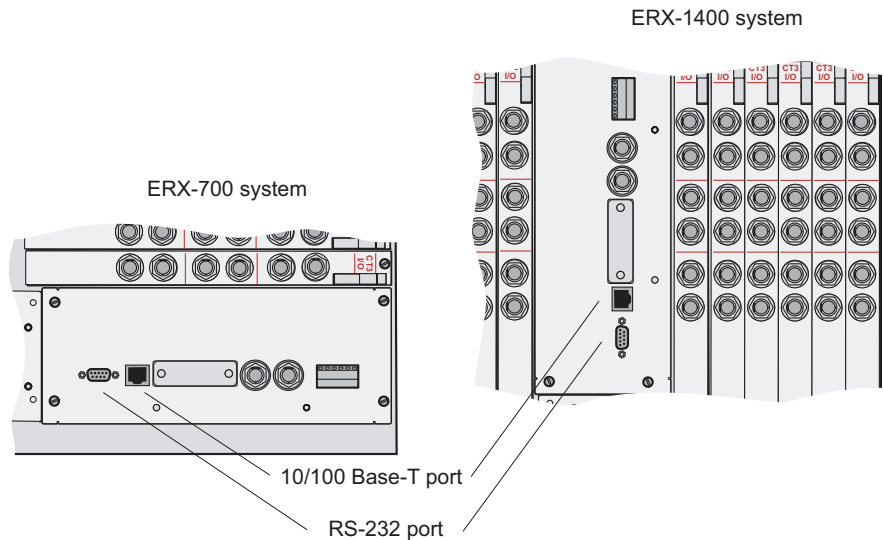


Figure 5-1 ERX-700 series and ERX-1400 series management ports

- 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 [ERX System Basics Configuration Guide](#).



Note: Direct access through the RS-232 serial port allows you to monitor the system as it boots.

Assigning an IP Address

When your console is ready to communicate with the system, power up the system (see [Chapter 6, Powering Up the System](#)), and 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.
- 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 the next section, [Telnet Setup](#).

Telnet Setup

When you have configured an IP address for the system, you can run Telnet on your console to access the system through its Ethernet port. To connect the console to the system:

- 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 the [ERX System Basics Configuration Guide, Chapter 6, Passwords and Security](#) for information on setting a password.

- 5 Run Telnet from the management console (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 [ERX 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 the [ERX System Basics Configuration Guide, Chapter 3, Configuring SNMP](#) for information on SNMP. See the [ERX Command Reference Guide](#) for the commands that are available for configuring the system as an SNMP agent.

The Next Step

Go to [Chapter 6, Powering Up the System](#).

6

Powering Up the System

This chapter provides instructions for powering up the system and information on electrical specifications.

Topic	Page
Before You Power Up the System	6-1
Powering Up	6-2
Status LEDs	6-3
Powering Down	6-3
The Next Step	6-4

Before You Power Up the System

Before powering up the system, you should complete the tasks shown in [Table 6-1](#). Refer to the appropriate chapters in this guide for information about these tasks.

Table 6-1 Installation tasks

Installation Task	Reference
Install an SRP module and SRP I/O module in slot 6 or 7 in the ERX-1400 series chassis or slot 0 or 1 in the ERX-700 series chassis.	Chapter 3, Installing ERX Modules
Install the line modules and their corresponding I/O modules in the system.	Chapter 3, Installing ERX Modules
Cover unused slots with blank faceplates.	Chapter 3, Installing ERX Modules



Warning: Be sure the power source is turned off and the system is turned off before performing the next task.

Table 6-1 Installation tasks (continued)

Installation Task	Reference
Connect DC power (–48 VDC) to the power input lugs on the power input module.	Chapter 4, Cabling the ERX System
Connect a management console to the system.	Chapter 5, Accessing the ERX System
(Optional) Connect the 10/100Base-T port to the network.	Chapter 5, Accessing the ERX System

Powering Up

This procedure assumes that the system is already connected to a DC power source. See [Chapter 4, Cabling the ERX System](#).

For specifications on the electrical requirements for the system, see [Appendix A, System Specifications](#). For details on the power consumed by the different ERX modules, see [Appendix B, Module Specifications](#).



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

To power up the system:

- 1 Turn on the power switches located on the power input module in the rear of the system. See [Figure 6-1](#).
- 2 Monitor the LEDs on the front of the SRP modules to verify that the system is booting properly. See [Table 8-2](#) in [Chapter 8, Troubleshooting](#).

When the prompt appears on the system console, the system is in User Exec mode:

```
host1>
```

- 3 Enter the **enable** command to access the Privileged Exec mode:

```
host1>enable  
host1#
```

In Privileged Exec mode you can begin to configure the system. See the [ERX System Basics Configuration Guide, Chapter 2, Command Line Interface](#) for more information.

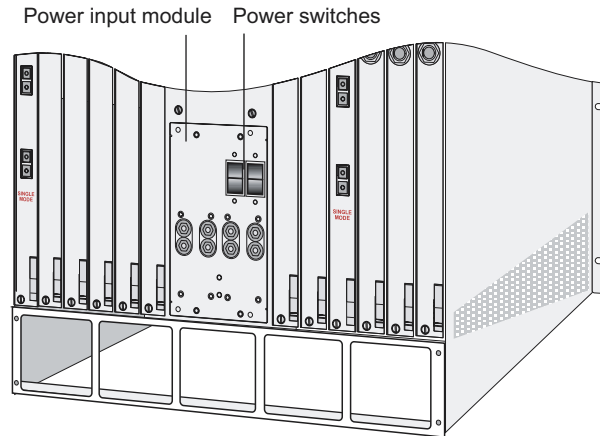


Figure 6-1 ERX-1400 series power switches

Initialization Sequence

Each ERX line module is initialized independently. As a result, the CLI on the SRP module may become available before the line modules have completed initialization. Commands relating to a line module may fail if the module has not completed initialization. The **show version** command can be used to display line module status. Do not enter commands for a line module until its state is “online.”

Status LEDs

For information on the system’s LEDs, see [Chapter 8, Troubleshooting](#).

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 [ERX System Basics Configuration Guide, Chapter 4, Managing the System](#) for more information.



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

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

The Next Step

If you have problems powering up the system, go to [Chapter 8, Troubleshooting](#), for help.

7

Maintaining the ERX System

This chapter describes the procedures that you must complete to maintain the ERX system and its components. Other maintenance procedures must be performed by an authorized Juniper Networks technician.

Topic	Page
Required Tools and Items	7-1
Storing Modules and Components	7-2
Upgrading NVS Cards on SRP Modules	7-2
Replacing SFPs on GE I/O Modules	7-5
Cleaning the System	7-9
Replacing Fan Trays	7-9

Required Tools and Items

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

- Flathead and Phillips screwdrivers
- Insulated adjustable wrench
- Antistatic wrist strap
- Antistatic bags (or other protective packaging to hold components)

Storing Modules and Components



Caution: Failure to store electronic modules and components correctly may lead to damage of these items.

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 NVS cards, are shipped in antistatic plastic containers within an antistatic padded box. 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.

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



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

- 1 Enter the **halt** command.

See [ERX System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP 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 ERX system 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 ERX system'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 your ERX system.
- 3 Power down the system (see [Chapter 6, Powering Up the System](#)).
- 4 Remove the SRP I/O module.
- 5 Replace the NVS card on the SRP module (see [Replacing an NVS Card](#), later in this chapter).
- 6 Power up the system (see [Chapter 6, Powering Up the System](#)).

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 ERX system 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 ERX system'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 ERX system.
- 2 Reboot the redundant SRP module.

```
host1#reload slot 6
```
- 3 Immediately remove the redundant SRP module from the chassis.
- 4 Replace the NVS card on this SRP module (see [Replacing an NVS Card](#), later in this chapter).
- 5 Reposition 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 6
```

- 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 Immediately remove the former primary SRP module.

- 11 Repeat steps 4–8 for the former primary SRP module.

Replacing an NVS Card

To replace an NVS card on an SRP module:

- 1 Obtain an antistatic container for the NVS card you will remove (see [Storing Modules and Components](#), earlier in this chapter).
- 2 With a small flathead screwdriver, remove the faceplate from the NVS card slot on the SRP module (see [Figure 7-1](#)).
- 3 Use the screwdriver to depress the button next to the NVS card (see [Figure 7-1](#)).

This action releases the NVS card.

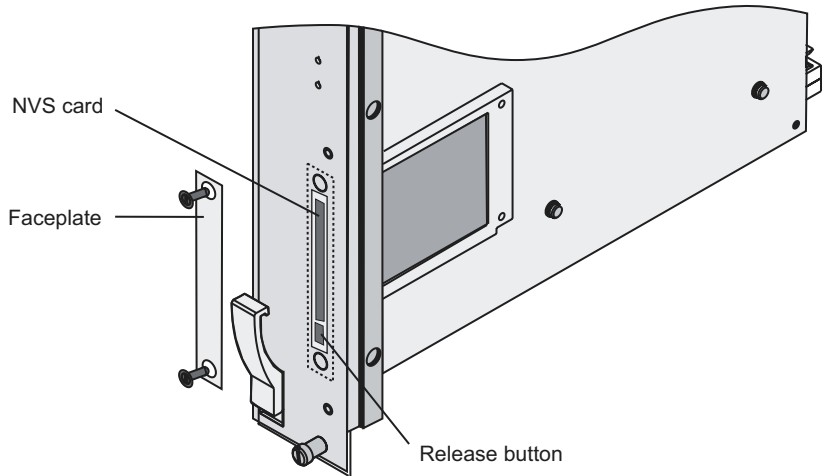


Figure 7-1 NVS card slot on SRP module

- 4** Remove the NVS card and place it in the antistatic container.
- 5** Insert the higher-capacity NVS card into the slot.
- 6** Push the higher-capacity NVS card as far as you can in the slot.
When you push the card far enough, it will click into place.
- 7** Replace the faceplate on the NVS card slot.

Replacing SFPs on GE I/O Modules

This section describes how to replace small form-factor pluggable transceivers (SFPs) on Gigabit Ethernet (GE) 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 ERX system 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 will remove (see [Storing Modules and Components](#), earlier in this chapter).
- 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 7-2](#)). 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

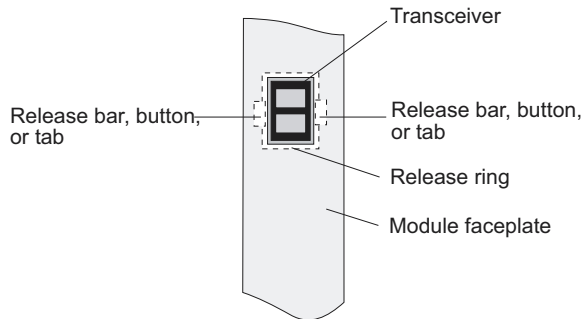


Figure 7-2 Possible release mechanisms on the SFP

- 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 ERX GE I/O module, repeat steps 3 through 6 for the other SFP.



Caution: For port redundancy to operate correctly, both the primary and redundant ports on an ERX 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 (see [Figure 7-3](#)):
 - The connection circuitry on the base
 - The cable connectors on the front

The cable connectors will be protected by a dust cover.

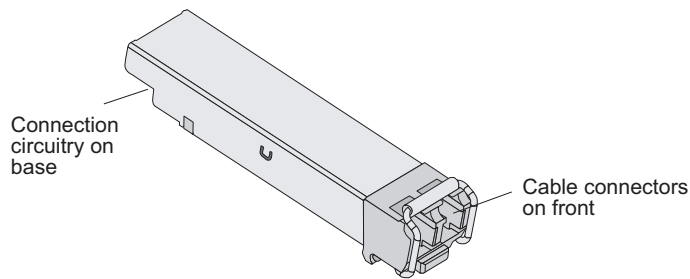


Figure 7-3 Example of SFP



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 a picture of the correct orientation, see [Figure 7-4](#).

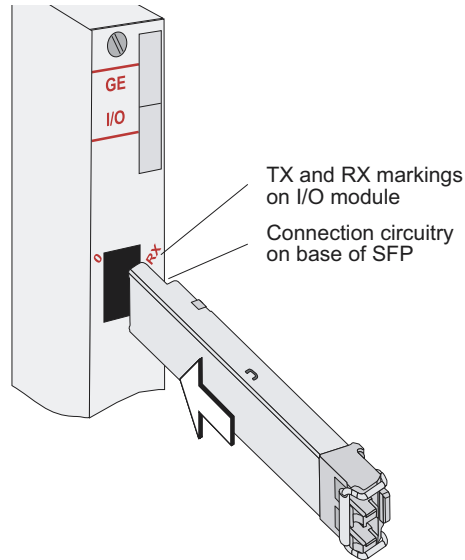


Figure 7-4 Installing an SFP on an ERX GE I/O module

- 4 Insert the SFP as far as you can into the I/O module.

The SFP should slide smoothly into the I/O module and should click into place. If the SFP does not slide smoothly into the I/O module, check that the orientation of the SFP is correct.

- 5 Gently pull the SFP to confirm that it is inserted correctly.

The SFP should not move when you pull it. 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 ERX GE I/O module, repeat steps 2 through 7 for the other port.

Verifying the Installation

When you have replaced the SFPs and connected the cables, issue the **show interface gigabitEthernet** command for each interface to check 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
```

Cleaning 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 ERX system 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.

Dust is attracted to the side of the system on which the air intake vent is situated (see [Figure D-2](#)). Clean this side of the system with a dry cloth every couple of weeks to prevent excessive accumulation of dust. This cleaning will maintain the efficiency of the cooling system and prevent damage to electronic components.

Replacing Fan Trays

A tray of cooling fans provides forced air cooling for components in the ERX-1400 series and ERX-700 series. The location of the fans depends on the model. The ERX-700 series and ERX-1400 series support hot-swapping of the fan tray. Hot-swapping allows you to replace the fan tray without powering down the system. However, if you do not replace the fan tray within a few minutes, the system will go into thermal protection mode. For information about thermal protection mode, see [Monitoring Temperatures of Modules](#) in [Chapter 8, Troubleshooting](#).



Caution: If the 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 system with inadequate air circulation may damage the modules.

ERX-1400 Series

Figure 7-5 and Figure 7-6 show the location of the fan tray in the ERX-1400 series.

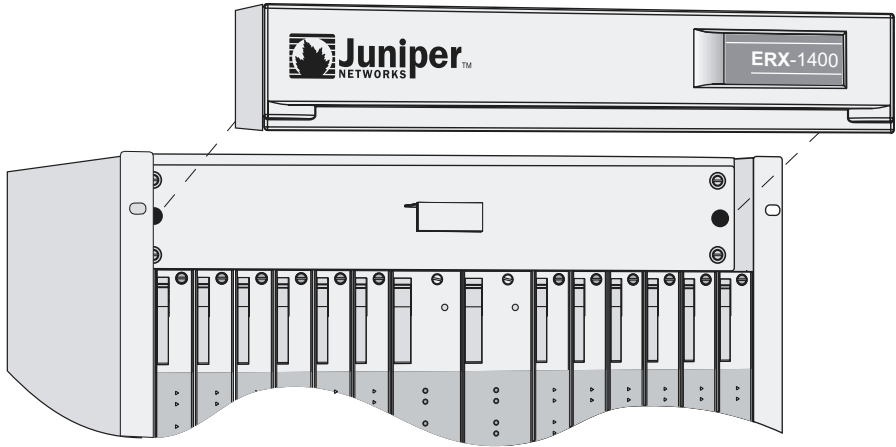


Figure 7-5 Location of fan tray in ERX-1400 series

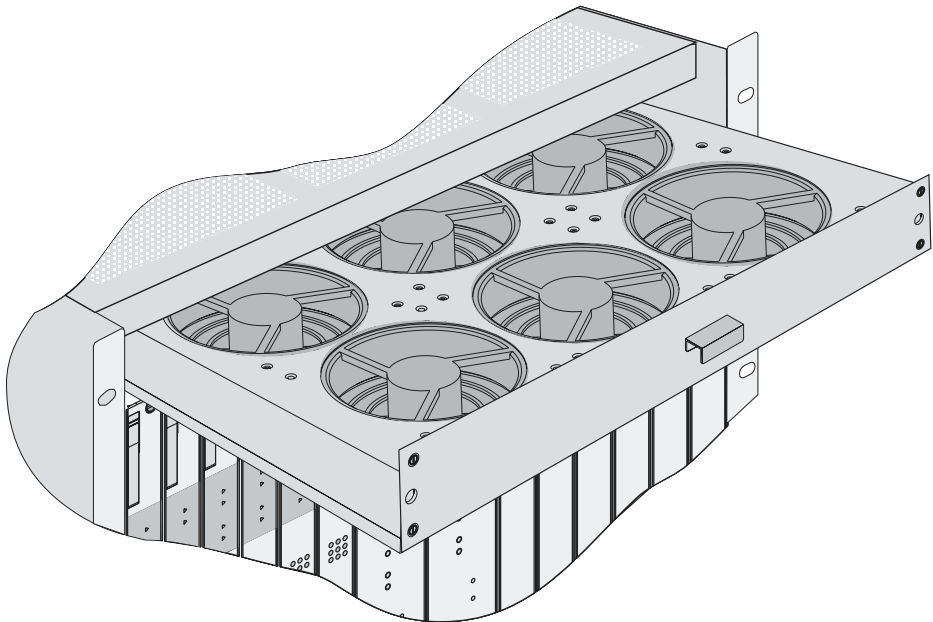


Figure 7-6 Fan tray in ERX-1400 series

Removing the Fan Tray

To remove the fan tray:



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.

- 1 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 a flathead screwdriver, loosen the four 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 may 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 has no 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 vertically so that the captive screws point towards 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.

There is an electrical connector on the back of the fan tray that pairs with an electrical connector at the back of the shelf.

- 4 With a flathead 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 Push the top bezel back on the front of the system.

ERX-700 Series

Figure 7-7 shows the location of the fan tray in the ERX-700 series.

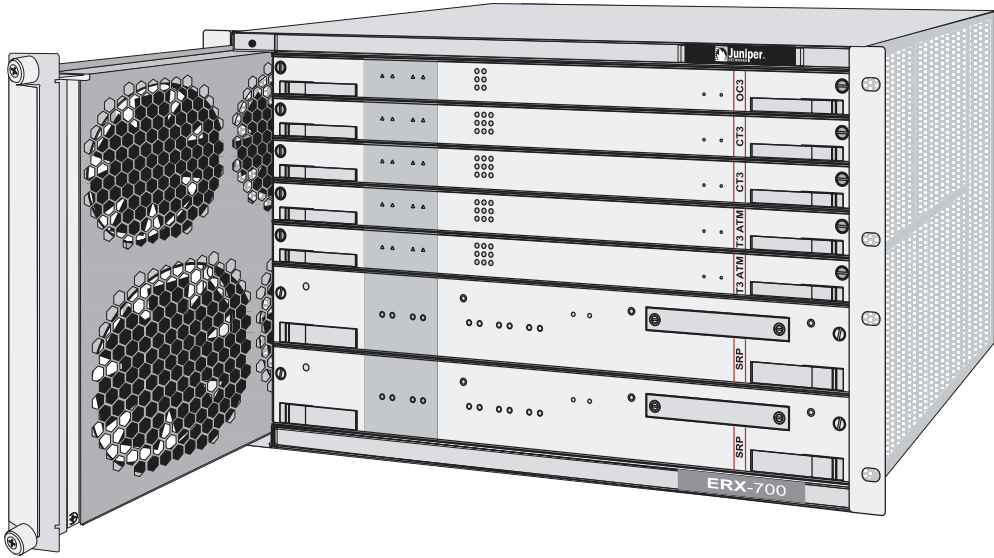


Figure 7-7 Location of fan tray on the front of the ERX-700 series

Removing the Fan Tray



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.

To remove the fan tray:

- 1 Using a Philips screwdriver, loosen the two captive screws located at top and bottom of the fan tray.



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

- 2 Pull the fan tray halfway out of the shelf.



Warning: Slowly slide the fan tray out of the chassis. The tray has no stops to prevent it from sliding all the way out.

- 3 Pull the tray out of the chassis.

Installing the Fan Tray



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

To install the fan tray:

- 1** Hold the tray vertically so that the captive screws point towards 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.

There is an electrical connector on the back of the fan tray that pairs with an electrical connector at the back of the shelf.

- 4** With a Philips screwdriver, tighten the captive screws on the fan tray.

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

Troubleshooting

8

This chapter explains how you can troubleshoot a specific problem at system power-up, such as abnormal LED activity or no system power.

Topic	Page
Diagnosing Problems	8-1
Troubleshooting Power Failures	8-2
Understanding Status LEDs	8-3
Monitoring Temperatures of Modules	8-10
Resetting Line Modules and SRP Modules	8-11
Double-Bit Errors on SRP Modules	8-11

Diagnosing Problems

The information in this chapter can help you identify problems by observing diagnostic signs. Your initial response to a system problem should be to check power connections, observe the system's LEDs carefully, and check cable connections on the system modules.

If a problem is beyond the scope of this chapter, refer to [Appendix F, Customer Service](#) for instructions.

Power Failure

When you power up the system and it does not respond normally, refer to the troubleshooting suggestions in [Table 8-1](#).

LED Activity

Module LEDs can show you the immediate status of a module and alert you to a problem with the module or one of its ports. It is helpful to familiarize yourself with LED activity so that you can easily detect and correct a module-related problem with minimal or no system downtime. See [Table 8-2](#) and [Table 8-3](#) for specific information on normal LED activity. See [Table 8-4](#) for specific information on troubleshooting abnormal LED activity.

Module Cables

See [Chapter 4, Cabling the ERX System](#), for information about cabling modules.

Initialization Sequence

Each ERX line module is initialized independently. As a result, the CLI on the SRP module may become available before the line modules have completed initialization. Commands relating to a line module may fail if the module has not completed initialization. The **show version** command can be used to display line module status. Do not enter commands for a line module until its state is “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 [Appendix A, System Specifications](#) for specifications of power consumption and heat dissipation. If you suspect a power problem, refer to [Table 8-1](#).

Table 8-1 Causes of power failures

Symptom	Possible Problems	Actions
System does not power up.	<ul style="list-style-type: none"> System is not receiving power. A module’s power supply has malfunctioned. Power source cannot handle system load. 	<p>Note: 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. Refer to Appendix A, System Specifications. 3 If the system still does not operate, contact Juniper Networks Customer Service.

Table 8-1 Causes of power failures (continued)

Symptom	Possible Problems	Actions
System shuts down.	<ul style="list-style-type: none"> • Temperature too high • Loss of power 	<p>Note: <i>The following actions apply to all of the possible problems.</i></p> <ol style="list-style-type: none"> 1 Verify that power connections are properly attached. 2 Verify that system is receiving power. 3 Check whether or not the LEDs are lit. 4 Run diagnostics on SRP and line modules. 5 If system will not reset, contact Juniper Networks Customer Service.

Understanding Status LEDs

When you power up the system, it runs a series of tests for each module installed in the system. Refer to the tables in this section to understand normal and abnormal LED activity. For troubleshooting information, see [Table 8-4](#).

LED Identification

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

The number against 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 two sets of port status LEDs are active during OC12/STM4 operation.

[Table 8-2](#) shows the functions of the module and port status LEDs.

Table 8-2 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

Table 8-2 LED identification and activity descriptions (continued)

LED Location	LED Label	LED Indicator	LED Color	OFF to ON	ON to OFF
All modules	REDUNDANT	Redundancy	Green	See Redundancy Status later in this chapter. Note: The REDUNDANT LED on the cOCx/STMx, FE-8, GE/FE, HSSI, OC3 (dual port), 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	Fan failure
	FAN FAIL	Fan	Red	Fan failure	Fan online
	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
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 LE 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.

Table 8-2 LED identification and activity descriptions (continued)

LED Location	LED Label	LED Indicator	LED Color	OFF to ON	ON to OFF
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. (See)	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 8-1](#))
- Ethernet line module ([Figure 8-2](#))
- Other line modules ([Figure 8-3](#))

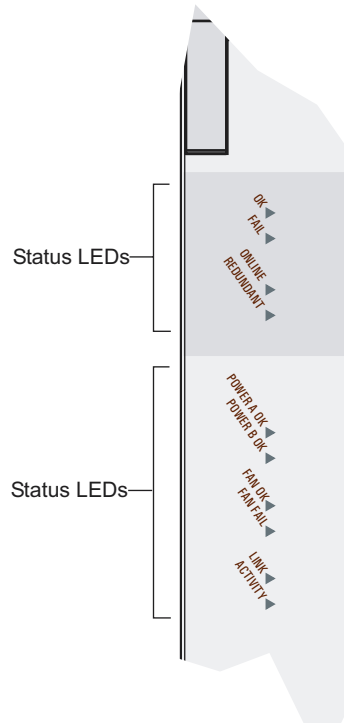


Figure 8-1 SRP module LEDs



Note: The primary SRP illuminates the REDUNDANT LED only when the SRP detects that there is a secondary or standby SRP module online. The standby SRP monitors an activity signal from the primary SRP module to determine its state; it does not shadow the operations of the primary SRP. If the standby SRP detects that the primary SRP is not active, it reboots the system and takes control.

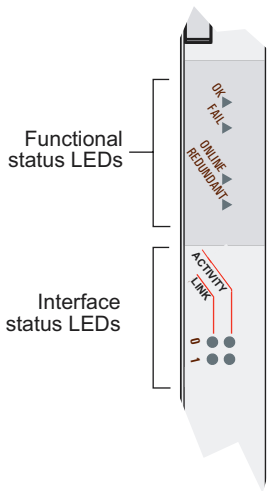


Figure 8-2 FE2 module LEDs

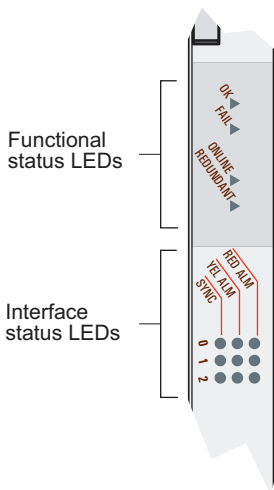


Figure 8-3 E3 and T3 module LEDs

LED Activity During Booting

When the system boots, it runs diagnostic tests, and the module status LEDs display various configurations. Observe the scenario presented in [Table 8-3](#) to verify that the system has booted properly.



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

Table 8-3 Normal activity of functional status LEDs during booting

OK	FAIL	ONLINE	Status Process
off	on	off	1 Module is in the power-up restart state; the FAIL LED stays on briefly.
off	off	off	2 Module is initializing, and diagnostic tests are running.
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 turns on. Some failure conditions may cause the board not to boot. In this case, the LEDs may all be off. The system should then reset the board.

If the operational software detects an error, the FAIL LED turns on. Some errors may cause a board reset. Crash information can be displayed from the console and is printed to the screen on the next reboot.

Abnormal LED Activity

See [Table 8-4](#) to diagnose and correct problems.

Table 8-4 Troubleshooting abnormal LED activity on modules

Diagnostic Signs	Possible Problems	Actions
<ul style="list-style-type: none"> POWER A OK is not lit POWER B OK 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 Check Power A and Power B terminal connections. 2 Verify that power switches are on. 3 Check connections to power sources. 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 Check that the line 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 should automatically reset the module. 4 If condition persists, contact Juniper Networks Customer Service.
<ul style="list-style-type: none"> FAN OK 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.

Table 8-4 Troubleshooting abnormal LED activity on modules (continued)

Diagnostic Signs	Possible Problems	Actions
LINK LED is not lit	<ul style="list-style-type: none"> Ethernet connection is down. 	<ol style="list-style-type: none"> 1 Check that Ethernet cables are properly connected to both the Ethernet port and the appropriate network device. 2 Contact Juniper Networks Customer Service.
RED ALM	<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 Check that all cables are firmly plugged into OC3 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><i>Note: Problem is corrected when normal LED activity is observed.</i></p>
YEL ALM <i>Note: This LED is not functional on the HSSI line module.</i>	<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><i>Note: Problem is corrected when normal LED activity is observed.</i></p>
<ul style="list-style-type: none"> System will not boot. Module(s) 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 board status. 2 Review section on proper slot group configuration in Chapter 3, Installing ERX Modules. 3 Reconfigure system with correct slot group configuration. 4 Reset system.
None	<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 Check 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 indicating the failure is displayed. 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. See [Table 8-5](#).



Note: The REDUNDANT LED on the cOCx/STMx, FE-8, GE/FE, HSSI, OC3 (dual port), and OCx/STMx modules is nonfunctional.

Table 8-5 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.

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

Table 8-6 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 Appendix A, System Specifications).	Increase space around system.
Ambient temperature exceeds specifications	Ambient temperature exceeds specifications (see Appendix A, System Specifications).	Provide extra cooling or heating in the room where the system is located.
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 Chapter 7, Maintaining the ERX System).
Module failure	FAIL LED on module is illuminated.	Replace module (see Chapter 3, Installing ERX Modules).

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 button to reset the software on the module and the board reset button to reset the module. See [Figure 1-8](#) and [Figure 1-9](#).

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

If depressing the software reset button fails to correct the issue with the line module, depress the board reset button. This action reboots the line module.

The buttons work in the same way for the SRP module. Depressing the board reset button on an SRP module is equivalent to rebooting the ERX system 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. If 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](#).

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 board reset button on the SRP module (see [Figure 1-8](#)).

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.

System Specifications

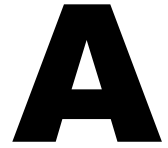


Table A-1 ERX specifications

	ERX-1400 Series	ERX-700 Series
Weight		
Chassis only	42 lb (18.9 kg)	22 lb (9.9 kg)
Chassis fully configured	88 lb (39.6 kg)	46 lb (20.7 kg)
Dimensions	22.75 (H) x 19 (W) x 16 (D) inches (57.78 x 48.26 x 40.64 cm)	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	Long term: 41° to 104° F (5° to 40° C) Short term: 23° to 122° F (-5° to 50° C)	
Ambient operating humidity	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	1400 W, 4780 BTU/hour maximum
Space Requirements	<ul style="list-style-type: none"> • 3 feet (90 cm) behind system or rack • No space requirements for sides of units or rack • Do not block air vents on front or back of the system. 	<ul style="list-style-type: none"> • 3 feet (90 cm) behind system or rack • Do not block air vents on sides of the system. • Do not place equipment that exhausts hot air to right of the system. • Be aware that system exhausts hot air from its left side. • Allow at least 18 inches (45 cm) at side of the unit or rack.

Table A-1 ERX specifications (continued)

	ERX-1400 Series	ERX-700 Series
Airflow	<ul style="list-style-type: none"> An integral air plenum directs system's exhaust air below the system and out the back. See Figure D-1 in Appendix D, Preparing Your Site. 	<ul style="list-style-type: none"> Airflow direction is in through the right side and out through the left side. See Figure D-2 in Appendix D, Preparing Your Site.
DC Input		
Voltage	–40 to –72 VDC ^a	–40 to –72 VDC
Current	50 A @ –48 VDC	30 A @ –48 VDC
Power	2400 W maximum	1400 W maximum
Redundancy (input power)	2 independent line feeds	2 independent line feeds
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 (LSSGR, FD-15): Network Equipment Building System (NEBS) Requirements: Physical Protection, Issue 1, October 1995 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 3260:1993: Safety of Information Technology Equipment Including Electrical Business Equipment CAN/CSA C22.2, No. 60950-00, 3rd Edition, Safety of Information Technology Equipment EN60825-1, Safety of Laser Products - Part 1: Equipment Class, Requirements, and User's Guide (2001) EN60950:2000, 3rd Edition, Safety of Information Technology Equipment IEC 60950-1(2001-10) Ed. 1.0 Information technology equipment - Safety - Part 1: General requirements Low Voltage Directive (73/23/EEC) UL 60950, 3rd Edition, Safety of Information Technology Equipment 	
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 A-1 ERX specifications (continued)

	ERX-1400 Series	ERX-700 Series
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) 	

a.If the voltage rises above -40 VDC, the system will power off. The system will not power on again until the input voltage reaches -43 +/- 0.5 VDC.

Module Specifications

B

This appendix provides information about line modules, SRP modules, and I/O modules. All line modules, with the exception of the IPSec Service and Tunnel Service module, combine with I/O modules to provide particular capabilities and connections. In this appendix, the term module assembly is used to describe the combination of a line module and an I/O module.

Topic	Page
Module Assemblies and Model Compatibility	B-1
Performance Specifications	B-4
Connection Information	B-7

Module Assemblies and Model Compatibility

[Table B-1](#) provides a description of the module assemblies

Table B-1 Module assemblies available for ERX edge routers

Module Assembly Name	Module Assembly Description	Type	Model Compatibility	SRP Module Compatibility
CE1	Channelized E1	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
cOC3/STM1 F0	OC3/STM channelized to DS3, DS1, E1, and DS0 (single mode and multimode)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+

Table B-1 Module assemblies available for ERX edge routers (continued)

Module Assembly Name	Module Assembly Description	Type	Model Compatibility	SRP Module Compatibility
cOC12/STM4 F0	OC12/STM4 channelized to DS3, DS1, E1, and DS0 (single mode and multimode; multimode with and without SONET APS redundancy)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
CT1	Channelized T1	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
CT3	Channelized T3 (3 ports)	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
CT3 12 F0	Channelized T3 (12 ports)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
E3 ATM	Unchannelized E3 for ATM	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
E3 FRAME (3 ports)	Unchannelized E3 for Frame (3 ports)	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
E3 FRAME (12 ports)	Unchannelized E3 for Frame (12 ports)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
FE-2	Fast Ethernet (2 ports)	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
FE-8	Fast Ethernet (8 ports)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
Gigabit Ethernet	Gigabit Ethernet (1000 Base-SX, 1000 Base-LH, 1000 Base-ZX) ^a	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+

Table B-1 Module assemblies available for ERX edge routers (continued)

Module Assembly Name	Module Assembly Description	Type	Model Compatibility	SRP Module Compatibility
HSSI	High Speed Serial Interface	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
IPSec Service	IPSec Tunnel Service	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
OC3 (dual port)	OC3/STM1 for ATM and Frame, unchannelized, concatenated (2 ports, single mode and multimode)	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
OC3/STM1 ATM	Unchannelized, concatenated OC3/STM1 for ATM (4 ports, single mode and multimode)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
OC3/STM1 POS	Unchannelized, concatenated OC3/STM1 for POS (4 ports, single mode and multimode)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
OC12/STM4 ATM	Unchannelized, concatenated OC12/STM4 for ATM (single mode and multimode; with and without SONET APS redundancy)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
OC12/STM4 POS	Unchannelized, concatenated OC12/STM4 for POS (single mode and multimode; with and without SONET APS redundancy)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
SRP-5G	Switch route processor (5 Gbps)	N/A	ERX-700 system	SRP-5G
SRP-5G+	Switch route processor (5 Gbps)	N/A	ERX-705 system	SRP-5G+
SRP-10G	Switch route processor (10 Gbps)	N/A	ERX-700 system ERX-1410 system	SRP-10G

Table B-1 Module assemblies available for ERX edge routers (continued)

Module Assembly Name	Module Assembly Description	Type	Model Compatibility	SRP Module Compatibility
SRP-40G SRP-40G+	Switch route processor (40 Gbps)	N/A	ERX-1440 system	SRP-40G SRP-40G+
T3 ATM (3 ports)	Unchannelized T3 for ATM (3 ports)	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
T3 FRAME (3 ports)	Unchannelized T3 for Frame (3 ports)	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G
T3 FRAME (12 ports)	Unchannelized T3 for Frame (12 ports)	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
TSM	Tunnel Service for IP Tunnels, L2F Tunnels and LNS Termination	ASIC	ERX-700 series ERX-1400 series	SRP-5G+ SRP-10G SRP-40G SRP-40G+
X.21/V.35	X.21/V.35 synchronous serial interface	Non-ASIC	ERX-700 series ERX-1410 system	SRP-5G SRP-5G+ SRP-10G

a. Newer GE I/O module uses a range of small form-factor pluggable transceivers (SFPs) that support different operating modes and distances.

Performance Specifications

Table B-2 provides details about the performance of the line module assemblies.

Table B-2 Performance specifications for module assemblies

Name	Capability	Redundancy Support	Power Use
CE1	E1 HDLC Framing	1:N redundancy	40 W
cOC3/STM1 F0 (single mode and multimode)	OC3/STM1 DS3 T1, E1 DS0 HDLC Framing	1:N redundancy	130 W

Table B-2 Performance specifications for module assemblies (continued)

Name	Capability	Redundancy Support	Power Use
cOC12/STM4 F0 (single mode and multimode, multimode with and without SONET APS redundancy)	OC12/STM4 OC3/STM1 DS3 T1, E1 DS0 HDLC Framing	<ul style="list-style-type: none"> 1:N redundancy SONET APS redundancy^a 	130 W
CT1	DS1, DS0 HDLC Framing	1:N redundancy	40 W
CT3	DS3, DS1, DS0 HDLC Framing	1:N redundancy	60 W
CT3 12 F0	DS3, DS1, DS0 HDLC Framing	1:N redundancy	130 W
E3 ATM	ATM/AAL5	1:N redundancy	60 W
E3 FRAME (3 ports)	E3 HDLC Framing	1:N redundancy	60 W
E3 FRAME (12 ports)	E3 HDLC Framing	N/A	135 W
FE-2	Ethernet (IEEE 802.3) 10/100Base-T	N/A	60 W
FE-8	Ethernet (IEEE 802.3) 10/100Base-T	N/A	130 W
Gigabit Ethernet	Ethernet (IEEE 802.3z) 1000 Base-SX 1000 Base-LH 1000 Base-ZX	Redundant port	130 W
HSSI	Up to 44.736 MHz data rate HDLC	N/A	60 W
IPSec Service	IPSec Tunnels	Multiple IPSec Service modules provide redundancy	130 W
OC3 (dual port)	OC3c/STM1 ATM/AAL5 HDLC Framing	N/A	60 W
OC3/STM1 ATM (single mode and multimode)	OC3/STM-1, ATM:AAL5	1:N redundancy	130 W

Table B-2 Performance specifications for module assemblies (continued)

Name	Capability	Redundancy Support	Power Use
OC3/STM1 POS (single mode and multimode))	OC3/STM-1, HDLC Framing	1:N redundancy	120 W
OC12/STM4 ATM (single mode and multimode)	OC12/STM-4, ATM:AAL-5	<ul style="list-style-type: none"> • 1:N redundancy • SONET APS redundancy^a 	130 W
OC12/STM4 POS (single mode and multimode)	OC12/STM-4 HDLC Framing	1:N redundancy	120 W
SRP-5G (5 Gbps)	Ethernet (IEEE 802.3) 10/100Base-T RS-232	1:1 redundancy	100 W
SRP-5G+ (5 Gbps)	Ethernet (IEEE 802.3) 10/100Base-T RS-232	1:1 redundancy	125 W
SRP-10G (10 Gbps)	Ethernet (IEEE 802.3) 10/100Base-T RS-232	1:1 redundancy	125 W
SRP-40G (40 Gbps)	Ethernet (IEEE 802.3) 10/100Base-T RS-232	1:1 redundancy	210 W
SRP-40G+ (40 Gbps)	Ethernet (IEEE 802.3) 10/100Base-T RS-232	1:1 redundancy	210 W
T3 ATM (3 ports)	ATM/AAL5	1:N redundancy	60 W
T3 FRAME (3 ports)	DS3 Subrate DS3 HDLC Framing	1:N redundancy	60 W
T3 FRAME (12 ports)	DS3 Subrate DS3 HDLC Framing	N/A	135 W
TSM	IP Tunnels LNS Termination	Multiple TSMs provide redundancy	130 W
X.21/V.35	HDLC	N/A	60 W

a. Not all I/O modules of this type support SONET APS redundancy. See *Release Notes* for details of which I/O modules support SONET APS redundancy.

Connection Information

Table B-3 shows the names of the line modules and I/O modules that you can combine to form the different module assemblies. This table also provides cabling specifications for the I/O modules.

Table B-3 Connection information for module assemblies

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
CE1	CE1	CE1 FULL I/O	20	<ul style="list-style-type: none"> RJ-48C, 120 ohm BNC, 75 ohm via a balun panel that connects to the I/O module 	<ul style="list-style-type: none"> Use shielded cables to maintain EMC compliance. The transmitted signal complies with ITUT G.703: Physical/electrical characteristics of hierarchical digital interfaces (November 2001) for cable lengths up to 450 m (492 yards).
cOC3/STM1 multimode	cOCx/STMx F0	cOC3 STM1 F0 I/O MULTI MODE	4	SC full duplex	<ul style="list-style-type: none"> Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm Center wavelength: 1310 nm Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB
cOC3/STM1 single mode intermediate reach	cOCx/STMx F0	cOC3 STM1 F0 I/O SINGLE MODE	4	SC full duplex	<ul style="list-style-type: none"> Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm Center wavelength: 1310 nm Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm Rated for 15 km (9.3 miles) of 9-micron core cable

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
cOC3/STM1 single mode long reach	cOCx/STMx F0	cOC3 STM1 F0 I/O LONG HAUL	4	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -5.0 dBm › max: 0 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -34 dBm › max: -7 dBm • Fiber type: 9-micron core • Rated for 40 km (24.8 miles) of 9-micron core cable
cOC12/STM4 multimode without SONET APS redundancy	cOCx/STMx F0	cOC12 STM4 F0 I/O MULTI MODE	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB
cOC12/STM4 multimode with SONET APS redundancy	cOCx/STMx F0	COC12 F0 APS MULTI MODE	1 active 1 redundant	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
cOC12/STM4 single mode intermediate reach	cOCx/STMx F0	cOC12 STM4 F0 I/O SINGLE MODE	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm • Rated for 15 km (9.3 miles) of 9-micron core cable
cOC12/STM4 single mode long reach	cOCx/STMx F0	cOC12 STM4 F0 I/O LONG HAUL	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -5.0 dBm › max: 0 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -34 dBm › max: -7 dBm • Fiber type: 9-micron core • Rated for 40 km (24.8 miles) of 9-micron core cable
CT1	CT1	CT1 FULL I/O	24	RJ-48C 100 ohm	<ul style="list-style-type: none"> • Use shielded cables to maintain EMC compliance. • The line interface unit supports multiple line build-outs. • Signal strength is software controlled. • The transmitted signal complies with ANSI T1.102-1993: Digital Hierarchy – Electrical Interfaces (1999) for cable lengths up to 201 m (660 feet).

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
CT3	CT3	CT3/T3 I/O	3	BNC 75 ohm	<ul style="list-style-type: none"> The line interface unit supports two line build-outs: <ul style="list-style-type: none"> › 0–68.5 m (0–225 feet) › 69–137 m (226–450 feet) Signal strength is software controlled. The transmitted signal complies with ANSI T1.102-1993: Digital Hierarchy – Electrical Interfaces (1999) for cable lengths up to 201 m (660 feet).
CT3 12 F0	CT3/T3-F0	CT3/T3 12 I/O	12	BT43 SMB (cable that adapts to 75-ohm BNC is available)	<ul style="list-style-type: none"> The line interface unit supports two line build-outs: <ul style="list-style-type: none"> › 0–68.5 m (0–225 feet) › 69–137 m (226–450 feet) Signal strength is software controlled. The transmitted signal complies with ANSI T1.102-1993: Digital Hierarchy – Electrical Interfaces (1999) for cable lengths up to 201 m (660 feet).
E3 ATM	E3 ATM	E3 I/O	3	BNC 75 ohm	The transmitted signal complies with ITUT G.703: Physical/electrical characteristics of hierarchical digital interfaces (November 2001) for cable lengths from 0–137 m (0–450 feet).
E3 FRAME (3 ports)	E3 FRAME	E3 I/O	3	BNC 75 ohm	The transmitted signal complies with ITUT G.703: Physical/electrical characteristics of hierarchical digital interfaces (November 2001) for cable lengths from 0–137 m (0–450 feet).

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
E3 FRAME (12 ports)	COCX-F3	E3-12 FRAME I/O	12	BT43 SMB (cable that adapts to 75-ohm BNC is available)	The transmitted signal complies with ITUT G.703: Physical/electrical characteristics of hierarchical digital interfaces (November 2001) for cable lengths from 0–137 m (0–450 feet).
FE-2	FE-2	FE-2 I/O	2	RJ-45	<ul style="list-style-type: none"> For 10-Mbps operation, use CAT 3, 4, or 5 UTP cable. For 100-Mbps operation, use only CAT 5 UTP cable. The transmitted signal complies with IEEE 802.3/802.3u for cable lengths up to 100 m (328 feet).
FE-8	GE/FE	FE-8 I/O	8	RJ-45	<ul style="list-style-type: none"> For 10-Mbps operation, use CAT 3, 4, or 5 UTP cable. For 100-Mbps operation, use only CAT 5 UTP cable. The transmitted signal complies with IEEE 802.3/802.3u for cable lengths up to 100 m (328 feet).
GE 1000 Base-SX	GE/FE	GE I/O SFP ^a	1 active 1 redundant	LC full duplex	<ul style="list-style-type: none"> Tx power <ul style="list-style-type: none"> › min: –9.5 dBm › max: –4 dBm Center wavelength: 850 nm Rx input power <ul style="list-style-type: none"> › min: –17 dBm › max: –3 dBm Rated for 275 m (300 yards) over 62.5-micron core cable Rated for 550 m (601 yards) over 50-micron core cable

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
GE 1000 Base-LH	GE/FE	GE I/O SFP ^a	1 active 1 redundant	LC full duplex	<ul style="list-style-type: none"> • Tx power <ul style="list-style-type: none"> › min: -9.5 dBm › max: -3 dBm • Center wavelength: 1300 nm • Rx input power <ul style="list-style-type: none"> › min: -20 dBm › max: -3 dBm • Rated for 10 km (6.2 miles) over 10-micron core cable
GE 1000 Base-ZX	GE/FE	GE I/O SFP ^a	1 active 1 redundant	LC full duplex	<ul style="list-style-type: none"> • Tx power <ul style="list-style-type: none"> › min: -3 dBm › max: 2 dBm • Center wavelength: 1550 nm • Rx input power <ul style="list-style-type: none"> › min: -23 dBm › max: -3 dBm • Rated for 70 km (43.4 miles) over 10-micron core cable
GE multimode ^b	GE/FE	GE I/O MULTI MODE	1 active 1 redundant	SC full duplex	<ul style="list-style-type: none"> • Tx power <ul style="list-style-type: none"> › min: -9.5 dBm › max: -4 dBm • Center wavelength: 850 nm • Rx input power <ul style="list-style-type: none"> › min: -17 dBm › max: -3 dBm • Rated for 275 m (300 yards) over 62.5-micron core cable • Rated for 550 m (601 yards) over 50-micron core cable

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
GE single mode ^b	GE/FE	GE I/O SINGLE MODE	1 active 1 redundant	SC full duplex	<ul style="list-style-type: none"> • Tx power <ul style="list-style-type: none"> › min: -11 dBm › max: -3 dBm • Center wavelength: 1300 nm • Rx input power <ul style="list-style-type: none"> › min: -20 dBm › max: -3 dBm • Rated for 550 m (601 yards) over 62.5-micron core or 50-micron core MM fiber • Rated for 5 km (3.1 miles) over 10-micron core cable
HSSI	HSSI-3F	HSSI-3	3	Standard HSSI connector: 2-row, 50-pin, receptacle header with rails and latch blocks	<ul style="list-style-type: none"> • 50 feet (15.24 m) maximum cable length
IPSec Service	IPSEC SERVICE	No I/O module	N/A	N/A	N/A
OC3 (dual port) multimode	OC3	OC3 I/O MULTI MODE	2	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB
OC3 (dual port) single mode	OC3	OC3 I/O SINGLE MODE	2	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm • Rated for 15 km (9.3 miles) of 9-micron core cable

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
OC3/STM1 ATM multimode	OCx/STMx ATM	OC3-4 I/O MULTI MODE	4	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB
OC3/STM1 ATM single mode, intermediate reach	OCx/STMx ATM	OC3-4 I/O SINGLE MODE	4	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm • Rated for 15 km (9.3 miles) of 9-micron core cable
OC3/STM1 ATM single mode, long reach	OCx/STMx ATM	OC3-4 I/O LONG HAUL	4	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -5.0 dBm › max: 0 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -34 dBm › max: -7 dBm • Rated for 40 km (24.8 miles) of 9-micron core cable

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
OC3/STM1 POS multimode	OCx/STMx POS	OC3-4 I/O MULTI MODE	4	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB
OC3/STM1 POS single mode, intermediate reach	OCx/STMx POS	OC3-4 I/O SINGLE MODE	4	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm • Rated for 15 km (9.3 miles) of 9-micron core cable
OC3/STM1 POS single mode, long reach	OCx/STMx POS	OC3-4 I/O LONG HAUL	4	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -5.0 dBm › max: 0 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -34 dBm › max: -7 dBm • Fiber type: 9 micron core • Rated for 40 km (24.8 miles) of 9-micron core cable

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
OC12/STM4 ATM multimode without SONET APS redundancy	OCx/STMx ATM	OC12 STM4 I/O MULTI MODE	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB
OC12/STM4 ATM multimode with SONET APS redundancy	OCx/STMx ATM	OC12 STM4 APS MULTI MODE	1 active 1 redundant	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB
OC12/STM4 ATM single mode, intermediate reach without SONET APS redundancy	OCx/STMx ATM	OC12 STM4 I/O SINGLE MODE	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm • Rated for 15 km (9.3 miles) of 9-micron core cable

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
OC12/STM4 ATM single mode, intermediate reach with SONET APS redundancy	OCx/STMx ATM	OC12 STM4 APS SINGLE MODE	1 active 1 redundant	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm • Rated for 15 km (9.3 miles) of 9-micron core cable
OC12/STM4 ATM single mode, long reach	OCx/STMx ATM	OC12 STM4 I/O LONG HAUL	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -5.0 dBm › max: 0 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -34 dBm › max: -7 dBm • Fiber type: 9 micron core • Rated for 40 km (24.8 miles) of 9-micron core cable
OC12/STM4 POS multimode without SONET APS redundancy	OCx/STMx POS	OC12 STM4 I/O MULTI MODE	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
OC12/STM4 POS multimode with SONET APS redundancy	OCx/STMx POS	OC12 STM4 APS MULTI MODE	1 active 1 redundant	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -19 dBm › max: -14 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -30 dBm › max: -14 dBm • Rated for 2 km (1.2 miles) over 62.5-micron core cable with an optical loss of 0-9 dB or 50-micron core cable with an optical loss of 7 dB
OC12/STM4 POS single mode, intermediate reach without SONET APS redundancy	OCx/STMx POS	OC12 STM4 I/O SINGLE MODE	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm • Rated for 15 km (9.3 miles) of 9-micron core cable
OC12/STM4 POS single mode, intermediate reach with SONET APS redundancy	OCx/STMx POS	OC12 STM4 APS SINGLE MODE	1 active 1 redundant	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -15 dBm › max: -8 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -31 dBm › max: -8 dBm • Rated for 15 km (9.3 miles) of 9-micron core cable
OC12/STM4 POS single mode, long reach	OCx/STMx POS	OC12 STM4 I/O LONG HAUL	1	SC full duplex	<ul style="list-style-type: none"> • Tx power: <ul style="list-style-type: none"> › min: -5.0 dBm › max: 0 dBm • Center wavelength: 1310 nm • Rx input power: <ul style="list-style-type: none"> › min: -34 dBm › max: -7 dBm • Rated for 40 km (24.8 miles) of 9-micron core cable

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
SRP (5 Gbps) ^b	SRP-5G	SRP I/O	7	<ul style="list-style-type: none"> Terminal blocks BNC Wire wrap posts RJ-45 RS-232 (DB-9) 	See Chapter 4, Cabling the ERX System .
SRP (5 Gbps)	SRP-5G+	SRP I/O	7	<ul style="list-style-type: none"> Terminal blocks BNC Wire wrap posts RJ-45 RS-232 (DB-9) 	See Chapter 4, Cabling the ERX System .
SRP (10 Gbps)	SRP-10G	SRP I/O	7	<ul style="list-style-type: none"> Terminal blocks BNC 75 ohm Wire wrap posts RJ-45 RS-232 (DB-9) 	See Chapter 4, Cabling the ERX System .
SRP (40 Gbps) ^b	SRP-40G	SRP I/O	7	<ul style="list-style-type: none"> Terminal blocks BNC 75 ohm Wire wrap posts RJ-45 RS-232 (DB-9) 	See Chapter 4, Cabling the ERX System .
SRP (40 Gbps)	SRP-40G+	SRP I/O	7	<ul style="list-style-type: none"> Terminal blocks BNC 75 ohm Wire wrap posts RJ-45 RS-232 (DB-9) 	See Chapter 4, Cabling the ERX System .

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
T3 ATM (3 ports)	T3 ATM	CT3/T3 I/O	3	BNC 75 ohm	<ul style="list-style-type: none"> The line interface unit supports two line build-outs: <ul style="list-style-type: none"> › 0–68.5 m (0–225 feet) › 69–137 m (226–450 feet) Signal strength is software controlled. The transmitted signal complies with ANSI T1.102-1993: Digital Hierarchy – Electrical Interfaces (1999) for cable lengths up to 201 m (660 feet).
T3 FRAME (3 ports)	T3 FRAME	CT3/T3 I/O	3	BNC 75 ohm	<ul style="list-style-type: none"> The line interface unit supports two line build-outs: <ul style="list-style-type: none"> › 0–68.5 m (0–225 feet) › 69–137 m (226–450 feet) Signal strength is software controlled. The transmitted signal complies with ANSI T1.102-1993: Digital Hierarchy – Electrical Interfaces (1999) for cable lengths up to 201 m (660 feet).
T3 FRAME (12 ports)	COCX-F3	CT3/T3 12 I/O	12	BT43 SMB (cable that adapts to 75-ohm BNC is available)	<ul style="list-style-type: none"> The line interface unit supports two line build-outs: <ul style="list-style-type: none"> › 0–68.5 m (0–225 feet) › 69–137 m (226–450 feet) Signal strength is software controlled. The transmitted signal complies with ANSI T1.102-1993: Digital Hierarchy – Electrical Interfaces (1999) for cable lengths up to 201 m (660 feet).
TSM	TUNNEL SERVICE	No I/O module	N/A	N/A	N/A

Table B-3 Connection information for module assemblies (continued)

Assembly Name and Capability	Line Module Label	I/O Module Label	No. of Ports	Connector Type	Cabling Specifications
X.21/V.35	X.21/V.35	X.21/V.35 I/O	16	200-pin proprietary socket on I/O module DB15 X.21 or DB34 V.35 at remote end	See Table B-4 .

- a. The GE SFP I/O module uses a range of simple form factor pluggable transceivers (SFPs) to support different modes and cable lengths.
- b. Assembly is superseded by a newer assembly; however, assembly is supported by current software.

Cable Lengths for X.21/V.35 Cables

Serial signals can travel a limited distance without significant degradation. Slower serial signals can travel farther without degradation than faster serial signals. [Table B-4](#) shows the maximum cable lengths you can use to prevent signal degradation at various transmission speeds.

Table B-4 Maximum cable lengths for X.21/V.35 connections

Transmission Speed (Hz)	Cable Length (Feet)	Cable Length (m)
2400	4,100	1,250
4800	2,050	625
9600	1,025	312
19200	513	156
38400	256	78
56000	102	31
2048000	25	8

Cable Pinouts

C

This appendix lists the cables and connector pinout assignments for the cables used with the ERX-700 series and ERX-1400 series.

Topic	Page
SRP I/O Module	C-1
CT1 and CE1 I/O Modules	C-4

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 C-1](#) shows the location of the serial port and the sequence of the pins in the RS-232 connector.

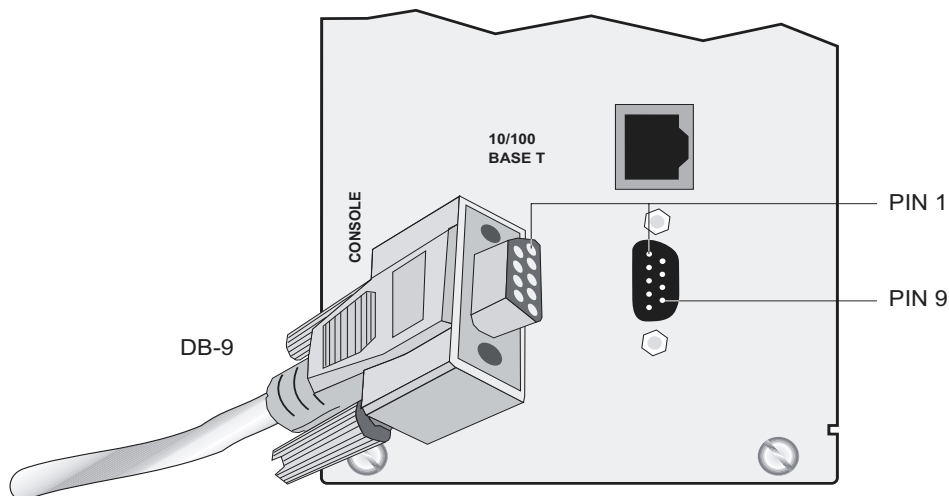


Figure C-1 SRP I/O module serial port

[Table C-2](#) lists the pinout for the serial cable's RS-232 connector.

Table C-1 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

Once you have configured an IP address on the system, you can connect a console running Telnet to the 10/100Base-T Ethernet port on the SRP I/O module. The system ships with a straight-through cable having a male RJ-45 Ethernet connector on each end. [Figure C-2](#) shows the location of the Ethernet port and the sequence of the pins in the RJ-45 connector.

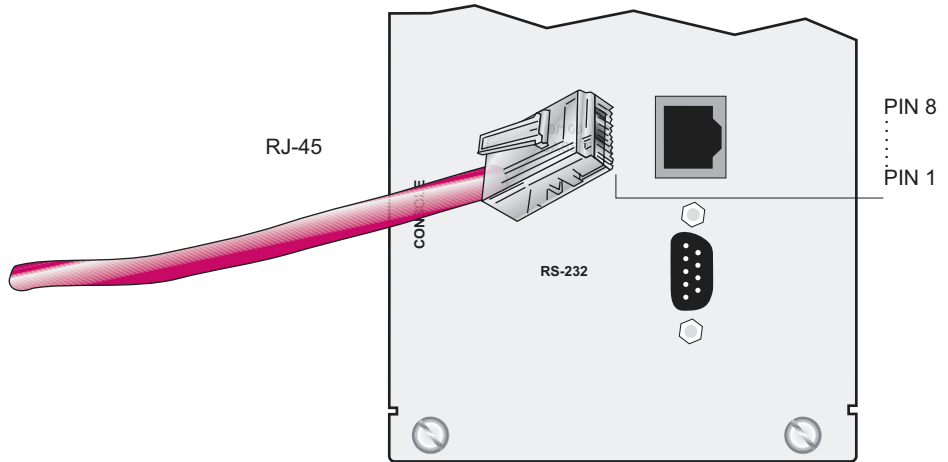


Figure C-2 SRP I/O module Ethernet port

[Table C-2](#) lists the pinout for the Ethernet cable's RJ-45 connector.

Table C-2 SRP I/O module – RJ-45 connector pinout

Pin	Signal
1	TX +
2	TX –
3	RX +
4	n/c
5	n/c
6	RX –
7	n/c
8	n/c

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 C-3 lists the pinout for the crossover adapter.

Table C-3 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	n/c

Table C-4 lists the pinout for the straight-through adapter.

Table C-4 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	n/c
5	GND (signal)	5	n/c
6	DSR	6	RX –
7	RTS	7	n/c
8	CTS	8	n/c
9	RNG	n/c	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 C-3 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.

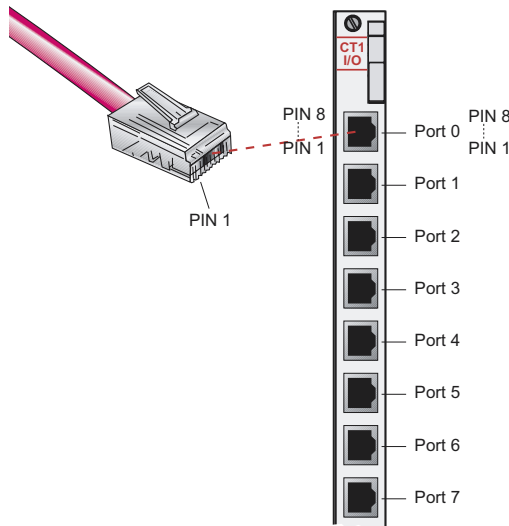


Figure C-3 CT1 I/O module ports

[Table C-5](#) lists the pinout for the CT1/CE1 connector.

Table C-5 CT1/CE1 I/O module – RJ-48C connector pinout

Pin	Signal
1	RX Ring
2	RX Tip
3	n/c
4	TX Ring
5	TX Tip
6	n/c
7	n/c
8	n/c

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 C-4](#) shows the location of the Telco connectors on a CE1 I/O module and the sequence of the pins in the connectors.

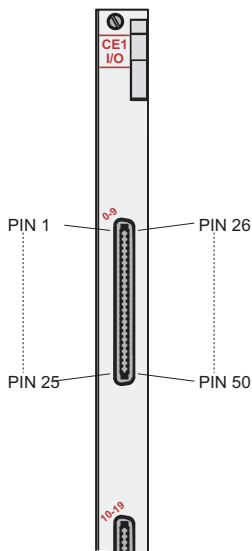


Figure C-4 CE1 I/O module with Telco connectors

Figure C-5 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.

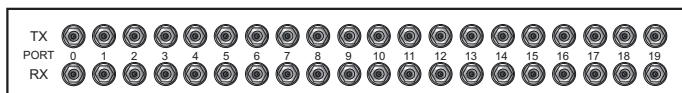


Figure C-5 Twenty-port balun panel

Table C-6 lists the pinout for the Telco connectors on each cable.

Table C-6 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

Table C-6 Pinout of 50-pin Telco connector to ports 0–9 (continued)

Pin	Signal	Pin	Signal
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	n/c	46	n/c
22	n/c	47	n/c
23	n/c	48	n/c
24	n/c	49	n/c
25	n/c	50	n/c

Table C-7 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

Table C-7 Pinout of 50-pin Telco connector to ports 10–19 (continued)

Pin	Signal	Pin	Signal
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	n/c	46	n/c
22	n/c	47	n/c
23	n/c	48	n/c
24	n/c	49	n/c
25	n/c	50	n/c

Preparing Your Site

D

This chapter provides information about preparing your site before installing the ERX system. We recommend that you consider all requirements and specifications indicated in this appendix before installing the system.

Topic	Page
Your Preinstallation Responsibilities	D-1
Environmental Requirements	D-2
Safety Guidelines	D-2
Rack Requirements	D-3
Cabling Recommendations	D-7

Your Preinstallation Responsibilities

Complete the following tasks before installing the system:

- Verify that the electrical supply meets all AC and DC power requirements. See [Appendix A, System Specifications](#).
- Verify that the site meets all environment specifications. See [Environmental Requirements](#) later in this chapter and [Appendix A, System Specifications](#).
- Verify that the cables you plan to use meet the specifications, and review the cabling recommendations. See [Cabling Recommendations](#) later in this appendix.
- 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 Autonomous System (AS) number, port IP address and mask, management Ethernet port IP address and mask, and broadcast address.

Environmental Requirements

Choose a location for the system 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 system in a location with sufficient access to power and network cables.

Like other network devices, the system generates a significant amount of heat. It is important to provide a balanced environment so that the system performs properly and safely. See [Appendix A, System Specifications](#) for acceptable ranges of temperature and humidity.

Be sure to allow enough space around the system for adequate ventilation. Inadequate ventilation can cause the system to overheat. See [Appendix A, System Specifications](#) and [Chapter 2, Installing the ERX System](#) for details about space requirements.



Caution: Do not block the air vents on the ERX system. Otherwise, the system may overheat.

Safety Guidelines

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



Temperature Warning: The recommended maximum ambient temperature is 50° C (122° F). The internal temperature of the rack should be considered for safe operation.



Rack Installation Warning: Install equipment in the rack from the bottom upward. This will maintain the stability of the rack and reduce the chance of the rack's tipping over.



Heavy Equipment Warning: Two people are required to lift an ERX system. Three people are required to install an ERX system in a rack. The equipment is extremely heavy.



Ground (Earth) Warning: Connect the ERX system or rack to ground (earth), and ensure that a reliable grounding path is maintained in the rack.



Lightning Activity Warning: Do not work on the system or connect or disconnect cables during lightning activity.



DC Power Disconnection Warning: Before powering on the ERX system, remove power from the DC circuit by deactivating the circuit breaker on the panel board that services the DC circuit.



Power Connection Warning: Before servicing the ERX system, turn off the power.



Jewelry Removal 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.



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



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

Rack Requirements

Your distribution rack should meet some basic mechanical and space requirements. Your rack should comply with conventional standards. In the U.S., use EIA Standard RS-310-C: *Racks, Panels, and Associated Equipment*.

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-C.
- Do not use an enclosed rack for the ERX-700 series. It does not provide adequate ventilation.
- A fully loaded rack with three ERX-1400 series systems must structurally support 300 pounds (136 kilograms).
- The system fits in a 19-inch rack. You can install a system in a 23-inch rack if you use the *23-inch ears* available from Juniper Networks. Contact your Juniper Networks sales representative for more information.

Space Requirements

If you use an enclosed rack for an ERX-1400 series system, ensure that there is a minimum of 3 inches of clearance between the inner side wall and the system. This clearance space will allow adequate air flow.

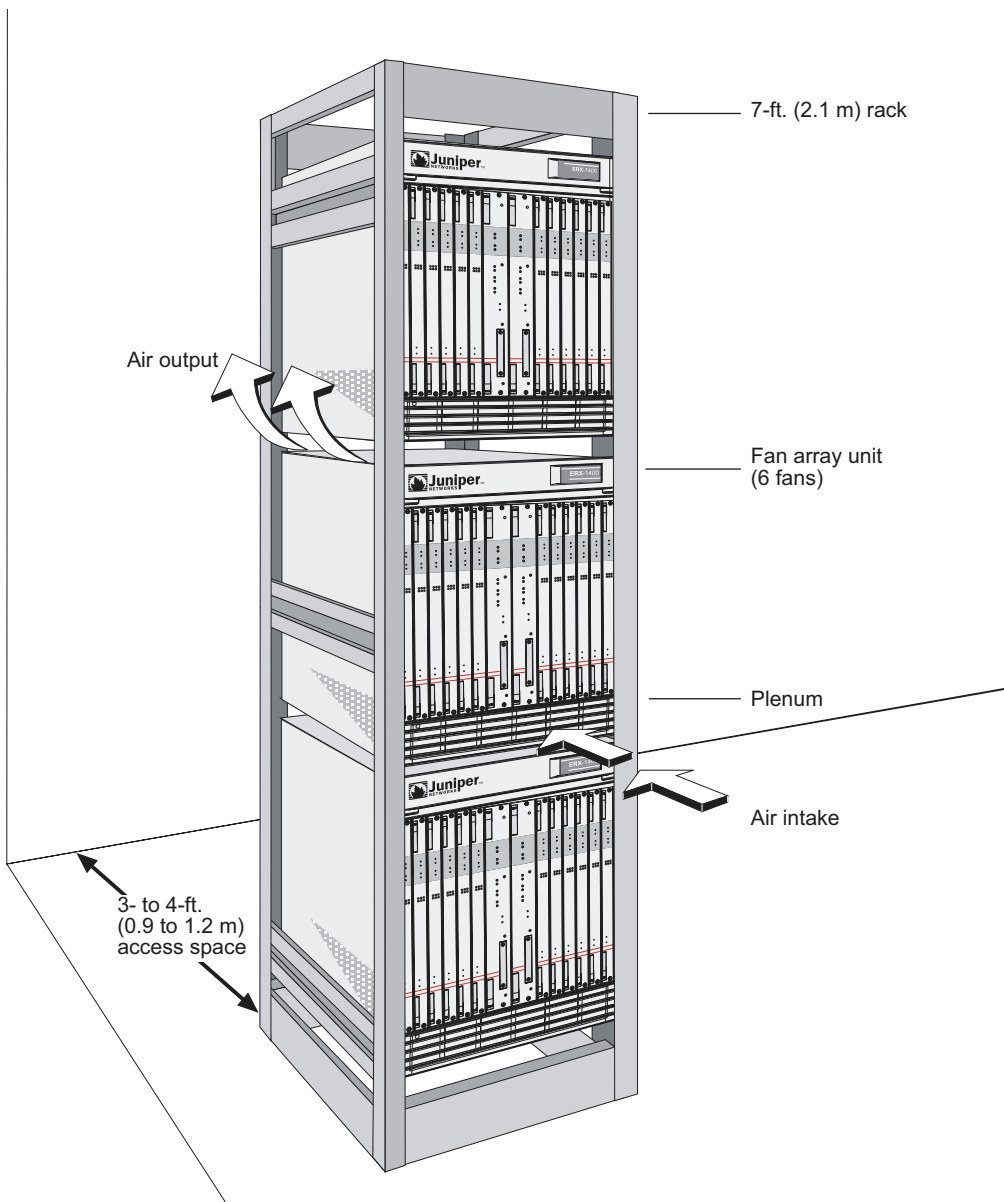


Figure D-1 Fully loaded 84-inch rack

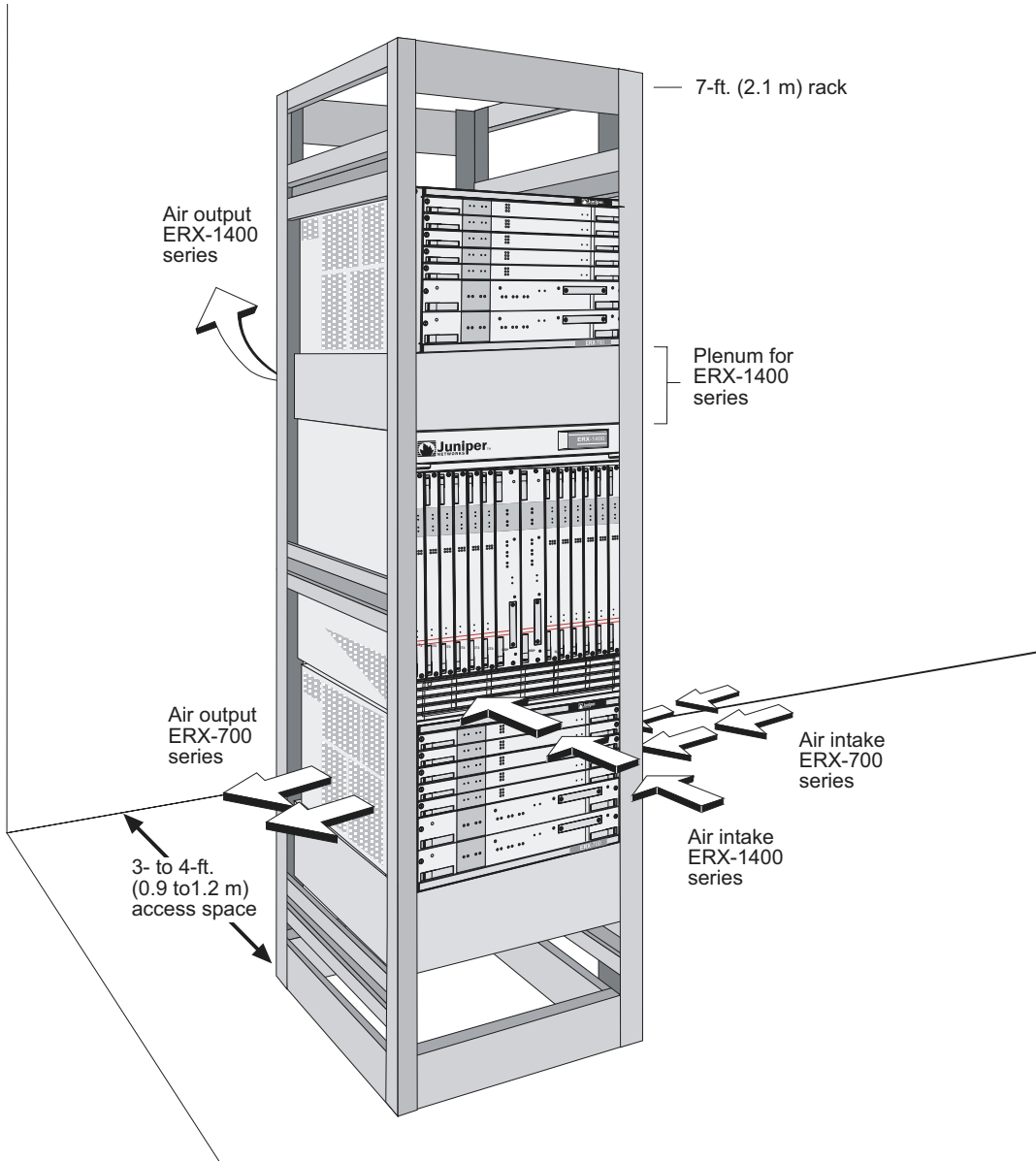


Figure D-2 ERX-700 series and ERX-1400 series systems installed in 84-inch rack

Cabling Recommendations

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.

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 \(1995\)](#)
 - > [AT&T \(Lucent\) Technical Note Power Margin Analysis \(November 1995\)](#)
- Ensure that power cables deliver sufficient power to the system.
- In accordance with [IEC 825-1, Safety of Laser Products - Part 1](#), laser fiber connectors are for connection only to Class 1 laser devices.
- 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 [Appendix B, Module Specifications](#).

Installing ERX System Software



Caution: Check the Release Notes for extra information about installing and upgrading the software.

This appendix provides information on how to install new software on the Juniper Networks ERX systems.

Topic	Page
Overview	E-1
Installing Software When a Firewall Exists	E-2
Installing Software When a Firewall Does Not Exist	E-7
Copying Release Files from One ERX System to Another	E-14
Upgrading Systems That Are Operating with Two SRP Modules	E-15

Overview

When installing new ERX software, you must mount the software CD on a network host and transfer the release files to at least one ERX system in the network. Depending on the network configuration, you can copy the release files from either the network host or the first ERX system to the other ERX systems in the network.

Identifying the Software Release File

The ERX system software CD contains two software releases: one for the ERX-1440 system and one for all other ERX systems. Both releases are in the software directory, which is identified by the release number. For

example, if the release number is x.y.z, the name of the directory is x-y-z. To identify the software release file:

- 1** Access the software directory.
- 2** Find the files with the extension .rel.
 - The software release file for the ERX-1440 system has the format `erx40_x-y-z.rel`, where x.y.z is the release number.
 - The software release file for all other ERX systems has the format `erx_x-y-z.rel`, where x.y.z is the release number.

The procedures outlined in the following sections provide detailed instructions for typical installations. For additional information about commands and troubleshooting, refer to the [ERX System Basics Configuration Guide](#) and the [ERX Command Reference Guide](#).

Installing Software When a Firewall Exists

When a firewall separates the ERX system from the network host, you must FTP the software release files from the network host to the ERX system. In this case, you must configure the FTP server on the ERX system and ensure that FTP client software is installed on the network host.

For this network configuration, you must install the software from the normal operational mode of the command line interface (CLI). You can access the CLI through either the local console or a Telnet session. If you have not yet configured the ERX system to support Telnet, then you must use the local console. See [Chapter 5, Accessing the ERX System](#), for information on using a local console or a Telnet session.

To install the software, perform the following tasks:

- 1** Obtain the required information for the installation.
- 2** Access the Privileged Exec CLI command mode.
- 3** Configure IP on an interface.
- 4** Mount the CD on the network host.
- 5** Configure access to the network host.
- 6** Enable the FTP server on the ERX system.
- 7** Identify the files to transfer.
- 8** Transfer the files to the user space on the ERX system.

- 9 Install the software release file to the system space on the ERX system.
- 10 Save the current configuration.
- 11 Reboot the system.

Task 1: Obtain the Required Information

Before you install the software, obtain the following information:

- The password (if one is configured) that allows you to access Privileged Exec mode on the ERX system
- The IP address of the network host
- The IP address of the ERX system
- The IP address of the next hop to reach the destination network (for example, a gateway)
- The login name and password for the vty line
- The procedure for mounting a CD on the network host

Task 2: Access Privileged Exec Mode

To access this mode via the CLI:

- 1 Issue the enable command.

```
host1>enable
```
- 2 Type the password if the system prompts you.

Task 3: Configure IP on an Interface

Typically, you configure IP on the Fast Ethernet interface of the SRP module. To configure IP on an interface:

- 1 Determine the slot number of the module.

```
host1#show version
```
- 2 Determine the port number of the module.
- 3 Determine whether the interface already has an IP address.

```
host1#show ip interface fastEthernet 6/0
```



Note: If an IP interface is not configured, you see the message “Invalid interface.”

If the interface already has an IP address, go to step 5. Otherwise, proceed with step 4.

- 4 Set an IP address on the interface.

```
host1#configure
Configuring from terminal or file [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#interface fastEthernet 6/0
host1(config-if)#ip address ipAddress [ mask ]
```

- 5 Press <CTRL-Z>, to return to Privileged Exec mode.

Task 4: Mount the CD on the Network Host

The way you mount the CD on the network host depends on the type of computer you use, the operating system, and the network configuration. To find out how to mount a CD on the network host, review the manual for the operating system, or check with your network administrator.

Task 5: Configure Access to the Network Host

To configure access to the network host:

- 1 Use the **ping** command to determine whether the ERX system can reach the network host.

```
host1#ping hostname
```

If the ERX system can reach the network host, go to the next section. Otherwise, go to step 2.

- 2 Determine if a route exists between the ERX system and the network host.

```
host1#show ip route
```

If the appropriate route is displayed, go to step 4. Otherwise, proceed with step 3.

- 3 Configure a route to reach the network host.

```
host1#configure
Configuring from terminal or file [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#ip route ipNetwork networkMask ipNextHop
```

- 4 Press <CTRL-Z> to return to Privileged Exec mode.
- 5 Determine whether the ERX system has been configured to recognize the network host.

```
host1#show host
```

If the network host is listed, go to step 8. Otherwise, proceed with step 6.

- 6 Add an entry to the Static Host Table so that the ERX system can access the network host. The **host** command allows you to specify the network host name and IP address.

```
host1#configure
Configuring from terminal or file [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#host hostName ipAddress ftp loginname password
```

- 7 Press <CTRL-Z> to return to Privileged Exec mode.
- 8 Use the **ping** command to determine whether the ERX system can now reach the network host.

```
host1#ping hostname
```

If the ERX system cannot reach the network host, verify that you performed the previous steps in this procedure correctly and that the network host is operational.

Task 6: Enable the FTP Server on the ERX System

The ERX system divides its vty resources among Telnet, SSH, and FTP services. Each FTP session requires one vty line, and the FTP service uses the authentication method configured for the vty line. If you configured more than one vty line for Telnet access, the FTP service will use one of those lines. If you configured only one line for Telnet access, configure another vty line. See [Chapter 5, Accessing the ERX System](#).

To enable the FTP Server, use the **ftp-server enable** command.

```
host1(config)#ftp-server enable
```

Task 7: Identify the Files to Transfer

To identify all the files for the release, open the software release (.rel) file on the ERX software CD with a text editor. The software release file contains a list of all the files associated with the release. You must transfer the software release file and all the files it contains to the user space.

Task 8: Transfer Files to the User Space

To transfer the files for the release to the ERX user space, use the FTP client software on the network host to connect to the FTP server on the ERX system. Transfer the files to a subdirectory within the incoming

directory. If you specify a subdirectory that does not exist, the ERX system creates the directory.



Note: Be sure to transfer the software release file and all the files it lists.

Task 9: Install Files on the System Space

Installing the software release file to the system space installs all files listed in the software release file. To install the software release file from the incoming directory in the ERX user space to the ERX system space, use the **copy** command.



Note: The destination file must have a *.rel* extension.

For example:

```
host1#copy /incoming/releases/x-y-z.rel x-y-z.rel
```

The software release will be copied from the network host to the ERX system. This process can take several minutes.

Task 10: Save the Current Configuration

To save the current configuration, use the **copy running-configuration** command:

```
host1#copy running-configuration filename.cnf
```

Task 11: Reboot the System

To reboot the system using the newly installed software:

- 1 Access Global Configuration mode.

```
host1#configure
Configuring from terminal or file [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#
```

- 2 Run the **boot system** command, specifying the *.rel* filename of the software release.

For example:

```
host1(config)#boot system x-y-z.rel
```

The following message appears when you execute this command:

```
WARNING: It is recommended that you copy the current
running-configuration to a file prior to reloading a
different release of software.
```

- 3 Press <CTRL-Z> to return to Privileged Exec mode.
- 4 Check that the ERX system is ready to boot with the new software release.

```
host1#show boot
```

If the old software version is still listed, verify that you completed the previous steps correctly.

- 5 Run the **reload** command.

```
host1#reload
```

The following message appears when you execute this command:

```
WARNING: Execution of this command will cause the system to  
reboot. Proceed with reload? [confirm]
```

The system reboots. The reboot may take longer than normal because line modules initialize with the old version of the software, acquire the new version from the SRP module, and reinitialize. When you observe the LEDs on the line modules, the line modules appear to boot twice.

Installing Software When a Firewall Does Not Exist

If there is no firewall between the ERX system and the network host on which you mount the software CD, you can transfer the software release files from the network host to the ERX system via the ERX FTP server or by issuing the **copy** command. To transfer files via the ERX FTP server, refer to the previous section, *Installing Software When a Firewall Exists*. This section describes how to transfer files by issuing the **copy** command.

If you use the **copy** command to transfer the files, the network host must be an FTP server. This command activates a hidden FTP client on the ERX system.

For this network configuration, you can install the software in the normal command line interface (CLI) operational mode or in boot mode.

Installing Software in Normal Operational Mode

For this procedure, you must access the CLI through either the local console or a Telnet session. If you have not yet configured the ERX system to support Telnet, then you must use the local console. See *Chapter 5, Accessing the ERX System*, for information on using a local console or a Telnet session.

To install the software, perform the following tasks:

- 1 Obtain the required information for the installation.
- 2 Access the Privileged Exec CLI command mode.
- 3 Configure IP on an interface.
- 4 Configure access to the network host.
- 5 Mount the CD on the network host.
- 6 Copy the software release file to the ERX system.
- 7 Save the current configuration.
- 8 Reboot the system.

Task 1: Obtain the Required Information

Before you install the software, obtain the following information:

- The password (if one is configured) that allows you to access Privileged Exec mode on the ERX system
- The IP address of the network host
- The IP address of the ERX system
- The IP address of the next hop to reach the destination network (for example, a gateway)
- The login name and password for the FTP server
- The procedure for mounting a CD on the network host

Task 2: Access Privileged Exec Mode

To access this mode via the CLI:

- 1 Issue the enable command.

```
host1>enable
```
- 2 Type the password if the system prompts you.

Task 3: Configure IP on an Interface

Typically, you configure IP on the Fast Ethernet interface of the SRP module. To configure IP on an interface:

- 1 Determine the slot number of the module.

```
host1#show version
```


- 2 Determine the port number of the module.
- 3 Determine whether the interface already has an IP address.

```
host1#show ip interface fastEthernet 6/0
```



Note: If an IP interface is not configured, you see the message: "Invalid interface."

If the interface already has an IP address, go to step 5. Otherwise, proceed with step 4.

- 4 Set an IP address on the interface.

```
host1#configure
Configuring from terminal or file [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#interface fastEthernet 6/0
host1(config-if)#ip address ipAddress [ mask ]
```

- 5 Press <CTRL-Z> to return to Privileged Exec mode.

Task 4: Configure Access to the Network Host

To configure access to the network host:

- 1 Use the **ping** command to determine whether the ERX system can reach the network host.

```
host1#ping ipAddress
```

If the ERX system can reach the network host, go to the next section. Otherwise, go to step 2.

- 2 Determine if a route exists between the ERX system and the network host.

```
host1#show ip route
```

If the appropriate route is displayed, go to step 4. Otherwise, proceed with step 3.

- 3 Configure a route to reach the network host.

```
host1#configure
Configuring from terminal or file [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#ip route ipNetwork networkMask ipNextHop
```

- 4 Press <CTRL-Z> to return to Privileged Exec mode.
- 5 Determine whether the ERX system has been configured to recognize the network host.

```
host1#show host
```

If the network host is listed, go to step 8. Otherwise, proceed with step 6.

- 6 Add an entry to the Static Host Table so that the ERX system can access the network host. The **host** command allows you to specify the network host name and IP address.

```
host1#configure
Configuring from terminal or file [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#host hostName ipAddress ftp loginname password
```

- 7 Press <CTRL-Z> to return to Privileged Exec mode.
- 8 Use the **ping** command to determine whether the ERX system can now reach the network host.

```
host1#ping hostname
```

If the ERX system cannot reach the network host, verify that you performed the previous steps in this procedure correctly and that the network host is operational.

Task 5: Mount the CD on the Network Host

The way you mount the CD on the network host depends on the type of network host you use, the operating system, and the way your network is configured. To find out how to mount a CD on the network host, review the manual for the operating system, or check with your network administrator.

Task 6: Copy the Software Release File

To copy the software release file to the ERX system, use the **copy** command.



Note: *The destination file must have a .rel extension.*

For example:

```
host1#copy hostname:/cdrom/x-y-z/x-y-z.rel x-y-z.rel
```

The software release will be copied from the network host to the ERX system. This process can take several minutes.

Task 7: Save the Current Configuration

To save the current configuration, use the **copy running-configuration** command:

```
host1#copy running-configuration filename.cnf
```

Task 8: Reboot the System

To reboot the system using the newly installed software:

- 1 Access Global Configuration mode.

```
host1#configure
Configuring from terminal or file [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
host1(config)#
```

- 2 Run the **boot system** command, specifying the .rel filename of the software release. For example:

```
host1(config)#boot system x-y-z.rel
```

The following message appears when you execute this command:

```
WARNING: It is recommended that you copy the current
running- configuration to a file prior to reloading a
different release of software.
```

- 3 Press <CTRL-Z> to return to Privileged Exec mode.
- 4 Check that the ERX system is ready to boot with the new software release.

```
host1#show boot
```

If the old software version is still listed, verify that you completed the previous steps correctly.

- 5 Run the **reload** command.

```
host1#reload
```

The following message appears when you execute this command:

```
WARNING: Execution of this command will cause the system to
reboot. Proceed with reload? [confirm]
```

The system reboots. The reboot may take longer than normal because line modules initialize with the old version of the software, acquire the new version from the SRP module, and reinitialize. When you observe the LEDs on the line modules, the line modules appear to boot twice.

Installing Software in Boot Mode

To install the ERX software in Boot mode, you must access the CLI via the local console.

To install the software:

- 1** Obtain the required information for the installation.
- 2** Access the Boot mode.
- 3** Assign an IP address to the ERX system.
- 4** Configure access to the network host.
- 5** Mount the CD on the network host.
- 6** Copy the software release file to the ERX system.
- 7** Reboot the system.

Task 1: Obtain the Required Information

Before you install the software, obtain the following information:

- The IP address of the network host
- The IP address of the ERX system
- The IP address of the next hop to reach the destination network (for example, a gateway)
- The login name and password for the FTP server
- The procedure for mounting a CD on the network host

Task 2: Access the Boot Mode

To access Boot mode from the local console:

- 1** At the Privileged Exec prompt, type the **reload** command.
Information on the reloading process appears.
- 2** When the countdown begins, press the key sequence <mb>.
This action puts the CLI in Boot mode and the `:boot##` prompt appears.



Note: *If you do not press the key sequence <mb> before the countdown ends, the reloading process continues and returns the CLI to the normal User Exec mode.*

Task 3: Assign an IP Address

When you assign an IP address to the ERX system in boot mode, the address is configured on the Fast Ethernet port of the primary SRP module. To assign an Internet address to the ERX system, use the **ip address** command.

```
:boot##ip address ipAddress [ mask ]
```

Task 4: Configure Access to the Network Host

To configure access to the network host, complete the following steps:

- 1 Configure a gateway through which the ERX system will reach the network host.

```
:boot##ip gateway ipAddress
```

- 2 Determine whether the ERX system has been configured to recognize the network host.

```
:boot##show host
```

If the network host is listed, go to the next section. Otherwise, proceed with step 3.

- 3 Add an entry to the Static Host Table so that the ERX system can access the network host.

```
:boot##host hostName ipAddress ftp login-name password
```

The **host** command allows you to specify the network host name and IP address.

Task 5: Mount the CD on the Network Host

The way you mount the CD on the network host depends on the type of network host you use, the operating system, and the way your network is configured. To find out how to mount a CD on the network host, review the manual for the operating system, or check with your network administrator.

Task 6: Copy the Software Release File

To copy the software release file to the ERX system, use the **copy** command.



Note: The destination file must have a *.rel* extension.

For example:

```
:boot##copy hostname:/cdrom/x-y-z/x-y-z.rel x-y-z.rel
```

The software release will be copied from the network host to the ERX system. This process can take several minutes.

Task 7: Reboot the System

To reboot the system using the newly installed software:

- 1 Run the **boot system** command, specifying the .rel filename of the software release. For example:

```
:boot##boot system x-y-z.rel
```

The following message appears when you execute this command:

```
WARNING: It is recommended that you copy the current  
running-configuration to a file prior to reloading a  
different release of software.
```

- 2 Run the **reload** command.

```
:boot##reload
```

The following message appears when you execute this command:

```
WARNING: Execution of this command will cause the system to  
reboot. Proceed with reload? [confirm]
```

The system reboots. The reboot may take longer than normal because line modules initialize with the old version of the software, acquire the new version from the SRP module, and reinitialize. When you observe the LEDs on the line modules, the line modules appear to boot twice.

Copying Release Files from One ERX System to Another

When you have copied the release files from a network host to one ERX system, you can transfer files from that ERX system to other ERX systems on the network. This feature is useful when:

- The other ERX systems are unreachable from the network host but have network connectivity to the ERX system on which you installed the new software.
- The connection between ERX systems is faster than the connection between an ERX system and the network host to which it is connected.

The procedures for transferring release files from a source ERX system to a destination ERX system are almost identical to transferring release files from a network host to an ERX system on the same side of the firewall.



Note: You must enable the FTP server on the source ERX system.

To transfer release files from a source ERX system to a destination ERX system, follow the instructions in *Installing Software When a Firewall Does Not Exist*, with the following changes:

- Substitute the source ERX system for the network host.
- Omit the step about mounting the CD.
- Copy the file to the system space of the second ERX system from the user space of the first ERX system.

```
host1#copy boston:/outgoing/releases/x-y-z.rel x-y-z.rel
```

Upgrading Systems That Are Operating with Two SRP Modules

Use this procedure if the system contains two SRP modules and is already operating with an earlier software release. Each SRP module will keep the system operational while you upgrade the software on the other, so that you can avoid interrupting service.



Caution: You must upgrade the software on the redundant SRP module when you upgrade the software on the primary SRP module. This action prevents the redundant SRP module from overwriting the new software on the primary SRP module if the primary SRP module fails and the redundant SRP module assumes control.

To upgrade the software on a system that is operational and contains two SRP modules:

- 1 Turn off autosynchronization.

```
host1(config)#disable-autosync
```

- 2 Copy the new release of the software to NVS of the primary SRP module.

```
host1#copy host1:x-y-z.rel x-y-z.rel
```

- 3 Save the current configuration.

```
host1#copy running-configuration system2.cnf
```

- 4 Specify that the ERX system should use the new software release when it reboots.

```
host1(config)#boot system x-y-z.rel
```

- 5 Synchronize the NVS file system of the redundant module to that of the primary module.

```
host1#synchronize
```

The redundant SRP module will automatically reboot, because the software release that it is configured to run differs from the software release it is running.

- 6 Wait for the redundant SRP module to boot, initialize, and reach the standby state.

When the module is in standby state, the REDUNDANT LED is on and the ONLINE LED is off. If you issue the **show version** command, the *state* field for the module should be *standby*.

After any type of reboot, the primary and redundant SRP module NVS file systems will be unsynchronized again.

- 7 Synchronize the NVS file system of the redundant module to that of the primary module.

```
host1#synchronize
```

- 8 Switch from the primary SRP module to the redundant SRP module.

```
host1#srp switch
```


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-700, 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](#)

Declaration of Conformity according to ISO/IEC Guide 22 and EN4514

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.

Westford, MA, July 01, 2002

David H. Schilling
Regulatory Affairs

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