



**E-series™ Routing Platforms**

## **ERX™ Module Guide**

*Release 9.3.x*

**Juniper Networks, Inc.**

1194 North Mathilda Avenue  
Sunnyvale, California 94089  
USA

408-745-2000

**[www.juniper.net](http://www.juniper.net)**

Part Number: 162-02000-00, Revision A00

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 E-series routers: ERX-14xx models, ERX-7xx models, and the ERX-310 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 *JUNOS 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 three appendixes:

- Module Protocol Support on page 107
- Module LEDs on page 133
- Product Reclamation and Recycling Program on page 139

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

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

**Table 1: ERX Module Combinations**

Combination Name and Type	Line Module Label	I/O Module Label	First JUNOS <sup>e</sup> Support	Page
<b>Channelized OC3/STM1</b>				
cOC3/STM1 multimode	cOCx/STMx F0	cOC3 STM1 F0 I/O	2.2.0	9
		MULTIMODE		
cOC3/STM1 single-mode intermediate reach	cOCx/STMx F0	cOC3 STM1 F0 I/O	2.2.0	11
		SINGLE MODE		
cOC3/STM1 single-mode long reach	cOCx/STMx F0	cOC3 STM1 F0 I/O	2.2.0	13
		LONG HAUL		
<b>Channelized OC12/STM4</b>				
cOC12/STM4 multimode without APS/MSP redundancy	cOCx/STMx F0	cOC12 STM4 F0 I/O	2.2.0	15
		MULTI MODE		
cOC12/STM4 single-mode intermediate reach without APS/MSP redundancy	cOCx/STMx F0	cOC12 STM4 F0 I/O	2.2.0	17
		SINGLE MODE		
cOC12/STM4 single-mode intermediate reach with APS/MSP redundancy	cOCx/STMx F0	COC12 F0 APS SINGLE MODE	6.1.3, 7.0.2, 7.2.0	19
cOC12/STM4 single-mode long reach	cOCx/STMx F0	cOC12 STM4	2.2.0	21
		LONG HAUL		
<b>Channelized T3</b>				
CT3/T3 12 (12 ports)	CT3/T3-F0	CT3/T3 12 I/O	3.2.0	23
<b>E3</b>				
E3 Frame (12 ports)	COCX-F3	E3-12	4.0.2	24
		FRAME I/O		
<b>Fast Ethernet</b>				
FE-8 (8 ports) (256-MB memory)	GE/FE	FE-8 I/O	5.0.0	25
FE-8 SFP (8 ports) (256-MB memory)	GE/FE	FE-8 SFP I/O	6.0.0	26
<b>Gigabit Ethernet (1-port)</b>				
GE 1000Base-SX (256-MB memory)	GE/FE	GE I/O SFP	5.0.0	28

**Table 1: ERX Module Combinations** *(continued)*

Combination Name and Type	Line Module Label	I/O Module Label	First JUNOS <sup>e</sup> Support	Page
GE 1000Base-LH (256-MB memory)	GE/FE	GE I/O SFP	5.0.0	30
GE 1000Base-ZX (256-MB memory)	GE/FE	GE I/O SFP	5.0.0	32
GE multimode	GE/FE	GE I/O	2.0.0	34
		MULTI MODE		
GE single-mode	GE/FE	GE I/O	2.0.0	36
		SINGLE MODE		
<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	38
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	40
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	42
<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	44
GE High Density (8 ports)	GE-HDE	GE-8 I/O	7.0.0	46

**Table 1: ERX Module Combinations** *(continued)*

Combination Name and Type	Line Module Label	I/O Module Label	First JUNOS <sup>e</sup> Support	Page
<b>IPSec Service</b>				
IPSec Service	IPSEC SERVICE	No I/O module	4.0.2	48
<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	49
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)	51
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	53
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)	55
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	57
<b>OC3/STM1 GE/FE</b>				
OC3/STM1 GE/FE	OC3/STM1 GE/FE	OC3-2 GE APS I/O	6.1.0	59
<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	63
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)	65
OC3/STM1 POS single-mode intermediate reach without APS/MSP redundancy	OCx/STMx POS	OC3-4 I/O SINGLE MODE	2.0.0	67

**Table 1: ERX Module Combinations** *(continued)*

Combination Name and Type	Line Module Label	I/O Module Label	First JUNOS <sup>e</sup> 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)	69
OC3/STM1 POS single-mode long reach	OCx/STMx POS	OC3-4 I/O  LONG HAUL	2.0.0	71
<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	73
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)	75
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	77
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)	79
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	81
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)	83
<b>OC12/STM4 POS</b>				
OC12/STM4 POS multimode without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O  MULTI MODE	2.0.0	85

**Table 1: ERX Module Combinations** *(continued)*

Combination Name and Type	Line Module Label	I/O Module Label	First JUNOS <sup>e</sup> Support	Page
OC12/STM4 POS multimode with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS	2.0.0	87
		MULTI MODE		
OC12/STM4 POS single-mode intermediate reach without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O	2.0.0	89
		SINGLE MODE		
OC12/STM4 POS single-mode intermediate reach with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS	2.0.0	91
		SINGLE MODE		
OC12/STM4 POS single-mode long reach without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O	2.0.0	93
		LONG HAUL		
OC12/STM4 POS single-mode long reach with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS	2.0.0	95
		LONG HAUL		
<b>OC48/STM16</b>				
OC48/STM16 POS single-mode short reach	OC48	OC48 FRAME APS	4.1.x	97
<b>Service Module (SM)</b>				
SM	SERVICE MODULE	No I/O module	5.1.0	98
<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	99
SRP-5G + (2-GB memory)	SRP-5G +	SRP I/O	4.1.3, 5.0.4, 5.1.2, 5.2.0	100
SRP-10G (2-GB memory)	SRP-10G	SRP I/O	4.1.3, 5.0.4, 5.1.2, 5.2.0	101
SRP-40G PLUS (2-GB memory)	SRP-40G PLUS	SRP I/O	4.0.0	102

**Table 1: ERX Module Combinations** *(continued)*

Combination Name and Type	Line Module Label	I/O Module Label	First JUNOS <sup>e</sup> Support	Page
SRP-SE10G (1-GB memory)	SRP-SE10G	SRP-SE I/O	5.3.0	103
<b>T3</b>				
T3 ATM (4 ports)	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	4xDS3 ATM I/O	4.1.0 (128 MB)  5.0.0 (256 MB)	104
T3 Frame (12 ports)	COCX-F3	CT3/T3 12 I/O	4.0.2	105



## cOC3/STM1 Multimode Module Combination

<b>Line module label</b>	cOCx/STMx F0
<b>I/O module label</b>	cOC3 STM1 F0 I/O  MULTI MODE
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.2.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ OC3/STM1 channelized to DS3, DS1, E1, and DS0</li> <li>■ Supports either E1 or T1 operation, but not E1 and T1 operation simultaneously</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM1</li> <li>■ DS3</li> <li>■ T1, E1</li> <li>■ DS0</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “Channelized OCx/STMx Modules” on page 107 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ Up to four SC full duplex connectors</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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 4, Configuring Channelized OCx/STMx Interfaces</i>.</li> </ul>

## cOC3/STM1 Single-Mode Intermediate Reach Module Combination

<b>Line module label</b>	cOCx/STMx F0
<b>I/O module label</b>	cOC3 STM1 F0 I/O  SINGLE MODE
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.2.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ OC3/STM1 channelized to DS3, DS1, E1, and DS0</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM1</li> <li>■ DS3, DS1</li> <li>■ T1, E1</li> <li>■ DS0</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Channelized OCx/STMx Modules” on page 107 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<ul style="list-style-type: none"><li>■ Up to four SC full duplex connectors</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>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 133.</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>■ See <i>Monitoring Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 4, Configuring Channelized OCx/STMx Interfaces</i>.</li></ul>

## cOC3/STM1 Single-Mode Long Reach Module Combination

<b>Line module label</b>	cOCx/STMx F0
<b>I/O module label</b>	cOC3 STM1 F0 I/O  LONG HAUL
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.2.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ OC3/STM1 channelized to DS3, DS1, E1, and DS0</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM1</li> <li>■ DS3, DS1</li> <li>■ T1, E1</li> <li>■ DS0</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Channelized OCx/STMx Modules” on page 107 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ Up to four SC full duplex connectors</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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 4, Configuring Channelized OCx/STMx Interfaces</i>.</li> </ul>

## cOC12/STM4 Multimode Without APS/MSP Redundancy Module Combination

<b>Line module label</b>	cOCx/STMx F0
<b>I/O module label</b>	cOC12 STM4 F0 I/O MULTI MODE
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.2.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ OC12/STM4 channelized to DS3, DS1, E1, and DS0</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ OC3/STM1</li> <li>■ DS3, DS1</li> <li>■ T1, E1</li> <li>■ DS0</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “Channelized OCx/STMx Modules” on page 107 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ SC full duplex connector</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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 4, Configuring Channelized OCx/STMx Interfaces</i>.</li> </ul>



## cOC12/STM4 Single-Mode Intermediate Reach Without APS/MSP Redundancy Module Combination

<b>Line module label</b>	cOCx/STMx F0
<b>I/O module label</b>	cOC12 STM4 F0 I/O  SINGLE MODE
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	■ First supported: 2.2.0 ■ Final supported: Not applicable
<b>Description</b>	■ 130 W ■ OC12/STM4 channelized to DS3, DS1, E1, and DS0
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ OC12/STM4 ■ OC3/STM1 ■ DS3, DS1 ■ T1, E1 ■ DS0 ■ HDLC framing
<b>Software features</b>	■ See “Channelized OCx/STMx Modules” on page 107 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ 1:N redundancy ■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.

<b>Cables and connectors</b>	<ul style="list-style-type: none"><li>■ SC full duplex connector</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>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 133.</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>■ See <i>Monitoring Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 4, Configuring Channelized OCx/STMx Interfaces</i>.</li></ul>

## cOC12/STM4 Single-Mode Intermediate Reach With APS/MSP Redundancy Module Combination

<b>Line module label</b>	cOCx/STMx F0
<b>I/O module label</b>	COC12 F0 APS SINGLE MODE
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>■ 2</li> <li>■ 1 active, 1 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 6.1.3 or later 6.1.x release, 7.0.2 or later 7.0.x release, 7.2.0 and higher-numbered release</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ OC12/STM4 channelized to DS3, DS1, E1, and DS0</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ EFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ OC3/STM1</li> <li>■ DS3, DS1</li> <li>■ T1, E1</li> <li>■ DS0</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Channelized OCx/STMx Modules” on page 107 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ SC full duplex connector</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: -7 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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 4, Configuring Channelized OCx/STMx Interfaces</i>.</li> </ul>

## cOC12/STM4 Single-Mode Long Reach Module Combination

<b>Line module label</b>	cOCx/STMx F0
<b>I/O module label</b>	cOC12 STM4 LONG HAUL
<b>Number of I/O ports</b>	■ 1 active, 1 redundant
<b>Software release</b>	■ First supported: 2.2.0 ■ Final supported: Not applicable
<b>Description</b>	■ 130 W ■ OC12/STM4 channelized to DS3, DS1, E1, and DS0
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ OC12/STM4 ■ OC3/STM1 ■ DS3, DS1 ■ T1, E1 ■ DS0 ■ HDLC framing
<b>Software features</b>	■ See “Channelized OCx/STMx Modules” on page 107 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ 1:N redundancy ■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.

<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ SC full duplex connector</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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 4, Configuring Channelized OCx/STMx Interfaces</i>.</li> </ul>

## CT3/T3 12 Module Combination (12 Ports)

<b>Line module label</b>	CT3/T3-F0
<b>I/O module label</b>	CT3/T3 12 I/O
<b>Number of I/O ports</b>	■ 12
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 3.2.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ Channelized and unchannelized T3</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ DS3, DS1, DS0</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “Channelized T3 Modules” on page 110 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ BT43 SMB connector</li> <li>■ Cable that adapts to 75-ohm BNC is available.</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> <li>■ See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 1, Configuring Channelized T3 Interfaces</i> .

## E3 Frame Module Combination (12 Ports)

<b>Line module label</b>	COCX-F3
<b>I/O module label</b>	E3-12 FRAME I/O
<b>Number of I/O ports</b>	■ 12
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 4.0.2</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 135 W</li> <li>■ Unchannelized E3 for Frame</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ E3</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Unchannelized E3 Modules” on page 126 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ BT43 SMB connector</li> <li>■ Cable that adapts to 75-ohm BNC is available.</li> <li>■ The transmitted signal complies with ITUT G.703, Physical/electrical characteristics of hierarchical digital interfaces (November 2001) for cable lengths from 0–137 m (0–450 feet).</li> <li>■ See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 2, Configuring T3 and E3 Interfaces</i>.</li> </ul>



## FE-8 Module Combination (8 Ports) (256-MB Memory)

<b>Line module label</b>	GE/FE
<b>I/O module label</b>	FE-8 I/O
<b>Number of I/O ports</b>	■ 8
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 5.0.0</li> <li>■ Final supported: Not applicable</li> <li>■ The GE/FE line module must have a minimum of 256 MB of memory to be used with JUNOS Release 5.3.0 or a higher-numbered release.</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ Fast Ethernet</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ IEEE 802.3 standards compliance</li> <li>■ 10/100Base-T</li> </ul>
<b>Software features</b>	■ See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	■ Not applicable
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ RJ-45 connectors</li> <li>■ For 10-Mbps operation, use CAT 3, 4, or 5 UTP cable.</li> <li>■ For 100-Mbps operation, use only CAT 5 UTP cable.</li> <li>■ The transmitted signal complies with IEEE 802.3/802.3u for cable lengths up to 100 m (328 feet).</li> <li>■ See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Ethernet Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i> .

## FE-8 SFP Module Combination (8 Ports) (256-MB Memory)

<b>Line module label</b>	GE/FE
<b>I/O module label</b>	FE-8 SFP I/O
<b>Number of I/O ports</b>	■ 8
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 6.0.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ Fast Ethernet</li> <li>■ The FE-8 SFP I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ IEEE 802.3 standards compliance</li> <li>■ 100Base-FX</li> </ul>
<b>Software features</b>	■ See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	■ Not applicable
<b>Cables and connectors (single-mode fiber)</b>	<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: 1300 nm</li> <li>■ Rx input power: <ul style="list-style-type: none"> <li>■ min: -28 dBm</li> <li>■ max: -14 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>

<b>Cables and connectors (multimode fiber)</b>	<ul style="list-style-type: none"><li>■ LC full duplex</li><li>■ Tx power: -20 dBm minimum and -14 dBm maximum</li><li>■ Center wavelength: 850 nm</li><li>■ Rx input power: -31 dBm minimum and -14 dBm maximum</li><li>■ Rated for 2 km (1.2 miles) over 62.5/125-micron core cable</li><li>■ See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 133.</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>■ See <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li></ul>

## GE 1000Base-SX Module Combination (1 Port) (256-MB Memory)

<b>Line module label</b>	GE/FE
<b>I/O module label</b>	GE I/O SFP
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>1 active, 1 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>First supported: 5.0.0</li> <li>Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>130 W</li> <li>Gigabit Ethernet</li> <li>256 MB of memory</li> <li>The 128-MB version has reached end-of-life.</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> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>EFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-SX</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>ERX-7xx models</li> <li>ERX-14xx models</li> <li>ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
<b>Cables and connectors (copper SFP)</b>	<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: -20 dBm
    - max: -0 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 133.

- Alarms, errors, and events**
- See *Monitoring Ethernet Interfaces* in *JUNOS 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

## GE 1000Base-LH Module Combination (1 Port) (256-MB Memory)

<b>Line module label</b>	GE/FE
<b>I/O module label</b>	GE I/O SFP
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>1 active, 1 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>First supported: 5.0.0</li> <li>Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>130 W</li> <li>Gigabit Ethernet</li> <li>256 MB of memory</li> <li>The 128-MB version has reached end-of-life.</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> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>EFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-LH</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>ERX-7xx models</li> <li>ERX-14xx models</li> <li>ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
<b>Cables and connectors (copper SFP)</b>	<ul style="list-style-type: none"> <li>Maximum range is 100 meters on CAT5 cable.</li> </ul>

<b>Cables and connectors (LX/LH)</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>

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

<b>Fiber Type</b>	<b>Nominal Wavelength (nm)</b>	<b>Maximum Operating Range (kilometers)</b>
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 1000Base-ZX Module Combination (1 Port) (256-MB Memory)

<b>Line module label</b>	GE/FE
<b>I/O module label</b>	GE I/O SFP
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>1 active, 1 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>First supported: 5.0.0</li> <li>Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>130 W</li> <li>Gigabit Ethernet</li> <li>256 MB of memory</li> <li>The 128-MB version has reached end-of-life.</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> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>EFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-ZX</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>ERX-7xx models</li> <li>ERX-14xx models</li> <li>ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
<b>Cables and connectors (copper SFP)</b>	<ul style="list-style-type: none"> <li>Maximum range is 100 meters on CAT5 cable.</li> </ul>



<b>Cables and connectors (ZX)</b>	<ul style="list-style-type: none"> <li>■ LC full duplex</li> <li>■ Tx power: <ul style="list-style-type: none"> <li>■ min: -2 dBm</li> <li>■ max: 3 dBm</li> </ul> </li> <li>■ Center wavelength: 1550 nm</li> <li>■ Rx input power: <ul style="list-style-type: none"> <li>■ min: -22 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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>

**Table 4: Single-strand SFPs Pairing**

<b>Fiber Type</b>	<b>Nominal Wavelength (nm)</b>	<b>Maximum Operating Range (kilometers)</b>
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 Multimode Module Combination (1 Port)

<b>Line module label</b>	GE/FE
<b>I/O module label</b>	GE I/O MULTI MODE
<b>Number of I/O ports</b>	■ 1 active, 1 redundant
<b>Software release</b>	■ First supported: 2.0.0 ■ Final supported: Not applicable
<b>Description</b>	■ 130 W ■ Gigabit Ethernet ■ This module combination has been superseded by a newer assembly; however, it is supported by current software.
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ Ethernet (IEEE 802.3z)
<b>Software features</b>	■ See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ Not applicable
<b>Cables and connectors</b>	■ SC 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 <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.

**LEDs**

- See “Module LEDs” on page 133.

**Alarms, errors, and events**

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

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

<b>Line module label</b>	GE/FE
<b>I/O module label</b>	GE I/O  SINGLE MODE
<b>Number of I/O ports</b>	■ 1 active, 1 redundant
<b>Software release</b>	■ First supported: 2.0.0 ■ Final supported: Not applicable
<b>Description</b>	■ 130 W ■ Gigabit Ethernet ■ This module combination has been superseded by a newer assembly; however, it is supported by current software.
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ Ethernet (IEEE 802.3z)
<b>Software features</b>	■ See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ Not applicable
<b>Cables and connectors</b>	■ SC full duplex ■ Tx power: ■ min: -11 dBm ■ max: -3 dBm ■ Center wavelength: 1300 nm ■ Rx input power: ■ min: -20 dBm ■ max: -3 dBm ■ Rated for 550 m (601 yards) over 62.5-micron core or 50-micron core MM fiber ■ Rated for 5 km (3.1 miles) over 10-micron core cable ■ See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.

<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i> .

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

<b>Line module label</b>	GE-2
<b>I/O module label</b>	GE-2 SFP I/O or 2XGE APS I/O SFP or GE-2 APS I/O SFP
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>■ 2 active, 2 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 5.3.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<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>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ FFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3z)</li> <li>■ 1000Base-SX</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-1440 router</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-40G</li> <li>■ SRP-40G PLUS</li> <li>■ SRP-SE10G</li> </ul>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ Not applicable</li> </ul>
<b>Cables and connectors (copper SFP)</b>	<ul style="list-style-type: none"> <li>■ Maximum range is 100 meters on CAT5 cable.</li> </ul>

<b>Cables and connectors (SX)</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>

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

<b>Fiber Type</b>	<b>Nominal Wavelength (nm)</b>	<b>Maximum Operating Range (kilometers)</b>
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)

<b>Line module label</b>	GE-2
<b>I/O module label</b>	GE-2 SFP I/O or 2XGE APS I/O SFP or GE-2 APS I/O SFP
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>2 active, 2 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>First supported: 5.3.0</li> <li>Final supported: Not applicable</li> </ul>
<b>Description</b>	<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>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>FFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-LH</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>ERX-1440 router</li> <li>ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>SRP-40G</li> <li>SRP-40G PLUS</li> <li>SRP-SE10G</li> </ul>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
<b>Cables and connectors (copper SFP)</b>	<ul style="list-style-type: none"> <li>Maximum range is 100 meters on CAT5 cable.</li> </ul>



<b>Cables and connectors (LX/LH)</b>	<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>
<b>Cables and connectors (single-mode LX40)</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS 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

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

<b>Line module label</b>	GE-2
<b>I/O module label</b>	GE-2 SFP I/O <i>or</i> 2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>■ 2 active, 2 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 5.3.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<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>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ FFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3z)</li> <li>■ 1000Base-ZX</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-1440 router</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-40G</li> <li>■ SRP-40G PLUS</li> <li>■ SRP-SE10G</li> </ul>
<b>Module redundancy support</b>	<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 133.

**Alarms, errors, and events**

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

**Table 7: Single-strand SFPs Pairing**

<b>Fiber Type</b>	<b>Nominal Wavelength (nm)</b>	<b>Maximum Operating Range (kilometers)</b>
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)

<b>Line module label</b>	GE-HDE
<b>I/O module label</b>	GE-2 SFP I/O or 2XGE APS I/O SFP or GE-2 APS I/O SFP
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>2 active, 2 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>First supported: 7.0.0</li> <li>Final supported: Not applicable</li> </ul>
<b>Description</b>	<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>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>FFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>Ethernet (IEEE 802.3z)</li> <li>1000Base-LH</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>ERX-1440 router</li> <li>ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>SRP-40G</li> <li>SRP-40G PLUS</li> <li>SRP-SE10G</li> </ul>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>Not applicable</li> </ul>
<b>Cables and connectors (copper SFP)</b>	<ul style="list-style-type: none"> <li>Maximum range is 100 meters on CAT5 cable.</li> </ul>

<b>Cables and connectors (LX/LH)</b>	<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>
<b>Cables and connectors (single-mode LX40)</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>

**Table 8: 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)

<b>Line module label</b>	GE-HDE
<b>I/O module label</b>	GE-8 I/O
<b>Number of I/O ports</b>	■ 8
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 7.0.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<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>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	■ FFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3z)</li> <li>■ 1000Base-LH</li> </ul>
<b>Software features</b>	■ See “Ethernet Modules” on page 112 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-1440 router</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-40G</li> <li>■ SRP-40G PLUS</li> <li>■ SRP-SE10G</li> </ul>
<b>Module redundancy support</b>	■ Not applicable

<b>Cables and connectors</b>	<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>
<b>Cables and connectors (single-mode LX40)</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Ethernet Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces</i>.</li> </ul>

**Table 9: Single-strand SFPs Pairing**

<b>Fiber Type</b>	<b>Nominal Wavelength (nm)</b>	<b>Maximum Operating Range (kilometers)</b>
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

## IPSec Service Module Combination

<b>Line module label</b>	IPSEC SERVICE
<b>I/O module label</b>	No I/O module
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>■ Not applicable</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 4.0.2</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ IPSec Tunnel Service</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ EFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ IPSec tunnels</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Service Modules” on page 124 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ Multiple IPSec Service modules provide redundancy.</li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ Not applicable</li> </ul>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Tunnel-Service Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Managing Tunnel-Service and IPSec-Service Interfaces</i>.</li> </ul>



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

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC3-4 I/O  MULTI MODE
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	<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>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM1</li> <li>■ ATM:AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ SC full duplex connector</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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

## OC3/STM1 ATM Multimode With APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	4XOC3  APS I/O  MULTI MODE
<b>Number of I/O ports</b>	■ 4 active, 4 redundant
<b>Software release</b>	<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 JUNOS Release 5.3.0 or a higher-numbered release.</li> </ul>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM-1</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

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

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC3-4 I/O  SINGLE MODE
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	<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>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM1</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 133.</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li></ul>

## OC3/STM1 ATM Single-Mode Intermediate Reach With APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	4XOC3  APS I/O  SINGLE MODE
<b>Number of I/O ports</b>	■ 4 active, 4 redundant
<b>Software release</b>	<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 JUNOS Release 5.3.0 or a higher-numbered release.</li> </ul>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM-1</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 133.</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li></ul>



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

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC3-4 I/O  LONG HAUL
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	<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>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM1</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

## OC3/STM1 GE/FE Module Combination

<b>Line module label</b>	OC3/STM1 GE/FE
<b>I/O module label</b>	OC3-2 GE APS I/O
<b>Number of I/O ports</b>	<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>
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 6.1.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<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>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ EFA ASIC</li> </ul>
<b>Capability</b>	<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>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx GE/FE Modules” on page 117 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ Not applicable</li> </ul>

**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.

<b>Cables and connectors (GE single-mode LX40)</b>	<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>
<b>Cables and connectors (GE SX)</b>	<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>
<b>Cables and connectors (GE ZX)</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces.</i></li> </ul>

**Table 10: Single-strand SFPs Pairing**

Fiber Type	Nominal Wavelength (nm)	Maximum Operating Range (kilometers)
9 microns	■ TX 1310, RX 1550	10 (6.2 miles), matching SFP must have the same operating range
	■ Pairs with TX 1550 / RX 1310	

**Table 10: Single-strand SFPs Pairing (continued)**

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

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC3-4 I/O MULTI MODE
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	■ First supported: 2.0.0 ■ Final supported: Not applicable
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ OC3/STM1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ 1:N redundancy ■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>



## OC3/STM1 POS Multimode With APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	4XOC3 APS I/O MULTI MODE
<b>Number of I/O ports</b>	■ 4 active, 4 redundant
<b>Software release</b>	■ First supported: 5.1.2, 5.2.0 (APS/MSP) ■ Final supported: Not applicable
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ OC3/STM-1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ 1:N redundancy ■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

## OC3/STM1 POS Single-Mode Intermediate Reach Without APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC3-4 I/O SINGLE MODE
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	■ First supported: 2.0.0 ■ Final supported: Not applicable
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ OC3/STM1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ 1:N redundancy ■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.
<b>Cables and connectors</b>	■ 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 <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.

**LEDs**

- See “Module LEDs” on page 133.

**Alarms, errors, and events**

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

## OC3/STM1 POS Single-Mode Intermediate Reach With APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	4XOC3  APS I/O  SINGLE MODE
<b>Number of I/O ports</b>	■ 4 active, 4 redundant
<b>Software release</b>	■ First supported: 5.1.2, 5.2.0 (APS/MSP) ■ Final supported: Not applicable
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ OC3/STM1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ 1:N redundancy ■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

## OC3/STM1 POS Single-Mode Long Reach Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC3-4 I/O  LONG HAUL
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	■ First supported: 2.0.0 ■ Final supported: Not applicable
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ OC3/STM1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ 1:N redundancy ■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.
<b>Cables and connectors</b>	■ 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 <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.

<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring SONET/SDH Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces.</i>



## OC12/STM4 ATM Multimode Without APS/MSP Redundancy Module Combination (256-MB Memory)

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC12 STM4 I/O  MULTI MODE
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	<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>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

## OC12/STM4 ATM Multimode With APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC12 STM4 APS MULTI MODE
<b>Number of I/O ports</b>	■ 1 active, 1 redundant
<b>Software release</b>	<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 JUNOS Release 5.3.0 or a higher-numbered release.</li> </ul>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

## OC12/STM4 ATM Single-Mode Intermediate Reach Without APS/MSP Redundancy Module Combination (256-MB Memory)

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC12 STM4 I/O  SINGLE MODE
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	<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>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

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

<b>Line module label</b>	OCx/STMx ATM or OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC12 STM4 APS  SINGLE MODE
<b>Number of I/O ports</b>	■ 1 active, 1 redundant
<b>Software release</b>	<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 JUNOS Release 5.3.0 or a higher-numbered release.</li> </ul>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>



## OC12/STM4 ATM Single-Mode Long Reach Without APS/MSP Redundancy Module Combination (256-MB Memory)

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC12 STM4 I/O  LONG HAUL
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	<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>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

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

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	OC12 STM4 APS  LONG HAUL
<b>Number of I/O ports</b>	■ 1 active, 1 redundant
<b>Software release</b>	<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 JUNOS Release 5.3.0 or a higher-numbered release.</li> </ul>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	■ See “OCx/STMx ATM Modules” on page 119 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

## OC12/STM4 POS Multimode Without APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC12 STM4 I/O MULTI MODE
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.0.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 120 W</li> <li>■ Unchannelized, concatenated OC12/STM4 for POS</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>

## OC12/STM4 POS Multimode With APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC12 STM4 APS MULTI MODE
<b>Number of I/O ports</b>	■ 1 active, 1 redundant
<b>Software release</b>	■ First supported: 2.0.0 ■ Final supported: Not applicable
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC12/STM4 for POS
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ OC12/STM4 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-7xx models ■ ERX-14xx models ■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-5G + ■ SRP-10G ■ SRP-40G ■ SRP-40G PLUS ■ SRP-SE10G
<b>Module redundancy support</b>	■ 1:N redundancy ■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.

<b>Cables and connectors</b>	<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>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i>.</li> </ul>



## OC12/STM4 POS Single-Mode Intermediate Reach Without APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC12 STM4 I/O SINGLE MODE
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.0.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 120 W</li> <li>■ Unchannelized, concatenated OC12/STM4 for POS</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>
<b>Cables and connectors</b>	<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>

<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i> .

## OC12/STM4 POS Single-Mode Intermediate Reach With APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC12 STM4 APS SINGLE MODE
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>1 active, 1 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>First supported: 2.0.0</li> <li>Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>120 W</li> <li>Unchannelized, concatenated OC12/STM4 for POS</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>EFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>OC12/STM4</li> <li>HDLC framing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>ERX-7xx models</li> <li>ERX-14xx models</li> <li>ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>1:N redundancy</li> <li><b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>
<b>Cables and connectors</b>	<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>

<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i> .

## OC12/STM4 POS Single-Mode Long Reach Without APS/MSP Redundancy Module Combination

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC12 STM4 I/O LONG HAUL
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.0.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 120 W</li> <li>■ Unchannelized, concatenated OC12/STM4 for POS</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>
<b>Cables and connectors</b>	<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>

<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i> .

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

<b>Line module label</b>	OCx/STMx POS
<b>I/O module label</b>	OC12 STM4 APS LONG HAUL
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>■ 1 active, 1 redundant</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.0.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 120 W</li> <li>■ Unchannelized, concatenated OC12/STM4 for POS</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ EFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>
<b>Cables and connectors</b>	<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>

**LEDs**

- See “Module LEDs” on page 133.

**Alarms, errors, and events**

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



## OC48/STM16 POS Single-Mode Short Reach Module Combination

<b>Line module label</b>	OC48
<b>I/O module label</b>	OC48 FRAME APS
<b>Number of I/O ports</b>	■ 1
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 4.1.x</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 120 W</li> <li>■ Unchannelized, concatenated OC48/STM16 for POS</li> </ul>
<b>Type</b>	■ FFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC48/STM16</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 121 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	■ ERX-1440 router
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-40G</li> <li>■ SRP-40G PLUS</li> </ul>
<b>Module redundancy support</b>	■ Not applicable
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ LC full duplex connector</li> <li>■ Transmit power: <ul style="list-style-type: none"> <li>■ min: –10 dBm</li> <li>■ max: –3 dBm</li> </ul> </li> <li>■ Center wavelength: 1310 nm</li> <li>■ Receive input power: <ul style="list-style-type: none"> <li>■ min: –18 dBm</li> <li>■ max: –3 dBm</li> </ul> </li> <li>■ Rated for 2 km (1.2 miles) of 9-micron core cable</li> <li>■ See <i>ERX Hardware Guide, Chapter 5, Cabling ERX Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring SONET/SDH Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces</i> .

## Service Module (SM) Module Combination

<b>Line module label</b>	SERVICE MODULE
<b>I/O module label</b>	No I/O module
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>■ Not applicable</li> </ul>
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 5.1.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ Tunnel Service for IP tunnels, L2F tunnels, and LNS termination</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ EFA ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ IP tunnels</li> <li>■ LNS termination</li> <li>■ Network Address Translation</li> <li>■ Stateful firewall</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Service Modules” on page 124 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ Multiple SMs provide redundancy.</li> <li>■ See <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Managing Tunnel-Service and IPSec-Service Interfaces</i></li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ Not applicable</li> </ul>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 133.</li> </ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Tunnel-Service Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Managing Tunnel-Service and IPSec-Service Interfaces</i>.</li> </ul>

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

<b>Line module label</b>	SRP-5G +
<b>I/O module label</b>	SRP I/O
<b>Number of I/O ports</b>	■ 7
<b>Software release</b>	<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>
<b>Description</b>	<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>
<b>Type</b>	■ Not applicable
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3)</li> <li>■ 10/100Base-T</li> <li>■ RS-232</li> </ul>
<b>Software features</b>	■ Not applicable
<b>Model compatibility</b>	■ ERX-705 router
<b>SRP module compatibility</b>	■ SRP-5G +
<b>Module redundancy support</b>	■ 1:1 redundancy
<b>Cables and connectors</b>	<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>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules in JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules</i> .

## SRP-5G+ Module Combination (2-GB Memory)

<b>Line module label</b>	SRP-5G +
<b>I/O module label</b>	SRP I/O
<b>Number of I/O ports</b>	■ 7
<b>Software release</b>	<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>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 125 W</li> <li>■ Switch route processor (5 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> <li>■ The 512-MB version has reached end-of-life.</li> </ul>
<b>Type</b>	■ Not applicable
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3)</li> <li>■ 10/100Base-T</li> <li>■ RS-232</li> </ul>
<b>Software features</b>	■ Not applicable
<b>Model compatibility</b>	■ ERX-705 router
<b>SRP module compatibility</b>	■ SRP-5G +
<b>Module redundancy support</b>	■ 1:1 redundancy
<b>Cables and connectors</b>	<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>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules in JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules</i> .

## SRP-10G Module Combination (2-GB Memory)

<b>Line module label</b>	SRP-10G
<b>I/O module label</b>	SRP I/O
<b>Number of I/O ports</b>	■ 7
<b>Software release</b>	<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>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 125 W</li> <li>■ Switch route processor (10 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> <li>■ The 512-MB version has reached end-of-life.</li> </ul>
<b>Type</b>	■ Not applicable
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3)</li> <li>■ 10/100Base-T</li> <li>■ RS-232</li> </ul>
<b>Software features</b>	■ Not applicable
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-710 router</li> <li>■ ERX-1410 router</li> </ul>
<b>SRP module compatibility</b>	■ SRP-10G
<b>Module redundancy support</b>	■ 1:1 redundancy
<b>Cables and connectors</b>	<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>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules in JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules</i> .

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

<b>Line module label</b>	SRP-40G PLUS
<b>I/O module label</b>	SRP I/O
<b>Number of I/O ports</b>	■ 7
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 4.0.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<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>
<b>Type</b>	■ Not applicable
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3)</li> <li>■ 10/100Base-T</li> <li>■ RS-232</li> </ul>
<b>Software features</b>	■ Not applicable
<b>Model compatibility</b>	■ ERX-1440 router
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-40G</li> <li>■ SRP-40G PLUS</li> </ul>
<b>Module redundancy support</b>	■ 1:1 redundancy
<b>Cables and connectors</b>	<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>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules</i> .

## SRP-SE10G Module Combination (1-GB Memory)

<b>Line module label</b>	SRP-SE10G
<b>I/O module label</b>	SRP-SE I/O
<b>Number of I/O ports</b>	■ 2
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 5.3.0</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 35 W</li> <li>■ Switch route processor for ERX-310 router only (10 Gbps)</li> </ul>
<b>Type</b>	■ Not applicable
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3)</li> <li>■ 10/100Base-T</li> <li>■ RS-232</li> </ul>
<b>Software features</b>	■ Not applicable
<b>Model compatibility</b>	■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-SE10G
<b>Module redundancy support</b>	■ Not applicable
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <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>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 6, Managing Modules</i> .

## T3 ATM Module Combination (4 Ports)

<b>Line module label</b>	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM
<b>I/O module label</b>	4xDS3 ATM I/O
<b>Number of I/O ports</b>	■ 4
<b>Software release</b>	<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>
<b>Description</b>	<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>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	■ ATM/AAL5
<b>Software features</b>	■ See “Unchannelized T3 Modules” on page 129 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	■ 1:N redundancy
<b>Cables and connectors</b>	<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>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 2, Configuring T3 and E3 Interfaces</i> .



## T3 Frame Module Combination (12 Ports)

<b>Line module label</b>	COCX-F3
<b>I/O module label</b>	CT3/T3 12 I/O
<b>Number of I/O ports</b>	■ 12
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 4.0.2</li> <li>■ Final supported: Not applicable</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 135 W</li> <li>■ Unchannelized T3 for Frame</li> </ul>
<b>Type</b>	■ EFA ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ DS3</li> <li>■ Subrate DS3</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “Unchannelized T3 Modules” on page 129 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.
<b>Model compatibility</b>	<ul style="list-style-type: none"> <li>■ ERX-7xx models</li> <li>■ ERX-14xx models</li> <li>■ ERX-310 router</li> </ul>
<b>SRP module compatibility</b>	<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>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> <li>■ <b>NOTE:</b> Line module redundancy is not supported on the ERX-310 router.</li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ BT43 SMB</li> <li>■ Cable that adapts to 75-ohm BNC is available.</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>
<b>LEDs</b>	■ See “Module LEDs” on page 133.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 2, Configuring T3 and E3 Interfaces</i> .



## 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:

- Channelized OCx/STMx Modules on page 107
- Channelized T3 Modules on page 110
- Ethernet Modules on page 112
- OCx/STMx GE/FE Modules on page 117
- OCx/STMx ATM Modules on page 119
- OCx/STMx POS and OC48 Modules on page 121
- Service Modules on page 124
- Unchannelized E3 Modules on page 126
- Unchannelized T3 Modules on page 129

### Channelized OCx/STMx Modules

**Table 11: Channelized OCx/STMx Modules**

Protocol or Application	cOCx FO Line Module with cOC3/STM1 Modules	cOCx FO Line Module with cOC12/STM4 FO I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	Yes (single-mode intermediate reach only)
ATM (point-to-point)	No	No
BERT	Yes	Yes

**Table 11: Channelized OCx/STMx Modules** *(continued)*

Protocol or Application	cOCx FO Line Module with cOC3/STM1 Modules	cOCx FO Line Module with cOC12/STM4 FO I/O Modules
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	No	No
DHCP local server	No	No
Dynamic interfaces	No	No
DVMRP and GRE support—access side	Yes	No
DVMRP and GRE support—server side	Yes	No
F4 OAM and F5 OAM (ATM administration)	No	No
FDL (facilities data link)	Yes	Yes
Firewall	Yes	Yes
Frame Relay	Yes	Yes
IEEE 802.3ad link aggregation	No	No
IP	Yes	Yes
IP multicast	Yes	Yes
IP reassembly for tunneled packets	No	No
IPSec	No	No
IPv6	No	No
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

**Table 11: Channelized OCx/STMx Modules** *(continued)*

Protocol or Application	cOCx FO Line Module with cOC3/STM1 Modules	cOCx FO Line Module with cOC12/STM4 FO I/O Modules
LAC support—peer side	No	No
LNS support—peer side	No	No
Local loopback	Yes	Yes
MDL (maintenance data link)	Yes	Yes
Mobile IP home agent	No	No
MPLS	Yes	Yes
Multilink Frame Relay	Yes	Yes
Multilink PPP	Yes (with fragmentation and reassembly)	Yes (with fragmentation and reassembly)
Network Address Translation (NAT)	Yes	Yes
NBMA (multipoint ATM)	No	No
OSPF	Yes	Yes
Packet Mirroring	Yes	Yes
Packet over SONET	No	No
PPP	Yes	Yes
PPPoE	No	No
Remote loopback	Yes	Yes (T3 layer)
RIP	Yes	Yes
Subscriber interfaces (static)	Yes	Yes
Subscriber interfaces (dynamic)	Yes	Yes
Transparent bridging	No	No
Tunnel-server ports	No	No
Unified ISSU	No	No
VPLS (network interfaces)	No	No
VPLS (virtual core interfaces)	Yes	Yes
VRRP	No	No

## Channelized T3 Modules

**Table 12: Channelized T3 Modules**

Protocol or Application	CT3/T3-F0 Line Modules with CT3/T3 12 I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes
APS/MSP	No
ATM	No
BERT	Yes
BFD	No
BGP	Yes
BGP/MPLS VPNs	Yes
Bridged Ethernet	No
Bridged IP	No
Cisco HDLC	Yes
DHCP external server	No
DHCP local server	No
DVMRP and GRE support—access side	Yes
DVMRP and GRE support—server side	No
Dynamic interfaces	No
F4 OAM and F5 OAM (ATM administration)	No
FDL (facilities data link)	Yes
Firewall	Yes
Frame Relay	Yes
IEEE 802.3ad link aggregation	No
IP	Yes
IP multicast	Yes
IP reassembly for tunneled packets	No
IPSec	No
IPv6	Yes

**Table 12: Channelized T3 Modules** *(continued)*

Protocol or Application	CT3/T3-F0 Line Modules with CT3/T3 12 I/O Modules
IPv6 multicast	Yes
IPv6 neighbor discovery	No
IS-IS	Yes
J-Flow Statistics	Yes
L2TP/IPSec	No
LAC support—access side	No
LAC support—peer side	No
LNS support—peer side	No
Local loopback	Yes
MDL (maintenance data link)	Yes
Mobile IP home agent	No
MPLS	Yes
Multilink Frame Relay	Yes
Multilink PPP	Yes
Network Address Translation (NAT)	Yes
NBMA (multipoint ATM)	No
OSPF	Yes
Packet Mirroring	No
Packet over SONET	No
PPP	Yes
PPPoE	No
Remote loopback	Yes
RIP	Yes
Subscriber interfaces (static)	Yes
Subscriber interfaces (dynamic)	Yes
Transparent bridging	No
Tunnel-server ports	No

**Table 12: Channelized T3 Modules** *(continued)*

Protocol or Application	CT3/T3-F0 Line Modules with CT3/T3 12 I/O Modules
Unified ISSU	No
VPLS (network interfaces)	No
VPLS (virtual core interfaces)	Yes
VRRP	No

## Ethernet Modules

**Table 13: Fast Ethernet Modules**

Protocol or Application	GE/FE Line Module with FE-8 I/O and FE-8 SFP I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes
APS/MSP	No
ATM	No
BERT	No
BFD	Yes
BGP	Yes
BGP/MPLS VPNs	Yes
Bridged Ethernet	No
Bridged IP	No
Cisco HDLC	No
DHCP external server	Yes
DHCP local server	Yes
DVMRP and GRE support—access side	Yes
DVMRP and GRE support—server side	No
Dynamic interfaces	Yes
F4 OAM and F5 OAM (ATM administration)	No
FDL (facilities data link)	No
Firewall	Yes



**Table 13: Fast Ethernet Modules** *(continued)*

Protocol or Application	GE/FE Line Module with FE-8 I/O and FE-8 SFP I/O Modules
Frame Relay	No
IEEE 802.3ad link aggregation	Yes
IP	Yes
IP multicast	Yes
IP reassembly for tunneled packets	No
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	Yes
LAC support—peer side	Yes
LNS support—peer side	Yes
Local loopback	No
MDL (maintenance data link)	No
Mobile IP home agent	Yes
MPLS	Yes
Multilink Frame Relay	No
Multilink PPP	No
Network Address Translation (NAT)	Yes
NBMA (multipoint ATM)	No
OSPF	Yes
Packet Mirroring	Yes
Packet over SONET	No
PPP	No

**Table 13: Fast Ethernet Modules** *(continued)*

Protocol or Application	GE/FE Line Module with FE-8 I/O and FE-8 SFP I/O Modules
PPPoE	Yes
Remote loopback	No
RIP	Yes
Subscriber interfaces (static)	Yes
Subscriber interfaces (dynamic)	Yes
Transparent bridging	Yes
Tunnel-server ports	No
Unified ISSU	No
VPLS (network interfaces)	Yes
VPLS (virtual core interfaces)	Yes
VRRP	Yes

**Table 14: 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 (formerly GE-2 APS I/O or 2XGE APS I/O)	GE-HDE Line Module with GE-8 I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes	Yes
APS/MSP	No	No	No
ATM	No	No	No
BERT	No	No	No
BFD	No	Yes	Yes
BGP	Yes	Yes	Yes
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

**Table 14: Gigabit Ethernet Modules** *(continued)*

<b>Protocol or Application</b>	<b>GE/FE Line Modules with GE I/O Modules</b>	<b>GE-2 Line Module or GE-HDE Line Module with GE-2 SFP I/O (formerly GE-2 APS I/O or 2XGE APS I/O)</b>	<b>GE-HDE Line Module with GE-8 I/O Modules</b>
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
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
IEEE 802.3ad link aggregation	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

**Table 14: 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 (formerly GE-2 APS I/O or 2XGE APS I/O)	GE-HDE Line Module with GE-8 I/O Modules
Mobile IP home agent	Yes	Yes (not yet fully qualified)	Yes (not yet fully qualified)
MPLS	Yes	Yes	Yes
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
Transparent bridging	Yes	Yes	Yes
Tunnel-server ports	No	Yes (shared only)	Yes (shared only)
Unified ISSU	Yes	Yes (GE-2 line module only)	No
VPLS (network interfaces)	Yes	Yes	Yes
VPLS (virtual core interfaces)	Yes	Yes	Yes
VRRP	Yes	Yes	Yes

## OCx/STMx GE/FE Modules

**Table 15: OCx/STMx GE/FE Modules**

Protocol or Application	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules
	(OC3/STM1 ATM Interfaces)	(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
F4 OAM and F5 OAM (ATM administration)	Yes	No
FDL (facilities data link)	No	No
Firewall	Yes	Yes
Frame Relay	No	No
IEEE 802.3ad link aggregation	No	No
IP	Yes	Yes
IP multicast	Yes	Yes
IP reassembly for tunneled packets	No	No

**Table 15: OCx/STMx GE/FE Modules** *(continued)*

Protocol or Application	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules	OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules
	(OC3/STM1 ATM Interfaces)	(Gigabit Ethernet Interfaces)
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	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

**Table 15: OCx/STMx GE/FE Modules** (continued)

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

## OCx/STMx ATM Modules

**Table 16: 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

**Table 16: OCx/STMx ATM Modules** *(continued)*

<b>Protocol or Application</b>	<b>OCx/STMx ATM Line Modules with OC3-4 I/O Modules</b>	<b>OCx/STMx ATM Line Modules with OC12/STM4 I/O Modules</b>
DHCP local server	Yes	Yes
DVMRP and GRE support—access side	Yes	Yes
DVMRP and GRE support—server side	No	No
Dynamic interfaces	Yes	Yes
F4 OAM and F5 OAM (ATM administration)	Yes	Yes
FDL (facilities data link)	No	No
Firewall	Yes	Yes
Frame Relay	No	No
IEEE 802.3ad link aggregation	No	No
IP	Yes	Yes
IP multicast	Yes	Yes
IP reassembly for tunneled packets	No	No
IPSec	No	No
IPv6	Yes	Yes
IPv6 multicast	Yes	Yes
IPv6 neighbor discovery	Yes	Yes
IS-IS	Yes	Yes
J-Flow Statistics	Yes	Yes
L2TP/IPSec	No	No
LAC support—access side	Yes	Yes
LAC support—peer side	Yes	Yes
LNS support—peer side	Yes	Yes
Local loopback	No	Yes
MDL (maintenance data link)	No	No
Mobile IP home agent	No	No
MPLS	Yes	Yes
Multilink Frame Relay	No	No



**Table 16: 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
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 (4xOC3 APS I/O not supported)	Yes (4xOC3 APS I/O not supported)
VPLS (network interfaces)	Yes	Yes
VPLS (virtual core interfaces)	Yes	Yes
VRRP	No	No

## OCx/STMx POS and OC48 Modules

**Table 17: 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	OC48 Line Module with OC48 Frame APS I/O Module
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes	Yes

**Table 17: 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	OC48 Line Module with OC48 Frame APS I/O Module
APS/MSP	No	Yes	No
ATM	No	No	No
BERT	No	No	No
BFD	No	No	No
BGP	Yes	Yes	Yes
BGP/MPLS VPNs	Yes	Yes	Yes
Bridged Ethernet	No	No	No
Bridged IP	No	No	No
Cisco HDLC	Yes	Yes	Yes
DHCP external server	No	No	No
DHCP local server	No	No	No
DVMRP and GRE support—access side	Yes	Yes	Yes
DVMRP and GRE support—access side	No	No	No
Dynamic interfaces	No	No	No
F4 OAM and F5 OAM (ATM administration)	No	No	No
FDL (facilities data link)	No	No	No
Firewall	Yes	Yes	Yes
Frame Relay	Yes	Yes	Yes
IEEE 802.3ad link aggregation	No	No	No
IP	Yes	Yes	Yes
IP multicast	Yes	Yes	Yes
IP reassembly for tunneled packets	No	No	No
IPSec	No	No	No
IPv6	Yes	Yes	Yes (PPP only)
IPv6 multicast	Yes	Yes	Yes
IPv6 neighbor discovery	No	No	No

**Table 17: 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	OC48 Line Module with OC48 Frame APS I/O Module
IS-IS	Yes	Yes	Yes
J-Flow Statistics	Yes	Yes	Yes
L2TP/IPSec	No	No	No
LAC support—access side	No	No	No
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	No	No	No
MPLS	Yes	Yes (Layer 2 over MPLS is not supported)	Yes (Layer 2 over MPLS is not supported)
Multilink Frame Relay	No	No	No
Multilink PPP	No	No	No
Network Address Translation (NAT)	Yes	Yes	Yes
NBMA (multipoint ATM)	No	No	No
OSPF	Yes	Yes	Yes
Packet Mirroring	Yes	Yes	Yes
Packet over SONET	Yes	Yes	Yes
PPP	Yes	Yes	Yes
PPPoE	No	No	No
Remote loopback	No	No	No
RIP	Yes	Yes	Yes
Subscriber interfaces (static)	Yes (over POS)	Yes (over POS)	No
Subscriber interfaces (dynamic)	No	No	No
Transparent bridging	No	No	No
Tunnel-server ports	No	No	No

**Table 17: 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	OC48 Line Module with OC48 Frame APS I/O Module
Unified ISSU	Yes (4xOC3 APS I/O not supported)	Yes (4xOC3 APS I/O not supported)	No
VPLS (network interfaces)	No	No	No
VPLS (virtual core interfaces)	Yes	Yes	Yes
VRRP	No	No	No

## Service Modules

**Table 18: Service Modules**

Protocol or Application	Service Line Module (SM)	IPSec Service Line Module
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	No	No
APS/MSP	No	No
ATM	No	No
BERT	No	No
BFD	No	No
BGP	Yes	Yes
BGP/MPLS VPNs	No	No
Bridged Ethernet	No	No
Bridged IP	No	No
Cisco HDLC	No	No
DHCP external server	No	No
DHCP local server	No	No
DVMRP and GRE support—access side	No	No
DVMRP and GRE support—server side	Yes (over dedicated tunnel server ports)	Yes (over dedicated tunnel server ports; DVMRP over IPSec only; GRE over IPSec)
Dynamic interfaces	No	No

**Table 18: Service Modules** *(continued)*

Protocol or Application	Service Line Module (SM)	IPSec Service Line Module
F4 OAM and F5 OAM (ATM administration)	No	No
FDL (facilities data link)	No	No
Firewall	Yes	No
Frame Relay	No	No
IEEE 802.3ad link aggregation	No	No
IP	Yes	Yes
IP multicast	Yes	No
IP reassembly for tunneled packets	Yes	Yes
IPSec	No	Yes
IPv6	Yes	No
IPv6 multicast	Yes	No
IPv6 neighbor discovery	No	No
IS-IS	Yes	Yes
J-Flow Statistics	Yes	Yes
L2TP/IPSec	No	Yes
LAC support—access side	No	No
LAC support—peer side	No	No
LNS support—peer side	Yes	No
Local loopback	No	No
MDL (maintenance data link)	No	No
Mobile IP home agent	Yes	No
MPLS	No (over GRE only)	No (over GRE only)
Multilink Frame Relay	No	No
Multilink PPP	Yes (with fragmentation and reassembly; dynamic only)	No
Network Address Translation (NAT)	Yes	No
NBMA (multipoint ATM)	No	No

**Table 18: Service Modules** *(continued)*

Protocol or Application	Service Line Module (SM)	IPSec Service Line Module
OSPF	Yes	Yes
Packet Mirroring	Yes	Yes
Packet over SONET	No	No
PPP	Yes (dynamic only)	No
PPPoE	No	No
Remote loopback	No	No
RIP	Yes	Yes
Subscriber interfaces (static)	Yes (GRE tunnels only)	No
Subscriber interfaces (dynamic)	Yes (over GRE tunnels only)	No
Transparent bridging	No	No
Tunnel-server ports	Yes (dedicated only)	Yes (dedicated only)
Unified ISSU	Yes	No
VPLS (network interfaces)	No	No
VPLS (virtual core interfaces)	No	No
VRRP	No	No

## Unchannelized E3 Modules

**Table 19: Unchannelized E3 Modules**

Protocol or Application	COCX-F3 Line Modules with E3-12 FRAME I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes
APS/MSP	No
ATM (point-to-point)	No
BERT	No
BFD	No
BGP	Yes
BGP/MPLS VPNs	Yes

**Table 19: Unchannelized E3 Modules** *(continued)*

Protocol or Application	COCX-F3 Line Modules with E3-12 FRAME I/O Modules
Bridged Ethernet	No
Bridged IP	No
Cisco HDLC	Yes
DHCP external server	No
DHCP local server	No
DVMRP and GRE support—access side	Yes
DVMRP and GRE support—server side	No
Dynamic interfaces	No
F4 OAM and F5 OAM (ATM administration)	No
FDL (facilities data link)	No
Firewall	Yes
Frame Relay	Yes
IEEE 802.3ad link aggregation	No
IP	Yes
IP multicast	Yes
IP reassembly for tunneled packets	No
IPSec	No
IPv6	Yes
IPv6 multicast	Yes
IPv6 neighbor discovery	No
IS-IS	Yes
J-Flow Statistics	Yes
L2TP/IPSec	No
LAC support—access side	No
LAC support—peer side	No
LNS support—peer side	No
Local loopback	No

**Table 19: Unchannelized E3 Modules** *(continued)*

Protocol or Application	COCX-F3 Line Modules with E3-12 FRAME I/O Modules
MDL (maintenance data link)	No
Mobile IP home agent	No
MPLS	Yes (over PPP and Cisco HDLC; also supports Martini encapsulation of HDLC and Frame Relay over MPLS)
Multilink Frame Relay	Yes
Multilink PPP	Yes (with fragmentation and reassembly)
Network Address Translation (NAT)	Yes
NBMA (multipoint ATM)	No
OSPF	Yes
Packet Mirroring	Yes
Packet over SONET	No
PPP	Yes
PPPoE	No
Remote loopback	No
RIP	Yes
Subscriber interfaces (static)	No
Subscriber interfaces (dynamic)	No
Transparent bridging	No
Tunnel-server ports	No
Unified ISSU	No
VPLS (network interfaces)	No
VPLS (virtual core interfaces)	Yes
VRRP	No



## Unchannelized T3 Modules

**Table 20: 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	CT3/T3-F0 Line Modules with CT3/T3 12 I/O Modules
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes	Yes
APS/MSP	No	No	No
ATM (point-to-point)	No	Yes	No
BERT	Yes	No	Yes
BFD	No	No	No
BGP	Yes	Yes	Yes
BGP/MPLS VPNs	Yes	Yes	Yes
Bridged Ethernet	No	Yes	No
Bridged IP	No	Yes	No
Cisco HDLC	Yes	No	Yes
DHCP external server	No	Yes	No
DHCP local server	No	Yes	No
DVMRP and GRE support—access side	Yes	Yes	Yes
DVMRP and GRE support—access side	No	No	No
Dynamic interfaces	No	Yes	No
F4 OAM and F5 OAM (ATM administration)	No	Yes	No
FDL (facilities data link)	No	No	No
Firewall	Yes	Yes	Yes
Frame Relay	Yes	No	Yes
IEEE 802.3ad link aggregation	No	No	No
IP	Yes	Yes	Yes
IP multicast	No	No	No

**Table 20: Unchannelized T3 Modules** *(continued)*

<b>Protocol or Application</b>	<b>COCX-F3 Line Modules with CT3/T3 12 I/O Modules</b>	<b>OCx/STMx ATM Line Modules with 4xDS3 ATM I/O Modules</b>	<b>CT3/T3-F0 Line Modules with CT3/T3 12 I/O Modules</b>
IP reassembly for tunneled packets	No	No	No
IPSec	No	No	No
IPv6	No	No	No
IPv6 multicast	Yes	Yes	Yes
IPv6 neighbor discovery	No	No	No
IS-IS	Yes	Yes	Yes
J-Flow Statistics	Yes	Yes	Yes
L2TP/IPSec	No	No	No
LAC support—access side	No	Yes	No
LAC support—peer side	No	Yes	No
LNS support—peer side	No	Yes	No
Local loopback	Yes	No	Yes
MDL (maintenance data link)	Yes	No	Yes
Mobile IP home agent	No	No	No
MPLS	Yes (over PPP and Cisco HDLC; also supports Martini encapsulation of HDLC and Frame Relay over MPLS)	Yes	Yes (over PPP and Cisco HDLC; also supports Martini encapsulation of HDLC and Frame Relay over MPLS)
Multilink Frame Relay	Yes	No	Yes
Multilink PPP	Yes (with fragmentation and reassembly)	No	Yes
Network Address Translation (NAT)	Yes	Yes	Yes
NBMA (multipoint ATM)	No	Yes	No
OSPF	Yes	Yes	Yes
Packet Mirroring	Yes	Yes	Yes
Packet over SONET	No	No	No
PPP	Yes	Yes	Yes

**Table 20: Unchannelized T3 Modules** *(continued)*

<b>Protocol or Application</b>	<b>COCX-F3 Line Modules with CT3/T3 12 I/O Modules</b>	<b>OCx/STMx ATM Line Modules with 4xDS3 ATM I/O Modules</b>	<b>CT3/T3-F0 Line Modules with CT3/T3 12 I/O Modules</b>
PPPoE	No	Yes	No
Remote loopback	Yes	No	Yes
RIP	Yes	Yes	Yes
Subscriber interfaces (static)	Yes	Yes (over bridged Ethernet and IPoA)	Yes
Subscriber interfaces (dynamic)	Yes	Yes (over bridged Ethernet)	Yes
Transparent bridging	No	Yes	No
Tunnel-server ports	No	No	No
Unified ISSU	No	Yes	No
VPLS (network interfaces)	No	Yes	No
VPLS (virtual core interfaces)	Yes	Yes	Yes
VRRP	No	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 133
- Redundancy Status on page 137

### 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 21 on page 133 lists the functions of the module and port status LEDs.

**Table 21: 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 21: LED Identification and Activity Descriptions** (continued)

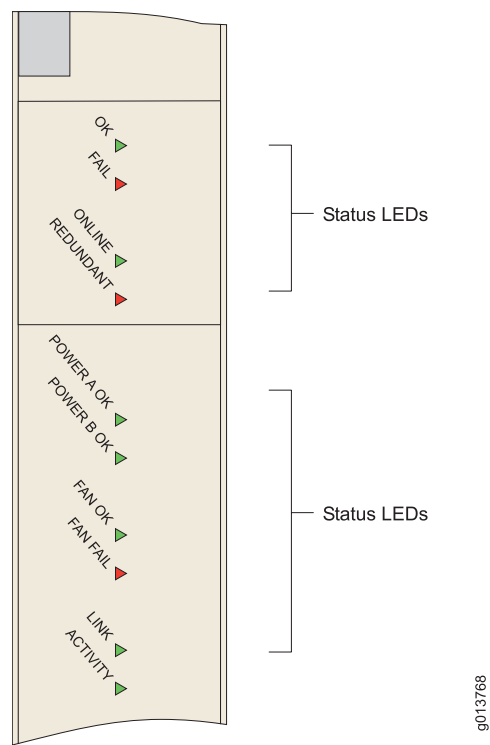
LED Location	LED Label	LED Indicator	LED Color	OFF to ON	ON to OFF
All modules	REDUNDANT	Redundancy	Green	See <i>Redundancy Status</i> later in this appendix.  <b>NOTE:</b> The REDUNDANT LED on the cOCx/STMx, FE-8, GE/FE, HSSI, and X.21/V.35 line modules is nonfunctional.	
SRP module	POWER A OK	Power	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
HSSI line module	ACTIVITY	Ethernet	Green	Blinks when Ethernet traffic on link	No Ethernet traffic on link
	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 21: 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:

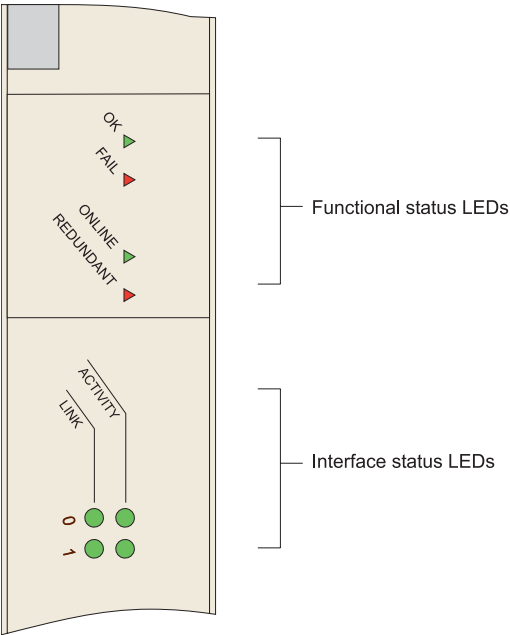
- SRP module (Figure 1 on page 136)
- Ethernet line module (Figure 2 on page 137)
- Other line modules (Figure 3 on page 137)

**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. (ERX-7xx/14xx models only)

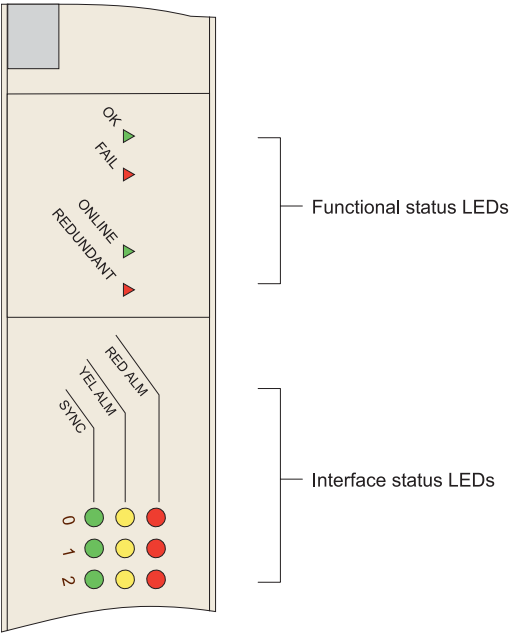


Figure 2: FE2 Module LEDs



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 (ERX-7xx/14xx models only). See Table 22 on page 138.



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

**Table 22: 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

# Product Reclamation and Recycling Program

- Product Reclamation and Recycling Program on page 139

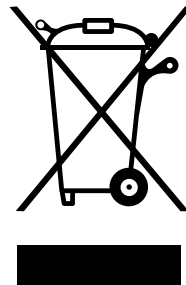
## Product Reclamation and Recycling Program

---

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

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

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



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

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



Juniper Networks, the Juniper Networks logo, JUNOS, NetScreen, ScreenOS, and Steel-Belted Radius are registered trademarks of Juniper Networks, Inc. in the United States and other countries. JUNOSe is a trademark of Juniper Networks, Inc. All other trademarks, service marks, registered trademarks, or registered service marks are the property of their respective owners.

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

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

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

Copyright © 2008, Juniper Networks, Inc.

All rights reserved. Printed in USA.

Writing: John Borelli, Sarah Lesway-Ball, Fran Singer

Editing: Ben Mann

Illustration: John Borelli

Revision History

17 October 2008—Revision 1

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