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# E Series™ Broadband Services Routers

## ERX™ Module Guide

Release

13.2.x



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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 73](#)
- [Module LEDs on page 93](#)
- [Module Name Cross-Reference Information on page 99](#)
- [Product Reclamation and Recycling Program on page 103](#)

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	<a href="#">7</a>
GE single-mode	GE/FE	GE I/O SINGLE MODE	2.0.0	<a href="#">9</a>
<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	<a href="#">11</a>
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	<a href="#">13</a>
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	<a href="#">15</a>
<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	<a href="#">17</a>
GE High Density (8 ports)	GE-HDE	GE-8 I/O	7.0.0	<a href="#">19</a>

Table 1: ERX Module Combinations (*continued*)

Combination Name and Type	Line Module Label	I/O Module Label	First JunosE Support	Page
<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	<a href="#">21</a>
OC3/STM1 ATM multimode with APS/MSP redundancy	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	4XOC3 APS I/O MULTI MODE	5.1.2 5.2.0 (APS/MSP)	<a href="#">23</a>
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	<a href="#">25</a>
OC3/STM1 ATM single-mode intermediate reach with APS/MSP redundancy	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	4XOC3 APS I/O SINGLE MODE	5.1.2 5.2.0 (APS/MSP)	<a href="#">27</a>
OC3/STM1 ATM single-mode long reach without APS/MSP redundancy (256-MB memory)	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC3-4 I/O LONG HAUL	5.0.0, 5.3.0	<a href="#">29</a>
<b>OC3/STM1 GE/FE</b>				
OC3/STM1 GE/FE	OC3/STM1 GE/FE	OC3-2 GE APS I/O	6.1.0	<a href="#">31</a>
<b>OC3/STM1 POS</b>				
OC3/STM1 POS multimode without APS/MSP redundancy	OCx/STMx POS	OC3-4 I/O MULTI MODE	2.0.0	<a href="#">35</a>
OC3/STM1 POS multimode with APS/MSP redundancy	OCx/STMx POS	4XOC3 APS I/O MULTI MODE	5.1.2 5.2.0 (APS/MSP)	<a href="#">37</a>
OC3/STM1 POS single-mode intermediate reach without APS/MSP redundancy	OCx/STMx POS	OC3-4 I/O SINGLE MODE	2.0.0	<a href="#">39</a>

Table 1: ERX Module Combinations (*continued*)

Combination Name and Type	Line Module Label	I/O Module Label	First JunosE Support	Page
OC3/STM1 POS single-mode intermediate reach with APS/MSP redundancy	OCx/STMx POS	4XOC3 APS I/O  SINGLE MODE	5.1.2  5.2.0 (APS/MSP)	41
OC3/STM1 POS single-mode long reach	OCx/STMx POS	OC3-4 I/O  LONG HAUL	2.0.0	43
<b>OC12/STM4 ATM</b>				
OC12/STM4 ATM multimode without APS/MSP redundancy (256-MB memory)	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 I/O  MULTI MODE	5.0.0, 5.3.0	45
OC12/STM4 ATM multimode with APS/MSP redundancy	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 APS  MULTI MODE	2.0.0 (128 MB)  5.0.0 (256 MB)	47
OC12/STM4 ATM single-mode intermediate reach without APS/MSP redundancy (256-MB memory)	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 I/O  SINGLE MODE	5.0.0, 5.3.0	49
OC12/STM4 ATM single-mode intermediate reach with APS/MSP redundancy	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 APS  SINGLE MODE	2.0.0 (128 MB)  5.0.0 (256 MB)	51
OC12/STM4 ATM single-mode long reach without APS/MSP redundancy (256-MB memory)	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 I/O  LONG HAUL	5.0.0, 5.3.0	53
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)	55
<b>OC12/STM4 POS</b>				

Table 1: ERX Module Combinations (*continued*)

Combination Name and Type	Line Module Label	I/O Module Label	First JunosE Support	Page
OC12/STM4 POS multimode without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O  MULTI MODE	2.0.0	<a href="#">57</a>
OC12/STM4 POS multimode with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS  MULTI MODE	2.0.0	<a href="#">59</a>
OC12/STM4 POS single-mode intermediate reach without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O  SINGLE MODE	2.0.0	<a href="#">61</a>
OC12/STM4 POS single-mode intermediate reach with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS  SINGLE MODE	2.0.0	<a href="#">63</a>
OC12/STM4 POS single-mode long reach without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O  LONG HAUL	2.0.0	<a href="#">65</a>
OC12/STM4 POS single-mode long reach with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS  LONG HAUL	2.0.0	<a href="#">67</a>
<b>Service Module (SM)</b>				
SM	SERVICE MODULE	No I/O module	5.1.0	<a href="#">69</a>
<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	<a href="#">70</a>
SRP-40G PLUS (2-GB memory)	SRP-40G PLUS	SRP I/O	4.0.0	<a href="#">71</a>
<b>T3</b>				
T3 ATM (4 ports)	OCx/STMx ATM or OCx/STMx /DS3-ATM	4xDS3 ATM I/O	4.1.0 (128 MB) 5.0.0 (256 MB)	<a href="#">72</a>

## 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 73</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 93</a>.</li> </ul>

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Alarms, errors, and events

- See *Monitoring Ethernet Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.
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## 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” on page 73</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: -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” on page 93</a>.</li> </ul>

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Alarms, errors, and events

- See *Monitoring Ethernet Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.
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## 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” on page 73</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)

- LC full duplex
- Tx power:
  - min: -9.5 dBm
  - max: -4 dBm
- Center wavelength: 850 nm
- Rx input power:
  - 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
- See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.

## LEDs

- See [“Module LEDs” on page 93](#).

## Alarms, errors, and events

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

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" on page 73</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 (LX/LH)	<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: -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 10 km (6.2 miles) over 9-micron core cable</li> <li>• See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
Cables and connectors (single-mode LX40)	<ul style="list-style-type: none"> <li>• LC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -4.5 dBm</li> <li>• max: 0 dBm</li> </ul> </li> <li>• Center wavelength: 1300 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -35 dBm</li> <li>• max: -22.5 dBm</li> </ul> </li> <li>• Rated for 40 km (24.85 miles) over 9-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 “Module LEDs” on page 93.</li> </ul>
Alarms, errors, and events	<ul style="list-style-type: none"> <li>• See <i>Monitoring Ethernet Interfaces</i> in <i>JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>

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 73</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 93](#).

## 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" on page 73</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 (LX/LH)	<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: -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 10 km (6.2 miles) over 10-micron core cable</li> <li>• See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
Cables and connectors (single-mode LX40)	<ul style="list-style-type: none"> <li>• LC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -4.5 dBm</li> <li>• max: 0 dBm</li> </ul> </li> <li>• Center wavelength: 1300 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -35 dBm</li> <li>• max: -22.5 dBm</li> </ul> </li> <li>• Rated for 40 km (24.85 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 93.</li> </ul>
Alarms, errors, and events	<ul style="list-style-type: none"> <li>• See <i>Monitoring Ethernet Interfaces</i> in <i>JunosE Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>

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 <a href="#">“Ethernet Modules” on page 73</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	<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: -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 10 km (6.2 miles) over 10-micron core cable</li> <li>• See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
Cables and connectors (single-mode LX40)	<ul style="list-style-type: none"> <li>• LC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -4.5 dBm</li> <li>• max: 0 dBm</li> </ul> </li> <li>• Center wavelength: 1300 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -35 dBm</li> <li>• max: -22.5 dBm</li> </ul> </li> <li>• Rated for 40 km (24.85 miles) over 9-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 93</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 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 80 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>

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**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.

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**LEDs**

- See “Module LEDs” on page 93.

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**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 Multimode With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx ATM or OCx/STMx /DS3-ATM
I/O module label	4XOC3 APS I/O MULTI MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>4 active, 4 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 5.1.2, 5.2.0 (APS/MSP)</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 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/STM-1</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 80 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>

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**Cables and connectors**

- LC full duplex
- 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.

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## 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 <a href="#">“OCx/STMx ATM Modules” on page 80</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>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>

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LEDs

- See “Module LEDs” on page 93.

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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 With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx ATM or OCx/STMx /DS3-ATM
I/O module label	4XOC3 APS I/O SINGLE MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>4 active, 4 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 5.1.2, 5.2.0 (APS/MSP)</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 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/STM-1</li> <li>ATM/AAL5</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx ATM Modules” on page 80</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>1:N redundancy</li> <li><b>NOTE:</b> Line module redundancy is not supported on the ERX310 router.</li> </ul>

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**Cables and connectors**

- LC full duplex
- Tx power:
  - min: -15 dBm
  - max: -8 dBm
- Center wavelength: 1310 nm
- Rx input power:
  - min: -31 dBm
  - max: -8 dBm
- Rated for 15 km (9.3 miles) of 9-micron core cable
- See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.

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**LEDs**

- See "[Module LEDs](#)" on page 93.

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC3/STM1 ATM Single-Mode Long 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 LONG HAUL
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” on page 80</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>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: –5.0 dBm</li> <li>max: 0 dBm</li> </ul> </li> <li>Center wavelength: 1310 nm</li> <li>Rx input power: <ul style="list-style-type: none"> <li>min: –34 dBm</li> <li>max: –7 dBm</li> </ul> </li> <li>Rated for 40 km (24.8 miles) of 9-micron core cable</li> <li>See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>

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**LEDs**

- See “Module LEDs” on page 93.

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC3/STM1 GE/FE Module Combination

Line module label	OC3/STM1 GE/FE
I/O module label	OC3-2 GE APS I/O
Number of I/O ports	<ul style="list-style-type: none"> <li>3; one active and one redundant port per SFP               <ul style="list-style-type: none"> <li>Ports 0 and 1—ATM interfaces</li> <li>Port 2—GE interface</li> </ul> </li> <li>Port redundancy is not supported.</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 6.1.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>150 W</li> <li>Unchannelized OC3/STM1 ATM operation via two line interfaces and</li> <li>Gigabit Ethernet operation via one line interface</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>Depending on the configuration, a variety of SFP combinations can occur.</li> <li>The OC3-2 GE APS I/O module accepts up to three LC-style fiber-optic or copper SFPs.</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 table (Single-strand SFPs Pairing) for more information.</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> <li>Ethernet (IEEE 802.3x)</li> <li>1000Base-LX/SX/ZX</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx GE/FE Modules” on page 77</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>

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**Cables and connectors (ATM LX)**

- LC-style fiber-optic connectors
  - Tx power:
    - min: -19.0 dBm
    - max: -14dBm
  - 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 0–9db or over 50-micron core cable with an optical loss of 7 db
  - See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.
- 

**Cables and connectors (ATM SX)**

- LC-style fiber-optic connectors
  - Tx power:
    - min: -15.0 dBm
    - max: -8 dBm
  - Center wavelength: 1310 nm
  - Rx input power:
    - min: -31 dBm
    - max: -8 dBm
  - Rated for 15 km (9.3 miles) of 9-micron core cable
  - See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.
- 

**Cables and connectors (ATM ZX)**

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

**Cables and connectors (GE LX)**

- 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 (GE single-mode LX40)	<ul style="list-style-type: none"> <li>• LC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -4.5 dBm</li> <li>• max: -0 dBm</li> </ul> </li> <li>• Center wavelength: 1300 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -35 dBm</li> <li>• max: -22.5 dBm</li> </ul> </li> <li>• Rated for 40 km (28.85 miles) over 9-micron core cable</li> <li>• See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
Cables and connectors (GE 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>
Cables and connectors (GE ZX)	<ul style="list-style-type: none"> <li>• LC full duplex</li> <li>• Tx power: <ul style="list-style-type: none"> <li>• min: -3 dBm</li> <li>• max: 2 dBm</li> </ul> </li> <li>• Center wavelength: 1550 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -23 dBm</li> <li>• max: -3 dBm</li> </ul> </li> <li>• Rated for 70 km (43.4 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” on page 93</a>.</li> </ul>
Alarms, errors, and events	<ul style="list-style-type: none"> <li>• See <i>Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

Table 7: 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

Table 7: Single-strand SFPs Pairing (*continued*)

Fiber Type	Nominal Wavelength (nm)	Maximum Operating Range (kilometers)
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 POS Multimode Without APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
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: 2.0.0</li> <li>• Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>• 120 W</li> <li>• Unchannelized, concatenated OC3/STM1 for POS</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>• HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>• See <a href="#">"OCx/STMx POS and OC48 Modules"</a> on page 83 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: -19 dBm</li> <li>• max: -14 dBm</li> </ul> </li> <li>• Center wavelength: 1310 nm</li> <li>• Rx input power: <ul style="list-style-type: none"> <li>• min: -30 dBm</li> <li>• max: -14 dBm</li> </ul> </li> <li>• 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</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 93.</li> </ul>

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Alarms, errors, and events

- See *Monitoring SONET/SDH Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC3/STM1 POS Multimode With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
I/O module label	4XOC3 APS I/O MULTI MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>4 active, 4 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 5.1.2, 5.2.0 (APS/MSP)</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>120 W</li> <li>Unchannelized, concatenated OC3/STM1 for POS</li> </ul>
Type	<ul style="list-style-type: none"> <li>EFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>OC3/STM-1</li> <li>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx POS and OC48 Modules” on page 83</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>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>LC full duplex</li> <li>Tx power: <ul style="list-style-type: none"> <li>min: –19 dBm</li> <li>max: –14 dBm</li> </ul> </li> <li>Center wavelength: 1310 nm</li> <li>Rx input power: <ul style="list-style-type: none"> <li>min: –30 dBm</li> <li>max: –14 dBm</li> </ul> </li> <li>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</li> <li>See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>

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**LEDs**

- See “Module LEDs” on page 93.

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC3/STM1 POS Single-Mode Intermediate Reach Without APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
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: 2.0.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>120 W</li> <li>Unchannelized, concatenated OC3/STM1 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx POS and OC48 Modules” on page 83</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>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>

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC3/STM1 POS Single-Mode Intermediate Reach With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
I/O module label	4XOC3 APS I/O SINGLE MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>4 active, 4 redundant</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 5.1.2, 5.2.0 (APS/MSP)</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>120 W</li> <li>Unchannelized, concatenated OC3/STM1 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx POS and OC48 Modules” on page 83</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>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>LC 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>

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**LEDs**

- See “Module LEDs” on page 93.

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces.*
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## OC3/STM1 POS Single-Mode Long Reach Module Combination

Line module label	OCx/STMx POS
I/O module label	OC3-4 I/O LONG HAUL
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: 2.0.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>120 W</li> <li>Unchannelized, concatenated OC3/STM1 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx POS and OC48 Modules” on page 83</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>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: -5.0 dBm</li> <li>max: 0 dBm</li> </ul> </li> <li>Center wavelength: 1310 nm</li> <li>Rx input power: <ul style="list-style-type: none"> <li>min: -34 dBm</li> <li>max: -7 dBm</li> </ul> </li> <li>Fiber type: 9-micron core</li> <li>Rated for 40 km (24.8 miles) of 9-micron core cable</li> <li>See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC12/STM4 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	OC12 STM4 I/O MULTI MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>1</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 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” on page 80</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>1:N redundancy</li> <li><b>NOTE:</b> Line module redundancy is not supported on the ERX310 router.</li> </ul>

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**Cables and connectors**

- SC full duplex
- 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.

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**LEDs**

- See “Module LEDs” on page 93.

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC12/STM4 ATM Multimode With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
I/O module label	OC12 STM4 APS 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 (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” on page 80</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>1:N redundancy</li> <li><b>NOTE:</b> Line module redundancy is not supported on the ERX310 router.</li> </ul>

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**Cables and connectors**

- SC full duplex
- 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.

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**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 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	OC12 STM4 I/O SINGLE MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>1</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 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” on page 80</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>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>

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LEDs

- See “Module LEDs” on page 93.

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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 Intermediate 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 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 (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” on page 80</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>1:N redundancy</li> <li><b>NOTE:</b> Line module redundancy is not supported on the ERX310 router.</li> </ul>

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**Cables and connectors**

- SC full duplex
  - Tx power:
    - min: -15 dBm
    - max: -8 dBm
  - Center wavelength: 1310 nm
  - Rx input power:
    - min: -31 dBm
    - max: -8 dBm
  - Rated for 15 km (9.3 miles) of 9-micron core cable
  - See *ERX Hardware Guide, Chapter 5, Cabling ERX Routers* for more information.
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**LEDs**

- See ["Module LEDs" on page 93](#).
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**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 Without APS/MSP Redundancy Module Combination (256-MB Memory)

Line module label	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
I/O module label	OC12 STM4 I/O LONG HAUL
Number of I/O ports	<ul style="list-style-type: none"> <li>1</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 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 80 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>

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**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.

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**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 <a href="#">page 80</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>1:N redundancy</li> <li><b>NOTE:</b> Line module redundancy is not supported on the ERX310 router.</li> </ul>

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**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.

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**LEDs**

- See ["Module LEDs" on page 93](#).

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC12/STM4 POS Multimode Without APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
I/O module label	OC12 STM4 I/O MULTI MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>1</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>120 W</li> <li>Unchannelized, concatenated OC12/STM4 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">"OCx/STMx POS and OC48 Modules"</a> on page 83 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: -19 dBm</li> <li>max: -14 dBm</li> </ul> </li> <li>Center wavelength: 1310 nm</li> <li>Rx input power: <ul style="list-style-type: none"> <li>min: -30 dBm</li> <li>max: -14 dBm</li> </ul> </li> <li>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</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 93.</li> </ul>

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Alarms, errors, and events

- See *Monitoring SONET/SDH Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC12/STM4 POS Multimode With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
I/O module label	OC12 STM4 APS 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>120 W</li> <li>Unchannelized, concatenated OC12/STM4 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx POS and OC48 Modules” on page 83</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>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: –19 dBm</li> <li>max: –14 dBm</li> </ul> </li> <li>Center wavelength: 1310 nm</li> <li>Rx input power: <ul style="list-style-type: none"> <li>min: –30 dBm</li> <li>max: –14 dBm</li> </ul> </li> <li>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</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 93</a>.</li> </ul>

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Alarms, errors, and events

- See *Monitoring SONET/SDH Interfaces* in *JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC12/STM4 POS Single-Mode Intermediate Reach Without APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
I/O module label	OC12 STM4 I/O SINGLE MODE
Number of I/O ports	<ul style="list-style-type: none"> <li>1</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>120 W</li> <li>Unchannelized, concatenated OC12/STM4 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">"OCx/STMx POS and OC48 Modules" on page 83</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>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>

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC12/STM4 POS Single-Mode Intermediate Reach With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
I/O module label	OC12 STM4 APS 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>120 W</li> <li>Unchannelized, concatenated OC12/STM4 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx POS and OC48 Modules” on page 83</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>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>

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC12/STM4 POS Single-Mode Long Reach Without APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
I/O module label	OC12 STM4 I/O LONG HAUL
Number of I/O ports	<ul style="list-style-type: none"> <li>1</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>120 W</li> <li>Unchannelized, concatenated OC12/STM4 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx POS and OC48 Modules” on page 83</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>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: -5.0 dBm</li> <li>max: 0 dBm</li> </ul> </li> <li>Center wavelength: 1310 nm</li> <li>Rx input power:             <ul style="list-style-type: none"> <li>min: -34 dBm</li> <li>max: -7 dBm</li> </ul> </li> <li>Rated for 40 km (24.8 miles) of 9-micron core cable</li> <li>See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**Alarms, errors, and events**

- See *Monitoring SONET/SDH Interfaces in JunosE Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces*.
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## OC12/STM4 POS Single-Mode Long Reach With APS/MSP Redundancy Module Combination

Line module label	OCx/STMx POS
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</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>120 W</li> <li>Unchannelized, concatenated OC12/STM4 for POS</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>HDLC framing</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“OCx/STMx POS and OC48 Modules” on page 83</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>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: -5.0 dBm</li> <li>max: 0 dBm</li> </ul> </li> <li>Center wavelength: 1310 nm</li> <li>Rx input power: <ul style="list-style-type: none"> <li>min: -34 dBm</li> <li>max: -7 dBm</li> </ul> </li> <li>Rated for 40 km (24.8 miles) of 9-micron core cable</li> <li>See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>

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**LEDs**

- See [“Module LEDs” on page 93](#).

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**Alarms, errors, and events**

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

## Service Module (SM) Module Combination

Line module label	SERVICE MODULE
I/O module label	No I/O module
Number of I/O ports	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
Software release	<ul style="list-style-type: none"> <li>First supported: 5.1.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>130 W</li> <li>Tunnel Service for IP tunnels, L2F tunnels, and LNS termination</li> </ul>
Type	<ul style="list-style-type: none"> <li>EFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>IP tunnels</li> <li>LNS termination</li> <li>Network Address Translation</li> <li>Stateful firewall</li> <li>Service Modules on ERX14xx models, ERX7xx models, and the ERX310 router can handle up to 800 Mbps of traffic, depending on the size of the packets. The throughput might be less with packets of smaller sizes.</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“Service Modules” on page 85</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>Multiple SMs provide redundancy.</li> <li>See <i>JunosE Physical Layer Configuration Guide, Chapter 6, Managing Tunnel-Service and IPSec-Service Interfaces</i></li> </ul>
Cables and connectors	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
LEDs	<ul style="list-style-type: none"> <li>See <a href="#">“Module LEDs” on page 93</a>.</li> </ul>
Alarms, errors, and events	<ul style="list-style-type: none"> <li>See <i>Monitoring Tunnel-Service Interfaces</i> in <i>JunosE Physical Layer Configuration Guide, Chapter 6, Managing Tunnel-Service and IPSec-Service Interfaces</i>.</li> </ul>

## 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 93</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>

## SRP-40G PLUS Module Combination (2-GB Memory)

Line module label	SRP-40G PLUS
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: 4.0.0</li> <li>Final supported: Not applicable</li> </ul>
Description	<ul style="list-style-type: none"> <li>210 W</li> <li>Switch route processor (40 Gbps)</li> <li>Has a minimum of 2 GB of error checking and correction (ECC) memory with a 1-GB nonvolatile storage (NVS) card.</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>ERX1440 router</li> </ul>
SRP module compatibility	<ul style="list-style-type: none"> <li>SRP-40G</li> <li>SRP-40G PLUS</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</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 93</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>

## T3 ATM Module Combination (4 Ports)

Line module label	OCx/STMx ATM or OCx/STMx /DS3-ATM
I/O module label	4xDS3 ATM I/O
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: 4.1.0 (128 MB), 5.0.0 (256 MB)</li> <li>Final supported: Not applicable</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 T3 for ATM</li> </ul>
Type	<ul style="list-style-type: none"> <li>EFA ASIC</li> </ul>
Capability	<ul style="list-style-type: none"> <li>ATM/AAL5</li> </ul>
Software features	<ul style="list-style-type: none"> <li>See <a href="#">“Unchannelized T3 Modules” on page 88</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>1:N redundancy</li> </ul>
Cables and connectors	<ul style="list-style-type: none"> <li>75-ohm connector</li> <li>The line interface unit supports two line buildouts:             <ul style="list-style-type: none"> <li>0–68.5 m (0–225 feet)</li> <li>69–137 m (226–450 feet)</li> </ul> </li> <li>Signal strength is software controlled.</li> <li>The transmitted signal complies with ANSI T1.102-1993 Digital Hierarchy - Electrical Interfaces (1999) for cable lengths up to 201 m (660 feet).</li> </ul>
LEDs	<ul style="list-style-type: none"> <li>See <a href="#">“Module LEDs” on page 93</a>.</li> </ul>
Alarms, errors, and events	<ul style="list-style-type: none"> <li>See <i>Monitoring Interfaces in JunosE Physical Layer Configuration Guide, Chapter 2, Configuring T3 and E3 Interfaces</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 73](#)
- [OCx/STMx GE/FE Modules on page 77](#)
- [OCx/STMx ATM Modules on page 80](#)
- [OCx/STMx POS and OC48 Modules on page 83](#)
- [Service Modules on page 85](#)
- [Unchannelized T3 Modules on page 88](#)

## Ethernet Modules

Table 8: 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

Table 8: 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
BFD	No	Yes	Yes
BGP	Yes	Yes	Yes
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)

Table 8: 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
IEEE 802.3ad link aggregation	No	Yes	Yes
IEEE 802.3ah OAM link-fault management	No	Yes	Yes
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

Table 8: 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 Frame Relay	No	No	No
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

Table 8: 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
VRRP	Yes	Yes	Yes

## OCx/STMx GE/FE Modules

Table 9: OCx/STMx GE/FE Modules

Protocol or Application	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (OC3/STM1 ATM Interfaces)	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (Gigabit Ethernet Interfaces)
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	No
ATM	Yes	No
BERT	No	No
BFD	No	No
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	Yes	No
Bridged IP	Yes	No
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

Table 9: OCx/STMx GE/FE Modules (*continued*)

Protocol or Application	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (OC3/STM1 ATM Interfaces)	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (Gigabit Ethernet Interfaces)
F4 OAM and F5 OAM (ATM administration)	Yes	No
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	Yes
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

Table 9: OCx/STMx GE/FE Modules (*continued*)

Protocol or Application	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (OC3/STM1 ATM Interfaces)	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (Gigabit Ethernet Interfaces)
Local loopback	No	No
MDL (maintenance data link)	No	No
Mobile IP home agent	No	Yes (not yet fully qualified)
MPLS	Yes	Yes
Multilink Frame Relay	No	No
Multilink PPP	Yes (with fragmentation and reassembly)	No
Network Address Translation (NAT)	Yes	Yes
NBMA (multipoint ATM)	Yes	No
OSPF	Yes	Yes
Packet Mirroring	Yes	Yes
Packet over SONET	No	No
PPP	Yes	No
PPPoE	Yes	Yes
Remote loopback	No	No
RIP	Yes	Yes
Subscriber interfaces (static)	Yes (over bridged Ethernet and IPoA)	Yes
Subscriber interfaces (dynamic)	Yes (over bridged Ethernet)	Yes
Transparent bridging	Yes	Yes
Tunnel-server ports	No	No
Unified ISSU	No	No
VPLS (network interfaces)	Yes	Yes

Table 9: OCx/STMx GE/FE Modules (*continued*)

Protocol or Application	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (OC3/STM1 ATM Interfaces)	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (Gigabit Ethernet Interfaces)
VPLS (virtual core interfaces)	Yes	Yes
VRRP	No	Yes

## OCx/STMx ATM Modules

Table 10: 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



Table 10: 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
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
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

Table 10: 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
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
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

## OCx/STMx POS and OC48 Modules

Table 11: OCx/STMx POS and OC48 Modules

Protocol or Application	OCx/STMx POS Line Modules with OC3-4 I/O Modules	OCx/STMx POS 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	No	No
BERT	No	No
BFD	No	No
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	No	No
Bridged IP	No	No
Cisco HDLC	Yes	Yes
DHCP external server	Yes (for POS uplink interfaces; POS access interfaces not yet fully qualified)	Yes (for POS uplink interfaces; POS access interfaces not yet fully qualified)
DHCP local server	Yes (for POS access interfaces; not yet fully qualified)	Yes (for POS access interfaces; not yet fully qualified)
DVMRP and GRE support—access side	No	No
DVMRP and GRE support—server side	Yes	Yes
Dynamic interfaces	No	No
F4 OAM and F5 OAM (ATM administration)	No	No
FDL (facilities data link)	No	No
Firewall	Yes	Yes
Frame Relay	Yes	Yes
ICMP unreachable messages for packets reaching null 0 interfaces with static routes	Yes	Yes

Table 11: OCx/STMx POS and OC48 Modules (*continued*)

Protocol or Application	OCx/STMx POS Line Modules with OC3-4 I/O Modules	OCx/STMx POS Line Modules with OC12/STM4 I/O Modules
ICR	No	No
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	No	No
IS-IS	Yes	Yes
J-Flow Statistics	Yes	Yes
L2TP/IPSec	No	No
LAC support—access side	No	No
LAC support—peer side	Yes	Yes
LNS support—peer side	Yes	Yes
Local loopback	No	No
MDL (maintenance data link)	No	No
Mobile IP home agent	No	No
MPLS	Yes	Yes (Layer 2 over MPLS is not supported)
Multilink Frame Relay	No	No
Multilink PPP	No	No
Network Address Translation (NAT)	Yes	Yes

Table 11: OCx/STMx POS and OC48 Modules (*continued*)

Protocol or Application	OCx/STMx POS Line Modules with OC3-4 I/O Modules	OCx/STMx POS Line Modules with OC12/STM4 I/O Modules
NBMA (multipoint ATM)	No	No
OSPF	Yes	Yes
Packet Mirroring	Yes	Yes
Packet over SONET	Yes	Yes
PPP	Yes	Yes
PPPoE	No	No
Remote loopback	No	No
RIP	Yes	Yes
Subscriber interfaces (static)	Yes (over POS)	Yes (over POS)
Subscriber interfaces (dynamic)	No	No
Transparent bridging	No	No
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)	No	No
VPLS (virtual core interfaces)	Yes	Yes
VRRP	No	No

## Service Modules

Table 12: Service Modules

Protocol or Application	Service Line Module (SM)
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	No
APS/MSP	No
ATM	No

Table 12: Service Modules (*continued*)

Protocol or Application	Service Line Module (SM)
BERT	No
BFD	No
BGP	Yes
BGP/MPLS VPNs	No
Bridged Ethernet	No
Bridged IP	No
Cisco HDLC	No
DHCP external server	No
DHCP local server	No
DVMRP and GRE support—access side	No
DVMRP and GRE support—server side	Yes (over dedicated tunnel server ports)
Dynamic interfaces	No
F4 OAM and F5 OAM (ATM administration)	No
FDL (facilities data link)	No
Firewall	Yes
Frame Relay	No
ICMP unreachable messages for packets reaching null 0 interfaces with static routes	Yes
ICR	No
IEEE 802.3ad link aggregation	No
IEEE 802.3ah OAM link-fault management	No
IP	Yes
IP multicast	Yes
IP reassembly for tunneled packets	Yes

Table 12: Service Modules (*continued*)

Protocol or Application	Service Line Module (SM)
IPSec	No
IPv6	Yes
IPv6 multicast	Yes
IPv6 neighbor discovery	Yes
IS-IS	Yes
J-Flow Statistics	Yes
L2TP/IPSec	No
LAC support—access side	No
LAC support—peer side	No
LNS support—peer side	Yes
Local loopback	No
MDL (maintenance data link)	No
Mobile IP home agent	Yes
MPLS	No (over GRE only)
Multilink Frame Relay	No
Multilink PPP	Yes (with fragmentation and reassembly; dynamic only)
Network Address Translation (NAT)	Yes
NBMA (multipoint ATM)	No
OSPF	Yes
Packet Mirroring	Yes
Packet over SONET	No
PPP	Yes (dynamic only)
PPPoE	No
Remote loopback	No

Table 12: Service Modules (*continued*)

Protocol or Application	Service Line Module (SM)
RIP	Yes
Subscriber interfaces (static)	Yes (GRE tunnels only)
Subscriber interfaces (dynamic)	Yes (over GRE tunnels only)
Transparent bridging	No
Tunnel-server ports	Yes (dedicated only)
Unified ISSU	Yes
VPLS (network interfaces)	No
VPLS (virtual core interfaces)	No
VRRP	No

## Unchannelized T3 Modules

Table 13: Unchannelized T3 Modules

Protocol or Application	COCX-F3 Line Modules with CT3/T3 12 I/O Modules	OCx/STMx ATM Line Modules with 4xDS3 ATM I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	No
ATM (point-to-point)	No	Yes
BERT	Yes	No
BFD	No	No
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	No	Yes
Bridged IP	No	Yes
Cisco HDLC	Yes	No
DHCP external server	No	Yes



Table 13: Unchannelized T3 Modules (*continued*)

Protocol or Application	COCX-F3 Line Modules with CT3/T3 12 I/O Modules	OCx/STMx ATM Line Modules with 4xDS3 ATM I/O Modules
DHCP local server	No	Yes
DVMRP and GRE support—access side	No	No
DVMRP and GRE support—server side	Yes	Yes
Dynamic interfaces	No	Yes
F4 OAM and F5 OAM (ATM administration)	No	Yes
FDL (facilities data link)	No	No
Firewall	Yes	Yes
Frame Relay	Yes	No
ICMP unreachable messages for packets reaching null 0 interfaces with static routes	Yes	Yes
ICR	No	No
IEEE 802.3ad link aggregation	No	No
IEEE 802.3ah OAM link-fault management	No	No
IP	Yes	Yes
IP multicast	No	No
IP reassembly for tunneled packets	No	No
IPSec	No	No
IPv6	No	No
IPv6 multicast	No	No
IPv6 neighbor discovery	No	No
IS-IS	Yes	Yes
J-Flow Statistics	Yes	Yes
L2TP/IPSec	No	No

Table 13: Unchannelized T3 Modules (*continued*)

Protocol or Application	COCX-F3 Line Modules with CT3/T3 12 I/O Modules	OCx/STMx ATM Line Modules with 4xDS3 ATM I/O Modules
LAC support—access side	No	Yes
LAC support—peer side	No	Yes
LNS support—peer side	No	Yes
Local loopback	Yes	No
MDL (maintenance data link)	Yes	No
Mobile IP home agent	No	No
MPLS	Yes (over PPP and Cisco HDLC; also supports Martini encapsulation of HDLC and Frame Relay over MPLS)	Yes
Multilink Frame Relay	Yes	No
Multilink PPP	Yes (with fragmentation and reassembly)	No
Network Address Translation (NAT)	Yes	Yes
NBMA (multipoint ATM)	No	Yes
OSPF	Yes	Yes
Packet Mirroring	Yes	Yes
Packet over SONET	No	No
PPP	Yes	Yes
PPPoE	No	Yes
Remote loopback	Yes	No
RIP	Yes	Yes
Subscriber interfaces (static)	Yes	Yes (over bridged Ethernet and IPoA)
Subscriber interfaces (dynamic)	Yes	Yes (over bridged Ethernet)
Transparent bridging	No	Yes
Tunnel-server ports	No	No

Table 13: Unchannelized T3 Modules (*continued*)

Protocol or Application	COCX-F3 Line Modules with CT3/T3 12 I/O Modules	OCx/STMx ATM Line Modules with 4xDS3 ATM I/O Modules
Unified ISSU	No	Yes
VPLS (network interfaces)	No	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 93](#)
- [Redundancy Status on page 97](#)

## 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 14 on page 93](#) lists the functions of the module and port status LEDs.

**Table 14: 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 14: 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 <a href="#">"Redundancy Status" on page 97</a> .  <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
Ethernet line modules	ACTIVITY	Ethernet	Green	Blinks when Ethernet traffic on link	No Ethernet traffic on link
	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 LED goes out when both the DCE and the clock source are available.  If the port is configured as DCE, the LED goes out when the DTE is available.

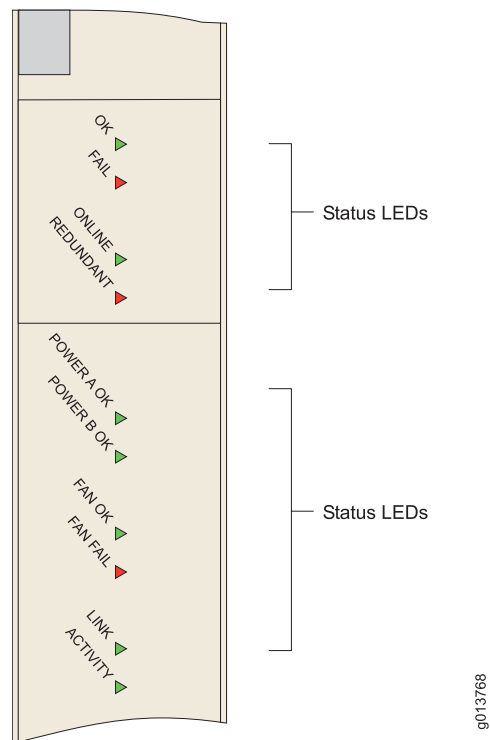
Table 14: LED Identification and Activity Descriptions (*continued*)

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 96](#))
- Ethernet line module ([Figure 2 on page 97](#))
- Other line modules ([Figure 3 on page 97](#))

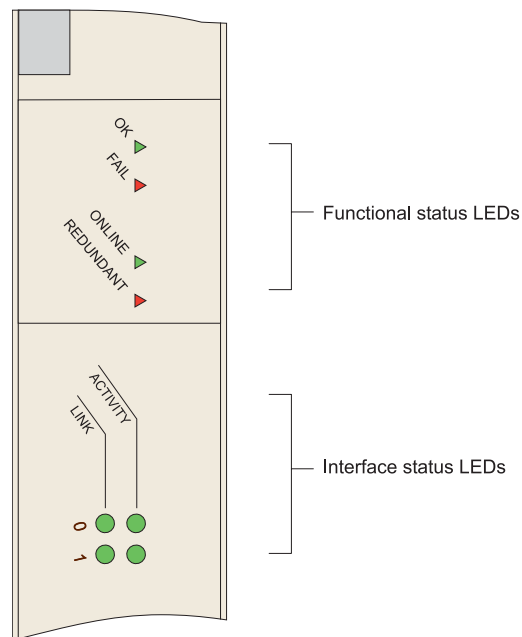
Figure 1: SRP Module LEDs



**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)

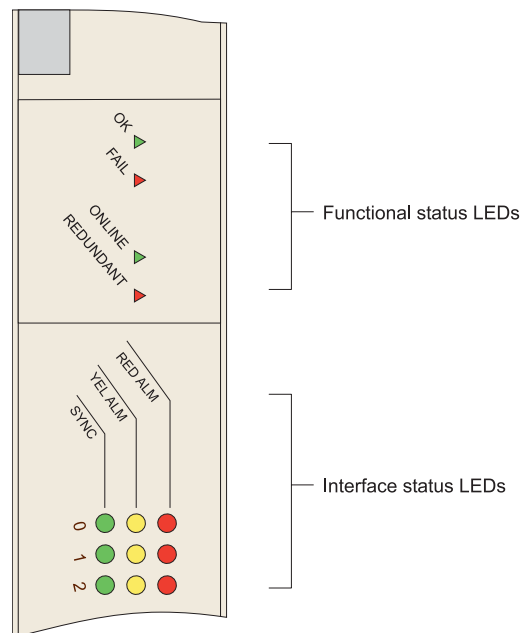


Figure 2: FE2 Module LEDs



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 15 on page 98](#).



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

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**Table 15: 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 99](#)

## Module Name Cross-Reference Information

Use [Table 16 on page 99](#) to find the label name, software display name, and model number of a module.

**Table 16: 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 16: 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 16: 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 103](#)

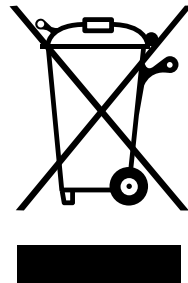
## Product Reclamation and Recycling Program

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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.





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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.