



## **E-series™ Routing Platforms**

# **Module Guide**

*Release 7.0.0*

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This guide provides an overview and description of the line modules, 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 E-series router.



**NOTE:** A release may support multiple versions of a module. For information, see *Software Compatibility* in *JUNOS System Basics Configuration Guide, Chapter 5, Managing Modules*.

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Table 1 lists the module combinations supported by E-series routers.

This book also contains two appendixes:

- “Module Protocol Support” on page 117
- “Module LEDs” on page 141

For more information about E-series routers and modules, refer to the following books:

- Module installation and maintenance—*E-series Hardware Guide*
- Managing E-series routers—*JUNOS System Basics Configuration Guide*
- Configuring E-series modules—*JUNOS Link Layer Configuration Guide*

**Table 1: E-series Module Combinations**

<b>Combination Name and Type</b>	<b>Line Module Label</b>	<b>I/O Module Label</b>	<b>First JUNOS<sup>e</sup> Support</b>	<b>Page</b>
<b>Channelized OC3/STM1</b>				
cOC3/STM1 multimode	cOCx/STMx F0	cOC3 STM1 F0 I/O MULTIMODE	2.2.0	7
cOC3/STM1 single-mode intermediate reach	cOCx/STMx F0	cOC3 STM1 F0 I/O SINGLE MODE	2.2.0	9
cOC3/STM1 single-mode long reach	cOCx/STMx F0	cOC3 STM1 F0 I/O LONG HAUL	2.2.0	11
<b>Channelized OC12/STM4</b>				
cOC12/STM4 multimode without APS/MSP redundancy	cOCx/STMx F0	cOC12 STM4 F0 I/O MULTI MODE	2.2.0	13
cOC12/STM4 multimode with APS/MSP redundancy	cOCx/STMx F0	cOC12 F0 APS MULTI MODE	2.2.0	15
cOC12/STM4 single-mode intermediate reach	cOCx/STMx F0	cOC12 STM4 F0 I/O SINGLE MODE	2.2.0	17
cOC12/STM4 single-mode long reach	cOCx/STMx F0	cOC12 STM4 LONG HAUL	2.2.0	19
<b>Channelized T1</b>				
CT1	CT1	CT1 FULL I/O	1.1.0	21
<b>Channelized T3</b>				
CT3/T3 12 (12 ports)	CT3/T3-F0	CT3/T3 12 I/O	3.2.0	22
<b>E3</b>				
E3 ATM	E3 ATM	E3 I/O	1.1.0	24
E3 Frame (12 ports)	COCX-F3	E3-12 FRAME I/O	4.0.2	25
<b>Fast Ethernet</b>				
FE-8 (8 ports) (256-MB memory)	GE/FE	FE-8 I/O	5.0.0	27
FE-8 SFP (8 ports) (256-MB memory)	GE/FE	FE-8 SFP I/O	6.0.0	29
<b>Gigabit Ethernet (1-port)</b>				
GE 1000Base-LH (256-MB memory)	GE/FE	GE I/O SFP	5.0.0	31
GE 1000Base-SX (256-MB memory)	GE/FE	GE I/O SFP	5.0.0	33
GE 1000Base-ZX (256-MB memory)	GE/FE	GE I/O SFP	5.0.0	35
GE multimode	GE/FE	GE I/O MULTI MODE	2.0.0	37

<b>Combination Name and Type</b>	<b>Line Module Label</b>	<b>I/O Module Label</b>	<b>First JUNOS<sup>e</sup> Support</b>	<b>Page</b>
GE single-mode	GE/FE	GE I/O SINGLE MODE	2.0.0	39
<b>Gigabit Ethernet (2-port)</b>				
GE2 1000 Base-LH	GE-2	2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP	5.3.0	41
GE2 1000 Base-SX	GE-2	2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP	5.3.0	43
GE2 1000 Base-ZX	GE-2	2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP	5.3.0	45
GE-HDE (2 port)	GE-HDE	2XGE APS I/O SFP <i>or</i> GE-2 APS I/O SFP	7.0.0	47
GE-HDE (8 port)	GE-HDE	GE-8 I/O	7.0.0	49
<b>HSSI</b>				
HSSI	HSSI-3F	HSSI-3 I/O	3.1.0	51
<b>IPSec Service</b>				
IPSec Service	IPSEC SERVICE	No I/O module	4.0.2	52
<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	53
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)	55
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	57
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)	59
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	61
<b>OC3/STM1 GE/FE</b>				
OC3/STM1 GE/FE	OC3/STM1 GE/FE	OC3-2 GE APS I/O	6.1.0	63
<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	67

<b>Combination Name and Type</b>	<b>Line Module Label</b>	<b>I/O Module Label</b>	<b>First JUNOS<sup>e</sup> Support</b>	<b>Page</b>
OC3/STM1 POS multimode with APS/MSP redundancy	OCx/STMx POS	4XOC3 APS I/O	5.1.2	69
		MULTI MODE	5.2.0 (APS/MSP)	
OC3/STM1 POS single-mode intermediate reach without APS/MSP redundancy	OCx/STMx POS	OC3-4 I/O	2.0.0	71
		SINGLE MODE		
OC3/STM1 POS single-mode intermediate reach with APS/MSP redundancy	OCx/STMx POS	4XOC3 APS I/O	5.1.2	73
		SINGLE MODE	5.2.0 (APS/MSP)	
OC3/STM1 POS single-mode long reach	OCx/STMx POS	OC3-4 I/O	2.0.0	75
		LONG HAUL		
<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	5.0.0	77
		MULTI MODE		
OC12/STM4 ATM multimode with APS/MSP redundancy	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 APS	2.0.0 (128 MB)	79
		MULTI MODE	5.0.0 (256 MB)	
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	5.0.0	81
		SINGLE MODE		
OC12/STM4 ATM single-mode intermediate reach with APS/MSP redundancy	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 APS	2.0.0 (128 MB)	83
		SINGLE MODE	5.0.0 (256 MB)	
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	5.0.0	85
		LONG HAUL		
OC12/STM4 ATM single-mode long reach with APS/MSP redundancy	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	OC12 STM4 APS	2.0.0 (128 MB)	87
		LONG HAUL	5.0.0 (256 MB)	
<b>OC12/STM4 POS</b>				
OC12/STM4 POS multimode without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O	2.0.0	89
		MULTI MODE		
OC12/STM4 POS multimode with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS	2.0.0	91
		MULTI MODE		
OC12/STM4 POS single-mode intermediate reach without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O	2.0.0	93
		SINGLE MODE		
OC12/STM4 POS single-mode intermediate reach with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS	2.0.0	95
		SINGLE MODE		
OC12/STM4 POS single-mode long reach without APS/MSP redundancy	OCx/STMx POS	OC12 STM4 I/O	2.0.0	97
		LONG HAUL		

<b>Combination Name and Type</b>	<b>Line Module Label</b>	<b>I/O Module Label</b>	<b>First JUNOS<sup>e</sup> Support</b>	<b>Page</b>
OC12/STM4 POS single-mode long reach with APS/MSP redundancy	OCx/STMx POS	OC12 STM4 APS LONG HAUL	2.0.0	99
<b>OC48/STM16</b>				
OC48/STM16 POS single-mode short reach	OC48	OC48 FRAME APS	4.1.x	101
<b>Service Module (SM)</b>				
SM	SERVICE MODULE	No I/O module	5.1.0	102
<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	103
SRP-5G+ (2-GB memory)	SRP-5G+	SRP I/O	4.1.3, 5.0.4, 5.1.2, 5.2.0	104
SRP-10G (1-GB memory)	SRP-10G	SRP I/O	4.1.3, 5.0.4, 5.1.2, 5.2.0	105
SRP-10G (2-GB memory)	SRP-10G	SRP I/O	4.1.3, 5.0.4, 5.1.2, 5.2.0	106
SRP-40G PLUS (2-GB memory)	SRP-40G PLUS	SRP I/O	4.0.0	107
SRP-SE10G (512-MB memory)	SRP-SE10G	SRP-SE I/O	5.1.0	108
SRP-SE10G (1-GB memory)	SRP-SE10G	SRP-SE I/O	5.3.0	109
<b>T3</b>				
T3 ATM (4 ports) (256-MB memory)	OCx/STMx ATM <i>or</i> OCx/STMx /DS3-ATM	4xDS3 ATM I/O	5.0.0	110
T3 Frame (12 ports)	COCX-F3	CT3/T3 12 I/O	4.0.2	111
CT3/T3 12 (12 ports)	CT3/T3-F0	CT3/T3 12 I/O	3.2.0	113
<b>X.21/V.35</b>				
X.21/V.35	X.21/V.35	X.21/ V.35 I/O	2.10.1, 3.3.2	115

## 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: N/A</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>	■ 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 118 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 router</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>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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 5, Configuring Channelized OCx/STMx Interfaces</i>.</li></ul>

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## 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: N/A</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>	■ 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>	■ See “Channelized OCx/STMx Modules” on page 118 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 5, Configuring Channelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	■ First supported: 2.2.0 ■ Final supported: N/A
<b>Description</b>	■ 130 W ■ OC3/STM1 channelized to DS3, DS1, E1, and DS0
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC3/STM1 ■ DS3, DS1 ■ T1, E1 ■ DS0 ■ HDLC framing
<b>Software features</b>	■ See “Channelized OCx/STMx Modules” on page 118 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 5, Configuring Channelized OCx/STMx Interfaces</i> .

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## 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>	■ First supported: 2.2.0 ■ Final supported: N/A
<b>Description</b>	■ 130 W ■ OC12/STM4 channelized to DS3, DS1, E1, and DS0
<b>Type</b>	■ 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 118 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 5, Configuring Channelized OCx/STMx Interfaces</i>.</li></ul>

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## cOC12/STM4 Multimode With APS/MSP Redundancy Module Combination

<b>Line module label</b>	cOCx/STMx F0
<b>I/O module label</b>	cOC12 F0 APS MULTI MODE
<b>Number of I/O ports</b>	■ 1 active, 1 redundant
<b>Software release</b>	■ First supported: 2.2.0 ■ Final supported: N/A
<b>Description</b>	■ 130 W ■ OC12/STM4 channelized to DS3, DS1, E1, and DS0
<b>Type</b>	■ 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 118 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 5, Configuring Channelized OCx/STMx Interfaces</i>.</li></ul>

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## cOC12/STM4 Single-Mode Intermediate Reach 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: N/A
<b>Description</b>	■ 130 W ■ OC12/STM4 channelized to DS3, DS1, E1, and DS0
<b>Type</b>	■ 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 118 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 5, Configuring Channelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	<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: 2.2.0</li> <li>■ Final supported: N/A</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>■ 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 118 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 5, Configuring Channelized OCx/STMx Interfaces</i>.</li></ul>

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## CT1 Module Combination

<b>Line module label</b>	CT1
<b>I/O module label</b>	CT1 FULL I/O
<b>Number of I/O ports</b>	■ 24
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 1.1.0</li> <li>■ Final supported: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 40 W</li> <li>■ Channelized T1</li> </ul>
<b>Type</b>	■ Non-ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ DS1, DS0</li> <li>■ HDLC Framing</li> </ul>
<b>Software features</b>	■ See “Channelized T1 and E1 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-1410 models</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-5G</li> <li>■ SRP-5G +</li> <li>■ SRP-10G</li> </ul>
<b>Module redundancy support</b>	■ 1:N redundancy
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ RJ-48C 100-ohm connector</li> <li>■ Use shielded cables to maintain EMC compliance.</li> <li>■ The line interface unit supports multiple line buildouts.</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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 3, Configuring CT1 and CE1 Interfaces</i> .

## 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: N/A</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>	■ ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ DS5, DS1, DS0</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “Channelized T3 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>

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**Cables and connectors**

- BT43 SMB connector
- Cable that adapts to 75-ohm BNC is available.
- The line interface unit supports two line buildouts:
  - 0–68.5 m (0–225 feet)
  - 69–137 m (226–450 feet)
- Signal strength is software controlled.
- The transmitted signal complies with ANSI T1.102-1993 Digital Hierarchy - Electrical Interfaces (1999) for cable lengths up to 201 m (660 feet).
- See *E-series Hardware Guide, Chapter 6, Cabling E-series Routers* for more information.

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**LEDs**

- See “Module LEDs” on page 141.

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**Alarms, errors, and events**

- See *Monitoring Interfaces* in *JUNOS Physical Layer Configuration Guide, Chapter 1, Configuring Channelized T3 Interfaces*.
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## E3 ATM Module Combination

<b>Line module label</b>	E3 ATM
<b>I/O module label</b>	E3 I/O
<b>Number of I/O ports</b>	3
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 1.1.0</li> <li>■ Final supported: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 60 W</li> <li>■ Unchannelized E3 for ATM</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ Non-ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Unchannelized E3 Modules” on page 134 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-1410 router</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-5G</li> <li>■ SRP-5G +</li> <li>■ SRP-10G</li> </ul>
<b>Module redundancy support</b>	<ul style="list-style-type: none"> <li>■ 1:N redundancy</li> </ul>
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ BNC 75-ohm connector</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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 141.</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 2, Configuring T3 and E3 Interfaces</i>.</li> </ul>



## 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: N/A</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>	■ ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ E3</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “Unchannelized E3 Modules” on page 134 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 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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>

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<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 2, Configuring T3 and E3 Interfaces</i> .

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## 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: N/A</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>	■ 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 123 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>	■ N/A
<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>

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<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Configuring Ethernet Interfaces</i> .

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## FE-8 SFP Module Combination (8 Ports)

<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: N/A</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> <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>	<ul style="list-style-type: none"> <li>■ Line module: ASIC</li> <li>■ I/O module: non-ASIC</li> </ul>
<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>	<ul style="list-style-type: none"> <li>■ See “Ethernet Modules” on page 123 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>	■ N/A

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series 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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</li></ul>
<b>Alarms, errors, and events</b>	<ul style="list-style-type: none"><li>■ For more information, see <i>Monitoring Ethernet Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Configuring Ethernet Interfaces</i>.</li></ul>

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## 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ The GE SFP I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> <li>■ The transceivers on this GE I/O module are 1000Base-LX/LH compliant.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ 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 123 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>■ N/A</li> </ul>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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## 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ The GE SFP I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> <li>■ The transceivers on this GE I/O module are 1000Base-SX compliant.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ 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 123 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>■ N/A</li> </ul>

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<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: -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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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## 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ The GE SFP I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> <li>■ The transceivers on this GE I/O module are 1000Base-ZX compliant.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ 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 123 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>■ N/A</li> </ul>

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<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: -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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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## 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>	<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: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ Gigabit Ethernet</li> <li>■ This module combination has been superseded by a newer assembly; however, it is supported by current software.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3z)</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Ethernet Modules” on page 123 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>■ N/A</li> </ul>

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<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: -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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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## 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>	<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: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ Gigabit Ethernet</li> <li>■ This module combination has been superseded by a newer assembly; however, it is supported by current software.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Ethernet (IEEE 802.3z)</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “Ethernet Modules” on page 123 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>■ N/A</li> </ul>

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<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: -11 dBm</li><li>■ max: -3 dBm</li></ul></li><li>■ Center wavelength: 1300 nm</li><li>■ Rx input power:<ul style="list-style-type: none"><li>■ min: -20 dBm</li><li>■ max: -3 dBm</li></ul></li><li>■ Rated for 550 m (601 yards) over 62.5-micron core or 50-micron core MM fiber</li><li>■ Rated for 5 km (3.1 miles) over 10-micron core cable</li><li>■ See <i>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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

<b>Line module label</b>	GE-2
<b>I/O module label</b>	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: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 100 W</li> <li>■ Gigabit Ethernet</li> <li>■ The 2XGE APS I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> <li>■ The transceivers on this 2XGE APS I/O module are 1000Base-LX/LH compliant.</li> <li>■ For information about bandwidth and line rate considerations for the GE2 1000Base-LH module combination, see <i>2XGE APS I/O Module</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ 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 123 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>■ N/A</li> </ul>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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

<b>Line module label</b>	GE-2
<b>I/O module label</b>	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: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 100 W</li> <li>■ Gigabit Ethernet</li> <li>■ The 2XGE APS I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> <li>■ The transceivers on this 2XGE APS I/O module are 1000Base-SX compliant.</li> <li>■ For information about bandwidth and line rate considerations for the GE2 1000Base-SX module combination, see <i>2XGE APS I/O Module</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ 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 123 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>■ N/A</li> </ul>

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<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: -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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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

<b>Line module label</b>	GE-2
<b>I/O module label</b>	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: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 100 W</li> <li>■ Gigabit Ethernet</li> <li>■ The GE-2 APS I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> <li>■ The transceivers on this GE-2 APS I/O module are 1000Base-ZX compliant.</li> <li>■ For information about bandwidth and line rate considerations for the GE2 1000Base-ZX module combination, see <i>GE-2 APS I/O Module</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ 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 123 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>■ N/A</li> </ul>

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<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: -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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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

<b>Line module label</b>	GE-HDE
<b>I/O module label</b>	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: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 100 W</li> <li>■ Gigabit Ethernet</li> <li>■ The GE-2 APS I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> <li>■ The transceivers on this GE-2 APS I/O module are 1000Base-LX/LH compliant.</li> <li>■ For information about bandwidth and line rate considerations for the GE2 1000Base-LH module combination, see <i>GE-2 APS I/O Module</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ 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 123 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>■ N/A</li> </ul>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Ethernet Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 6, Configuring Ethernet Interfaces</i> .

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## 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: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 100 W</li> <li>■ Gigabit Ethernet</li> <li>■ The GE-8 I/O module uses a range of small form-factor pluggable (SFP) transceivers to support different modes and cable lengths.</li> <li>■ The transceivers on this GE-8 I/O module are 1000Base-LX/LH compliant.</li> <li>■ For information about bandwidth and line rate considerations for the GE-8 1000Base-LH module combination, see <i>GE-8 I/O Module</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 6, Configuring Ethernet Interfaces</i>.</li> </ul>
<b>Type</b>	■ 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 123 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>	■ N/A

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 6, Configuring Ethernet Interfaces</i>.</li></ul>

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## HSSI Module Combination

<b>Line module label</b>	HSSI-3F
<b>I/O module label</b>	HSSI-3 I/O
<b>Number of I/O ports</b>	■ 3
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 3.1.0</li> <li>■ Final supported: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 60 W</li> <li>■ High-speed serial interface</li> </ul>
<b>Type</b>	■ Non-ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ Up to 44.736 MHz data rate</li> <li>■ HDLC Framing</li> </ul>
<b>Software features</b>	■ See “HSSI Modules” on page 126 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-1410 router</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-5G</li> <li>■ SRP-5G +</li> <li>■ SRP-10G</li> </ul>
<b>Module redundancy support</b>	■ N/A
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ Standard HSSI connector: 2-row, 50-pin, receptacle header with rails and latch blocks</li> <li>■ 50 feet (15.24 m) maximum cable length</li> <li>■ See <i>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces in JUNOS Physical Layer Configuration Guide, Chapter 7, Configuring HSSIs</i> .

## 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>	■ N/A
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 4.0.2</li> <li>■ Final supported: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 130 W</li> <li>■ IPSec Tunnel Service</li> </ul>
<b>Type</b>	■ ASIC
<b>Capability</b>	■ IPSec tunnels
<b>Software features</b>	■ See “Service Modules” on page 133 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>	■ Multiple IPSec Service modules provide redundancy.
<b>Cables and connectors</b>	■ N/A
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Tunnel Service Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 9</i> , <i>Managing Tunnel-Service and IPSec-Service Interfaces</i> .

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

<b>Line module label</b>	OCx/STMx ATM or 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ Unchannelized, concatenated OC3/STM1 for ATM</li> </ul>
<b>Type</b>	■ 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 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## OC3/STM1 ATM Multimode 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>	4XOC3 APS I/O MULTI MODE
<b>Number of I/O ports</b>	<ul style="list-style-type: none"> <li>■ 4 active, 4 redundant</li> </ul>
<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: N/A</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>	<ul style="list-style-type: none"> <li>■ ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM-1</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx ATM Modules” on page 129 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>

<p><b>Cables and connectors</b></p>	<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<p><b>LEDs</b></p>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 141.</li> </ul>
<p><b>Alarms, errors, and events</b></p>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 4, 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 or 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ Unchannelized, concatenated OC3/STM1 for ATM</li> </ul>
<b>Type</b>	■ 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 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	<ul style="list-style-type: none"> <li>■ 4 active, 4 redundant</li> </ul>
<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: N/A</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>	<ul style="list-style-type: none"> <li>■ ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM-1</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx ATM Modules” on page 129 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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

<b>Line module label</b>	OCx/STMx ATM or 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ Unchannelized, concatenated OC3/STM1 for ATM</li> </ul>
<b>Type</b>	■ 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 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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: N/A</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 or</li> <li>■ OC3/STM1 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 cable lengths.</li> <li>■ Depending on the configuration, a variety of SFP combinations can occur.</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ 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>■ 1000 Base-LX/SX/ZX</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx GE/FE Modules” on page 128 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>	■ N/A
<b>Cables and connectors (ATM LX)</b>	<ul style="list-style-type: none"> <li>■ LC-style fiber-optic connectors</li> <li>■ Tx power: <ul style="list-style-type: none"> <li>■ min: -19.0 dBm</li> <li>■ max: -14dBm</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 0-9db or 50-micron core cable with an optical loss of 7 db</li> <li>■ See <i>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>Cables and connectors (ATM SX)</b>	<ul style="list-style-type: none"> <li>■ LC-style fiber-optic connectors</li> <li>■ Tx power: <ul style="list-style-type: none"> <li>■ min: -15.0 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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>



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**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 *E-series Hardware Guide, Chapter 6, Cabling E-series 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 *E-series Hardware Guide, Chapter 6, Cabling E-series Routers* for more information.
- 

**Cables and connectors (GE SX)**

- LC full duplex
  - Tx power:
    - min: -9.5 dBm
    - max: -4 dBm
  - Center wavelength: 850 nm
  - Rx input power:
    - min: -17 dBm
    - max: -3 dBm
  - Rated for 275 m (300 yards) over 62.5-micron core cable
  - Rated for 550 m (601 yards) over 50-micron core cable
  - See *E-series Hardware Guide, Chapter 6, Cabling E-series Routers* for more information.
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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC3/STM1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	<ul style="list-style-type: none"> <li>■ 4 active, 4 redundant</li> </ul>
<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: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 120 W</li> <li>■ Unchannelized, concatenated OC3/STM1 for POS</li> </ul>
<b>Type</b>	<ul style="list-style-type: none"> <li>■ ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC3/STM-1</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 131 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC3/STM1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC3/STM1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC3/STM1 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC3/STM1 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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

<b>Line module label</b>	OCx/STMx ATM or 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ Unchannelized, concatenated OC12/STM4 for ATM</li> </ul>
<b>Type</b>	■ 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 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## OC12/STM4 ATM Multimode 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 MULTI 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 (128 MB), 5.0.0 (256 MB)</li> <li>■ Final supported: N/A</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>	<ul style="list-style-type: none"> <li>■ ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx ATM Modules” on page 129 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>

<p><b>Cables and connectors</b></p>	<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<p><b>LEDs</b></p>	<ul style="list-style-type: none"> <li>■ See “Module LEDs” on page 141.</li> </ul>
<p><b>Alarms, errors, and events</b></p>	<ul style="list-style-type: none"> <li>■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 4, 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 or 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ Unchannelized, concatenated OC12/STM4 for ATM</li> </ul>
<b>Type</b>	■ 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 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## OC12/STM4 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>	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 (128 MB), 5.0.0 (256 MB)</li> <li>■ Final supported: N/A</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>	<ul style="list-style-type: none"> <li>■ ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx ATM Modules” on page 129 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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

<b>Line module label</b>	OCx/STMx ATM or 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: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> <li>■ Unchannelized, concatenated OC12/STM4 for ATM</li> </ul>
<b>Type</b>	■ 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 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	<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 (128 MB), 5.0.0 (256 MB)</li> <li>■ Final supported: N/A</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>	<ul style="list-style-type: none"> <li>■ ASIC</li> </ul>
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC12/STM4</li> <li>■ ATM/AAL5</li> </ul>
<b>Software features</b>	<ul style="list-style-type: none"> <li>■ See “OCx/STMx ATM Modules” on page 129 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	■ First supported: 2.0.0 ■ Final supported: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC12/STM4 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC12/STM4 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC12/STM4 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC12/STM4 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	■ First supported: 2.0.0 ■ Final supported: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC12/STM4 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC12/STM4 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	■ 1 active, 1 redundant
<b>Software release</b>	■ First supported: 2.0.0 ■ Final supported: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC12/STM4 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC12/STM4 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	■ First supported: 2.0.0 ■ Final supported: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC12/STM4 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC12/STM4 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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>	■ 1 active, 1 redundant
<b>Software release</b>	■ First supported: 2.0.0 ■ Final supported: N/A
<b>Description</b>	■ 120 W ■ Unchannelized, concatenated OC12/STM4 for POS
<b>Type</b>	■ ASIC
<b>Capability</b>	■ OC12/STM4 ■ HDLC framing
<b>Software features</b>	■ See “OCx/STMx POS and OC48 Modules” on page 131 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.

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 Unchannelized OCx/STMx Interfaces</i>.</li></ul>

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## 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: N/A</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>	■ ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ OC48/STM16</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 131 for information about the layer 2 and layer 3 protocols and applications that this module combination supports.</li> </ul>
<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>	■ N/A
<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 4, 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>	■ N/A
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 5.1.0</li> <li>■ Final supported: N/A</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>	■ ASIC
<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>	■ See “Service Modules” on page 133 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>■ Multiple SMs provide redundancy.</li> <li>■ See <i>JUNOSe Physical Layer Configuration Guide, Chapter 9, Managing Tunnel-Service and IPSec-Service Interfaces</i></li> </ul>
<b>Cables and connectors</b>	■ N/A
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Tunnel Service Interfaces</i> in <i>JUNOSe Physical Layer Configuration Guide, Chapter 9, Managing Tunnel-Service and IPSec-Service Interfaces</i> .

## 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</li> <li>■ Final supported: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> </ul>
<b>Type</b>	■ N/A
<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>	■ N/A
<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP 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</li> <li>■ Final supported: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> </ul>
<b>Type</b>	■ N/A
<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>	■ N/A
<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules</i> .



## SRP-10G Module Combination (1-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</li> <li>■ Final supported: N/A</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 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. See <i>E-series End-of-Life Modules Guide</i>.</li> </ul>
<b>Type</b>	■ N/A
<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>	■ N/A
<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP 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</li> <li>■ Final supported: N/A</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. See <i>E-series End-of-Life Modules Guide</i>.</li> </ul>
<b>Type</b>	■ N/A
<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>	■ N/A
<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP 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: N/A</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>Description</b>	<ul style="list-style-type: none"> <li>■ 210 W</li> <li>■ Switch route processor (40 Gbps)</li> </ul>
<b>Type</b>	■ N/A
<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>	■ N/A
<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules</i> .

## SRP-SE10G Module Combination (512-MB 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: 5.1.0</li> <li>■ Final supported: N/A</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>	■ N/A
<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>	■ N/A
<b>Model compatibility</b>	■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-SE10G
<b>Module redundancy support</b>	■ N/A
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ RJ-45</li> <li>■ RS-232 (DB-9)</li> <li>■ See <i>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP 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: 5.1.1</li> <li>■ Final supported: N/A</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>	■ N/A
<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>	■ N/A
<b>Model compatibility</b>	■ ERX-310 router
<b>SRP module compatibility</b>	■ SRP-SE10G
<b>Module redundancy support</b>	■ N/A
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ RJ-45</li> <li>■ RS-232 (DB-9)</li> <li>■ See <i>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li> </ul>
<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Modules</i> in <i>JUNOS System Basics Configuration Guide, Chapter 5, Managing Line Modules and SRP Modules</i> .

## T3 ATM Module Combination (4 Ports)

<b>Line module label</b>	OCx/STMx ATM or 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: N/A</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>	■ ASIC
<b>Capability</b>	■ ATM/AAL5
<b>Software features</b>	■ See “Unchannelized T3 Modules” on page 136 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 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces</i> in <i>JUNOSe 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: N/A</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>	■ 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 136 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>

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<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 2, Configuring T3 and E3 Interfaces</i> .

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## 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: N/A</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>	■ ASIC
<b>Capability</b>	<ul style="list-style-type: none"> <li>■ DS5, DS1, DS0</li> <li>■ HDLC framing</li> </ul>
<b>Software features</b>	■ See “Channelized T3 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>

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<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>E-series Hardware Guide, Chapter 6, Cabling E-series Routers</i> for more information.</li></ul>
<b>LEDs</b>	<ul style="list-style-type: none"><li>■ See “Module LEDs” on page 141.</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 1, Configuring Channelized T3 Interfaces</i>.</li></ul>

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## X.21/V.35 Module Combination

<b>Line module label</b>	X.21/V.35
<b>I/O module label</b>	X.21/ V.35 I/O
<b>Number of I/O ports</b>	■ 16
<b>Software release</b>	<ul style="list-style-type: none"> <li>■ First supported: 2.10.1, 3.3.2</li> <li>■ Final supported: N/A</li> </ul>
<b>Description</b>	<ul style="list-style-type: none"> <li>■ 60 W</li> <li>■ X.21/V.35 synchronous serial interface</li> </ul>
<b>Type</b>	■ Non-ASIC
<b>Capability</b>	■ HDLC framing
<b>Software features</b>	■ See “X.21/V.35 Modules” on page 139 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-1410 router</li> </ul>
<b>SRP module compatibility</b>	<ul style="list-style-type: none"> <li>■ SRP-5G</li> <li>■ SRP-5G +</li> <li>■ SRP-10G</li> </ul>
<b>Module redundancy support</b>	■ N/A
<b>Cables and connectors</b>	<ul style="list-style-type: none"> <li>■ 200-pin proprietary socket on I/O module</li> <li>■ DB15 X.21 or DB34 V.35 at remote end</li> <li>■ Serial signals can travel a limited distance without significant degradation. Slower serial signals can travel farther without degradation than faster serial signals. See below for the maximum cable lengths you can use to prevent signal degradation at various transmission speeds.</li> </ul>
<b>Cable Lengths</b>	
<b>Transmission Speed (Hz)</b>	<b>Cable Length (Feet/Meters)</b>
■ 2400	■ 4,100/1,250
■ 4800	■ 2,050/625
■ 9600	■ 1,025/312
■ 19200	■ 513/156
■ 38400	■ 256/78
■ 56000	■ 102/31
■ 2048000	■ 25/8

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<b>LEDs</b>	■ See “Module LEDs” on page 141.
<b>Alarms, errors, and events</b>	■ See <i>Monitoring Interfaces</i> in <i>JUNOS Physical Layer Configuration Guide, Chapter 8, Configuring X.21/V.35 Interfaces</i> .

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## 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 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. These features will be fully tested and supported in a future release. We expect that these features will behave as documented; however, 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 118
- Channelized T1 and E1 Modules on page 119
- Channelized T3 Modules on page 121
- Ethernet Modules on page 123
- HSSI Modules on page 126
- OCx/STMx GE/FE Modules on page 128
- OCx/STMx ATM Modules on page 129
- OCx/STMx POS and OC48 Modules on page 131
- Service Modules on page 133
- Unchannelized E3 Modules on page 134
- Unchannelized T3 Modules on page 136
- X.21/V.35 Modules on page 139

## Channelized OCx/STMx Modules

**Table 2: Channelized OCx/STMx Modules**

<b>Protocol or Application</b>	<b>cOCx Line Module with cOC3/STM1 Modules</b>	<b>cOCx Line Module with cOC12/STM4 FO I/O Modules</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	Multimode I/O module only
ATM (point-to-point)	No	No
BERT	Yes	Yes
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	No	No
Bridged IP	No	No
CBF	No	No
Cisco HDLC	Yes	Yes
DHCP external server	No	No
DHCP local server	No	No
Dynamic interfaces	No	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
LAC support—access side	No	No
LAC support—peer side	No	No
LNS support—peer side	No	No
Local loopback	Yes	Yes

<b>Protocol or Application</b>	<b>cOCx Line Module with cOC3/STM1 Modules</b>	<b>cOCx Line Module with cOC12/STM4 FO I/O Modules</b>
MDL (maintenance data link)	Yes	Yes
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
SMDS (trunk encapsulation)	No	No
Subscriber interfaces (static)	No	No
Subscriber interfaces (dynamic)	No	No
Transparent bridging	No	No
Tunnel-server ports	No	No
VRRP	No	No

## Channelized T1 and E1 Modules

**Table 3: Channelized T1 and E1 Modules**

<b>Protocol or Application</b>	<b>CT1 Line Module with CT1 Full I/O Modules</b>	<b>CE1 Line Modules with CE1 Full I/O Modules</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	No
ATM (point-to-point)	No	No
BERT	Yes	Yes
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	No	No
Bridged IP	No	No

<b>Protocol or Application</b>	<b>CT1 Line Module with CT1 Full I/O Modules</b>	<b>CE1 Line Modules with CE1 Full I/O Modules</b>
CBF	No	No
Cisco HDLC	Yes	Yes
DHCP external server	No	No
DHCP local server	No	No
Dynamic interfaces	No	No
F4 OAM and F5 OAM (ATM administration)	No	No
FDL (facilities data link)	Yes	No
Firewall	Yes	Yes
Frame Relay	Yes	Yes
IEEE 802.3ad link aggregation	No	No
IP	Yes	Yes
IP multicast	No	No
IP reassembly for tunneled packets	No	No
IPSec	No	No
IPv6	No	No
IPv6 multicast	No	No
IPv6 neighbor discovery	No	No
IS-IS	Yes	Yes
J-Flow Statistics	No	No
LAC support—access side	No	No
LAC support—peer side	No	No
LNS support—peer side	No	No
Local loopback	Yes (T1 layer with AIS)	No
MDL (maintenance data link)	Yes (T1 layer)	No
MPLS	Yes	Yes
Multilink Frame Relay	Yes	Yes
Multilink PPP	Yes	Yes
Network Address Translation (NAT)	No	No
NBMA (multipoint ATM)	No	No
OSPF	Yes	Yes
Packet Mirroring	No	No
Packet over SONET	No	No
PPP	Yes	Yes
PPPoE	No	No
Remote loopback	Yes	No



<b>Protocol or Application</b>	<b>CT1 Line Module with CT1 Full I/O Modules</b>	<b>CE1 Line Modules with CE1 Full I/O Modules</b>
RIP	Yes	Yes
SMDS (trunk encapsulation)	No	No
Subscriber interfaces (static)	No	No
Subscriber interfaces (dynamic)	No	No
Transparent bridging	No	No
Tunnel-server ports	No	No
VRRP	No	No

## Channelized T3 Modules

**Table 4: Channelized T3 Modules**

<b>Protocol or Application</b>	<b>CT3 Line Modules with CT3/T3 I/O Modules</b>	<b>CT3/T3-F0 Line Modules with CT3/T3 12 I/O Modules</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	No
ATM	No	No
BERT	Yes (T1 layer)	Yes
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	No	No
Bridged IP	No	No
CBF	No	No
Cisco HDLC	Yes	Yes
DHCP external server	No	No
DHCP local server	No	No
Dynamic interfaces	No	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	No	Yes

<b>Protocol or Application</b>	<b>CT3 Line Modules with CT3/T3 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
IPSec	No	No
IPv6	No	Yes
IPv6 multicast	No	Yes
IPv6 neighbor discovery	No	No
IS-IS	Yes	Yes
J-Flow Statistics	Yes	Yes
LAC support—access side	No	No
LAC support—peer side	No	No
LNS support—peer side	No	No
Local loopback	Yes (with AIS)	Yes
MDL (maintenance data link)	Yes	Yes
MPLS	No (Layer 2 over MPLS only)	Yes (Layer 2 over MPLS only)
Multilink Frame Relay	Yes	Yes
Multilink PPP	Yes	Yes
Network Address Translation (NAT)	No	Yes
NBMA (multipoint ATM)	No	No
OSPF	Yes	Yes
Packet Mirroring	No	No
Packet over SONET	No	No
PPP	Yes	Yes
PPPoE	No	No
Remote loopback	Yes	Yes
RIP	Yes	Yes
SMDS (trunk encapsulation)	No	No
Subscriber interfaces (static)	No	No
Subscriber interfaces (dynamic)	No	No
Transparent bridging	No	No
Tunnel-server ports	No	No
VRRP	No	No

## Ethernet Modules

**Table 5: Fast Ethernet Modules**

<b>Protocol or Application</b>	<b>FE-2 Line Module with FE-2 I/O Modules</b>	<b>GE/FE Line Module with FE-8 I/O and FE-8 SFP I/O Modules</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	No
ATM	No	No
BERT	No	No
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	No	No
Bridged IP	No	No
CBF	No	No
Cisco HDLC	No	No
DHCP external server	Yes	Yes
DHCP local server	Yes	Yes
Dynamic interfaces	Yes	Yes
F4 OAM and F5 OAM (ATM administration)	No	No
FDL (facilities data link)	No	No
Firewall	No	Yes
Frame Relay	No	No
IEEE 802.3ad link aggregation	No	Yes
IP	Yes	Yes
IP multicast	No	Yes
IP reassembly for tunneled packets	No	No
IPSec	No	No
IPv6	No	Yes
IPv6 multicast	No	Yes
IPv6 neighbor discovery	No	Yes
IS-IS	Yes	Yes
J-Flow Statistics	No	Yes
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

<b>Protocol or Application</b>	<b>FE-2 Line Module with FE-2 I/O Modules</b>	<b>GE/FE Line Module with FE-8 I/O and FE-8 SFP I/O Modules</b>
MPLS	Yes	Yes
Multilink Frame Relay	No	No
Multilink PPP	No	No
Network Address Translation (NAT)	No	Yes
NBMA (multipoint ATM)	No	No
OSPF	Yes	Yes
Packet Mirroring	No	Yes
Packet over SONET	No	No
PPP	No	No
PPPoE	Yes	Yes
Remote loopback	No	No
RIP	Yes	Yes
SMDS (trunk encapsulation)	No	No
Subscriber interfaces (static)	No	Yes
Subscriber interfaces (dynamic)	No	Yes
Transparent bridging	No	Yes
Tunnel-server ports	No	No
VRRP	Yes	Yes

**Table 6: Gigabit Ethernet Modules**

<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 APS SFP I/O Modules (formerly 2XGE APS I/O)</b>	<b>GE Line Module with GE-8 I/O Modules</b>
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			
BGP	Yes	Yes	Yes
BGP/MPLS VPNs	Yes	Yes	Yes
Bridged Ethernet	No	No	No
Bridged IP	No	No	No

<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 APS SFP I/O Modules (formerly 2XGE APS I/O)</b>	<b>GE Line Module with GE-8 I/O Modules</b>
CBF	No	No	No
Cisco HDLC	No	No	No
DHCP external server	Yes	Yes	Yes
DHCP local server	Yes	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
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
MPLS	Yes	Yes	Yes
Multilink Frame Relay	No	No	No
Multilink PPP	No	No	No
Network Address Translation (NAT)	Yes	Yes (not yet fully qualified)	No
NBMA (multipoint ATM)	No	No	No
OSPF	Yes	Yes	Yes
Packet Mirroring	Yes	No	No

<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 APS SFP I/O Modules (formerly 2XGE APS I/O)</b>	<b>GE Line Module with GE-8 I/O Modules</b>
Packet over SONET	No	No	No
PPP	No	No	No
PPPoE	Yes	Yes	Yes
Remote loopback	No	No	No
RIP	Yes	Yes	Yes
SMDS (trunk encapsulation)	No	No	No
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 (dynamic only)	Yes (dynamic only)
VRRP	Yes	Yes	Yes

## HSSI Modules

**Table 7: HSSI Modules**

<b>Protocol or Application</b>	<b>HSSI-3F Line Modules with HSSI-3F I/O Modules</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	No
APS/MSP	No
ATM	No
BERT	No
BGP	Yes
BGP/MPLS VPNs	No
Bridged Ethernet	No
Bridged IP	No
CBF	Yes
Cisco HDLC	Yes
DHCP external server	No
DHCP local server	No
Dynamic interfaces	No
F4 OAM and F5 OAM (ATM administration)	No
FDL (facilities data link)	No

<b>Protocol or Application</b>	<b>HSSI-3F Line Modules with HSSI-3F I/O Modules</b>
Firewall	No
Frame Relay	Yes
IEEE 802.3ad link aggregation	No
IP	Yes
IP multicast	No
IP reassembly for tunneled packets	No
IPSec	No
IPv6	No
IPv6 multicast	No
IPv6 neighbor discovery	No
IS-IS	Yes
J-Flow Statistics	No
LAC support—access side	No
LAC support—peer side	No
LNS support—peer side	No
Local loopback	No
MDL (maintenance data link)	No
MPLS	No
Multilink Frame Relay	No
Multilink PPP	No
Network Address Translation (NAT)	No
NBMA (multipoint ATM)	No
OSPF	Yes
Packet Mirroring	No
Packet over SONET	No
PPP	Yes
PPPoE	No
Remote loopback	No
RIP	Yes
SMDS (trunk encapsulation)	Yes
Subscriber interfaces (static)	No
Subscriber interfaces (dynamic)	No
Transparent bridging	No
Tunnel-server ports	No
VRRP	No

## OCx/STMx GE/FE Modules

**Table 8: OCx/STMx GE/FE Modules**

<b>Protocol or Application</b>	<b>OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (OC3/STM1 ATM Interfaces)</b>	<b>OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (Gigabit Ethernet Interfaces)</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	No
ATM	Yes	No
BERT	No	No
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	Yes	No
Bridged IP	Yes	No
CBF	No	No
Cisco HDLC	No	No
DHCP external server	Yes	Yes
DHCP local server	Yes	Yes
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
IPSec	No	No
IPv6	Yes	Yes
IPv6 multicast	Yes	Yes
IPv6 neighbor discovery	Yes	Yes
IS-IS	Yes	Yes
J-Flow Statistics	Yes	Yes
LAC support—access side	Yes	Yes
LAC support—peer side	Yes	Yes
LNS support—peer side	Yes	Yes
Local loopback	No	No



<b>Protocol or Application</b>	<b>OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (OC3/STM1 ATM Interfaces)</b>	<b>OCx/STMx GE/FE Line Modules with OC3-2 GE APS I/O Modules (Gigabit Ethernet Interfaces)</b>
MDL (maintenance data link)	No	No
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
SMDS (trunk encapsulation)	No	No
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
VRRP	No	Yes

## OCx/STMx ATM Modules

**Table 9: OCx/STMx ATM Modules**

<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>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes
APS/MSP	No	Yes
ATM	Yes	Yes
BERT	No	No
BGP	Yes	Yes
BGP/MPLS VPNs	Yes	Yes
Bridged Ethernet	Yes	Yes
Bridged IP	Yes	Yes

<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>
CBF	No	No
Cisco HDLC	No	No
DHCP external server	Yes	Yes
DHCP local server	Yes	Yes
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
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
MPLS	Yes	Yes
Multilink Frame Relay	No	No
Multilink PPP	Yes (with fragmentation and reassembly)	Yes (with fragmentation and reassembly)
Network Address Translation (NAT)	Yes	Yes
NBMA (multipoint ATM)	Yes	Yes
OSPF	Yes	Yes
Packet Mirroring	Yes	Yes
Packet over SONET	No	No
PPP	Yes	Yes
PPPoE	Yes	Yes
Remote loopback	No	No

<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>
RIP	Yes	Yes
SMDS (trunk encapsulation)	No	No
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
VRRP	No	No

## OCx/STMx POS and OC48 Modules

**Table 10: OCx/STMx POS and OC48 Modules**

<b>Protocol or Application</b>	<b>OCx/STMx POS Line Modules with OC3-4 I/O Modules</b>	<b>OCx/STMx POS Line Modules with OC12/STM4 I/O Modules</b>	<b>OC48 Line Module with OC48 Frame APS I/O Module</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes	Yes
APS/MSP	No	Yes	No
ATM	No	No	No
BERT	No	No	No
BGP	Yes	Yes	Yes
BGP/MPLS VPNs	Yes	Yes	Yes
Bridged Ethernet	No	No	No
Bridged IP	No	No	No
CBF	No	No	No
Cisco HDLC	Yes	Yes	Yes
DHCP external server	No	No	No
DHCP local server	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

<b>Protocol or Application</b>	<b>OCx/STMx POS Line Modules with OC3-4 I/O Modules</b>	<b>OCx/STMx POS Line Modules with OC12/STM4 I/O Modules</b>	<b>OC48 Line Module with OC48 Frame APS I/O Module</b>
IP	Yes	Yes	Yes
IP multicast	Yes	Yes	Yes
IP reassembly for tunneled packets	No	No	No
IPSec	No	No	Yes
IPv6	Yes	Yes	Yes (PPP only)
IPv6 multicast	Yes	Yes	Yes
IPv6 neighbor discovery	No	No	No
IS-IS	Yes	Yes	Yes
J-Flow Statistics	Yes	Yes	Yes
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
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	No
Packet over SONET	Yes	Yes	Yes
PPP	Yes	Yes	Yes
PPPoE	No	No	No
Remote loopback	No	No	No
RIP	Yes	Yes	Yes
SMDS (trunk encapsulation)	No	No	No
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
VRRP	No	No	No

## Service Modules

**Table 11: Service Modules**

<b>Protocol or Application</b>	<b>Tunnel Service Line Module (TSM)</b>	<b>Service Line Module (SM)</b>	<b>IPSec Service Line Module</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	No	No	No
APS/MSP	No	No	No
ATM	No	No	No
BERT	No	No	No
BGP	Yes	Yes	Yes
BGP/MPLS VPNs	No	No	No
Bridged Ethernet	No	No	No
Bridged IP	No	No	No
CBF	No	No	No
Cisco HDLC	No	No	No
DHCP external server	No	No	No
DHCP local server	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	No
Frame Relay	No	No	No
IEEE 802.3ad link aggregation	No	No	No
IP	Yes	Yes	Yes
IP multicast	Yes	Yes	No
IP reassembly for tunneled packets	Yes	Yes	Yes
IPSec	No	No	Yes
IPv6	Yes	Yes	No
IPv6 multicast	Yes	Yes	No
IPv6 neighbor discovery	No	No	No
IS-IS	Yes	Yes	Yes
J-Flow Statistics	Yes	Yes	Yes
LAC support—access side	No	No	No
LAC support—peer side	No	No	No
LNS support—peer side	Yes	Yes	No

<b>Protocol or Application</b>	<b>Tunnel Service Line Module (TSM)</b>	<b>Service Line Module (SM)</b>	<b>IPSec Service Line Module</b>
Local loopback	No	No	No
MDL (maintenance data link)	No	No	No
MPLS	No (over GRE only)	No (over GRE only)	No (over GRE only)
Multilink Frame Relay	No	No	No
Multilink PPP	Yes (with fragmentation and reassembly; dynamic only)	Yes (with fragmentation and reassembly; dynamic only)	No
Network Address Translation (NAT)	Yes	Yes	No
NBMA (multipoint ATM)	No	No	No
OSPF	Yes	Yes	Yes
Packet Mirroring	Yes	Yes	Yes
Packet over SONET	No	No	No
PPP	Yes (dynamic only)	Yes (dynamic only)	No
PPPoE	No	No	No
Remote loopback	No	No	No
RIP	Yes	Yes	Yes
SMDS (trunk encapsulation)	No	No	No
Subscriber interfaces (static)	Yes (GRE tunnels only)	Yes (GRE tunnels only)	No
Subscriber interfaces (dynamic)	Yes (over GRE tunnels only)	Yes (over GRE tunnels only)	No
Transparent bridging	No	No	No
Tunnel-server ports	Yes (static only)	Yes (static only)	Yes (static only)
VRRP	No	No	No

## Unchannelized E3 Modules

**Table 12: Unchannelized E3 Modules**

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

<b>Protocol or Application</b>	<b>E3 ATM Line Modules with E3 I/O Modules</b>	<b>E3 FRAME Line Modules with E3 I/O Modules</b>	<b>COCX-F3 Line Modules with E3-12 FRAME I/O Modules</b>
BGP/MPLS VPNs	No	Yes	Yes
Bridged Ethernet	Yes	No	No
Bridged IP	Yes (over bridged Ethernet)	No	No
CBF	No	Yes	Yes
Cisco HDLC	No	Yes	Yes
DHCP external server	Yes	No	No
DHCP local server	Yes	No	No
Dynamic interfaces	Yes	No	No
F4 OAM and F5 OAM (ATM administration)	Yes	No	No
FDL (facilities data link)	No	No	No
Firewall	No	No	Yes
Frame Relay	No	Yes	Yes
IEEE 802.3ad link aggregation	No	No	No
IP	Yes	Yes	Yes
IP multicast	No	No	Yes
IP reassembly for tunneled packets	No	No	No
IPSec	No	No	No
IPv6	No	No	Yes
IPv6 multicast	No	No	Yes
IPv6 neighbor discovery	No	No	No
IS-IS	Yes	Yes	Yes
J-Flow Statistics	Yes	Yes	Yes
LAC support—access side	Yes	No	No
LAC support—peer side	Yes	No	No
LNS support—peer side	Yes	No	No
Local loopback	No	No	No
MDL (maintenance data link)	No	No	No
MPLS	No	No (Layer 2 over MPLS only)	Yes (over PPP and Cisco HDLC; also supports Martini encapsulation of HDLC and Frame Relay over MPLS)
Multilink Frame Relay	No	No	Yes
Multilink PPP	No	No	Yes
Network Address Translation (NAT)	No	No	Yes

<b>Protocol or Application</b>	<b>E3 ATM Line Modules with E3 I/O Modules</b>	<b>E3 FRAME Line Modules with E3 I/O Modules</b>	<b>COCX-F3 Line Modules with E3-12 FRAME I/O Modules</b>
NBMA (multipoint ATM)	No	No	No
OSPF	Yes	Yes	Yes
Packet Mirroring	No	No	Yes
Packet over SONET	No	No	No
PPP	Yes	Yes	Yes
PPPoE	Yes (over bridged Ethernet)	No	No
Remote loopback	No	No	No
RIP	Yes	Yes	Yes
SMDS (trunk encapsulation)	No	Yes	Yes
Subscriber interfaces (static)	No	No	No
Subscriber interfaces (dynamic)	No	No	No
Transparent bridging	No	No	No
Tunnel-server ports	No	No	No
VRRP	No	No	No

## Unchannelized T3 Modules

**Table 13: Unchannelized T3 Modules**

<b>Protocol or Application</b>	<b>T3 ATM Line Modules with CT3/T3 I/O Modules</b>	<b>T3 FRAME Line Modules with CT3/T3 I/O Modules</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>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	Yes	Yes	Yes	Yes	Yes
APS/MSP	No	No	No	No	No
ATM (point-to-point)	Yes	No	No	Yes	No
BERT	No	No	Yes	No	Yes
BGP	Yes	Yes	Yes	Yes	Yes
BGP/MPLS VPNs	No	Yes	Yes	Yes	Yes
Bridged Ethernet	Yes (without VLANs)	No	No	Yes	No



<b>Protocol or Application</b>	<b>T3 ATM Line Modules with CT3/T3 I/O Modules</b>	<b>T3 FRAME Line Modules with CT3/T3 I/O Modules</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>
Bridged IP	Yes (over bridged Ethernet)	No	No	Yes	No
CBF	No	Yes	Yes	No	No
Cisco HDLC	No	Yes	Yes	No	Yes
DHCP external server	Yes	No	No	Yes	No
DHCP local server	Yes	No	No	Yes	No
Dynamic interfaces	Yes	No	No	Yes	No
F4 OAM and F5 OAM (ATM administration)	Yes	No	No	Yes	No
FDL (facilities data link)	No	No	No	No	No
Firewall	No	No	Yes	Yes	Yes
Frame Relay	No	Yes	Yes	No	Yes
IEEE 802.3ad link aggregation	No	No	No	No	No
IP	Yes	Yes	Yes	Yes	Yes
IP multicast	No	No	No	No	No
IP reassembly for tunneled packets	No	No	No	No	No
IPSec	No	No	No	No	No
IPv6	No	No	No	No	No
IPv6 multicast	No	No	Yes	Yes	Yes
IPv6 neighbor discovery	No	No	No	No	No
IS-IS	Yes	Yes	Yes	Yes	Yes
J-Flow Statistics	Yes	Yes	Yes	Yes	Yes
LAC support—access side	Yes	No	No	Yes	No
LAC support—peer side	Yes	No	No	Yes	No
LNS support—peer side	Yes	No	No	Yes	No
Local loopback	No	Yes	Yes	No	Yes
MDL (maintenance data link)	Yes	Yes	Yes	No	Yes

<b>Protocol or Application</b>	<b>T3 ATM Line Modules with CT3/T3 I/O Modules</b>	<b>T3 FRAME Line Modules with CT3/T3 I/O Modules</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>
MPLS	No	No (Layer 2 over MPLS only)	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	No	No	Yes	No	Yes
Multilink PPP	No	No	Yes	No	Yes
Network Address Translation (NAT)	No	No	Yes	Yes	Yes
NBMA (multipoint ATM)	No	No	No	Yes	No
OSPF	Yes	Yes	Yes	Yes	Yes
Packet Mirroring	No	No	Yes	Yes	Yes
Packet over SONET	No	No	No	No	No
PPP	Yes	Yes	Yes	Yes	Yes
PPPoE	Yes (over bridged Ethernet)	No	No	Yes	No
Remote loopback	No	Yes	Yes	No	Yes
RIP	Yes	Yes	Yes	Yes	Yes
SMDS (trunk encapsulation)	No	Yes	Yes	No	No
Subscriber interfaces (static)	No	No	No	Yes (over bridged Ethernet and IPoA)	No
Subscriber interfaces (dynamic)	No	No	No	Yes (over bridged Ethernet)	No
Transparent bridging	No	No	No	Yes	No
Tunnel-server ports	No	No	No	No	No
VRRP	No	No	No	No	No

## X.21/V.35 Modules

**Table 14: X.21/V.35 Modules**

<b>Protocol or Application</b>	<b>X.21/V.35-16 Line Modules with X.21/V.35-16 I/O Modules</b>
Accepts traffic destined for GRE tunnels or DVMRP (IP-in-IP) tunnels	No
APS/MSP	No
ATM	No
BERT	No
BGP	Yes
BGP/MPLS VPNs	No
Bridged Ethernet	No
Bridged IP	No
CBF	No
Cisco HDLC	Yes
DHCP external server	No
DHCP local server	No
Dynamic interfaces	No
F4 OAM and F5 OAM (ATM administration)	No
FDL (facilities data link)	No
Firewall	No
Frame Relay	Yes
IEEE 802.3ad link aggregation	No
IP	Yes
IP multicast	No
IP reassembly for tunneled packets	No
IPSec	No
IPv6	No
IPv6 multicast	No
IPv6 neighbor discovery	No
IS-IS	Yes
J-Flow Statistics	No
LAC support—access side	No
LAC support—peer side	No
LNS support—peer side	No
Local loopback	No
MDL (maintenance data link)	No

<b>Protocol or Application</b>	<b>X.21/V.35-16 Line Modules with X.21/V.35-16 I/O Modules</b>
MPLS	No
Multilink Frame Relay	Yes
Multilink PPP	Yes
Network Address Translation (NAT)	No
NBMA (multipoint ATM)	No
OSPF	Yes
Packet Mirroring	No
Packet over SONET	No
PPP	Yes
PPPoE	No
Remote loopback	No
RIP	Yes
SMDS (trunk encapsulation)	No
Subscriber interfaces (static)	No
Subscriber interfaces (dynamic)	No
Transparent bridging	No
Tunnel-server ports	No
VRRP	No

## Appendix B

# Module LEDs

This appendix describes the LEDs found on E-series 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. It is helpful to familiarize yourself with LED activity so that you can easily detect and correct a module-related problem with minimal or no system downtime. This appendix contains the following sections:

- LED Identification on page 141
- Redundancy Status on page 146

### LED Identification

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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 15 shows the functions of the module and port status LEDs.

**Table 15: 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

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, OCx/STMx, and X.21/V.35 line modules is nonfunctional.	
SRP module	POWER A OK	Power	Green	Power online on source A	Power off
	POWER B OK	Power	Green	Power online on source B	Power off
	FAN OK	Fan	Green	Fan online	Critical fan failure
	FAN FAIL	Fan	Red	Critical fan failure	Fan online
<b>NOTE:</b> When the LED alternates between OK and FAIL at ten-second intervals, a non-critical fan failure exists.					
	LINK	Ethernet	Green	Ethernet link up	Ethernet link down
	ACTIVITY	Ethernet	Green	Blinks when Ethernet traffic on link	No Ethernet traffic on link
Ethernet line modules	LINK	Ethernet	Green	Ethernet link up	Ethernet link down
	ACTIVITY	Ethernet	Green	Blinks when Ethernet traffic on link	No Ethernet traffic on link

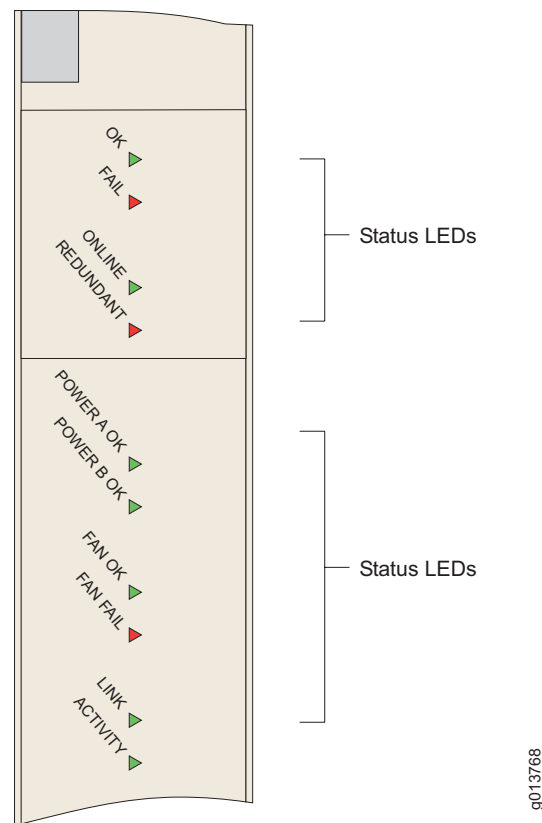
LED Location	LED Label	LED Indicator	LED Color	OFF to ON	ON to OFF
HSSI line module	SYNC	Port status	Green	If the port is configured as DTE, the LED lights when both the DCE and the clock source are available.  If the port is configured as DCE, the LED lights when the DTE is available.	If the port is configured as DTE, the LED goes out when either the DCE or the clock source becomes unavailable.  If the port is configured as DCE, the LED goes out when the DTE becomes unavailable.
	YEL ALM	<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.
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

LED Location	LED Label	LED Indicator	LED Color	OFF to ON	ON to OFF
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)
- Ethernet line module (Figure 2)
- Other line modules (Figure 3)

**Figure 1: SRP Module LEDs**



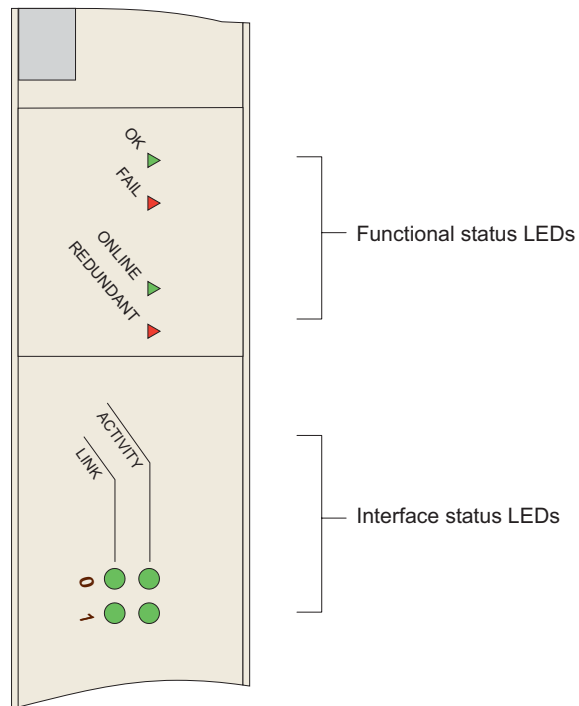
**NOTE:** The primary SRP module illuminates the REDUNDANT LED only when the SRP module detects that there is a secondary or standby SRP module online. The standby SRP module monitors an activity signal from the primary SRP module to determine its state; it does not shadow the operations of the primary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

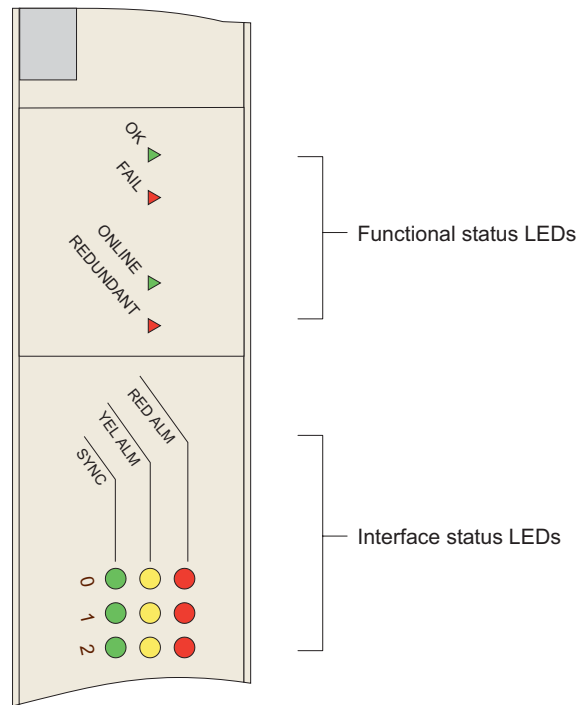
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**Figure 2: FE2 Module LEDs**



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 16.



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

**Table 16: 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.

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1 April 2005—Beta draft; added IEEE to protocol tables; 7.0.0b1  
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