Overview: Cisco 7304 Router Shared Port Adapters

This chapter describes the shared port adapters (SPAs) that are supported on the Cisco 7304 router and contains the following sections:

SPA Summary

Summary descriptions of the SPAs that are supported on the Cisco 7304 router are shown in Table 3-1.

Table 3-1   SPA Summary for Cisco 7304 Routers

SPA	Product Number	Description	Number of Ports	Minimum Cisco IOS Release
FastEthernet SPA	SPA-4FE-7304	4-port 10/100 FastEthernet SPA	4	Release 12.2(20)S2
GigabitEthernet SPA	SPA-2GE-7304	2-port 10/100/1000 GigabitEthernet SPA	2	Release 12.2(20)S2
OC-3 SPA	SPA-2XOC3-POS	2-Port OC-3c/STM-1 POS SPA	2	Release 12.2(25)S3
OC-3 SPA	SPA-4XOC3-POS	4-Port OC-3c/STM-1 POS SPA	4	Release 12.2(25)S3
OC-12 SPA	SPA-1OC12-POS	1-Port OC-12c/STM-4 POS SPA	1	Release 12.2(25)S3
T3/E3 Serial SPA	SPA-2XT3/E3	2-Port T3/E3 Serial SPA	2	Release 12.2(25)S3
T3/E3 Serial SPA	SPA-4XT3/E3	4-Port T3/E3 Serial SPA	4	Release 12.2(25)S3

Checking Hardware and Software Compatibility

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

For information on bandwidth oversubscription on the Cisco 7304 router, including information on how SPAs and carrier cards impact the overall bandwidth of the router, see *Bandwidth Information for Cisco 7304 Routers*.
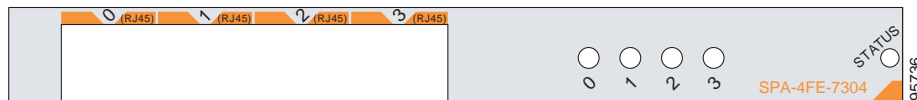
FastEthernet SPA Overview

The following sections describe the SPA-4FE-7304:

- LEDs, page 3-2
- Cables, Connectors, and Pinouts, page 3-3

LEDs

The SPA-4FE-7304 has the LEDs shown in Figure 3-1.

Figure 3-1   SPA-4FE-7304 Faceplate

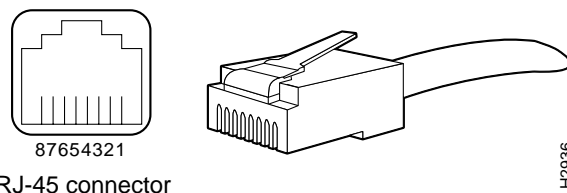The SPA-4FE-7304 LEDs are described in Table 3-2.

Table 3-2   SPA-4FE-7304 LEDs

LED Label	Color	State	Meaning
STATUS	Green	On	The SPA is online.
	Yellow	On	The SPA is receiving power and bootstrapping.
	Off	Off	The SPA is offline and deactivated.
Port Number (0, 1, 2, or 3)[1]	Green	On	The port is enabled and the link is up.
	Yellow	On	The port is enabled and the link is down.
	Off	Off	The port is disabled.

1. In this case, port number refers to the numbered LEDs on the SPA-4FE-7304 (0, 1, 2, or 3). Each LED number on the FastEthernet SPA references a port on the SPA.

Cables, Connectors, and Pinouts

The interface connectors on the SPA-4FE-7304 are four individual RJ-45 receptacles. You can use all four interface connectors simultaneously. Each connection supports IEEE 802.3 and Ethernet 10BASE-T interfaces compliant with appropriate standards. The RJ-45 connections require external transceivers. Cisco Systems does not supply Category 5 unshielded twisted-pair (UTP) RJ-45 cables; these cables are available commercially.

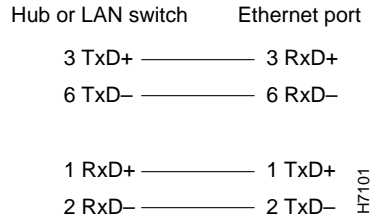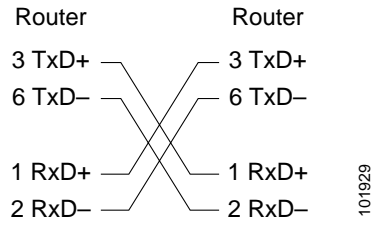Figure 3-2 shows the RJ-45 connector. Table 3-3 lists the pinouts and signals for the RJ-45 connector.

Figure 3-2   RJ-45 Connections, Plug, and Receptacle

87654321

RJ-45 connector

H2936

Table 3-3   RJ-45 Connector Pinout

Pin	Description
1	Transmit data + (TxD+)
2	TxD–
3	Receive data + (RxD+)
6	RxD–

Note   Referring to the RJ-45 pinout in Table 3-3, 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 SPA-4FE-7304.

Depending on your RJ-45 interface cabling requirements, use the pinouts in Figure 3-3 and Figure 3-4.

Figure 3-3   Straight-Through Cable Pinout, RJ-45 Connection to a Hub or Repeater

Hub or LAN switch   Ethernet port

3 TxD+ ——————— 3 RxD+
6 TxD– ——————— 6 RxD–

1 RxD+ ——————— 1 TxD+
2 RxD– ——————— 2 TxD–   H7101

Figure 3-4   Crossover Cable Pinout, RJ-45 Connections Between Routers

Router   Router

3 TxD+   3 TxD+
6 TxD–   6 TxD–

1 RxD+   1 RxD+
2 RxD–   2 RxD–   101929

GigabitEthernet SPA Overview

The following sections describe the SPA-2GE-7304:

LEDs

The SPA-2GE-7304 has three LEDs, as shown in Figure 3-5.

Figure 3-5   SPA-2GE-7304 Faceplate

The SPA-2GE-7304 LEDs are described in Figure 3-5.

Table 3-4   SPA-2GE-7304 LEDs

LED Label	Color	State	Meaning
STATUS	Green	On	The SPA is online.
	Yellow	On	The SPA is receiving power and bootstrapping.
	Off	Off	The SPA is offline and deactivated.
Port Number (0 or 1)[1]	Green	On	The port is enabled and the link is up.
	Yellow	On	The port is enabled and the link is down.
	Off	Off	The port is disabled.

1. In this case, port number refers to the numbered LEDs on the SPA-2GE-7304 (0 or 1). Each LED number on the GigabitEthernet SPA references a port on the SPA.

Cables, Connectors, and Pinouts

The interface connectors on the SPA-2GE-7304 are two individual RJ-45 receptacles and two fiber optic receivers that support SFPs. It is import to note that the SPA-2GE-7304 can only send and receive traffic from two ports, port 0 and port 1. Each port can send and receive traffic using either the RJ-45 port or the optical fiber connection.

The following sections describe the cable, connection, and pinout requirements for the SPA-2GE-7304:

RJ-45 Connectors

The SPA-2GE-7304 router has two RJ-45 ports for 10/100/1000 Ethernet/FastEthernet/GigabitEthernet connections. The RJ-45 ports support IEEE 802.3ab (Gigabit Ethernet) and IEEE 802.3u (Fast Ethernet) interfaces compliant with 10BASE-T, 100BASE-TX, and 1000BASE-T specifications.

The RJ-45 ports support standard straight-through and crossover Category 5 UTP cables with RJ-45 connectors. Cisco Systems does not supply Category 5 UTP cables; these cables are available commercially.
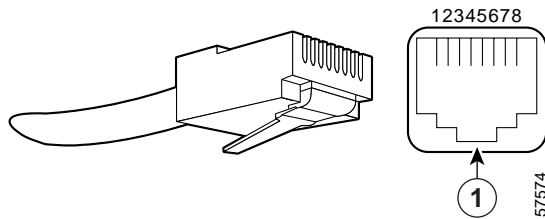
⚠

Warning   **To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.**

Figure 3-6 shows an RJ-45 connector. Table 3-5 lists the pinouts and signals for the RJ-45 port.

Figure 3-6   RJ-45 Port and Connector

1	RJ-45 connector		

Table 3-5   RJ-45 Receptacle Pinouts

Pin	GE Signal
1	Tx A+[1]
2	Tx A–
3	Rx B+[2]
4	Tx C+
5	Tx C–
6	Rx B–
7	Rx D+
8	Rx D–

1. TX DATA = Transmit Data

2. RX DATA = Receive Data

SFP Connections

The small form-factor pluggable (SFP) module is an input/output (I/O) device that plugs into the Gigabit Ethernet optical slot on the SPA-2GE-7304, linking the port with a 1000BASE-X fiber-optic network. An SFP module is shown in Figure 3-7.
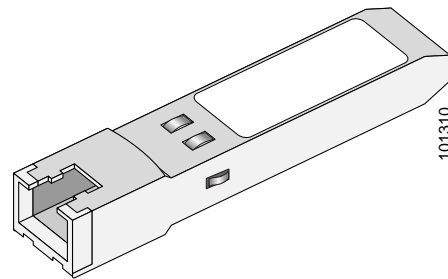
> **Note**   The SPA-2GE-7304 will only accept the SFP modules listed as supported in this document. An SFP check is run every time an SFP is inserted into the SPA-2GE-7304 and only SFP modules that pass this check will be usable by the SPA-2GE-7304.
>
> SFP modules exist for technologies other than Gigabit Ethernet and for products other than the SPA-2GE-7304. However, the information in this document pertains only to SFP modules that plug into the SPA-2GE-7304 fiber-optic ports.

Figure 3-7   SFP Module

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 3-6, Table 3-7, and Table 3-8 provide SFP module information and specifications.

Table 3-6   SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-FCGE-S	Short wavelength (1000BASE-SX)	Contains a Class 1 laser of 850 nm for 1000BASE-SX (short wavelength) applications.
SFP-FCGE-L	Long wavelength/long haul (1000BASE-LX/LH)	Contains a Class 1 laser of 1300 nm for 1000BASE-LX/LH (long wavelength) applications.
SFP-GE-Z	Extended distance (1000BASE-ZX)	Contains a Class 1 laser of 1550 nm for 1000BASE-ZX (extended wavelength) applications.

Table 3-7   SFP Module Transmit Power, Receive Power, and Power Budget

| SFP Module | Transmit Power | | Receive Power | |
	Minimum	Maximum	Minimum	Maximum
SFP-FCGE-S	–9.5 dBm[1]	–4 dBm[1]	–17 dBm	0 dBm

Table 3-7   SFP Module Transmit Power, Receive Power, and Power Budget

SFP Module	Transmit Power		Receive Power	
	Minimum	Maximum	Minimum	Maximum
SFP-FCGE-L	–9.5 dBm[2]	–3 dBm[3]	–19 dBm	–3 dBm
SFP-GE-Z	0 dBm	5 dBm	–23 dBm	–3 dBm

1. For fiber types 50/125 μm, NA = 0.20 fiber and 62.5/125 μm, NA = 0.275 fiber.

2. For fiber types 9/125 μm SMF.

3. For fiber types 9/125 μm SMF, 62.5/125 μm MMF, and 50/125 μm MMF.

Table 3-8   SFP Module Specifications

Specification	Description
Dimensions (H x W x D)	0.03 in x 0.53 in x 2.22 in (8.5 mm x 13.4mm x 56.5 mm)
Connectors	Multimode fiber-optic: LC-type connector Single-mode fiber-optic: LC-type connector
Wavelength	SFP-FCGE-S: 770-860 nm SFP-FCGE-L: 1270-1355 nm SFP-GE-Z: 1500-1580 nm
Cabling distance (maximum)	SFP-FCGE-S: 1804 feet (550 m) SFP-FCGE-L: 6.2 miles (10 km) SFP-GE-Z: 43.5 to 62.1 miles (70 to 100 km)
Operating temperature range	32 to 122 degrees F (0 to 50 degrees C)
Storage temperature range	-40 to 185 degrees F (-40 to 85 degrees C)

SFP-FCGE-S Modules

The 1000BASE-SX (short wavelength) module operates on standard multimode fiber-optic link spans of up to 1804 feet (550 m). (See Table 3-9.)

SFP-FCGE-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. (See Table 3-9.)

SFP-GE-Z Modules

The 1000BASE-ZX (extended wavelength) module operates on ordinary single-mode fiber-optic link spans of up to 43.5 miles (70 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 Module Cabling and Connection Equipment

Table 3-9 provides cabling specifications for the SFP modules that can be installed on the SPA-2GE-7304. Note that all SFP ports have LC-type connectors.

The minimum cable distance for the SFP-FCGE-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 3-9   SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-FCGE-S	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	902 ft (275 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-FCGE-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)

1. Multimode fiber (MMF) only.

2. A mode-conditioning patch cord is required.
   When using the SFP-FCGE-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-FCGE-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).

3. 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.

CWDM SFPs

CWDM SFPs were first supported on the SPA-2GE-7304 in Cisco IOS Release 12.2(28)SB. CWDM SFPs for the SPA-2GE-7304 come in eight wavelengths that range from 1470 nm to 1610 nm. Color markings on the devices identify the wavelength to which the Gigabit Ethernet channel is mapped. Table 3-10 lists the CWDM SFPs with their wavelengths and color codes that are supported on the SPA-2GE-7304.

Table 3-10   CWDM SFP Wavelengths and Color Coding

SFP Product Number	Wavelength	Color Identifier
CWDM-SFP-1470=	Longwave 1470 nm laser, single mode	Gray
CWDM-SFP-1490=	Longwave 1490 nm laser, single mode	Violet
CWDM-SFP-1510=	Longwave 1510 nm laser, single mode	Blue
CWDM-SFP-1530=	Longwave 1530 nm laser, single mode	Green
CWDM-SFP-1550=	Longwave 1550 nm laser, single mode	Yellow
CWDM-SFP-1570=	Longwave 1570 nm laser, single mode	Orange
CWDM-SFP-1590=	Longwave 1590 nm laser, single mode	Red
CWDM-SFP-1610=	Longwave 1610 nm laser, single mode	Brown

For more detailed information on these CWDM SFP modules, see the *Cisco CWDM GBIC and SFP Solution Data Sheet*.

OC-3 POS SPA Overview

The 2-Port and 4-Port OC-3c/STM-1 POS SPA is a single-height SPA that installs into one MSC 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.

For more information about SPA bandwidth, see the "Bandwidth Oversubscription" topic in this chapter. For more information about SPAs and their compatibility with MSCs and modular optics, see the "MSC and SPA Product Overview" chapter in this guide.
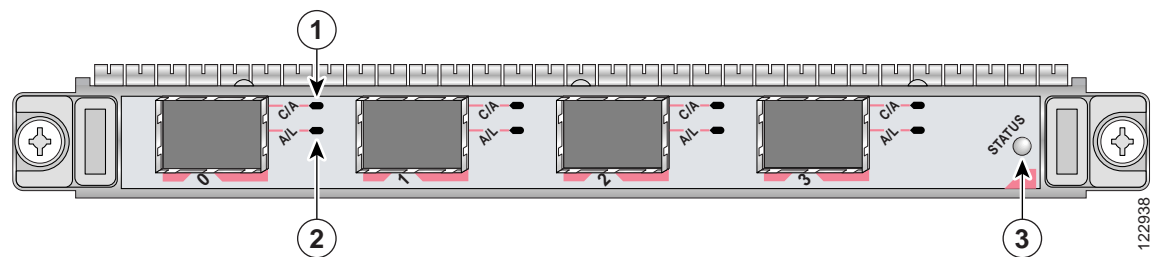
The following sections describe the 2-Port and 4-Port OC-3c/STM-1 POS SPA :

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

The 2-Port and 4-Port OC-3c/STM-1 POS SPA has three LEDs, as shown in Figure 3-8. There are two LEDs for each port on the SPA, and one STATUS LED.

Figure 3-8   4-Port OC-3c/STM-1 POS SPA Faceplate

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

The 2-Port and 4-Port OC-3c/STM-1 POS SPA LEDs are described in Table 3-11.

Table 3-11   2-Port and 4-Port OC-3c/STM-1 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.

2-Port and 4-Port OC-3c/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-3c/STM-1 POS SPA interface is compliant with the following RFCs:

- RFC 1619, *PPP over SONET/SDH*

- RFC 1662, *PPP in HDLC-like Framing*

The 2-Port and 4-Port OC-3c/STM-1 POS SPA also provides support for SNMP agent v1
(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)*

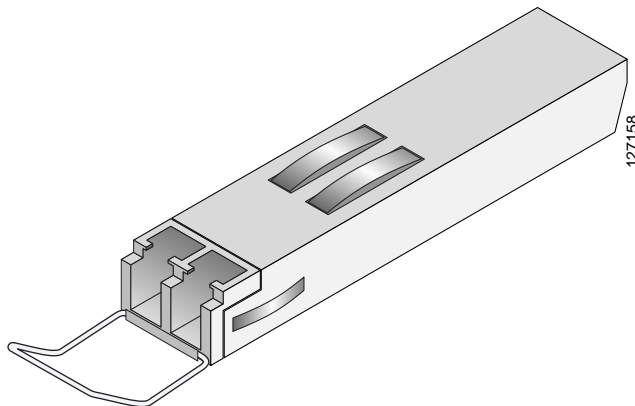- RFC 1213, *Management Information Base (MIB) for Network Management of TCP/IP-Based Internets:MIB II.*

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

The 2-Port and 4-Port OC-3c/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 3-9).

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 2-Port and 4-Port OC-3c/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

- LR SFP module (80 km)—SFP-OC3-LR2

Figure 3-9   SFP Optics Module

The SFP optical transceiver modules used with the 2-Port and 4-Port OC-3c/STM-1 POS SPA provide the following optical fiber options:
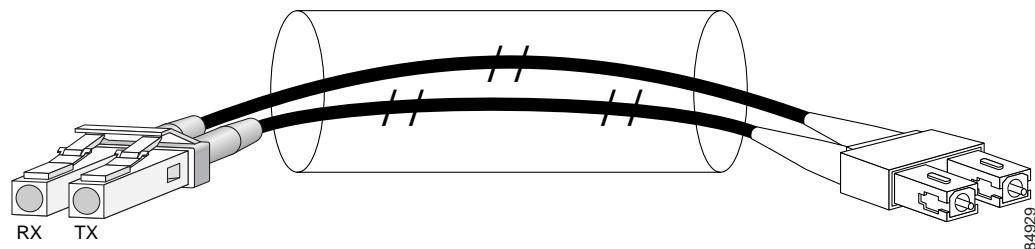
- Multimode—155-Mbps, OC-3c/STM-1 optical fiber (SONET STS-3c or SDH STM-1)

  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 3-10) 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 OC-3c/STM-1-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 3-10   LC-Type Cable

OC-12 POS SPA Overview

The 1-Port OC-12c/STM-4 POS SPA is single-height SPA that installs into one MSC subslot. The 1-Port OC-12c/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 MSCs and modular optics, see the "MSC and SPA Product Overview" chapter in this guide.
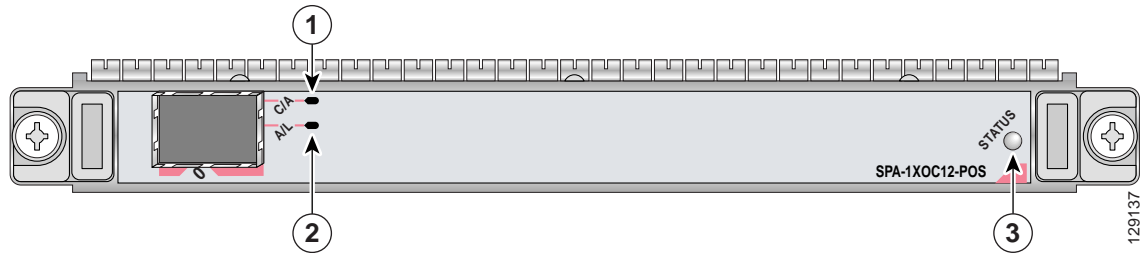
The following sections describe the 1-Port OC-12c/STM-4 POS SPA:

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

The 1-Port OC-12c/STM-4 POS SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 3-11 shows an example of these LEDs on a 1-Port OC-12c/STM-4 POS SPA.

Figure 3-11   1-Port OC-12c/STM-4 POS SPA Faceplate

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

The 1-Port OC-12c/STM-4 POS SPA LEDs are described in Table 3-12.

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

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-12c/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-12c/STM-4 frame.

The 1-Port OC-12c/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-12c/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)*
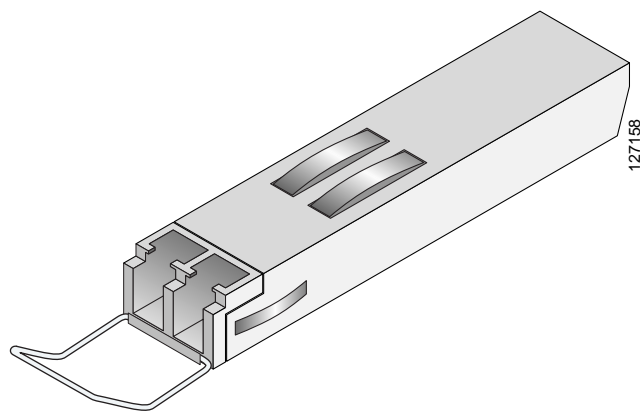- RFC 1213, *Management Information Base (MIB) for Network Management of TCP/IP-Based Internets:MIB II.*

1-Port OC-12c/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 3-12).

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 1-Port OC-12c/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 3-12 SFP Optics Module

The SFP optical transceiver modules used with the POS SPAs provide the following optical fiber options:
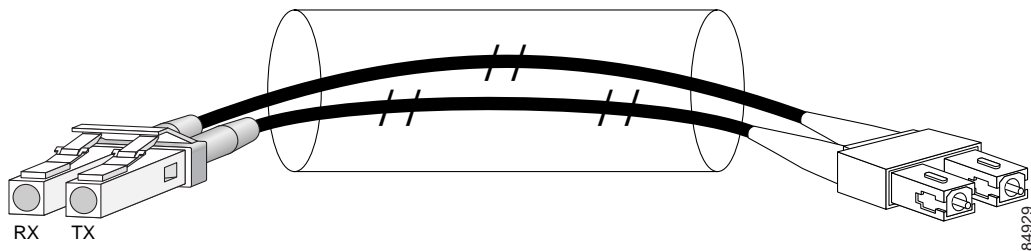
- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

  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 3-13) 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-12c/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.

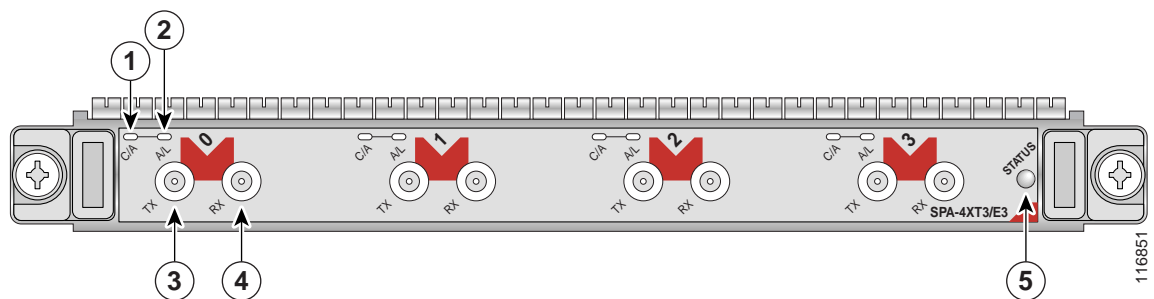*Figure 3-13   LC-Type Cable*

T3/E3 Serial SPA Overview

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

*   2-Port and 4-Port T3/E3 Serial SPA LEDs, page 3-16
*   2-Port and 4-Port T3/E3 Serial SPA Interface Specifications, page 3-17
*   2-Port and 4-Port T3/E3 Serial SPA Cables and Connectors, page 3-17

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

The 2-Port and 4-Port T3/E3 Serial SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 3-14 shows an example of these LEDs on a 4-Port T3/E3 Serial SPA.

Figure 3-14   4-Port T3/E3 Serial 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 T3/E3 Serial SPA LEDs are described in Table 3-13.

Table 3-13   2-Port and 4-Port T3/E3 Serial 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.
	Amber	On	SPA power is on and good, and the SPA is being configured.
	Green	On	SPA is ready and operational.

2-Port and 4-Port T3/E3 Serial 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 (44.2/34.0 Mbps) depending on which mode it is configured in.

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 T3/E3 Serial SPA Cables and Connectors

The interface connectors on the 2-Port and 4-Port T3/E3 Serial 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 T3/E3 Serial SPA. The cables have BNC 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 3-14 shows the connectors on the 4-Port T3/E3 Serial SPA, and Table 3-14 describes the signal descriptions for these connectors.

Table 3-14   2-Port and 4-Port T3/E3 Serial 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.