



## **Cisco ASR 9000 Series Aggregation Services Router SIP and SPA Hardware Installation Guide**

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## Preface

This preface describes the objectives and organization of this document and explains how to find additional information on related products and services. This preface contains the following sections:

- [Changes to This Document, on page ix](#)
- [Objectives, on page xi](#)
- [Organization, on page xii](#)
- [Related Documentation, on page xii](#)
- [Obtaining Documentation and Submitting a Service Request, on page xiii](#)

## Changes to This Document

This table lists the technical changes made to this document since it was first created.

**Table 1: Changes to This Document**

<b>Date</b>	<b>Summary</b>
March 2014	Adds support for the following SPA: <ul style="list-style-type: none"><li>• SPA-8XCHT1/E1-V2 8-Port Channelized T1/E1 SPA</li></ul>
May 2013	Adds description for the following SIP and SPAs: <ul style="list-style-type: none"><li>• A9K-SIP-700-8G Cisco ASR 9000 SIP-700</li><li>• SPA-2CHT3-CE-ATM 2-Port Channelized T3/E3 ATM CEoP SPA</li><li>• SPA-24CHT1-CE-ATM 24-Port Channelized T1/E1/J1 CEoP SPA</li></ul>

Date	Summary
December 2012	<p>Adds descriptions and installation instructions for the following SPAs:</p> <ul style="list-style-type: none"> <li>• SPA-2XSTM1/OC3/STM4/OC12 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA</li> <li>• SPA-4XSTM1/OC3/STM4/OC12 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA</li> <li>• SPA-4XOC-48/STM-16 POS/RPR 4-Port OC-48/STM-16 POS/RPR SPA</li> </ul>
December 2011	<p>Adds descriptions and installation instructions for the following SPAs:</p> <ul style="list-style-type: none"> <li>• SPA-1/3XOC3ATM 1-Port and 3-Port Clear Channel OC-3 ATM SPA</li> <li>• SPA-1XOC12ATM 1-Port Clear Channel OC-12 ATM SPA</li> <li>• SPA-1xOC3-CE-ATM 1-Port Channelized OC-3 ATM CEoP SPA</li> </ul>
April 2011	<p>Adds descriptions and installation instructions for the following SPAs:</p> <ul style="list-style-type: none"> <li>• SPA-4XCT3/DS0 4-Port Channelized T3 to DS0</li> <li>• SPA-8XCHT1/E1 8-Port Channelized T1/E1 SPA</li> </ul>

Date	Summary
December 2010	<p>Adds descriptions and installation instructions for the following SPAs:</p> <ul style="list-style-type: none"> <li>• SPA-2XT3E3 2-port and 4-Port Clear Channel T3/E3 SPA</li> <li>• SPA-1XCHSTM1/OC3 1-Port Channelized OC-3/STM-1 SPA</li> <li>• SPA-4XOC3 4-Port OC-3/STM-1 POS SPA</li> <li>• SPA-8XOC3 8-Port OC-3/STM-1 POS SPA</li> </ul>
September 2010	<p>Adds descriptions and installation instructions for the following SPAs:</p> <ul style="list-style-type: none"> <li>• SPA-1XCHOC48/DS3 1-Port Channelized OC48/STM16 DS3 SPA</li> <li>• SPA-2XOC48POS/RPR 2-Port OC-48/STM16 SPA</li> <li>• SPA-8XOC12-POS 8-Port OC12/STM4 SPA</li> <li>• SPA-OC192POS-XFP 1-Port OC-192/STM-64 POS/RPR SPA</li> </ul>
December 2009	<p>Initial release and first publication. Provides descriptions and installation instructions for the following SIPs and SPAs:</p> <ul style="list-style-type: none"> <li>• Cisco ASR 9000 SIP-700</li> <li>• 2-Port Channelized OC-12/DS0 SPA</li> </ul>

## Objectives

This document describes the shared port adapters (SPAs) and SPA Interface Processors (SIPs) that are supported on Cisco ASR 9000 Series Routers. This document also describes how to install the supported SIPs and SPAs and how to troubleshoot the installation.

# Organization

This document contains the following chapters:

Title	Description
<a href="#">Overview: Cisco ASR 9000 Series Router SPA Interface Processors, on page 1</a>	Provides a SIP/SPA compatibility summary. For each supported SIP, provides a summary of SIP characteristics and a SIP overview.
<a href="#">Overview: Cisco ASR 9000 Series Router Shared Port Adapters, on page 9</a>	For each supported SPA, provides a summary of SPA characteristics and a SPA overview.
<a href="#">Preparing to Install a Shared Port Adapter or a SPA Interface Processor, on page 65</a>	Describes the required tools, equipment, and safety guidelines for installing SIPs and SPAs.
<a href="#">Installing and Removing a SPA Interface Processor, on page 69</a>	Describes the procedures for installing and removing a SIP on a Cisco ASR 9000 Series Router.
<a href="#">Installing and Removing a Shared Port Adapter, on page 75</a>	Describes the procedures for installing and removing a SPA on a Cisco ASR 9000 Series Router. It also describes how to verify the SIP and SPA installation.
<a href="#">Troubleshooting the Installation, on page 83</a>	Provides information for troubleshooting the installation of SIPs and SPAs.

## Related Documentation

This section refers you to other documentation that also might be useful as you configure your Cisco ASR 9000 Series Router.

The documentation listed below is available online.

- *Cisco IOS XR Getting Started Guide for the Cisco ASR 9000 Series Router*
- *Cisco configuration guides and command references for the Cisco ASR 9000 Series Router*
- *Cisco IOS XR Diagnostics for the Cisco ASR 9000 Series Router*
- *Cisco IOS XR ROM Monitor Guide for the Cisco ASR 9000 Series Router*
- *Cisco IOS XR Security Guide for the Cisco ASR 9000 Series Router*
- *Cisco IOS XR System Error Message Reference Guide for the Cisco ASR 9000 Series Router*
- *Cisco ASR 9000 Series Router Chassis Installation Guide*
- *Release Notes for Cisco IOS XR Software for the Cisco ASR 9000 Series Router*
- *Regulatory Compliance and Safety Information for Cisco ASR 9000 Series Routers*

# Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see *What's New in Cisco Product Documentation*, at: <http://www.cisco.com/c/en/us/td/docs/general/whatsnew/whatsnew.html>.

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# CHAPTER 1

## Overview: Cisco ASR 9000 Series Router SPA Interface Processors

This chapter describes the SPA interface processors (SIPs) that are supported on the Cisco ASR 9000 Series Aggregation Services Routers and contains the following sections:

- [SIP and SPA Compatibility, on page 1](#)
- [Router Hardware Installation, on page 2](#)
- [SIP Summary, on page 2](#)
- [Cisco ASR 9000 SIP-700 Overview, on page 4](#)

### SIP and SPA Compatibility

The following table shows the SPAs that are supported on the Cisco ASR 9000 Series Aggregation Services Routers and the SIPs that support them:

**Table 2: SIP and SPA Compatibility on the Cisco ASR 9000 Series Router**

SPA	SIP-700
2-Port Channelized OC-12/DS0 SPA	X
1-Port Channelized OC48/STM16 DS3 SPA	X
2-Port OC-48/STM16 SPA	X
8-Port OC12/STM4 SPA	X
1-Port OC-192/STM-64 POS/RPR SPA	X
4-Port OC-3/STM-1 POS SPA	X
8-Port OC-3/STM-1 POS SPA	X
2-Port and 4-Port Clear Channel T3/E3 SPA	X
4-Port Channelized T3 to DS0	X
8-Port Channelized T1/E1 SPA	X

SPA	SIP-700
1-Port Channelized OC-3/STM-1 SPA	X
1-Port Channelized OC-3 ATM CEoP SPA	X
1-Port and 3-Port Clear Channel OC-3 ATM SPA	X
1-Port Clear Channel OC-12 ATM SPA	X
2-Port OC-3 STM-1/OC-12 STM-4 POS SPA	X
4-Port OC-3 STM-1/OC-12 STM-4 POS SPA	X
4-Port OC-48/STM-16 POS-RPR SPA	X
2-Port Channelized T3/E3 ATM CEoP SPA <sup>1</sup>	X
24-Port Channelized T1/E1/J1 ATM CEoP SPA	X

<sup>1</sup> The 2-Port Channelized T3/E3 ATM CEoP SPA (SPA-2CHT3-CE-ATM) does not support ATM on the SIP-700.

## Router Hardware Installation

For Cisco ASR 9000 Series Router hardware installation and configuration information, refer to the installation and configuration guide for your router. The guide includes information on the router switch fabric and how it affects the operation of SIPs, as well as SIP slot locations, slot width, and other requirements.



**Note** References to line cards in the router hardware installation and configuration guides apply equally to SIPs.

## Supported Platforms

Cisco ASR 9000 SIP-700 SIPs are supported on all Cisco ASR 9000 Series Routers.

## SIP Summary

Summary descriptions of all SIPs supported on the Cisco ASR 9000 Series Router are shown in the following table.



Table 3: SIP Summary

SIP	Product Number	Description	Maximum Number of Each Type of SPA Supported per SIP
Cisco ASR 9000 SIP-700	A9K-SIP-700	20G SPA Interface Processor, 4GB memory	2 single-width, double-height
	A9K-SIP-700-8G	20G SPA Interface Processor, 8GB memory	4 single-width, single-height <b>Note</b> The OC192 POS SPA is single-width, single-height, however it is “logically” double-width in that it cannot run with another SPA in the adjacent bay, unless the other SPA is shut down.  1 double-width, double-height 2 double-width, single-height

## SIP Software and Hardware Compatibility



**Note** The ASR 9000 SIP-700 is not supported on Cisco IOS XR 64-bit images.

For software configuration information, refer to the Cisco IOS XR software configuration and command reference publications for the installed Cisco IOS XR release. Also refer to the Cisco IOS XR software release notes for additional information. The following table lists the Cisco IOS XR releases that are compatible with supported SIPs.

To ensure compatibility with the software, your SIPs should have a specific hardware revision number. The number is printed on a label affixed to the component side of the card. The hardware revision number can be displayed by using the `show diag rack/slot/CPU0` command. This table lists the hardware revision number for all supported SIPs.

Table 4: SIP Hardware and Software Compatibility

SIP	Part Number	Minimum Cisco IOS XR Software Release	Minimum Hardware Revision
Cisco ASR 9000 SIP-700	A9K-SIP-700	3.9	1.0
Cisco ASR 9000 SIP-700	A9K-SIP-700-8G	4.3.1	1.0

The **show version** command shows the system software version that is currently loaded and running. The **show platform** or `show diag` commands display the current hardware configuration of the router, including the ROMMON system software version that is currently loaded and running. For complete descriptions of **show** commands, refer to the *Cisco IOS XR Configuration Fundamentals Configuration Guide* and the *Cisco IOS XR Configuration Fundamentals Command Reference* for the installed Cisco IOS XR release.

# Cisco ASR 9000 SIP-700 Overview

There are two types of Cisco ASR 9000 SIP-700 available; A9K-SIP-700 and A9K-SIP-700-8G.

- A9K-SIP-700 supports 4 GB of memory.
- A9K-SIP-700-8G supports 8 GB of memory.

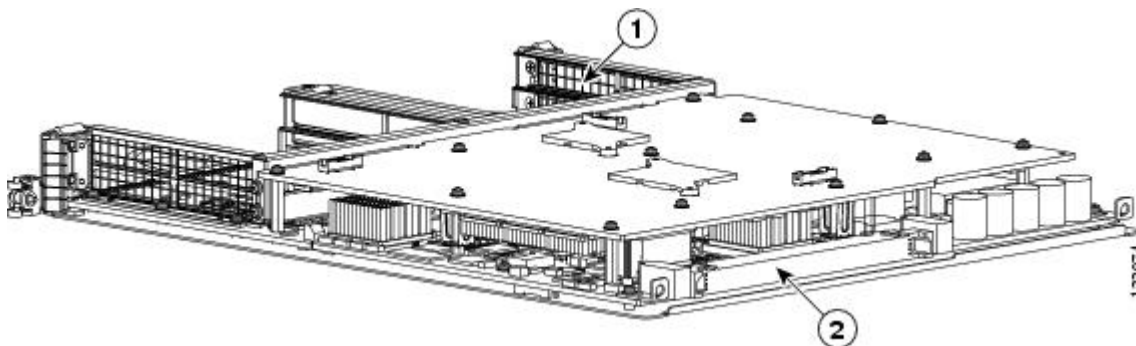
Both types of Cisco ASR 9000 SIP-700 are identical in appearance and can be identified by the PID located on the faceplate of the SIP

The following sections describe the Cisco ASR 9000 SIP-700:

## Cisco ASR 9000 SIP-700 Board Components

The main Cisco ASR 9000 SIP-700 board components are shown in the figure below.

Figure 1: Cisco ASR 9000 SIP-700 Board—Rear View

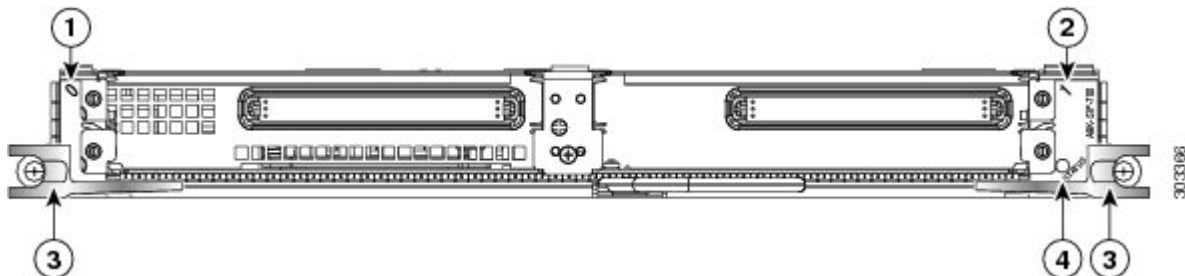


1	SPA enclosure	2	Backplane connector
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## Cisco ASR 9000 SIP-700 LED

The Cisco ASR 9000 SIP-700 supports a maximum of 2 single-width, double-height SPAs, 4 single-width, single-height SPAs, 2 double-width, single-height SPAs, or 1 double-width, double-height SPA. Combinations are also supported, for example 2 single-width, single-height SPAs and 1 double-width, single-height SPA. The Cisco ASR 9000 SIP-700 faceplate has one Status LED. The following figure shows the Cisco ASR 9000 SIP-700 faceplate with 2 double-width, single-height SPAs.

Figure 2: Cisco ASR 9000 SIP-700 Faceplate



1	SPA subslot 0	3	Ejector Levers
2	SPA subslot 1	4	Status LED for SPA in subslot 1

The Cisco ASR 9000 SIP-700 LED is described in the following table.

**Table 5: Cisco ASR 9000 SIP-700 LED**

LED Label	Color	State	Meaning
Status	Amber	On	SIP is powered and IOS-XR is loading.
	Green	On	SIP is active.
	N/A	Off	SIP is not installed correctly or is not powered.

## Cisco ASR 9000 SIP-700 Physical Specifications

The Cisco ASR 9000 SIP-700 physical specifications are shown in the following table.

**Table 6: Cisco ASR 9000 SIP-700 Physical Specifications**

Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco ASR 9000 Series Aggregation Services Router
Shipping weight	10kg (22 lbs)
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	-4 to 149°F (-20 to 65°C)

## SPA Subslot Numbering on the Cisco ASR 9000 SIP-700

The Cisco ASR 9000 SIP-700 supports up to 2 single-width, double-height SPAs, up to 4 single-width, single-height SPAs, or up to 2 double-width, single-height SPAs. The Cisco ASR 9000 SIP-700 does not support double-width, double-height SPAs. Note that while the OC192 POS SPA is single-width, single-height, it is “logically” double-width in that it cannot run with another SPA in the adjacent bay, unless the other SPA is shut down.

Bay 2 (Top Left)

Bay 0 (Top Right)

Bay 3 (Bottom Left)

Bay 1 (Bottom Right)

The following figure shows a Cisco ASR 9000 SIP-700 with 2 SPAs installed. The left SPA slot is subslot 0 and the right SPA slot is subslot 1.

Figure 3: Subslot Locations for the 2-Port Channelized OC-12/DS0 SPA

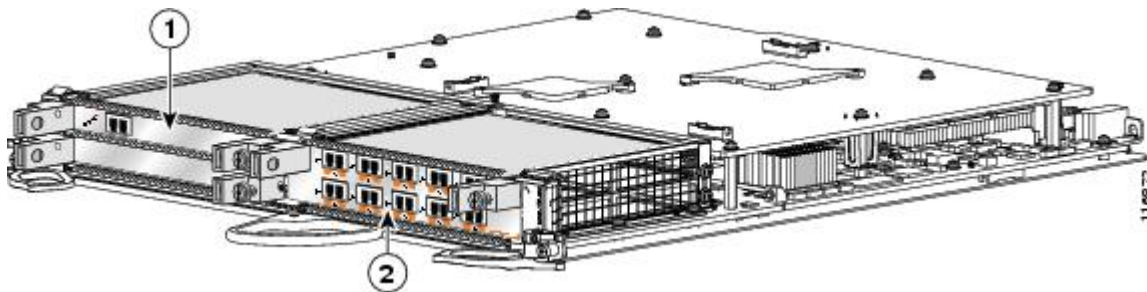


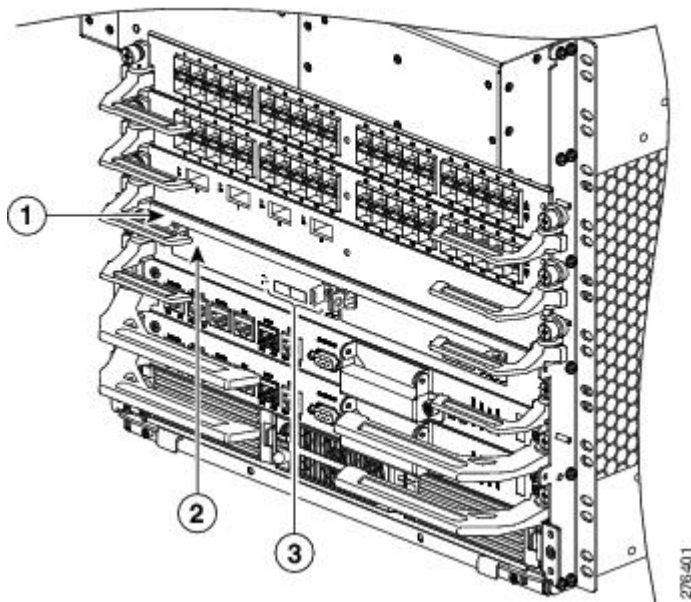
Table 7: Subslot Locations for the 2-Port Channelized OC-12/DS0 SPA

Call Out Number	Description
1	Single height single width SPA in Subslot 1, Bay 0
2	Double height single width SPA in Subslot 0, Bay 3

## SPA Interface Addresses on the Cisco ASR 9000 SIP-700

A Cisco ASR 9000 Series Aggregation Services Router identifies a SPA interface address by its rack number, SIP slot number, SPA subslot, and port number on the SPA, in the format *rack/slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco ASR 9000 SIP-700 has two subslots 0 (left) and 1 (right). For example, the interface addresses of a 2-port SPA located in the second SIP subslot, where the SIP is inserted into router line card slot 3 in rack 0 are 0/3/1/0 and 0/3/1/1. The following figure shows the slot, subslot, and port locations for the 2-Port Channelized OC-12/DS0 SPA on a Cisco ASR 9006 6-slot chassis.

Figure 4: Slot, Subslot, and Port Locations for the 2-Port Channelized OC-12/DS0 SPA on a Cisco ASR 9006 Chassis

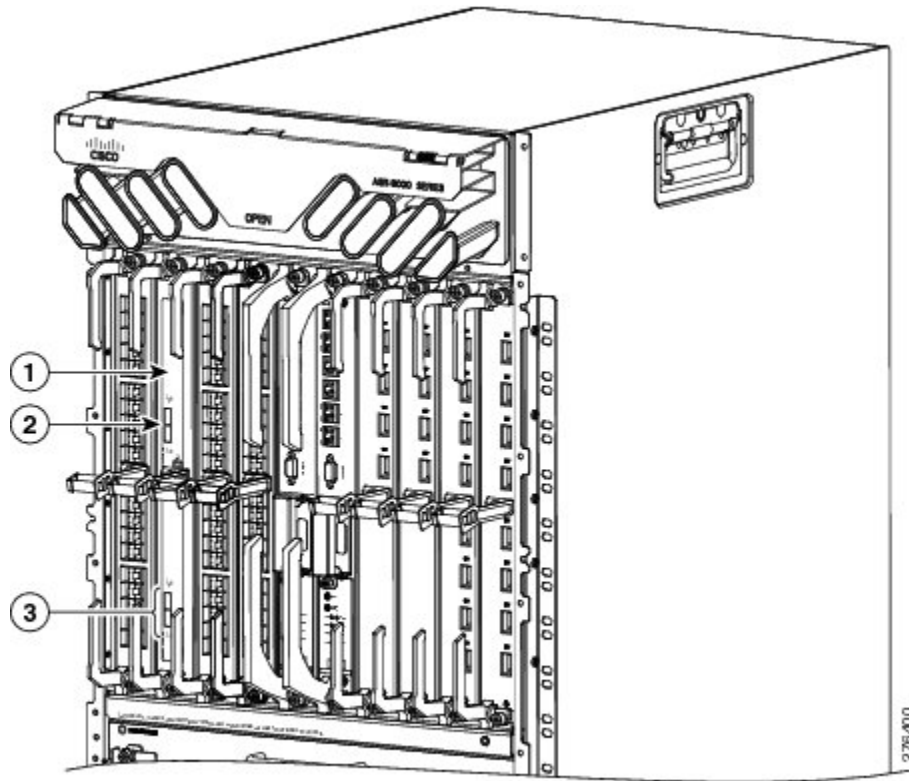


**Table 8: Slot and Port Locations for the 2-Port Channelized OC-12/DS0 SPA**

Call Out Number	Description
1	Slot 0
2	SPA in Subslot 0
3	Ports 0/0/0/0 and 0/0/0/1

The following figure shows the slot, subslot, and port locations for the 2-Port Channelized OC-12/DS0 SPA on a Cisco ASR 9010 10-slot chassis.

**Figure 5: Slot, Subslot, and Port Locations for the 2-Port Channelized OC-12/DS0 SPA on a Cisco ASR 9010 Chassis**



**Table 9: Slot and Port Locations for the 2-Port Channelized OC-12/DS0 SPA in Slot 3**

Call Out Number	Description
1	Slot 3
2	Subslot 0, Port 3/1/0/0 to 3/1/0/1
3	Ports of RSP1 in Slot 5





## CHAPTER 2

# Overview: Cisco ASR 9000 Series Router Shared Port Adapters

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This chapter describes the shared port adapters (SPAs) that are supported on the Cisco ASR 9000 Series Aggregation Services Router and contains the following sections:

- [SPA Summary, on page 9](#)
- [2-Port Channelized OC-12/DS0 SPA Overview, on page 12](#)
- [1-Port Channelized STM-16/OC-48 SPA Overview, on page 14](#)
- [1-Port OC-48 POS RPR SPA Overview, on page 16](#)
- [2-Port OC-48 POS RPR SPA Overview, on page 18](#)
- [8-Port OC-12 STM-4 POS SPA Overview, on page 21](#)
- [1-Port OC-192 STM-64 POS RPR XFP SPA Overview, on page 24](#)
- [2-Port and 4-Port Clear Channel T3/E3 SPA Overview, on page 28](#)
- [4-Port Channelized T3 to DS0 Overview, on page 30](#)
- [8-Port Channelized T1/E1 SPA Overview, on page 32](#)
- [1-Port Channelized STM-1/OC-3 SPA Overview, on page 34](#)
- [4-Port OC-3/STM-1 POS SPA Overview, on page 37](#)
- [8-Port OC-3/STM-1 POS SPA Overview, on page 40](#)
- [1-Port Channelized OC-3 ATM CEoP SPA Overview, on page 43](#)
- [1-Port and 3-Port Clear Channel OC-3 ATM SPA Overview, on page 45](#)
- [1-Port Clear Channel OC-12 ATM SPA Overview, on page 47](#)
- [2-Port OC-3 STM-1/OC-12 STM-4 POS SPA Overview, on page 49](#)
- [4-Port OC-3 STM-1/OC-12 STM-4 POS SPA Overview, on page 52](#)
- [4-Port OC-48/STM-16 POS/RPR SPA Overview, on page 55](#)
- [2-Port Channelized T3/E3 ATM CEoP SPA Overview, on page 58](#)
- [24-Port Channelized T1/E1/J1 CEoP SPA Overview, on page 60](#)

## SPA Summary

The following table shows the summary descriptions of the SPAs that are supported on the Cisco ASR 9000 Series Aggregation Services Router.

Table 10: Supported SPAs on Cisco ASR 9000 Series Aggregation Services Routers

Product Number	Description	Number and Type of Ports	Minimum Cisco IOS XR Release	Minimum Hardware Revision
SPA-2XCHOC12/DS0	2-Port Channelized OC-12/DS0 SPA double-height	2 OC12	3.9.0	1.0
SPA-1XCHOC48/DS3	1-Port Channelized OC48/STM16 DS3 SPA double-height	1 OC48	4.0.0	1.0
SPA-2XOC48POS/RPR	2-Port OC-48/STM16 SPA double-height	2 OC48	4.0.0	1.0
SPA-8XOC12-POS	8-Port OC12/STM4 SPA single-height	8 OC12	4.0.0	1.0
SPA-OC192POS-XFP	1-Port OC-192/STM-64 POS/RPR SPA single-height	1 OC192	4.0.0	1.0
SPA-2XT3E3 SPA-4XT3E3	2-Port and 4-Port Clear Channel T3/E3 SPA single-height	2 or 4 T3/E3	4.0.1	1.0
SPA-4XCT3/DS0	4-Port Channelized T3 to DS0 single-height	4 T3	4.1.0	1.0
SPA-8XCHT1/E1	8-Port Channelized T1/E1 SPA single-height	8 T1/E1	4.1.0	1.0
SPA-1XCHSTM1/OC3	1-Port Channelized OC-3/STM-1 SPA single-height	1 OC3	4.0.1	1.0
SPA-4XOC3-POS-V2	4-Port OC-3/STM-1 POS SPA single-height	4 OC3	4.0.1	1.0
SPA-8XOC3-POS	8-Port OC-3/STM-1 POS SPA single-height	8 OC3	4.0.1	1.0
SPA-1CHOC3-CE-ATM	1-Port Channelized OC-3 ATM CEoP SPA single-height	1 OC3	4.2.0	1.0
SPA-1XOC3-ATM-V2 SPA-3XOC3-ATM-V2	1-Port and 3-Port Clear Channel OC-3 ATM SPA single-height	1 or 3 OC3	4.2.0	1.0



Product Number	Description	Number and Type of Ports	Minimum Cisco IOS XR Release	Minimum Hardware Revision
SPA-1XOC12-ATM-V2	1-Port Clear Channel OC-12 ATM SPA single-height	1 OC12	4.2.0	1.0
SPA-2XOC12-POS	2-Port OC-3 STM-1/OC-12 STM-4 POS SPA single-height	2 OC12	4.3.0	1.0
SPA-4XOC12-POS	4-Port OC-3 STM-1/OC-12 STM-4 POS SPA single-height	4 OC12	4.3.0	1.0
SPA-4XOC48POS/RPR	4-Port OC-48/STM-16 POS/RPR SPA double-height	4 OC48	4.3.0	1.0
SPA-2CHT3-CE-ATM	2-Port Channelized T3/E3 ATM CEoP SPA single-height	2 T3/E3	4.3.0	1.0
SPA-24CHT1-CE-ATM	24-Port Channelized T1/E1/J1 CEoP SPA single-height	24 T1/E1	4.3.0	1.0
SPA-8XCHT1/E1-V2	8-Port Channelized T1/E1 SPA single-height	8 T1/E1	5.1.1	1.0
SPA-1XOC48POS/RPR	1-Port OC-48/STM16 SPA single-height	1 OC48	5.1.1	1.0
			6.3.1	2.0

## 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.

## 2-Port Channelized OC-12/DS0 SPA Overview

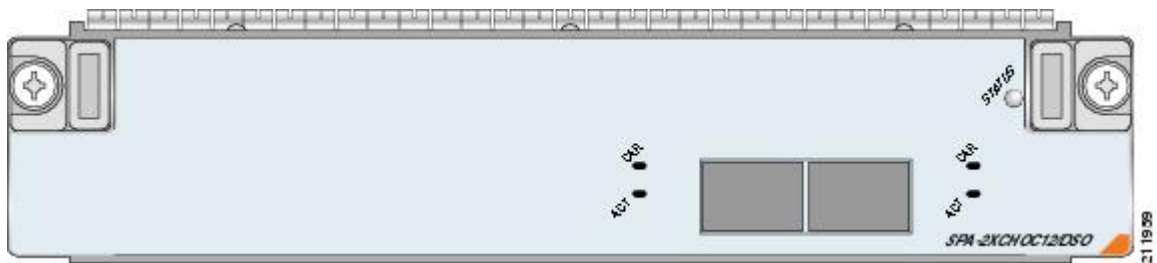
The 2-Port Channelized OC-12/DS0 SPA is a double-height SPA that provides Synchronous Optical Network (SONET) network connectivity with a bandwidth of 622.08 Mbps.

The following sections describe the 2-Port Channelized OC-12/DS0 SPA:

### 2-Port Channelized OC-12/DS0 SPA LEDs

The 2-Port Channelized OC-12/DS0 SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. The following figure shows an example of these LEDs on a SPA.

**Figure 6: 2-Port Channelized OC-12/DS0 SPA Faceplate**



1	CAR (Carrier/Alarm) LED	3	STATUS LED
2	ACT (Active Loopback) LED		

The following table describes the 2-Port Channelized OC-12/DS0 SPA LEDs.

**Table 11: 2-Port Channelized OC-12/DS0 SPA LEDs**

LED Label	Color	State	Meaning
CAR	Off	Off	Port is not enabled by software.
CAR and ACT LEDs are per port.	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.
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 STATUS LED is per SPA.	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and SPA is being configured.

## 2-Port Channelized OC-12/DS0 SPA Interface Specifications

The framer processes incoming and outgoing SONET 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 mapped into the STS-12c/STM-4 frame. The main operational mode of the framer is OC-12, where each one of the 12 Paths can carry a DS3 and each DS3 can carry 28 DS1s.

The 2-Port Channelized OC-12/DS0 SPA interface is compliant with ANSI and Telco standards.

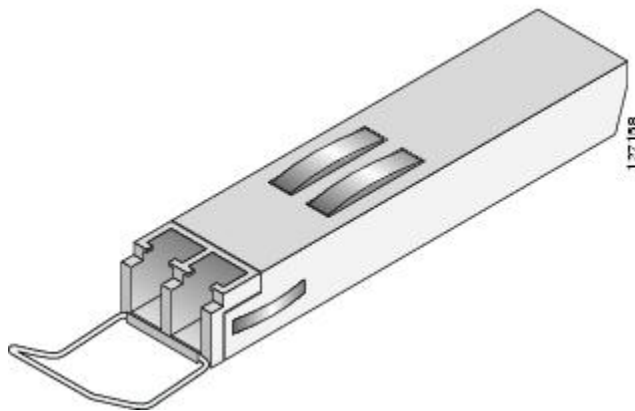
## 2-Port Channelized OC-12/DS0 SPA SFP Optical Transceiver Modules and Cables

The 2-Port Channelized OC-12/DS0 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET single-mode and multimode optical fiber connection. (See the following figure.)

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 2-Port Channelized OC-12/DS0 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 7: SFP Optics Module*



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

- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c)

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)

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

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 2-Port Channelized OC-12/DS0 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.

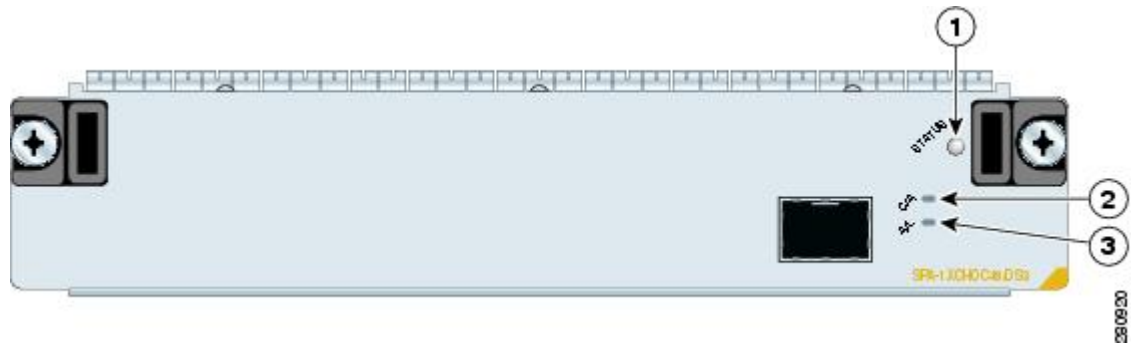
## 1-Port Channelized STM-16/OC-48 SPA Overview

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

### 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 the port and a STATUS LED, as shown in the following figure.

**Figure 8: 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 the following table.

**Table 12: 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.

LED Label	Color	State	Meaning
	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).

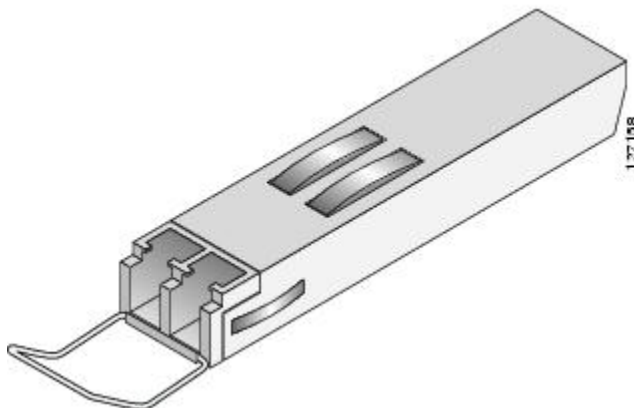
Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-48/STM-16 frame. HDLC and Frame-Relay are also supported. The main operational mode of the framer is OC-48, where each one of the 48 Paths can carry a DS3 and each DS3 can carry 28 DS1s.

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 the port for SONET and SDH single-mode and multimode optical fiber connection (see the following figure).

**Figure 9: 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)

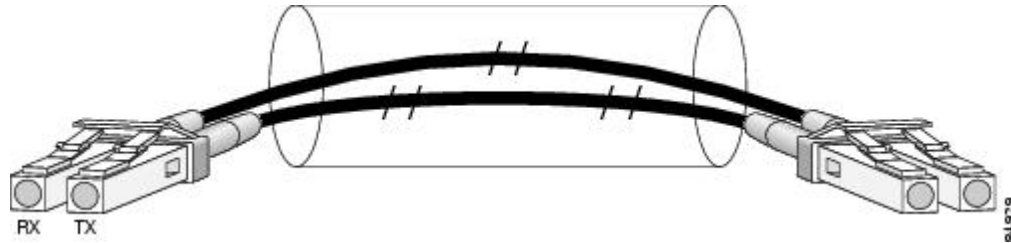
Use a single-mode optical fiber that has a modal-field diameter of  $8.7 \pm 0.5$  microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see the figure below) 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 10: LC Type Cable



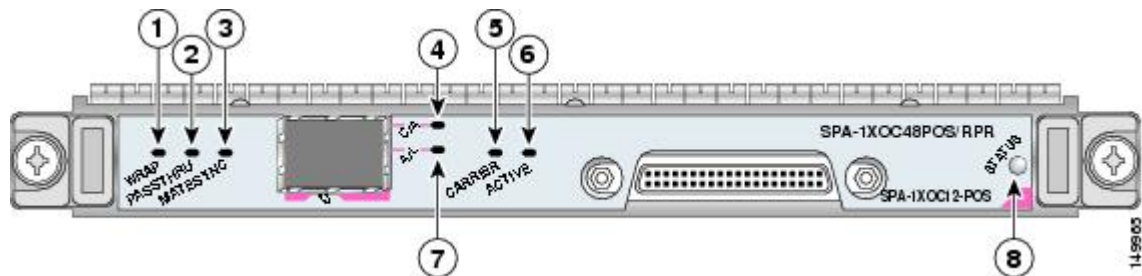
## 1-Port OC-48 POS RPR SPA Overview

The following sections describe the 1-Port OC48-POS/RPR SPA:

### 1-Port OC48-POS/RPR SPA LEDs

The 1-Port OC48-POS/RPR SPA has eight LEDs, as shown in the following figure.

Figure 11: 1-Port OC48-POS/RPR SPA Faceplate



1	WRAP	5	CARRIER LED
2	PASSTHROUGH LED	6	ACTIVE LED
3	MATESYNC LED	7	A/L (Active/Loopback) LED
4	CAR (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 OC48-POS/RPR SPA LEDs are described in the following table.

**Table 13: 1-Port OC48-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-through mode.
	Amber	On	Port is in pass-through 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, 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.
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 OC48-POS/RPR SPA Interface Specifications

The physical layer interface for the 1-Port OC48-POS/RPR SPA is Optical Carrier-48 (OC-48), and the 1-Port OC48-POS/RPR SPA is designed to comply with POS specifications. The 1-Port OC48-POS/RPR SPA provides one 2.488-Gbps network interface for all supported platforms.

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

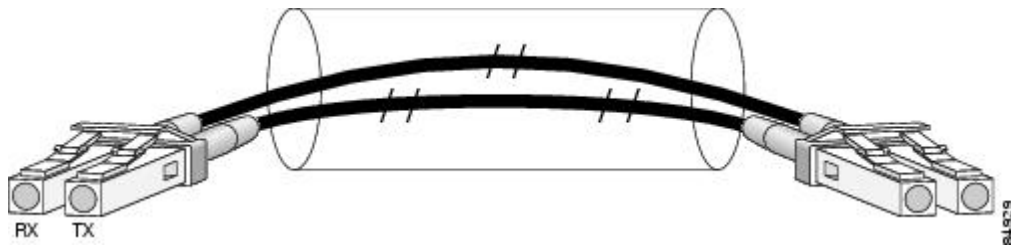
Use single-mode (for intermediate-configurations) optical fiber cable to connect your router to a network or to connect two OC-48-equipped routers back-to-back.

The 1-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

The 1-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 the below figure) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

**Figure 12: Duplex Patch Cable with LC-Type Connectors**



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

## 2-Port OC-48 POS RPR SPA Overview

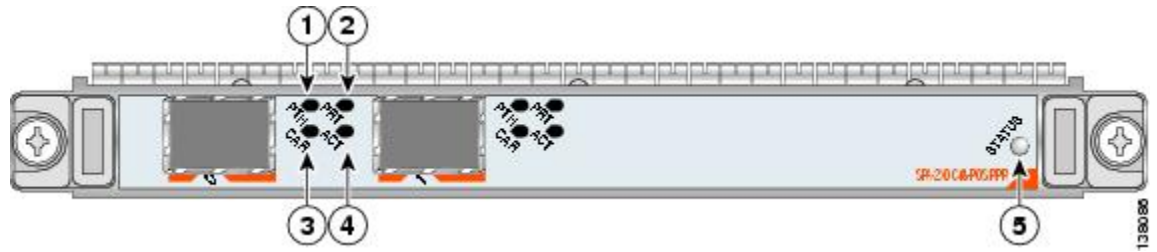
The following sections describe the 2-Port OC48-POS/RPR SPA:

### 2-Port OC48-POS/RPR SPA LEDs

The 2-Port OC48-POS/RPR SPA has five LEDs, as shown in the following figure.



Figure 13: 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 the following table.

Table 14: 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

LED Label	Color	State	Meaning
	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

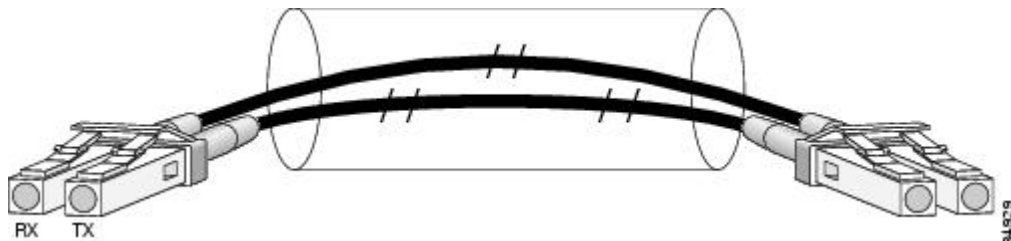
Use single-mode (for intermediate-configurations) optical fiber cable to connect your router to a network or to connect two OC-48-equipped routers back-to-back.

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 the below figure) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

**Figure 14: Duplex Patch Cable with LC-Type Connectors**



## 8-Port OC-12 STM-4 POS SPA Overview

The 8-Port OC12/STM4 SPA is a single-height SPA that installs into one SIP subslot. 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 an OC-12 SFP module, so the per-port bandwidth can be 622.08 Mbps.



**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.

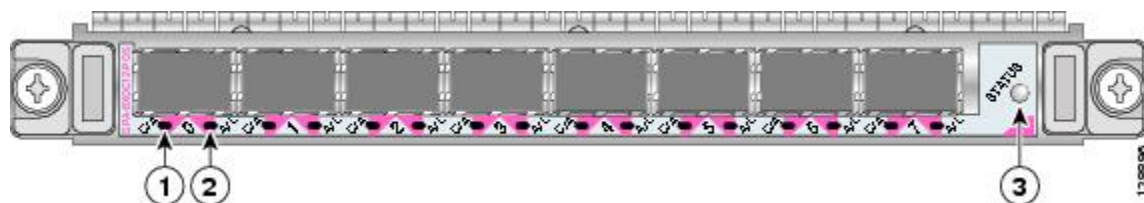
For more information about SPA bandwidth, see the “Bandwidth Oversubscription” topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

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

### 8-Port OC12/STM4 SPA LEDs

The 8-Port OC12/STM4 SPA has three types of LEDs: two LEDs for each port on the SPA and one STATUS LED. The following figure shows the 8-Port OC12/STM4 SPA faceplate.

Figure 15: 8-Port OC12/STM4 SPA Faceplate



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

The following table describes the 8-Port OC12/STM4 SPA LEDs.

Table 15: 8-Port OC12/STM4 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.

LED Label	Color	State	Meaning
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 OC12/STM4 SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at 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 OC12/STM4 SPA interface complies with the following RFCs:

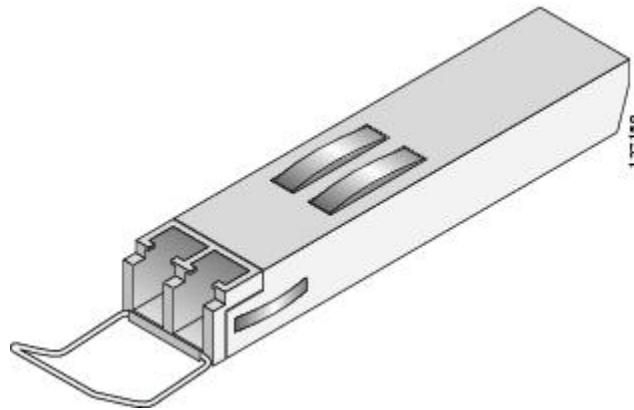
- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2427, *Multiprotocol Interconnect over Frame Relay*
- RFC 2615, *PPP over SONET/SDH*

## 8-Port OC12/STM4 SPA Optical Transceiver Modules and Cables

The 8-Port OC12/STM4 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 the below figure).

Cisco Systems qualifies the optics that are approved for use with its SPAs. The following OC-12 optical transceiver modules are supported on the 8-Port OC12/STM4 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 16: SFP Optics Module**

The following OC-12 optical fiber options are available for the 8-Port OC-12c/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.

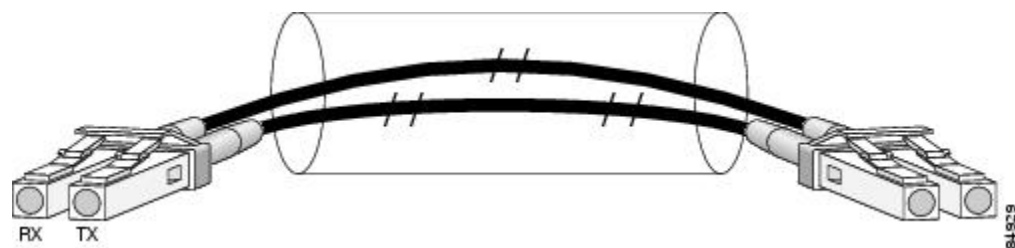
- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

Use a single-mode optical fiber that has a modal-field diameter of  $8.7 \pm 0.5$  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 the following figure) 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-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 17: LC-Type Cable**

## OC-12 Module Connections

The following table shows the OC-12 specifications of the optics on the 8-Port OC-12c/STM-4 POS SPA.

Table 16: 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 dBm OC-12 SR: –23 dBm OC-12 IR-1: –28 dBm OC-12 LR-1: –28 dBm OC-12 LR-2: –28 dBm
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-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 SIP overview chapter in this guide.

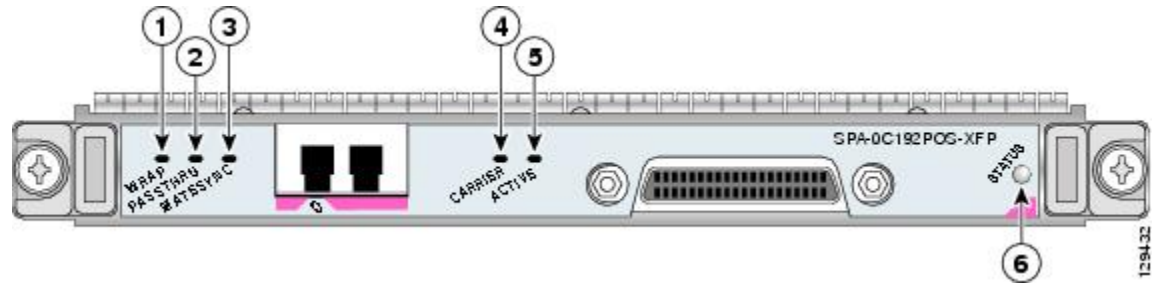
The 1-Port OC-192/STM-64 POS/RPR XFP SPA uses a 10-Gbps small form-factor pluggable optical receptacle for the port allowing connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the [1-Port OC-192/STM-64 POS/RPR XFP SPA Optical Transceiver Modules, Connectors, and Cables, on page 26](#).

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

The 1-Port OC-192/STM-64 POS/RPR XFP SPA has six LEDs, as shown in the following figure.

Figure 18: 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

The following table describes the 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs.

Table 17: 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-through mode.
	Amber	On	Port is in pass-through 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.
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.

LED Label	Color	State	Meaning
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-192c/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-192c/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*



**Note** For Cisco IOS XR Software Release 3.8.0, the 1-Port OC-192c/STM-64 POS/RPR XFP SPA supports the Dynamic Packet Transport (DPT) feature. The Cisco DPT family of products delivers scalable Internet service, reliable IP-aware optical transport, and simplified network operations. The Spatial Reuse Protocol (SRP) is a MAC-layer protocol developed by Cisco and is used in conjunction with Cisco DPT products, which use a pair of counter-rotating rings in an optimum fashion to provide improved bandwidth utilization over an equivalent SONET network.

## 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-192c optical fiber (SONET STS-192c 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

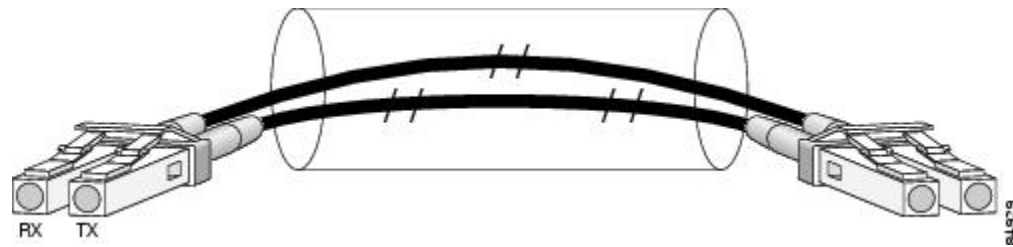
Cisco Systems qualifies the optics that are approved for use with its SPAs. The above-listed XFPs are the only optical transceiver modules qualified for use.

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

The following figure 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 19: LC-Type Cable for the XFP Optical Transceiver Modules



## OC-192 Module Connections

The following table shows the OC-192 specifications for use with the 1-Port OC-192/STM-64 POS/RPR XFP SPA.

Table 18: 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

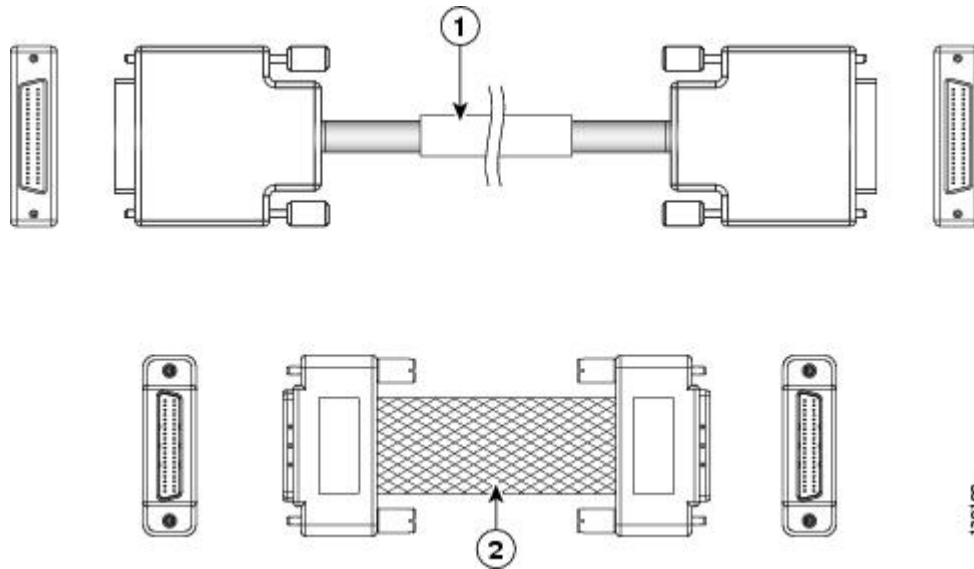
## Mate Interface Cables

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

- Mate between two OC-192c SPAs in the same SIP
- Mate between two OC-192c 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. The following figure shows the mate cables used to connect the SPAs.

Figure 20: 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 using SPA datasheets or by contacting your Cisco representative.

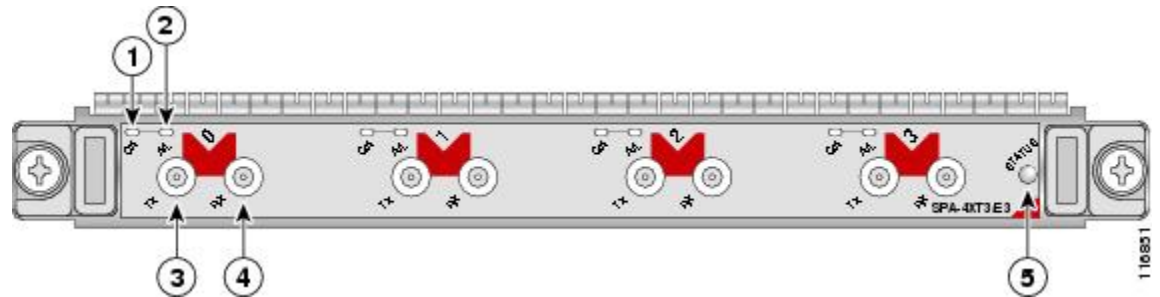
## 2-Port and 4-Port Clear Channel T3/E3 SPA Overview

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

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 the following figure.

Figure 21: 2-Port and 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		

The following table describes the 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs.

Table 19: 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).

The *2-Port and 4-Port Clear Channel T3/E3 SPA Faceplate* figure shows the connectors on the 2-Port and 4-Port Clear Channel T3/E3 SPA, and the following table describes the signal descriptions for these connectors.

**Table 20: 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.

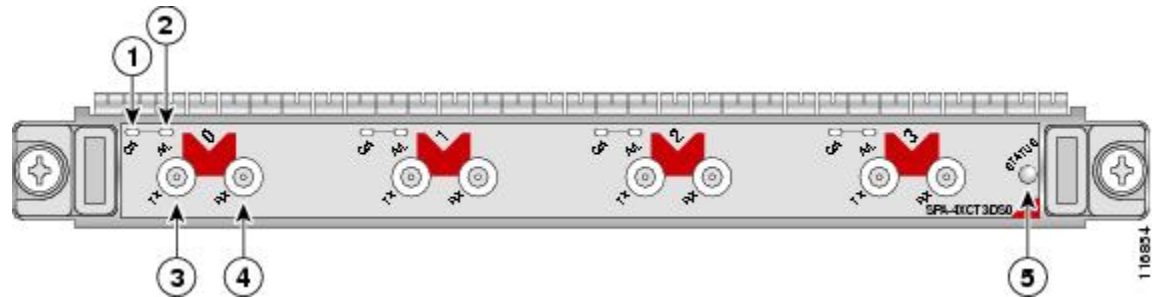
## 4-Port Channelized T3 to DS0 Overview

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

### 4-Port Channelized T3 to DS0 LEDs

The 4-Port Channelized T3 to DS0 has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. The following figure shows an example of these LEDs on a 4-Port Channelized T3 to DS0.

Figure 22: 4-Port Channelized T3 to DS0 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 4-Port Channelized T3 to DS0 LEDs are described in the following table.

Table 21: 4-Port Channelized T3 to DS0 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.

## 4-Port Channelized T3 to DS0 Interface Specifications

The framer processes incoming and outgoing T3 frames (cbit, m13/m23, and unframe). The framer operates at T3 line rates (44.2 Mbps).

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 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 4-Port Channelized T3 to DS0 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 4-Port Channelized T3 to DS0 supports Frame Relay Fragmentation (FRF.12) and Multilink Frame Relay (MFR) features for Cisco IOS XR Software Release 3.6.0 and later releases.

## 4-Port Channelized T3 to DS0 Cables and Connectors

The interface connectors on the 4-Port Channelized T3 to DS0 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 4-Port Channelized T3 to DS0. 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 should have Siemax connectors.

- 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 previous figure shows the Siemax connectors on the 4-Port Channelized T3 to DS0, and the following table provides the signal descriptions for these connectors.

*Table 22: 4-Port Channelized T3 to DS0 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.

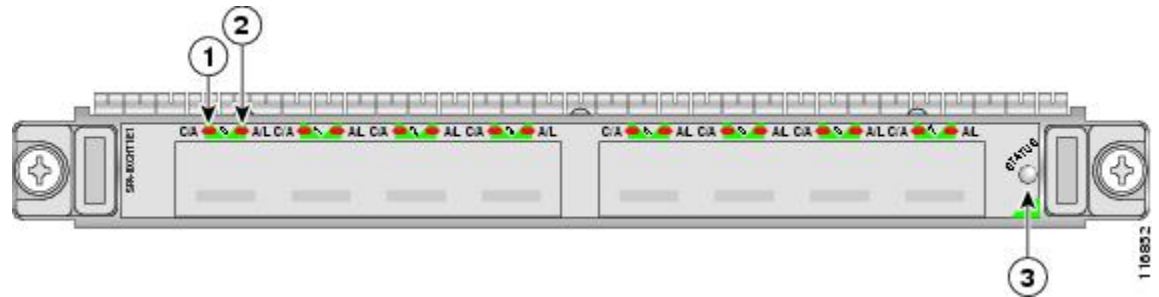
## 8-Port Channelized T1/E1 SPA Overview

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

### 8-Port Channelized T1/E1 SPA LEDs

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 the following figure.

Figure 23: 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 the following table.

Table 23: 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.



**Caution** 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.

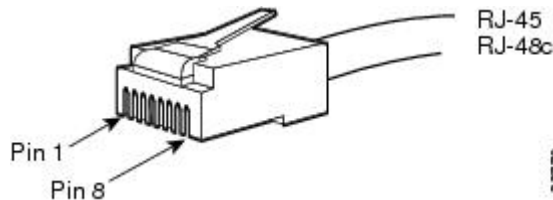
## 8-Port Channelized T1/E1 SPA Cables, Connectors, and Pinouts

The following figure 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 24: RJ-45 Connector*



The following table describes the signals and connector pinouts for RJ-45 cable connectors.

*Table 24: 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

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

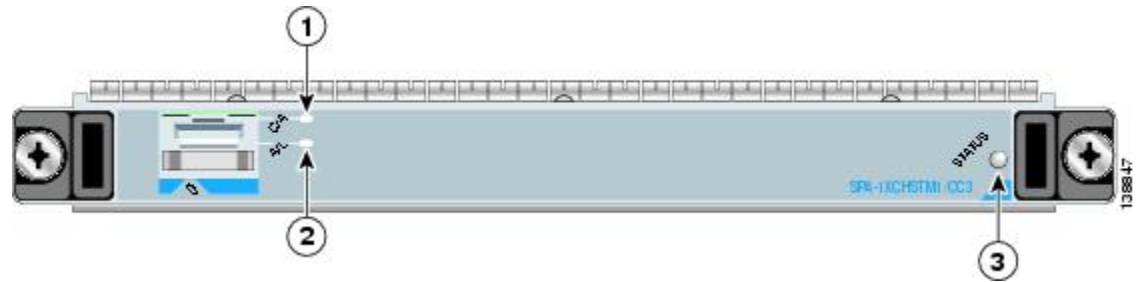
The following sections describe the 1-Port Channelized STM-1/OC-3 SPA:

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

The 1-Port Channelized STM-1/OC-3 SPA has two types of LEDs: an A/L LED for the port and a STATUS LED, as shown in the following figure.



Figure 25: 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 SPA LEDs are described in the following table.

Table 25: 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).

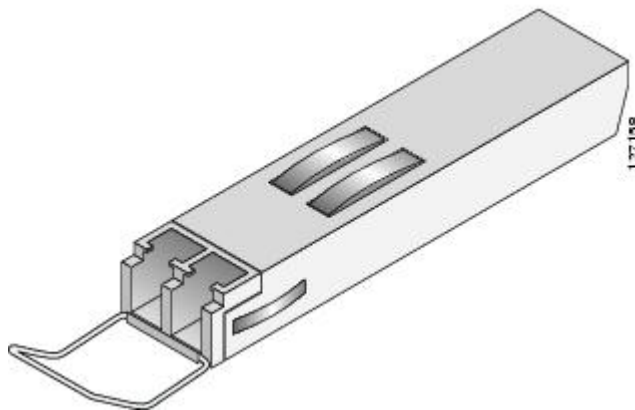


**Note** The 1-Port Channelized STM-1/OC-3 SPA supports Frame Relay Fragmentation (FRF.12) and Multilink Frame Relay (MFR) features for Cisco IOS XR Software Release 4.0.1 and later releases.

## 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 the port for SONET and SDH single-mode and multimode optical fiber connection (see the below figure).

**Figure 26: 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)

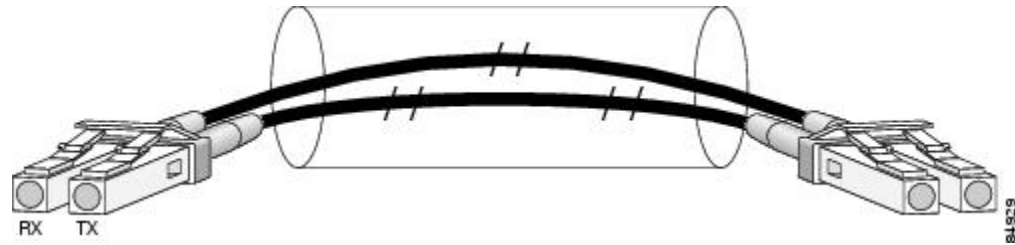
Use a single-mode optical fiber that has a modal-field diameter of  $8.7 \pm 0.5$  microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see the below figure) 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 27: LC Type Cable



The 1-Port Channelized STM-1/OC-3 SPA is a single-height SPA that installs into one SIP subslot. The 1-Port Channelized STM-1/OC-3 SPA with small form-factor pluggable (SFP) optical transceiver modules supports SONET and SDH protocols with a per-port bandwidth of 155.52 Mbps. The 1-Port Channelized STM-1/OC-3 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.

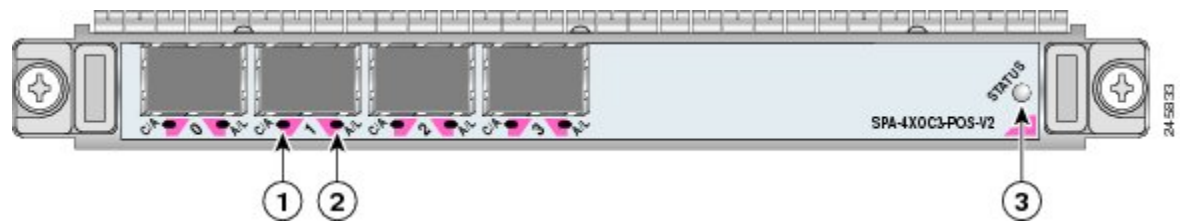
## 4-Port OC-3/STM-1 POS SPA Overview

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

### 4-Port OC-3/STM-1 POS SPA LEDs

The 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. The following figure shows the 4-Port OC-3/STM-1 POS SPA.

Figure 28: 4-Port OC-3/STM-1 POS SPA Faceplate



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

The following table describes the 4-Port OC-3/STM-1 POS SPA LEDs.

Table 26: 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.
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.

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

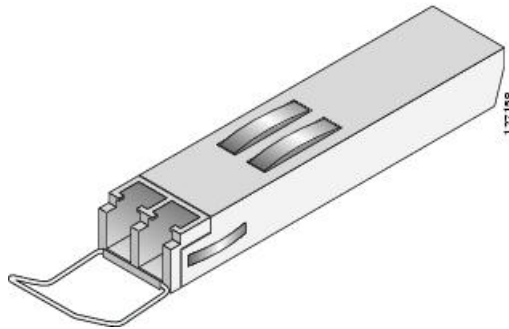
- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2427, *Multiprotocol Interconnect over Frame Relay*
- RFC 2615, *PPP over SONET/SDH*

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

The 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 the below figure).

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 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 29: SFP Optics Module**

The SFP optical transceiver modules used with the 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.

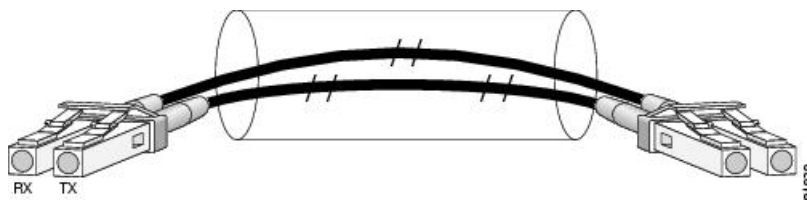
- Single-mode—155-Mbps, OC-3c/STM-1 optical fiber (SONET STS-3c or SDH STM-1)

Use a single-mode optical fiber that has a modal-field diameter of  $8.7 \pm 0.5$  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 the below figure) 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 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 30: LC-Type Cable**

## OC-3 Module Connections

The following table shows the OC-3 specifications of the optics on the 4-Port OC-3/STM-1 POS SPA.

**Table 27: 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

Specification	Description
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 POS SPA Overview

The 8-Port OC-3/STM-1 POS SPA is a single-height SPA that installs into one SIP subslot. 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 an OC-3 SFP module, so the per-port bandwidth can be 155.52 Mbps.



**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.

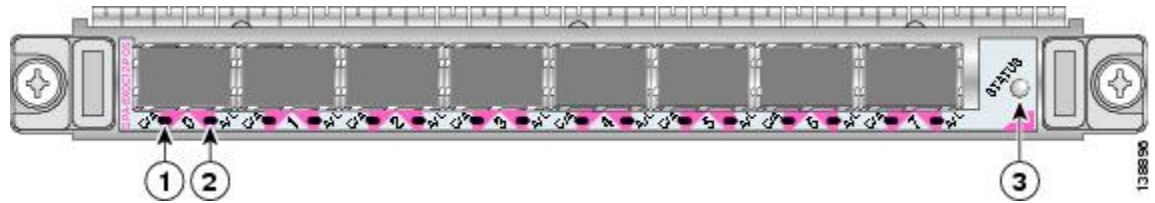
For more information about SPA bandwidth, see the “Bandwidth Oversubscription” topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

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

### 8-Port OC-3/STM-1 POS SPA LEDs

The 8-Port OC-3/STM-1 POS SPA has three types of LEDs: two LEDs for each port on the SPA and one STATUS LED. The following figure shows the 8-Port OC-3/STM-1 POS SPA faceplate.

Figure 31: 8-Port OC-3/STM-1 POS SPA Faceplate



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

The following table describes the 8-Port OC-3/STM-1 POS SPA LEDs.

Table 28: 8-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.
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 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). 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 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*

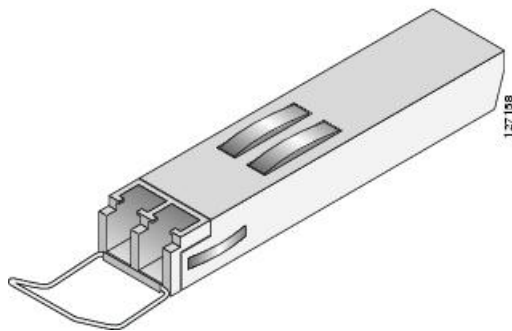
## 8-Port OC-3/STM-1 POS SPA Optical Transceiver Modules and Cables

The 8-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 connections (see the following figure).

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 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

**Figure 32: SFP Optics Module**



The following OC-3 optical fiber options are available for the 8-Port OC-3/STM-1 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)

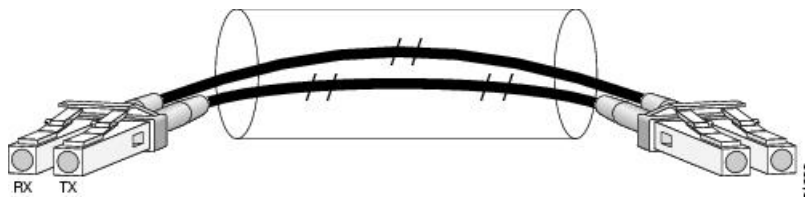
Use a single-mode optical fiber that has a modal-field diameter of  $8.7 \pm 0.5$  microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see the below figure) 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 33: LC-Type Cable**





## OC-3 Module Connections

The following table shows the OC-3 specifications of the optics on the 8-Port OC-3/STM-1 POS SPA.

**Table 29: 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

## 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 34: 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 30: 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.
	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.

## 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 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

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. The following figure shows an example of these LEDs on a 3-Port Clear Channel OC-3 ATM SPA.

Figure 35: 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 the table below.

Table 31: 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.
	Green	On	Port is enabled by software, and loopback is off.

LED Label	Color	State	Meaning
	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

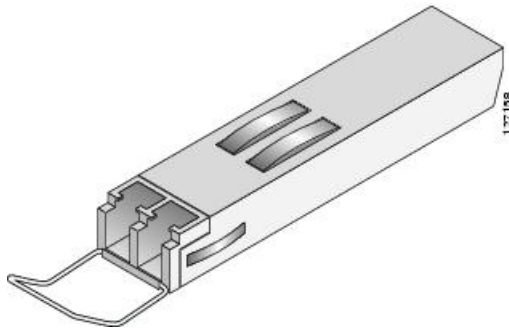
The physical layer interface for the 1-Port and 3-Port Clear Channel OC-3 ATM SPA is Optical Carrier-3 (OC-3), and the data link layer is designed to comply with ATM specifications. The 1-Port and 3-Port Clear Channel OC-3 ATM SPA provides up to one and three 155-Mbps OC-3 network interfaces, respectively,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

**Figure 36: 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)

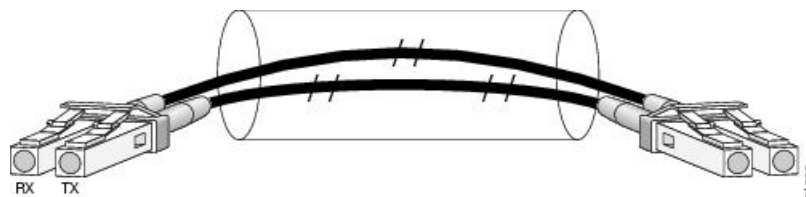
Use a single-mode optical fiber that has a modal-field diameter of  $8.7 \pm 0.5$  microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable 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 37: 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

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 the following figure.

Figure 38: 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 the following table.

Table 32: 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.

LED Label	Color	State	Meaning
	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 the below figure).

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

Multimode (MM) SFP module—SFP-OC12-MM

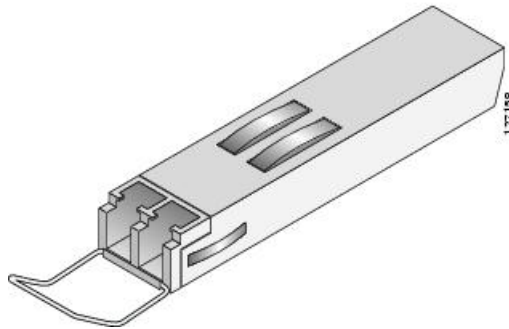
Short-reach (SR) SFP module—SFP-OC12-SR

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 39: SFP Optics Module**

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

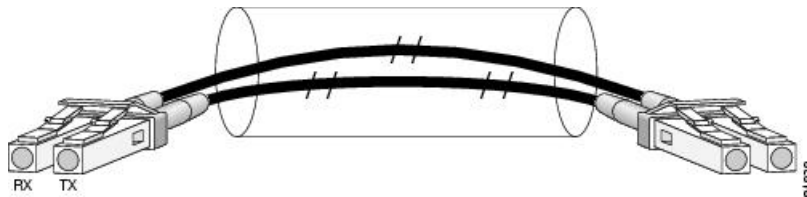
- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

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  $8.7 \pm 0.5$  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 or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

**Figure 40: Duplex Patch Cable with LC-Type Connectors**

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

The 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA is a single-height OC-12 SPA that can be installed into one SIP subslot. The OC-12 SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity. Since any given channel can be configured as either OC-3 or OC-12, so the per-port bandwidth can be either 155.52 Mbps or 622.08 Mbps respectively, depending on the type of small form-factor pluggable (SFP) optical transceiver module installed.



**Note** When SFP modules are replaced, the SPA interface retains any previously-defined configurations. This includes settings for IP address, clock source, loopback, CRC, and POS flags.

The 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA is a half rate SPA.

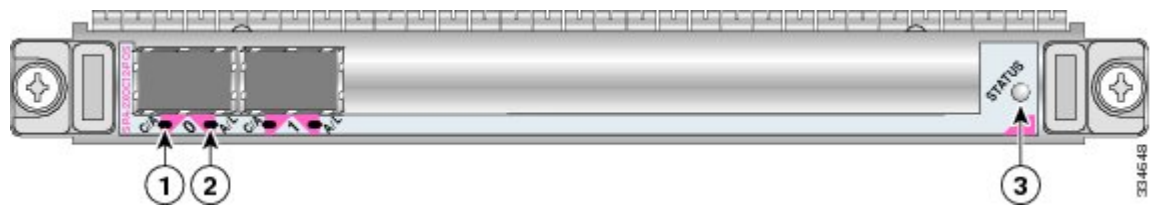
For more information about SPA bandwidth, see the “Bandwidth Oversubscription” topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

The following sections describe the 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

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

The 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA has three LEDs: two LEDs for each port on the SPA and one STATUS LED. The following figure shows the 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA faceplate.

**Figure 41: 2-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		

The 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs are described in the following table.

**Table 33: 2-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, 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 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 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA interface complies with the following IETF RFCs:

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

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

The 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA uses an SFP optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see the below figure).

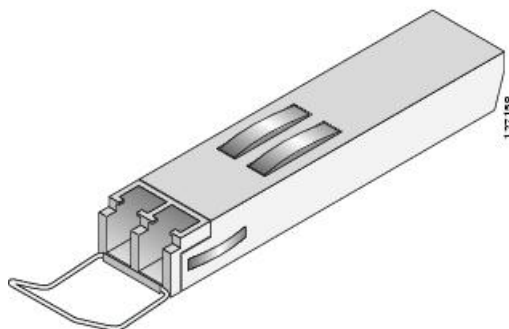
Cisco Systems qualifies the optics that are approved for use with its SPAs. The 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA when configured as OC-3 supports the following types of optical transceiver modules:

- 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

The 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA when configured as OC-12 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 42: SFP Optics Module**



The SFP optical transceiver modules used with the 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA configured for OC-3 provide the following optical fiber options:

- 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  $8.7 \pm 0.5$  microns. (Nominal diameter is approximately 10/125 microns.)

The SFP optical transceiver modules used with the 2-Port OC-3 STM-1/OC-12 STM-4 POS SPA configured for OC-12 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.

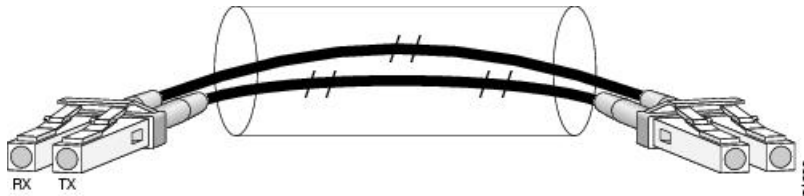
- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

Use a single-mode optical fiber that has a modal-field diameter of  $8.7 \pm 0.5$  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 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 to connect 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 the two of them.

**Figure 43: LC-Type Cable**



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

The 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA is a single-height OC-12 SPA that can be installed into one SIP subslot. The OC-12 SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity. Since any given channel can be configured as either OC-3 or OC-12, so the per-port bandwidth can be either 155.52 Mbps or 622.08 Mbps respectively, depending on the type of small form-factor pluggable (SFP) optical transceiver module installed.



**Note** When SFP modules are replaced, the SPA interface retains any previously-defined configurations. This includes settings for IP address, clock source, loopback, CRC, and POS flags.

The 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA is a half rate SPA.

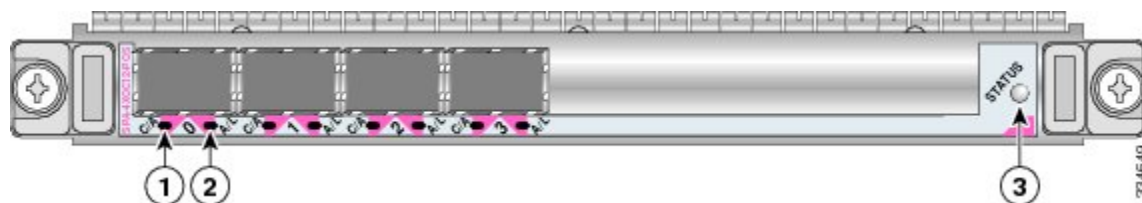
For more information about SPA bandwidth, see the “Bandwidth Oversubscription” topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

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

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

The 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA has three LEDs: two LEDs for each port on the SPA and one STATUS LED. The following figure shows the 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA faceplate.

Figure 44: 4-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		

The 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs are described in the following table.

Table 34: 4-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, 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.

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

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

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

The 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA uses an SFP optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see the figure below).

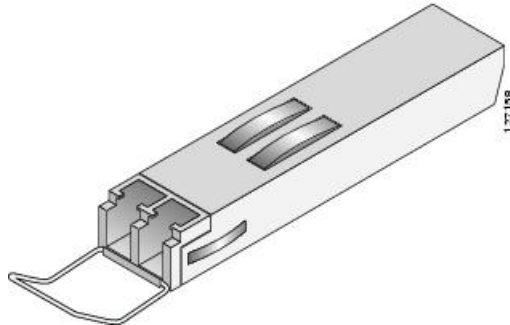
Cisco Systems qualifies the optics that are approved for use with its SPAs. The 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA when configured as OC-3 supports the following types of optical transceiver modules:

- 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

The 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA when configured as OC-12 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 45: SFP Optics Module**



The SFP optical transceiver modules used with the 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA configured for OC-3 provide the following optical fiber options:

- 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  $8.7 \pm 0.5$  microns. (Nominal diameter is approximately 10/125 microns.)

The SFP optical transceiver modules used with the 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA configured for OC-12 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.

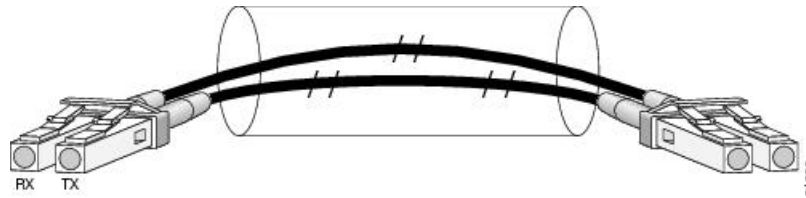
- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

Use a single-mode optical fiber that has a modal-field diameter of  $8.7 \pm 0.5$  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 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 to connect 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 the two of them.

**Figure 46: LC-Type Cable**



## 4-Port OC-48/STM-16 POS/RPR SPA Overview

The 4-Port OC-48/STM-16 POS/RPR SPA is a single-height OC-48 SPA that can be installed into one SIP subslot. The OC-48 SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity. The 4-Port OC-48/STM-16 POS/RPR SPA supports a per-port bandwidth of 2.488 Gbps.



**Note** When SFP modules are replaced, the SPA interface retains any previously-defined configurations. This includes settings for IP address, clock source, loopback, CRC, and POS flags.

The 4-Port OC-3 STM-1/OC-12 STM-4 POS SPA is a half rate SPA.

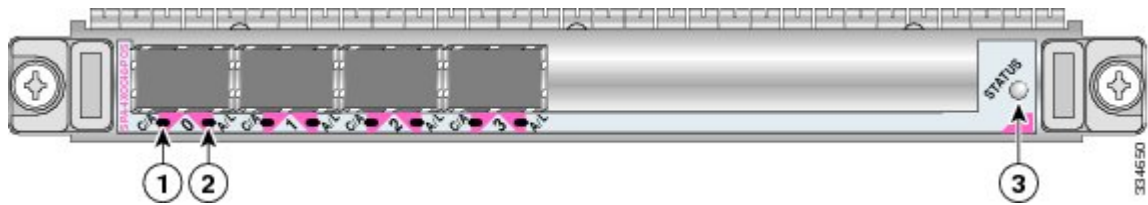
For more information about SPA bandwidth, see the “Bandwidth Oversubscription” topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the “SIP and SPA Product Overview” chapter in this guide.

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

### 4-Port OC-48/STM-16 POS/RPR SPA LEDs

The 4-Port OC-48/STM-16 POS/RPR SPA has five types of LEDs: four LEDs for each port on the SPA and one STATUS LED, as shown in the following figure.

Figure 47: 4-Port OC-48/STM-16 POS/RPR SPA Faceplate



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

The following table describes the 4-Port OC-48/STM-16 POS/RPR SPA LEDs.

Table 35: 4-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, 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.

## 4-Port OC-48/STM-16 POS/RPR SPA Interface Specifications

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

Each port on the has one duplex LC-type receptacle that allows connection to single-mode optical fiber.

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

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

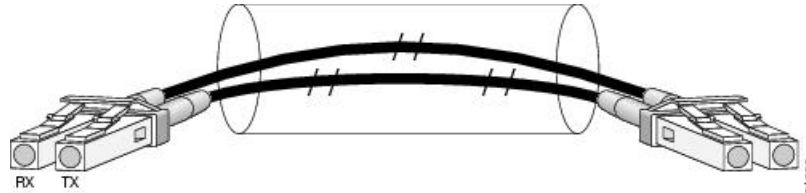
The 4-Port OC-48/STM-16 POS/RPR SPA supports the following types of optical transceiver modules:

- 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 4-Port OC-48/STM-16 POS/RPR SPA has one duplex LC-type receptacle. For single-mode optical fiber connections, you can use either a duplex LC-type cable or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

**Figure 48: LC-Type Cable**



## OC-48 Module Connections

The following table shows the OC-48 specifications for use with the 4-Port OC-48/STM-16 POS/RPR SPA.

**Table 36: 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

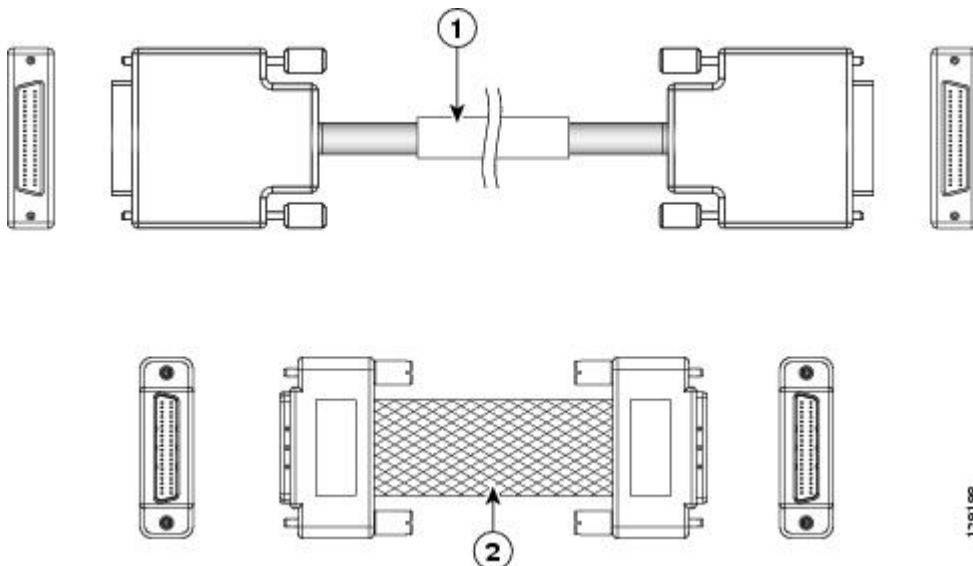
## Mate Interface Cables

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

- Mate between two OC-192c SPAs in the same SIP
- Mate between two OC-192c 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. The following figure shows the mate cables used to connect the SPAs.

Figure 49: 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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## 2-Port Channelized T3/E3 ATM CEoP SPA Overview

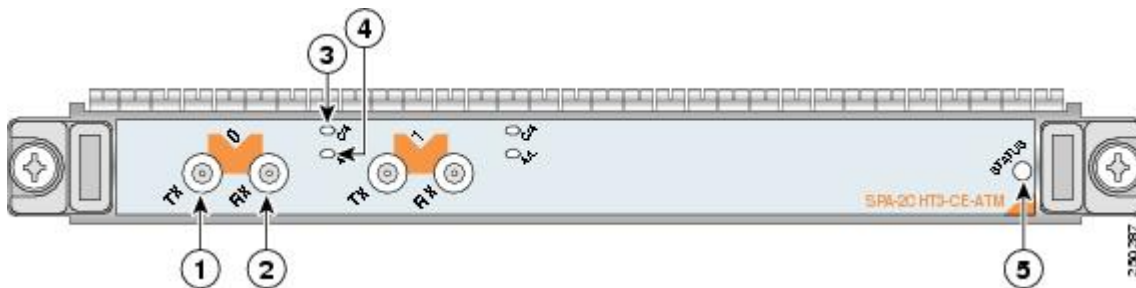
The following sections describe the 2-Port Channelized T3/E3 ATM CEoP SPA:

- [2-Port Channelized T3/E3 ATM CEoP SPA LEDs, on page 58](#)
- [2-Port Channelized T3/E3 ATM CEoP SPA Interface Specifications, on page 59](#)
- [2-Port Channelized T3/E3 ATM CEoP SPA Cables and Connectors, on page 59](#)

## 2-Port Channelized T3/E3 ATM CEoP SPA LEDs

The 2-Port Channelized T3/E3 ATM CEoP SPA has three types of LEDs (see the following figure). There are two LEDs for each port on the SPA, and a single STATUS LED for the SPA.

Figure 50: 2-Port Channelized T3/E3 ATM CEoP 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 CEoP SPA LEDs are described in the following table.

**Table 37: 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 the SPA is being configured.
	Green	On	SPA is ready and operational.

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

The framer processes the incoming and outgoing T3 (C-Bit, m13/m23, and unframe) and E3 (g751) 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.

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

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 DIN 1.0/2.3 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 DIN 1.0/2.3 connectors on the other end. If similar SPAs are connected back-to-back, both ends of the cable are DIN 1.0/2.3.

The cables specifications that can be used for the 2-Port Channelized T3/E3 ATM CEoP SPA are:

- CAB-T3E3-RF-BNC-M (T3 or E3 Cable, 1.0/2.3 RF to mini BNC-Male, 10 feet)
- CAB-T3E3-RF-BNC-F (T3 or E3 Cable, 1.0/2.3 RF to mini 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 (for the male BNC end) and 72-4131-01 (for the female BNC end). A SPA can receive data over the cable up to a maximum distance of 1350 ft (411.5 meters).

The following table describes the signal descriptions for the 2-Port Channelized T3/E3 ATM CEoP SPA connectors shown in the previous figure.

**Table 38: 2-Port Channelized T3/E3 ATM CEoP SPA Connectors**

Connector Label	Meaning
TX	Transmitted signals appear on the center contact. The outer shield is ground for the 75-ohm coaxial cable you attach to the TX DIN 1.0/2.3 connector.
RX	Received signals appear on the center contact. The outer shield is ground for the 75-ohm coaxial cable you attach to the RX DIN 1.0/2.3 connector.

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

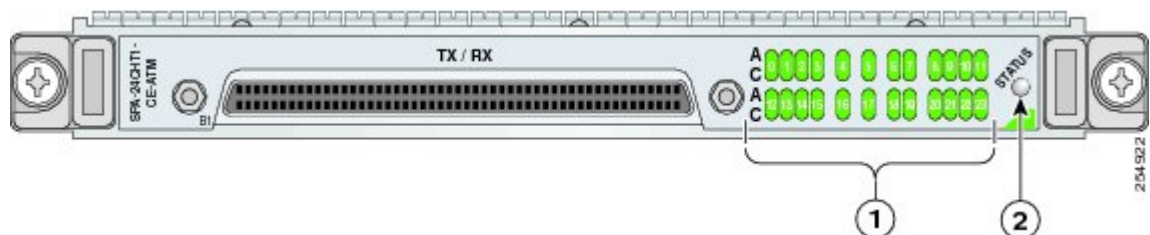
The following sections describe the 24-Port Channelized T1/E1/J1 CEoP SPA:

- [24-Port Channelized T1/E1/J1 CEoP SPA LEDs, on page 60](#)
- [24-Port Channelized T1/E1/J1 CEoP SPA Interface Specifications, on page 61](#)
- [24-Port Channelized T1/E1/J1 CEoP SPA Cables and Connectors, on page 61](#)

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

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

**Figure 51: 24-Port Channelized T1/E1/J1 CEoP SPA Faceplate**



1	A/C (Alarm/Carrier) LEDs	2	STATUS LED
---	--------------------------	---	------------

The following table describes the 24-Port Channelized T1/E1/J1 CEoP SPA LEDs.

**Table 39: 24-Port Channelized T1/E1/J1 CEoP SPA LEDs**

LED Label	Color	State	Meaning
STATUS	Off	Off	SPA power is off.

LED Label	Color	State	Meaning
	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.

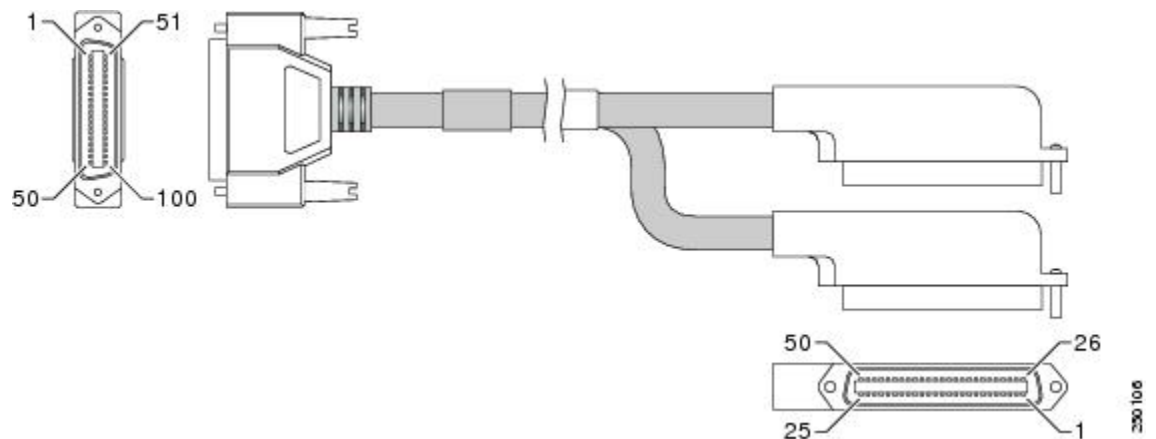
## 24-Port Channelized T1/E1/J1 CEoP SPA Interface Specifications

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

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

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

**Figure 52: 24-Port Channelized T1/E1/J1 CEoP SPA High-Density Cable**

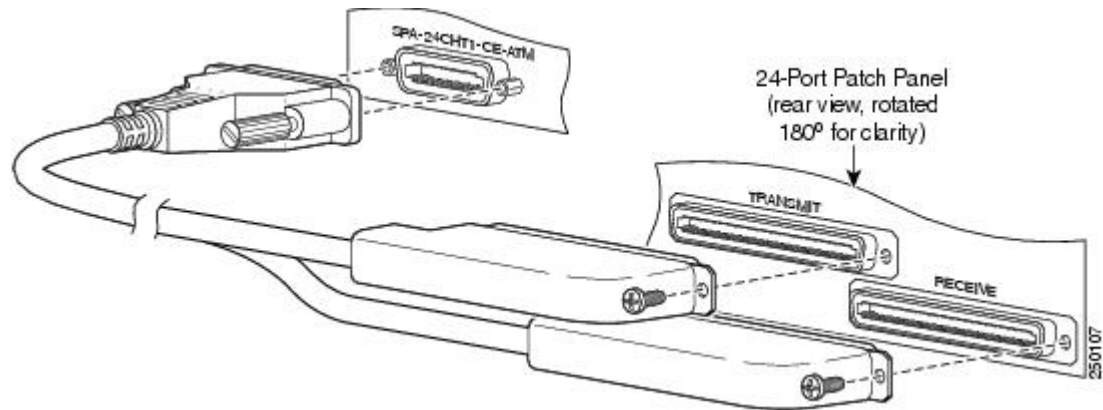


### Cable Installation

One end of the cable has a 100-pin connector that plugs into the front of the 24-Port Channelized T1/E1/J1 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 can be attached 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 CEoP SPA and the patch panel.

Figure 53: Cable Installation Between the SPA and the 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 CEoP SPA and the rear of the patch panel.

Table 40: 24-Port Channelized T1/E1/J1 CEoP SPA Cable Connector Pinouts

Subscriber	Connector Pins			
Line	Signal	SPA	TX Cable Lead	RX Cable Lead
Line 1	TX TipTX Ring	252	126	Not connected
	RX TipRX Ring	2676	Not connected	126
Line 2	TX TipTX Ring	353	227	Not connected
	RX TipRX Ring	2777	Not connected	227
Line 3	TX TipTX Ring	454	328	Not connected
	RX TipRX Ring	2878	Not connected	328
Line 4	TX TipTX Ring	555	429	Not connected
	RX TipRX Ring	2979	Not connected	429
Line 5	TX TipTX Ring	656	530	Not connected
	RX TipRX Ring	3080	Not connected	530
Line 6	TX TipTX Ring	757	631	Not connected
	RX TipRX Ring	3181	Not connected	631
Line 7	TX TipTX Ring	858	732	Not connected
	RX TipRX Ring	3282	Not connected	732

Subscriber	Connector Pins			
Line 8	TX TipTX Ring	959	833	Not connected
	RX TipRX Ring	3383	Not connected	833
Line 9	TX TipTX Ring	1060	934	Not connected
	RX TipRX Ring	3484	Not connected	934
Line 10	TX TipTX Ring	1161	1035	Not connected
	RX TipRX Ring	3585	Not connected	1035
Line 11	TX TipTX Ring	1262	1136	Not connected
	RX TipRX Ring	3686	Not connected	1136
Line 12	TX TipTX Ring	1363	1237	Not connected
	RX TipRX Ring	3787	Not connected	1237
Line 13	TX TipTX Ring	1464	1338	Not connected
	RX TipRX Ring	3888	Not connected	1338
Line 14	TX TipTX Ring	1565	1439	Not connected
	RX TipRX Ring	3989	Not connected	1439
Line 15	TX TipTX Ring	1666	1540	Not connected
	RX TipRX Ring	4090	Not connected	1540
Line 16	TX TipTX Ring	1767	1641	Not connected
	RX TipRX Ring	4191	Not connected	1641
Line 17	TX TipTX Ring	1868	1742	Not connected
	RX TipRX Ring	4292	Not connected	1742
Line 18	TX TipTX Ring	1969	1843	Not connected
	RX TipRX Ring	4393	Not connected	1843
Line 19	TX TipTX Ring	2070	1944	Not connected
	RX TipRX Ring	4494	Not connected	1944
Line 20	TX TipTX Ring	2171	2045	Not connected
	RX TipRX Ring	4595	Not connected	2045
Line 21	TX TipTX Ring	2272	2146	Not connected
	RX TipRX Ring	4696	Not connected	2146

Subscriber	Connector Pins			
Line 22	TX TipTX Ring	2373	2247	Not connected
	RX TipRX Ring	4797	Not connected	2247
Line 23	TX TipTX Ring	2474	2348	Not connected
	RX TipRX Ring	4898	Not connected	2348
Line 24	TX TipTX Ring	2575	2449	Not connected
	RX TipRX Ring	4999	Not connected	2449

## RJ-45 Cable Pinouts

T1 lines from individual subscribers are attached to the 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 CEoP SPAs to each other, you must cable both the SPA's patch panels together using a T1 crossover cable or a T1 straight through cable. The type of cable you use (crossover or straight through) depends on how the CEoP SPAs are cabled to their patch panels:

- If both the 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 crossover cable to connect the patch panels to each other.
- If both the 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.



## CHAPTER 3

# Preparing to Install a Shared Port Adapter or a SPA Interface Processor

---

This chapter describes the general equipment, safety, and site preparation requirements for installing SIPs and SPAs. This chapter contains the following sections:

- [Safety Guidelines, on page 65](#)
- [Preventing Electrostatic Discharge, on page 67](#)
- [Required Tools and Equipment, on page 67](#)

## Safety Guidelines

Before you perform any procedure in this publication, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

The following guidelines are for your safety and to protect equipment. The guidelines do not include all hazards. Be alert.

## Safety Warnings



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**Note** Review the safety warnings listed in the Regulatory Compliance and Safety Information for Cisco ASR 9000 Series Aggregation Services Routers publication (Document Number OL-17505-01) before installing, configuring, or maintaining a line card.

---

- Keep the work area clear and dust free during and after installation. Do not allow dirt or debris to enter into any laser-based components.
- Do not wear loose clothing, jewelry, or other items that could get caught in the router while working with line cards.
- Cisco equipment operates safely when it is used in accordance with its specifications and product usage instructions.

## Electromagnetic Compatibility Regulatory Statements

Electromagnetic compatibility regulatory statements are listed in the Regulatory Compliance and Safety Information for Cisco ASR 9000 Series Aggregation Services Routers publication (Document Number OL-17505-01). Review these before installing, configuring, or maintaining your SIP or SPA.

## Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe; carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

## Telephone Wiring Guidelines

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

## Laser/LED Safety

The single-mode transmitter in the module uses a small laser to transmit the light signal to the network ring. Keep the transmit port covered whenever a cable is not connected to it. Although multimode transceivers typically use LEDs for transmission, it is good practice to keep open ports covered and avoid staring into open ports or apertures. The single-mode aperture port contains a laser warning label, as shown in the figure below.

**Figure 54: Laser Warning Labels for Single-Mode Port**



### Warning

Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051






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**Warning** Class 1 laser product. Statement 1008

---

The multimode aperture contains a Class 1 LED warning label, as shown in the figure below.

*Figure 55: Class 1 LED Warning Label for Multimode Port*




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**Warning** Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051

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**Warning** Class 1 LED product. Statement 1027

---

## Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Electromagnetic interference (EMI) shielding is an integral component of the line card. Cisco recommends using an ESD-preventive strap whenever you are handling network equipment or one of its components.

The following are guidelines for preventing ESD damage:

- Always use an ESD-preventive wrist or ankle strap and ensure that it makes good skin contact. Connect the equipment end of the connection cord to an ESD connection socket on the router or to bare metal on the chassis.
- Handle SIPs by the captive installation screws, the provided handle, ejector levers, or the line card metal carrier only; avoid touching the board or connector pins.
- Place removed SIPs board-side-up on an antistatic surface or in a static shielding bag. If you plan to return the component to the factory, immediately place it in a static shielding bag.
- Avoid contact between the SIPs and clothing. The wrist strap only protects the board from ESD voltages on the body; ESD voltages on clothing can still cause damage.




---

**Caution** For safety, periodically check the resistance value of the ESD strap. The measurement should be between 1 and 10 megohms.

---

## Required Tools and Equipment

You need the following tools and parts to remove and install SIPs:

- Flat-blade or Phillips screwdriver

**Required Tools and Equipment**

- ESD-preventive wrist or ankle strap and instructions
- Interface cables to connect the SIP with another router or switch



## CHAPTER 4

# Installing and Removing a SPA Interface Processor

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This chapter describes how to install or remove SIPs on Cisco ASR 9000 Series Aggregation Services Routers. This chapter contains the following sections:

- [Handling SIPs, on page 69](#)
- [Removing and Installing a SIP, on page 70](#)

## Handling SIPs

Each SIP circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage. Before you begin installation, read [Preparing to Install a Shared Port Adapter or a SPA Interface Processor, on page 65](#) for a list of parts and tools required for installation.



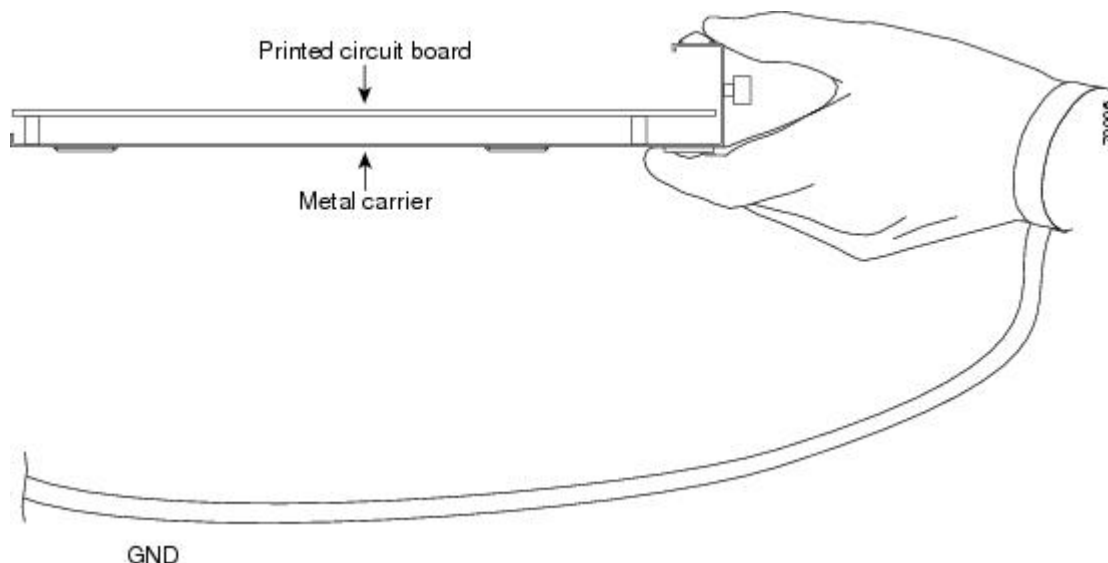
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**Caution** Always handle the SIP by the carrier edges and handle; never touch the SIP components or connector pins. (See the figure below.)

---

When a slot is not in use, a blank must fill the empty slot to allow the router to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the installed modules. If you plan to install an SIP in a slot that is not in use, you must first remove the blank.

Figure 56: Handling a SIP



## Removing and Installing a SIP

The following sections describe the procedures for removing and installing SIPs:

- [Guidelines for SIP Removal and Installation, on page 70](#)
- [Removing a SIP, on page 71](#)
- [Installing a SIP, on page 72](#)



**Note** Some of the procedures in the following sections use illustrations of a 10-slot Cisco ASR 9000 Series Router to support the descriptions of removing and installing SIPs. Although the card cages of Cisco ASR 9000 Series Aggregation Services Routers differ, the designated use of slots and the process of installing and removing a SIP are basically the same. Therefore, separate procedures and illustrations are not included in this publication.

## Guidelines for SIP Removal and Installation

Guidelines for SIP removal and installation include the following:

- Online insertion and removal (OIR) is supported, enabling you to remove and install SIPs while the router is operating. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation. We recommend that you perform a graceful shutdown to shut down a line card prior to removing it from the chassis.



**Note** With OIR, notifying the software or resetting the power is not required. However, you have the option of using the **hw-module loc rack/slot/CPU0 maint** command before removing a SIP.



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**Note** When you perform a graceful shutdown on a SIP, `cefcFRUInserted` and `cefcFRURemoved` traps are not generated.

---

- After you reinstall a SIP, the router automatically downloads the necessary software from the Route Switch Processor (RSP). Next, the router brings online only those interfaces that match the current configuration and were previously configured as administratively up. You must configure all others with the **configure** command.



---

**Caution** The router may indicate a hardware failure if you do not follow proper procedures. Remove or insert only one SIP at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or inserting another SIP.

---

- SIPs have two ejector levers to release the card from its backplane connector. Use the levers when you are removing the SIP and to seat the SIP firmly in its backplane connector when you are installing the SIP. The ejector levers align and seat the card connectors in the backplane.



---

**Caution** When you remove a SIP, always use the ejector levers to ensure that the connector pins disconnect from the backplane in the logical sequence expected by the router. Any card that is only partially connected to the backplane can halt the router. When you install a SIP, always use the ejector levers to ensure that the card is correctly aligned with the backplane connector; the connector pins should make contact with the backplane in the correct order, indicating that the card is fully seated in the backplane. A card that is only partially seated in the backplane will cause the router to hang and subsequently crash.

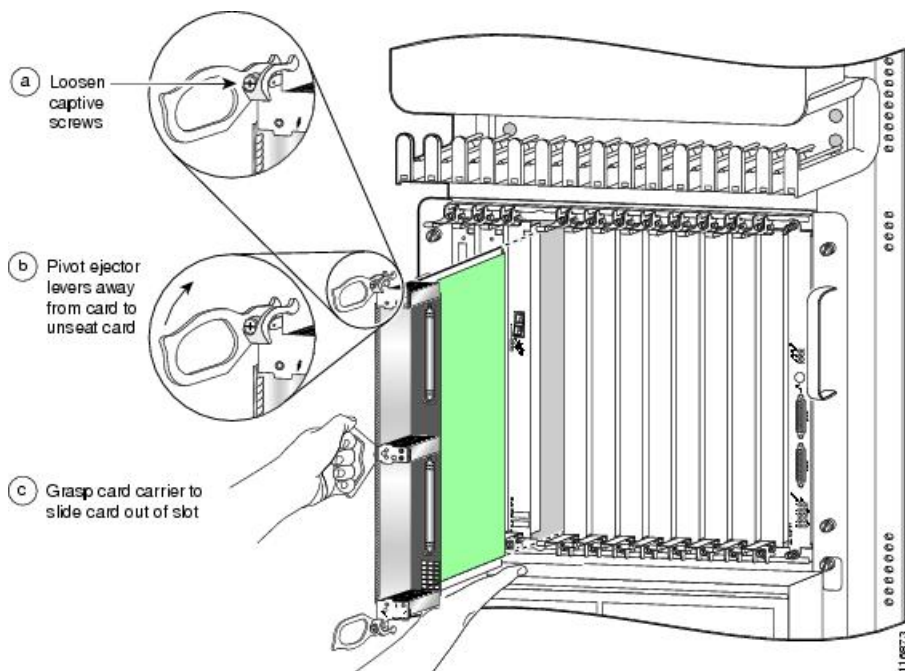
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## Removing a SIP

If you are replacing a failed SIP, remove the existing SIP first, then install the new SIP in the same slot. To remove a SIP, follow these steps:

- 
- Step 1** Attach an ESD-preventive wrist strap and follow its instructions for use.
  - Step 2** Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the SPAs, if any, and SPA locations if you remove the SPAs.
  - Step 3** Detach the SIP cable-management bracket from the SIP.
  - Step 4** Use a screwdriver to loosen the captive screw at each end of the SIP faceplate.

Figure 57: SIP Removal and Installation



**Caution** When you remove a SIP, always use the ejector levers to ensure that the SIP connector pins disconnect from the backplane in the logical sequence expected by the router. Any SIP that is only partially connected to the backplane can halt the router.

- Step 5** Simultaneously pivot the ejector levers away from each other to release the SIP from the backplane connector.
- Step 6** Grasp the ejector levers and pull the SIP halfway out of the slot.
- Step 7** Grasp the SIP by the handle and gently pull it straight out of the slot, keeping your other hand under the SIP to guide it. Avoid touching the SIP printed circuit board, components, or any connector pins.
- Step 8** Place the removed SIP on an antistatic mat, or immediately place it in an antistatic bag if you plan to return it to the factory.
- Step 9** If the SIP slot is to remain empty, install a line card blank to keep dust out of the chassis and to maintain proper airflow through the SIP compartment. Secure the line card blank to the chassis by tightening its captive screws.

## Installing a SIP

A SIP slides into any available line card slot and connects directly to the backplane. If you install a new SIP, you must first remove the line card blank from the available slot.



**Note** Refer to Figure 2-6 Cisco ASR 9010 Router Components and Slot Numbering and Figure 2-7 Cisco ASR 9006 Router Components and Slot Numbering in the Unpacking and Installing the Chassis chapter of the *Cisco ASR 9000 Series Aggregation Services Router Hardware Installation Guide* for information on line card slot types in order to determine an appropriate slot in which to install the SIP.

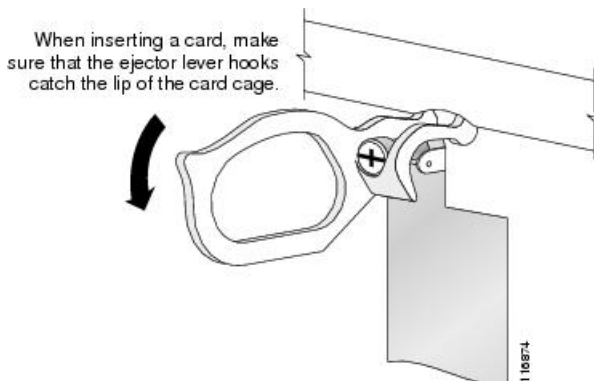


**Caution** The router may indicate a hardware failure if you do not follow proper procedures. Remove or insert only one SIP at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or inserting another SIP.

To install a SIP, follow these steps:

- Step 1** Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.
- Step 2** Choose an available SIP slot for the SIP, and verify that the SPA interface cables are long enough for you to connect the SIP with any external equipment.
- Caution** To prevent ESD damage, handle SIPs by the captive installation screws, the provided handle, ejector levers, or the card carrier edges only. Do not touch any of the electrical components or circuitry.
- Step 3** Grasp the handle of the SIP with one hand and place your other hand under the card carrier to support the weight of the card; position the card for insertion into the card cage slot. Avoid touching the SIP printed circuit board, components, or any connector pins.
- Step 4** Carefully slide the SIP into the slot until the ejector levers make contact with the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the SIP until the ejector lever hooks are fully latched.

**Figure 58: Ejector Levers**



**Caution** When you install a SIP, always use the ejector levers to ensure that the card is correctly aligned with the backplane connector, the card connector pins make contact with the backplane in the correct order, and the card is fully seated in the backplane. A card that is only partially seated in the backplane can cause the router to hang and subsequently crash.

- Step 5** Simultaneously pivot both ejector levers toward each other until they are perpendicular to the SIP faceplate. This action firmly seats the card in the backplane.
- Step 6** Use a 3/16-inch flat-blade screwdriver to tighten the captive screw on each end of the SIP faceplate to ensure proper EMI shielding and to prevent the SIP from becoming partially dislodged from the backplane. Tighten the locking thumbscrews on both sides of the SIP to a torque of between 8.3 and 11 inch-pounds (94 to 124 N-cm). Do not overtighten.
- Caution** To ensure adequate space for additional SIPs, always tighten the captive installation screws on each newly installed SIP *before* you insert any additional SIPs. These screws also prevent accidental removal and provide proper grounding and EMI shielding for the router.

- Step 7** Install the SPAs and SFP modules in the SPAs that use them. Refer to the [SPA Installation and Removal, on page 76](#) section.
- Step 8** If you are replacing a SIP install the SPAs in the same bays as you noted in Step 2 under the [Removing a SIP, on page 71](#) section.
- Step 9** Install the interface cables.
-





## CHAPTER 5

# Installing and Removing a Shared Port Adapter

This chapter describes how to install or remove SPAs on the Cisco ASR 9000 Series Aggregation Services Router. This chapter contains the following sections:

- [Handling SPAs, on page 75](#)
- [Online Insertion and Removal, on page 76](#)
- [SPA Installation and Removal, on page 76](#)
- [Optical Device Installation and Removal, on page 77](#)
- [Checking the Installation, on page 78](#)

## Handling SPAs

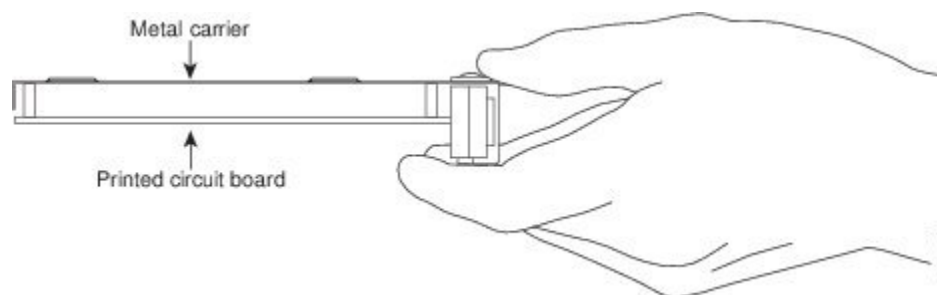
Each SPA circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage. Before you begin installation, read [Preparing to Install a Shared Port Adapter or a SPA Interface Processor, on page 65](#) for a list of parts and tools required for installation.



**Caution** Always handle the SPA by the carrier edges and handle; never touch the SPA components or connector pins. (See the figure below.)

When a bay is not in use, a blank must fill the empty bay to allow the router or switch to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the installed modules. If you plan to install a SPA in a bay that is not in use, you must first remove the blank.

**Figure 59: Handling a SPA**



# Online Insertion and Removal

Cisco ASR 9000 Series Router SIPs and SPAs support online insertion and removal (OIR). SPAs can be inserted or removed independently from the SIP. OIR of a SIP with installed SPAs is also supported.

## SPA Installation and Removal

This section provides step-by-step instructions for removing and installing a SPA in an SIP.



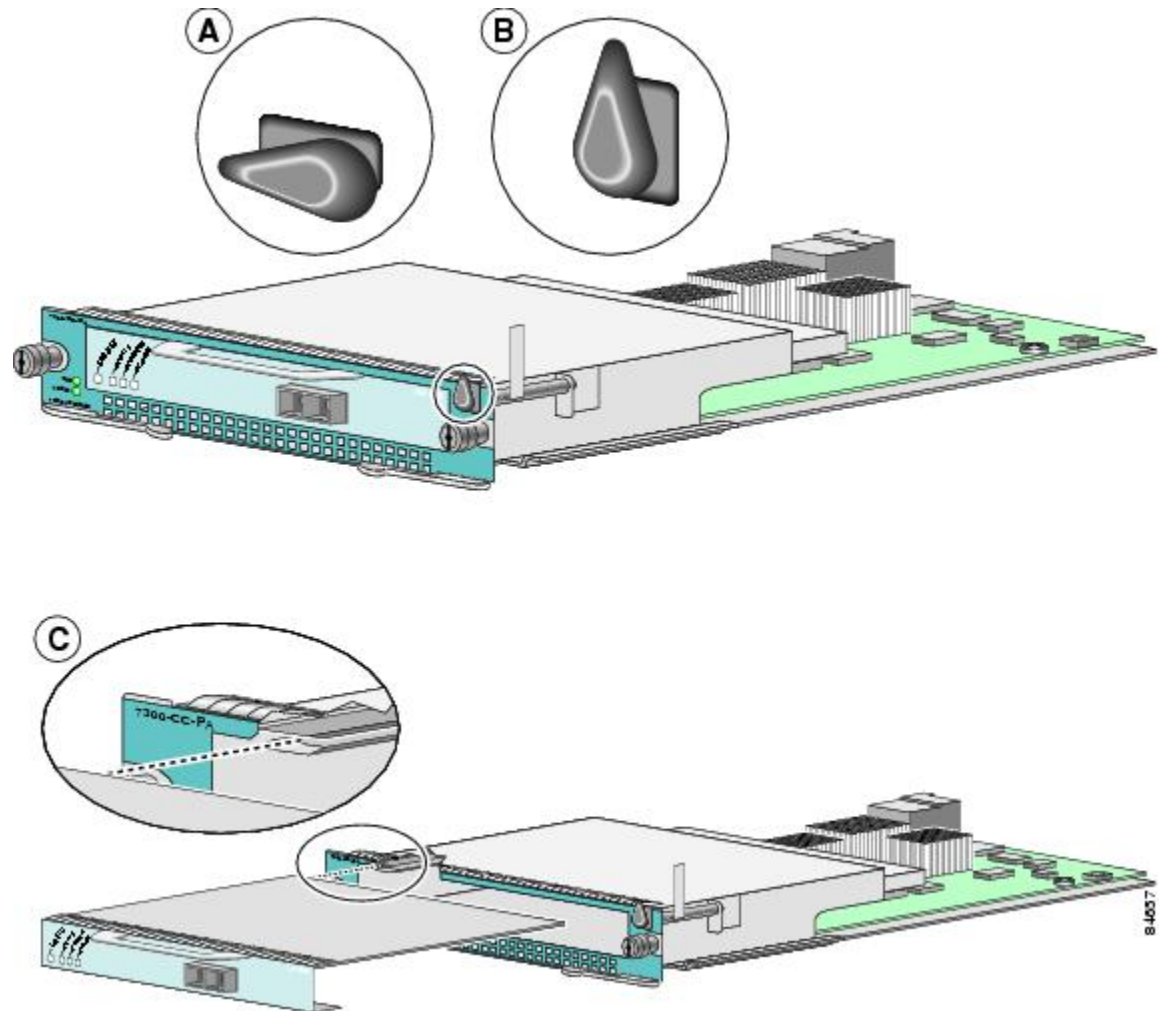
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**Caution** When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the SPA. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the midplane or backplane with your hand or any metal tool, or you could shock yourself.

---

To remove and install a SPA in a SIP, do the following:

- 
- Step 1** To insert the SPA in the SIP, locate the guide rails inside the SIP that hold the SPA in place. They are at the top left and top right of the SPA slot and are recessed about an inch, as shown in C of the below figure.
- Step 2** Carefully slide the SPA all the way in the SIP until the SPA is firmly seated in the SPA interface connector. When fully seated, the SPA might be slightly behind the SIP faceplate.
- Note** The SPA will slide easily into the slot if it is properly aligned on the tracks. If the SPA does not slide easily, do NOT force it. Remove the SPA and reposition it, paying close attention to engaging it on the tracks.
- Step 3** After the SPA is properly seated, turn the SPA lock to its locked and horizontal position, as shown in A of the below figure.
- Step 4** To remove the SPA from the SIP, turn the SPA lock from its locked and horizontal position shown in A of the below figure to its unlocked and vertical position shown in B of the below figure.
- Step 5** Grasp the handle of the SPA and pull the SPA from the SIP. (You have already disconnected the cables from the SPA).
-

**What to do next***Figure 60: SPA Installation and Removal*

## Optical Device Installation and Removal

Any contamination of the fiber connection can cause failure of the component or failure of the whole system. A particle that partially or completely blocks the core generates strong back reflections, which can cause instability in the laser system. Inspection, cleaning, and reinspection are critical steps to take before making fiber-optic connections.

### Cleaning Optical Devices

Refer to the [Inspection and Cleaning Procedures for Fiber-Optic Connections](#) document for information on cleaning optical devices.

# Checking the Installation

This section describes the procedures you can use to verify the SIP and SPA installation, and includes information on the following topics:

## Verifying the Installation

This section describes how to verify the SIP and SPA installation by observing the SIP LED states, the SPA LED states, and the information displayed on the console terminal.

When the system has reinitialized all interfaces, the SIP STATUS LED should be green (on) and the SPA STATUS LEDs should be green (on). The port LEDs (C/A and A/L) may be green (on), depending on your connections and configuration. The console screen also displays a message as the system discovers each interface during its reinitialization.

The following sample display shows the events logged by the system as a SIP with a POS SPA was removed from module slot 4 in the router. In this example, interface 0 (interface 4/0/0) on the POS SPA was up and active when the SIP was removed from the router. Note that the system logs that the SIP card was removed from slot 4 and that interface 4/0/0 is changed to *down*.

```
Router#
00:06:17:%WS_ALARM-6-INFO:ASSERT CRITICAL slot 4 Active Card Removed OIR Alarm
00:06:17:%OIR-6-REMCARD:Card removed from slot 4, interfaces disabled
00:06:18:%LINEPROTO-5-UPDOWN:Line protocol on Interface pos4/0/0, changed state to down
```

When you reinsert the SIP with the installed POS SPA, the system automatically brings up the interface that was changed to *down* when the SIP was removed.

```
Router#
00:07:29:%OIR-6-INSCARD:Card inserted in slot 4, interfaces administratively shut down
00:07:32:%WS_ALARM-6-INFO:CLEAR CRITICAL slot 4 Active Card Removed OIR Alarm
00:07:35:%LINK-3-UPDOWN:Interface pos4/0/0, changed state to up
00:07:36:%LINEPROTO-5-UPDOWN:Line protocol on Interface pos4/0/0, changed state to up
```

Use the following procedure to verify that a SIP and SPA are installed correctly:

---

**Step 1** Observe the console display messages and verify that the system discovers the SIP, while the system reinitializes each interface, as follows:

- As a SIP is initialized, the STATUS LED will first be amber, indicating that power is on, but the SIP is being configured. When the SIP is active, the STATUS LED will illuminate green.
- SPAs will follow the same sequence after the SIP has completed its initialization. The SPA STATUS LEDs will illuminate amber, turning to green when the SPAs become active.

**Step 2** When the SIP and SPA STATUS LEDs are green, all associated interfaces are configurable.

Refer to Cisco ASR 9000 Series Router Getting Started Guide and *Cisco ASR 9000 Series Router Interface and Hardware Component Configuration Guide* for configuration instructions.

- If a SIP or SPA is replaced with a module of the same type (as in an OIR or hardware swap), the previous configuration is reinstated when the SIP or SPA becomes active.
- If a SIP or SPA has not been previously installed in the same slot or subslot, then the configuration for all associated interfaces is empty.

**Note** New interfaces are not available until you configure them.

**Step 3** If the SIPs and SPAs have not become active within three minutes, refer to the system console messages. If there is no indication that a field-programmable device (FPD) upgrade is underway, see [Troubleshooting the Installation, on page 83](#).

## Using show Commands to Verify SIP and SPA Status

The following procedure uses **show** commands to verify that the new SPAs are configured and operating correctly.

**Step 1** Use the **show running-config** command to display the system configuration. Verify that the configuration includes the new SPA interfaces.

**Step 2** Display information about the installed SIPs using the **show diag** command.

**Step 3** Use the **hw-module fpd location <rack/slot/subslot>** command to verify the FPD version information of the SPAs installed in the system.

**Note** If a SPA does not meet the minimum version required, the FPD may need to be updated. Refer to *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide* for instructions. If the update fails, the failing module is powered down and an error message displays on the system console.

**Step 4** Use the **show platform** command to check the state of all the boards in the chassis, including the SIP and the SPAs. The SPA state should be “OK” and the SIP card state should be “IOS XR RUN” in the **show platform** command output.

**Step 5** Finally, you can use the **show version** command to obtain software version information for the installed SIPs as well as interfaces available.

## Using show Commands to Display SPA Information

The following table describes the show commands you can use to display SPA information.

**Table 41: show Commands to Display SPA Information**

Command	Type of Information Provided
show running-config	Router’s running configuration and interfaces available in the system.
show platform	Router’s installed linecard and SPA type, slot, and state information.
show diag	SPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.
<b>show hw-module fpd location</b> <i>&lt;rack/slot/subslot&gt;</i>	FPD version information of SPAs in the system.
<b>show version</b>	Cisco IOS XR software version, names and sources of configuration files, and boot images.

Table 42: show Commands to Display SPA Information

Command	Type of Information Provided	Example
show controllers <i>type rack/slot/subslot/port</i>	Network link status, register contents, and controller chip errors.	<b>show controllers sonet 0/1/0/1</b>
show interfaces <i>type rack/slot/subslot/port</i>	Line status and data link protocol status for a particular SPA port. Statistics about data traffic sent and received by the port.	<b>show interface serial 0/1/0/0/1/1:0</b>
show diag <i>rack/slot/subslot/</i>	SPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.	<b>show diag 0/1/CPU0</b>
<b>show version</b>	Cisco IOS XR software version and boot images.	<b>show version</b>



**Note** When a SIP is moved to a new slot, the system recognizes the new interfaces but leaves them in the shutdown state until you configure them and change their state to up. When a new SIP is inserted into a slot where a SIP previously resided, provided you reinstall the SPAs and interfaces cables in the same configuration as in the previous SIP, the interfaces will come up in the same state as though you reinserted the old SIP.

The following sample display shows the events logged by the system as you insert a *new* SIP in module slot 3.

```
Router#
18:05:25: %LINEPROTO-5-UPDOWN: Line protocol on Interface 0/POS3/1, changed state to down
```

Use the following procedure to verify that the SIP is installed correctly:

- Step 1** Observe the console display messages and verify that the system discovers the SIP, while the system reinitializes each interface, as follows:
- If you installed a new SIP, the STATUS LED should be on (green). The system should recognize all new interfaces but leave them configured as *down*.
  - If you replaced a SIP, the STATUS LED should be on (green). The interfaces will come up in the same state as though you reinserted the old SIP.
- Step 2** Verify that the STATUS LED on the SPA goes on (is green) and remains on after the reinitialization is complete. If the STATUS LED remains on, proceed to Step 5. If the STATUS LED does not remain on, proceed to Step 3.
- Step 3** If the STATUS LED on a SPA fails to go on, the SPA or the SIP might not be fully seated even if the SPA lock is in the locked and horizontal position.
- Remove the SPA from the SIP.
  - Inspect the SPA. Verify there are no bent pins or parts and that there is nothing lodged in the two devices that could prevent a good connection.
  - Insert the SPA in the SIP by sliding the SPA all the way in the SIP until the SPA is firmly seated in the SPA interface connector. When fully seated in the SIP, the SPA might be slightly behind the SIP faceplate.

**Note** The SPA will slide easily into the slot if it is properly aligned on the tracks. If the SPA does not slide easily, do NOT force it. Remove the SPA and reposition it, paying close attention to engaging it on the tracks.

- After the system reinitialization, the STATUS LED on the SPA should go on and remain on. If the STATUS LED remains on, proceed to Step 5. If it does not, try reseating the SPA in a different subslot within the SIP.
- If the STATUS LED on a SPA fails to go on after reseating the SPA in a different subslot within the SIP, proceed to Step 4.

**Step 4** If the STATUS LED on a SPA still fails to go on, remove the SPA from the SIP, then remove the SIP and install it in another available slot on the router. Wait for the STATUS LED on the SIP to turn green.

- If the STATUS LED goes on, suspect a failed backplane port in the original slot.
- If the STATUS LED fails to go on, remove the SIP and ensure the SPA is firmly seated in its slot. Remove and reinstall it accordingly.
- If the STATUS LED still fails to go on, but other LEDs on the SPA go on to indicate activity, proceed to Step 5 to resume the installation checkout; suspect that the STATUS LED on the SPA or the SPA bay has failed. Contact a service representative to report the problem and obtain further instructions.

**Note** If the **show platform** command shows the SPA in this bay as “NOT ALLOWED ONLINE”, then either software version is incompatible, or the SPA is incompatible with the adjacent SPA (for example, in Cisco IOS XR software release 4.0.1, OC192 will not allow any adjacent SPAs).

- If no LEDs on the SPA go on:
  - Verify that the SPA is supported on the SIP and that it has the required hardware revision. If the SPA is not supported or has an old hardware revision, the show diag command indicates that the SIP is deactivated.
  - If there is another SIP available in the router, to test your SPA move the SPA to the other SIP.
  - Suspect a faulty SIP. Contact a service representative to report the problem and obtain further instructions.

**Note** If you move the SPA to a different subslot in the SIP and it works, there are probably issues with the subslot in the SIP. Contact a service representative re: the broken subslot. If you test the SPA in another SIP and it works, the original SIP probably has some issues and needs troubleshooting. Contact a service representative to report the problem and obtain further instructions.

**Step 5** If the SPA is new and is not a replacement, configure the new SPA using the instructions in *Cisco IOS XR Getting Started Guide for the Cisco ASR 9000 Series Router* and *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* .

**Note** New interfaces are not available until you configure them.

**Step 6** If the SIP is a replacement, use the **show interfaces** command or the **show controllers** command to verify the status of the SPAs. (See the [Using show Commands to Verify SIP and SPA Status, on page 79](#) section.)

If you replaced a SIP with another SIP with a different SPA installed, the system recognizes the interfaces on the previously configured SPA but does not recognize the new SPA interfaces. The new interfaces remain in the shutdown state until you configure them.

**Step 7** When the interfaces are up, check the activity of each SPA by observing the carrier LED.

**Step 8** If the carrier LED fails to go on and a cable is connected to the interface port, check the cable connection and make certain it is properly seated in the connector.

**Step 9** Repeat Step 1 through Step 8 to verify that any additional SIPs are properly installed.

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### What to do next

If you experience other problems that you are unable to solve, contact TAC (see [Obtaining Documentation and Submitting a Service Request, on page xiii](#)) or a service representative for assistance.

To configure the new interface, use *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

## Using the Ping Command to Verify Network Connectivity

This section provides brief descriptions of the **ping** command. The **ping** command allows you to verify that a SPA port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. After you verify that the system and the SIP have booted successfully and are operational, you can use this command to verify the status of the SPA ports. Refer to *Cisco ASR 9000 Series Aggregation Services Router Getting Started Guide* and *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* for more information on bringing up and configuring the Cisco ASR 9000 Series Router and the Cisco ASR 9000 SIP-700 or Cisco ASR 9000 SIP-500. For more information on command syntax, refer to the publications listed in the [Related Documentation, on page xii](#) for detailed command descriptions and examples.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the IP address 10.1.1.60:

```
Router# ping 10.1.1.60
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.1.1.60, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the destination device and that the destination device is active (powered on), and then repeat the **ping** command.





## CHAPTER 6

# Troubleshooting the Installation

This chapter describes how to troubleshoot the installation of SIPs and SPAs on the Cisco ASR 9000 Series Aggregation Services Router. This chapter contains the following sections:

- [Troubleshooting the SIP, on page 83](#)
- [Using \*\*debug\*\* Commands, on page 83](#)
- [Packing a SIP for Shipment, on page 84](#)
- [Packing a SPA for Shipment, on page 85](#)

## Troubleshooting the SIP

If a SIP fails to operate or to power up upon installation:

- Make sure that the SIP is seated firmly in the line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the SIP is even with the fronts of the other line cards installed in the card cage.
- Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the SIP.
- Determine whether there are any active alarms by looking at the alarm LEDs on the route processor.
- Examine the power distribution units (PDUs) to see whether the chassis, as a whole, is receiving power.
- Use the LED on the SIP to verify the correct installation and operation of the card. The STATUS LED indicates whether the card is properly seated and operating correctly:
  - Green—The card is properly installed and operating correctly.
  - Amber—The card is properly installed, is powered, and IOS XR is loading.
  - Off (dark)—Verify that the card is installed correctly. Also verify that there is power to the card by looking at the indicators on the power shelf (10-slot) or PDU (6-slot).

## Using **debug** Commands

Along with the other **debug** commands supported on the Cisco ASR 9000 Series Router, you can obtain specific debug information for SPAs on the Cisco ASR 9000 Series Router using the **debug spa** privileged EXEC command.

The **debug spa** command is intended for use by Cisco Systems technical support personnel.



**Caution** Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use **debug** commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco technical support personnel. Moreover, it is best to use **debug** commands during periods of lower network traffic and fewer users. Debugging during these periods decreases the likelihood that increased **debug** command processing overhead will affect system use.

Alternatively, you could use the **show hw-module trace** command to debug your SPA. The syntax is:

```
show hw-module trace pltfm driver level [detailed | error | summary] location <location>
```

where <location > is your SPA location in the rack/slot/subslot notation, like 0/4/cpu0

Refer to the Hardware Redundancy and Node Administration Commands on Cisco ASR 9000 Series Router chapter of the *Cisco ASR 9000 Series Aggregation Services Router System Management Command Reference, Release 4.0* for the **show hw-module trace** command syntax:

[http://www.cisco.com/en/US/docs/routers/asr9000/software/asr9k\\_r4.0/system\\_management/command/reference/yr40asr9k\\_chapter7.html](http://www.cisco.com/en/US/docs/routers/asr9000/software/asr9k_r4.0/system_management/command/reference/yr40asr9k_chapter7.html)

## Packing a SIP for Shipment

This section provides step-by-step instructions for packing a SIP for shipment. Before beginning this procedure, you should have the following original Cisco Systems packaging materials:

- Clipboard insert
- Smaller inner carton
- Larger exterior carton
- Two packing cushions



**Caution** The Cisco Systems original packaging is to be used for the shipment of all SIPs. Failure to properly use Cisco Systems packaging can result in damage or loss of product.



**Warning** During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself. Statement 94



**Note** These instructions assume that the SIP has been removed from the router according to the recommended procedures specified in this guide.

To pack a SIP for shipment, perform the following steps:

**Step 1** Insert the SIP into the clipboard insert by carefully aligning the edges of the SIP between the upper and lower edges of the clipboard insert.

- Step 2** Slide the SIP all the way into the clipboard insert until it clicks into place. You might have to lift the clip assembly to ensure that it securely engages with the sheet-metal carrier.
- Step 3** Place the clipboard insert containing the SIP into the smaller inner carton.
- Step 4** Close the carton top, and tape the sides closed.
- Step 5** Apply the packing cushions to the sealed smaller inner carton.
- Step 6** Place the sealed smaller inner carton and packing cushions into the larger exterior carton, and seal the exterior carton with tape for shipment.

## Packing a SPA for Shipment

This section provides step-by-step instructions for packing a SPA and the cable-management brackets for shipment. Before beginning this procedure, you should have the following original Cisco Systems packaging materials:

- Thermoform container (transparent plastic-molded clamshell)
- Carton



### Caution

The Cisco Systems original packaging is to be used for the shipment of all SPAs and cable-management brackets. Failure to properly use Cisco Systems packaging can result in damage or loss of product.



### Warning

During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.



### Note

These instructions assume that the SPA and cable-management brackets have been removed from the router according to the recommended procedures specified in this guide.

To pack a SPA and the cable-management brackets for shipment, perform the following steps:

- Step 1** Open the Thermoform container and place the SPA and each of the cable-management brackets into the appropriate cavities.
- Caution** Always handle the SPA by the carrier edges and handle; never touch the SPA components or connector pins.
- Step 2** Close the Thermoform container. Be sure to lock the snaps securely.
- Step 3** Check that the Thermoform container is fully closed. Apply tape or a label closure over the opening to ensure the container stays closed during shipping.
- Step 4** Place the Thermoform container into the carton.
- Step 5** Close the carton.

**Step 6** Apply tape over the carton flap to ensure the carton stays closed during shipping.

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