



Overview: Cisco XR 12000 Series Router Shared Port Adapters

This chapter describes the shared port adapters (SPAs) that are supported on the Cisco XR 12000 Series Router and contains the following sections:

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- [Bandwidth Oversubscription, page 2-3](#)
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- [2-Port and 4-Port Channelized T3 to DS0 SPA Overview, page 2-6](#)
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- [24-Port Channelized T1/E1/J1 ATM CEoP SPA Overview, page 2-75](#)
- [1-Port Channelized OC-3 ATM CEoP SPA Overview, page 2-81](#)
- [1-Port 10-Gigabit Ethernet DWDM SPA Overview, page 2-82](#)
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SPA Summary

Table 2-1 shows the summary descriptions of the SPAs that are supported on the Cisco XR 12000 Series Router.

Table 2-1 Supported SPAs on Cisco XR 12000 Series Routers

Product Number	Description	Number of Ports	Minimum IOS XR Release	Minimum Hardware Revision
SPA-2XT3/E3	2-Port T3/E3 Serial SPA	2	3.3.0	1.0
SPA-4XT3/E3	4-Port T3/E3 Serial SPA	4	3.3.0	1.0
SPA-2XCT3/DS0	2-Port Channelized T3 to DS0 SPA	2	3.3.0	1.0
SPA-4XCT3/DS0	4-Port Channelized T3 to DS0 SPA	4	3.3.0	1.0
SPA-8XCHT1/E1	8-Port Channelized T1/E1 SPA	8	3.6.0	1.0
SPA-8XFE	8-Port FastEthernet SPA	8	3.3.0	1.0
SPA-8X1FE-TX-V2	8-Port Fast Ethernet SPA	8	3.4.0	1.0
SPA-1XTENGE-XFP	1-Port 10-Gigabit Ethernet SPA	1	3.2	1.0
SPA-1X10GE-L-V2	1-Port 10-Gigabit Ethernet SPA	1	3.4.0	1.0
SPA-2X1GE-V2	2-Port Gigabit Ethernet SPA	2	3.4.1	1.0
SPA-5XGE	5-Port Gigabit Ethernet SPA	5	3.2	1.0
SPA-5XGE-V2	5-Port Gigabit Ethernet SPA	5	3.4.0	1.0
SPA-10XGE	10-Port Gigabit Ethernet SPA	10	3.2	1.0
SPA-10X1GE-V2	10-Port Gigabit Ethernet SPA	10	3.4.0	1.0
SPA-1XCHOC3/DS0	1-Port Channelized STM-1/OC-3 SPA	1	3.5.0	1.0
SPA-1XCHOC12/DS0	1-Port Channelized STM-4/OC-12 SPA	1	3.5.0	1.0
SPA-1XCHOC48/DS3	1-Port Channelized STM-16/OC-48 SPA	1	3.6.0	1.0
SPA-OC192POS	1-Port OC-192/STM-64 POS SPA	1	3.2	1.0
SPA-4XOC3POS	4-Port OC-3/STM-1 POS SPA	4	3.5.0	1.0
SPA-8XOC12-POS	8-Port OC-3 STM-1/OC-12 STM-4 POS SPA	8	3.5.0	1.0
SPA-OC48POS	1-Port OC-48/STM-16 POS SPA	1	3.6.0	1.0
SPA-4XOC48POS	4-Port OC-48/STM-16 POS/RPR SPA	4	3.5.0	1.0
SPA-2XOC48POS	2-Port OC48-POS/RPR SPA	2	3.3.0	1.0
SPA-IPSEC-2G-2	IPSec VPN SPA	-	3.4.0	1.0
SPA-1XOC3-ATM-V2	1-Port Clear Channel OC-3 ATM SPA	1	3.7.0	1.0

Table 2-1 Supported SPAs on Cisco XR 12000 Series Routers (continued)

Product Number	Description	Number of Ports	Minimum IOS XR Release	Minimum Hardware Revision
SPA-3XOC3-ATM-V2	3-Port Clear Channel OC-3 ATM SPA	3	3.7.0	1.0
SPA-1XOC12-ATM-V2	1-Port Clear Channel OC-12 ATM SPA	1	3.7.0	1.0
SPA-2CHT3-CE-ATM	2-Port Channelized T3/E3 ATM CEoP SPA	2	3.7.0	1.0
SPA-24CHT1-CE-ATM	24-Port Channelized T1/E1/J1 ATM CEoP SPA	24	4.0.1	1.0
SPA-1CHOC3-CE-ATM	1-Port Channelized OC-3 ATM CEoP SPA	1	4.1.1	1.0
SPA-1X10GE-L-IT	1-Port 10-Gigabit Ethernet DWDM SPA	1	4.1.1	1.0
SPA-1X10GE-WL-V2	1-Port 10-Gigabit Ethernet WAN PHY SPA	1	4.3.0	1.0

Checking Hardware and Software Compatibility

To check the minimum software requirements of Cisco IOS XR software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com. This tool does not verify whether SIPs or SPAs within a system are compatible, but it does provide the minimum Cisco IOS XR requirements for individual hardware modules or components.



Note

Access to this tool is limited to users with Cisco.com login accounts.

To access Software Advisor, click **Login** at Cisco.com, type “Software Advisor” in the SEARCH box, and click **GO**. Click the link for the Software Advisor tool.

Choose a product family or enter a specific product number to search for the minimum supported software release needed for your hardware.

Bandwidth Oversubscription

Oversubscribing the bandwidth limit recommendations of a router can result in decreased or degraded performance. For this reason, it is important to determine the amount of bandwidth used by the SPAs on the router and verify that the total bandwidth used by all SPAs does not exceed the recommended bandwidth limit of the router. The aggregate throughput should not exceed 2 full-rate SPAs for 10G SIPs.



Note

The SIP-600 [10G SIP], SIP-401 [2.5G SIP], SIP-501 [5G SIP], and SIP-601 [10G SIP] can support up to 20G of installed SPAs, but the bandwidth through the engine and the fabric is no more than 10G (SIP-600 or SIP-601). The bandwidth through the engine and the fabric is no more than 5G for the SIP-501 and is no more than 2.5G for the SIP-401.



Note

In Cisco IOS XR software release 3.9.1 or prior, the full-rate SPAs need to be positioned in bay 0 and 1.

Table 2-2 provides information about the bandwidth for each port (per-port bandwidth) on a SPA, as well as the cumulative bandwidth (total bandwidth) for all ports available on the SPA.

Table 2-2 SPA Bandwidth Capacity

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
2-Port Channelized T3 SPA	44.736 Mbps	2	89.47 Mbps
4-Port Channelized T3 SPA	44.736 Mbps	4	178.94 Mbps
2-Port Clear Channel T3/E3 SPA	44.736 Mbps (T3) 34.368 Mbps (E3)	2	89.47 Mbps (T3) 68.74 Mbps (E3)
4-Port Clear Channel T3/E3 SPA	44.736 Mbps (T3) 34.368 Mbps (E3)	4	178.94 Mbps (T3) 137.47 Mbps (E3)
8-Port Channelized T1/E1 SPA	1.544 Mbps (T1) 2.048 Mbps (E1)	8	12.35 Mbps (T1) 16.38 Mbps (E1)
1-Port 10-Gigabit Ethernet SPA	10 Gbps	1	10 Gbps
5-Port Gigabit Ethernet SPA	1 Gbps	5	5 Gbps
10-Port Gigabit Ethernet SPA	1 Gbps	10	10 Gbps
1-Port Channelized STM-1/OC-3 SPA	155.52 Mbps	1	155.52 Mbps
1-Port Channelized STM-4/OC-12 SPA	622.08 Mbps	1	622.08 Mbps
1-Port Channelized STM-16/OC-48 SPA	2.488 Gbps	1	2.488 Gbps
1-Port OC-192/STM-64 POS SPA	9.953 Gbps	1	9.953 Gbps
4-Port OC-3/STM-1 POS SPA	155.52 Mbps	4	622.08 Mbps
8-Port OC-3 STM-1/OC-12 STM-4 POS SPA	155.52 Mbps or 622.08 Mbps	8	5 Gbps ¹
1-Port OC-12/STM-4 POS SPA	622.08 Mbps	1	622.08 Mbps
1-Port OC-48/STM-16 POS SPA	2.488 Gbps	1	2.488 Gbps
4-Port OC-48/STM-16 POS/RPR SPA	2.488 Gbps	4	10 Gbps
2-Port OC48-POS/RPR SPA	2.488 Gbps	2	4.976 Gbps
1-Port Clear Channel OC-3 ATM SPA	155.52 Mbps	1	155.52 Mbps
3-Port Clear Channel OC-3 ATM SPA	155.52 Mbps	3	466.56 Mbps
1-Port Clear Channel OC-12 ATM SPA	622.08 Mbps	1	622.08 Mbps
2-Port Channelized T3/E3 ATM CEoP SPA	44.210 Mbps 34.010 Mbps	2	88.42 Mbps 68.02 Mbps
24-Port Channelized T1/E1/J1 ATM CEoP SPA	1.544 Mbps 2.048 Mbps	24	37.056 Mbps 49.152 Mbps
1-Port Channelized OC-3 ATM CEoP SPA	155.52 Mbps	1	155.52 Mbps
1-Port 10-Gigabit Ethernet DWDM SPA	10 Gbps	1	10 Gbps
1-Port 10-Gigabit Ethernet WAN PHY SPA	10 Gbps	1	10 Gbps

1. Total bandwidth value assumes eight OC-12/STM-4 optics modules.

2-Port and 4-Port T3/E3 Serial SPA Overview

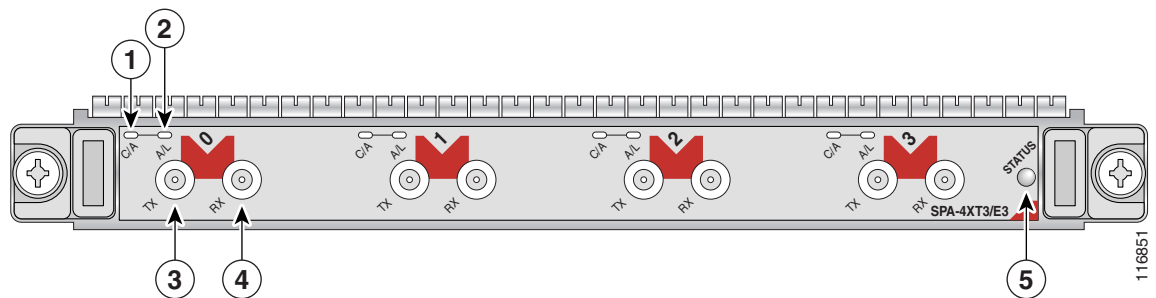
The following sections describe the 2-Port and 4-Port Clear Channel T3/E3 SPA:

- [2-Port and 4-Port Clear Channel T3/E3 SPA LEDs, page 2-5](#)
- [2-Port and 4-Port Clear Channel T3/E3 SPA Interface Specifications, page 2-6](#)
- [2-Port and 4-Port Clear Channel T3/E3 SPA Cables and Connectors, page 2-6](#)

2-Port and 4-Port Clear Channel T3/E3 SPA LEDs

The 2-Port and 4-Port Clear Channel T3/E3 SPA has three types of LEDs: two LEDs for each port on the SPA, and one STATUS LED, as shown in [Figure 2-1](#).

Figure 2-1 4-Port Clear Channel T3/E3 SPA Faceplate



1	C/A (Carrier/Alarm) LED	4	RX (Receive) connector
2	A/L (Active Loopback) LED	5	STATUS LED
3	TX (Transmit) connector		

[Table 2-3](#) describes the 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs.

Table 2-3 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid E3 or T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

2-Port and 4-Port Clear Channel T3/E3 SPA Interface Specifications

The framer processes incoming and outgoing T3 (cbit, m13/m23, and unframe) and E3 (g751, g832, and unframe) frames. The framer operates at T3/E3 line rates (44.736 /34.368 Mbps) depending on the mode in which it is configured.

Packet data is transported with a user-configurable encapsulation (such as Point-to-Point Protocol [PPP] or High-Level Data Link Control [HDLC]), and is mapped to T3 and E3 frames. The encapsulations add transport overhead to the packet of data frames before transporting, and are stripped when a packet is transported to the far end.

The T3/E3 SPA interface is compliant with ANSI and Telco standards. The interface also provides support for Management Information Base (MIB) RFC 2496 and T1.231.

2-Port and 4-Port Clear Channel T3/E3 SPA Cables and Connectors

The interface connectors on the 2-Port and 4-Port Clear Channel T3/E3 SPA are 75-ohm coaxial Siemax types, with one connector and cable for transmit (TX) and one for receive (RX).

The following cables can be used with the 2-Port and 4-Port Clear Channel T3/E3 SPA. The cables have BNC connectors on one end and the Siemax connectors on the other. If similar SPAs are connected back-to-back, both ends of cable will be Siemax.

- CAB-T3E3-RF-BNC-M (T3 or E3 Cable, 1.0/2.3 RF to BNC-Male, 10 feet)
- CAB-T3E3-RF-BNC-F (T3 or E3 Cable, 1.0/2.3 RF to BNC-Female, 10 feet)
- CAB-T3E3-RF-OPEN (T3 or E3 Cable, 1.0/2.3 RF to BNC-Open end, 10 feet)



Note

The Cisco cable part numbers are 72-4124-01 (with male BNC end) and 72-4131-01 (with female BNC end).

Figure 2-1 shows the connectors on the 4-Port Clear Channel T3/E3 SPA, and Table 2-4 describes the signal descriptions for these connectors.

Table 2-4 2-Port and 4-Port Clear Channel T3/E3 SPA Connectors

Connector Label	Meaning
TX	Transmitted signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the TX BNC connector.
RX	Received signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the RX BNC connector.

2-Port and 4-Port Channelized T3 to DS0 SPA Overview

The following sections describe the 2-Port and 4-Port Channelized T3 SPA:

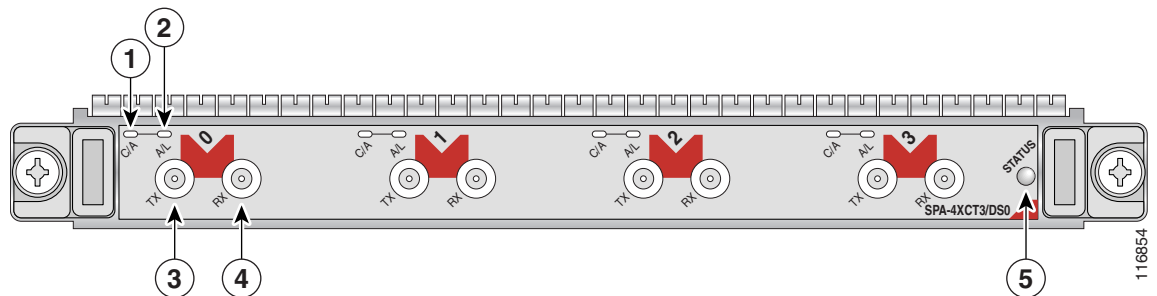
- [2-Port and 4-Port Channelized T3 SPA LEDs, page 2-7](#)
- [2-Port and 4-Port Channelized T3 SPA Interface Specifications, page 2-7](#)

- [2-Port and 4-Port Channelized T3 SPA Cables and Connectors, page 2-8](#)

2-Port and 4-Port Channelized T3 SPA LEDs

The 2-Port and 4-Port Channelized T3 SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. [Figure 2-2](#) shows an example of these LEDs on a 4-Port Channelized T3 SPA.

Figure 2-2 4-Port Channelized T3 SPA Faceplate



1	C/A (Carrier/Alarm) LED	4	RX (Receive) connector
2	A/L (Active Loopback) LED	5	STATUS LED
3	TX (Transmit) connector		

The 2-Port and 4-Port Channelized T3 SPA LEDs are described in [Table 2-5](#).

Table 2-5 2-Port and 4-Port Channelized T3 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid E3 or T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

2-Port and 4-Port Channelized T3 SPA Interface Specifications

The framer processes incoming and outgoing T3 frames (cbit, m13/m23, and unframe) and E3 (g751, g832) frames. The framer operates at T3/E3 line rates (44.2 44.736/34.368 Mbps) depending on the mode in which it is configured.

Packet data is transported with a user-configurable encapsulation (such as Point-to-Point Protocol [PPP] or High-Level Data Link Control [HDLC]), and is mapped to T3 and E3 frames. The encapsulations add transport overhead to the packet of data frames before transporting, and are stripped when a packet is transported to the far end.

The T3/E3 SPA interface is compliant with ANSI and Telco standards. The interface also provides support for Management Information Base (MIB) RFC 2495, RFC 2496, and T1.231.

**Note**

The 2-Port and 4-Port Channelized T3 SPA supports Frame Relay Fragmentation (FRF.12) and Multilink Frame Relay (MFR) features for Cisco IOS XR Software Release 3.6.0 and later releases.

2-Port and 4-Port Channelized T3 SPA Cables and Connectors

The interface connectors on the 2-Port and 4-Port Channelized T3 SPA are 75-ohm coaxial Siemax types, with one connector and cable for transmit (TX) and one for receive (RX).

The following cables can be used with the 2-Port and 4-Port Channelized T3 SPA. The cables have BNC connectors on one end and the Siemax connectors on the other.

- CAB-T3E3-RF-BNC-M (T3 or E3 Cable, 1.0/2.3 RF to BNC-Male, 10 feet)
- CAB-T3E3-RF-BNC-F (T3 or E3 Cable, 1.0/2.3 RF to BNC-Female, 10 feet)
- CAB-T3E3-RF-OPEN (T3 or E3 Cable, 1.0/2.3 RF to BNC-Open end, 10 feet)

**Note**

The Cisco cable part numbers are 72-4124-01 (with Male BNC end) and 72-4131-01 (with Female BNC end).

Figure 2-2 shows the Siemax connectors on the 2-Port and 4-Port Channelized T3 SPA, and Table 2-6 provides the signal descriptions for these connectors.

Table 2-6 2-Port and 4-Port Channelized T3 SPA Connectors

Connector Label	Meaning
TX	Transmitted signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the TX BNC Siemax connector.
RX	Received signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the RX BNC Siemax connector.

8-Port Channelized T1/E1 SPA Overview

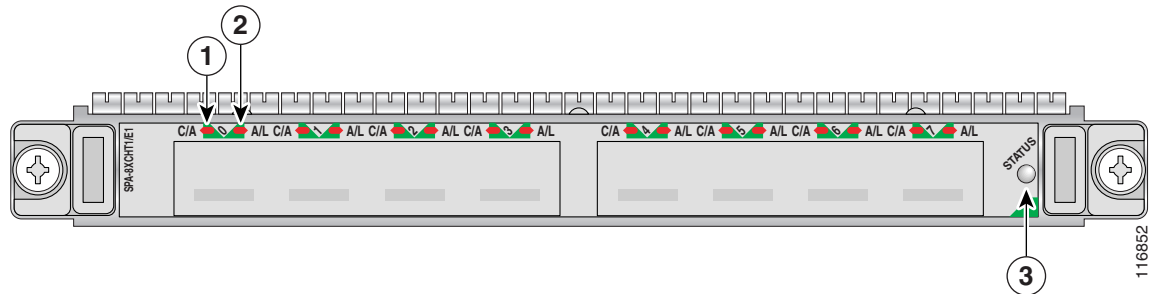
The following sections describe the 8-Port Channelized T1/E1 SPA:

- [8-Port Channelized T1/E1 SPA LEDs, page 2-9](#)
- [XFP Connections, page 2-14](#)
- [8-Port Channelized T1/E1 SPA Cables, Connectors, and Pinouts, page 2-10](#)

8-Port Channelized T1/E1 SPA LEDs

The 8-Port Channelized T1/E1 SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED as shown in [Figure 2-3](#).

Figure 2-3 8-Port Channelized T1/E1 SPA Faceplate



1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

The 8-Port Channelized T1/E1 SPA LEDs are described in [Table 2-7](#).

Table 2-7 8-Port Channelized T1/E1 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T1 or E1 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

8-Port Channelized T1/E1 SPA Interface Specifications

The E1 interface on the 8-Port Channelized T1/E1 SPA uses RJ-48c receptacles for E1 (120-Ohm) cables with RJ-45 connectors. You can use all ports simultaneously. Each E1 connection supports interfaces that meet G.703 standards. The RJ-45 connection does not require an external transceiver. The E1 ports are E1 interfaces that use 120-ohm shielded twisted pair (STP) cables.

**Warning**

Shielded twisted pair (STP) T1/E1 cables must be used to comply with EN55022/CISPR22 Class A emissions requirements. For revisions 73-8358-05 through 73-8358-08 Shielded Twisted pair (STP) T1/E1 cables must be used to comply with FCC Class A emissions requirements.

8-Port Channelized T1/E1 SPA Cables, Connectors, and Pinouts

Figure 2-4 shows an RJ-45 connector.

**Note**

The terms RJ-45 and RJ-48c are sometimes used interchangeably. The RJ-48c is the jack or receptacle; the RJ-45 is the connector.

Figure 2-4 RJ-45 Connector

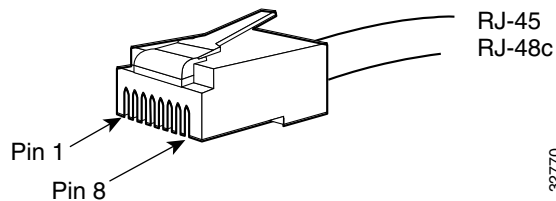


Table 2-8 describes the signals and connector pinouts for RJ-45 cable connectors.

Table 2-8 RJ-45 Connector Pinouts

Pin	Signal	Description
1	RX-	Receive ring -
2	RX+	Receive tip +
3	NC	No connection
4	TX-	Transmit ring -
5	TX+	Transmit tip +
6	NC	No connection
7	NC	No connection
8	NC	No connection

8 Port FastEthernet SPA Overview

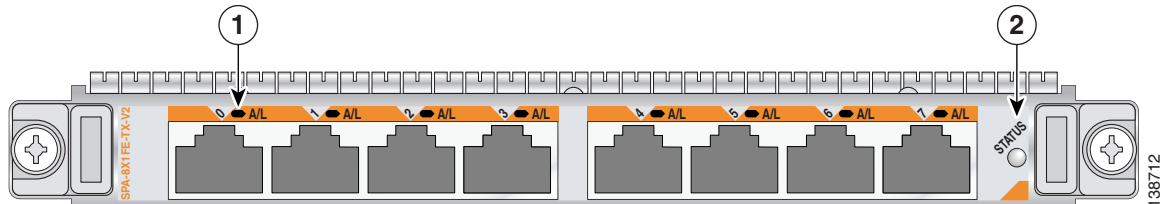
The following sections describe the 8-Port FastEthernet SPA:

- [8-Port FastEthernet SPA LEDs, page 2-11](#)
- [8-Port FastEthernet SPA Cables, Connectors, and Pinouts, page 2-11](#)

8-Port FastEthernet SPA LEDs

The 8-Port FastEthernet SPA has two types of LEDs: an A/L LED for each individual port and a STATUS LED for the SPA, as shown in [Figure 2-5](#).

Figure 2-5 8-Port FastEthernet SPA Faceplate



1	A/L (Active/Link) LED	2	STATUS LED
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[Table 2-9](#) describes the 8-Port FastEthernet SPA LEDs.

Table 2-9 8-Port FastEthernet SPA LEDs

LED Label	Color	State	Meaning
Port Number A/L (0, 1, 2, 3, 4, 5, 6 or 7) ¹	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

1. In this case, port number refers to the numbered LEDs on the 8-Port FastEthernet SPA (0, 1, 2, 3, 4, 5, 6 or 7). Each LED number on the 8-Port FastEthernet SPA references a port on the SPA.

8-Port FastEthernet SPA Cables, Connectors, and Pinouts

The interface connectors on the 8-Port FastEthernet SPA are eight individual RJ-45 receptacles. You can use all eight interface connectors simultaneously. Each connection supports IEEE 802.3 and Ethernet 10/100BASE-T interfaces compliant with appropriate standards. Cisco Systems does not supply Category 5 unshielded twisted-pair (UTP) RJ-45 cables; these cables are available commercially.

[Figure 2-6](#) shows the RJ-45 connector.

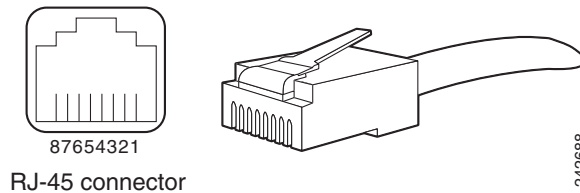
Figure 2-6 *RJ-45 Connections, Plug, and Receptacle*

Table 2-10 lists the pinouts and signals for the RJ-45 connector.

Table 2-10 *RJ-45 Connector Pinout*

Pin	Description
1	Transmit data + (TxD+)
2	TxD-
3	Receive data + (RxD+)
4	Reserved
5	Reserved
6	RxD-
7	Reserved
8	Reserved

**Note**

Referring to the RJ-45 pinout in Table 2-10, proper common-mode line terminations should be used for the unused Category 5 UTP cable pairs 4/5 and 7/8. Common-mode termination reduces the contributions to electromagnetic interference (EMI) and susceptibility to common-mode sources. Wire pairs 4/5 and 7/8 are actively terminated in the RJ-45 port circuitry in the 8-Port FastEthernet SPA.

The 8-Port FastEthernet SPA supports automatic MDI/MDIX crossover at all speeds of operation allowing the SPA to work with straight-through and crossover Ethernet cables. Depending on your RJ-45 interface cabling requirements, use the pinouts in Figure 2-7 and Figure 2-8.

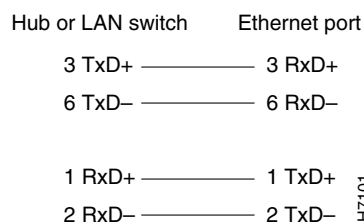
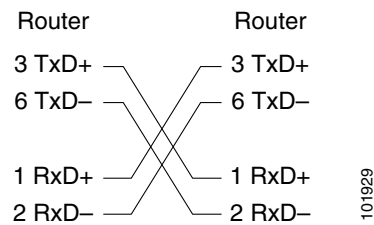
Figure 2-7 *Straight-Through Cable Pinout, RJ-45 Connection to a Hub or Repeater*

Figure 2-8 Crossover Cable Pinout, RJ-45 Connections Between Routers

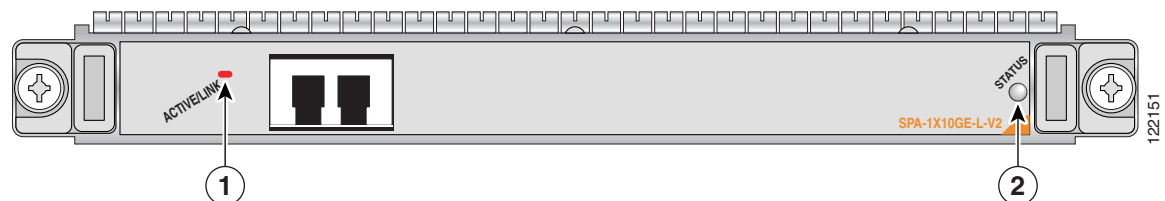
1 Port 10-Gigabit Ethernet SPA Overview

The following sections describe the 1-Port 10-Gigabit Ethernet SPA:

- [1-Port 10-Gigabit Ethernet SPA LEDs, page 2-13](#)
- [1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables, page 2-14](#)

1-Port 10-Gigabit Ethernet SPA LEDs

The 1-Port 10-Gigabit Ethernet SPA has two LEDs, an ACTIVE/LINK LED for the port and a STATUS LED, as shown in [Figure 2-9](#).

Figure 2-9 1-Port 10-Gigabit Ethernet SPA Faceplate

1	ACTIVE/LINK LED	2	STATUS LED
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[Table 2-11](#) describes the 1-Port 10-Gigabit Ethernet SPA LEDs.

Table 2-11 1-Port 10-Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
ACTIVE/LINK	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software and the link is up.
	Amber	On	Port is enabled by software and the link is down.
STATUS	Off	Off	SPA power is off.

Table 2-11 1-Port 10-Gigabit Ethernet SPA LEDs (continued)

LED Label	Color	State	Meaning
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables

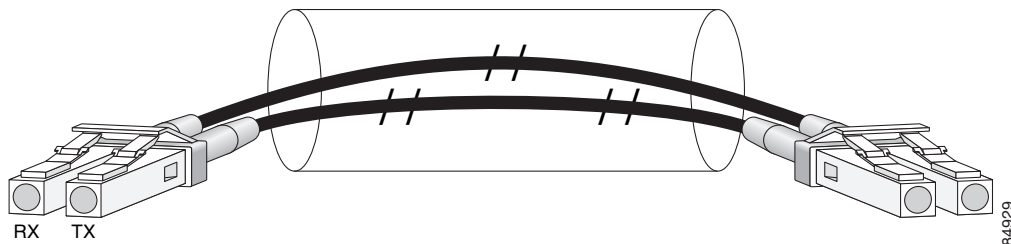
The 1-Port 10-Gigabit Ethernet SPA supports the following types of optical transceiver modules:

- Single-mode short-reach (SR) XFP module—XFP-10GLR-OC192SR
- Single-mode intermediate-reach (IR) XFP module—XFP-10GER-OC192IR
- Single-mode very-long-reach (ZR) XFP module—XFP-10GER-OC192LR
- Multi-mode short reach (SR) XFP module—XFP-10G-MM-SR

Cisco Systems qualifies the optics that are approved for use with its SPAs. As of Cisco IOS XR Release 3.4.1, the above-listed small form-factor pluggable (XFPs) are the only optical transceiver modules qualified for use.

Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns (nominal diameter is approximately 10/125 microns) to connect your router to a network.

Figure 2-10 shows the cable type for use with the XFP optical transceiver module on the 1-Port 10-Gigabit Ethernet SPA.

Figure 2-10 LC-Type Cable for the XFP Optical Transceiver Modules**Note**

The 40-pin connector on the 1-Port 10-Gigabit Ethernet SPA is used for resilient packet ring (RPR) connections. This feature is not supported in Cisco IOS XR Release 4.3.0.

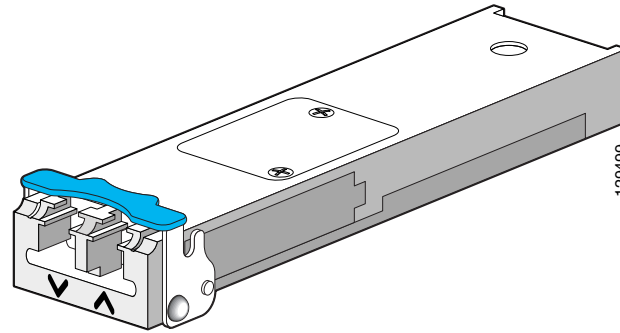
XFP Connections

The 10GLR, 10GER, and 10GZR XFP modules include an optical transmitter and receiver pair integrated with Clock and Data Recovery (CDR) integrated circuits. The XFP modules provide high-speed serial links at the rate of 10.3125 Gbps (10 Gigabit Ethernet) on single-mode fiber (SMF). The transmit side recovers and retimes the 10-Gbps serial data and passes it to a laser driver. The laser

driver biases and modulates a 1310-nm, 850 nm or 155-nm laser, enabling data transmission over SMF through an LC connector. The receive side recovers and retimes the 10-Gbps optical data stream from a photo detector transimpedance amplifier and passes it to an output driver.

See the label on the XFP module for technology type and model. [Figure 2-11](#) shows an XFP module and [Table 2-12](#) shows the XFP module specifications.

Figure 2-11 XFP Module



XFP module dimensions are:

- Height: 12.5 mm
- Width: 18.35 mm
- Length: 71.1mm

Table 2-12 XFP Module Specifications for 10-Gigabit Ethernet SPA

Specification	Description
Wavelength (TX)	10GLR SR-1: 1260 nm to 1355 nm 10GER IR-2: 1530 nm to 1565 nm 10GZR LR-2: 1530 nm to 1565 nm 10G-MM-SR: 840 nm to 860 nm
Cabling distance (maximum)	10GLR SR-1: 6.2 miles (10 km) 10GER IR-2: 24.8 miles (40 km) 10GZR LR-2: 50 miles (80 km) 10G-MM-SR: 26m, 33m, 66m, 82m, 300m
Operating case temperature range	10GLR SR-1: 23 to 158 degrees F (–5 to 70 degrees C) 10GER IR-2: 23 to 158 degrees F (–5 to 70 degrees C) 10GZR LR-2: 23 to 158 degrees F (–5 to 70 degrees C) 10G-MM-SR: 32 to 158 degrees F (0 to 70 degrees C)
Storage temperature range	10GLR SR-1: –40 to 185 degrees F (–40 to 85 degrees C) 10GER IR-2: –40 to 185 degrees F (–40 to 85 degrees C) 10GZR LR-2: –40 to 185 degrees F (–40 to 85 degrees C) 10G-MM-SR: –40 to 185 degrees F (–40 to 85 degrees C)
TX power	10GLR SR-1: –8.2 to 0.5 dBm 10GER IR-2: –4.7 to 4 dBm 10GZR LR-2: 0 to 4 dBm 10G-MM-SR: 3dBm, –1.5dBm, –1dBm

Table 2-12 XFP Module Specifications for 10-Gigabit Ethernet SPA (continued)

Specification	Description
Receiver sensitivity (maximum)	10GLR SR-1: -12.6 dBm 10GER IR-2: -14.1 dBm 10GZR LR-2: -24 dBm 10G-MM-SR: -11.1dBm
RX overload	10GLR SR-1: 0.5 dBm 10GER IR-2: -1.0 dBm 10GZR LR-2: -7.0 dBm 10G-MM-SR: 1.0 dBm
Maximum receiver power damage	10GLR SR-1: +5 dBm 10GER IR-2: +5 dBm 10GZR LR-2: +5 dBm 10G-MM-SR: -1dBm

XFP Port Cabling Specifications

Table 2-13 shows the port cabling specifications for an XFP module.

Table 2-13 XFP Port Cabling Specifications

XFP Module	Wavelength	Fiber Type
XFP-10GLR-OC192SR	1310 nm	SMF
XFP-10GER-OC192IR	1550 nm	SMF
XFP-10GZR-OC192LR	1550 nm	SMF
XFP-10G-MM-SR	850 nm	MMF

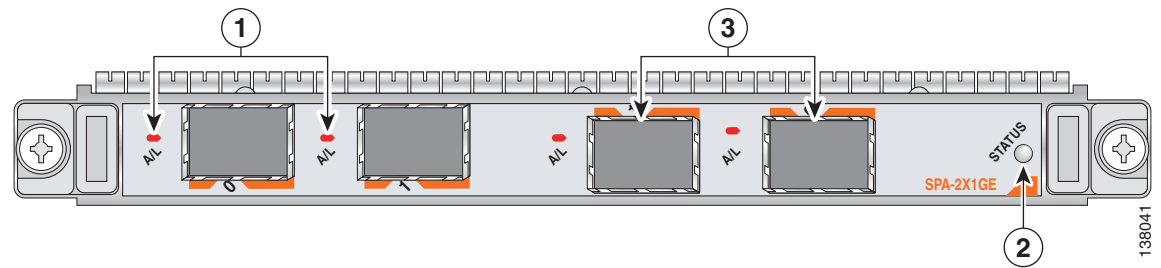
2-Port Gigabit Ethernet SPA Overview

The following sections describe the version 1 and version 2 of the 2-Port Gigabit Ethernet SPA:

- [2-Port Gigabit Ethernet SPA LEDs, page 2-16](#)
- [2-Port Gigabit Ethernet SPA \(Version 2\) LEDs, page 2-17](#)
- [SFP Module Cabling and Connection Equipment, page 2-20](#)

2-Port Gigabit Ethernet SPA LEDs

The 2-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in [Figure 2-12](#).

Figure 2-12 2-Port Gigabit Ethernet SPA Faceplate

1	A/L (Active/Link) LED	3	RJ-45 port (not supported on Cisco XR 12000 Series Router)
2	STATUS LED		

Table 2-14 describes the 2-Port Gigabit Ethernet SPA LEDs.

Table 2-14 2-Port Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

2-Port Gigabit Ethernet SPA (Version 2) LEDs

The 2-Port Gigabit Ethernet SPA (Version 2) has two types of LEDs: an A/L LED for each SFP port and a STATUS LED, as shown in Figure 2-13.

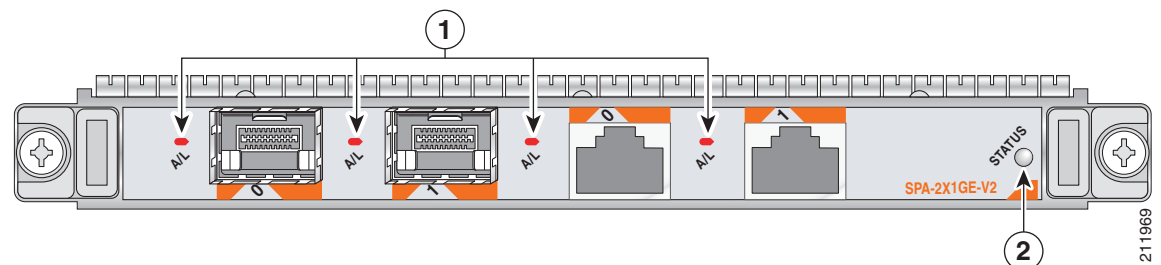
Figure 2-13 2-Port Gigabit Ethernet SPA (Version 2) Faceplate

Table 2-15 describes the 2-Port Gigabit Ethernet SPA (Version 2) LEDs.

1	A/L (Active/Link) LED	2	STATUS LED
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Table 2-15 2-Port Gigabit Ethernet SPA (Version 2) LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled by software and the link is up.
	Amber	On	Port is enabled by software and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

The valid configuration of the SFP ports for the 2-Port Gigabit Ethernet SPA (Version 2) is Port 0 (SFP) and Port 1 (SFP), or any single port.

**Note**

The 2-Port Gigabit Ethernet SPA has two RJ-45 ports. However, these RJ-45 ports are not supported by the Cisco XR 12000 Series Router.

2-Port Gigabit Ethernet SPA Cables and Connectors

The interface connectors on the 2-Port Gigabit Ethernet SPA are two individual fiber-optic receivers that support SFP modules. Each port can send and receive traffic using the optical fiber connections.

SFP Module Connections

The small form-factor pluggable (SFP) module is an input/output (I/O) device that plugs into the Gigabit Ethernet ports on the 2-Port Gigabit Ethernet SPA, linking the port with a fiber-optic network.

**Note**

The 2-Port Gigabit Ethernet SPA will only accept the SFP modules listed as supported in this document. An SFP module check is run every time an SFP module is inserted into the 2-Port Gigabit Ethernet SPA and only SFP modules that pass this check will be usable by the 2-Port Gigabit Ethernet SPA. SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 2-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 2-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. [Table 2-16](#) and [Table 2-17](#) provide SFP module information and specifications.

Table 2-16 SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-GE-S	Short wavelength (1000BASE-SX)	Contains a Class 1 laser of 850 nm for 1000BASE-SX (short wavelength) applications.
SFP-GE-L	Long wavelength/long haul (1000BASE-LX/LH)	Contains a Class 1 laser of 1310 nm for 1000BASE-LX/LH (long wavelength) applications.

Table 2-16 SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-GE-Z	Extended wavelength (1000BASE-ZX)	Contains a Class 1 laser of 1550 nm for 1000BASE-ZX (extended wavelength) applications.
SFP-GE-T	RJ-45 copper SFP module (1000BASE-T)	Provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure.

Table 2-17 SFP Module Specifications

Specification	Description
Wavelength	SFP-GE-S: 770 to 860 nm SFP-GE-L: 1270 to 1355 nm SFP-GE-Z: 1500 to 1580 nm SFP-GE-T: N/A.
Cabling distance (maximum)	SFP-GE-S: 500 m on 50/125um MMF; 300 m on 62.5/125um MMF SFP-GE-L: 6.2 miles (10 km) SFP-GE-Z: 49.7 miles (80 km) SFP-GE-T: 328 ft. (100 m)
Operating case temperature range	SFP-GE-S: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-L: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-Z: 23 to 185 degrees F (–5 to 85 degrees C)
Storage temperature range	SFP-GE-S: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-L: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-Z: –40 to 185 degrees F (–40 to 85 degrees C)
Supply voltage range	SFP-GE-S: 3.1 to 3.5 V SFP-GE-L: 3.1 to 3.5 V SFP-GE-Z: 3.1 to 3.5 V

SFP-GE-S Modules

The 1000BASE-SX (short wavelength) module operates on standard multimode fiber-optic link spans of up to 500 m on 50/125um MMF and 300 m on 62.5/125um MMF.

SFP-GE-L Modules

The 1000BASE-LX/LH (long wavelength/long haul) module interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 6.2 miles (10 km) over single-mode fiber (SMF) versus the 3.1 miles (5 km) specified in the standard.

SFP-GE-Z Modules

The 1000BASE-ZX (extended wavelength) module operates on ordinary single-mode fiber-optic link spans of up to 49.7 miles (80 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber (premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation and less dispersion).

The 1000BASE-ZX module must be coupled to single-mode fiber-optic cable, which is the type of cable typically used in long-haul telecommunications applications. The 1000BASE-ZX module will not operate correctly when coupled to multimode fiber, and it is not intended to be used in environments where multimode fiber is frequently used (for example, building backbones, or horizontal cabling).

The 1000BASE-ZX module is intended to be used as a Physical Medium Dependent (PMD) component for Gigabit Ethernet interfaces found on various switch and router products. It operates at a signaling rate of 1250 Mbaud, transmitting and receiving 8B/10B encoded data.

When shorter lengths of single-mode fiber are used, it may be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver.

- Insert a 10-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is less than 15.5 miles (25 km).
- Insert a 5-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is equal to or greater than 15.5 miles (25 km) but less than 31 miles (50 km).

SFP-GE-T Modules

The SFP-GE-T (1000BASE-T copper SFP module) provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure. The SFP-GE-T maximum cabling distance is 328 feet (100 m).

SFP Module Cabling and Connection Equipment

Table 2-18 provides cabling specifications for the SFP modules that can be installed on the 2-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

The minimum cable distance for the SFP-GE-S is 6.5 feet (2 m), and the minimum link distance for the SFP-GE-Z is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the SFP-GE-Z is 24.9 miles (40 km).

Table 2-18 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF ¹	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)

Table 2-18 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-L	1300	MMF ² and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF ³	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

- Multimode fiber (MMF) only.
- A mode-conditioning patch cord is required.
When using the SFP-GE-L with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord between the SFP module and the MMF cable on both the transmit and the receive ends of the link when link distances are greater than 984 ft (300 m).
We do not recommend using the SFP-GE-L and MMF with no patch cord for very short link distance (tens of meters). The result could be an elevated bit error rate (BER).
- Dispersion-shifted single-mode fiber-optic cable.

**Note**

The 1000BASE-ZX SFP modules provide an optical power budget of 21.5 dB. You should measure your cable plant with an optical loss test set to verify that the optical loss of the cable plant (including connectors and splices) is less than or equal to 21.5 dB. The optical loss measurement must be performed with a 1550-nm light source.

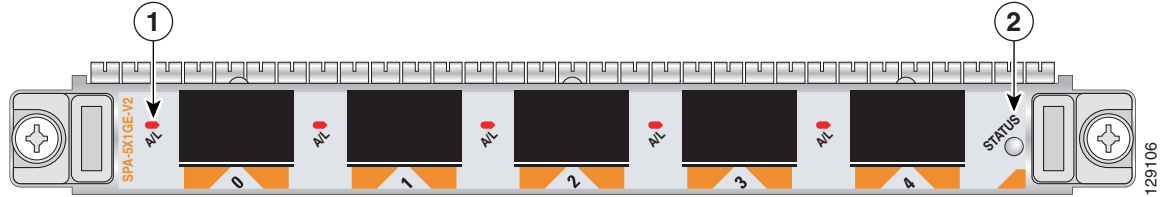
5-Port Gigabit Ethernet SPA Overview

The following sections describe the 5-Port Gigabit Ethernet SPA:

- [5-Port Gigabit Ethernet SPA LEDs, page 2-21](#)
- [5-Port Gigabit Ethernet SPA Cables and Connectors, page 2-22](#)

5-Port Gigabit Ethernet SPA LEDs

The 5-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each individual port and a STATUS LED for the SPA, as shown in [Figure 2-14](#).

Figure 2-14 5-Port Gigabit Ethernet SPA Faceplate

1	A/L (Active/Link) LED	2	STATUS LED
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Table 2-19 describes the 5-Port Gigabit Ethernet SPA LEDs.

Table 2-19 5-Port Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

5-Port Gigabit Ethernet SPA Cables and Connectors

The 5-Port Gigabit Ethernet SPA has five electrical connectors that support SFP modules. Each port can send and receive traffic using cabling appropriate for the SFP module inserted.

SFP Module Connections

The small form-factor pluggable (SFP) module is an input/output (I/O) device that plugs into the Gigabit Ethernet ports on the 5-Port Gigabit Ethernet SPA, linking the port with a fiber-optic network.



Note

The 5-Port Gigabit Ethernet SPA accepts only the SFP modules listed as supported in this document. An SFP module check is run every time an SFP module is inserted into the 5-Port Gigabit Ethernet SPA, and only SFP modules that pass this check can be used by the 5-Port Gigabit Ethernet SPA. SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 5-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 5-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 2-20 and Table 2-21 provide SFP module information and specifications.

Table 2-20 SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-GE-S	Short wavelength (1000BASE-SX)	Contains a Class 1 laser of 850 nm for 1000BASE-SX (short-wavelength) applications.
SFP-GE-L	Long wavelength/long haul (1000BASE-LX/LH)	Contains a Class 1 laser of 1310 nm for 1000BASE-LX/LH (long-wavelength) applications.
SFP-GE-Z	Extended wavelength (1000BASE-ZX)	Contains a Class 1 laser of 1550 nm for 1000BASE-ZX (extended-wavelength) applications.
SFP-GE-T	RJ-45 copper SFP module (1000BASE-T)	Provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure.

Table 2-21 SFP Module Specifications

Specification	Description
Wavelength	SFP-GE-S: 770 to 860 nm SFP-GE-L: 1270 to 1355 nm SFP-GE-Z: 1500 to 1580 nm SFP-GE-T: N/A
Cabling distance (maximum)	SFP-GE-S: 500 m on 50/125um MMF; 300 m on 62.5/125um MMF SFP-GE-L: 6.2 miles (10 km) SFP-GE-Z: 49.7 miles (80 km) SFP-GE-T: 328 ft. (100 m)
Operating case temperature range	SFP-GE-S: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-L: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-Z: 23 to 185 degrees F (–5 to 85 degrees C)
Storage temperature range	SFP-GE-S: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-L: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-Z: –40 to 185 degrees F (–40 to 85 degrees C)
Supply voltage range	SFP-GE-S: 3.1 to 3.5 V SFP-GE-L: 3.1 to 3.5 V SFP-GE-Z: 3.1 to 3.5 V

SFP-GE-S Modules

The 1000BASE-SX (short-wavelength) module operates on standard multimode fiber-optic link spans of up to 500 m on 50/125um multimode fiber (MMF) and 300 m on 62.5/125um MMF.

SFP-GE-L Modules

The 1000BASE-LX/LH (long-wavelength/long-haul) module interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 6.2 miles (10 km) over single-mode fiber (SMF) versus the 3.1 miles (5 km) specified in the standard.

SFP-GE-Z Modules

The 1000BASE-ZX (extended wavelength) module operates on ordinary single-mode fiber-optic link spans of up to 49.7 miles (80 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber. (Premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation and less dispersion.)

The 1000BASE-ZX module must be coupled to single-mode fiber-optic cable, which is the type of cable typically used in long-haul telecommunications applications. The 1000BASE-ZX module does not operate correctly when coupled to multimode fiber, and it is not intended to be used in environments in which multimode fiber is frequently used (for example, building backbones or horizontal cabling).

The 1000BASE-ZX module is intended to be used as a Physical Medium Dependent (PMD) component for Gigabit Ethernet interfaces found on various switch and router products. It operates at a signaling rate of 1250 Mbaud, transmitting and receiving 8B/10B encoded data.

When shorter lengths of single-mode fiber are used, it may be necessary to insert an inline optical attenuator in the link to avoid overloading the receiver. Use the following guidelines:

- Insert a 10-dB inline optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is less than 15.5 miles (25 km).
- Insert a 5-dB inline optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is equal to or greater than 15.5 miles (25 km) but less than 31 miles (50 km).

SFP-GE-T Modules

The SFP-GE-T (1000BASE-T copper SFP module) provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure. The SFP-GE-T maximum cabling distance is 328 feet (100 m).

SFP Module Cabling and Connection Equipment

Table 2-22 provides cabling specifications for the SFP modules that can be installed on the 5-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

The minimum cable distance for the SFP-GE-S is 6.5 feet (2 m), and the minimum link distance for the SFP-GE-Z is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the SFP-GE-Z is 24.9 miles (40 km).

Table 2-22 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF ¹	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)

Table 2-22 SFP Module Port Cabling Specifications (continued)

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-L	1300	MMF ² and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF ³	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

- Multimode fiber (MMF) only.
- A mode-conditioning patch cord is required.
When using the SFP-GE-L with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord between the SFP module and the MMF cable on both the transmit and the receive ends of the link when link distances are greater than 984 ft (300 m).
We do not recommend using the SFP-GE-L and MMF with no patch cord for very short link distance (tens of meters). The result could be an elevated bit error rate (BER).
- Dispersion-shifted single-mode fiber-optic cable.

**Note**

The 1000BASE-ZX SFP modules provide an optical power budget of 21.5 dB. You should measure your cable plant with an optical loss test set to verify that the optical loss of the cable plant (including connectors and splices) is less than or equal to 21.5 dB. The optical loss measurement must be performed with a 1550-nm light source.

10-Port Gigabit Ethernet SPA Overview

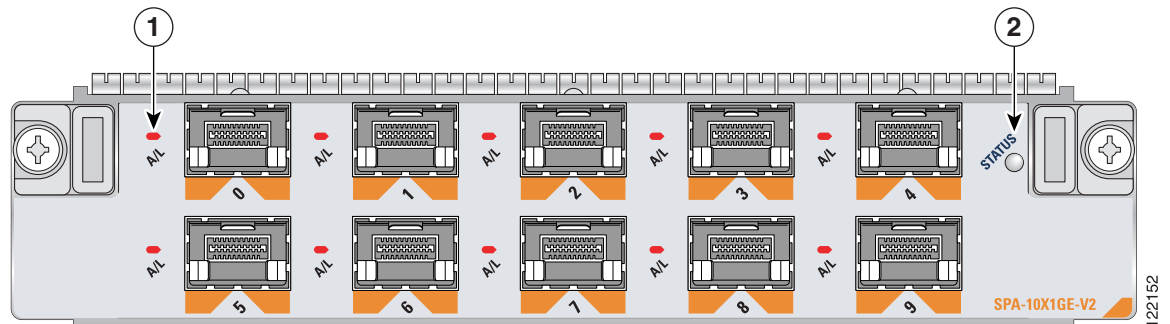
The following sections describe the 10-Port Gigabit Ethernet SPA:

- [10-Port Gigabit Ethernet SPA LEDs, page 2-26](#)
- [10-Port Gigabit Ethernet SPA Cables and Connectors, page 2-26](#)

10-Port Gigabit Ethernet SPA LEDs

The 10-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each individual port and a STATUS LED for the SPA, as shown in [Figure 2-15](#).

Figure 2-15 10-Port Gigabit Ethernet SPA Faceplate



1	A/L (Active/Link) LED	2	STATUS LED
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[Table 2-23](#) describes the 10-Port Gigabit Ethernet SPA LEDs.

Table 2-23 10-Port Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

10-Port Gigabit Ethernet SPA Cables and Connectors

The 10-Port Gigabit Ethernet SPA has ten electrical connectors that support SFP modules. Each port can send and receive traffic using cabling appropriate for the SFP module inserted.

SFP Module Connections

The small form-factor pluggable (SFP) module is an input/output (I/O) device that plugs into the Gigabit Ethernet optical slots on the 10-Port Gigabit Ethernet SPA, linking the port with a 1000BASE-X fiber-optic network.

**Note**

The 10-Port Gigabit Ethernet SPA accepts only the SFP modules listed as supported in this document. An SFP module check is run every time an SFP is inserted into the 10-Port Gigabit Ethernet SPA, and only SFP modules that pass this check can be used by the 10-Port Gigabit Ethernet SPA. SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 10-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 10-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. [Table 2-24](#) and [Table 2-25](#) provide SFP information and specifications.

Table 2-24 10-Port Gigabit Ethernet SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-GE-S	Short wavelength (1000BASE-SX)	Contains a Class 1 laser of 850 nm for 1000BASE-SX (short-wavelength) applications.
SFP-GE-L	Long wavelength/long haul (1000BASE-LX/LH)	Contains a Class 1 laser of 1310 nm for 1000BASE-LX/LH (long-wavelength) applications.
SFP-GE-Z	Extended wavelength (1000BASE-ZX)	Contains a Class 1 laser of 1550 nm for 1000BASE-ZX (extended-wavelength) applications.

Table 2-25 10-Port Gigabit Ethernet SFP Module Specifications

Specification	Description
Wavelength	SFP-GE-S: 770 to 860 nm SFP-GE-L: 1270 to 1355 nm SFP-GE-Z: 1500 to 1580 nm
Cabling distance (maximum)	SFP-GE-S: 500 m on 50/125um MMF; 300 m on 62.5/125um MMF SFP-GE-L: 6.2 miles (10 km) SFP-GE-Z: 49.7 miles (80 km)
Operating case temperature range	SFP-GE-S: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-L: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-Z: 23 to 185 degrees F (–5 to 85 degrees C)
Storage temperature range	SFP-GE-S: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-L: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-Z: –40 to 185 degrees F (–40 to 85 degrees C)
Supply voltage range	SFP-GE-S: 3.1 to 3.5 V SFP-GE-L: 3.1 to 3.5 V SFP-GE-Z: 3.1 to 3.5 V

SFP-GE-S Modules

The 1000BASE-SX (short-wavelength) module operates on standard multimode fiber-optic link spans of up to 500 m on 50/125um multimode fiber (MMF) and 300 m on 62.5/125um MMF.

SFP-GE-L Modules

The 1000BASE-LX/LH (long-wavelength/long-haul) module interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 6.2 miles (10 km) over single-mode fiber (SMF) versus the 3.1 miles (5 km) specified in the standard.

SFP-GE-Z Modules

The 1000BASE-ZX (extended-wavelength) module operates on ordinary single-mode fiber-optic link spans of up to 49.7 miles (80 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber. (Premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation and less dispersion.)

The 1000BASE-ZX module must be coupled to single-mode fiber-optic cable, which is the type of cable typically used in long-haul telecommunications applications. The 1000BASE-ZX module does not operate correctly when coupled to multimode fiber, and it is not intended to be used in environments in which multimode fiber is frequently used (for example, building backbones or horizontal cabling).

The 1000BASE-ZX module is intended to be used as a Physical Medium Dependent (PMD) component for Gigabit Ethernet interfaces found on various switch and router products. It operates at a signaling rate of 1250 Mbaud, transmitting and receiving 8B/10B encoded data.

When shorter lengths of single-mode fiber are used, it may be necessary to insert an inline optical attenuator in the link to avoid overloading the receiver. Use the following guidelines:

- Insert a 10-dB inline optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is less than 15.5 miles (25 km).
- Insert a 5-dB inline optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is equal to or greater than 15.5 miles (25 km) but less than 31 miles (50 km).

SFP Module Cabling and Connection Equipment

Table 2-26 provides cabling specifications for the SFP modules that can be installed on the 10-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

The minimum cable distance for the SFP-GE-S is 6.5 feet (2 m), and the minimum link distance for the SFP-GE-Z is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the SFP-GE-Z is 24.9 miles (40 km).

Table 2-26 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF ¹	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	SMF	9/10	—	6.2 miles (10 km)

Table 2-26 SFP Module Port Cabling Specifications (continued)

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF ²	8	—	62.1 miles (100 km)

1. Multimode fiber (MMF) only.
2. Dispersion-shifted single-mode fiber-optic cable.

**Note**

The 1000BASE-ZX SFP modules provide an optical power budget of 21.5 dB. You should measure your cable plant with an optical loss test set to verify that the optical loss of the cable plant (including connectors and splices) is less than or equal to 21.5 dB. The optical loss measurement must be performed with a 1550-nm light source.

1-Port Channelized STM-1/OC-3 SPA Overview

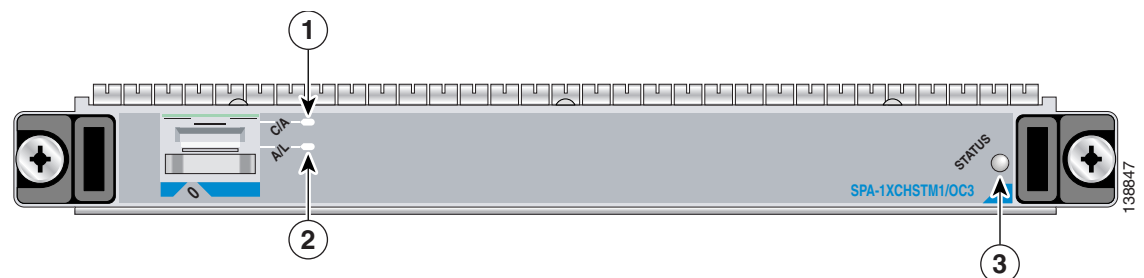
The following sections describe the 1-Port Channelized STM-1/OC-3 SPA:

- [1-Port Channelized STM-1/OC-3 SPA LEDs, page 2-29](#)
- [1-Port Channelized STM-1/OC-3 SPA Interface Specifications, page 2-30](#)
- [1-Port Channelized STM-1/OC-3 SPA Cables and Connectors, page 2-30](#)

1-Port Channelized STM-1/OC-3 SPA LEDs

The 1-Port Channelized STM-1/OC-3 SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in [Figure 2-16](#).

Figure 2-16 1-Port Channelized STM-1/OC-3 SPA Faceplate



1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Channelized STM-1/OC-3 SPALEDs are described in [Table 2-27](#).

Table 2-27 1-Port Channelized STM-1/OC-3 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

1-Port Channelized STM-1/OC-3 SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-3/STM-1 line rates (155.52 Mbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-3/STM-1 frame.

The 1-Port Channelized STM-1/OC-3 SPA interface is compliant with RFC 1619, *PPP over SONET/SDH*, and RFC 1662, *PPP in HDLC-like Framing*. The 1-Port Channelized STM-1/OC-3 SPA also provides support for SNMP v1 agent (RFC 1155–1157), and Management Information Base (MIB) II (RFC 1213).

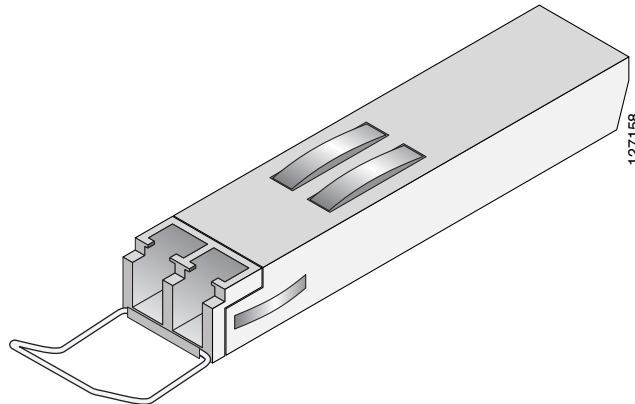


Note

The 1-Port Channelized STM-1/OC-3 SPA supports Frame Relay Fragmentation (FRF.12) and Multilink Fame Relay (MFR) features for Cisco IOS XR Software Release 3.6.0 and later releases.

1-Port Channelized STM-1/OC-3 SPA Cables and Connectors

The 1-Port Channelized STM-1/OC-3 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see [Figure 2-17](#)).

Figure 2-17 SFP Optics Module

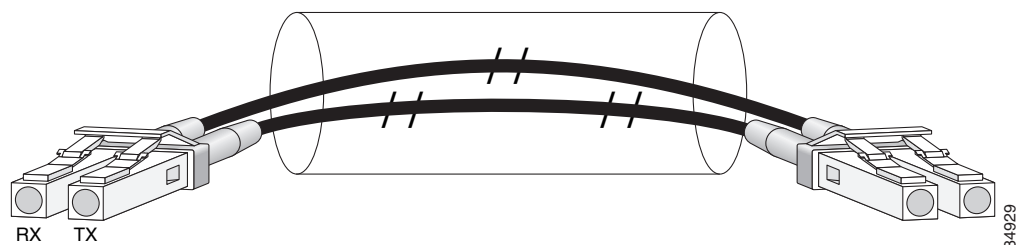
The SFP optical transceiver modules used with the 1-Port Channelized STM-1/OC-3 SPA provide the following optical fiber options:

- **Multimode**—155-Mbps, OC-3/STM-1 optical fiber (SONET STS-3 or SDH STM-1)
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- **Single-mode**—155-Mbps, OC-3/STM-1 optical fiber (SONET STS-3 or SDH STM-1)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-18](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 1-Port Channelized STM-1/OC-3 SPA-equipped routers back to back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between the two of them.

Figure 2-18 LC Type Cables

1-Port Channelized STM-4/OC-12 SPA Overview

The following sections describe the 1-Port Channelized STM-4/OC-12 SPA:

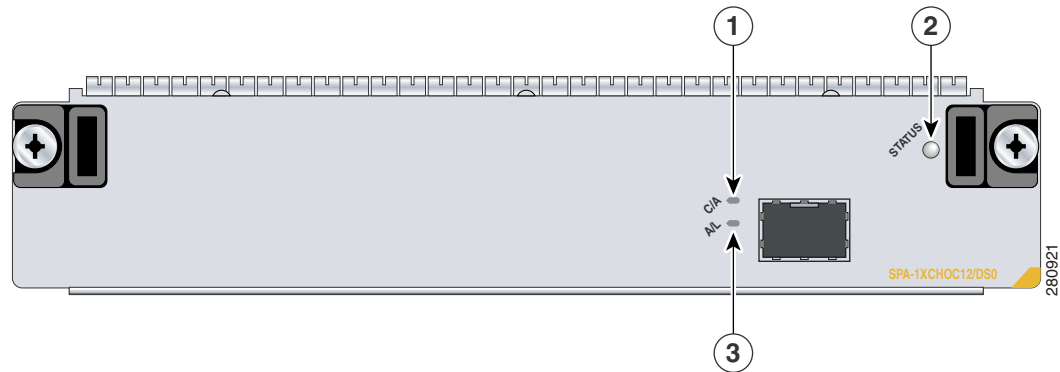
- [1-Port Channelized STM-4/OC-12 SPA LEDs, page 2-32](#)

- [1-Port Channelized STM-4/OC-12 SPA Interface Specifications](#), page 2-33
- [1-Port Channelized STM-4/OC-12 SPA Cables and Connectors](#), page 2-33

1-Port Channelized STM-4/OC-12 SPA LEDs

The 1-Port Channelized STM-4/OC-12 SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in [Figure 2-19](#).

Figure 2-19 1-Port Channelized STM-4/OC-12 SPA Faceplate



1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Channelized STM-4/OC-12 SPA LEDs are described in [Table 2-28](#).

Table 2-28 1-Port Channelized STM-4/OC-12 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

1-Port Channelized STM-4/OC-12 SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-12/STM-4 line rates (622.08 Mbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-12/STM-4 frame.

The 1-Port Channelized STM-4/OC-12 SPA interface is compliant with RFC 1619, *PPP over SONET/SDH*, and RFC 1662, *PPP in HDLC-like Framing*. The 1-Port Channelized STM-4/OC-12 SPA also provides support for SNMP v1 agent (RFC 1155–1157), and Management Information Base (MIB) II (RFC 1213).

**Note**

For Cisco IOS XR Software Release 3.8.0 and beyond, the 1-Port Channelized STM-4/OC-12 SPA supports Frame Relay Fragmentation (FRF.12) to achieve fragmentation of data packets and interleaving of voice packets. FRF.12 provides a method to fragment low-priority packets and interleave high-priority packets in between the low-priority fragments to provide less delay or jitter for high-priority traffic like voice and video.

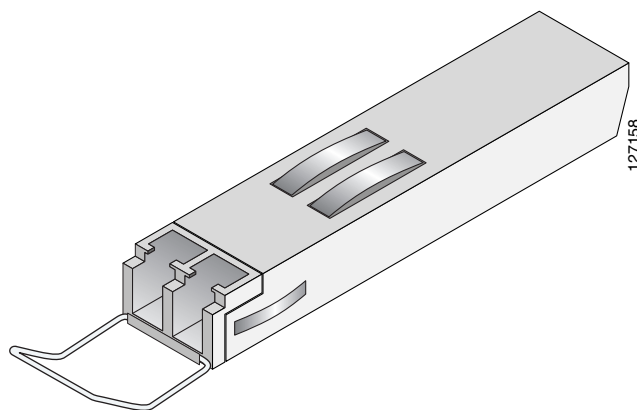
**Note**

For Cisco IOS XR Software Release 3.8.0 and beyond, the 1-Port Channelized STM-4/OC-12 SPA supports Multilink Frame Relay (MFR) feature. MFR provides a mechanism for aggregating multiple serial links into a bundle to provide greater bandwidth, load balancing between links, and improved service availability by protecting against single point link failures.

1-Port Channelized STM-4/OC-12 SPA Cables and Connectors

The 1-Port Channelized STM-4/OC-12 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see [Figure 2-20](#)).

Figure 2-20 SFP Optics Module



The SFP optical transceiver modules used with the 1-Port Channelized STM-4/OC-12 SPA provide the following optical fiber options:

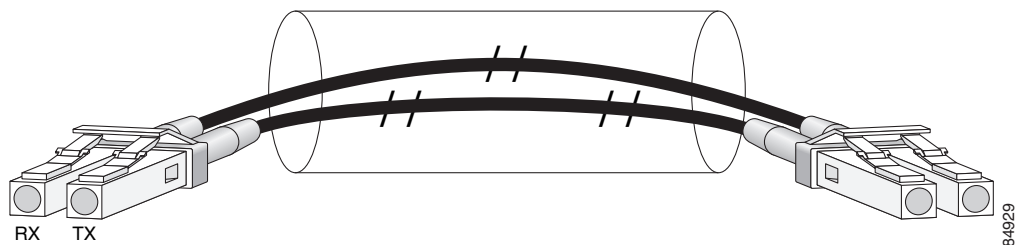
- Multimode—622-Mbps, OC-12/STM-4 optical fiber (SONET STS-12 or SDH STM-4)
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—622-Mbps, OC-12/STM-4 optical fiber (SONET STS-12 or SDH STM-4)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-21](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 1-Port Channelized STM-4/OC-12 SPA-equipped routers back to back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between the two of them.

Figure 2-21 LC Type Cables



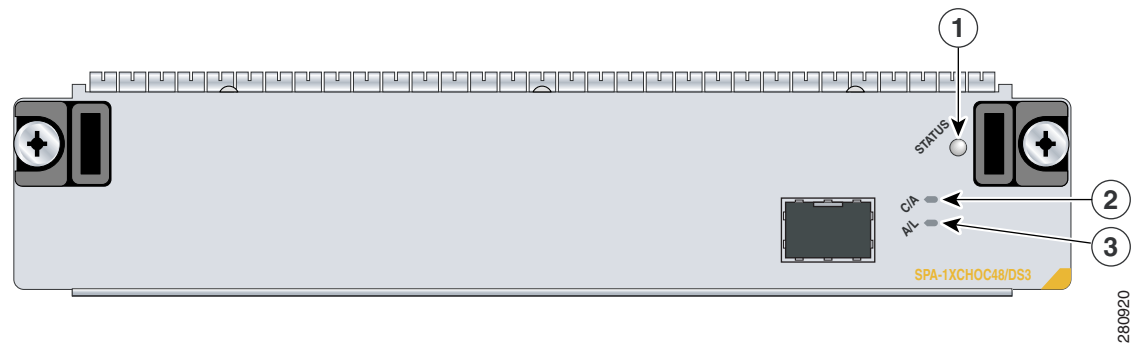
1-Port Channelized STM-16/OC-48 SPA Overview

The following sections describe the 1-Port Channelized STM-4/OC-12 SPA:

- [1-Port Channelized STM-16/OC-48 SPA LEDs](#), page 2-34
- [1-Port Channelized STM-16/OC-48 SPA Interface Specifications](#), page 2-35
- [1-Port Channelized STM-16/OC-48 SPA Cables and Connectors](#), page 2-36

1-Port Channelized STM-16/OC-48 SPA LEDs

The 1-Port Channelized STM-16/OC-48 SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in [Figure 2-22](#).

Figure 2-22 1-Port Channelized STM-16/OC-48 SPA Faceplate

1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Channelized STM-16/OC-48 SPA LEDs are described in [Table 2-29](#).

Table 2-29 1-Port Channelized STM-16/OC-48 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

1-Port Channelized STM-16/OC-48 SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-48/STM-16 line rates (2.488 Gbps).

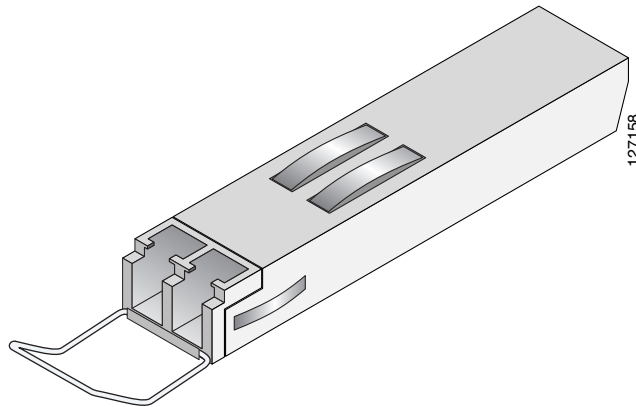
Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-48/STM-16 frame.

The 1-Port Channelized STM-16/OC-48 SPA interface is compliant with RFC 1619, *PPP over SONET/SDH*, and RFC 1662, *PPP in HDLC-like Framing*. The 1-Port Channelized STM-16/OC-48 SPA also provides support for SNMP v1 agent (RFC 1155–1157), and Management Information Base (MIB) II (RFC 1213).

1-Port Channelized STM-16/OC-48 SPA Cables and Connectors

The 1-Port Channelized STM-16/OC-48 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see [Figure 2-23](#)).

Figure 2-23 SFP Optics Module



The SFP optical transceiver modules used with the 1-Port Channelized STM-16/OC-48 SPA provide the following optical fiber options:

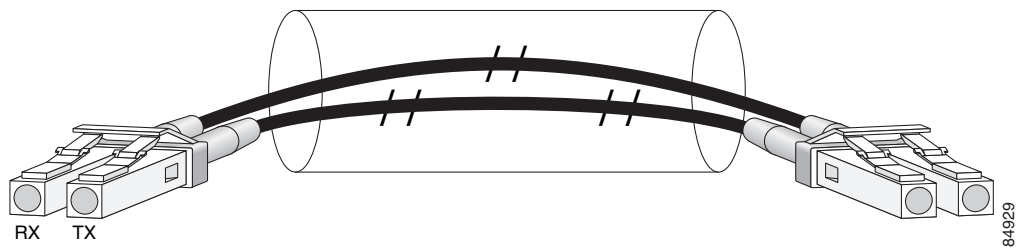
- Multimode—2.488-Gbps, OC-48/STM-16 optical fiber (SONET STS-48 or SDH STM-16)
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—2.488-Gbps, OC-48/STM-16 optical fiber (SONET STS-48 or SDH STM-16)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-24](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 1-Port Channelized STM-16/OC-48 SPA-equipped routers back to back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back to back without using an attenuator between the two of them.

Figure 2-24 LC Type Cables



1-Port OC-192/STM-64 POS SPA Overview

The 1-Port OC-192/STM-64 POS/RPR SPA is a double-height SPA that is installed in two SIP subslots. The 1-Port OC-192/STM-64 POS/RPR SPA provides SONET and SDH network connectivity with a bandwidth of 9.95 Gbps.

For more information about SPA bandwidth, see the “Bandwidth Oversubscription” section on page 2-2. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Compatibility” chapter in this guide.

The 1-Port OC-192/STM-64 POS/RPR SPA uses a single, 10-Gbps fixed optical receptacle allowing a connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the “1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables” section on page 2-39.

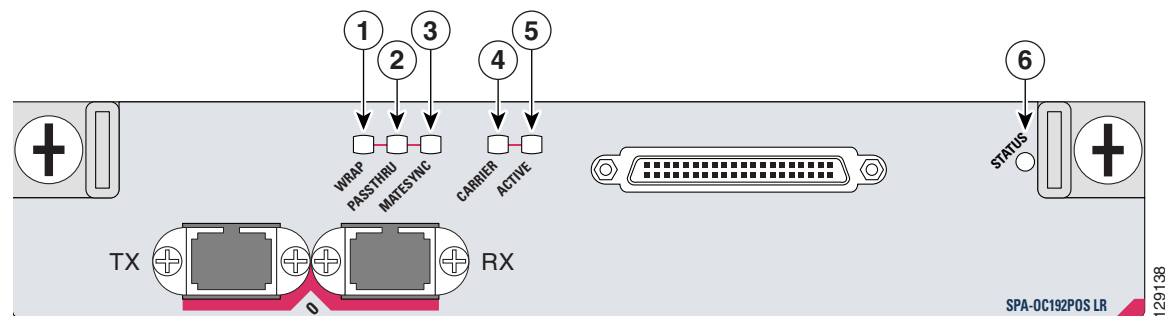
The following sections describe the 1-Port OC-192/STM-64 POS/RPR SPA:

- [1-Port OC-192/STM-64 POS/RPR SPA LEDs, page 2-37](#)
- [1-Port OC-192/STM-64 POS/RPR SPA Interface Specifications, page 2-38](#)
- [1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables, page 2-39](#)

1-Port OC-192/STM-64 POS/RPR SPA LEDs

The 1-Port OC-192/STM-64 POS/RPR SPA has six LEDs, as shown in [Figure 2-25](#).

Figure 2-25 1-Port OC-192/STM-64 POS/RPR SPA Faceplate



1	WRAP LED	4	CARRIER LED
2	PASSTHRU LED	5	ACTIVE LED
3	MATESYNC LED	6	STATUS LED



Note

The WRAP, PASSTHRU, and MATESYNC LEDs apply to the SPA in RPR/SRP mode only. In Cisco IOS Release 12.0(31)S, RPR/SRP mode is not supported.

The 1-Port OC-192/STM-64 POS/RPR SPA LEDs are described in [Table 2-30](#).

Table 2-30 1-Port OC-192/STM-64 POS/RPR SPA LEDs

LED Label	Color	State	Meaning
WRAP	Off	Off	Port is not in wrap mode.
	Green	On	Port is in wrap mode somewhere on the ring.
	Amber	On	Port is in wrap mode locally.
PASSTHRU	Off	Off	Port is not in pass-thru mode.
	Amber	On	Port is in pass-thru mode.
MATESYNC	Off	Off	Mate port is not synchronized.
	Green	On	Mate port is synchronized.
CARRIER	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software; there is a valid SONET signal without alarms.
	Amber	On	Port is enabled by software; there is at least one alarm (LOS, LOF, RDI, and so on).
		Blinking	Indicates SRP mode mismatch alarm.
ACTIVE	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software; loopback is off.
	Amber	On	Port is enabled by software; loopback is on.
STATUS	Off	Off	SPA power off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good; SPA is being configured.

1-Port OC-192/STM-64 POS/RPR SPA Interface Specifications

The 1-Port OC-192/STM-64 POS/RPR SPA contains a SONET/SDH framer to process incoming and outgoing SONET or SDH frames. The framer operates at OC-192/STM-64 line rates (9.95 Gbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-192/STM-64 frame.

The 1-Port OC-192/STM-64 POS/RPR SPA interface is compliant with the following RFCs:

- RFC 1619, *PPP over SONET/SDH*
- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2615, *PPP over SONET/SDH*

The 1-Port OC-192/STM-64 POS/RPR SPA also provides support for SNMP v1 agent (RFC 1155–1157) and RFC 1213:

- RFC 1155, *Structure and Identification of Management Information for TCP/IP-Based Internets*
- RFC 1156, *Management Information Base for Network Management of TCP/IP-Based Internets*
- RFC 1157, *Simple Network Management Protocol (SNMP)*

- RFC 1213, *Management Information Base (MIB) for Network Management of TCP/IP-Based Internets: MIB II*

1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables

The 1-Port OC-192/STM-64 POS/RPR SPA uses fixed optical transceivers, one for receive (RX) and one for transmit (TX), for SONET and SDH connection to the network. In Cisco IOS Release 12.0(31)S, only long-reach (LR) optics are supported.

Cisco Systems qualifies the optics that are approved for use with its SPAs. As of Cisco IOS Release 12.0(31)S and Cisco IOS XR Software Release 3.2, the XFP-10GLR-OC192SR and the XFP-10GER-OC192IR are the only optical transceiver modules qualified for use.

The 1-Port OC-192/STM-64 POS/RPR SPA uses single-mode SC-type connectors:

- Single-mode—9.95 Gbps, OC-192 optical fiber (SONET STS-192 or SDH STM-64c)

Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

Use a single-mode optical fiber cable to connect your router to a network.

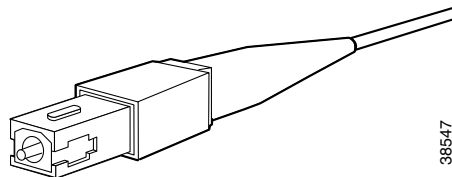


Note

The 40-pin connector on the 1-Port OC-192/STM-64 POS/RPR SPA is used for resilient packet ring (RPR) connections.

Figure 2-26 shows the cable type for use with the fixed optical transceiver module on the 1-Port OC-192/STM-64 POS/RPR SPA.

Figure 2-26 SC-Type Connectors for the Fixed Optical Transceivers



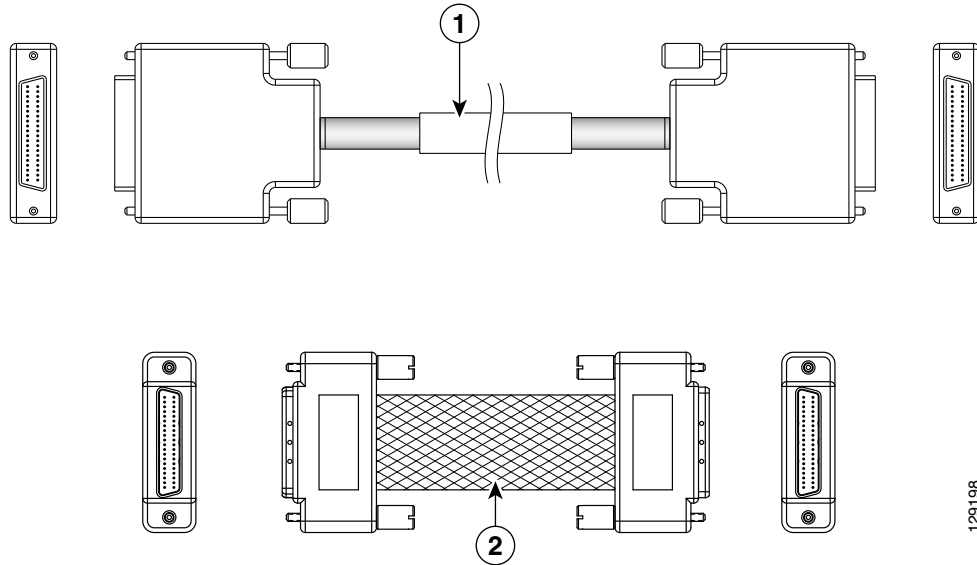
Mate Interface Cables

The 1-Port OC-192/STM-64 POS/RPR SPA supports two mate interface configurations:

- Mate between two OC-192 SPAs in the same SIP
- Mate between two OC-192 SPAs in adjacent SIPs

Two 1-Port OC-192/STM-64 POS/RPR SPAs are connected using a 40-pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-27 shows the mate cables used to connect the SPAs.

Figure 2-27 SPA Mate Cables



1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC192-L)	2	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC192-S)
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**Note**

The RPR mate cable is necessary only when the SPA is to be used in RPR mode. It is not needed in POS mode. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature support by reviewing the relevant SPA datasheets or by contacting your Cisco representative.

1-Port OC-192 STM-64 POS RPR XFP SPA Overview

The 1-Port OC-192/STM-64 POS/RPR XFP SPA is a single-height SPA that is installed in one SIP subslot. The 1-Port OC-192/STM-64 POS/RPR XFP SPA provides SONET and SDH network connectivity with a bandwidth of 9.95 Gbps.

For more information about SPA bandwidth, see the “Bandwidth Oversubscription” section in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the product overview chapter in this guide.

The 1-Port OC-192/STM-64 POS/RPR XFP SPA uses a 10-Gbps small form-factor pluggable optical receptacle for each port allowing connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the “1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables” section on page 2-39.

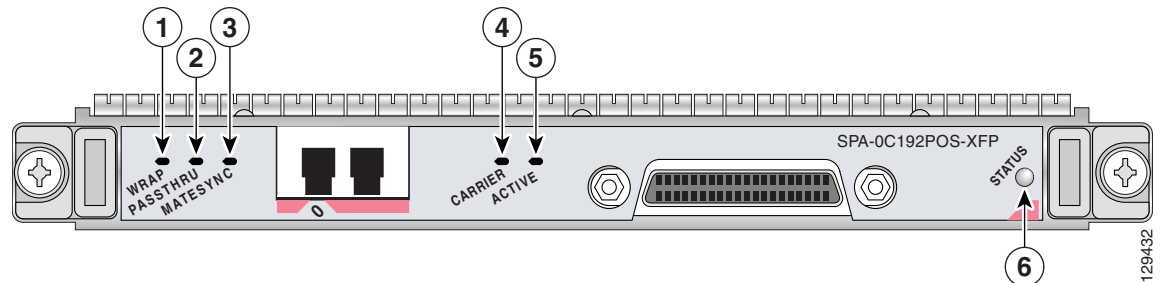
The following sections describe the 1-Port OC-192/STM-64 POS/RPR XFP SPA:

- [1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs, page 2-41](#)
- [1-Port OC-192/STM-64 POS/RPR XFP SPA Interface Specifications, page 2-42](#)
- [1-Port OC-192/STM-64 POS/RPR XFP SPA Optical Transceiver Modules, Connectors, and Cables, page 2-42](#)

1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs

The 1-Port OC-192/STM-64 POS/RPR XFP SPA has six LEDs, as shown in [Figure 2-28](#).

Figure 2-28 1-Port OC-192/STM-64 POS/RPR XFP SPA Faceplate



1	WRAP LED	4	CARRIER LED
2	PASSTHRU LED	5	ACTIVE LED
3	MATESYNC LED	6	STATUS LED



Note

The WRAP, PASSTHRU, and MATESYNC LEDs apply to the SPA in RPR/SRP mode only. As of Cisco IOS XR Software Release 3.4.0, RPR/SRP mode is not supported.

[Table 2-31](#) describes the 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs.

Table 2-31 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs

LED Label	Color	State	Meaning
WRAP	Off	Off	Port is not in wrap mode.
	Green	On	Port is in wrap mode somewhere on the ring.
	Amber	On	Port is in wrap mode locally.
PASSTHRU	Off	Off	Port is not in pass-thru mode.
	Amber	On	Port is in pass-thru mode.
MATESYNC	Off	Off	Mate port is not synchronized.
	Green	On	Mate port is synchronized.
CARRIER	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm (LOS, LOF, RDI, and so on).
	Blinking		SRP mode mismatch alarm is indicated.

Table 2-31 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs (continued)

LED Label	Color	State	Meaning
ACTIVE	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

1-Port OC-192/STM-64 POS/RPR XFP SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-192/STM-64 line rates (9.95 Gbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-192/STM-64 frame.

The 1-Port OC-192/STM-64 POS/RPR XFP SPA interface is compliant with the following RFCs:

- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2615, *PPP over SONET/SDH*

For information on SNMP MIB support, see “Implementing SNMP on Cisco IOS XR Software” in *Cisco IOS XR System Management Configuration Guide*.

1-Port OC-192/STM-64 POS/RPR XFP SPA Optical Transceiver Modules, Connectors, and Cables

The 1-Port OC-192/STM-64 POS/RPR XFP SPA uses a single-mode, 9.95 Gbps, OC-192 optical fiber (SONET STS-192 or SDH STM-64) optical transceiver module for SONET and SDH connection to the network.

The 1-Port OC-192/STM-64 POS/RPR XFP SPA supports the following types of optical transceiver module:

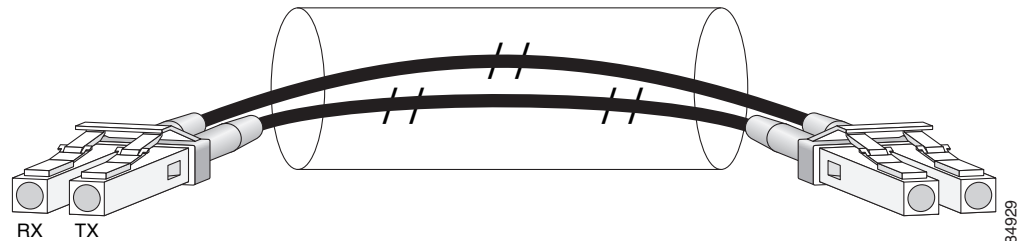
- Single-mode short-reach (SR) XFP module—XFP-10GLR-OC192SR
- Single-mode intermediate-reach (IR) XFP module—XFP-10GER-OC192IR
- Single-mode very-long reach XFP module—XFP-10GZR-OC192LR

Cisco Systems qualifies the optics that are approved for use with its SPAs. As of Cisco IOS XR Software Release 3.4.0, the above-listed XFPs are the only optical transceiver modules qualified for use.

Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns (nominal diameter is approximately 10/125 microns) to connect your router to a network.

Figure 2-29 shows the cable type for use with the XFP optical transceiver module on the 1-Port OC-192/STM-64 POS/RPR XFP SPA.

Figure 2-29 LC-Type Cable for the XFP Optical Transceiver Modules



Note

The 40-pin connector on the 1-Port OC-192/STM-64 POS/RPR XFP SPA is used for resilient packet ring (RPR) connections. This feature is not supported in Cisco IOS XR Software Release 3.4.0.

OC-192 Module Connections

Table 2-32 shows the OC-192 specifications for use with the 1-Port OC-192/STM-64 POS/RPR XFP SPA.

Table 2-32 OC-192 Specifications

Specification	Description
Wavelength	OC-192 SR-1: 1290 nm to 1330 nm OC-192 IR-2: 1530 nm to 1565 nm OC-192 LR-2: 1530 nm to 1565 nm
Cabling distance (maximum)	OC-192 SR-1: 2 km (1.2 miles) OC-192 IR-2: 40 km (24.8 miles) OC-192 LR-2: 50 miles (80 km)
Operating case temperature range	OC-192 SR-1: 23 to 158 degrees F (–5 to 70 degrees C) OC-192 IR-2: 23 to 158 degrees F (–5 to 70 degrees C) OC-192 LR-2: 23 to 158 degrees F (–5 to 70 degrees C)
Tx Power	OC-192 SR-1: –6 dBm –1 dBm OC-192 IR-2: –1 dBm +2 dBm OC-192 LR-2: 0 to +4 dBm
Receiver Sensitivity (maximum)	OC-192 SR-1: –11 dBm OC-192 IR-2: –14 dBm OC-192 LR-2: –24 dBm
RX Overload	OC-192 SR-1: –1 dBm OC-192 IR-2: +2 dBm OC-192 LR-2: –7.0 dBm
Maximum Receiver Power Damage	OC-192 SR-1: +5 dBm OC-192 IR-2: +5 dBm OC-192 LR-2: +5 dBm

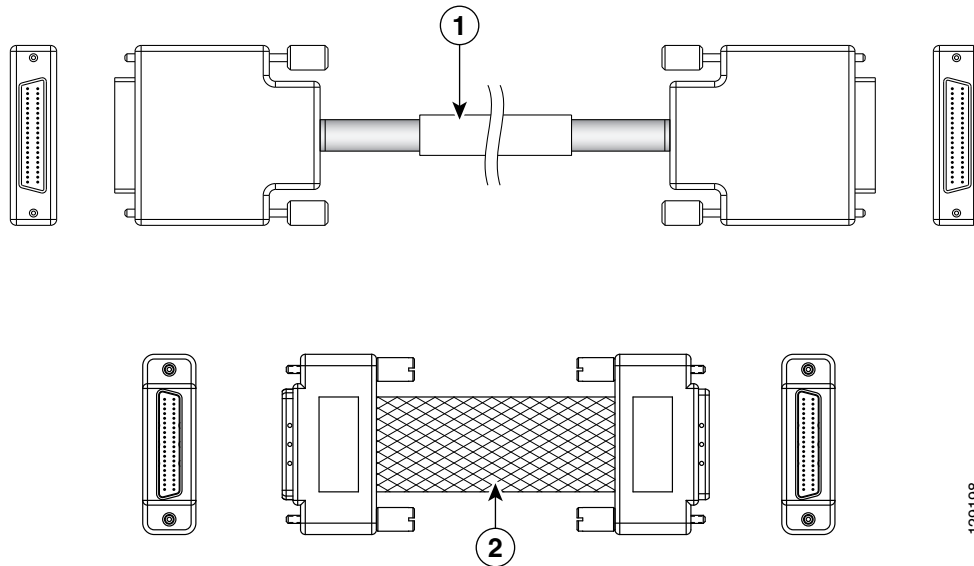
Mate Interface Cables

The 1-Port OC-192/STM-64 POS/RPR XFP SPA supports two mate interface configurations:

- Mate between two OC-192 SPAs in the same SIP
- Mate between two OC-192 SPAs in adjacent SIPs

Two 1-Port OC-192/STM-64 POS/RPR XFP SPAs are connected using a 40-pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-30 shows the mate cables used to connect the SPAs.

Figure 2-30 SPA Mate Cables



1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC192-L)	2	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC192-S)
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Note

The RPR mate cable is necessary only when the SPA is to be used in RPR mode. It is not needed in POS mode. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature support via SPA datasheets or by contacting your Cisco representative.

4-Port OC-3/STM-1 POS SPA Overview

The 2-Port and 4-Port OC-3/STM-1 POS SPA is a single-height SPA that installs into one SIP subslot. The OC-3c/STM-1 POS SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity with a per-port bandwidth of 155.52 Mbps. The 2-Port and 4-Port OC-3/STM-1 POS SPA operates at quarter rate.

**Note**

When SFP modules are replaced, the SPA interface retains any previously defined configurations. These configurations include settings for IP address, clock source, loopback, Cyclic Redundancy Check (CRC), and POS flags.

For more information about SPA bandwidth, see the “Bandwidth Oversubscription” section in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

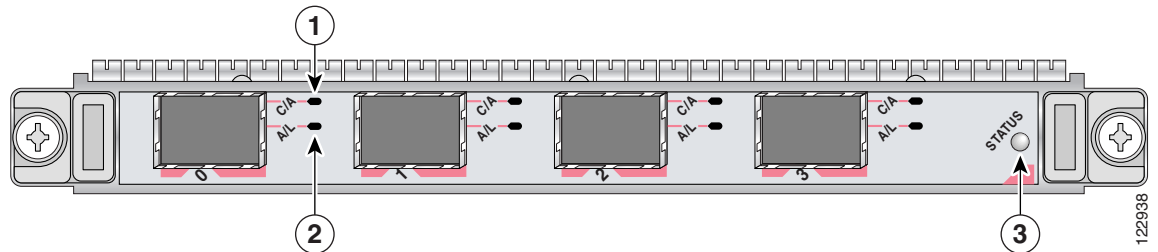
The following sections describe the 2-Port and 4-Port OC-3/STM-1 POS SPA:

- [2-Port and 4-Port OC-3/STM-1 POS SPA LEDs](#), page 2-45
- [2-Port and 4-Port OC-3/STM-1 POS SPA Interface Specifications](#), page 2-46
- [2-Port and 4-Port OC-3/STM-1 POS SPA Optical Transceiver Modules and Cables](#), page 2-46

2-Port and 4-Port OC-3/STM-1 POS SPA LEDs

The 2-Port and 4-Port OC-3/STM-1 POS SPA has three types of LEDs: two LEDs for each port on the SPA and one STATUS LED. [Figure 2-31](#) shows the 4-Port OC-3/STM-1 POS SPA.

Figure 2-31 4-Port OC-3/STM-1 POS SPA Faceplate



1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active/Loopback) LED		

[Table 2-33](#) describes the 2-Port and 4-Port OC-3/STM-1 POS SPA LEDs.

Table 2-33 2-Port and 4-Port OC-3/STM-1 POS SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	SONET controller is shut down.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Interface is shut down.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.

Table 2-33 2-Port and 4-Port OC-3/STM-1 POS SPA LEDs (continued)

LED Label	Color	State	Meaning
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

2-Port and 4-Port OC-3/STM-1 POS SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-3c/STM-1 line rates (155.52 Mbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-3c/STM-1 frame.

The 2-Port and 4-Port OC-3/STM-1 POS SPA interface complies with the following RFCs:

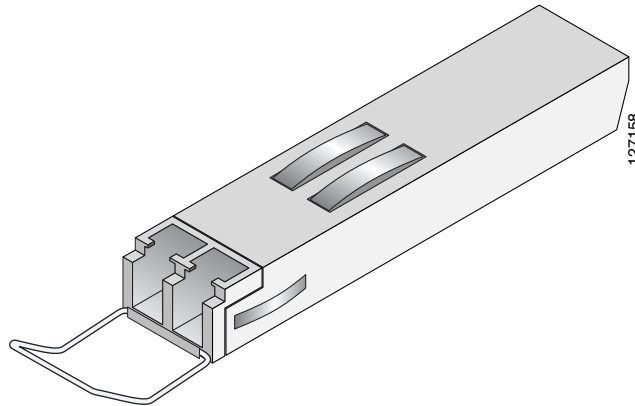
- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2427, *Multiprotocol Interconnect over Frame Relay*
- RFC 2615, *PPP over SONET/SDH*

2-Port and 4-Port OC-3/STM-1 POS SPA Optical Transceiver Modules and Cables

The 2-Port and 4-Port OC-3/STM-1 POS SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see [Figure 2-32](#)).

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 2-Port and 4-Port OC-3/STM-1 POS SPA supports the following types of optical transceiver modules:

- Multimode (MM) SFP module—SFP-OC3-MM
- Short-reach (SR) SFP module—SFP-OC3-SR
- Intermediate-reach (IR) SFP module (15 km)—SFP-OC3-IR1
- Long-reach (LR) SFP module (40 km)—SFP-OC3-LR1
- Long-reach (LR) SFP module (80 km)—SFP-OC3-LR2

Figure 2-32 SFP Optics Module

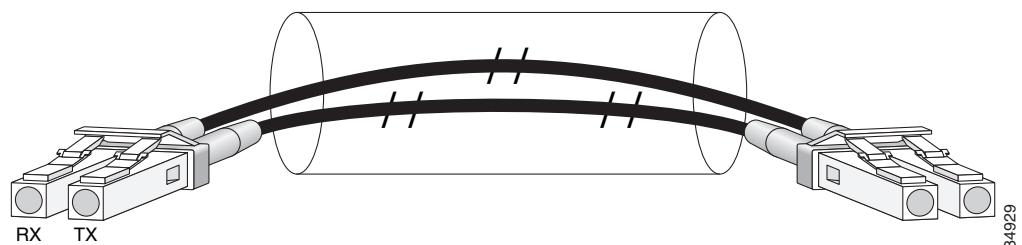
The SFP optical transceiver modules used with the 2-Port and 4-Port OC-3/STM-1 POS SPA provide the following optical fiber options:

- **Multimode**—155-Mbps, OC-3c/STM-1 optical fiber (SONET STS-3c or SDH STM-1)
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- **Single-mode**—155-Mbps, OC-3c/STM-1 optical fiber (SONET STS-3c or SDH STM-1)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-33](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate-reach or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 2-Port and 4-Port OC-3/STM-1 POS SPA-equipped routers back-to-back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between them.

Figure 2-33 LC-Type Cable

OC-3 Module Connections

Table 2-34 shows the OC-3 specifications of the optics on the 2-Port and 4-Port OC-3/STM-1 POS SPA.

Table 2-34 OC-3 Specifications

Specification	Description
Wavelength	OC-3 MM: 1270 nm to 1380 nm OC-3 SR: 1260 nm to 1360 nm OC-3 IR-1: 1261 nm to 1360 nm OC-3 LR-1: 1263 nm to 1360 nm OC-3 LR-2: 1480 nm to 1580 nm
Cabling distance (maximum)	OC-3 MM: 2 km (1.2 miles) OC-3 SR: 2 km (1.2 miles) OC-3 IR-1: 15 km (9.3 miles) OC-3 LR-1: 40 km (24.8 miles) OC-3 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-3 MM: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 SR: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 IR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-2: 23 to 185 degrees F (–5 to 85 degrees C)
TX power	OC-3 MM: –19 to –14 dBm OC-3 SR: –15 to –8 dBm OC-3 IR-1: –15 to –8 dBm OC-3 LR-1: –5 to 0 dBm OC-3 LR-2: –5 to 0 dBm
Receiver sensitivity (maximum)	OC-3 MM: –30 dBm OC-3 SR: –23 dBm OC-3 IR-1: –28 dBm OC-3 LR-1: –34 dBm OC-3 LR-2: –34 dBm
RX overload	OC-3 MM: –5 dBm OC-3 SR: –8 dBm OC-3 IR-1: –8 dBm OC-3 LR-1: –10 dBm OC-3 LR-2: –10 dBm
Maximum receiver power damage	OC-3 MM: +5 dBm OC-3 SR: +5 dBm OC-3 IR-1: +5 dBm OC-3 LR-1: +5 dBm OC-3 LR-2: +5 dBm

8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Overview

The 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA is a single-height SPA that installs into one SIP subplot. The SPA with small form-factor pluggable (SFP) optical transceiver modules provides Optical Carrier Level (OC-*n*) for SONET and Synchronous Transport Module (STM-*n*) for SDH network connectivity. On this SPA, any given port can use either an OC-3 or OC-12 SFP module, so the per-port bandwidth can be either 155.52 Mbps or 622.08 Mbps, respectively, depending on the customer configuration.



Note

When SFP modules are replaced, the SPA interface retains any previously defined configurations. These configurations include settings for IP address, clock source, loopback, CRC, and POS flags.

For more information about SPA bandwidth, see the “Bandwidth Oversubscription” topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

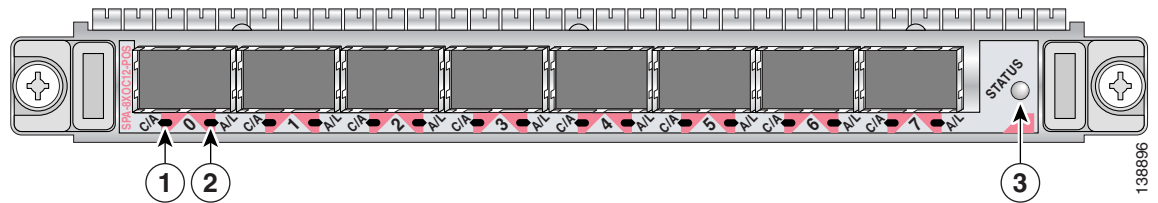
The following sections describe the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- [8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs, page 2-49](#)
- [8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Interface Specifications, page 2-50](#)
- [8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Optical Transceiver Modules and Cables, page 2-50](#)

8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs

The 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA has three types of LEDs: two LEDs for each port on the SPA and one STATUS LED. [Figure 2-34](#) shows the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA faceplate.

Figure 2-34 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Faceplate



1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active/Loopback) LED		

Table 2-35 describes the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs.

Table 2-35 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	SONET controller is shut down.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Interface is shut down.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-3 line rates (155.52 Mbps) and OC-12 line rates (622.08 Mbps). Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the Layer 2 frame.

The 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA interface complies with the following RFCs:

- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2427, *Multiprotocol Interconnect over Frame Relay*
- RFC 2615, *PPP over SONET/SDH*

8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Optical Transceiver Modules and Cables

The 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connections (see [Figure 2-35](#)).

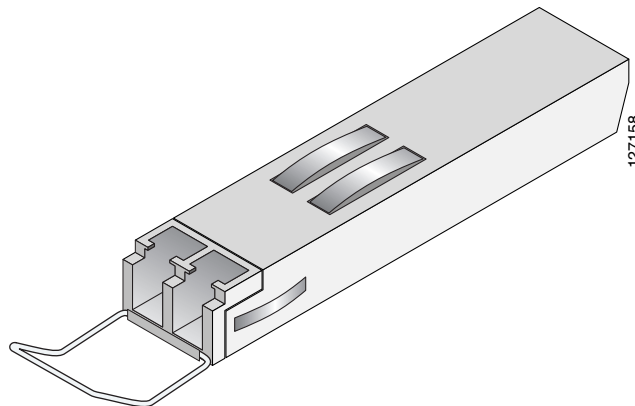
Cisco Systems qualifies the optics that are approved for use with its SPAs. The following OC-3 optical transceiver modules are supported on the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- Multimode (MM) SFP module—SFP-OC3-MM
- Short-reach (SR) SFP module—SFP-OC3-SR
- Intermediate-reach (IR) SFP module (15 km)—SFP-OC3-IR1
- Long-reach (LR) SFP module (40 km)—SFP-OC3-LR1
- Long-reach (LR) SFP module (80 km)—SFP-OC3-LR2

The following OC-12 optical transceiver modules are supported on the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- Multimode (MM) SFP module—SFP-OC12-MM
- Short-reach (SR) SFP module—SFP-OC12-SR
- Intermediate-reach (IR) SFP module (15 km)—SFP-OC12-IR1
- Long-reach (LR) SFP module (40 km)—SFP-OC12-LR1
- Long-reach (LR) SFP module (80 km)—SFP-OC12-LR2

Figure 2-35 SFP Optics Module



The following OC-3 optical fiber options are available for the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- Multimode—155.52-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—155.52-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

The following OC-12 optical fiber options are available for the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

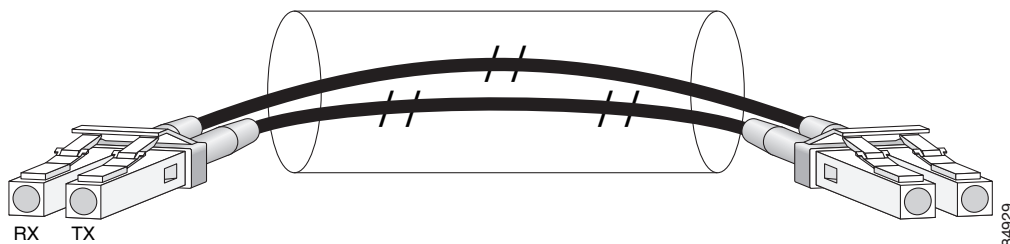
- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-36](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for short-, intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or two OC-3-equipped or OC-12-equipped routers back-to-back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between them.

Figure 2-36 LC-Type Cable



OC-3 Module Connections

Table 2-36 shows the OC-3 specifications of the optics on the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA.

Table 2-36 OC-3 Specifications

Specification	Description
Wavelength	OC-3 MM: 1270 nm to 1380 nm OC-3 SR: 1260 nm to 1360 nm OC-3 IR-1: 1261 nm to 1360 nm OC-3 LR-1: 1263 nm to 1360 nm OC-3 LR-2: 1480 nm to 1580 nm
Cabling distance (maximum)	OC-3 MM: 2 km (1.2 miles) OC-3 SR: 2 km (1.2 miles) OC-3 IR-1: 15 km (9.3 miles) OC-3 LR-1: 40 km (24.8 miles) OC-3 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-3 MM: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 SR: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 IR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-2: 23 to 185 degrees F (–5 to 85 degrees C)
TX power	OC-3 MM: –19 to –14 dBm OC-3 SR: –15 to –8 dBm OC-3 IR-1: –15 to –8 dBm OC-3 LR-1: –5 to 0 dBm OC-3 LR-2: –5 to 0 dBm
Receiver sensitivity (maximum)	OC-3 MM: –30 dBm OC-3 SR: –23 dBm OC-3 IR-1: –28 dBm OC-3 LR-1: –34 dBm OC-3 LR-2: –34 dBm

Table 2-36 OC-3 Specifications (continued)

Specification	Description
RX overload	OC-3 MM: -5 dBm OC-3 SR: -8 dBm OC-3 IR-1: -8 dBm OC-3 LR-1: -10 dBm OC-3 LR-2: -10 dBm
Maximum receiver power damage	OC-3 MM: +5 dBm OC-3 SR: +5 dBm OC-3 IR-1: +5 dBm OC-3 LR-1: +5 dBm OC-3 LR-2: +5 dBm

OC-12 Module Connections

Table 2-37 shows the OC-12 specifications of the optics on the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA.

Table 2-37 OC-12 Specifications

Specification	Description
Wavelength	OC-12 MM: 1270 nm to 1380 nm OC-12 SR: 1261 nm to 1360 nm OC-12 IR-1: 1293 nm to 1334 nm OC-12 LR-1: 1280 nm to 1335 nm OC-12 LR-2: 1480 nm to 1580 nm
Cabling distance (maximum)	OC-12 MM: 0.5 km (0.3 miles) OC-12 SR: 2 km (1.2 miles) OC-12 IR-1: 15 km (9.3 miles) OC-12 LR-1: 40 km (24.8 miles) OC-12 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-12 MM: 23 to 185 degrees F (-5 to 85 degrees C) OC-12 SR: 23 to 185 degrees F (-5 to 85 degrees C) OC-12 IR-1: 23 to 185 degrees F (-5 to 85 degrees C) OC-12 LR-1: 23 to 185 degrees F (-5 to 85 degrees C) OC-12 LR-2: 23 to 185 degrees F (-5 to 85 degrees C)
TX power	OC-12 MM: -20 to -14 dBm OC-12 SR: -15 to -8 dBm OC-12 IR-1: -15 to -8 dBm OC-12 LR-1: -3 to 2 dBm OC-12 LR-2: -3 to 2 dBm
Receiver sensitivity (maximum)	OC-12 MM: -26 dB OC-12 SR: -23 dBm OC-12 IR-1: -28 dBm OC-12 LR-1: -28 dBm OC-12 LR-2: -28 dBm

Table 2-37 OC-12 Specifications (continued)

Specification	Description
RX overload	OC-12 MM: -6 dBm OC-12 SR: -8 dBm OC-12 IR-1: -8 dBm OC-12 LR-1: -8 dBm OC-12 LR-2: -8 dBm
Maximum receiver power damage	OC-12 MM: +5 dBm OC-12 SR: +5 dBm OC-12 IR-1: +5 dBm OC-12 LR-1: +5 dBm OC-12 LR-2: +5 dBm

1-Port OC-12/STM-4 POS SPA Overview

The 1-Port OC-12/STM-4 POS SPA is single-height SPA that installs into one SIP subslot. The 1-Port OC-12/STM-4 POS SPA with a small form-factor pluggable (SFP) optical transceiver module provides SONET and SDH network connectivity with a bandwidth of 622.08 Mbps.

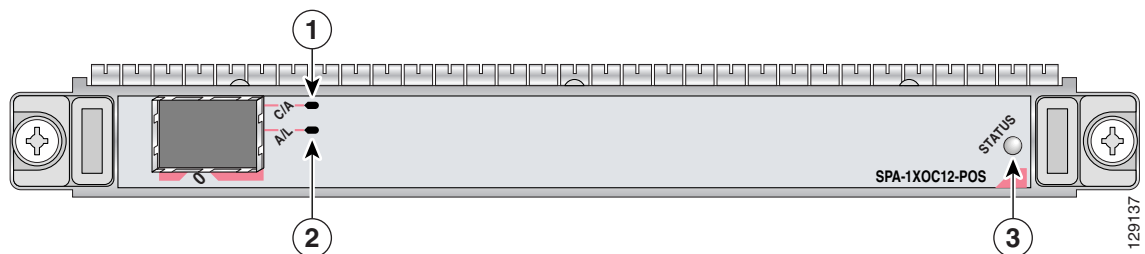
For more information about SPA bandwidth, see the “Bandwidth Oversubscription” topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

The following sections describe the 1-Port OC-12/STM-4 POS SPA:

- [1-Port OC-12/STM-4 POS SPA LEDs, page 2-54](#)
- [1-Port OC-12/STM-4 POS SPA Interface Specifications, page 2-55](#)
- [1-Port OC-12/STM-4 POS SPA SFP Optical Transceiver Modules and Cables, page 2-55](#)

1-Port OC-12/STM-4 POS SPA LEDs

The 1-Port OC-12/STM-4 POS SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. [Figure 2-37](#) shows an example of these LEDs on a 1-Port OC-12/STM-4 POS SPA.

Figure 2-37 1-Port OC-12/STM-4 POS SPA Faceplate

1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port OC-12/STM-4 POS SPA LEDs are described in [Table 2-38](#).

Table 2-38 1-Port OC-12/STM-4 POS SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good; SPA is being configured.

1-Port OC-12/STM-4 POS SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-12/STM-4 line rates (622.08 Mbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-12/STM-4 frame.

The 1-Port OC-12/STM-4 POS SPA interface is compliant with the following RFCs:

- RFC 1619, *PPP over SONET/SDH*
- RFC 1662, *PPP in HDLC-like Framing*

The 1-Port OC-12/STM-4 POS SPA also provides support for SNMP v1 agent (RFC 1155–1157) and RFC 1213:

- RFC 1155, *Structure and Identification of Management Information for TCP/IP-based Internets*
- RFC 1156, *Management Information Base for Network Management of TCP/IP-Based Internets*
- RFC 1157, *Simple Network Management Protocol (SNMP)*
- RFC 1213, *Management Information Base (MIB) for Network Management of TCP/IP-Based Internets: MIB II*.

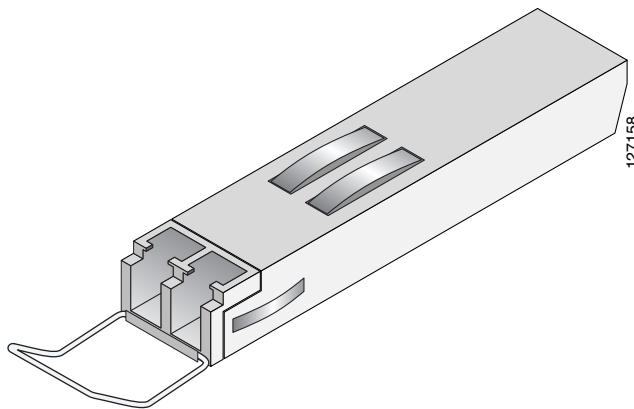
1-Port OC-12/STM-4 POS SPA SFP Optical Transceiver Modules and Cables

The POS SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see [Figure 2-38](#)).

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 1-Port OC-12/STM-4 POS SPA supports the following types of optical transceiver modules:

- Multimode (MM) SFP module—SFP-OC12-MM
- Short reach (SR) SFP module—SFP-OC12-SR
- Intermediate reach (IR) SFP module (15 km)—SFP-OC12-IR1
- Long reach (LR) SFP module (40 km)—SFP-OC12-LR1
- LR SFP module (80 km)—SFP-OC12-LR2

Figure 2-38 SFP Optics Module



The SFP optical transceiver modules used with the POS SPAs provide the following optical fiber options:

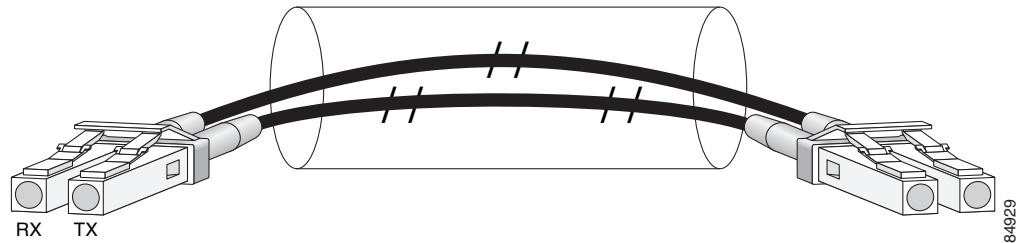
- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12 or SDH STM-4)
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12 or SDH STM-4)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-39](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 1-Port OC-12/STM-4 POS SPA-equipped routers back to back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between the two of them.

Figure 2-39 LC-Type Cable



1-Port OC-48/STM-16 POS SPA Overview

The 1-Port OC-48/STM-16 POS SPA is a single-height SPA that is installed in a SIP subslot. The 1-Port OC-48/STM-16 POS SPA provides RPR over SONET (IEEE 802.17), SRP over SONET (Cisco Proprietary), and Packet over SONET (POS) network connectivity with a bandwidth of 9.95 Gbps.

For more information about SPA bandwidth, see the “Bandwidth Oversubscription” topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

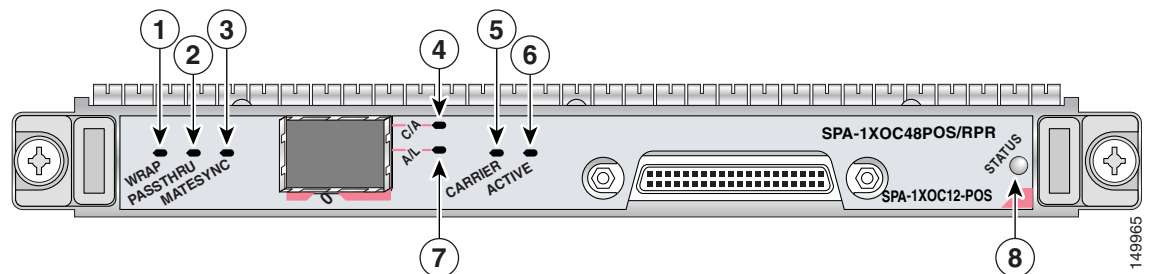
The following sections describe the 1-Port OC-48/STM-16 POS SPA:

- [1-Port OC-48/STM-16 POS SPA LEDs, page 2-57](#)
- [1-Port OC-48/STM-16 POS SPA Interface Specifications, page 2-58](#)
- [1-Port OC-48/STM-16 POS SPA Optical Transceiver Modules, Connectors, and Cables, page 2-59](#)

1-Port OC-48/STM-16 POS SPA LEDs

The 1-Port OC-48/STM-16 POS SPA has six LEDs, as shown in [Figure 2-40](#).

Figure 2-40 1-Port OC-48/STM-16 POS SPA Faceplate



1	WRAP LED	5	CARRIER LED
2	PASSTHRU LED	6	ACTIVE LED
3	MATESYNC LED	7	A/L (Active Loopback) LED
4	C/A (Carrier/Alarm) LED	8	STATUS LED

**Note**

The WRAP, PASSTHRU, and MATESYNC LEDs apply to the SPA in RPR/SRP mode only.

The 1-Port OC-48/STM-16 POS SPA LEDs are described in [Table 2-39](#).

Table 2-39 1-Port OC-48/STM-16 POS SPA LEDs

LED Label	Color	State	Meaning
WRAP	Off	Off	Port is not in wrap mode.
	Green	On	Port is in wrap mode somewhere on the ring.
	Amber	On	Port is in wrap mode locally.
PASSTHRU	Off	Off	Port is not in pass-thru mode.
	Amber	On	Port is in pass-thru mode.
MATESYNC	Off	Off	Mate port is not synchronized.
	Green	On	Mate port is synchronized.
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
CARRIER	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software; there is a valid SONET signal without alarms.
	Amber	On	Port is enabled by software; there is at least one alarm (LOS, LOF, RDI, and so on).
		Blinking	
ACTIVE	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software; loopback is off.
	Amber	On	Port is enabled by software; loopback is on.
STATUS	Off	Off	SPA power off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good; SPA is being configured.

1-Port OC-48/STM-16 POS SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-48/STM-64 line rates (9.95 Gbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-48/STM-64 frame.

The 1-Port OC-48/STM-16 POS SPA interface is compliant with the following RFCs:

- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2615, *PPP over SONET/SDH*

1-Port OC-48/STM-16 POS SPA Optical Transceiver Modules, Connectors, and Cables

The 1-Port OC-48/STM-16 POS SPA uses a single-mode, 9.95 Gbps, OC-48 optical fiber (SONET STS-48) optical transceiver module for SONET connection to the network.

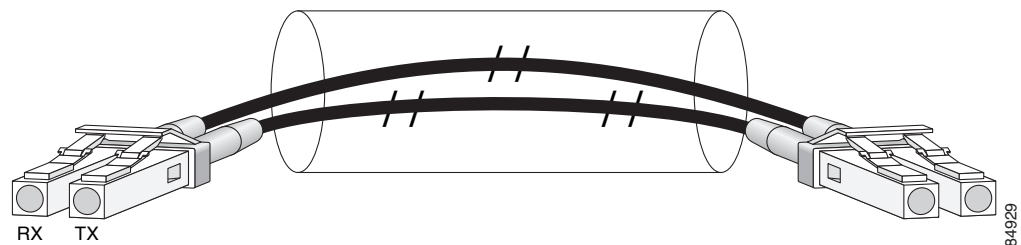
The 1-Port OC-48/STM-16 POS SPA supports the following type of optical transceiver module:

- Single-mode short reach (SR) SFP module—SFP-OC48-SROC-48/STM-16c
- Single-mode intermediate reach (IR) SFP module—SFP-OC48-IR1OC-48/STM-16c
- Single-mode long reach (LR) SFP module—SFP-OC48-LR2OC-48/STM-16c

Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns (nominal diameter is approximately 10/125 microns) to connect your router to a network.

Figure 2-41 shows the cable type for use with the XFP optical transceiver module on the 1-Port OC-48/STM-16 POS SPA.

Figure 2-41 LC-Type Cable for the SFP Optical Transceiver Modules



Note

The 40-pin connector on the 1-Port OC-48/STM-16 POS SPA is used for resilient packet ring (RPR) connections.

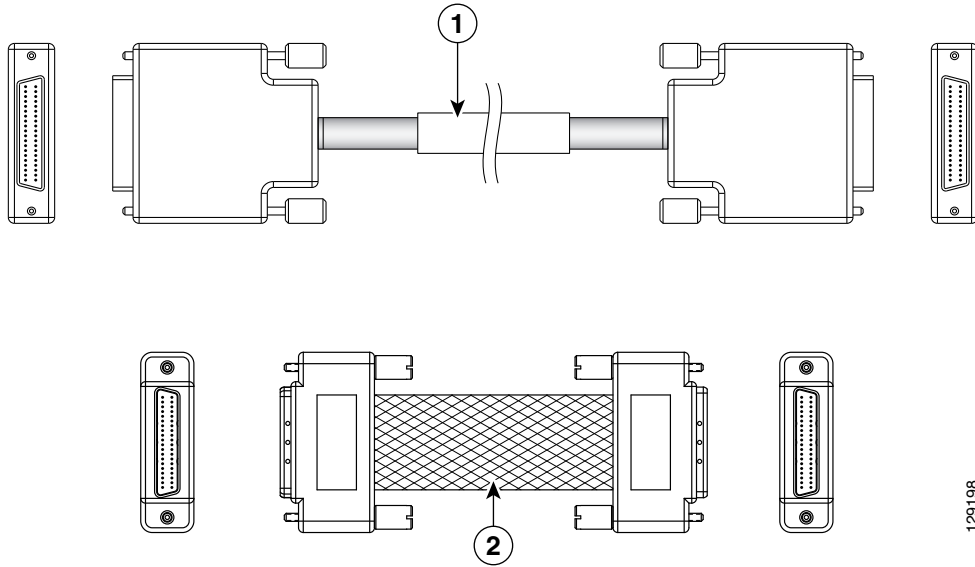
Mate Interface Cables

The 1-Port OC-48/STM-16 POS SPA supports two mate interface configurations:

- Mate between two OC-48 SPAs in the same SIP
- Mate between two OC-48 SPAs in adjacent SIPs

Two 1-Port OC-48/STM-16 POS SPAs are connected using a 40-pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-42 shows the mate cables used to connect the SPAs.

Figure 2-42 SPA Mate Cables



1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC48-L)	2	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC48-S)
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**Note**

The RPR mate cable is necessary only when the SPA is to be used in RPR mode. It is not needed in POS mode. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature support by reviewing the relevant SPA datasheets or by contacting your Cisco representative.

2-Port and 4-Port OC-48/STM-16 POS SPA Overview

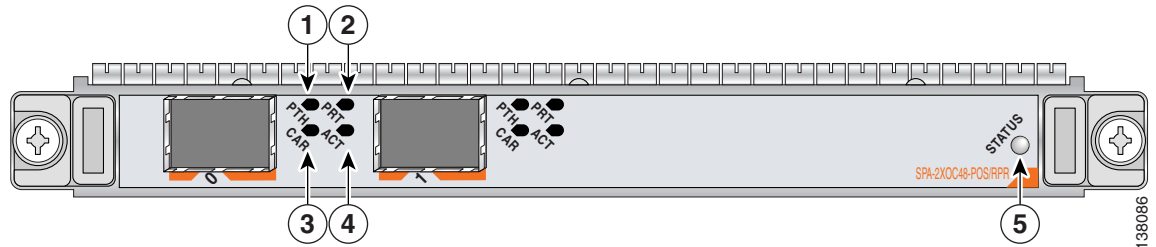
The following sections describe the 2-Port and 4-Port OC-48/STM-16 POS SPA:

- [2-Port and 4-Port OC-48/STM-16 POS SPA LEDs, page 2-61](#)
- [2-Port and 4-Port OC-48/STM-16 POS SPA Interface Specifications, page 2-62](#)
- [2-Port and 4-Port OC-48/STM-16 POS SPA Cables, Optical Transceiver Modules, and Connectors, page 2-62](#)

2-Port and 4-Port OC-48/STM-16 POS SPA LEDs

The 2-Port and 4-Port OC-48/STM-16 POS SPA has five types of LEDs: four LEDs for each port on the SPA and one STATUS LED, as shown in [Figure 2-43](#).

Figure 2-43 2-Port OC-48 POS/RPR SPA Faceplate



1	PTH (Pass Through) LED	4	ACT (Active Loopback) LED
2	PRT (Protect) LED	5	STATUS LED
3	CAR (Carrier Alarm) LED		

[Table 2-40](#) describes the 2-Port and 4-Port OC-48/STM-16 POS SPA LEDs.

Table 2-40 2-Port and 4-Port OC-48/STM-16 POS SPA LEDs

LED Label	Color	State	Meaning
PTH	Off	Off	Port is not in pass-through mode.
	Green	On	Port is in pass-through mode.
CAR	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
Amber	Flashing		Port is enabled by software, and there is a side mismatch.
	Off	Off	Port is not wrapped or steering.
PRT	Green	On	A node on the ring is wrapped.
	Green	Flashing	A node on the ring is steering.
Amber	On		Port is locally wrapped.
	Flashing		Port is locally steering.
ACT	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.

Table 2-40 2-Port and 4-Port OC-48/STM-16 POS SPA LEDs (continued)

LED Label	Color	State	Meaning
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

2-Port and 4-Port OC-48/STM-16 POS SPA Interface Specifications

The physical layer interface for the 2-Port and 4-Port OC-48/STM-16 POS SPA is Optical Carrier-48 (OC-48), and provides SONET and SDH network connectivity with a per-port bandwidth of 2.488 Gbps.

Each port on the 2-Port and 4-Port OC-48/STM-16 POS SPA has one duplex LC-type receptacle that allows connection to single-mode optical fiber.

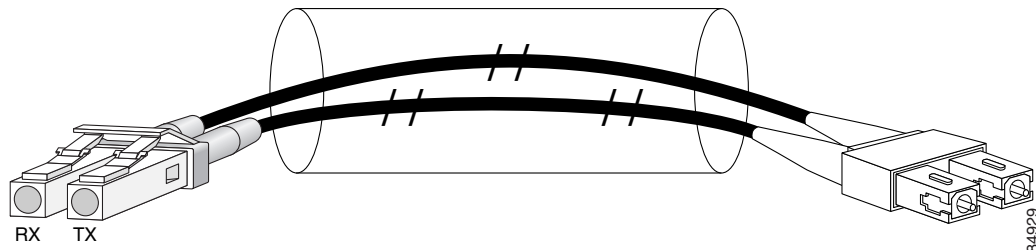
2-Port and 4-Port OC-48/STM-16 POS SPA Cables, Optical Transceiver Modules, and Connectors

Use single-mode (for intermediate-reach configurations) optical fiber cable to connect your router to a network or to connect two OC-48-equipped routers back-to-back.

The 2-Port and 4-Port OC-48/STM-16 POS SPA supports the following types of optical transceiver modules:

- Single-mode short-reach (SR) SFP module—SFP-OC48-SR OC48/STM16c
- Single-mode intermediate-reach (IR) SFP module—SFP-OC48-IR1 OC48/STM16c
- Single-mode long-reach (LR) SFP module—SFP-OC48-LR2 OC48/STM16c

Each port on the 2-Port and 4-Port OC-48/STM-16 POS SPA has one duplex LC-type receptacle. For single-mode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-44](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 2-44 LC-Type Cable

OC-48 Module Connections

Table 2-41 shows the OC-48 specifications for use with the 2-Port and 4-Port OC-48/STM-16 POS SPA.

Table 2-41 OC-48 Specifications

Specification	Description
Wavelength	OC-48 SR: 1266 nm to 1360 nm OC-48 IR-1: 1260 nm to 1360 nm OC-48 LR-2: 1500 nm to 1580 nm
Cabling distance (maximum)	OC-48 SR: 2 km (1.2 miles) OC-48 IR-1: 15 km (9.3 miles) OC-48 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-48 SR: 23 to 158 degrees F (–5 to 70 degrees C) OC-48 IR-1: 23 to 158 degrees F (–5 to 70 degrees C) OC-48 LR-2: 23 to 158 degrees F (–5 to 70 degrees C)
TX power	OC-48 SR: –10 to –3 dBm OC-48 IR-1: –5 to 0 dBm OC-48 LR-2: –2 to +3 dBm
Receiver sensitivity (maximum)	OC-48 SR: –18 dBm OC-48 IR-1: –18 dBm OC-48 LR-2: –28 dBm
RX overload	OC-48 SR: –3 dBm OC-48 IR-1: 0 dBm OC-48 LR-2: –9 dBm
Maximum receiver power damage	OC-48 SR: +5 dBm OC-48 IR-1: +5 dBm OC-48 LR-2: +5 dBm

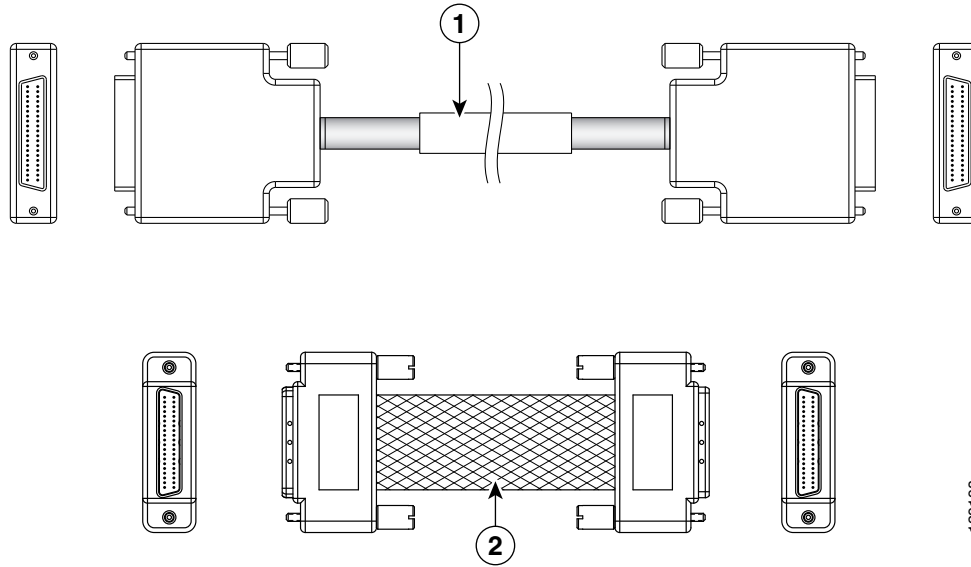
Mate Interface Cables

The 2-Port and 4-Port OC-48/STM-16 POS SPA supports two mate interface configurations:

- Mate between two OC-192 SPAs in the same SIP
- Mate between two OC-192 SPAs in adjacent SIPs

Two SPAs are connected using a 40-pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-45 shows the mate cables used to connect the SPAs.

Figure 2-45 SPA Mate Cables



129198

1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC192-L)	2	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC192-S)
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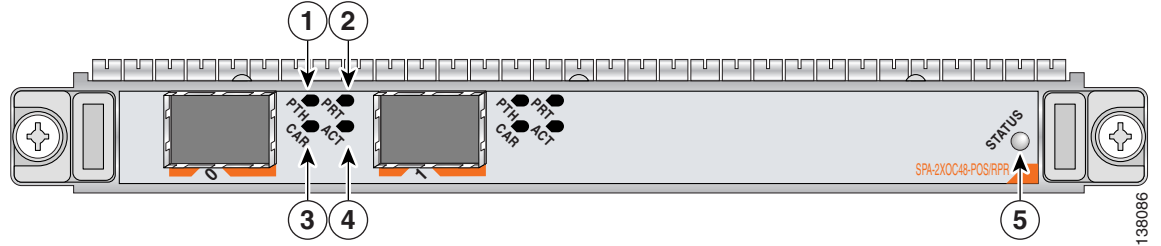
2-Port OC-48 POS RPR SPA Overview

The following sections describe the 2-Port OC48-POS/RPR SPA:

- [2-Port OC48-POS/RPR SPA LEDs, page 2-64](#)
- [2-Port OC48-POS/RPR SPA Interface Specifications, page 2-66](#)
- [2-Port OC48-POS/RPR SPA Cables, Optical Transceiver Modules, and Connectors, page 2-66](#)

2-Port OC48-POS/RPR SPA LEDs

The 2-Port OC48-POS/RPR SPA has five LEDs, as shown in [Figure 2-46](#).

Figure 2-46 2-Port OC48-POS/RPR SPA Faceplate

1	PTH (Pass-Through) LED	4	ACT (Active Loopback) LED
2	PRT (Protect) LED	5	STATUS LED
3	CAR (Carrier/Alarm) LED		

The 2-Port OC48-POS/RPR SPA LEDs are described in [Table 2-42](#).

Table 2-42 2-Port OC48-POS/RPR SPA LEDs

LED Label	Color	State	Meaning
PTH	Off	Off	Port is not in pass-through mode.
	Amber	On	Port is in pass-through mode.
CAR	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
	Amber	Blinking	Port is enabled by software, and there is a side mismatch.
PRT	Off	Off	Port is not in wrap mode or steer.
	Green	On	A node on the ring is wrapped.
	Green	Blinking	A node on the ring is steering pass-through
	Amber	On	Port is locally wrapped
	Amber	Blinking	Port is locally steering
ACT	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

2-Port OC48-POS/RPR SPA Interface Specifications

The physical layer interface for the 2-Port OC48-POS/RPR SPA is Optical Carrier-48 (OC-48), and the 2-Port OC48-POS/RPR SPA is designed to comply with POS specifications. The 2-Port OC48-POS/RPR SPA provides two 2.488-Gbps network interfaces for all supported platforms.

2-Port OC48-POS/RPR SPA Cables, Optical Transceiver Modules, and Connectors

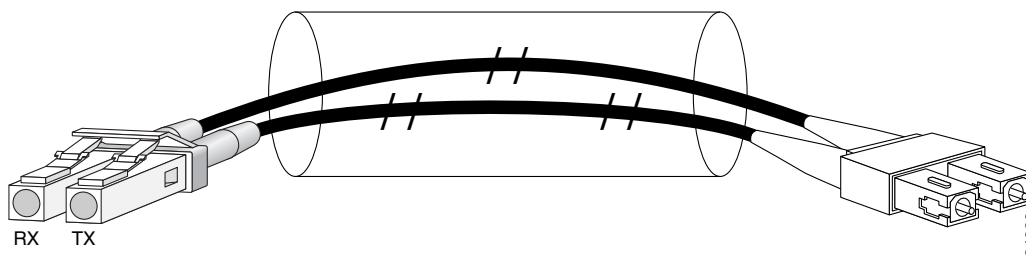
Use single-mode (for intermediate-configurations) optical fiber cable to connect your router to a network or to connect two OC-48-equipped routers back-to-back.

The 2-Port OC48-POS/RPR SPA supports the following types of optical transceiver modules:

- Single-mode short-reach (SR) SFP module—SFP-OC48-SR
- Single-mode intermediate-reach (IR) SFP module —SFP-OC48-IR1
- Single-mode long-reach (LR) SFP module — SFP-OC48-LR2

Each port on the 2-Port OC48-POS/RPR SPA has one duplex LC-type receptacle. For single-mode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-47](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 2-47 Duplex Patch Cable with LC-Type Connectors



Cisco XR12000 IPSec VPN SPA Overview

The Cisco XR12000 IPSec VPN SPA (SPA) provides remote access and remote site VPN connectivity for the Cisco XR 12000 Series Router.

The following features are supported:

- Site-to-Site communication over point-to-point IPSec/GRE tunnels
- Remote User Access over IPSec tunnels.

Any slot of the Cisco XR 12000 Series Router that contains a Cisco XR 12000 SIP-401, Cisco XR 12000 SIP-501, or a Cisco XR 12000 SIP-601 can support up to two Cisco XR12000 IPSec VPN SPAs, or any mixture of the Cisco XR12000 IPSec VPN SPA with other interface SPA types on the same SIP card.

Note that the Cisco XR12000 IPSec VPN SPA (SPA-IPSEC-2G-2) supported on the Cisco XR 12000 Series Router is a different form factor from the IPSec VPN SPA supported on the Cisco 7600 router (SPA-IPSEC-2G-1).



Warning

Attempting to install a SPA-IPSEC-2G-1 into a Cisco XR 12000 SIP-401, Cisco XR 12000 SIP-501, or a Cisco XR 12000 SIP-601 will result in mounting rail damage. Only the Cisco XR12000 IPSec VPN SPA (SPA-IPSEC-2G-2) is supported on the Cisco XR 12000 Series Router.

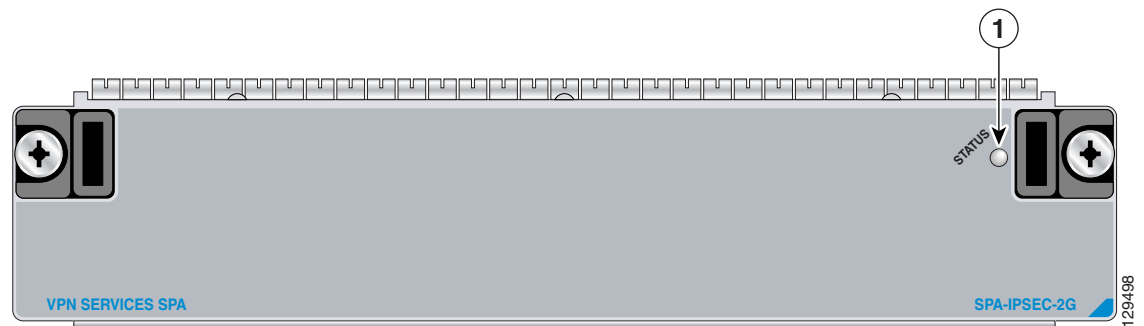
The following sections describe the IPSec VPN SPA:

- [IPSec VPN SPA LEDs, page 2-67](#)

IPSec VPN SPA LEDs

The IPSec VPN SPA has one LED, as shown in [Figure 2-48](#).

Figure 2-48 IPSec VPN SPA Faceplate



1	STATUS LED		
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The IPSec VPN SPA LED is described in [Table 2-43](#).

Table 2-43 IPSec VPN SPA LED

LED Label	Color	State	Meaning
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA is on and good, and the SPA is being configured.
	Green	On	SPA is ready and operational.



Caution

The Cisco XR 12000 SIP-401, Cisco XR 12000 SIP-501, and Cisco XR 12000 SIP-601 do not support the IPSec VPN SPA (SPA-IPSEC-2G). Installing a IPSec VPN SPA in these carrier cards could damage the guide rails.

1-Port and 3-Port Clear Channel OC-3 ATM SPA Overview

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA is a single-height SPA that installs into one SIP subslot. The Clear Channel OC-3 ATM SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity with a per-port bandwidth of 155.52 Mbps. For more information about SPA bandwidth, see the “Bandwidth Oversubscription” section in this chapter.

The following sections describe the 1-Port and 3-Port Clear Channel OC-3 ATM SPA:

- [1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs, page 2-68](#)
- [1-Port and 3-Port Clear Channel OC-3 ATM SPA Interface Specifications, page 2-69](#)
- [1-Port and 3-Port Clear Channel OC-3 ATM SPA Cables and Connectors, page 2-69](#)

1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. [Figure 2-49](#) shows an example of these LEDs on a 3-Port Clear Channel OC-3 ATM SPA.

Figure 2-49 3-Port Clear Channel OC-3 ATM SPA Faceplate



1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs are described in [Table 2-44](#).

Table 2-44 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.

Table 2-44 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs (continued)

LED Label	Color	State	Meaning
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

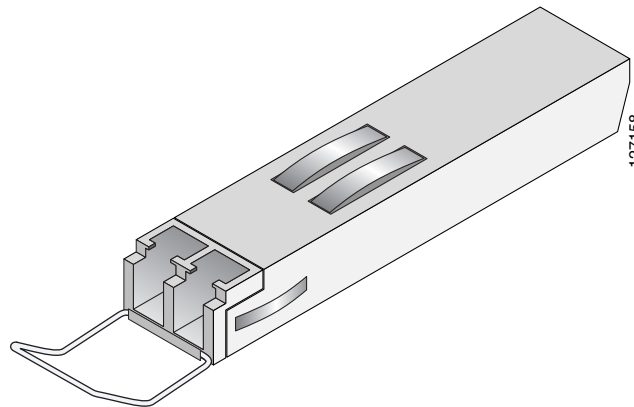
1-Port and 3-Port Clear Channel OC-3 ATM SPA Interface Specifications

The physical layer interface for the 1-Port and 3-Port Clear Channel OC-3 ATM SPA is Optical Carrier-3 (OC-3), and the data link layer is designed to comply with ATM specifications. The 1-Port and 3-Port Clear Channel OC-3 ATM SPA provides up to one and three 155-Mbps OC-3 network interfaces, respectively, for all supported platforms.

Each SPA port accepts an SFP module with a duplex LC-type receptacle that allows connection to single-mode or multimode optical fiber.

1-Port and 3-Port Clear Channel OC-3 ATM SPA Cables and Connectors

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see [Figure 2-50](#)).

Figure 2-50 SFP Optics Module

The SFP optical transceiver modules used with the 1-Port and 3-Port Clear Channel OC-3 ATM SPA provide the following optical fiber options:

- Multimode—155-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)

Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.

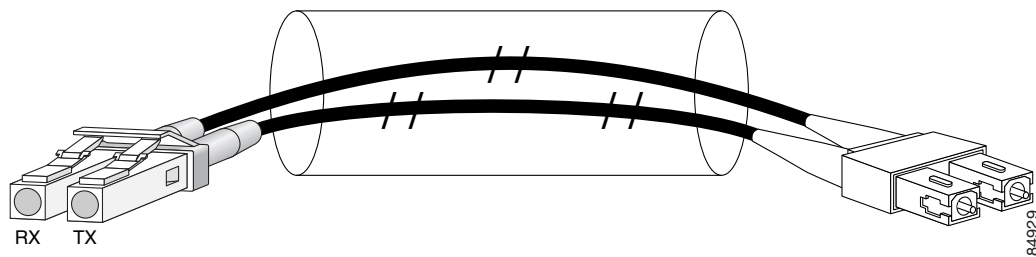
- Single-mode—155-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-51](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use a single-mode (for intermediate-reach or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two OC-3-equipped routers back-to-back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between them.

Figure 2-51 Duplex Patch Cable with LC-Type Connectors



1-Port Clear Channel OC-12 ATM SPA Overview

The 1-Port Clear Channel OC-12 ATM SPA is a single-height ATM SPA that can be installed into one SIP subslot. The OC-12 ATM SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity with a per-port bandwidth of 622.08 Mbps. For more information about SPA bandwidth, see the “Bandwidth Oversubscription” section in this chapter.

The following sections describe the 1-Port Clear Channel OC-12 ATM SPA:

- [1-Port Clear Channel OC-12 ATM SPA LEDs, page 2-70](#)
- [1-Port Clear Channel OC-12 ATM SPA Interface Specifications, page 2-71](#)
- [1-Port Clear Channel OC-12 ATM SPA Cables and Connectors, page 2-72](#)

1-Port Clear Channel OC-12 ATM SPA LEDs

The 1-Port Clear Channel OC-12 ATM SPA has three types of LEDs. There are two LEDs for the port on the SPA, and one STATUS LED, as shown in [Figure 2-52](#).

Figure 2-52 1-Port Clear Channel OC-12 ATM SPA Faceplate

1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Clear Channel OC-12 ATM SPA LEDs are described in [Table 2-45](#).

Table 2-45 1-Port Clear Channel OC-12 ATM SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

1-Port Clear Channel OC-12 ATM SPA Interface Specifications

The physical layer interface for the 1-Port Clear Channel OC-12 ATM SPA is Optical Carrier-12 (OC-12), and the 1-Port Clear Channel OC-12 ATM SPA is designed to comply with ATM specifications. The 1-Port Clear Channel OC-12 ATM SPA provides one 622.08 Mbps OC-12 network interface for all supported platforms.

The single SPA port accepts an SFP module with a duplex LC-type receptacle that allows connection to single-mode or multimode optical fiber.

1-Port Clear Channel OC-12 ATM SPA Cables and Connectors

The 1-Port Clear Channel OC-12 ATM SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see [Figure 2-53](#)).

The 1-Port Clear Channel OC-12 ATM SPA supports the following types of optical transceiver modules:

Multimode (MM) SFP module—SFP-OC12-MM

Short-reach (SR) SFP module—SFP-OC12-SR

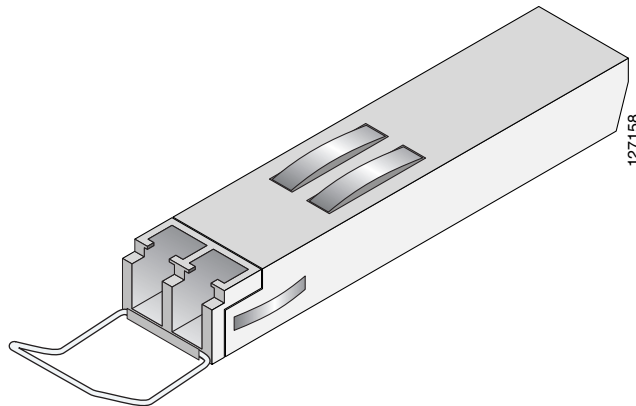
Intermediate-reach (IR) SFP module (15 km)—SFP-OC12-IR1

Long-reach (LR) SFP module (40 km)—SFP-OC12-LR1

Long-reach (LR) SFP module (80 km)—SFP-OC12-LR2

The SR, IR, and LR1 transceivers provide a full-duplex 622.08-Mbps, laser-based SONET/SDH-compliant interface with an average wavelength of 1310 nm. The LR2 transceivers provide a full-duplex, 622.08-Mbps, laser-based SONET/SDH-compliant interface with an average wavelength of 1530 nm. The multimode transceiver provides a full-duplex, 622.08-Mbps, LED-based SONET/SDH-compliant interface with an average wavelength of 1325 nm.

Figure 2-53 SFP Optics Module

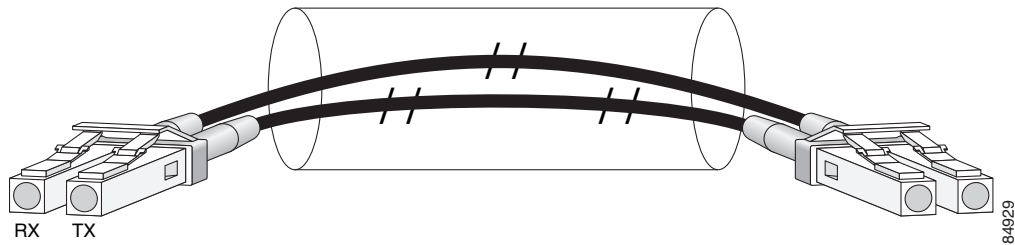


The 1-Port Clear Channel OC-12 ATM SPA provides the following optical fiber options:

- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see [Figure 2-54](#)) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 2-54 Duplex Patch Cable with LC-Type Connectors



2-Port Channelized T3/E3 ATM CCoP SPA Overview

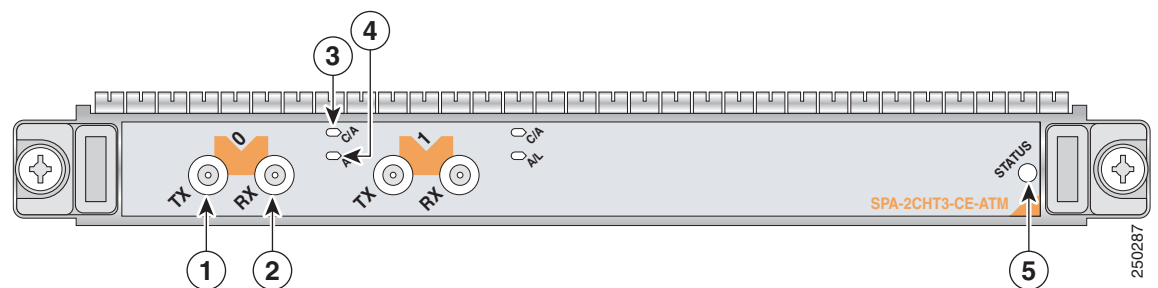
The following sections describe the 2-Port Channelized T3/E3 ATM CCoP SPA:

- [2-Port Channelized T3/E3 ATM CCoP SPA LEDs](#)
- [2-Port Channelized T3/E3 ATM CCoP SPA Interface Specifications](#)
- [2-Port Channelized T3/E3 ATM CCoP SPA Cables and Connectors](#)

2-Port Channelized T3/E3 ATM CCoP SPA LEDs

The 2-Port Channelized T3/E3 ATM CCoP SPA has three types of LEDs (see [Figure 2-55](#)). There are two LEDs for each port on the SPA, and a single STATUS LED for the SPA.

Figure 2-55 2-Port Channelized T3/E3 ATM CCoP SPA Faceplate



1	TX (Transmit) connector	4	A/L (Active/Loopback)
2	RX (Receive) connector	5	STATUS LED
3	C/A (Carrier/Alarm) LED		

The 2-Port Channelized T3/E3 ATM CCoP SPA LEDs are described in [Table 2-46](#).

Table 2-46 2-Port Channelized T3/E3 ATM CEoP SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

2-Port Channelized T3/E3 ATM CEoP SPA Interface Specifications

The framer processes incoming and outgoing T3 (cbit, m13/m23, and unframe) and E3 (g751 and unframe) frames. The framer operates at T3 or E3 line rates (44.736 or 34.368 Mbps), depending on the mode in which it is configured.



Note

For Cisco IOS XR Software Release 3.7.0, the 2-Port Channelized T3/E3 ATM CEoP SPA supports T3 ATM only. E3 ATM is not supported.

T3/E3 data is encapsulated and sent across the MPLS network over user-configurable pseudowires. In ATM mode, data is encapsulated into ATM cells and transported across the network.

In circuit emulation (CE) mode, channelized data is encapsulated in structured mode using the Circuit Emulation Services over Packet Switched Network (CESoPSN) format, and unchannelized data is encapsulated in unstructured mode using Structure-Agnostic TDM over Packet (SAToP) format. The encapsulation adds transport overhead to the CEM frames or ATM cells before transport and removes the overhead at the far end.



Note

For Cisco IOS XR Software Release 3.7.0, the 2-Port Channelized T3/E3 ATM CEoP SPA does not support circuit emulation (CE) mode.

The T3/E3 SPA interface is compliant with ANSI and Telco standards. The interface also provides support for Management Information Base (MIB) RFC 2495, RFC 2496, and T1.231.

2-Port Channelized T3/E3 ATM CEoP SPA Cables and Connectors

The interface connectors on the 2-Port Channelized T3/E3 ATM CEoP SPA are 75-ohm coaxial Siemax types, with one connector and cable for transmit (TX) and one for receive (RX).

The following cables can be used with the 2-Port Channelized T3/E3 ATM CEoP SPA. The cables have BNC connectors on one end and the Siemax connectors on the other. If similar SPAs are connected back-to-back, both ends of the cable are Siemax.

- CAB-T3E3-RF-BNC-M (T3 or E3 Cable, 1.0/2.3 RF to BNC-Male, 10 feet)
- CAB-T3E3-RF-BNC-F (T3 or E3 Cable, 1.0/2.3 RF to BNC-Female, 10 feet)
- CAB-T3E3-RF-OPEN (T3 or E3 Cable, 1.0/2.3 RF to BNC-Open end, 10 feet)

**Note**

- The Cisco cable part numbers are 72-4124-01 (with male BNC end) and 72-4131-01 (with female BNC end).
- The SPA can receive data over the cable up to a maximum distance of 1350 ft (411.5 meters).

Figure 2-55 shows the connectors on the 2-Port Channelized T3/E3 ATM CEoP SPA, and Table 2-47 describes the signal descriptions for these connectors.

Table 2-47 2-Port Channelized T3/E3 ATM CEoP SPA Connectors

Connector Label	Meaning
TX	Transmitted signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the TX Siemax connector.
RX	Received signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the RX Siemax connector.

24-Port Channelized T1/E1/J1 ATM CEoP SPA Overview

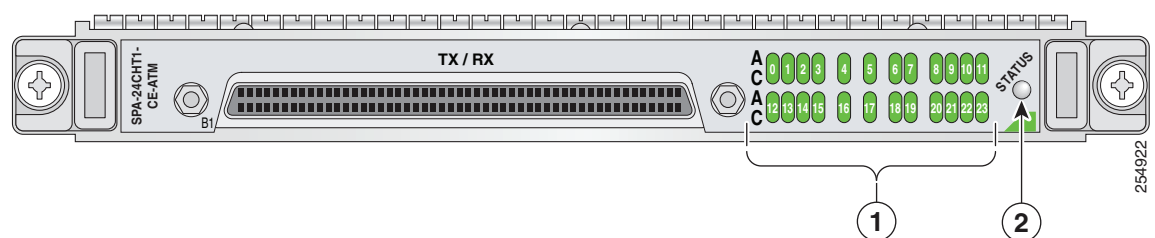
The following sections describe the 24-Port Channelized T1/E1/J1 ATM CEoP SPA:

- [24-Port Channelized T1/E1/J1 ATM CEoP SPA LEDs](#)
- [24-Port Channelized T1/E1/J1 ATM CEoP SPA Interface Specifications](#)
- [24-Port Channelized T1/E1/J1 ATM CEoP SPA Cables and Connectors](#)
- [24-Port Channelized T1/E1/J1 ATM CEoP SPA Patch Panel](#)

24-Port Channelized T1/E1/J1 ATM CEoP SPA LEDs

The 24-Port Channelized T1/E1/J1 ATM CEoP SPA has two types of LEDs, as shown in this figure:

Figure 2-56 24-Port Channelized T1/E1/J1 ATM CEoP SPA Faceplate



1	A/C (Alarm/Carrier) LEDs	2	STATUS LED
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The 24-Port Channelized T1/E1/J1 ATM CEoP SPA LEDs are described in the following table.

Table 2-48 24-Port Channelized T1/E1/J1 ATM CEoP SPA LEDs

LED Label	Color	State	Meaning
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.
A/C	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software.
	Amber	On	Port is enabled by software, and there is at least one alarm.

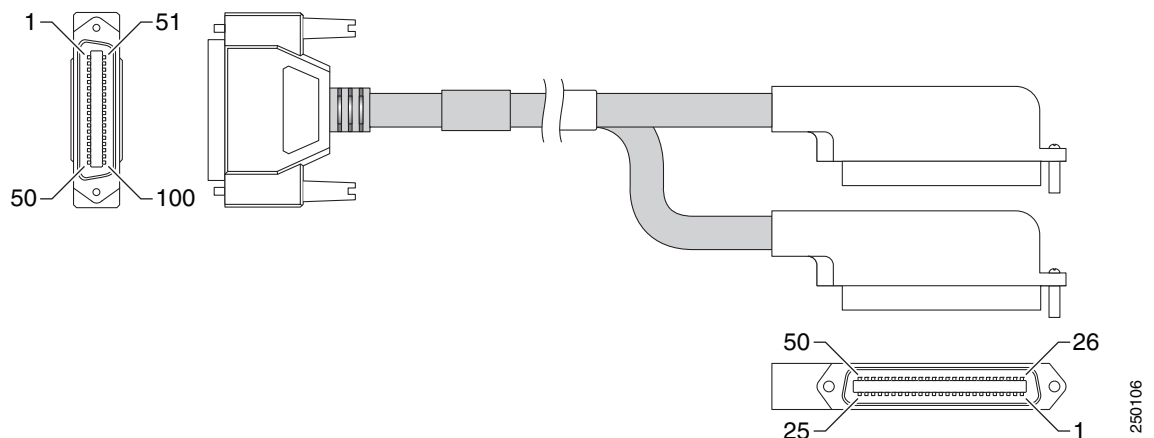
24-Port Channelized T1/E1/J1 ATM CEoP SPA Interface Specifications

The physical layer interface for the 24-Port Channelized T1/E1/J1 ATM CEoP SPA is a customer-installed high-density connector. The high-density connector has thumbscrews which should be screwed into the SPA when the cable is installed.

24-Port Channelized T1/E1/J1 ATM CEoP SPA Cables and Connectors

The 24-Port Channelized T1/E1/J1 ATM CEoP SPA requires a Cisco cable (part number CABLE-24T1E1J1), which is shown in the following figure.

Figure 2-57 24-Port Channelized T1/E1/J1 ATM CEoP SPA High-Density Cable

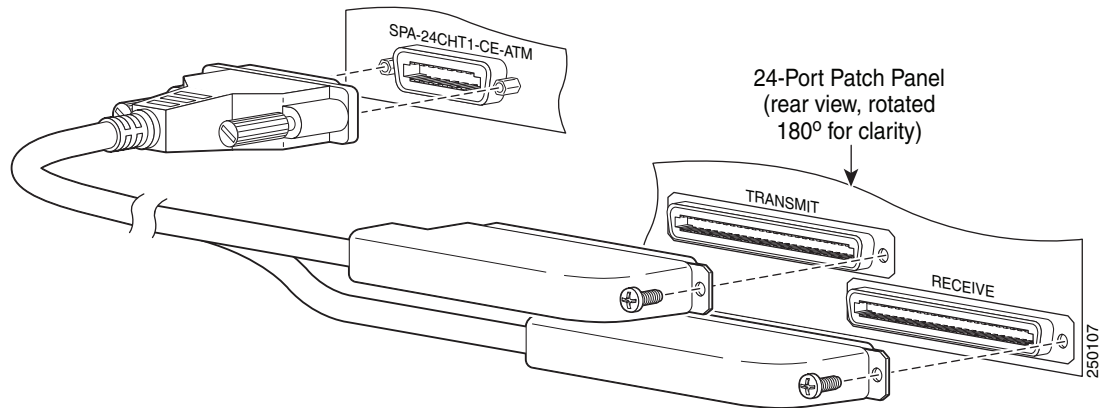


Cable Installation

One end of the cable has a 100-pin connector that plugs into the front of the 24-Port Channelized T1/E1/J1 ATM CEoP SPA. Use the thumbscrews on either side of the connector to secure the cable to the SPA.

The other end of the cable has two 50-pin Telco connectors that attach to the rear of a 24-port RJ-45 patch panel. Both connectors are identical: one is for Transmit (TX) and the other is for Receive (RX). The following figure shows how the cable is connected between the 24-Port Channelized T1/E1/J1 ATM CEoP SPA and the patch panel.

Figure 2-58 Cable Installation between SPA and Patch Panel



SPA Cable Pinouts

The following table shows the cable pinouts for the cable (part number CABLE-24T1E1J1) that is installed between the 24-Port Channelized T1/E1/J1 ATM CEoP SPA and the rear of the patch panel.

Table 2-49 24-Port Channelized T1/E1/J1 ATM CEoP SPA Cable Connector Pinouts

Subscriber		Connector Pins		
Line	Signal	SPA	TX Cable Lead	RX Cable Lead
Line 1	TX Tip	2	1	Not connected
	TX Ring	52	26	
	RX Tip	26	Not connected	1
	RX Ring	76		26
Line 2	TX Tip	3	2	Not connected
	TX Ring	53	27	
	RX Tip	27	Not connected	2
	RX Ring	77		27
Line 3	TX Tip	4	3	Not connected
	TX Ring	54	28	
	RX Tip	28	Not connected	3
	RX Ring	78		28

Table 2-49 24-Port Channelized T1/E1/J1 ATM CEoP SPA Cable Connector Pinouts (continued)

Subscriber		Connector Pins		
Line	Signal	SPA	TX Cable Lead	RX Cable Lead
Line 4	TX Tip	5	4	Not connected
	TX Ring	55	29	
	RX Tip	29	Not connected	4
	RX Ring	79		29
Line 5	TX Tip	6	5	Not connected
	TX Ring	56	30	
	RX Tip	30	Not connected	5
	RX Ring	80		30
Line 6	TX Tip	7	6	Not connected
	TX Ring	57	31	
	RX Tip	31	Not connected	6
	RX Ring	81		31
Line 7	TX Tip	8	7	Not connected
	TX Ring	58	32	
	RX Tip	32	Not connected	7
	RX Ring	82		32
Line 8	TX Tip	9	8	Not connected
	TX Ring	59	33	
	RX Tip	33	Not connected	8
	RX Ring	83		33
Line 9	TX Tip	10	9	Not connected
	TX Ring	60	34	
	RX Tip	34	Not connected	9
	RX Ring	84		34
Line 10	TX Tip	11	10	Not connected
	TX Ring	61	35	
	RX Tip	35	Not connected	10
	RX Ring	85		35
Line 11	TX Tip	12	11	Not connected
	TX Ring	62	36	
	RX Tip	36	Not connected	11
	RX Ring	86		36
Line 12	TX Tip	13	12	Not connected
	TX Ring	63	37	
	RX Tip	37	Not connected	12
	RX Ring	87		37
Line 13	TX Tip	14	13	Not connected
	TX Ring	64	38	
	RX Tip	38	Not connected	13
	RX Ring	88		38

Table 2-49 24-Port Channelized T1/E1/J1 ATM CCoP SPA Cable Connector Pinouts (continued)

Subscriber		Connector Pins		
Line	Signal	SPA	TX Cable Lead	RX Cable Lead
Line 14	TX Tip	15	14	Not connected
	TX Ring	65	39	
	RX Tip	39	Not connected	14
	RX Ring	89		39
Line 15	TX Tip	16	15	Not connected
	TX Ring	66	40	
	RX Tip	40	Not connected	15
	RX Ring	90		40
Line 16	TX Tip	17	16	Not connected
	TX Ring	67	41	
	RX Tip	41	Not connected	16
	RX Ring	91		41
Line 17	TX Tip	18	17	Not connected
	TX Ring	68	42	
	RX Tip	42	Not connected	17
	RX Ring	92		42
Line 18	TX Tip	19	18	Not connected
	TX Ring	69	43	
	RX Tip	43	Not connected	18
	RX Ring	93		43
Line 19	TX Tip	20	19	Not connected
	TX Ring	70	44	
	RX Tip	44	Not connected	19
	RX Ring	94		44
Line 20	TX Tip	21	20	Not connected
	TX Ring	71	45	
	RX Tip	45	Not connected	20
	RX Ring	95		45
Line 21	TX Tip	22	21	Not connected
	TX Ring	72	46	
	RX Tip	46	Not connected	21
	RX Ring	96		46
Line 22	TX Tip	23	22	Not connected
	TX Ring	73	47	
	RX Tip	47	Not connected	22
	RX Ring	97		47
Line 23	TX Tip	24	23	Not connected
	TX Ring	74	48	
	RX Tip	48	Not connected	23
	RX Ring	98		48

Table 2-49 24-Port Channelized T1/E1/J1 ATM CEoP SPA Cable Connector Pinouts (continued)

Subscriber		Connector Pins		
Line	Signal	SPA	TX Cable Lead	RX Cable Lead
Line 24	TX Tip	25	24	Not connected
	TX Ring	75	49	
	RX Tip	49	Not connected	24
	RX Ring	99		49

RJ-45 Cable Pinouts

T1 lines from individual subscribers are attached to RJ-45 connectors on the front of the 24-port patch panel. Each RJ-45 port accommodates an individual T1 subscriber line.

Pins 1 and 2 and 4 and 5 of the RJ-45 connectors are used for the 24-port CEoP SPA's Transmit (TX) and Receive (RX) signals. Depending on how the cable is installed between the SPA and its patch panel (rear), the RJ-45 connectors operate as follows:

- If the TX cable lead is connected to Transmit on the patch panel and RX is connected to Receive:
 - The SPA's TX signals are transmitted on RJ-45 pins 1 (ring) and 2 (tip).
 - The SPA's RX signals are received on RJ-45 pins 4 (ring) and 5 (tip).
- If the TX cable lead is connected to Receive on the patch panel and RX is connected to Transmit:
 - RJ-45 pins 1 and 2 are used for the SPA's RX signal.
 - RJ-45 pins 4 and 5 are used for the SPA's TX signal.

Patch Panel Cabling

If you are connecting two 24-Port Channelized T1/E1/J1 ATM CEoP SPAs to each other, you must cable both SPA's patch panels together using a T1 cross-over cable or a T1 straight-through cable. The type of cable you use (cross-over or straight-through) depends on how the CEoP SPAs are cabled to their patch panels:

- If both CEoP SPAs are connected to their patch panels in the same manner (TX to Transmit and RX to Receive, or TX to Receive and RX to Transmit), use a T1 cross-over cable to connect the patch panels to each other.
- If both CEoP SPAs are connected to their patch panels in a different configuration (TX to Transmit and RX to Receive on one SPA, and TX to Receive and RX to Transmit on the other SPA), use a T1 straight-through cable (standard RJ-45 patch cable) between the patch panels.

24-Port Channelized T1/E1/J1 ATM CEoP SPA Patch Panel

The recommended patch panel is part number DCC2484/25T1S from SMP Data Communications (<http://www.smpdata.com>).

To order the patch panel, contact the Sales and Marketing Support staff at SMP Data Communications:

- 800-880-7674 (toll free in the U.S.A.)
- 828-298-2260 (outside the U.S.A.)
- ciscoinfo@smpdata.com (email)

For product support for the patch panel, contact Cisco Engineering Support at SMP Data Communications:

- 800-880-7674 (toll free in the U.S.A.)
- 828-298-2260 (outside the U.S.A.)
- ciscoeng@smpdata.com (email)

1-Port Channelized OC-3 ATM CEoP SPA Overview

The following sections describe the 1-Port Channelized OC-3 ATM CEoP SPA:

- [1-Port Channelized OC-3 ATM CEoP SPA LEDs](#)
- [1-Port Channelized OC-3 ATM CEoP SPA Interface Specifications](#)
- [1-Port Channelized OC-3 ATM CEoP SPA Optical Transceiver Modules and Cables](#)

1-Port Channelized OC-3 ATM CEoP SPA LEDs

The 1-Port Channelized OC-3 ATM CEoP SPA has three types of LEDs. There are two LEDs for the port on the SPA, and one STATUS LED as shown in the following figure.

Figure 2-59 1-Port Channelized OC-3 ATM CEoP SPA Faceplate

1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Channelized OC-3 ATM CEoP SPA LEDs are described in the following table.

Table 2-50 1-Port Channelized OC-3 ATM CEoP SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.

Table 2-50 1-Port Channelized OC-3 ATM CEOp SPA LEDs (continued)

LED Label	Color	State	Meaning
STATUS	Amber	On	Port is enabled by software, loopback is on.
	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

1-Port Channelized OC-3 ATM CEOp SPA Interface Specifications

The physical layer interface for the 1-Port Channelized OC-3 ATM CEOp SPA is Optical Carrier-3 (OC-3). The 1-Port Channelized OC-3 ATM CEOp SPA provides one 155.52-Mbps OC-3 network interface for all supported platforms.

The single SPA port accepts an SFP module with a duplex LC-type receptacle that allows connection to optical fiber.

1-Port Channelized OC-3 ATM CEOp SPA Optical Transceiver Modules and Cables

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 1-Port Channelized OC-3 ATM CEOp SPA supports the following types of optical transceiver modules:

- Multimode (MM) SFP module—SFP-OC3-MM
- Short Reach (SR) SFP module—SFP-OC3-SR
- Intermediate Reach (IR) SFP module (15 km)—SFP-OC3-IR1
- Long Reach (LR) SFP module (40 km)—SFP-OC3-LR1
- Long Reach 2 (LR2) SFP module (80 km)—SFP-OC3-LR2

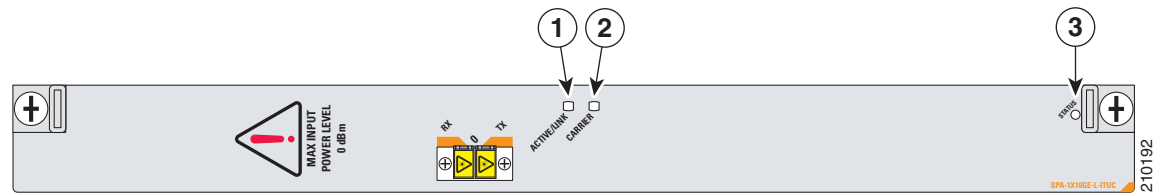
1-Port 10-Gigabit Ethernet DWDM SPA Overview

The following sections describe the 1-Port 10-Gigabit Ethernet DWDM SPA:

- [1-Port 10-Gigabit Ethernet SPA LEDs](#)
- [1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables](#)

1-Port 10-Gigabit Ethernet DWDM SPA LEDs

The 1-Port 10-Gigabit Ethernet DWDM SPA has three LEDs: an ACTIVE/LINK LED for the port, a CARRIER LED, and a STATUS LED, as shown in this figure.

Figure 2-60 1-Port 10-Gigabit Ethernet DWDM SPA Faceplate

1	ACTIVE/LINK LED	2	CARRIER LED
3	STATUS LED		

The 1-Port 10-Gigabit Ethernet DWDM SPA LEDs are described in this table.

Table 2-51 1-Port 10-Gigabit Ethernet DWDM SPA LEDs

LED Label	Color	State	Meaning
ACTIVE/LINK	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software and the link is up.
	Amber	On	Port is enabled by software and the link is down.
CARRIER	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and the interface is receiving valid frames, and the PCS is locked.
	Amber	On	Port is enabled by software, but there are active alarms that indicate either an out-of-frame condition or a PCS loss-of-lock condition.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

1-Port 10-Gigabit Ethernet DWDM SPA XFP Optical Transceiver Modules, Connectors, and Cables

The 1-Port 10-Gigabit Ethernet DWDM SPA supports the following types of optical transceiver modules:

- Multi-mode short reach (SR) XFP module—XFP-10G-MM-SR
- Single-mode short reach (SR) XFP module—XFP-10GLR
- Single-mode intermediate reach (IR) XFP module—XFP-10GER

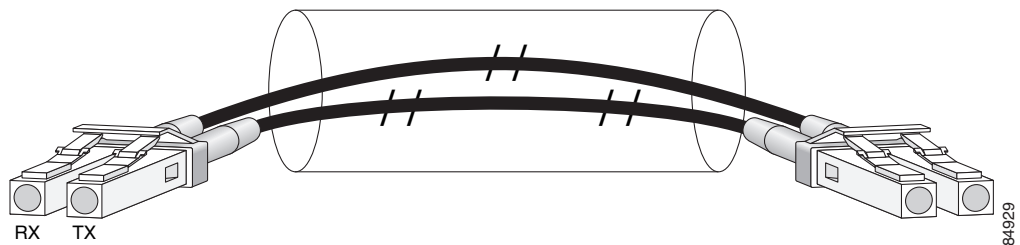
Cisco Systems qualifies the optics that are approved for use with its SPAs.

As of Cisco IOS Release 12.0(31)S, the above listed XFPs are the only optical transceiver modules qualified for use. Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns (nominal diameter is approximately 10/125 microns) to connect your router to a network.

The 1-Port 10-Gigabit Ethernet DWDM SPA has an in-built XFP optical transceiver module, and so, an external XFP module is not required.

This figure shows the cable type for use with the XFP optical transceiver module on the 1-Port 10-Gigabit Ethernet SPA.

Figure 2-61 LC-Type Cable for the XFP Optical Transceiver Modules



Note

The 40-pin connector on the 1-Port 10-Gigabit Ethernet SPA is used for resilient packet ring (RPR) connections.

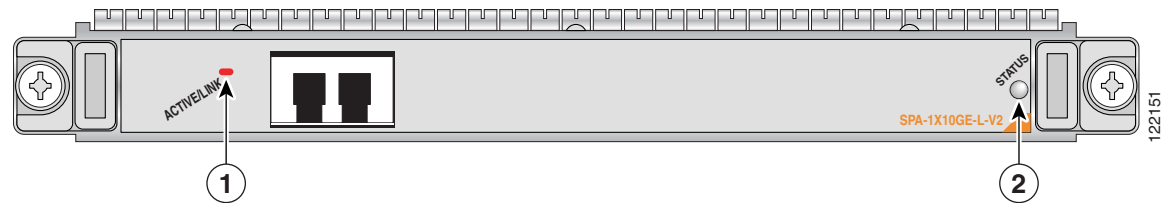
1-Port 10-Gigabit Ethernet WAN PHY SPA Overview

The 1-Port 10-Gigabit Ethernet SPA is a single-height SPA that installs into one SIP subslot. There are two types of 1-Port 10-Gigabit Ethernet SPA: the SPA-1X10GE-L-V2 and the SPA-1X10GE-WL-V2. The SPA-1X10GE-L-V2 supports the 10-Gigabit Ethernet LAN physical layer device (PHY) mode of operation at an optical interface bit rate of 10.3125 Gbps. The SPA-1X10GE-WL-V2 supports both the 10-Gigabit Ethernet LAN PHY mode of operation (at 10.3125 Gbps) as well as the 10-Gigabit Ethernet WAN PHY mode of operation (at 9.95328 Gbps). The following sections describe the 1-Port 10-Gigabit Ethernet SPA.

- [1-Port 10-Gigabit Ethernet SPA LEDs, page 2-84](#)
- [1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables, page 2-85](#)

1-Port 10-Gigabit Ethernet SPA LEDs

The 1-Port 10-Gigabit Ethernet SPA has two LEDs, as shown in [Figure 2-62](#).

Figure 2-62 1-Port 10-Gigabit Ethernet SPA Faceplate

1	ACTIVE/LINK LED	2	STATUS LED
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Table 2-52 describes the 1-Port 10-Gigabit Ethernet SPA LEDs. The LED behavior applies to both the SPA-1X10GE-L-V2 and the SPA-1X10GE-WL-V2 regardless of the mode of operation.

Table 2-52 1-Port 10-Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
ACTIVE/LINK	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software and the link is up.
	Amber	On	Port is enabled by software and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables

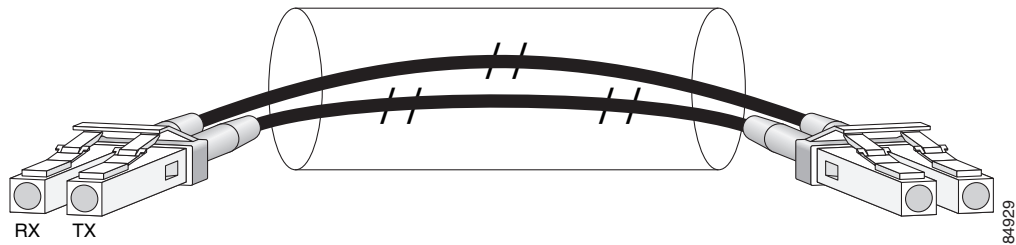
The 1-Port 10-Gigabit Ethernet SPA supports the following types of optical transceiver modules:

- Single-mode short reach (SR) XFP module—XFP-10GLR-OC192SR
- Single-mode intermediate reach (IR) XFP module—XFP-10GER-OC192IR
- Single-mode very-long reach (ZR) XFP module—XFP-10GZR-OC192LR

Cisco qualifies the optics that are approved for use with its SPAs. As of Cisco IOS XR Software Release 4.3.0, the above-listed XFP modules are the only optical transceiver modules qualified for use.

Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns (nominal diameter is approximately 10/125 microns) to connect your router to a network.

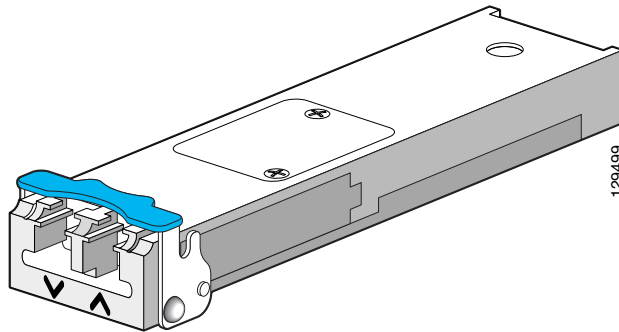
Figure 2-63 shows the cable type for use with the XFP optical transceiver module on the 1-Port 10-Gigabit Ethernet SPA.

Figure 2-63 LC-Type Cable for the XFP Optical Transceiver Modules

XFP Module Connections

The 10GLR, 10GER, and 10GZR XFP modules include an optical transmitter and receiver pair integrated with Clock and Data Recovery (CDR) integrated circuits. The XFP modules provide high-speed serial links at the rate of 10.3125 Gbps (10-Gigabit Ethernet LAN PHY mode) and 9.95328 Gbps (10-Gigabit Ethernet WAN PHY mode) on single-mode fibers (SMF). The transmit side recovers and retimes the 10-Gbps serial data and passes it to a laser driver. The laser driver biases and modulates a 1310-nm or 1550-nm laser, enabling data transmission over SMF through an LC connector. The receive side recovers and retimes the 10-Gbps optical data stream from a photo detector transimpedance amplifier and passes it to an output driver.

See the label on the XFP module for the technology type and model. [Figure 2-64](#) shows an XFP module and [Table 2-53](#) shows the XFP module specifications.

Figure 2-64 XFP Module

XFP module dimensions are:

- Height: 12.5 mm
- Width: 18.35 mm
- Length: 71.1mm

Table 2-53 XFP Module Specifications

Specification	Description
Wavelength (TX)	10GLR SR-1: 1260 nm to 1355 nm 10GER IR-2: 1530 nm to 1565 nm 10GZR LR-2: 1530 nm to 1565 nm
Cabling distance (maximum)	10GLR SR-1: 6.2 miles (10 km) 10GER IR-2: 24.8 miles (40 km) 10GZR LR-2: 50 miles (80 km)
Operating case temperature range	10GLR SR-1: 23 to 158 degrees F (–5 to 70 degrees C) 10GER IR-2: 23 to 158 degrees F (–5 to 70 degrees C) 10GZR LR-2: 23 to 158 degrees F (–5 to 70 degrees C)
Storage temperature range	10GLR SR-1: –40 to 185 degrees F (–40 to 85 degrees C) 10GER IR-2: –40 to 185 degrees F (–40 to 85 degrees C) 10GZR LR-2: –40 to 185 degrees F (–40 to 85 degrees C)
TX power	10GLR SR-1: –8.2 to 0.5 dBm 10GER IR-2: –4.7 to 4 dBm 10GZR LR-2: 0 to 4 dBm
Receiver sensitivity (maximum)	10GLR SR-1: –12.6 dBm 10GER IR-2: –14.1 dBm 10GZR LR-2: –24 dBm
RX overload	10GLR SR-1: 0.5 dBm 10GER IR-2: –1.0 dBm 10GZR LR-2: –7.0 dBm
Maximum receiver power damage	10GLR SR-1: +5 dBm 10GER IR-2: +5 dBm 10GZR LR-2: +5 dBm

XFP Port Cabling Specifications

Table 2-54 shows the port cabling specifications for an XFP module.

Table 2-54 XFP Port Cabling Specifications

XFP	Wavelength	Fiber Type
XFP-10GLR-OC192SR	1310 nm	SMF
XFP-10GER-OC192IR	1550 nm	SMF
XFP-10GZR-OC192LR	1550 nm	SMF

