



---

# E Series™ Broadband Services Routers

## ERX™ Module Guide

Release

14.3.x



---

Published: 2013-07-04

This guide provides an overview and description of the line modules (LMs), switch route processor (SRP) modules, and I/O modules available for the following Juniper Networks E Series Broadband Services Routers: ERX14xx models, ERX7xx models, and the ERX310 router.

Unless otherwise specified, all line modules pair with I/O modules to create a module combination. Each module combination provides particular capabilities and connections in an ERX router.



**NOTE:** A release may support multiple versions of a module. For information, see *Software Compatibility* in *JunosE System Basics Configuration Guide*, Chapter 6, *Managing Modules*.

---

Table 1 on page 3 lists the module combinations supported by ERX routers.

This book also contains four appendixes:

- [Module Protocol Support on page 27](#)
- [Module LEDs on page 35](#)
- [Module Name Cross-Reference Information on page 41](#)
- [Product Reclamation and Recycling Program on page 45](#)

For more information about ERX routers and modules, refer to the following books:

- Modules that have reached end-of-life—*E Series End-of-Life Module Guide*
- Module installation and maintenance—*ERX Hardware Guide*
- Managing ERX routers—*JunosE System Basics Configuration Guide*
- Configuring ERX modules—*JunosE Link Layer Configuration Guide*

**Table 1: ERX Module Combinations**

Combination Name and Type	Line Module Label	I/O Module Label	First JunosE Support	Page
<b>Gigabit Ethernet (1-port)</b>				
GE multimode	GE/FE	GE I/O MULTI MODE	2.0.0	5
GE single-mode	GE/FE	GE I/O SINGLE MODE	2.0.0	7
<b>Gigabit Ethernet (2-port)</b>				
GE2 1000Base-SX	GE-2	GE-2 SFP I/O <i>or</i> 2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP	5.3.0	9
GE2 1000Base-LH	GE-2	GE-2 SFP I/O <i>or</i> 2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP	5.3.0	11
GE2 1000Base-ZX	GE-2	GE-2 SFP I/O <i>or</i> 2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP	5.3.0	13
<b>GE High Density (HDE)</b>				
GE High Density (2 ports)	GE-HDE	GE-2 SFP I/O <i>or</i> 2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP	7.0.0	15
GE High Density (8 ports)	GE-HDE	GE-8 I/O	7.0.0	17
<b>OC3/STM1 ATM</b>				
OC3/STM1 ATM multimode without APS/MSP redundancy (256-MB memory)	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC3-4 I/O MULTI MODE	5.0.0, 5.3.0	19

Table 1: ERX Module Combinations (*continued*)

Combination Name and Type	Line Module Label	I/O Module Label	First JunosE Support	Page
OC3/STM1 ATM single-mode intermediate reach without APS/MSP redundancy (256-MB memory)	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC3-4 I/O SINGLE MODE	5.0.0, 5.3.0	21
<b>OC12/STM4 ATM</b>				
OC12/STM4 ATM single-mode long reach with APS/MSP redundancy	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 APS LONG HAUL	2.0.0 (128 MB) 5.0.0 (256 MB)	23
<b>SRPs</b>				
SRP-5G+ (1-GB memory)	SRP-5G+	SRP I/O	4.1.3, 5.0.4, 5.1.2, 5.2.0	25

## GE Multimode Module Combination (1 Port)

Line module label	GE/FE
I/O module label	GE I/O MULTI MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>• 1 active, 1 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>• First supported: 2.0.0</li> <li>• Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>• 130 W</li> <li>• Gigabit Ethernet</li> <li>• This module combination has been superseded by a newer assembly; however, it is supported by current software.</li> </ul>
Type	<ul style="list-style-type: none"> <li>• EFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>• Ethernet (IEEE 802.3z)</li> </ul>
Software features	<ul style="list-style-type: none"> <li>• See <a href="#">“Ethernet Modules” on page 27</a> for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>• ERX7xx models</li> <li>• ERX14xx models</li> <li>• ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>• SRP-5G+</li> <li>• SRP-10G</li> <li>• SRP-40G</li> <li>• SRP-40G PLUS</li> <li>• SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>• Not applicable</li> </ul>
Cables and connectors	<ul style="list-style-type: none"> <li>• SC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -9.5 dBm</li> <li>• max: -4 dBm</li> </ul> </li> <li>• Center wavelength: 850 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -17 dBm</li> <li>• max: -3 dBm</li> </ul> </li> <li>• Rated for 275 m (300 yards) over 62.5-micron core cable</li> <li>• Rated for 550 m (601 yards) over 50-micron core cable</li> <li>• See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
LEDs	<ul style="list-style-type: none"> <li>• See <a href="#">“Module LEDs” on page 35</a>.</li> </ul>

---

Alarms, errors, and events

- See *Monitoring Ethernet Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.
-

## GE Single-Mode Module Combination (1 Port)

Line module label	GE/FE
I/O module label	GE I/O SINGLE MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>• 1 active, 1 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>• First supported: 2.0.0</li> <li>• Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>• 130 W</li> <li>• Gigabit Ethernet</li> <li>• This module combination has been superseded by a newer assembly; however, it is supported by current software.</li> </ul>
Type	<ul style="list-style-type: none"> <li>• EFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>• Ethernet (IEEE 802.3z)</li> </ul>
Software features	<ul style="list-style-type: none"> <li>• See <a href="#">"Ethernet Modules"</a> on page 27 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>• ERX7xx models</li> <li>• ERX14xx models</li> <li>• ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>• SRP-5G+</li> <li>• SRP-10G</li> <li>• SRP-40G</li> <li>• SRP-40G PLUS</li> <li>• SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>• Not applicable</li> </ul>
Cables and connectors	<ul style="list-style-type: none"> <li>• SC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -11 dBm</li> <li>• max: -3 dBm</li> </ul> </li> <li>• Center wavelength: 1300 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -20 dBm</li> <li>• max: -3 dBm</li> </ul> </li> <li>• Rated for 550 m (601 yards) over 62.5-micron core or 50-micron core MM fiber</li> <li>• Rated for 5 km (3.1 miles) over 10-micron core cable</li> <li>• See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
LEDs	<ul style="list-style-type: none"> <li>• See <a href="#">"Module LEDs"</a> on page 35.</li> </ul>

---

Alarms, errors, and events

- See *Monitoring Ethernet Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.
-



## GE2 1000Base-SX Module Combination (2 Ports)

Line module label	GE-2
I/O module label	GE-2 SFP I/O or 2XGE APS I/O SFP or GE-2 APS I/O SFP
Number of I/O ports	<ul style="list-style-type: none"> <li>2 active, 2 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 5.3.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>100 W</li> <li>Gigabit Ethernet</li> <li>The I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cabling distances.</li> <li>Uses either optical or copper SFPs. <ul style="list-style-type: none"> <li>The optical transceivers are 1000Base-SX compliant.</li> <li>The copper transceivers are 1000Base-T compliant.</li> </ul> </li> <li>Single-strand SFPs can be used. These SFPs work in pairs and require a matching SFP at the opposite end of the Ethernet connection. For example, an SFP rated at TX 1310, RX 1550 must be paired with an SFP rated TX 1550, RX 1310 with the same maximum operating range. See the following corresponding table (Single-strand SFPs Pairing) for more information.</li> <li>For information about bandwidth and line rate considerations for the GE2 1000Base-SX module combination, see <i>GE-2 SFP I/O Module</i> in <i>JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
Type	<ul style="list-style-type: none"> <li>FFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-SX</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">"Ethernet Modules"</a> on <a href="#">page 27</a> for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>ERX1440 router</li> <li>ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>SRP-40G</li> <li>SRP-40G PLUS</li> <li>SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
Cables and connectors (copper SFP)	<ul style="list-style-type: none"> <li>Maximum range is 100 meters on CAT5 cable.</li> </ul>

Cables and connectors (SX)	<ul style="list-style-type: none"> <li>• LC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -9.5 dBm</li> <li>• max: -4 dBm</li> </ul> </li> <li>• Center wavelength: 850 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -17 dBm</li> <li>• max: -3 dBm</li> </ul> </li> <li>• Rated for 275 m (300 yards) over 62.5-micron core cable</li> <li>• Rated for 550 m (601 yards) over 50-micron core cable</li> <li>• See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
LEDs	<ul style="list-style-type: none"> <li>• See <a href="#">"Module LEDs" on page 35</a>.</li> </ul>
Alarms, errors, and events	<ul style="list-style-type: none"> <li>• See <i>Monitoring Ethernet Interfaces in JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>

Table 2: Single-strand SFPs Pairing

Fiber Type	Nominal Wavelength (nm)	Maximum Operating Range (kilometers)
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550 / RX 1310</li> <li>• Pairs with TX 1310, RX 1550</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1490</li> <li>• Pairs with TX 1490 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1490 / RX 1310</li> <li>• Pairs with TX 1310, RX 1490</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550, RX 1310</li> <li>• Pairs with TX 1310 / RX 1550</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range

## GE2 1000Base-LH Module Combination (2 Ports)

Line module label	GE-2
I/O module label	GE-2 SFP I/O or 2XGE APS I/O SFP or GE-2 APS I/O SFP
Number of I/O ports	<ul style="list-style-type: none"> <li>2 active, 2 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 5.3.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>100 W</li> <li>Gigabit Ethernet</li> <li>The I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cabling distances.</li> <li>Uses either optical or copper SFPs. <ul style="list-style-type: none"> <li>The optical transceivers are 1000Base-LX/LH compliant.</li> <li>The copper transceivers are 1000Base-T compliant.</li> </ul> </li> <li>Single-strand SFPs can be used. These SFPs work in pairs and require a matching SFP at the opposite end of the Ethernet connection. For example, an SFP rated at TX 1310, RX 1550 must be paired with an SFP rated TX 1550, RX 1310 with the same maximum operating range. See the following corresponding table (Single-strand SFPs Pairing) for more information.</li> <li>For information about bandwidth and line rate considerations for the GE2 1000Base-LH module combination, see <i>GE-2 SFP I/O Module</i> in <i>JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
Type	<ul style="list-style-type: none"> <li>FFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-LH</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">"Ethernet Modules"</a> on page 27 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>ERX1440 router</li> <li>ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>SRP-40G</li> <li>SRP-40G PLUS</li> <li>SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
Cables and connectors (copper SFP)	<ul style="list-style-type: none"> <li>Maximum range is 100 meters on CAT5 cable.</li> </ul>

- 
- Cables and connectors (LX/LH)**
- LC full duplex
  - Tx power:
    - min: -9.5 dBm
    - max: -3 dBm
  - Center wavelength: 1300 nm
  - Rx input power:
    - min: -20 dBm
    - max: -3 dBm
  - Rated for 10 km (6.2 miles) over 9-micron core cable
  - See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.
- 

- Cables and connectors (single-mode LX40)**
- LC full duplex
  - Tx power:
    - min: -4.5 dBm
    - max: 0 dBm
  - Center wavelength: 1300 nm
  - Rx input power:
    - min: -35 dBm
    - max: -22.5 dBm
  - Rated for 40 km (24.85 miles) over 9-micron core cable
  - See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.
- 

- LEDs**
- See ["Module LEDs" on page 35](#).
- 

- Alarms, errors, and events**
- See *Monitoring Ethernet Interfaces in JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.
- 

**Table 3: Single-strand SFPs Pairing**

Fiber Type	Nominal Wavelength (nm)	Maximum Operating Range (kilometers)
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550 / RX 1310</li> <li>• Pairs with TX 1310, RX 1550</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1490</li> <li>• Pairs with TX 1490 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1490 / RX 1310</li> <li>• Pairs with TX 1310, RX 1490</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550, RX 1310</li> <li>• Pairs with TX 1310 / RX 1550</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range

## GE2 1000Base-ZX Module Combination (2 Ports)

Line module label	GE-2
I/O module label	GE-2 SFP I/O or 2XGE APS I/O SFP or GE-2 APS I/O SFP
Number of I/O ports	<ul style="list-style-type: none"> <li>2 active, 2 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 5.3.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>100 W</li> <li>Gigabit Ethernet</li> <li>The I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cabling distances.</li> <li>Uses either optical or copper SFPs. <ul style="list-style-type: none"> <li>The optical transceivers are 1000Base-ZX compliant.</li> <li>The copper transceivers are 1000Base-T compliant.</li> </ul> </li> <li>Single-strand SFPs can be used. These SFPs work in pairs and require a matching SFP at the opposite end of the Ethernet connection. For example, an SFP rated at TX 1310, RX 1550 must be paired with an SFP rated TX 1550, RX 1310 with the same maximum operating range. See the following corresponding table (Single-strand SFPs Pairing) for more information.</li> <li>For information about bandwidth and line rate considerations for the GE2 1000Base-ZX module combination, see <i>GE-2 SFP I/O Module</i> in <i>JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
Type	<ul style="list-style-type: none"> <li>FFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-ZX</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See "<a href="#">Ethernet Modules</a>" on <a href="#">page 27</a> for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>ERX1440 router</li> <li>ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>SRP-40G</li> <li>SRP-40G PLUS</li> <li>SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>

## Cables and connectors

- LC full duplex
- Tx power:
  - min: -3 dBm
  - max: 2 dBm
- Center wavelength: 1550 nm
- Rx input power:
  - min: -23 dBm
  - max: -3 dBm
- Rated for 70 km (43.4 miles) over 10-micron core cable
- See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.

## LEDs

- See "Module LEDs" on page 35.

## Alarms, errors, and events

- See *Monitoring Ethernet Interfaces in JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.

Table 4: Single-strand SFPs Pairing

Fiber Type	Nominal Wavelength (nm)	Maximum Operating Range (kilometers)
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550 / RX 1310</li> <li>• Pairs with TX 1310, RX 1550</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1490</li> <li>• Pairs with TX 1490 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1490 / RX 1310</li> <li>• Pairs with TX 1310, RX 1490</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550, RX 1310</li> <li>• Pairs with TX 1310 / RX 1550</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range

## GE High Density (HDE) Module Combination (2 Ports)

Line module label	GE-HDE
I/O module label	GE-2 SFP I/O or 2XGE APS I/O SFP or GE-2 APS I/O SFP
Number of I/O ports	<ul style="list-style-type: none"> <li>2 active, 2 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 7.0.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>100 W</li> <li>Gigabit Ethernet</li> <li>The I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cabling distances.</li> <li>Uses either optical or copper SFPs. <ul style="list-style-type: none"> <li>The optical transceivers are 1000Base-LX/LH compliant.</li> <li>The copper transceivers are 1000Base-T compliant.</li> </ul> </li> <li>Single-strand SFPs can be used. These SFPs work in pairs and require a matching SFP at the opposite end of the Ethernet connection. For example, an SFP rated at TX 1310, RX 1550 must be paired with an SFP rated TX 1550, RX 1310 with the same maximum operating range. See the following corresponding table (Single-strand SFPs Pairing) for more information.</li> <li>For information about bandwidth and line rate considerations for the GE-HDE module combination, see <i>GE-2 SFP I/O Module</i> in <i>JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
Type	<ul style="list-style-type: none"> <li>FFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-LH</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">"Ethernet Modules"</a> on page 27 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>ERX1440 router</li> <li>ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>SRP-40G</li> <li>SRP-40G PLUS</li> <li>SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
Cables and connectors (copper SFP)	<ul style="list-style-type: none"> <li>Maximum range is 100 meters on CAT5 cable.</li> </ul>

- 
- Cables and connectors (LX/LH)**
- LC full duplex
  - Tx power:
    - min: -9.5 dBm
    - max: -3 dBm
  - Center wavelength: 1300 nm
  - Rx input power:
    - min: -20 dBm
    - max: -3 dBm
  - Rated for 10 km (6.2 miles) over 10-micron core cable
  - See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.
- 

- Cables and connectors (single-mode LX40)**
- LC full duplex
  - Tx power:
    - min: -4.5 dBm
    - max: 0 dBm
  - Center wavelength: 1300 nm
  - Rx input power:
    - min: -35 dBm
    - max: -22.5 dBm
  - Rated for 40 km (24.85 miles) over 10-micron core cable
  - See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.
- 

- LEDs**
- See ["Module LEDs" on page 35](#).
- 

- Alarms, errors, and events**
- See *Monitoring Ethernet Interfaces in JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.
- 

**Table 5: Single-strand SFPs Pairing**

Fiber Type	Nominal Wavelength (nm)	Maximum Operating Range (kilometers)
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550 / RX 1310</li> <li>• Pairs with TX 1310, RX 1550</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1490</li> <li>• Pairs with TX 1490 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1490 / RX 1310</li> <li>• Pairs with TX 1310, RX 1490</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550, RX 1310</li> <li>• Pairs with TX 1310 / RX 1550</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range



## GE High Density (HDE) Module Combination (8 Ports)

Line module label	GE-HDE
I/O module label	GE-8 I/O
Number of I/O ports	<ul style="list-style-type: none"> <li>8</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 7.0.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>100 W</li> <li>Gigabit Ethernet</li> <li>The I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cabling distances.</li> <li>Uses either optical or copper SFPs. <ul style="list-style-type: none"> <li>The optical transceivers are 1000Base-LX/LH compliant.</li> <li>The copper transceivers are 1000Base-T compliant.</li> </ul> </li> <li>Single-strand SFPs can be used. These SFPs work in pairs and require a matching SFP at the opposite end of the Ethernet connection. For example, an SFP rated at TX 1310, RX 1550 must be paired with an SFP rated TX 1550, RX 1310 with the same maximum operating range. See the following corresponding table (Single-strand SFPs Pairing) for more information.</li> <li>For information about bandwidth and line rate considerations for the GE–HDE module combination, see <i>GE-8 I/O Module</i> in <i>JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
Type	<ul style="list-style-type: none"> <li>FFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-LH</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See “Ethernet Modules” on page 27 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>ERX1440 router</li> <li>ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>SRP-40G</li> <li>SRP-40G PLUS</li> <li>SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>

## Cables and connectors

- LC full duplex
- Tx power:
  - min: -9.5 dBm
  - max: -3 dBm
- Center wavelength: 1300 nm
- Rx input power:
  - min: -20 dBm
  - max: -3 dBm
- Rated for 10 km (6.2 miles) over 10-micron core cable
- See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.

Cables and connectors  
(single-mode LX40)

- LC full duplex
- Tx power:
  - min: -4.5 dBm
  - max: 0 dBm
- Center wavelength: 1300 nm
- Rx input power:
  - min: -35 dBm
  - max: -22.5 dBm
- Rated for 40 km (24.85 miles) over 9-micron core cable
- See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.

## LEDs

- See [“Module LEDs” on page 35](#).

## Alarms, errors, and events

- See *Monitoring Ethernet Interfaces in JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.

Table 6: Single-strand SFPs Pairing

Fiber Type	Nominal Wavelength (nm)	Maximum Operating Range (kilometers)
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550 / RX 1310</li> <li>• Pairs with TX 1310, RX 1550</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1490</li> <li>• Pairs with TX 1490 / RX 1310</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1490 / RX 1310</li> <li>• Pairs with TX 1310, RX 1490</li> </ul>	10 (6.2 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1310, RX 1550</li> <li>• Pairs with TX 1550 / RX 1310</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range
9 microns	<ul style="list-style-type: none"> <li>• TX 1550, RX 1310</li> <li>• Pairs with TX 1310 / RX 1550</li> </ul>	40 (24.85 miles), matching SFP must have the same operating range

## OC3/STM1 ATM Multimode Without APS/MSP Redundancy Module Combination (256-MB Memory)

Line module label	OCx/STMx ATM or OCx/STMx /DS3-ATM
I/O module label	OC3-4 I/O MULTI MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>• 4</li> </ul>
Software release	<ul style="list-style-type: none"> <li>• First supported: 5.0.0, 5.3.0 or a higher-numbered release</li> <li>• Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>• 130 W</li> <li>• 256 MB of memory</li> <li>• The 128-MB version has reached end-of-life.</li> <li>• Unchannelized, concatenated OC3/STM1 for ATM</li> </ul>
Type	<ul style="list-style-type: none"> <li>• EFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>• OC3/STM1</li> <li>• ATM:AAL5</li> </ul>
Software features	<ul style="list-style-type: none"> <li>• See <a href="#">“OCx/STMx ATM Modules”</a> on page 31 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>• ERX7xx models</li> <li>• ERX14xx models</li> <li>• ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>• SRP-5G+</li> <li>• SRP-10G</li> <li>• SRP-40G</li> <li>• SRP-40G PLUS</li> <li>• SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>• 1:N redundancy</li> <li>• <b>NOTE:</b> Line module redundancy is not supported on the ERX310 router.</li> </ul>

---

**Cables and connectors**

- SC full duplex connector
- Tx power:
  - min: -19 dBm
  - max: -14 dBm
- Center wavelength: 1310 nm
- Rx input power:
  - 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
- See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.

---

**LEDs**

- See “Module LEDs” on page 35.

---

**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
-

## OC3/STM1 ATM Single-Mode Intermediate Reach Without APS/MSP Redundancy Module Combination (256-MB Memory)

Line module label	OCx/STMx ATM or OCx/STMx /DS3-ATM
I/O module label	OC3-4 I/O SINGLE MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>• 4</li> </ul>
Software release	<ul style="list-style-type: none"> <li>• First supported: 5.0.0, 5.3.0 or a higher-numbered release</li> <li>• Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>• 130 W</li> <li>• 256 MB of memory</li> <li>• The 128-MB version has reached end-of-life.</li> <li>• Unchannelized, concatenated OC3/STM1 for ATM</li> </ul>
Type	<ul style="list-style-type: none"> <li>• EFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>• OC3/STM1</li> <li>• ATM/AAL5</li> </ul>
Software features	<ul style="list-style-type: none"> <li>• See “OCx/STMx ATM Modules” on page 31 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>• ERX7xx models</li> <li>• ERX14xx models</li> <li>• ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>• SRP-5G+</li> <li>• SRP-10G</li> <li>• SRP-40G</li> <li>• SRP-40G PLUS</li> <li>• SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>• 1:N redundancy</li> <li>• <b>NOTE:</b> Line module redundancy is not supported on the ERX310 router.</li> </ul>
Cables and connectors	<ul style="list-style-type: none"> <li>• SC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -15 dBm</li> <li>• max: -8 dBm</li> </ul> </li> <li>• Center wavelength: 1310 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -31 dBm</li> <li>• max: -8 dBm</li> </ul> </li> <li>• Rated for 15 km (9.3 miles) of 9-micron core cable</li> <li>• See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>

---

**LEDs**

- See “Module LEDs” on page 35.

---

**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
-

## OC12/STM4 ATM Single-Mode Long Reach With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx ATM or OCx/STMx /DS3-ATM
I/O module label	OC12 STM4 APS LONG HAUL
Number of I/O ports	<ul style="list-style-type: none"> <li>1 active, 1 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 2.0.0 (128 MB), 5.0.0 (256 MB)</li> <li>Final supported: Not applicable</li> <li>The OCx/STMx ATM line module or the OCx/STMx /DS3-ATM line module must have a minimum of 256 MB of memory to be used with JunosE Release 5.3.0 or a higher-numbered release.</li> </ul>
Description	<ul style="list-style-type: none"> <li>130 W</li> <li>Can use either the 128-MB OCx/STMx ATM line module or the 256-MB OCx/STMx /DS3-ATM line module.</li> <li>Unchannelized, concatenated OC12/STM4 for ATM</li> </ul>
Type	<ul style="list-style-type: none"> <li>EFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>OC12/STM4</li> <li>ATM/AAL5</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">"OCx/STMx ATM Modules"</a> on page 31 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>ERX7xx models</li> <li>ERX14xx models</li> <li>ERX310 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>SRP-5G+</li> <li>SRP-10G</li> <li>SRP-40G</li> <li>SRP-40G PLUS</li> <li>SRP-SE10G</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>1:N redundancy</li> <li><b>NOTE:</b> Line module redundancy is not supported on the ERX310 router.</li> </ul>

---

**Cables and connectors**

- SC full duplex
- Tx power:
  - min: -5.0 dBm
  - max: 0 dBm
- Center wavelength: 1310 nm
- Rx input power:
  - min: -34 dBm
  - max: -7 dBm
- Fiber type: 9-micron core
- Rated for 40 km (24.8 miles) of 9-micron core cable
- See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.

---

**LEDs**

- See ["Module LEDs" on page 35](#).

---

**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
-



## SRP-5G+ Module Combination (1-GB Memory)

Line module label	SRP-5G+
I/O module label	SRP I/O
Number of I/O ports	<ul style="list-style-type: none"> <li>7</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 4.1.3 or later 4.1.x release, 5.0.4 or later 5.0.x release, 5.1.2 or higher-numbered release, 5.2.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>125 W</li> <li>Switch route processor (5 Gbps)</li> <li>Has a minimum of 1 GB of error checking and correction (ECC) memory with a 1-GB nonvolatile storage (NVS) card.</li> <li>The 512-MB version has reached end-of-life.</li> </ul>
Type	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
Capability	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3)</li> <li>10/100Base-T</li> <li>RS-232</li> </ul>
Software features	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
Model compatibility	<ul style="list-style-type: none"> <li>ERX705 Broadband Services Router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>SRP-5G+</li> </ul>
Module redundancy support	<ul style="list-style-type: none"> <li>1:1 redundancy</li> </ul>
Cables and connectors	<ul style="list-style-type: none"> <li>Terminal blocks</li> <li>BNC, 75-ohm</li> <li>Wire wrap posts</li> <li>RJ-45</li> <li>RS-232 (DB-9)</li> <li>See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
LEDs	<ul style="list-style-type: none"> <li>See <a href="#">"Module LEDs" on page 35</a>.</li> </ul>
Alarms, errors, and events	<ul style="list-style-type: none"> <li>See <i>Monitoring Modules in JunosE System Basics Configuration Guide, Chapter 6, Managing Modules</i>.</li> </ul>

## APPENDIX A

# Module Protocol Support

This appendix lists the layer 2 and layer 3 protocols and applications that line modules and their corresponding I/O modules support. Modules are identified by their physical labels. See [Table 1 on page 3](#) for a list of modules and their identifying labels.

The designation “not yet fully qualified” that appears in some tables in this appendix indicates that support for the protocol or application on the specified module has not yet been fully qualified by Juniper Networks. If you use a feature before it has been fully qualified, it is your responsibility to ensure that it operates correctly in your targeted configuration.

This appendix contains the following sections:

- [Ethernet Modules on page 27](#)
- [OCx/STMx ATM Modules on page 31](#)

## Ethernet Modules

---

Table 7: Gigabit Ethernet Modules

Protocol or Application	GE/FE Line Modules with GE I/O Modules	GE-2 Line Module or GE-HDE Line Module with GE-2 SFP I/O ( <i>formerly GE-2 APS I/O or 2XGE APS I/O</i> )	GE-HDE Line Module with GE-8 I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes	Yes
APS/MSP	No	No	No
ATM	No	No	No
BERT	No	No	No
BFD	No	Yes	Yes
BGP	Yes	Yes	Yes

Table 7: Gigabit Ethernet Modules (*continued*)

Protocol or Application	GE/FE Line Modules with GE I/O Modules	GE-2 Line Module or GE-HDE Line Module with GE-2 SFP I/O ( <i>formerly GE-2 APS I/O or 2XGE APS I/O</i> )	GE-HDE Line Module with GE-8 I/O Modules
BGP/MPLS VPNs	Yes	Yes	Yes
Bridged Ethernet	No	No	No
Bridged IP	No	No	No
Cisco HDLC	No	No	No
DHCP external server	Yes	Yes	Yes
DHCP local server	Yes	Yes	Yes
DVMRP and GRE support—access side	Yes	Yes	Yes
DVMRP and GRE support—server side	No	Yes	Yes
Dynamic interfaces	Yes	Yes	Yes
Ethernet raw mode encapsulation in Martini layer 2 circuits	Yes	Yes	Yes
F4 OAM and F5 OAM (ATM administration)	No	No	No
FDL (facilities data link)	No	No	No
Firewall	Yes	Yes (not yet fully qualified)	No
Frame Relay	No	No	No
ICMP unreachable messages for packets reaching null 0 interfaces with static routes	Yes	Yes	Yes
ICR	Yes (including fast reconnection of PPPoE subscribers)	Yes (including fast reconnection of PPPoE subscribers)	Yes (including fast reconnection of PPPoE subscribers)
IEEE 802.3ad link aggregation	No	Yes	Yes
IEEE 802.3ah OAM link-fault management	No	Yes	Yes

Table 7: Gigabit Ethernet Modules (*continued*)

Protocol or Application	GE/FE Line Modules with GE I/O Modules	GE-2 Line Module or GE-HDE Line Module with GE-2 SFP I/O ( <i>formerly GE-2 APS I/O or 2XGE APS I/O</i> )	GE-HDE Line Module with GE-8 I/O Modules
IP	Yes	Yes	Yes
IP multicast	Yes	Yes	Yes
IP reassembly for tunneled packets	No	Yes	Yes
IPsec	No	No	No
IPv6	Yes	Yes	Yes
IPv6 multicast	Yes	Yes	Yes
IPv6 neighbor discovery	Yes	Yes	Yes
IS-IS	Yes	Yes	Yes
J-Flow Statistics	Yes	Yes	Yes
L2TP/IPsec	No	No	No
LAC support—access side	Yes	Yes	Yes
LAC support—peer side	Yes	Yes	Yes
LNS support—peer side	Yes	Yes	Yes
Local loopback	No	No	No
MDL (maintenance data link)	No	No	No
Mobile IP home agent	Yes	Yes (not yet fully qualified)	Yes (not yet fully qualified)
MPLS	Yes	Yes	Yes
MPLS L2VPNs over the LAGs configured between customer edge (CE) and provider edge (PE) devices	Yes	Yes	No
Multilink Frame Relay	No	No	No

Table 7: Gigabit Ethernet Modules (*continued*)

Protocol or Application	GE/FE Line Modules with GE I/O Modules	GE-2 Line Module or GE-HDE Line Module with GE-2 SFP I/O ( <i>formerly GE-2 APS I/O or 2XGE APS I/O</i> )	GE-HDE Line Module with GE-8 I/O Modules
Multilink PPP	No	Yes (with fragmentation and reassembly; over MPL2TP on shared tunnel-server port; dynamic only)	Yes (with fragmentation and reassembly; over MPL2TP on shared tunnel-server port; dynamic only)
Network Address Translation (NAT)	Yes	Yes (not yet fully qualified)	No
NBMA (multipoint ATM)	No	No	No
OSPF	Yes	Yes	Yes
Packet Mirroring	Yes	Yes	Yes
Packet over SONET	No	No	No
PPP	No	No	No
PPPoE	Yes	Yes	Yes
Remote loopback	No	No	No
RIP	Yes	Yes	Yes
Subscriber interfaces (static)	Yes	Yes (GRE tunnels only)	Yes (GRE tunnels only)
Subscriber interfaces (dynamic)	Yes	Yes	Yes
S-VLAN subinterface with an untagged C-VLAN ID in Martini circuits	Yes	Yes	Yes
Transparent bridging	Yes	Yes	Yes
Tunnel-server ports	No	Yes (shared only)	Yes (shared only)
Unified ISSU	Yes	Yes	Yes
VPLS (network interfaces)	Yes	Yes	Yes
VPLS (virtual core interfaces)	Yes	Yes	Yes
VRRP	Yes	Yes	Yes

## OCx/STMx ATM Modules

**Table 8: OCx/STMx ATM Modules**

Protocol or Application	OCx/STMx ATM Line Modules with OC3-4 I/O Modules	OCx/STMx ATM Line Modules with OC12/STM4 I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	Yes
ATM	Yes	Yes
BERT	No	No
BFD	Yes	No
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	Yes	Yes
Bridged IP	Yes	Yes
Cisco HDLC	No	No
DHCP external server	Yes	Yes
DHCP local server	Yes	Yes
DVMRP and GRE support—access side	Yes	Yes
DVMRP and GRE support—server side	No	No
Dynamic interfaces	Yes	Yes
F4 OAM and F5 OAM (ATM administration)	Yes	Yes
FDL (facilities data link)	No	No
Firewall	Yes	Yes
Frame Relay	No	No
ICMP unreachable messages for packets reaching null 0 interfaces with static routes	Yes	Yes
ICR	No	No

Table 8: OCx/STMx ATM Modules (continued)

Protocol or Application	OCx/STMx ATM Line Modules with OC3-4 I/O Modules	OCx/STMx ATM Line Modules with OC12/STM4 I/O Modules
IEEE 802.3ad link aggregation	No	No
IEEE 802.3ah OAM link-fault management	No	No
IP	Yes	Yes
IP multicast	Yes	Yes
IP reassembly for tunneled packets	No	No
IPsec	No	No
IPv6	Yes	Yes
IPv6 multicast	Yes	Yes
IPv6 neighbor discovery	Yes	Yes
IS-IS	Yes	Yes
J-Flow Statistics	Yes	Yes
L2TP/IPsec	No	No
LAC support—access side	Yes	Yes
LAC support—peer side	Yes	Yes
LNS support—peer side	Yes	Yes
Local loopback	No	Yes
MDL (maintenance data link)	No	No
Mobile IP home agent	No	No
MPLS	Yes	Yes
Multilink Frame Relay	No	No
Multilink PPP	Yes (with fragmentation and reassembly)	Yes (with fragmentation and reassembly)
Network Address Translation (NAT)	Yes	Yes
NBMA (multipoint ATM)	Yes	Yes

Table 8: OCx/STMx ATM Modules (continued)

Protocol or Application	OCx/STMx ATM Line Modules with OC3-4 I/O Modules	OCx/STMx ATM Line Modules with OC12/STM4 I/O Modules
OSPF	Yes	Yes
Packet Mirroring	Yes	Yes
Packet over SONET	No	No
PPP	Yes	Yes
PPPoE	Yes	Yes
Remote loopback	No	No
RIP	Yes	Yes
Subscriber interfaces (static)	Yes (over bridged Ethernet and IPoA)	Yes (over bridged Ethernet and IPoA)
Subscriber interfaces (dynamic)	Yes (over bridged Ethernet)	Yes (over bridged Ethernet)
Transparent bridging	Yes	Yes
Tunnel-server ports	No	No
Unified ISSU	Yes (only for non-channelized APS IOAs when APS is not configured)	Yes (only for non-channelized APS IOAs when APS is not configured)
VPLS (network interfaces)	Yes	Yes
VPLS (virtual core interfaces)	Yes	Yes
VRRP	No	No





## APPENDIX B

# Module LEDs

This appendix describes the LEDs found on ERX modules. Module LEDs can show you the current status of a module and alert you to a problem with the module or one of its ports. We recommend that you familiarize yourself with LED activity so that you can easily detect and correct a module-related problem with minimal or no system downtime. This appendix contains the following sections:

- [LED Identification on page 35](#)
- [Redundancy Status on page 39](#)

## LED Identification

---

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

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

For example, an OCx/STMx line module can pair with either an OC3-4 or an OC12/STM4 I/O module. Consequently, the line module has four port status LEDs for OC3/STM1 operation. However, only the top set of port status LEDs is active during OC12/STM4 operation.

[Table 9 on page 35](#) lists the functions of the module and port status LEDs.

**Table 9: 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 9: 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" on page 39.  <b>NOTE:</b> The REDUNDANT LED on the cOCx/STMx, FE-8, GE/FE, HSSI, and X.21/V.35 line modules is nonfunctional.	
SRP module	POWER A OK	Power	Green	Power online on source A	Power off
	POWER B OK	Power	Green	Power online on source B	Power off
	FAN OK	Fan	Green	Fan online	Critical fan failure
	FAN FAIL	Fan	Red	Critical fan failure	Fan online
				<b>NOTE:</b> When the LED alternates between OK and FAIL at 10-second intervals, a non-critical fan failure exists.	
	LINK	Ethernet	Green	Ethernet link up	Ethernet link down
	ACTIVITY	Ethernet	Green	Blinks when Ethernet traffic on link	No Ethernet traffic on link
Ethernet line modules	LINK	Ethernet	Green	Ethernet link up	Ethernet link down
	ACTIVITY	Ethernet	Green	Blinks when Ethernet traffic on link	No Ethernet traffic on link
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	<b>NOTE:</b> 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.

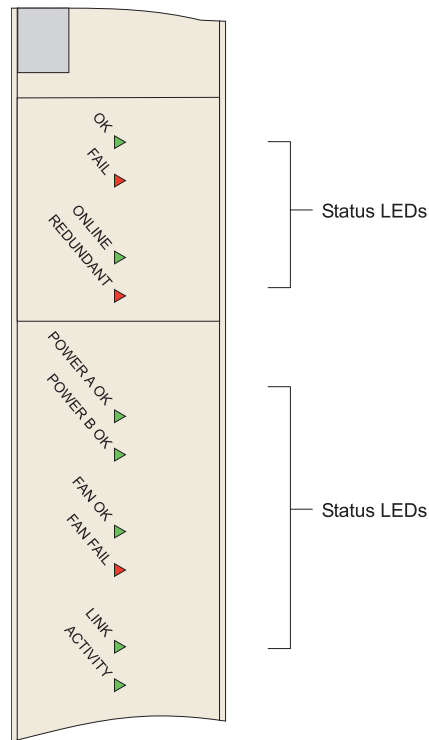
Table 9: LED Identification and Activity Descriptions (*continued*)

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.	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:

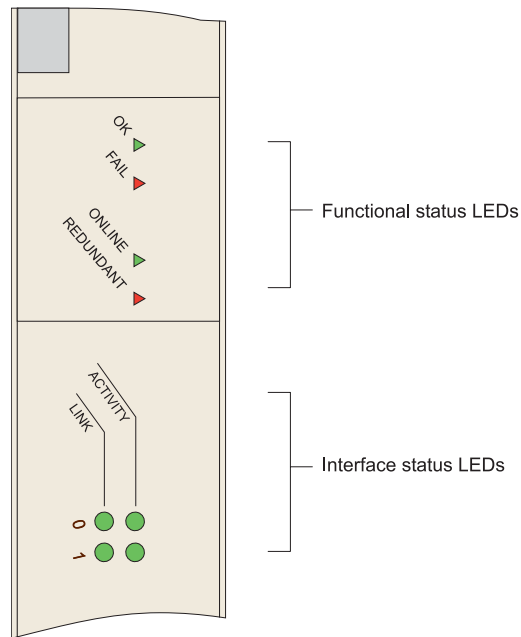
- SRP module ([Figure 1 on page 38](#))
- Ethernet line module ([Figure 2 on page 39](#))
- Other line modules ([Figure 3 on page 39](#))

Figure 1: SRP Module LEDs



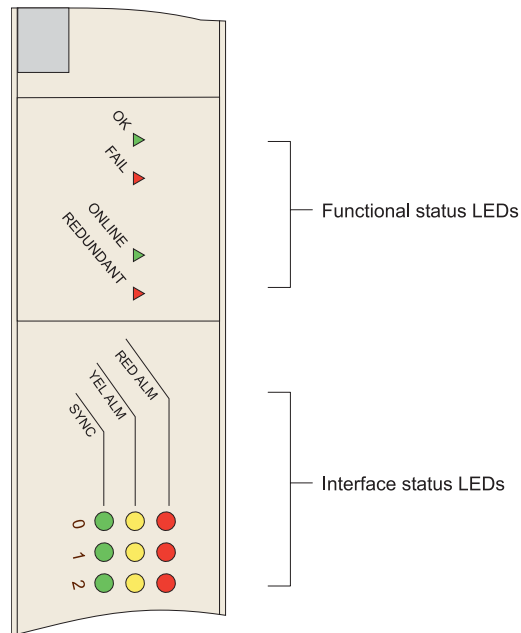
**NOTE:** The primary SRP module illuminates the REDUNDANT LED only when the SRP module detects that there is a secondary or standby SRP module online. The standby SRP module monitors an activity signal from the primary SRP module to determine its state; it does not shadow the operations of the primary SRP module. If the standby SRP module detects that the primary SRP module is not active, it reboots the system and takes control. (ERX7xx/14xx models only)

Figure 2: FE2 Module LEDs



g013769

Figure 3: E3 and T3 Module LEDs



g013770

## Redundancy Status

You can determine the redundancy state of line modules by examining the online and redundant status LEDs (ERX7xx/14xx models only). See [Table 10 on page 40](#).



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

**Table 10: 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.

## APPENDIX C

# Module Name Cross-Reference Information

- [Module Name Cross-Reference Information on page 41](#)

## Module Name Cross-Reference Information

---

Use [Table 11 on page 41](#) to find the label name, software display name, and model number of a module.

**Table 11: Module Naming Reference**

Label Name	Software Display Name	Model Number
<b>SRP Modules</b>		
SRP-5G +	SRP-5GPlus	ERX-5G2GEC2-SRP
SRP-10G	SRP-10G	ERX-10G2GEC2-SRP
SRP-40G Plus	SRP-40G+	ERX-40G2GEC2-SRP
SRP-SE10G	SRP-SE10G	EX3-1GSRP-MOD
<b>Line Modules</b>		
CT3/T3-F0	CT3-12	CT3-12-F0
COCX-F3	UT3f-12	ERX-UT3E3OCX-MOD
cOCx/STMx F0	COC3/COC12	COCX/STMX-F0
OCx/STMx ATM	OC3/OC12-ATM	ERX-O3O12A-MOD
OCx/STMx/DS3-ATM	OC3/OC12/DS3-ATM	ERX-OCXA256M-MOD
OCx/STMx POS	OC3/OC12-POS	ERX-O3O12P-MOD
OCx/STMx POS	OC3/OC12-POS	OC3/OC12-POS



Table 11: Module Naming Reference (*continued*)

Label Name	Software Display Name	Model Number
OC48	OC48-POS	ERX-OC48ST16-MOD
GE/FE	GE/FE	ERX-GEFE-MOD
GE/FE	GE/FE	ERX-GEFE256M-MOD
GE-HDE	GE-HDE-8	ERX-HDE-MOD
GE-HDE	GE-HDE-8	ERX-GE-MOD
OC3/STM1 GE/FE	2xOC3-ATM 1xGE I/O	ERX-OCXGE-MOD
<b>Service Modules</b>		
SERVICE MODULE	SERVICE MODULE	ERX-SERVICE-MOD
<b>I/O Modules</b>		
4xDS3 ATM I/O	DS3-4P I/O	ERX-4T3ATM-IOA
CT3/T3 12 I/O	CT3/T3-12 I/O	T312-F0-F3-I/O
OC12 STM4 APS MULTI MODE	OC12-MM-2P I/O	ERX-OC12MM-A-IOA
OC12 STM4 APS SINGLE MODE	OC12-SM-2P-IR I/O	ERX-OC12SM-A-IOA
4XOC3 APS I/O MULTI MODE	OC3(8) MM I/O	ERX-OC3M-APS-IOA
4XOC3 APS I/O SINGLE MODE	OC3(8) SM-IR I/O	ERX-OC3S-APS-IOA
OC48 FRAME APS	OC48-POS I/O	ERX-OC48ST16-IOA
OC12 STM4 I/O LONG HAUL	OC12-SM I/O	OC12-LH-I/O
OC12 STM4 I/O MULTI MODE	OC12-MM I/O	OC12-MM-I/O
OC12 STM4 I/O SINGLE MODE	OC12-SM I/O	OC12-SM-I/O
OC3-4 I/O LONG HAUL	OC3-4LH I/O	OC3-4LH-I/O
OC3-4 I/O MULTI MODE	OC3-4MM I/O	OC3-4MM-I/O
OC3-4 I/O SINGLE MODE	OC3-4SM I/O	OC3-4SM-I/O
FE-8 I/O SFP	FE-8 SFP FX I/O	ERX-8FXSFP-IOA

Table 11: Module Naming Reference (*continued*)

Label Name	Software Display Name	Model Number
FE-8 I/O	FE-8 I/O	FE-8-I/O
OC3-2 GE APS I/O SFP	OC3-2A GE	ERX-2OC3GE-IOA
GE I/O SFP	GE-SFP I/O	ERX-GIGESFP-IOA
GE-2 SFP I/O	GE-2 I/O	ERX-2GE-IOA
GE-8 I/O	GE-8 I/O	ERX-8GEHDE-IOA



## APPENDIX D

# Product Reclamation and Recycling Program

- Product Reclamation and Recycling Program on page 45

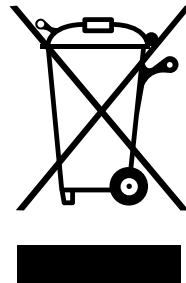
## Product Reclamation and Recycling Program

---

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

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

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



Juniper Networks provides recycling support for our equipment worldwide to comply with the WEEE Directive. For recycling information, go to <http://www.juniper.net/environmental>, and indicate the type of Juniper Networks

equipment that you wish to dispose of and the country where it is currently located, or contact your Juniper Networks account representative.

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



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

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

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

*E Series™ Broadband Services Routers ERX™ Module Guide, Release 14.3.x*  
Copyright © 2013, Juniper Networks, Inc.  
All rights reserved.

Revision History  
July 2013—FRS JunosE 14.3.x

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

#### YEAR 2000 NOTICE

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