Cisco 12000 Series Router SIP and SPA Hardware Installation Guide

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Cisco 12000 Series Router SIP and SPA Hardware Installation Guide

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Preface

Revised: Release 12.0(32)SY1, OL-8831-01, Rev. G6, July 19, 2007

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:

Document Change History

Table 1 provides a list of the changes to this document.

Table 1 Document Change History Table

Release No.	Revision	Date	Change Summary
12.0(31)S	Release 12.0(31)S	April 26, 2005	Initial release and 1st publication. Provides descriptions and installation instructions for the following SPAs installed in a Cisco 12000 SIP-400 or a Cisco 12000 SIP-600: • 1-Port 10-Gigabit Ethernet SPA • 5-Port 10 Gigabit Ethernet SPA • 10-Port Gigabit Ethernet SPA • 2-Port and 4-Port Clear Channel T3/E3 SPA • 2-Port and 4-Port Channelized T3 SPA • 1-Port OC-192c/STM-64 POS/RPR SPA
12.0(31)S2	Release 12.0(31)S2	September 22, 2005	Provides descriptions and installation instructions for the following SPAs installed in a Cisco 12000 SIP-600: • 2-Port OC-48c/STM-16 POS SPA

Table 1 Document Change History Table (continued)

Release No.	Revision	Date	Change Summary
12.0(32)S	Release 12.0(32)S	January 20, 2006	Support for the following SPA interface processor (SIP) hardware was introduced on the Cisco 12000 Series Routers: • Cisco 12000 SIP-401 • Cisco 12000 SIP-501 • Cisco 12000 SIP-601 Provides descriptions and installation instructions for the following SPAs installed in a SIP 401/501/601 on Cisco 12000 series routers: • 1-Port 10-Gigabit Ethernet SPA • 8-Port FastEthernet SPA • 10-Port Gigabit Ethernet SPA Support for the following hardware by the Cisco 12000 SIP-601 was introduced on the Cisco 12000 series router: • 1-Port OC-192c/STM-64 POS/RPR SPA • 1-Port OC-192c/STM-64 POS/RPR XFP SPA Support for the following hardware by the Cisco 12000 SIP-501 and Cisco 12000 SIP-601 was introduced on the Cisco 12000 series router: • 2-Port OC-48c/STM-16 POS SPA
12.0(32)SY	Release 12.0(32)SY	June 26, 2006	Support for the following hardware by the Cisco 12000 SIP-401, Cisco 12000 SIP-501 and Cisco 12000 SIP-601 was introduced on the Cisco 12000 series router: • 8-Port Fast Ethernet SPA (SPA-8X1FE-TX-V2) • 1-Port 10-Gigabit Ethernet SPA (SPA-1X10GE-L-V2) • 2-Port Gigabit Ethernet SPA (SPA-2X1GE-V2) • 5-Port Gigabit Ethernet SPA (SPA-5x1GE-V2) • 10-Port Gigabit Ethernet SPA (SPA-10X1GE-V2) • 2-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA • 4-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA • 4-Port OC-3c/STM-1 POS SPA • 8-Port OC-3c/STM-1 POS SPA Support for the following hardware by the Cisco 12000 SIP-501 and Cisco 12000 SIP-601 was introduced on the Cisco 12000 series router: • 8-port OC-12c/STM-4 POS SPA
12.0(32)SY1	Release 12.0(32)SY1	September 12, 2006	Support for the following hardware by the Cisco 12000 SIP-501 and Cisco 12000 SIP-601 was introduced on the Cisco 12000 series router: • 1-Port OC-48c/STM-16 POS SPA

Objectives

This document describes the SPA Interface Processors (SIPs) and shared port adaptors (SPAs) that are supported on the Cisco 12000 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:

Section	Title	Description
Chapter 1	Overview: Cisco 12000 Series Router SPA Interface Processors	Provides a SIP/SPA compatibility summary. For each supported SIP, provides a summary of SIP characteristics and a SIP overview.
Chapter 2	Overview: Cisco 12000 Series Router Shared Port Adapters	For each supported SPA, provides a summary of SPA characteristics and a SPA overview.
Chapter 3	Preparing to Install a SPA Interface Processor or a Shared Port Adapter	Describes the required tools, equipment, and safety guidelines for installing SIPs and SPAs.
Chapter 4	Installing and Removing a SPA Interface Processor	Describes the procedures for installing and removing a SIP on a Cisco 12000 series router.
Chapter 5	Installing and Removing a Shared Port Adapter	Describes the procedures for installing and removing a SPA on a Cisco 12000 series router. It also describes how to verify the SIP and SPA installation.
Chapter 6	Troubleshooting the Installation	Provides information for troubleshooting the installation of SIPs and SPAs. It also describes helpful debug commands and error messages.

Related Documentation

This section refers you to other documentation that also might be useful as you configure your Cisco xxxx series router. The documentation listed below is available online.

- *Cisco 12000 Series Router SIP and SPA Software Configuration Guide (Cisco IOS)*
- *Cisco IOS Release Notes for Cisco 12000 Series Routers*
- *Regulatory Compliance and Safety Information for Cisco 12000 Series Routers*

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Cisco.com

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http://www.cisco.com/en/US/products/products_psirt_rss_feed.html

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- Nonemergencies—psirt@cisco.com

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- 1 408 525-6532

Tip We encourage you to use Pretty Good Privacy (PGP) or a compatible product to encrypt any sensitive information that you send to Cisco. PSIRT can work from encrypted information that is compatible with PGP versions 2.*x* through 8.*x*.

Never use a revoked or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one linked in the Contact Summary section of the Security Vulnerability Policy page at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

The link on this page has the current PGP key ID in use.

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http://tools.cisco.com/RPF/register/register.do

Note Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support & Documentation website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

http://www.cisco.com/techsupport/servicerequest

For S1 or S2 service requests or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)
EMEA: +32 2 704 55 55
USA: 1 800 553-2447

For a complete list of Cisco TAC contacts, go to this URL:

http://www.cisco.com/techsupport/contacts

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—Your network is “down,” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

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Severity 3 (S3)—Operational performance of your network is impaired, but most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

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  or view the digital edition at this URL:

  http://ciscoiq.texterity.com/ciscoiq/sample/

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CHAPTER 1

Overview: Cisco 12000 Series Router SPA Interface Processors

Release 12.0(32)SY1, OL-8831-01, Rev. G6, July 19, 2007

This chapter describes the SPA interface processors (SIPs) that are supported on the Cisco 12000 series router and contains the following sections:

SIP and SPA Compatibility

Table 1-1 shows the SPAs that are supported on the Cisco 12000 series router and the SIPs that support them:

Table 1-1 SIP and SPA Compatibility on the Cisco 12000 Series Router

	SIP Type			
SPA	**2.5G ISE SIP**	**2.5G SIP**	**5G SIP**	**10G SIP**
2-Port T3/E3 Serial SPA	X	X	X	X
8-Port Channelized T1/E1 SPA		X	X	X
4-Port Clear Channel T3/E3 SPA	X	X	X	X
2-Port Channelized T3 SPA	X	X	X	X
4-Port Channelized T3 SPA	X	X	X	X
8-Port FastEthernet SPA		X	X	X
2-Port Gigabit Ethernet SPA		X	X	X

Table 1-1 SIP and SPA Compatibility on the Cisco 12000 Series Router (continued)

	SIP Type			
SPA	**2.5G ISE SIP**	**2.5G SIP**	**5G SIP**	**10G SIP**
1-Port 10-Gigabit Ethernet SPA				X
5-Port Gigabit Ethernet SPA			X	X
10-Port Gigabit Ethernet SPA				X
1-Port Channelized STM-1/OC-3 SPA		X	X	X
1-Port OC-48c/STM-16 POS SPA			X	X
2-Port OC48-POS/RPR SPA			X	X
1-Port OC-192c/STM-64 POS/RPR SPA				X
2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA		X	X	X

Router Hardware Installation

For Cisco 12000 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

SIPs are supported on all Cisco 12000 series routers. The 2.5G ISE SIP is supported on the Cisco 12016, 124xx, and 128xx routers. The Cisco 12000 SIP-401, the Cisco 12000 SIP-501, the Cisco 12000 SIP-600, and the Cisco 12000 SIP-601are supported on the Cisco 124xx and 128xx routers.

Note To support the requirements of this line card, the Cisco 12000 series router must have at least one clock and scheduler card (CSC) installed. For additional information, refer to the installation and configuration guide for your Cisco 12000 series router.

Power Management

Different types of power supplies are used in Cisco 12000 series routers. The chassis power supply configuration may cause limitations on the number of SPAs that can be installed in the chassis. If the number of SPAs installed in the chassis draw more power than the power supply configuration supports, the console displays a warning indicating that the configured power supply budget has been exceeded.

Power management is described in the Cisco 12000 series router chassis installation guides. Please refer to the chassis installation guide for your router for information about power management.

SIP Summary

Summary descriptions of all SIPs supported on the Cisco 12000 series router are shown in Table 1-2.

Table 1-2 SIP Summary

SIP	Product Number	Description	Number of Supported SPAs	Engine Type
Cisco 12000 SIP-400	12000-SIP-400	2.5G ISE SPA Interface Processor	4 single-width, single-height	Engine 3 (ISE)
Cisco 12000 SIP-600	12000-SIP-600	10G Engine 5 SPA Interface Processor	2 single-width, double-height 2 single-width, single-height[1] 1 dual-width, double-height[2]	Engine 5
Cisco 12000 SIP-401	12000-SIP-401	2.5G Engine 5 SPA Interface Processor	2 single-width, double-height 4 single-width, single-height 1 dual-width, double-height	Engine 5
Cisco 12000 SIP-501	12000-SIP-501	5G Engine 5 SPA Interface Processor	2 single-width, double-height 4 single-width, single-height 1 dual-width, double-height	Engine 5
Cisco 12000 SIP-601	12000-SIP-601	10G Engine 5 SPA Interface Processor	2 single-width, double-height 4 single-width, single-height 1 dual-width, double-height	Engine 5

1. Requires that a blank module filler plate be installed in the bottom subslot.
2. Requires the removal of the central septum between the SPA subslots.

SIP Software and Hardware Compatibility

For software configuration information, refer to the Cisco IOS software configuration and command reference publications for the installed Cisco IOS release. Also refer to the Cisco IOS software release notes for additional information. Table 1-3 lists the Cisco IOS 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 diags** *slot-number* command. Table 1-3 lists the hardware revision number for all supported SIPs.

Table 1-3 SIP Hardware and Software Compatibility

SIP	Part Number	Minimum Cisco IOS Software Release	Minimum Hardware Revision
Cisco 12000 SIP-400	12000-SIP-400	12.0(31)S	
Cisco 12000 SIP-600	12000-SIP-600	12.0(31)S	

Table 1-3 SIP Hardware and Software Compatibility

SIP	Part Number	Minimum Cisco IOS Software Release	Minimum Hardware Revision
Cisco 12000 SIP-401	12000-SIP-401	12.0(32)S	1.0
Cisco 12000 SIP-501	12000-SIP-501	12.0(32)S	1.0
Cisco 12000 SIP-601	12000-SIP-601	12.0(32)S	1.0

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

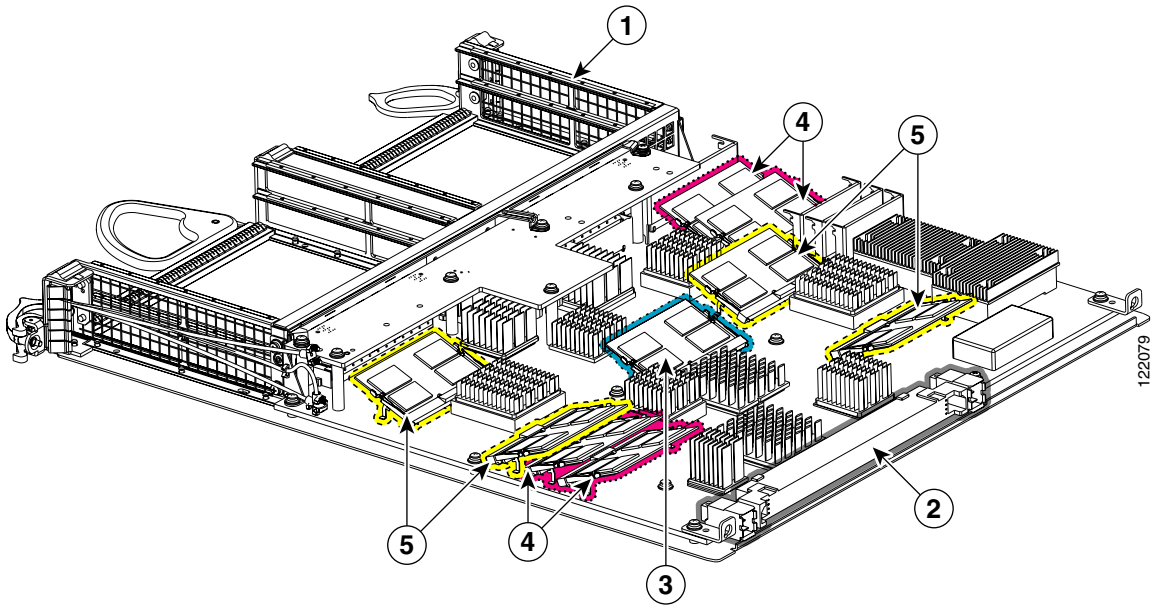
Cisco 12000 SIP-400 Overview

The following sections describe the Cisco 12000 SIP-400:

Cisco 12000 SIP-400 Board Components

The main Cisco 12000 SIP-400 board components are shown in Figure 1-1. Board reference designators are indicated after the board component name.

Figure 1-1 Cisco 12000 SIP-400 Board—Rear View

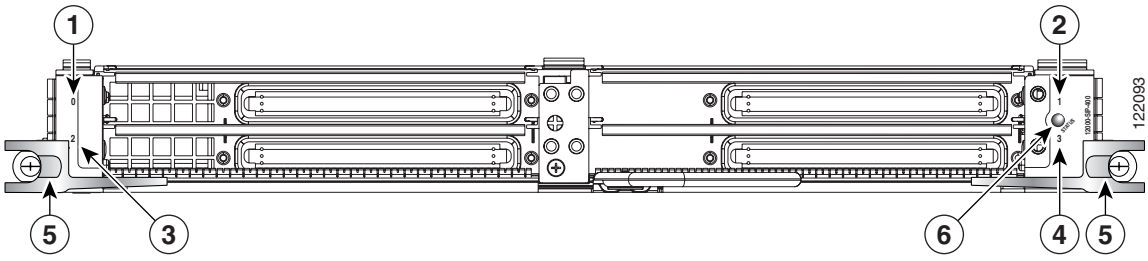


1	SPA enclosure	**4**	Four packet memory SODIMM sockets (not field serviceable)
2	Backplane connector	**5**	Four TLU/PLU memory SODIMM sockets (not field serviceable)
3	Route memory SODIMM		

Cisco 12000 SIP-400 LEDs

The Cisco 12000 SIP-400 has one LED, as shown in Figure 1-2.

Figure 1-2 Cisco 12000 SIP-400 Face Plate



1	SPA subslot 0	**4**	SPA subslot 3
2	SPA subslot 1	**5**	Ejector Levers
3	SPA subslot 2	**6**	Status LED

The Cisco 12000 SIP-400 LEDs are described in Table 1-4.

Table 1-4 Cisco 12000 SIP-400 LED

LED Label	Color	State	Meaning
Status	Yellow	On	IOS is loaded and SIP is ready to be enabled.
	Green	On	SIP is active.

Cisco 12000 SIP-400 Physical Specifications

The Cisco 12000 SIP-400 physical specifications are shown in the following table.

Table 1-5 Cisco 12000 SIP-400 Physical Specifications

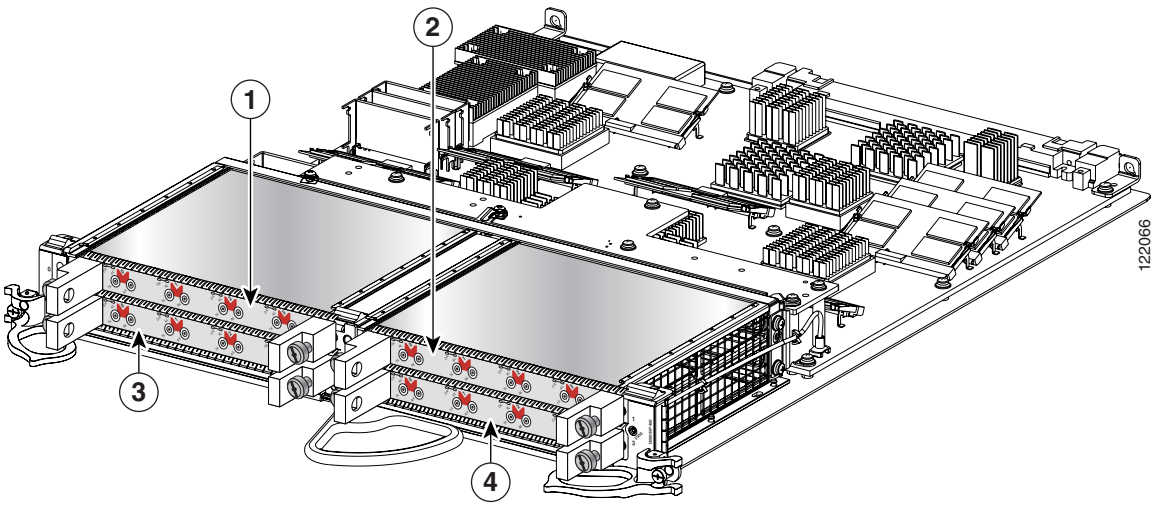
Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10 kg
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

SPA Slot Numbering on the Cisco 12000 SIP-400

The Cisco 12000 SIP-400 accepts 4 single-width, single-height SPAs.

Figure 1-3 shows a Cisco 12000 SIP-400 with 4 SPAs installed. The top leftmost SPA slot is subslot 0; the top rightmost SPA slot is subslot 1; the bottom leftmost SPA slot is subslot 2; the bottom rightmost SPA slot is subslot 3.

Figure 1-3 Cisco 12000 SIP-400 with SPAs Installed

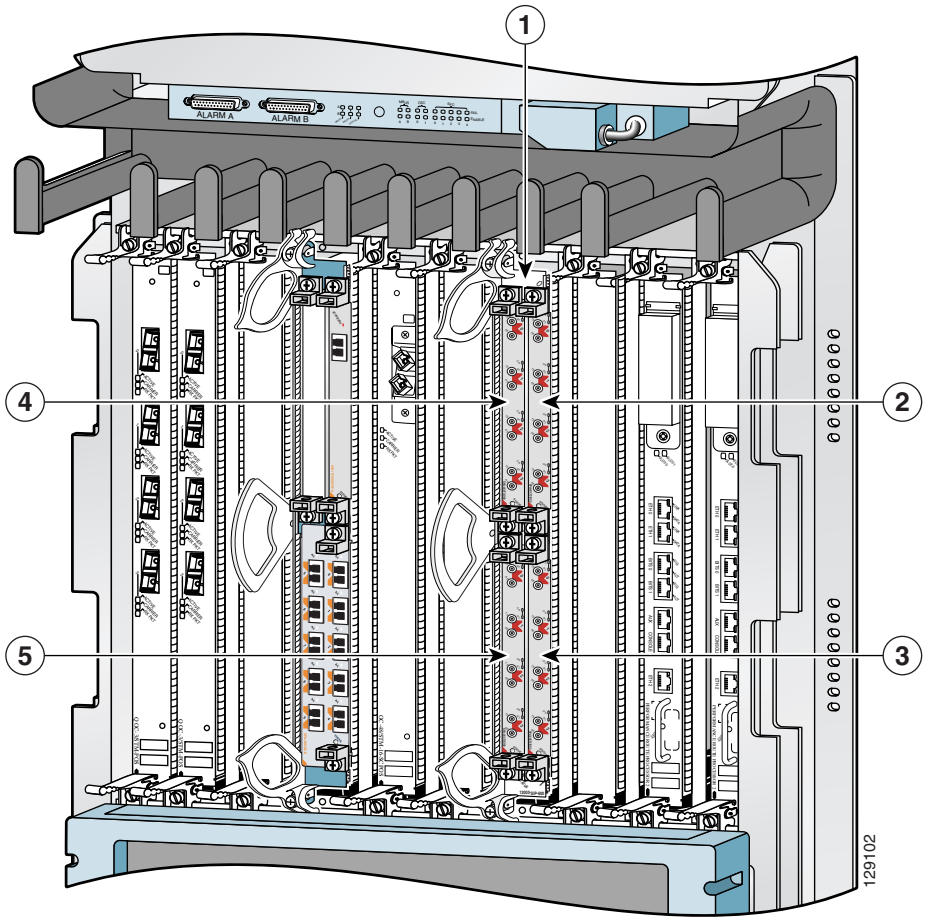


1	SPA subslot 0	**3**	SPA subslot 2
2	SPA subslot 1	**4**	SPA subslot 3

SPA Interface Addresses on the Cisco 12000 SIP-400

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco 12000 SIP-400 has four subslots. A 4-port SPA would have ports 0 to 3. For example, the interface address of the second port on a 4-port SPA located in the first SIP subslot, where the SIP is inserted into router line card slot 6 is 6/0/1.

Figure 1-4 Cisco 12000 Series Router with Cisco 12000 SIP-400 Installed



1	Router slot number 6	**4**	SPA subslot 2 with ports 6/2/0 to 6/2/3
2	SPA subslot 0 with ports 6/0/0 to 6/0/3	**5**	SPA subslot 3 with ports 6/3/0 to 6/3/3
3	SPA subslot 1 with ports 6/1/0 to 6/1/3		

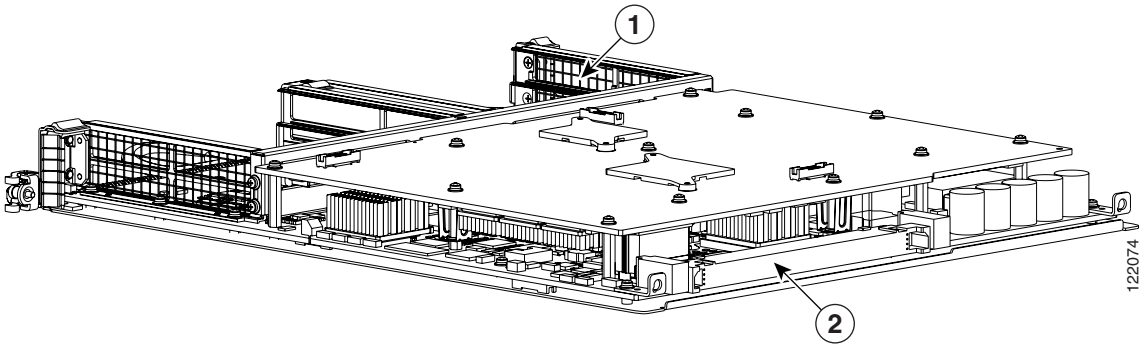
Cisco 12000 SIP-600 Overview

The following sections describe the Cisco 12000 SIP-600:

Cisco 12000 SIP-600 Board Components

The main Cisco 12000 SIP-600 board components are shown in Figure 1-5.

Figure 1-5 Cisco 12000 SIP-600 Board—Rear View

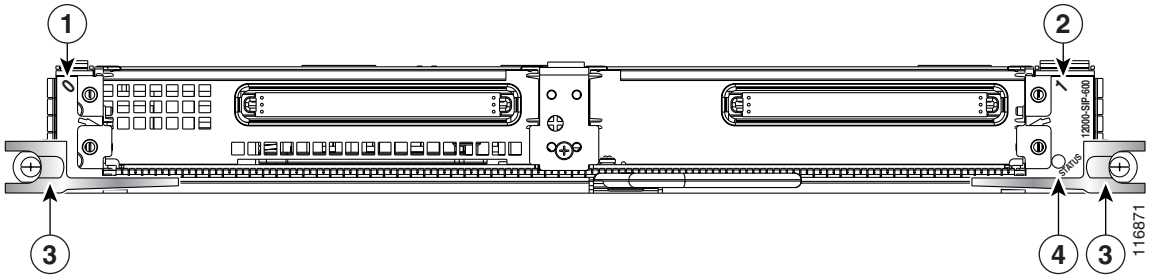


1	SPA enclosure	**2**	Backplane connector

Cisco 12000 SIP-600 LEDs

The Cisco 12000 SIP-600 supports 2 single-width, double-height SPAs, 2 single-width, single-height SPAs, or 1 dual-width, double-height SPA. The Cisco 12000 SIP-600 face plate has one Status LED. Figure 1-6 shows the Cisco 12000 SIP-600 face plate with 2 single-width, single-height SPAs.

Figure 1-6 Cisco 12000 SIP-600 Face Plate



1	SPA subslot 0	**3**	Ejector Levers
2	SPA subslot 1	**4**	Status LED

The Cisco 12000 SIP-600 LEDs are described in Table 1-6.

Table 1-6 Cisco 12000 SIP-600 LEDs

LED Label	Color	State	Meaning
Status	Yellow	On	SIP is powered and IOS is loading.
	Green	On	SIP is active.

Cisco 12000 SIP-600 Physical Specifications

The Cisco 12000 SIP-600 physical specifications are shown in the following table.

Table 1-7 Cisco 12000 SIP-600 Physical Specifications

Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10kg
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 12000 SIP-600

The Cisco 12000 SIP-600 accepts 2 single-width SPAs or 1 dual-width SPA.

Figure 1-7 shows a Cisco 12000 SIP-600 with 2 SPAs installed. The left SPA slot is subslot 0 and the right SPA slot is subslot 1. If one dual-width SPA is installed, it is recognized as being in subslot 0.

Figure 1-7 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

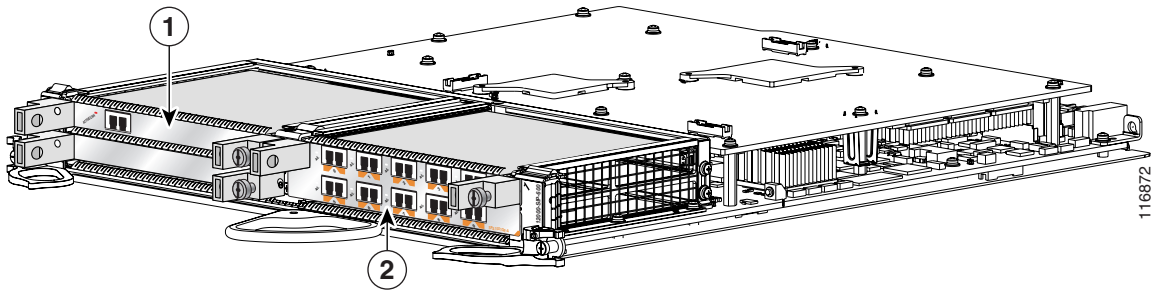


Table 1-8 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Subslot 0
2	Subslot 1

SPA Interface Addresses on the Cisco 12000 SIP-600

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco 12000 SIP-600 has two subslots 0 (left) and 1 (right). For example, the interface address of a 1-port SPA located in the second SIP subslot, where the SIP is inserted into router line card slot 3 is 3/1/0. Figure 1-8 shows the slot, subslot, and port locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

Figure 1-8 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

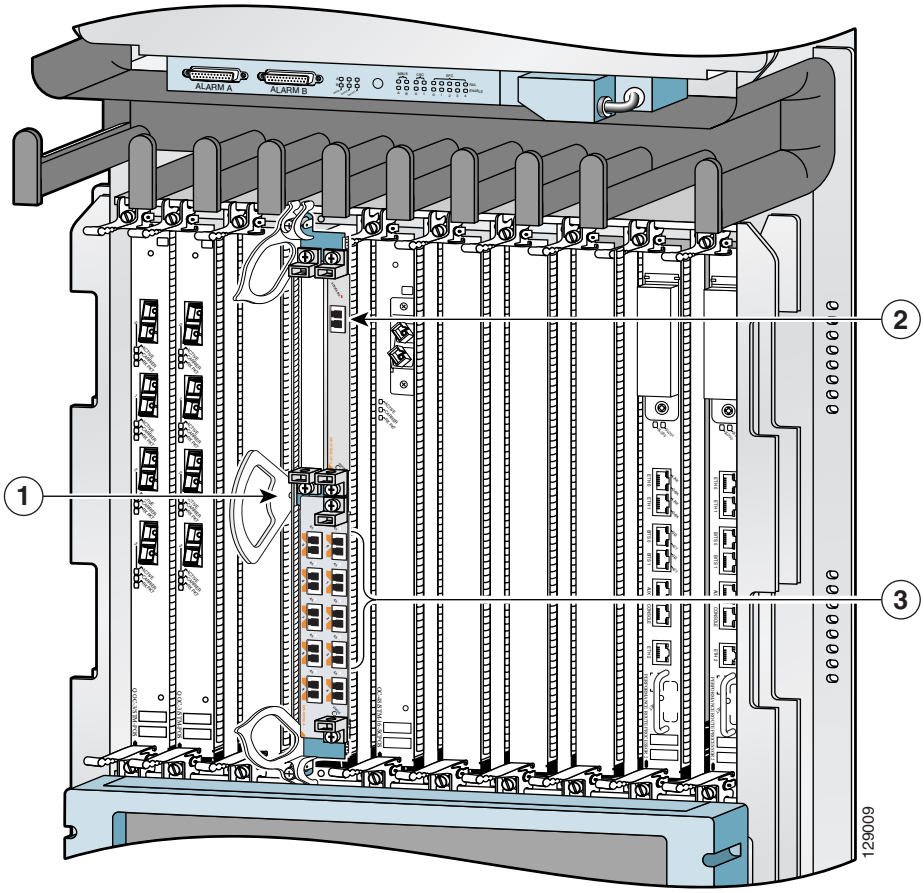


Table 1-9 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Slot 3
2	Subslot 0, Port 3/0/0
3	Subslot 1, Ports 3/1/0 to 3/1/9

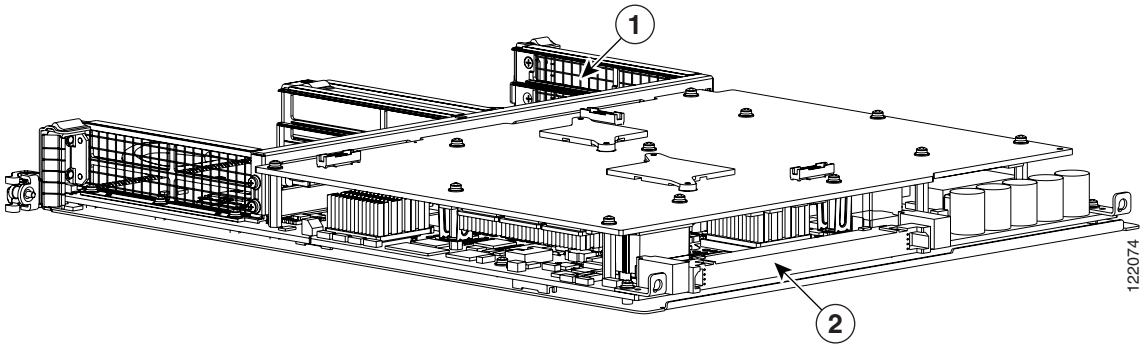
Cisco 12000 SIP-401 Overview

The following sections describe the Cisco 12000 SIP-401:

Cisco 12000 SIP-401 Board Components

The main Cisco 12000 SIP-501 board components are shown in Figure 1-9.

Figure 1-9 Cisco 12000 SIP-401 Board—Rear View

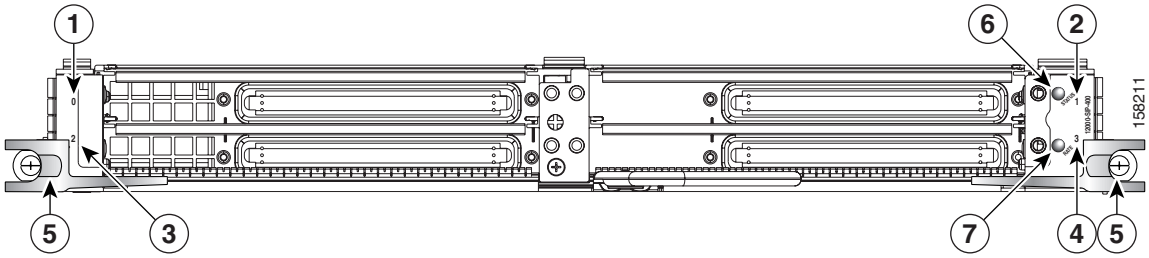


1	SPA enclosure	2	Backplane connector

Cisco 12000 SIP-401 LEDs

The Cisco 12000 SIP-401 has two LEDs, as shown in Figure 1-10.

Figure 1-10 Cisco 12000 SIP-401 Face Plate



1	SPA subslot 0	**5**	Ejector Levers
2	SPA subslot 1	**6**	Status LED
3	SPA subslot 2	**7**	Rate LED
4	SPA subslot 3		

The Cisco 12000 SIP-401 LEDs are described in Table 1-10.

Table 1-10 Cisco 12000 SIP-401 LED

LED Label	Color	State	Meaning
Status	Yellow	On	IOS is loaded and SIP is ready to be enabled.
	Green	On	SIP is active.
Rate	Off	Off	SIP is SIP-401 or SIP-501.
	Green	On	SIP is SIP-601.

Cisco 12000 SIP-401 Physical Specifications

The Cisco 12000 SIP-401 physical specifications are shown in the following table.

Table 1-11 Cisco 12000 SIP-401 Physical Specifications

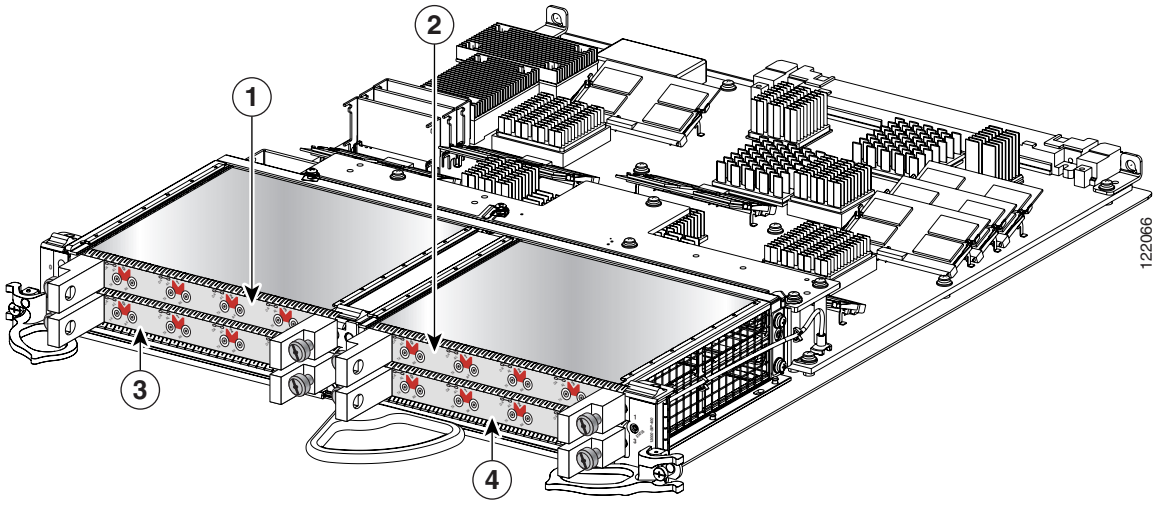
Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10 kg
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

SPA Slot Numbering on the Cisco 12000 SIP-401

The Cisco 12000 SIP-401 accepts 4 single-width, single-height SPAs.

Figure 1-11 shows a Cisco 12000 SIP-401 with 4 SPAs installed. The top leftmost SPA slot is subslot 0; the top rightmost SPA slot is subslot 1; the bottom leftmost SPA slot is subslot 2; the bottom rightmost SPA slot is subslot 3.

Figure 1-11 Cisco 12000 SIP-401 with SPAs Installed

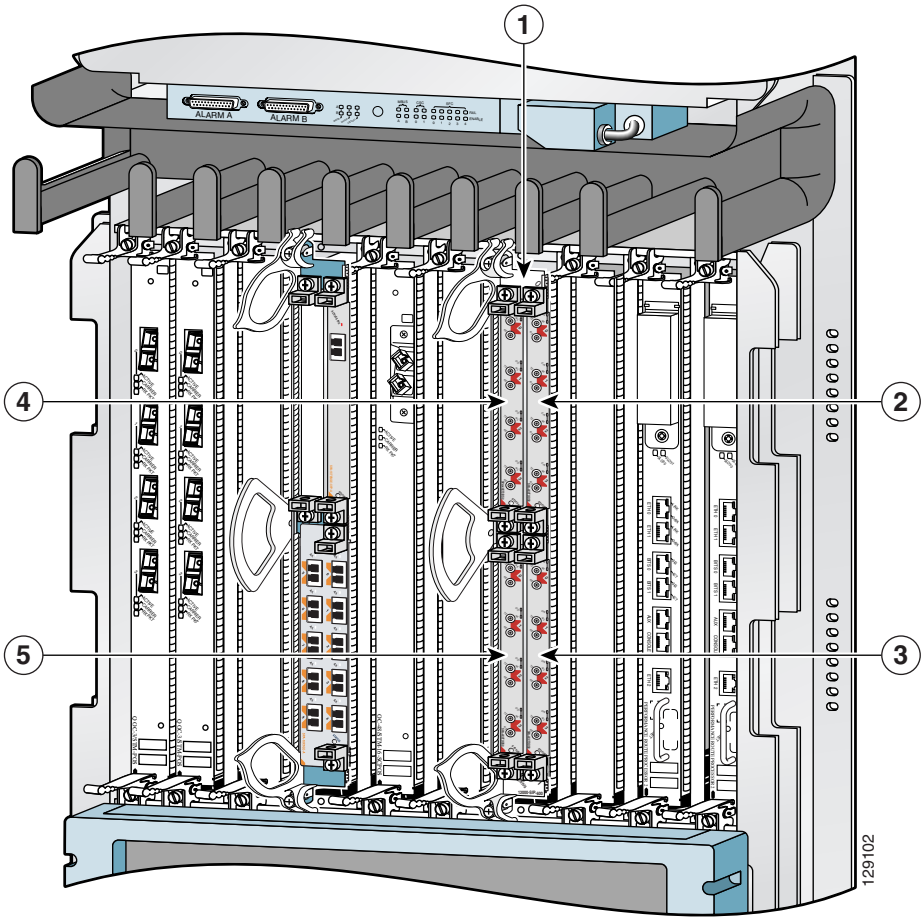


1	SPA subslot 0	**3**	SPA subslot 2
2	SPA subslot 1	**4**	SPA subslot 3

SPA Interface Addresses on the Cisco 12000 SIP-401

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco 12000 SIP-401 has four subslots. A 4-port SPA would have ports 0 to 3. For example, the interface address of the second port on a 4-port SPA located in the first SIP subslot, where the SIP is inserted into router line card slot 6 is 6/0/1.

Figure 1-12 Cisco 12000 Series Router with Cisco 12000 SIP-401 Installed



1	Router slot number 6	**4**	SPA subslot 2 with ports 6/2/0 to 6/2/3
2	SPA subslot 0 with ports 6/0/0 to 6/0/3	**5**	SPA subslot 3 with ports 6/3/0 to 6/3/3
3	SPA subslot 1 with ports 6/1/0 to 6/1/3		

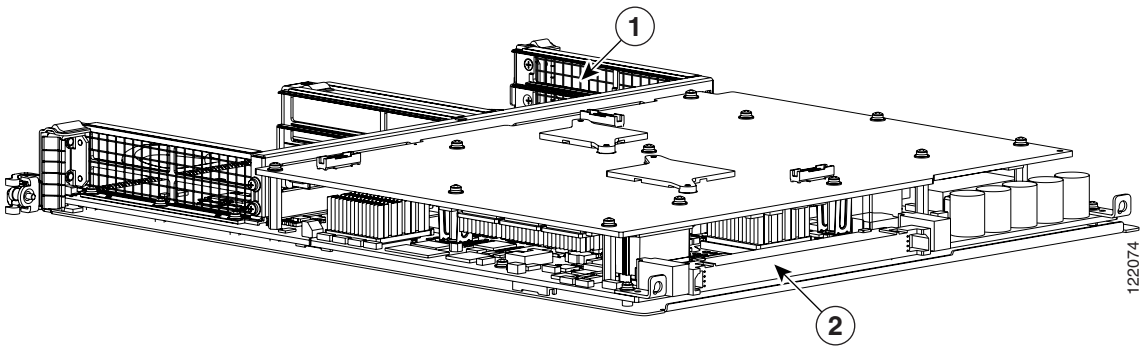
Cisco 12000 SIP-501 Overview

The following sections describe the Cisco 12000 SIP-501:

Cisco 12000 SIP-501 Board Components

The main Cisco 12000 SIP-501 board components are shown in Figure 1-13.

Figure 1-13 Cisco 12000 SIP-501 Board—Rear View



1	SPA enclosure	**2**	Backplane connector

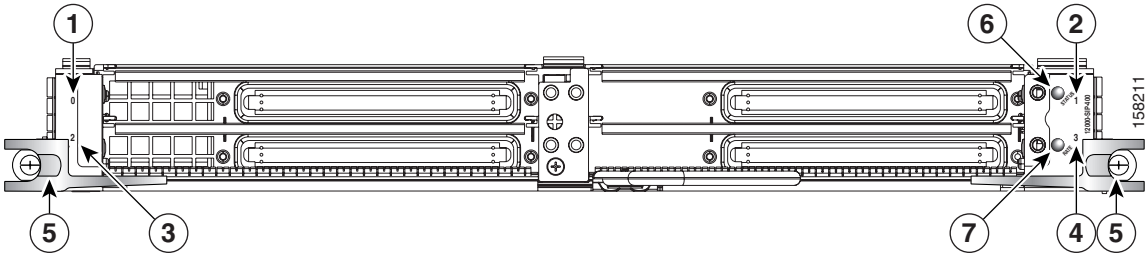
Cisco 12000 SIP-501 LEDs

The Cisco 12000 SIP-501 supports 4 single-height SPAs (the aggregate throughput should not exceed 2 full-rate SPAs); 2 double-height SPAs; 1 dual-width, double-height SPA, or a combination of single-height and double-height SPAs.

The interconnect between a SIP and a SPA can operate at either 2.5Gbps or 10Gbps. If the maximum capacity of a SPA is greater than 2.5Gbps the interconnect operates at 10Gbps and the SPA is a "full-rate" SPA. If the maximum capacity of a SPA is 2.5Gbps or less the interconnect operates at 2.5Gbps and the SPA is a "quarter-rate" SPA. The Cisco 12000 SIP-501 can support up to two full-rate SPAs, or one full-rate and three quarter-rate SPAs or four quarter-rate SPAs.

The Cisco 12000 SIP-501 face plate has one Status LED. Figure 1-14 shows the Cisco 12000 SIP-501 face plate with 4 single-width, single-height SPAs.

Figure 1-14 Cisco 12000 SIP-501 Face Plate



1	SPA subslot 0	**5**	Ejector Levers

2	SPA subslot 1	**6**	Status LED
3	SPA subslot 2	**7**	Rate LED
4	SPA subslot 3		

The Cisco 12000 SIP-501 LEDs are described in Table 1-12.

Table 1-12 Cisco 12000 SIP-501 LEDs

LED Label	Color	State	Meaning
Status	Yellow	On	SIP is powered and IOS is loading.
	Green	On	SIP is active.
Rate	Off	Off	SIP is SIP-401 or SIP-501.
	Green	On	SIP is SIP-601.

Cisco 12000 SIP-501 Physical Specifications

The Cisco 12000 SIP-501 physical specifications are shown in the following table.

Table 1-13 Cisco 12000 SIP-501 Physical Specifications

Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10kg
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 12000 SIP-501

The Cisco 12000 SIP-501 accepts up to 4 single-width SPAs or 1 dual-width SPA.

Figure 1-15 shows a Cisco 12000 SIP-501 with 2 SPAs installed. The left SPA slot is subslot 0 and the right SPA slot is subslot 1. If one dual-width SPA is installed, it is recognized as being in subslot 0.

Figure 1-15 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

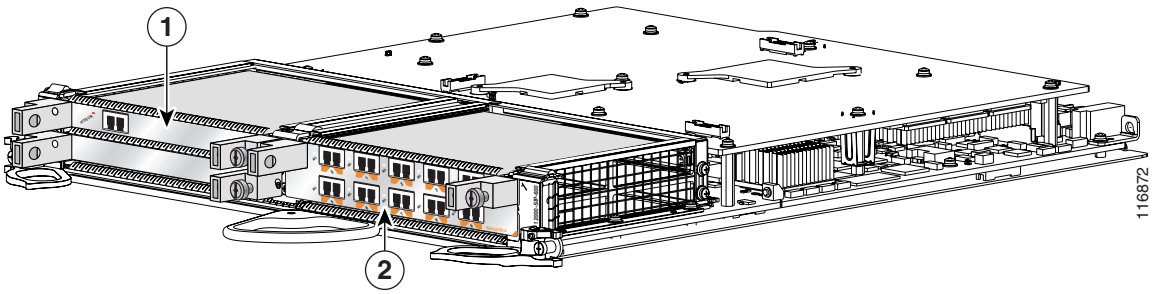


Table 1-14 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Subslot 0
2	Subslot 1

SPA Interface Addresses on the Cisco 12000 SIP-501

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco 12000 SIP-601 has two subslots 0 (left) and 1 (right). For example, the interface address of a 1-port SPA located in the second SIP subslot, where the SIP is inserted into router line card slot 3 is 3/1/0. Figure 1-16 shows the slot, subslot, and port locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

Figure 1-16 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

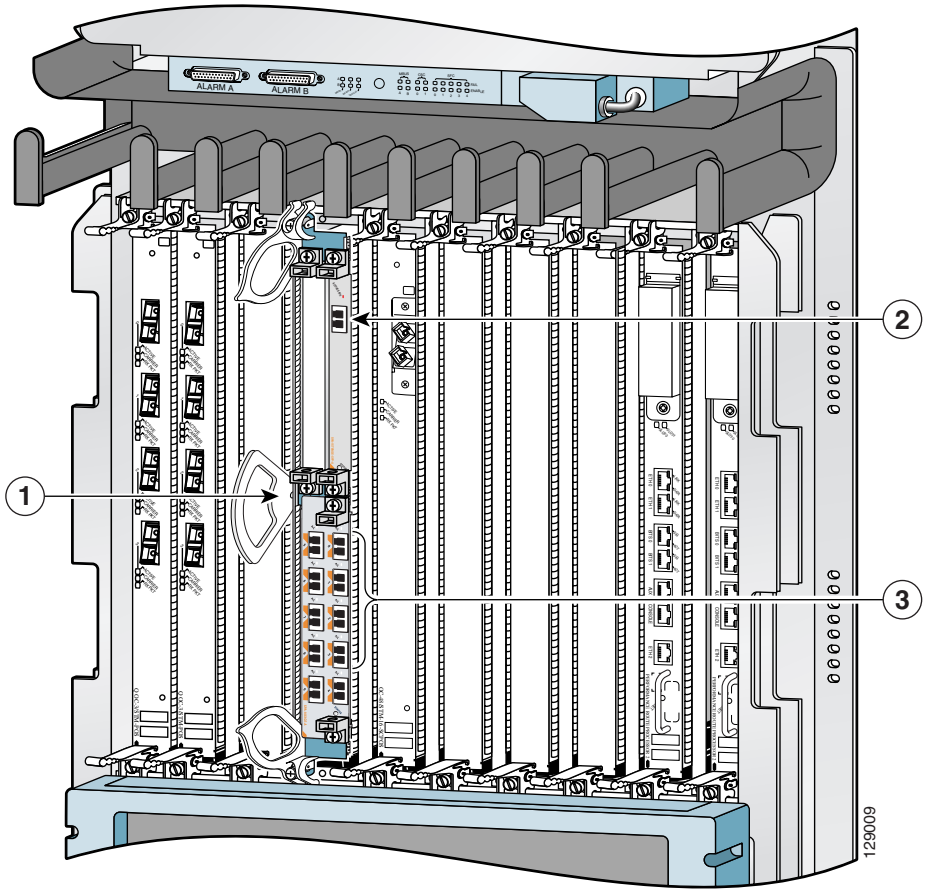


Table 1-15 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Slot 3
2	Subslot 0, Port 3/0/0
3	Subslot 1, Ports 3/1/0 to 3/1/9

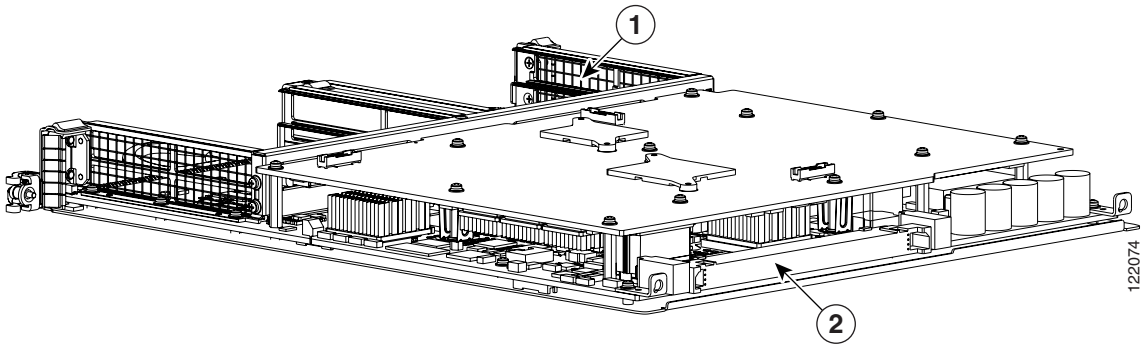
Cisco 12000 SIP-601 Overview

The following sections describe the Cisco 12000 SIP-601:

Cisco 12000 SIP-601 Board Components

The main Cisco 12000 SIP-601 board components are shown in Figure 1-17.

Figure 1-17 Cisco 12000 SIP-601 Board—Rear View



1	SPA enclosure	2	Backplane connector

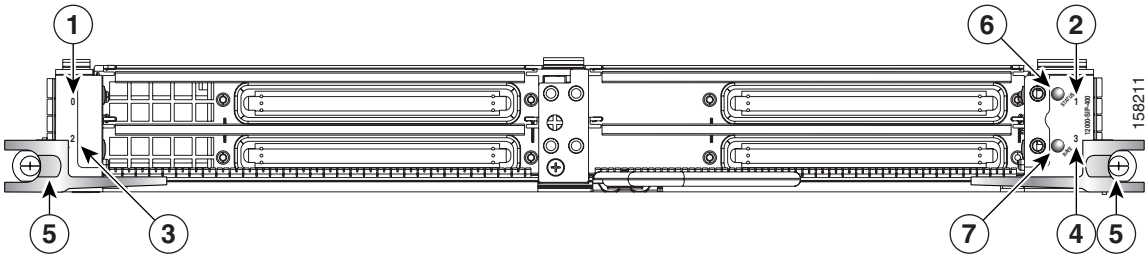
Cisco 12000 SIP-601 LEDs

The Cisco 12000 SIP-601 supports 4 single-height SPAs (the aggregate throughput should not exceed 2 full-rate SPAs); 2 double-height SPAs; 1 dual-width, double-height SPA, or a combination of single-height and double-height SPAs.

The interconnect between a SIP and a SPA can operate at either 2.5Gbps or 10Gbps. If the maximum capacity of a SPA is greater than 2.5Gbps the interconnect operates at 10Gbps and the SPA is a "full-rate" SPA. If the maximum capacity of a SPA is 2.5Gbps or less the interconnect operates at 2.5Gbps and the SPA is a "quarter-rate" SPA. The Cisco 12000 SIP-601 can support up to two full-rate SPAs, or one full-rate and three quarter-rate SPAs or four quarter-rate SPAs.

The Cisco 12000 SIP-601 face plate has one Status LED. Figure 1-18 shows the Cisco 12000 SIP-601 face plate with 2 single-width, single-height SPAs.

Figure 1-18 Cisco 12000 SIP-601 Face Plate



1	SPA subslot 0	**5**	Ejector Levers
2	SPA subslot 1	**6**	Status LED
3	SPA subslot 2	**7**	Rate LED
4	SPA subslot 3		

The Cisco 12000 SIP-601 LEDs are described in Table 1-16.

Table 1-16 Cisco 12000 SIP-601 LEDs

LED Label	Color	State	Meaning
Status	Yellow	On	SIP is powered and IOS is loading.
	Green	On	SIP is active.
Rate	Off	Off	SIP is SIP-401 or SIP-501.
	Green	On	SIP is SIP-601.

Cisco 12000 SIP-601 Physical Specifications

The Cisco 12000 SIP-601 physical specifications are shown in the following table.

Table 1-17 Cisco 12000 SIP-601 Physical Specifications

Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10kg
Operating temperature	32 to 104°F (0 to 40°C)

Table 1-17 Cisco 12000 SIP-601 Physical Specifications

Description	Specifications
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

SPA Subslot Numbering on the Cisco 12000 SIP-601

The Cisco 12000 SIP-601 accepts 4 single-height SPAs (the aggregate throughput should not exceed 2 full-rate SPAs); 2 double-height SPAs; 1 dual-width, double-height SPA, or a combination of single-height and double-height SPAs.

Figure 1-19 shows a Cisco 12000 SIP-601 with 2 SPAs installed. The left SPA slot is subslot 0 and the right SPA slot is subslot 1. If one dual-width SPA is installed, it is recognized as being in subslot 0.

Figure 1-19 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

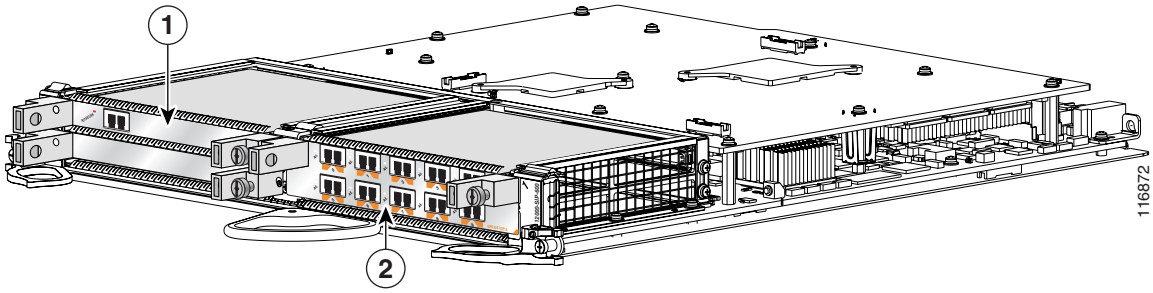


Table 1-18 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Subslot 0
2	Subslot 1

SPA Interface Addresses on the Cisco 12000 SIP-601

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco 12000 SIP-601 has two subslots 0 (left) and 1 (right). For example, the interface address of a 1-port SPA located in the second SIP subslot, where the SIP is inserted into router line card slot 3 is 3/1/0. Figure 1-20 shows the slot, subslot, and port locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

Figure 1-20 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

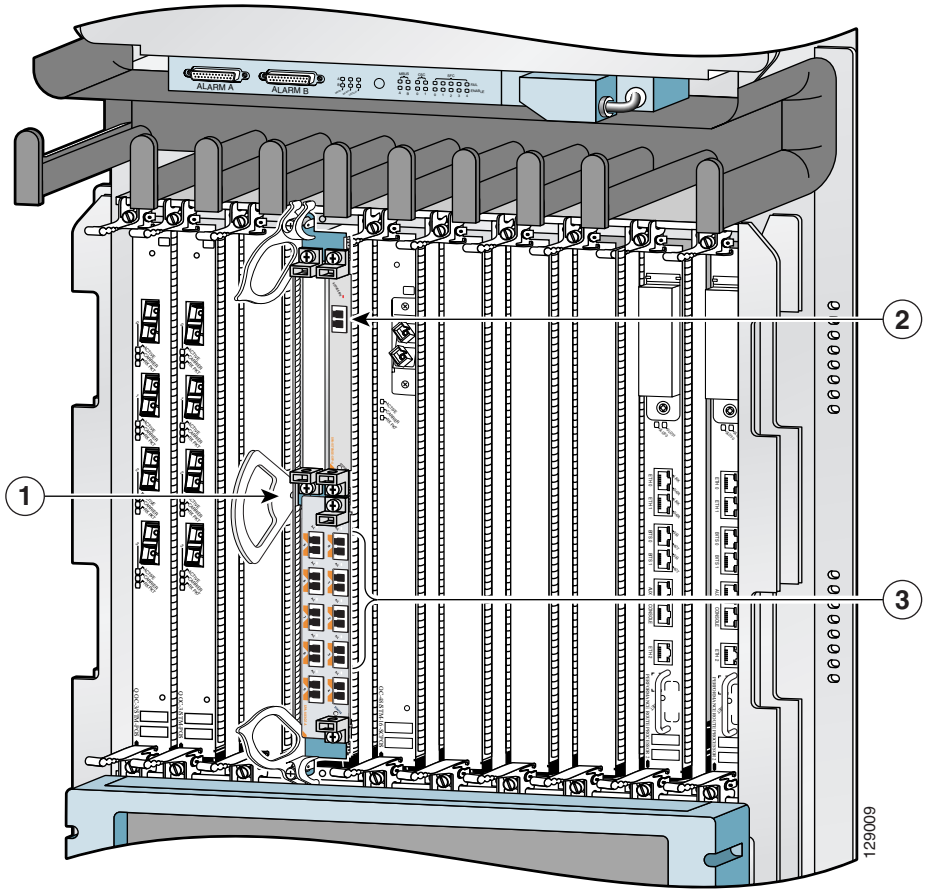


Table 1-19 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Slot 3
2	Subslot 0, Port 3/0/0
3	Subslot 1, Ports 3/1/0 to 3/1/9

CHAPTER 2

Overview: Cisco 12000 Series Router Shared Port Adapters

Release 12.0(32)SY1, OL-8831-01, Rev. G6, July 19, 2007

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

SPA Summary

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

Table 2-1 SPA Summary

Product Number	Description	Number of Ports	Minimum IOS Release	Minimum Hardware Revision
SPA-2XT3/E3	2-Port Clear Channel T3/E3 SPA	2	12.0(31)S	1.0
SPA-4XT3/E3	4-Port T3/E3 Serial SPA	4	12.0(31)S	1.0
SPA-2XCT3/DS0	2-Port Channelized T3 SPA	2	12.0(31)S	1.0
SPA-4XCT3/DS0	4-Port Channelized T3 SPA	4	12.0(31)S	1.0
SPA-8XCHT1/E1	8-Port Channelized T1/E1 SPA	8	12.0(32)S	1.0
SPA-8XFE	8-Port Fast Ethernet SPA	8	12.0(32)S	1.0
SPA-8X1FE-TX-V2	8-Port Fast Ethernet SPA	8	12.0(32)SY	1.0
SPA-1XTENGE-XFP	1-Port 10-Gigabit Ethernet SPA	1	12.0(31)S	1.0
SPA-1X10GE-L-V2	1-Port 10-Gigabit Ethernet SPA	1	12.0(32)SY	1.0
SPA-1XGE	1-Port Gigabit Ethernet SPA	1	12.0(32)S	1.0
SPA-2XGE	2-Port Gigabit Ethernet SPA	2	12.0(32)S	1.0
SPA-2X1GE-V2	2-Port Gigabit Ethernet SPA	2	12.0(32)SY4	1.0
SPA-5XGE	5-Port Gigabit Ethernet SPA	5	12.0(31)S	1.0
SPA-5XGE-V2	5-Port Gigabit Ethernet SPA	5	12.0(32)SY	1.0
SPA-10XGE	10-Port Gigabit Ethernet SPA	10	12.0(31)S	1.0
SPA-10X1GE-V2	10-Port Gigabit Ethernet SPA	10	12.0(32)SY	1.0
SPA-OC3POS	1-Port Channelized OC-3/STM-1 SPA	1	12.0(31)S	1.0
SPA-OC48POS	1-Port OC-48c/STM-16 POS SPA	1	12.0(32)SY1	1.0
SPA-OC192POS	1-Port OC-192c/STM-64 POS SPA	1	12.0(31)S	1.0
SPA-OC192POS	1-Port OC-192c/STM-64 POS/RPR XFP SPA	1	12.0(31)S	1.0
SPA-2XOC48POS	2-Port OC48-POS/RPR SPA	2	12.0(31)S2	1.0
SPA-2XOC12-POS	2-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA	2	12.0(32)SY	1.0
SPA-4XOC12-POS	4-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA	4	12.0(32)SY	1.0
SPA-8XOC12-POS	8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA	8	12.0(32)SY	1.0
SPA-4XOC3-POS-V2	4-Port OC-3c/STM-1 POS SPA	4	12.0(32)SY	1.0
SPA-8XOC3-POS	8-Port OC-3c/STM-1 POS SPA	8	12.0(32)SY	1.0

Checking Hardware and Software Compatibility

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

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

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

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

Bandwidth Oversubscription

Oversubscribing the bandwidth limit recommendations of a router can result in decreased or degraded performance. For this reason, it is important to determine the amount of bandwidth used by the SPAs on the router and verify that the total bandwidth used by all SPAs does not exceed the recommended bandwidth limit of the router.

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

Table 2-2 SPA Bandwidth Capacity

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
2-Port Channelized T3 SPA	44.736 Mbps	2	89.47 Mbps
4-Port Channelized T3 SPA	44.736 Mbps	4	178.94 Mbps
2-Port Clear Channel T3/E3 SPA	44.736 Mbps (T3) 34.368 Mbps (E3)	2	89.47 Mbps (T3) 68.74 Mbps (E3)
4-Port Clear Channel T3/E3 SPA	44.736 Mbps (T3) 34.368 Mbps (E3)	4	178.94 Mbps (T3) 137.47 Mbps (E3)
8-Port Channelized T1/E1 SPA	1.544 Mbps (T1) 2.048 Mbps (E1)	8	12.35 Mbps (T1) 16.38 Mbps (E1)
1-Port 10-Gigabit Ethernet SPA	10 Gbps	1	10 Gbps
2-Port Gigabit Ethernet SPA	1 Gbps	2	2 Gbps
5-Port Gigabit Ethernet SPA	1 Gbps	5	5 Gbps
10-Port Gigabit Ethernet SPA	1 Gbps	10	10 Gbps
1-Port OC-48c/STM-16 POS SPA	2.488 Gbps	1	2.488 Gbps
1-Port OC-192c/STM-64 POS SPA	9.953 Gbps	1	9.953 Gbps
2-Port OC48-POS/RPR SPA	2.488 Gbps	2	4.976 Gbps
2-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA	155.52 Mbps or 622.08 Mbps	2	1.244 Gbps
4-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA	155.52 Mbps or 622.08 Mbps	4	2.488 Gbps
8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA	155.52 Mbps or 622.08 Mbps	8	5 Gbps[1]

Table 2-2 SPA Bandwidth Capacity (continued)

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
4-Port OC-3c/STM-1 POS SPA	155.52 Mbps	4	622.08 Mbps
8-Port OC-3c/STM-1 POS SPA	155.52 Mbps	8	1.244 Gbps

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

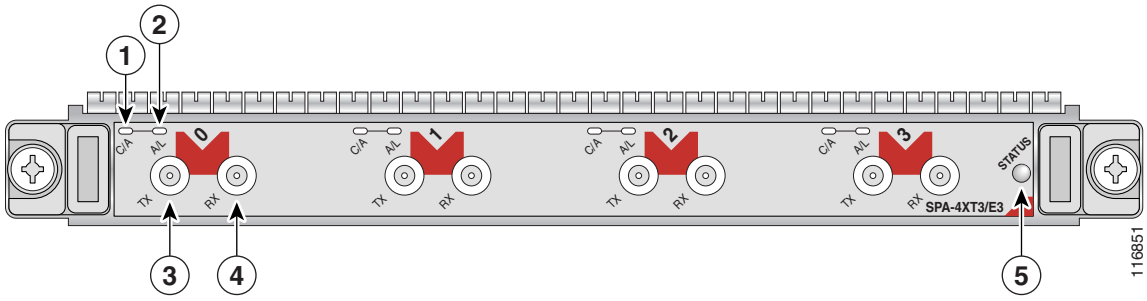
2-Port and 4-Port T3/E3 Serial SPA Overview

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

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

The 2-Port and 4-Port Clear Channel T3/E3 SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 2-1 shows an example of these LEDs on a 4-Port Clear Channel T3/E3 SPA.

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



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

The 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs are described in Table 2-3.

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

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid E3 or T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, 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 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 (44.2/34.0 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 RG-59 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.

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

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

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

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

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

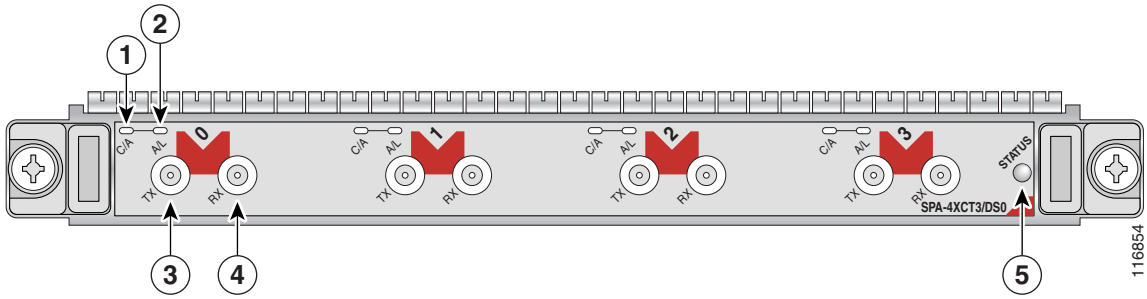
2-Port and 4-Port Channelized T3 to DS0 SPA Overview

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

2-Port and 4-Port Channelized T3 SPA LEDs

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

Figure 2-2 4-Port Channelized T3 SPA Faceplate



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

The 2-Port and 4-Port Channelized T3 SPA LEDs are described in Table 2-5.

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

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

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

The framer processes incoming and outgoing T3 frames (cbit, m13/m23, and unframe). 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 T3 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 and 4-Port Channelized T3 SPA Cables and Connectors

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

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

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

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

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

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

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

Note The 8-Port Channelized T1/E1 SPA supports the use of Intra-Building wiring only

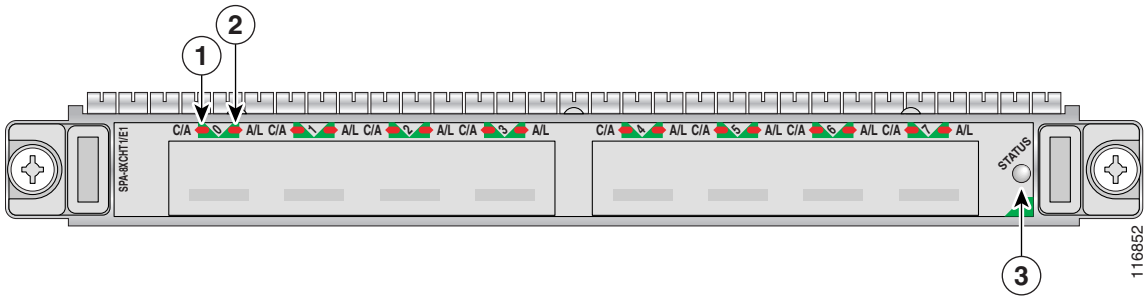
The following sections describe the 8-Port Channelized T1/E1 SPA:

- 8-Port Channelized T1/E1 SPA LEDs, page 2-8
- 8-Port Channelized T1/E1 SPA Interface Specifications, page 2-9
- 8-Port Channelized T1/E1 SPA Cables, Connectors, and Pinouts, page 2-9

8-Port Channelized T1/E1 SPA LEDs

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

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



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

The 8-Port Channelized T1/E1 SPA LEDs are described in Table 2-7.

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

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

8-Port Channelized T1/E1 SPA Interface Specifications

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

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

Figure 2-4 shows an RJ-45 connector.

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

Figure 2-4 RJ-45 Connector

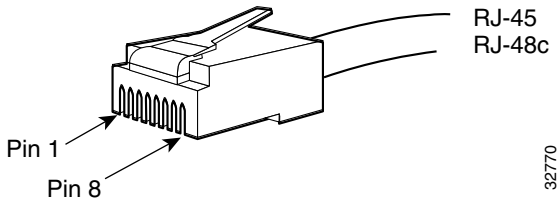


Table 2-8 describes the signals and connector pinouts for RJ-45 cable connectors.

Table 2-8 RJ-45 Connector Pinouts

Pin	Signal	Description
1	RX–	Receive ring –
2	RX+	Receive tip +

Table 2-8 RJ-45 Connector Pinouts

Pin	Signal	Description
3	NC	No connection
4	TX–	Transmit ring –
5	TX+	Transmit tip +
6	NC	No connection
7	NC	No connection
8	NC	No connection

8-Port Fast Ethernet SPA Overview

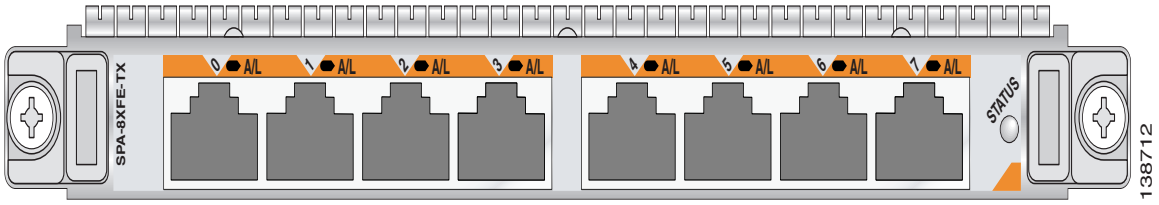
The following sections describe the 8-Port FastEthernet SPA:

- 8-Port FastEthernet SPA LEDs, page 2-10
- 8-Port FastEthernet SPA Cables, Connectors, and Pinouts, page 2-11

8-Port FastEthernet SPA LEDs

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

Figure 2-5 8-Port FastEthernet SPA Faceplate



1	A/L (Active/Link) LED	2	STATUS LED

Table 2-9 describes the 8-Port FastEthernet SPA LEDs.

Table 2-9 8-Port FastEthernet SPA LEDs

LED Label	Color	State	Meaning
Port Number A/L (0, 1, 2, 3, 4, 5, 6 or 7)[1]	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.

Table 2-9 8-Port FastEthernet SPA LEDs (continued)

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

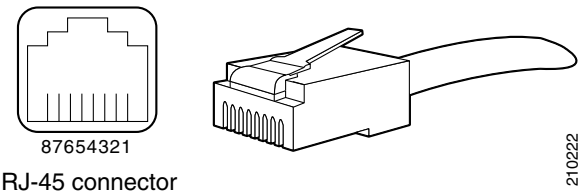
1. In this case, port number refers to the numbered LEDs on the 8-Port FastEthernet SPA (0, 1, 2, 3, 4, 5, 6 or 7). Each LED number on the 8-Port FastEthernet SPA references a port on the SPA.

8-Port FastEthernet SPA Cables, Connectors, and Pinouts

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

Figure 2-6 shows the RJ-45 connector.

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



RJ-45 connector

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

Table 2-10 RJ-45 Connector Pinout

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

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

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

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

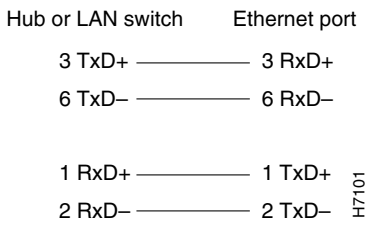
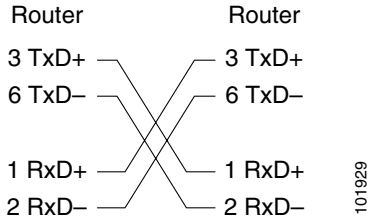


Figure 2-8 Crossover Cable Pinout, RJ-45 Connections Between Routers



1-Port 10-Gigabit Ethernet SPA Overview

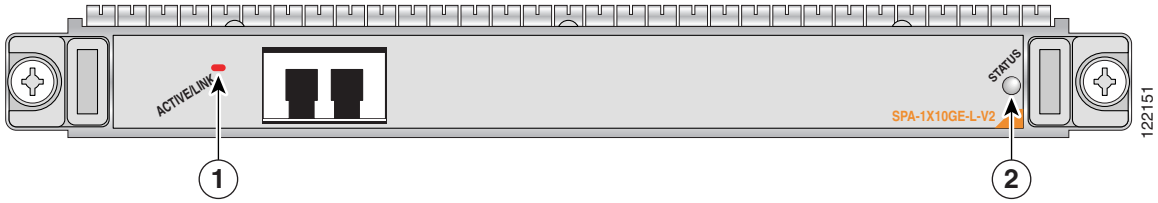
The following sections describe the 1-Port 10-Gigabit Ethernet SPA:

- 1-Port 10-Gigabit Ethernet SPA LEDs, page 2-13
- 1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables, page 2-13

1-Port 10-Gigabit Ethernet SPA LEDs

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

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



1	ACTIVE/LINK LED	2	STATUS LED

Table 2-11 describes the 1-Port 10-Gigabit Ethernet SPA LEDs.

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

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

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

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

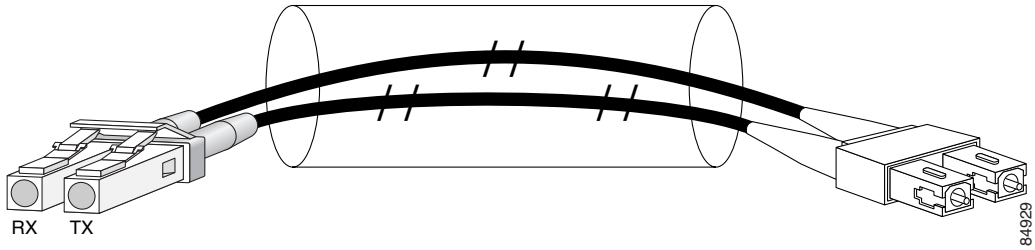
- Single-mode short-reach (SR) XFP module—XFP-10GLR
- Single-mode intermediate-reach (IR) XFP module—XFP-10GER
- Single-mode long-reach (LR) XFP module—XFP-10GZR

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

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

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

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



Note The 40-pin connector on the 1-Port 10-Gigabit Ethernet SPA is used for resilient packet ring (RPR) connections. This feature is not supported in Cisco IOS Release 12.0(32)SY.

XFP Connections

The XFP-10GLR-OC192SR, XFP-10GER-OC192IR, and XFP-10GZR-OC192LR XFPs include an optical transmitter and receiver pair integrated with Clock and Data Recovery (CDR) integrated circuits. The XFPs provide high-speed serial links at the following rates: 9.95 Gbps (OC-192) and 10.3125 Gbps (10 Gigabit Ethernet) on single mode fibers. The transmit side recovers and retimes the 10 Gbps serial data and passes it to a laser driver. The laser driver biases and modulates a 1310 nm or 1550 nm laser, enabling data transmission over SMF through an LC connector. The receive side recovers and retimes the 10 Gbps optical data stream from a photo detector trans impedance amplifier and passes it to an output driver.

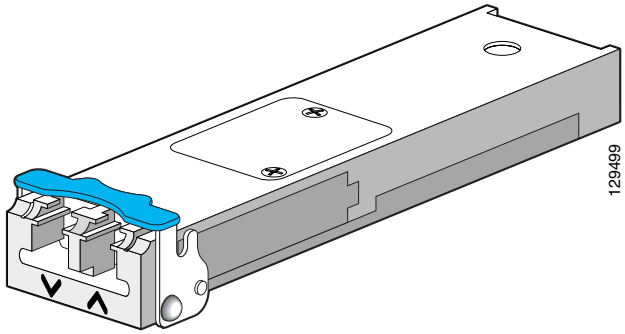
See the label on the XFP for technology type and model.

XFP dimensions are:

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

The XFP temperature range is 0°C to 70°C. For a picture of an XFP, see Figure 2-11.

Figure 2-11 XFP Illustration



XFP Port Cabling Specifications

Table 2-12 XFP Port Cabling Specifications

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

2-Port Gigabit Ethernet SPA Overview

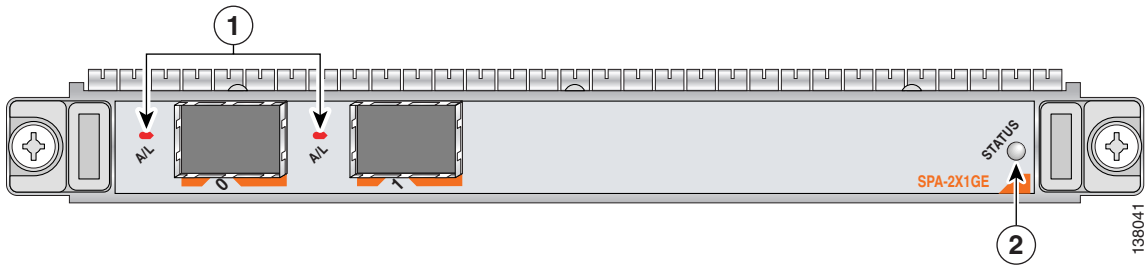
The following sections describe the 2-Port Gigabit Ethernet SPA:

- 2-Port Gigabit Ethernet SPA LEDs, page 2-16
- SFP Module Cabling and Connection Equipment, page 2-18

2-Port Gigabit Ethernet SPA LEDs

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

Figure 2-12 2-Port Gigabit Ethernet SPA Faceplate



1	A/L (Active/Link) LED	**2**	STATUS LED

Table 2-13 describes the 2-Port Gigabit Ethernet SPA LEDs.

Table 2-13 2-Port Gigabit Ethernet SPA LEDs

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

2-Port Gigabit Ethernet SPA Cables and Connectors

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

SFP Module Connections

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

Note The 2-Port Gigabit Ethernet SPA will only accept the SFP modules listed as supported in this document. An SFP module check is run every time an SFP module is inserted into the 2-Port Gigabit Ethernet SPA and only SFP modules that pass this check will be usable by the 2-Port Gigabit Ethernet SPA.

SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 2-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 2-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 2-14 and Table 2-15 provide SFP module information and specifications.

Table 2-14 SFP Module Options

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

Table 2-15 SFP Module Specifications

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

SFP-GE-S Modules

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

SFP-GE-L Modules

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

SFP-GE-Z Modules

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

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

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

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

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

SFP-GE-T Modules

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

SFP Module Cabling and Connection Equipment

Table 2-16 provides cabling specifications for the SFP modules that can be installed on the 2-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

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

Table 2-16 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	MMF[2] and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF[3]	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

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

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

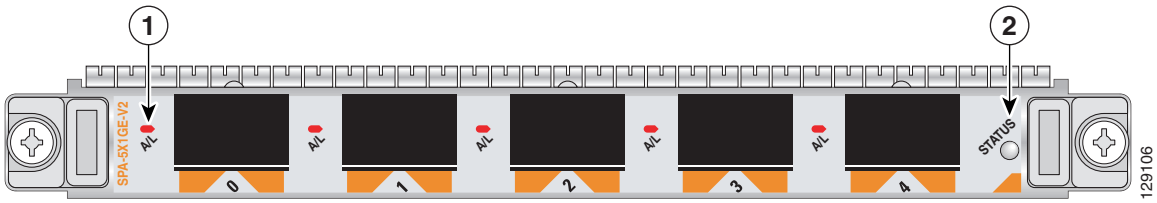
5-Port Gigabit Ethernet SPA Overview

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

5-Port Gigabit Ethernet SPA LEDs

The 5-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each individual port and a STATUS LED for the SPA, as shown in Figure 2-13.

Figure 2-13 5-Port Gigabit Ethernet SPA Faceplate



1	A/L (Active/Link) LED	**2**	STATUS LED

Table 2-17 describes the 5-Port Gigabit Ethernet SPA LEDs.

Table 2-17 5-Port Gigabit Ethernet SPA LEDs

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

5-Port Gigabit Ethernet SPA Cables and Connectors

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

SFP Module Connections

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

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

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 2-18 and Table 2-19 provide SFP module information and specifications.

Table 2-18 SFP Module Options

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

Table 2-19 SFP Module Specifications

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

SFP-GE-S Modules

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

SFP-GE-L Modules

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

SFP-GE-Z Modules

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

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

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

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

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

SFP-GE-T Modules

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

SFP Module Cabling and Connection Equipment

Table 2-20 provides cabling specifications for the SFP modules that can be installed on the 5-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

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

Table 2-20 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	MMF[2] and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF[3]	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

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

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

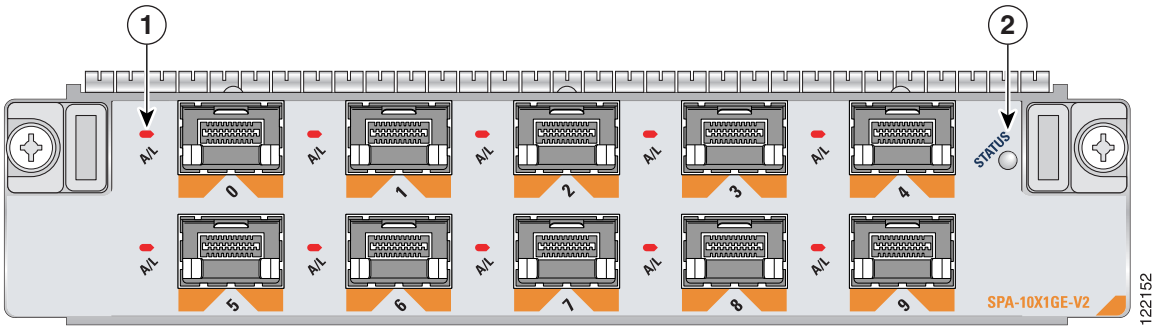
10-Port Gigabit Ethernet SPA Overview

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

10-Port Gigabit Ethernet SPA LEDs

The 10-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for the port and a STATUS LED, as shown in Figure 2-14.

Figure 2-14 10-Port Gigabit Ethernet SPA Faceplate



1	A/L (Active/Link) LED	**2**	STATUS LED

Table 2-21 describes the 10-Port Gigabit Ethernet SPA LEDs.

Table 2-21 10-Port Gigabit Ethernet SPA LEDs

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

10-Port Gigabit Ethernet SPA Cables and Connectors

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

SFP Module Connections

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

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

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 2-22 and Table 2-23 provide SFP information and specifications.

Table 2-22 SFP Module Options

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

Table 2-23 SFP Module Specifications

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

SFP-GE-S Modules

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

SFP-GE-L Modules

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

SFP-GE-Z Modules

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

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

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

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

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

SFP-GE-T Modules

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

SFP Module Cabling and Connection Equipment

Table 2-24 provides cabling specifications for the SFP modules that can be installed on the 10-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

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

Table 2-24 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	MMF[2] and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF[3]	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

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

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

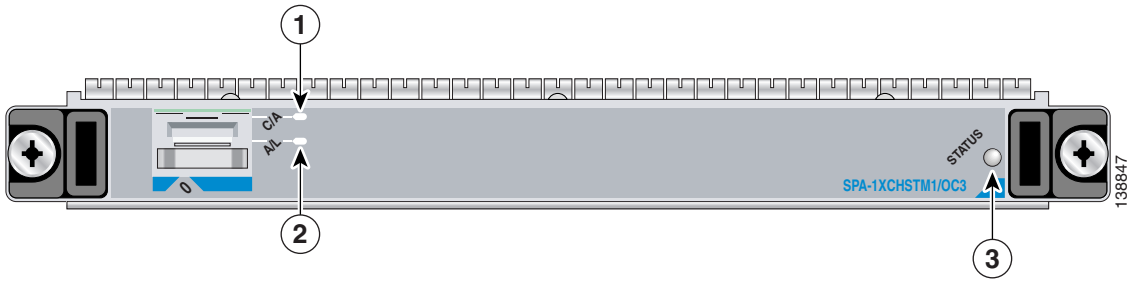
1-Port Channelized STM-1/OC-3 SPA Overview

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 each port and a STATUS LED, as shown in Figure 2-15.

Figure 2-15 1-Port Channelized STM-1/OC-3 SPA Faceplate



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

The 1-Port Channelized STM-1/OC-3 SPALEDs are described in Table 2-5.

Table 2-25 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-3c/STM-1 line rates (155.52 Mbps).

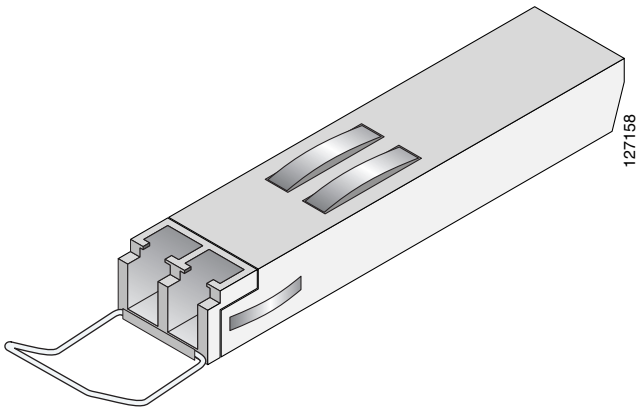
Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-3c/STM-1 frame.

The 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).

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

The 1-Port Channelized STM-1/OC-3 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-16).

Figure 2-16 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-3c/STM-1 optical fiber (SONET STS-3c or SDH STM-1)

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

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

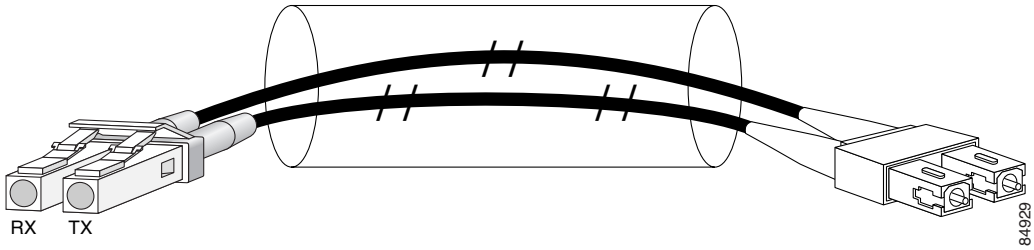
  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-17) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

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

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

Figure 2-17 LC Type Cables



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

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

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

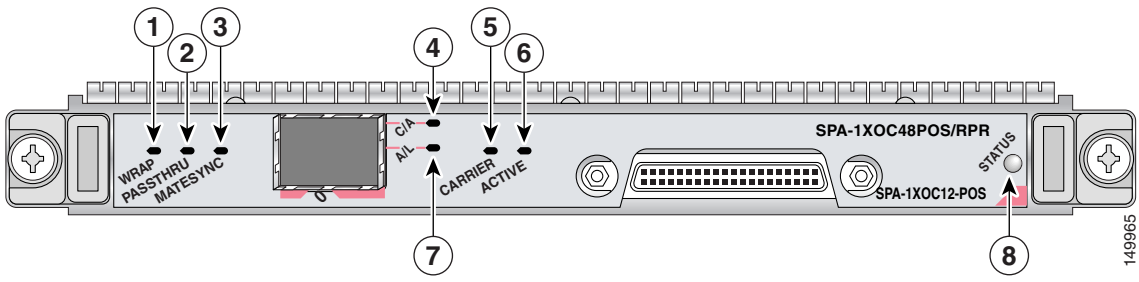
The following sections describe the 1-Port OC-48c/STM-16 POS SPA:

- 1-Port OC-192c/STM-64 POS/RPR SPA LEDs, page 2-34
- 1-Port OC-192c/STM-64 POS/RPR SPA Interface Specifications, page 2-35
- 1-Port OC-192c/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables, page 2-36

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

The 1-Port OC-48c/STM-16 POS SPA has six LEDs, as shown in Figure 2-24.

Figure 2-18 1-Port OC-48c/STM-16 POS SPA Faceplate



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

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

The 1-Port OC-48c/STM-16 POS SPA LEDs are described in Table 2-26.

Table 2-26 1-Port OC-48c/STM-16 POS SPA LEDs

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

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

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

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

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

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

RFC 2615, *PPP over SONET/SDH* The 1-Port OC-192c/STM-64 POS/RPR XFP SPA also provides support for SNMP v1 agent (RFC 1155–1157) and RFC 1213:

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

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

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

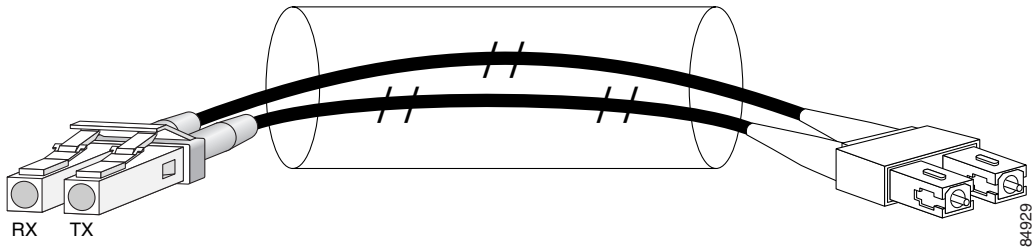
The 1-Port OC-48c/STM-16 POS SPA supports the following type of optical transceiver module:

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

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

Figure 2-25 shows the cable type for use with the XFP optical transceiver module on the 1-Port OC-48c/STM-16 POS SPA.

Figure 2-19 LC-Type Cable for the SFP Optical Transceiver Modules



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

Mate Interface Cables

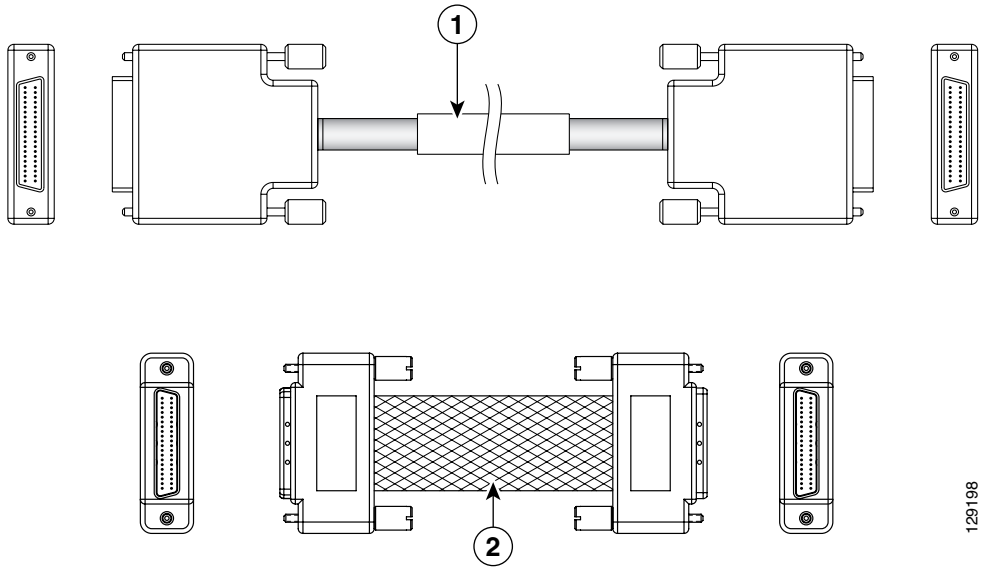
The 1-Port OC-48c/STM-16 POS SPA supports two mate interface configurations:

- Mate between two OC-48c SPAs in the same SIP

- Mate between two OC-48c SPAs in adjacent SIPs

Two 1-Port OC-48c/STM-16 POS SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-23 shows the mate cables used to connect the SPAs.

Figure 2-20 SPA Mate Cables



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

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

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

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

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

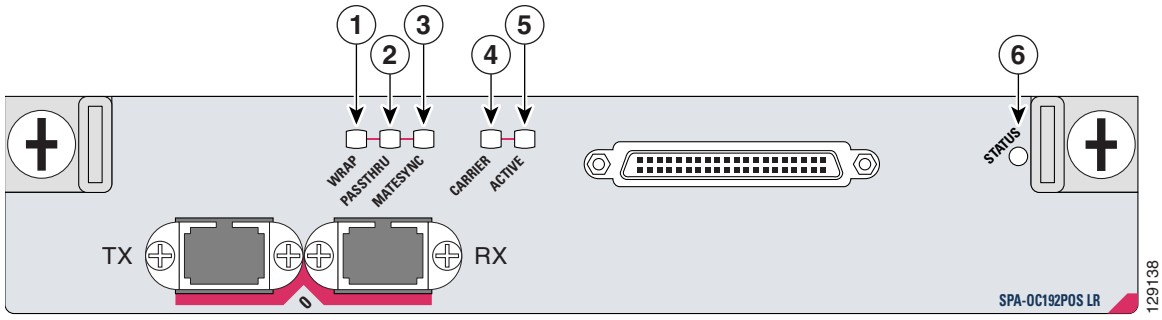
The 1-Port OC-192c/STM-64 POS/RPR SPA uses a single,10-Gbps fixed optical receptacle allowing a connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the "1-Port OC-192c/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables" section on page 2-36.

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

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

The 1-Port OC-192c/STM-64 POS/RPR SPA has six LEDs, as shown in Figure 2-21.

Figure 2-21 1-Port OC-192c/STM-64 POS/RPR SPA Faceplate



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

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

The 1-Port OC-192c/STM-64 POS/RPR SPA LEDs are described in Table 2-27.

Table 2-27 1-Port OC-192c/STM-64 POS/RPR SPA LEDs

LED Label	Color	State	Meaning
WRAP	Off	Off	Port is not in wrap mode.
	Green	On	Port is in wrap mode somewhere on the ring.
	Amber	On	Port is in wrap mode locally.
PASSTHRU	Off	Off	Port is not in pass-thru mode.
	Amber	On	Port is in pass-thru mode.

Table 2-27 1-Port OC-192c/STM-64 POS/RPR SPA LEDs (continued)

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

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

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

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

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

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

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

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

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

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

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

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

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

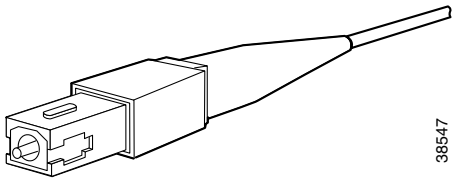
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

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

Note The 40-pin connector on the 1-Port OC-192c/STM-64 POS/RPR SPA is used for resilient packet ring (RPR) connections. This feature is not supported in Cisco IOS Release 12.0(31)S.

Figure 2-22 shows the cable type for use with the fixed optical transceiver module on the 1-Port OC-192c/STM-64 POS/RPR SPA.

Figure 2-22 SC-Type Connectors for the Fixed Optical Transceivers



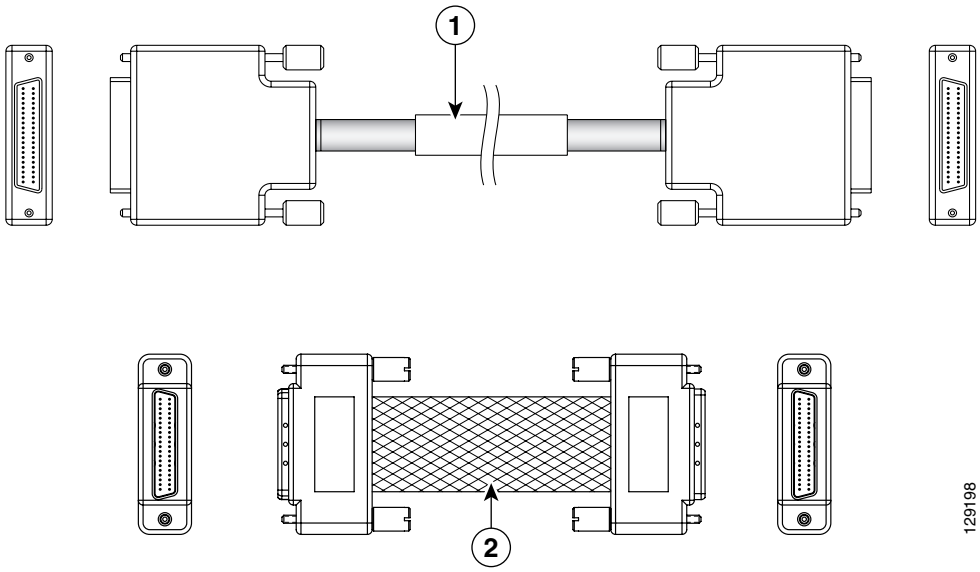
Mate Interface Cables

The 1-Port OC-192c/STM-64 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 1-Port OC-192c/STM-64 POS/RPR SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-23 shows the mate cables used to connect the SPAs.

Figure 2-23 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)

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

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

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

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

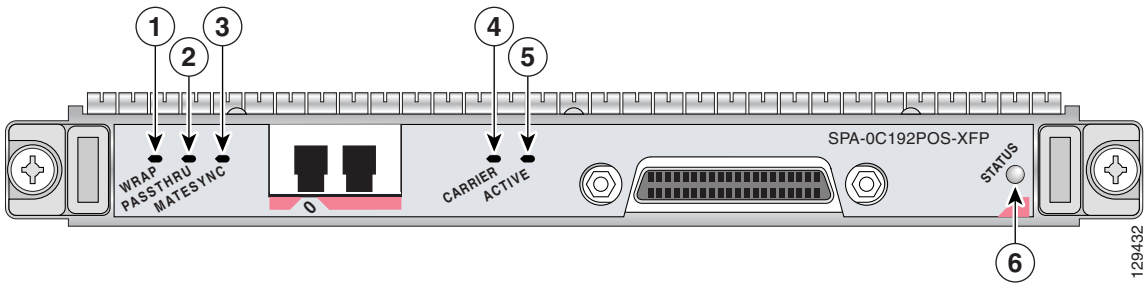
The 1-Port OC-192c/STM-64 POS/RPR XFP SPA uses a 10-Gbps small form-factor pluggable optical receptacle for each port allowing connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the "1-Port OC-192c/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables" section on page 2-36.

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

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

The 1-Port OC-192c/STM-64 POS/RPR XFP SPA has six LEDs, as shown in Figure 2-24.

Figure 2-24 1-Port OC-192c/STM-64 POS/RPR XFP SPA Faceplate



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

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

Table 2-28 describes the 1-Port OC-192c/STM-64 POS/RPR XFP SPA LEDs.

Table 2-28 1-Port OC-192c/STM-64 POS/RPR XFP SPA LEDs

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

Table 2-28 1-Port OC-192c/STM-64 POS/RPR XFP SPA LEDs (continued)

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

1-Port OC-192c/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-192c/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*

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

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

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

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

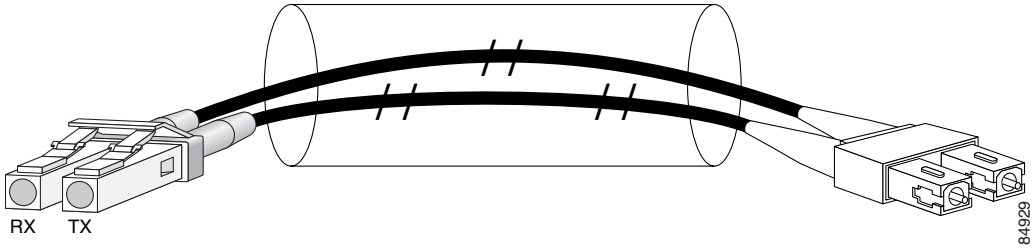
- Single-mode short-reach (SR) XFP module—XFP-10GLR-OC192SR
- Single-mode intermediate-reach (IR) XFP module—XFP-10GER-OC192IR
- Single-mode very-long reach XFP module—XFP-10GZR-OC192LR

Cisco Systems qualifies the optics that are approved for use with its SPAs. As of Cisco IOS Release 12.0(31)S, the above-listed XFPs are the only optical transceiver modules qualified for use.

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

Figure 2-25 shows the cable type for use with the XFP optical transceiver module on the 1-Port OC-192c/STM-64 POS/RPR XFP SPA.

Figure 2-25 LC-Type Cable for the XFP Optical Transceiver Modules



Note The 40-pin connector on the 1-Port OC-192c/STM-64 POS/RPR XFP SPA is used for resilient packet ring (RPR) connections. This feature is not supported in Cisco IOS Release 12.0(31)S.

OC-192 Module Connections

Table 2-29 shows the OC-192 specifications for use with the 1-Port OC-192c/STM-64 POS/RPR XFP SPA.

Table 2-29 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

Table 2-29 OC-192 Specifications (continued)

Specification	Description
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

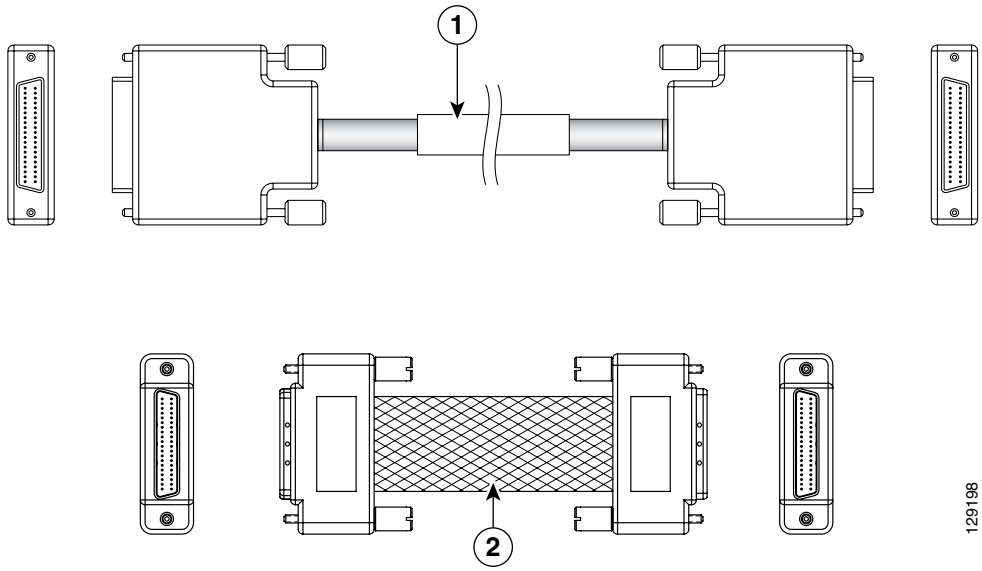
Mate Interface Cables

The 1-Port OC-192c/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-192c/STM-64 POS/RPR XFP SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-23 shows the mate cables used to connect the SPAs.

Figure 2-26 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)

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

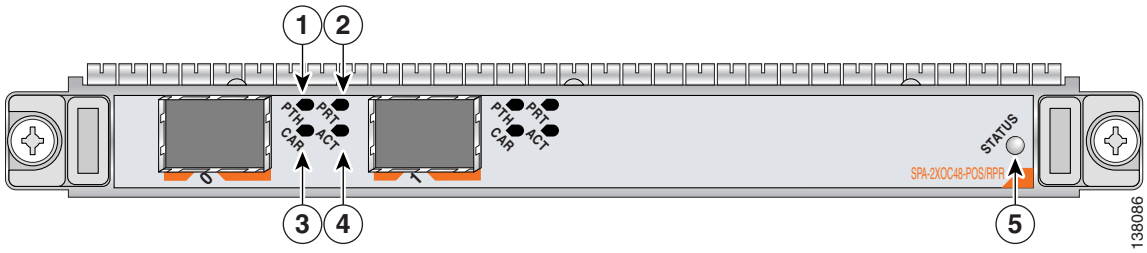
2-Port OC-48 POS RPR SPA Overview

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 Figure 2-27.

Figure 2-27 2-Port OC48-POS/RPR SPA Faceplate



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

The 2-Port OC48-POS/RPR SPA LEDs are described in Table 2-30.

Table 2-30 2-Port OC48-POS/RPR SPA LEDs

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

Table 2-30 2-Port OC48-POS/RPR SPA LEDs (continued)

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

2-Port OC48-POS/RPR SPA Interface Specifications

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

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

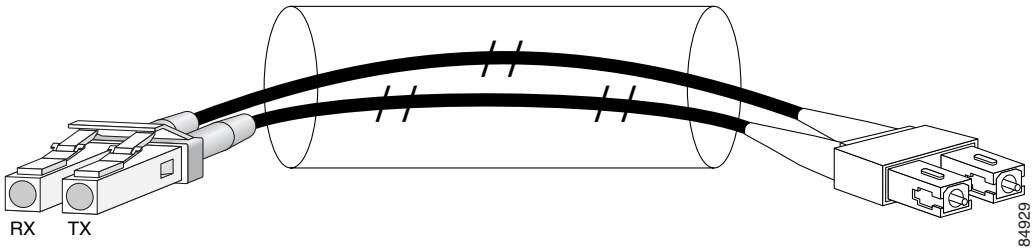
Use single-mode (for intermediate-configurations) optical fiber cable to connect your router to a network or to connect two OC-48-equipped routers back-to-back.

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

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

Each port on the 2-Port OC48-POS/RPR SPA has one duplex LC-type receptacle. For single-mode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-28) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 2-28 Duplex Patch Cable with LC-Type Connectors



2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA, 4-Port OC-3c/STM-1 POS SPA, and 8-Port OC-3c/STM-1 POS SPA Overview

This section provides the hardware overview for the following SPAs:

- 2-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA
- 4-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA
- 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA
- 4-Port OC-3c/STM-1 POS SPA
- 8-Port OC-3c/STM-1 POS SPA

The 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and the 4-Port and 8-Port OC-3c/STM-1 POS SPA are single-height SPAs that each install into one SIP subslot. The SPAs with small form-factor pluggable (SFP) optical transceiver modules provide Optical Carrier Level (OC-N) for SONET and Synchronous Transport Module (STM-N) for SDH network connectivity. For the OC-3 SPAs, the per-port bandwidth is 155.52 Mbps. For the OC-12 SPAs, 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 customer configuration.

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 8-port OC-12c/STM-4 POS SPA is a full rate SPA; therefore, it can only be installed in subslots 1 or 2 of the SIP. The 4-Port and 8-Port OC-3c/STM-1 POS SPA and the 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPAs are all half rate SPAs.

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, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and the 4-Port and 8-Port OC-3c/STM-1 POS SPA:

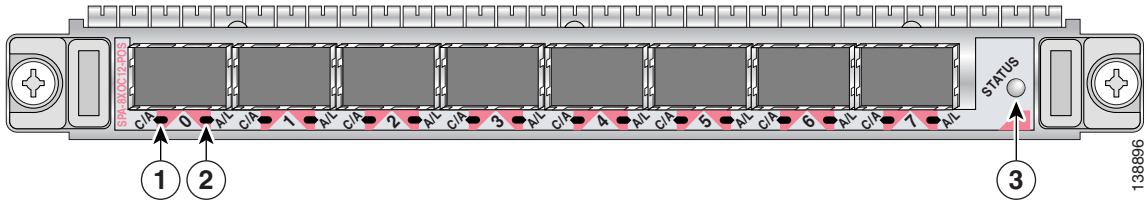
- 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and 4-Port and 8-Port OC-3c/STM-1 POS SPA LEDs, page 2-44
- 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and 4-Port and 8-Port OC-3c/STM-1 POS SPA Interface Specifications, page 2-45
- 1-Port OC-192c/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables, page 2-36

2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and 4-Port and 8-Port OC-3c/STM-1 POS SPA LEDs

The 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and the 4-Port and 8-Port OC-3c/STM-1 POS SPA have three LEDs: two LEDs for each port on the SPA and one STATUS LED. Figure 2-29 shows the 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA faceplate.

Note Three different faceplates exist for either the 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPAs. They each contain the same LEDs and the number of ports are 2, 4 and 8 respectively.

Figure 2-29 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA Faceplate



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

The 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and the 4-Port and 8-Port OC-3c/STM-1 POS SPA LEDs are described in Table 2-31.

Table 2-31 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and 4-Port and 8-Port OC-3c/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, 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, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and 4-Port and 8-Port OC-3c/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) 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, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and the 4-Port and 8-Port OC-3c/STM-1 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, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and 4-Port and 8-Port OC-3c/STM-1 POS SPA Optical Transceiver Modules and Cables

The 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA and the 4-Port and 8-Port OC-3c/STM-1 POS SPA use an SFP optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-30).

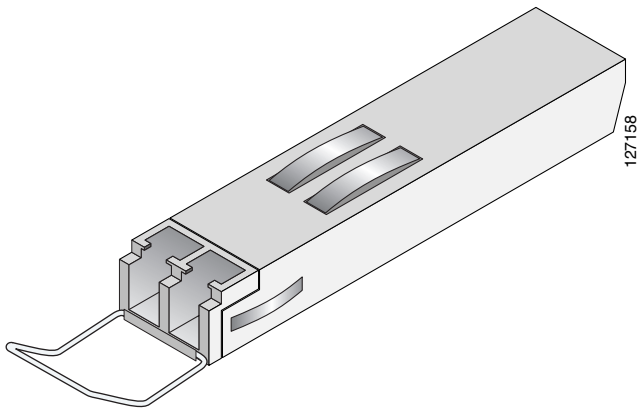
Cisco Systems qualifies the optics that are approved for use with its SPAs. The 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA when configured as OC-3 and the 4-Port and 8-Port OC-3c/STM-1 POS SPA support the following types of optical transceiver modules:

- 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, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/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 2-30 SFP Optics Module



The SFP optical transceiver modules used with the 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA configured for OC-3 and the 4-Port and 8-Port OC-3c/STM-1 POS SPA 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 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

The SFP optical transceiver modules used with the 2-Port, 4-Port, and 8-Port OC-3c/STM-1 and OC-12c/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.

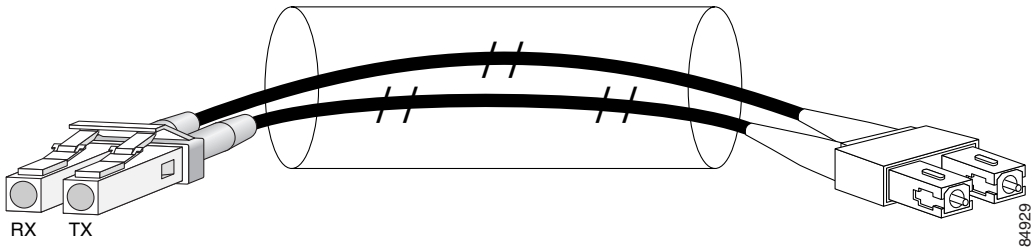
- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

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

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-31) 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 2-31 LC-Type Cable



CHAPTER 3

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

Release 12.0(32)SY1, OL-8831-01, Rev. G6, July 19, 2007

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

Required Tools and Equipment

You need the following tools and parts to install SIPs and SPAs. If you need additional equipment, contact a service representative for ordering information.

- Shared port adapter interface processor (SIP)
- Shared port adapter (SPA)
- Number 1 Phillips and a 3/16-inch flat-blade screwdriver
- Number 2 Phillips screwdriver
- Your own electrostatic discharge (ESD)-prevention equipment or the disposable grounding wrist strap supplied with the SIP or SPA
- Antistatic mat
- Antistatic container

Safety Guidelines

This section provides safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

- Required Tools and Equipment, page 3-1

Safety Warnings

Review the safety warnings listed in the *Regulatory Compliance and Safety Information for Cisco 12000 Series Internet Routers* before installing, configuring, or troubleshooting any installed SIP or SPA.

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, might harm you. A warning symbol precedes each warning statement.

Warning Definition

Warning **IMPORTANT SAFETY INSTRUCTIONS**

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES

¡Advertencia! **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

Varning! **VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

Figyelem **FONTOS BIZTONSÁGI ELOÍRÁSOK**

Ez a figyelmezeto jel veszélyre utal. Sérülésveszélyt rejto helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplo figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján keresheto meg.

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告 重要的安全性说明

此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。

请保存这些安全性说明

警告　安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

주의　중요 안전 지침

이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.

이 지시 사항을 보관하십시오.

تحذير　إرشادات الأمان الهامة

يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض لإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالإجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في أخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز.
قم بحفظ هذه الإرشادات

Upozorenje　**VAŽNE SIGURNOSNE NAPOMENE**

Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznati sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

SAČUVAJTE OVE UPUTE

Upozornění　**DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.

USCHOVEJTE TYTO POKYNY

Προειδοποίηση ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθεις πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה **הוראות בטיחות חשובות**

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כד לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

שמור הוראות אלה

Ostrzeżenie **WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA**

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie **DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY**

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

USCHOVAJTE SI TENTO NÁVOD

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.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. SIPs, SPAs, and processor modules comprise printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap during handling.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help to ensure that bus connectors are properly seated.
- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed board component-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.
- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal carrier.

Caution For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms (Mohms).

Laser/LED Safety

An optical single-mode transmitter 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 Figure 3-1. The multimode aperture contains a Class 1 LED warning label, as shown in Figure 3-1. These warnings apply to SPAs and SFP modules that transmit signals via an optical carrier signal.

Figure 3-1 Class 1 Laser Warning Labels for Single-Mode Port

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

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

Waarschuwing **Losgekoppelde of losgeraakte glasvezels of aansluitingen kunnen onzichtbare laserstraling produceren. Kijk niet rechtstreeks in de straling en gebruik geen optische instrumenten rond deze glasvezels of aansluitingen.**

Varoitus **Irrotetuista kuiduista tai liittimistä voi tulla näkymätöntä lasersäteilyä. Älä tuijota säteitä tai katso niitä suoraan optisilla välineillä.**

Attention **Les fibres ou connecteurs débranchés risquent d'émettre des rayonnements laser invisibles à l'œil. Ne regardez jamais directement les faisceaux laser à l'œil nu, ni d'ailleurs avec des instruments optiques.**

Warnung **Unterbrochene Fasern oder Steckerverbindungenkönnen unsichtbare Laserstrahlung abgeben. Blicken Sie weder mit bloßem Auge noch mit optischen Instrumenten direkt in Laserstrahlen.**

Avvertenza **Le fibre ottiche ed i relativi connettori possono emettere radiazioni laser. I fasci di luce non devono mai essere osservati direttamente o attraverso strumenti ottici.**

Advarsel **Det kan forekomme usynlig laserstråling fra fiber eller kontakter som er frakoblet. Stirr ikke direkte inn i strålene eller se på dem direkte gjennom et optisk instrument.**

Aviso **Radiação laser invisível pode ser emitida de conectores ou fibras desconectadas. Não olhe diretamente para os feixes ou com instrumentos ópticos.**

¡Advertencia! **Es posible que las fibras desconectadas emitan radiación láser invisible. No fije la vista en los rayos ni examine éstos con instrumentos ópticos.**

Varning! **Osynlig laserstrålning kan avges från frånkopplade fibrer eller kontaktdon. Rikta inte blicken in i strålar och titta aldrig direkt på dem med hjälp av optiska instrument.**

Figyelem **A nem csatlakoztatott üvegszálak és csatlakozók láthatatlan lézersugárzást bocsáthatnak ki. Ne nézzen bele a sugárba, és ne nézze közvetlenül, optikai berendezések segítségével!**

Предупреждение Отключенные световоды и разъемы могут испускать невидимое лазерное излучение. Не допускайте попадания лазерного луча в глаза и не смотрите на него через оптические приборы.

警告 断开的光纤或接头有可能发出不可见的激光辐射。请勿直视光束或直接用光学仪器观看光束。

警告 光ファイバ ケーブルまたはコネクタを取り外した状態では、目に見えないレーザー光が放射されていることがあります。光線をのぞきこんだり、光学機器を使用して光線を直接見たりしないでください。

주의 연결이 해제된 섬유나 커넥터에서 눈에 보이지 않는 레이저 방사열이 방출될 수 있습니다. 레이저 빔을 눈으로 쳐다 보거나 광학 기구를 사용하여 직접 보지 마십시오.

Aviso **Radiação laser invisível pode ser emitida a partir de fibras ou conectores desconectados. Não fixe o olhar nos feixes e nem olhe diretamente com instrumentos ópticos.**

Advarsel **Usynlig laserstråling kan forekomme fra brugte fibre eller stik. Stir ikke ind i stråler eller direkte med optiske instrumenter.**

تحذير **من المحتمل انبعاث أشعة الليزر من الألياف غير المتصلة أو التوصيلات. لا تحدق النظر في الشعاع أو النظر مباشرة بدون أي أداة بصرية.**

Upozornění **Odpojená vlákna kabelů či konektory mohou vyzařovat neviditelné laserové záření. Nedívejte se do paprsků ani nepozorujte přímo pomocí optických přístrojů.**

Προειδοποίηση Από αποσυνδεδεμένες ίνες ή υποδοχές μπορεί να εκπέμπεται αόρατη ακτινοβολία λέιζερ. Μην κοιτάτε απευθείας τις δέσμες φωτός και μην τις απεικονίζετε απευθείας με οπτικά όργανα.

אזהרה

תתיכן פליטה של קרינת לייזר בלתי-נראית מסיבים או ממחברים מנותקים. אל תביט ישירות לתוך קרני אור ואל תביט באמצעות במכשירים אופטיים.

Opomena

Невидливо ласерско зрачење може да зрачи од исклучените влакна или приклучоци. Не гледајте во зраци и не прегледувајте ги директно со оптички инструменти.

Ostrzeżenie

Odłączone światłowody lub złącza mogą emitować niewidzialne promieniowanie laserowe. Nie należy patrzeć prosto w wiązkę lasera ani bezpośrednio obserwować jej przy użyciu przyrządów optycznych.

Upozornenie

Odpojené vlákna káblov alebo konektory môžu vyžarovať neviditeľné laserové žiarenie. Nepozerajte sa do lúčov ani ich nepozorujte priamo pomocou optických prístrojov.

T

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

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

CHAPTER 4

Installing and Removing a SPA Interface Processor

Release 12.0(32)SY1, OL-8831-01, Rev. G6, July 19, 2007

This chapter describes how to install or remove SIPs on the Cisco 12000 series router. This chapter contains the following sections:

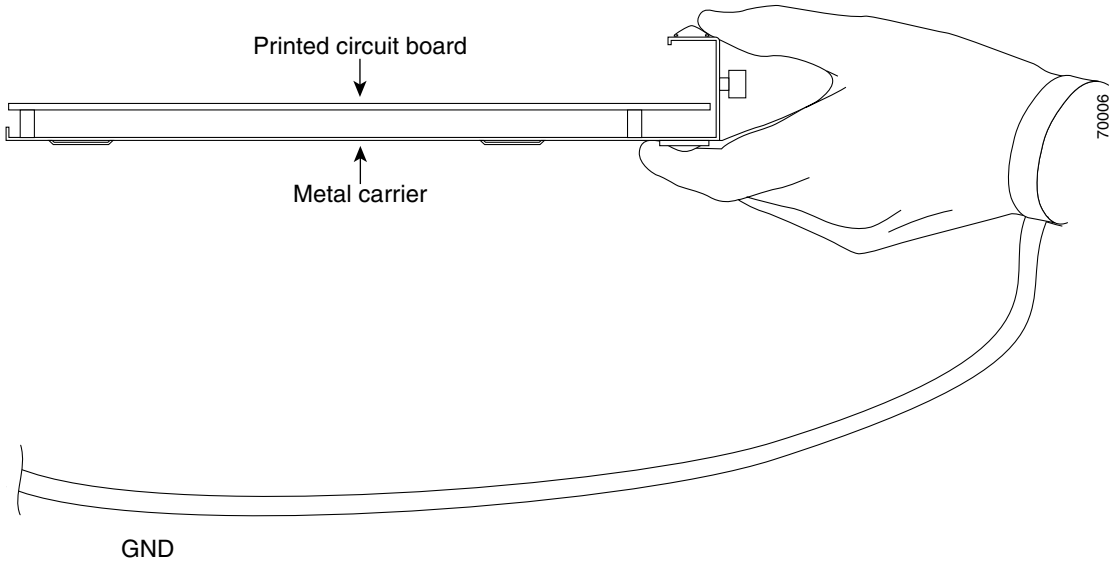
Handling SIPs

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 SPA Interface Processor or a Shared Port Adapter" for a list of parts and tools required for installation.

Caution Always handle the SIP by the carrier edges and handle; never touch the SIP components or connector pins. (See Figure 4-1.)

When a slot is not in use, a blank filler plate 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 a SIP in a slot that is not in use, you must first remove the blank filler plate.

Figure 4-1 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
- Removing a SIP
- Installing a SIP

Note Some of the procedures in the following sections use illustrations of a Cisco 12012 Router to support the descriptions of removing and installing SIPs. Although the card cages of Cisco 12000 Series 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.

Note With OIR, notifying the software or resetting the power is not required. However, you have the option of using the **shutdown** command before removing a SIP.

- After you reinstall a SIP, the router automatically downloads the necessary software from the route processor (RP). 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 SIP 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 SIP 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 SIP 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 SIP is correctly aligned with the backplane connector; the connector pins should make contact with the backplane in the correct order, indicating that the SIP is fully seated in the backplane. A SIP that is only partially seated in the backplane will cause the router to hang and subsequently crash.

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, use Figure 4-2 as a reference and follow these steps:

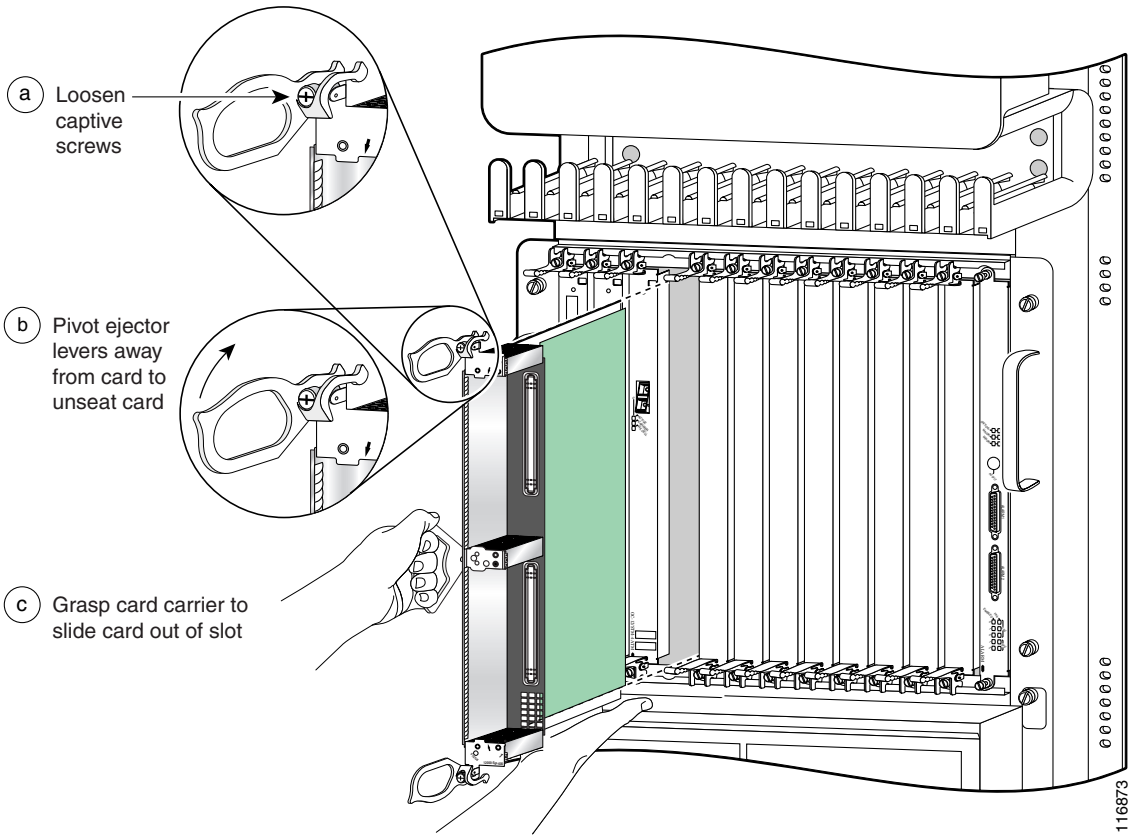
Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Step 2 Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the SIP.

Step 3 Detach the SIP cable-management bracket from the SIP.

Step 4 Use a screwdriver to loosen the captive installation screw at each end of the SIP faceplate. (See Figure 4-2a.)

Figure 4-2 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. (See Figure 4-2b.)

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. (See Figure 4-2c.) 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 blank filler plate (Product Number MAS-GSR-BLANK) to keep dust out of the chassis and to maintain proper airflow through the SIP compartment. Secure the SIP blank filler plate to the chassis by tightening its captive installation screws.

Installing a SIP

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

Note Refer to the installation and configuration guide for your router for information on SIP slot types, slot width, and slot location.

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.

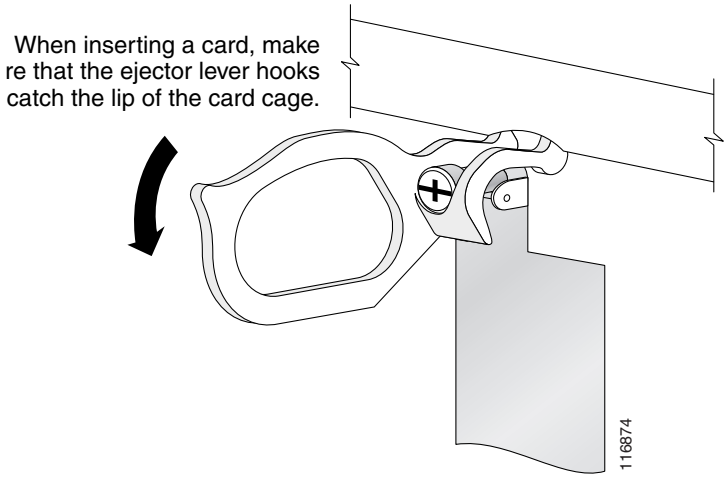
Step 2 Choose an available SIP slot for the SIP, and verify that the SIP interface cable is long enough for you to connect the SIP with any external equipment.

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. (See Figure 4-3.)

Figure 4-3 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 installation 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.

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. Refer to Chapter 5, "Installing and Removing a Shared Port Adapter".

Step 8 Install the SFP modules in the SPAs that use them. Refer to Chapter 5, "Installing and Removing a Shared Port Adapter".

Step 9 Install the interface cables.

CHAPTER 5

Installing and Removing a Shared Port Adapter

Release 12.0(32)SY1, OL-8831-01, Rev. G6, July 19, 2007

This chapter describes how to install or remove SPAs on the Cisco 12000 series router. This chapter contains the following sections:

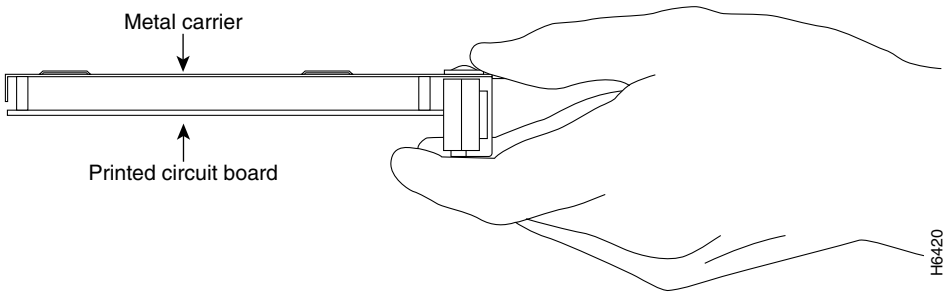
Handling SPAs

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 SPA Interface Processor or a Shared Port Adapter" 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 Figure 5-1.)

When a slot is not in use, a SPA blank filler plate must fill the empty slot 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 slot that is not in use, you must first remove the SPA blank filler plate.

Figure 5-1 Handling a SPA



SPA Installation and Removal

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

Warning **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.**

Installing a SPA in a SIP

To install a SPA in a SIP, refer to Figure 5-2 and 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 Figure 5-2.

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.

Step 3 After the SPA is properly seated, turn the SPA lock to its locked and horizontal position, as shown in A of Figure 5-2.

Removing a SPA from a SIP

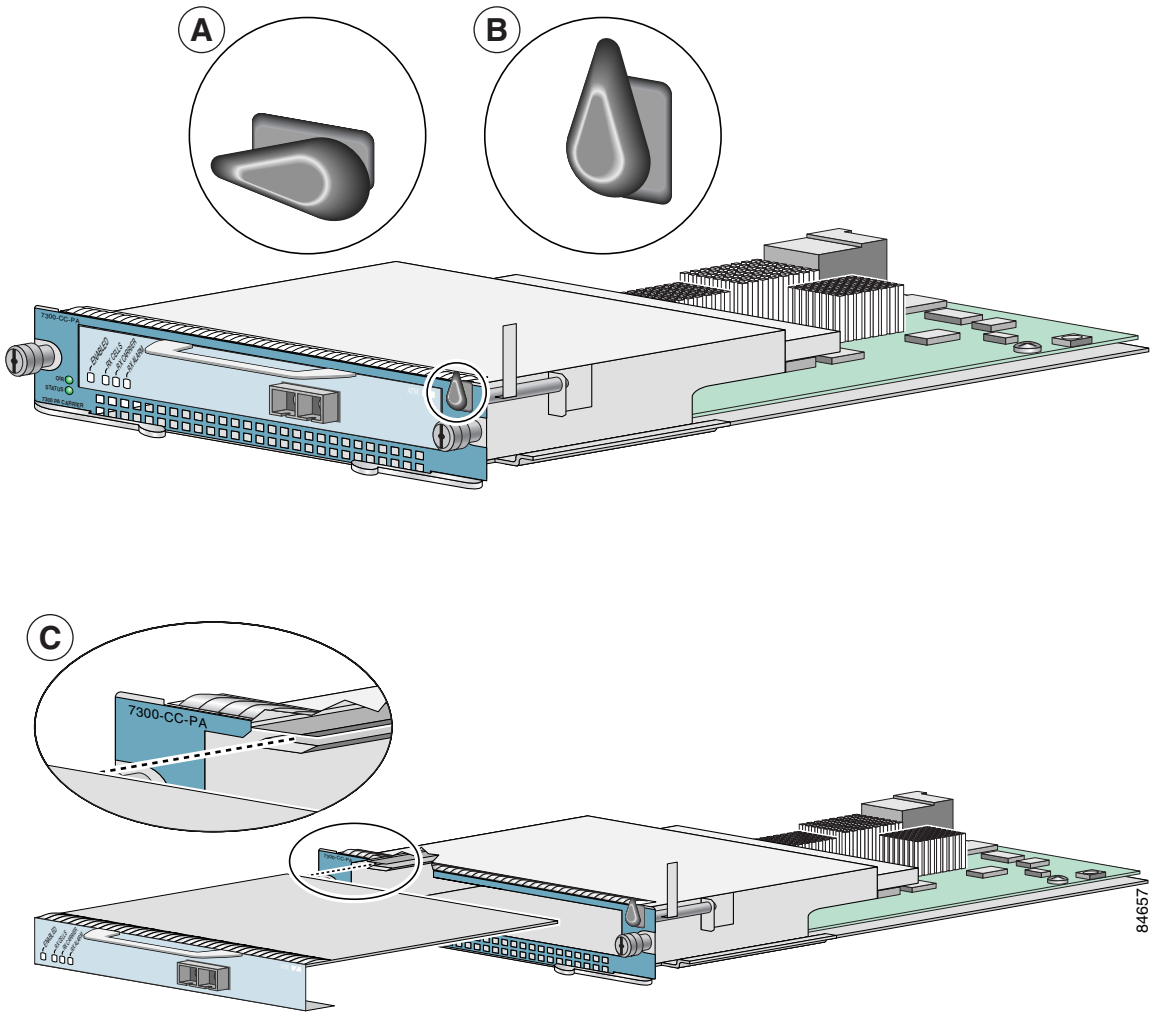
To remove a SPA from a SIP, refer to Figure 5-2 and do the following:

Step 1 If attached, remove any cables from the SPA.

Step 2 To remove the SPA from the SIP, turn the SPA lock from its locked and horizontal position shown in A of Figure 5-2 to its unlocked and vertical position shown in B of Figure 5-2.

Step 3 Grasp the handle of the SPA and pull the SPA from the SIP. (Ensure that you have already disconnected the cables from the SPA before removing the SPA from the SIP).

Figure 5-2 SPA Installation and Removal



Online Insertion and Removal

Cisco 12000 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.

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

See 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, 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.

Note A POS interface is used in the following examples for illustrative purposes.

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 yellow, 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 once the SIP has completed its initialization. The SPA STATUS LEDs will illuminate amber, turning to green when the SPAs become active.
- When the SIP and SPA STATUS LEDs are green, all associated interfaces are configurable.

Refer to the *Cisco 12000 Series Router SIP and SPA Software Configuration Guide (Cisco IOS)* 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 will be 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 will be empty.

Note New interfaces are not available until you configure them.

Step 2 If the SIPs and SPAs have not become active within three minutes, refer to the system console messages as follows:

- If a SIP or SPA is undergoing an FPD upgrade, then console messages will indicate that the FPD process has been initiated. The upgrade process might take several minutes. Use the **show fpd upgrade progress** command to obtain information about the FPD process. SIPs or SPAs that undergo an FPD upgrade will automatically be rebooted. Return to Step 1.
- If there is no indication that an FPD upgrade is underway, see Chapter 6, "Troubleshooting the Installation."

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 all of the current SPAs and a summary of their status using the **show hw-module subslot oir** command.

Step 3 Display information about the installed SIPs using the **show diag** command.

Step 4 Use the **show hw-module subslot fpd** command to verify the FPD version information of the SPAs installed in the system.

Note If a SPA does not meet the minimum FPD version required, it will be updated automatically. If the update fails, the failing module will be powered down and an error message will be reported on the system console.

For more information about FPD upgrades, refer to the "Upgrading Field-Programmable Devices" chapter of the *Cisco 7600 Series Router SIP, SSC, and SPA Software Configuration Guide*.

Step 5 Use the **show version** command to obtain a few details on the installed SIPs and interfaces available.

Using show Commands to Display SPA Information

Table 5-1 describes the **show** commands you can use to display SPA information.

Table 5-1 show Commands to Display SPA Information

Command	Type of Information Provided
show running-config	The router's running configuration and interfaces available in the system.
show hw-module subslot all oir	The operational status of all SPAs in the system.
show diag	SPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.
show hw-module subslot all fpd	FPD version information of SPAs in the system.
show version	Cisco IOS software version, names and sources of configuration files, and boot images.

Table 5-2 show Commands to Display SPA Information

Command	Type of Information Provided	Example
show controllers *type slot/subslot/port*	Network link status, register contents, and controller chip errors.	**show controllers pos 2/3/0**
show interfaces *type slot/subslot/port*	Line status and data link protocol status for a particular SPA port. Statistics about data traffic sent and received by the port.	**show interfaces pos 2/2/0**
show diag *slot*	SPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.	**show diag 4**
show version	Cisco IOS software version, names and sources of configuration files, and boot images.	**show version**

Note A Fast Ethernet interface is used in the following examples for illustrative purposes.

The following sample display shows the events logged by the system as an SIP with a Fast Ethernet SPA was removed from module slot 3; the system then reinitializes the remaining interface processors and marks as down the Fast Ethernet interface on the SIP that was removed from slot 3.

```
Router#
18:04:29: %OIR-6-REMCARD: Card removed from slot 3, interfaces disabled
18:04:30: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/0, changed state
to down
```

```
When you reinsert the SIP, the system automatically brings up the interfaces that were up
when the SIP was removed.
Router#
18:05:00: %OIR-6-INSCARD: Card inserted in slot 3, interfaces administratively shut down
18:05:08: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/0, changed state
to up
```

Note When a new SIP is inserted or 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.

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 FastEthernet3/1, 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 system does not recognize each interface and places it in the administratively down state.

Step 2 Verify that the ENABLED LED on the SPA goes on (is green) and remains on after the reinitialization is complete. If the ENABLED LED remains on, proceed to Step 5. If the ENABLED LED does not remain on, proceed to Step 3.

Step 3 If the ENABLED 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*. When a SPA is not recognized, the SIP is deactivated, and its OIR LED is yellow.

- Remove the SIP from the router.
- Remove the SPA from the SIP.
- Inspect the SIP and 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.
- Insert the SIP into the router.
- After the system reinitialization, the ENABLED LED on the SPA should go on and remain on. If the ENABLED LED remains on, proceed to Step 5. If it does not, proceed to Step 4.

Step 4 If the ENABLED LED on a SPA still fails to go on, remove the SIP and install it in another available slot on the router.

- If the ENABLED LED goes on, suspect a failed backplane port in the original slot.
- If the ENABLED 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 ENABLED LED still fails to go on, but other LEDs on the SIP SPA go on to indicate activity, proceed to Step 5 to resume the installation checkout; suspect that the ENABLED LED on the SPA has failed. Contact a service representative to report the problem and obtain further instructions.
- 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.
  - Suspect a faulty SIP. Contact a service representative to report the problem and obtain further instructions.

Step 5 If the SPA is new and not a replacement, configure the new SPA using the *Cisco 12000 Series Router SIP and SPA Software Configuration Guide (Cisco IOS)*.

Note New interfaces are not available until you configure them.

Step 6 If the SIP is a replacement, use the **show interfaces** *type slot-number/port-number* command or the **show controllers** command to verify the status of the SPAs. (See the "Using show Commands to Verify SIP and SPA Status" section on page 5-5.)

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 status LEDs.

Step 8 If an interface 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 MSCs are properly installed.

If you experience other problems that you are unable to solve, contact TAC (see the "Obtaining Documentation" section on page -xv in the Preface) or a service representative for assistance.

To configure the new interface, use the *Cisco 12000 Series Router SIP and SPA Software Configuration Guide (Cisco IOS)*.

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 the publications listed in the "Related Documentation" section on page xv 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 <Return>
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 server and that the server is active (powered on), and repeat the **ping** command.

Table 5-3 show Commands to Display SPA Information

Command	Type of Information Provided	Example
show controllers *type slot/subslot/port*	Network link status, register contents, and controller chip errors.	**show controllers pos 2/3/0**
show interfaces *type slot/subslot/port*	Line status and data link protocol status for a particular SPA port. Statistics about data traffic sent and received by the port.	**show interfaces pos 2/2/0**
show diag *slot*	SPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.	**show diag 4**
show version	Cisco IOS software version, names and sources of configuration files, and boot images.	**show version**

SPA Blank Filler Plates

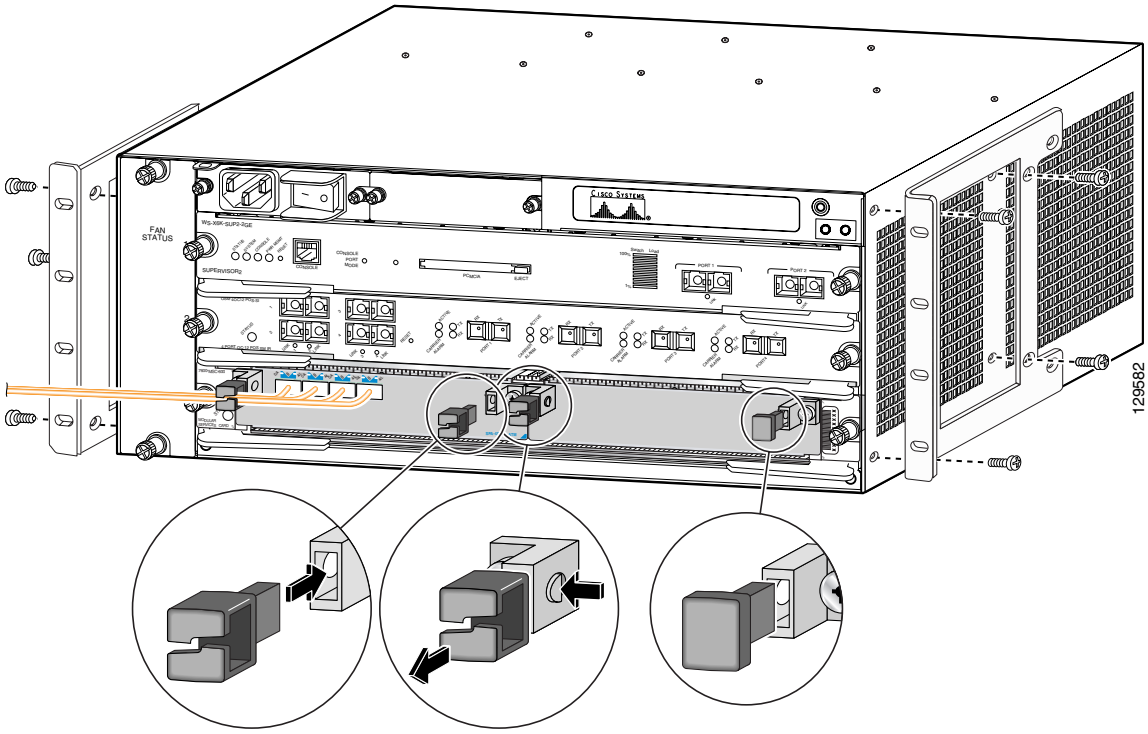
SPA blank filler plates are available to fill an unused SPA subslot. A special SPA blank filler plate is preinstalled for the 7600-SIP-600 bay 1.

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

SPA Cable-Management Brackets

SPAs are shipped with an accessory kit that includes cable-management brackets. Figure 5-3 shows cable-management brackets installed in a SPA, as well as cable routing.

Figure 5-3 SPA Cable-Management Brackets



To install cable-management brackets on a SPA, perform the following steps:

Step 1 Screw the two pull assemblies into both sides of the SPA.

Step 2 Insert the cable-management clip into the slot.

Step 3 To remove the cable-management clip, depress the button on the clip and pull it out.

Note Blank filler plugs are provided if no cable-management clips are installed.

CHAPTER 6

Troubleshooting the Installation

Release 12.0(32)SY1, OL-8831-01, Rev. G6, July 19, 2007

This chapter describes how to troubleshoot the installation of SIPs and SPAs on the Cisco 12000 series router. This chapter contains the following sections:

Using show Commands to Check Status

Each Cisco 12000 Series Router SIP maintains information about its configuration, traffic, errors, and so on. You can display this information by using th e following **show** commands.

Using the show version Command

Use the **show version** command to display the configuration of the router hardware (the number of each line card type installed), the Cisco IOS software release, the names and sources of configuration files, and the boot images.

Using the show gsr Command

Use the **show gsr** command to display information about the hardware modules installed in the Cisco 12000 Series Internet Router.

Using the show interfaces Command

The following commands display information about the router interfaces: **show interfaces**, **show interfaces pos** *slot/subslot/port*, and **show interfaces serial** *slot/subslot/port*, and so on depending on the SPA interface type.

Using the show running-config Command

Use the **show running-config** command to display the currently running configuration in RAM:

Advanced SIP Troubleshooting

This section provides advanced troubleshooting information in the event of a SIP failure. It also provides pointers for identifying whether or not the failure is hardware related. This section does not include any software-related failures, except for those that are often mistaken for hardware failures.

Note This section assumes that you possess basic proficiency in the use of Cisco IOS software commands.

By reading this section and by following the troubleshooting steps, you should be able to determine the nature of the problems you are having with your SIP. The first step is to identify the cause of the SIP failure or console errors that you are seeing. To discover which card may be at fault, it is essential to collect the output from the following commands:

- **show context summary**
- **show logging**
- **show logging summary**
- **show logging onboard**
- **show diag**
- **show context slot** *slot*

Along with these **show** commands, you should also gather the following information:

- Console Logs and Syslog Information—This information is crucial if multiple symptoms are occurring. If the router is configured to send logs to a Syslog server, you may see some information on what has occurred. For console logs, it is best to be directly connected to the router on the console port with logging enabled.
- Additional Data—The **show tech-support** command is a compilation of many different commands, including **show version**, **show running-config**, and **show stacks**. This information is required when working on issues with the Cisco Technical Assistance Center (TAC).

Note It is important to collect the **show tech-support** data before doing a reload or power cycle. Failure to do so can cause all information about the problem to be lost.

Note Output from these commands will vary slightly depending on which SIP you are using, but the basic information will be the same.

Output Examples

The following are examples of system output that you may see if your Cisco 12000 series router SIP fails. Key data in the output is underlined.

- show context summary Output

show context summary Output

```
Router# show context summary
CRASH INFO SUMMARY
Slot 0 : 0 crashes
Slot 1 : 1 crashes
1 . crash at 10:36:20 UTC Wed Dec 19 2001
Slot 2 : 0 crashes
Slot 3 : 0 crashes
Slot 4 : 0 crashes
Slot 5 : 0 crashes
Slot 6 : 0 crashes
(remainder of output omitted)
```

show logging Output

```
Router# show logging
Syslog logging: enabled (2 messages dropped, 0 messages rate.limited, 0 flushes,
0 overruns)
Console logging: level debugging, 24112 messages logged
Monitor logging: level debugging, 0 messages logged
Buffer logging: level debugging, 24411 messages logged
Logging Exception size (4096 bytes)
Trap logging: level informational, 24452 message lines logged
5d16h: %LCINFO.3.CRASH: Line card in slot 1 crashed
5d16h: %GRP.4.RSTSLOT: Resetting the card in the slot: 1,Event: 38
5d16h: %IPCGRP.3.CMDOP: IPC command 3
5d16h: %CLNS.5.ADJCHANGE: ISIS: Adjacency to malachim2 (GigabitEthernet1/0) Up,
n8 (slot1/0): linecard is disabled
.Traceback= 602ABCA8 602AD8B8 602B350C 602B3998 6034312C 60342290 601A2BC4 601A2BB0
5d16h: %LINK.5.CHANGED: Interface GigabitEthernet1/0, changed state to
administratively down
5d16h: %LINEPROTO.5.UPDOWN: Line protocol on Interface GigabitEthernet1/0,
changed state to down
5d16h: %GRP.3.CARVE_INFO: Setting mtu above 8192 may reduce available buffers
on Slot: 1.
SLOT 1:00:00:09: %SYS.5.RESTART: System restarted ..
(remainder of output omitted)
```

show logging onboard Output

The **show logging onboard** command can be used on a specific slot or on the router as a whole.

```
RouterA# show logging onboard slot 3
[using 329 of 32768 bytes]
Boot location #0: slot 3 in 'Test_2'
Location #0 runtime: 13 weeks 13h 00m (inexact)
Temperature after last boot in location #0: inlet 27 C, hotpoint 37 C
Boot location #1: slot 2 in 'RouterA'
Location #1 runtime: 5 weeks 07h 52m (inexact)
Temperature after last boot in location #1: inlet 27 C, hotpoint 37 C
<=== Crash at Aug 08 2004 11:10:37 ===>
<===End Crash ===>
```

```
Router# show logging onboard
MAIN: 800-2427-03 rev A0, S/N CAB0549LRMK
Cumulative runtime: 20h 00m (inexact)
```

Use the **show logging onboard** command to list information about a specific parameter. Type options are shown in Table 6-1.

Table 6-1 Type Options for show logging onboard Command

Type	Description
boot	Boot record
clear	Clear record
crash	Crash record
environment	Environmental error record
mem-errors	Memory error record
runtime	Runtime count

Example output of the **show logging onboard** command follows:

```
RouterA# show logging onboard slot 2 boot
Boot location #0: slot 8 in 'Test_1'
Location #0 runtime: 13 weeks 13h 00m (inexact)
Boot location #1: slot 2 in 'Test_2'
Temperature after last boot in location #0: inlet 30 C, hotpoint 39 C
Temperature after last boot in location #0: inlet 31 C, hotpoint 40 C
```

show diag *slot* Output

```
Router# show diag 1
SLOT 1 (RP/LC 1 ): 3 Port Gigabit Ethernet
MAIN: type 68, 800.6376.01 rev E0 dev 0
HW config: 0x00 SW key: 00.00.00
PCA: 73.4775.02 rev E0 ver 2
HW version 2.0 S/N CAB0450G8FX
MBUS: Embedded Agent
Test hist: 0x00 RMA#: 00.00.00 RMA hist: 0x00
DIAG: Test count: 0x00000001 Test results: 0x00000000
FRU: Linecard/Module: 3GE.GBIC.SC=
Route Memory: MEM.GRP/LC.64=
Packet Memory: MEM.LC1.PKT.256=
L3 Engine: 2 . Backbone OC48 (2.5 Gbps)
MBUS Agent Software version 01.46 (RAM) (ROM version is 02.10)
Using CAN Bus A
ROM Monitor version 10.06
Fabric Downloader version used 05.01 (ROM version is 05.01)
Primary clock is CSC 0 Board is analyzed
Board State is Line Card Enabled (IOS RUN )
Insertion time: 00:00:10 (5d16h ago)
DRAM size: 67108864 bytes
FrFab SDRAM size: 134217728 bytes, SDRAM pagesize: 8192 bytes
ToFab SDRAM size: 134217728 bytes, SDRAM pagesize: 8192 bytes
1 crash since restart
```

show context slot Output

```
Router# show context slot 2
CRASH INFO: Slot 2, Index 1, Crash at 12:24:22 MET Wed Nov 28 2001
VERSION:
GS Software (GLC1.LC.M), Version 12.0(18)S1, EARLY DEPLOYMENT RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Compiled Fri 07.Sep.01 20:13 by nmasa
Card Type: 3 Port Gigabit Ethernet, S/N
System exception: SIG=23, code=0x24, context=0x4103FE84
System restarted by a Software forced crash
STACK TRACE:
.Traceback= 400BEB08 40599554 4004FB64 4005B814 400A1694 400A1680
CONTEXT:
$0 : 00000000, AT : 41040000, v0 : 00000032, v1 : 4103FC00
a0 : 4005B0A4, a1 : 41400A20, a2 : 00000000, a3 : 00000000
t0 : 41D75220, t1 : 8000D510, t2 : 00000001, t3 : FFFF00FF
t4 : 400C2670, t5 : 00040000, t6 : 00000000, t7 : 4150A398
s0 : 0000003C, s1 : 00000036, s2 : 4103C4D0, s3 : 41D7EC60
s4 : 00000000, s5 : 00000001, s6 : 41027040, s7 : 00000000
t8 : 41A767B8, t9 : 00000000, k0 : 415ACE20, k1 : 400C4260
GP : 40F0DD00, SP : 41D7EC48, s8 : 4102D120, ra : 40599554
EPC : 0x400BEB08, SREG : 0x3400BF03, Cause : 0x00000024
ErrorEPC : 0x400C6698, BadVaddr : 0xFFBFFFFB
.Process Traceback= No Extra Traceback
SLOT 2:00:00:09: %SYS.5.RESTART: System restarted ..
(remainder of output omitted)
```

The type of failure that has occurred in the **show context slot 2** example is identified by the underlined SIG= value. The three most common types of SIP failures are:

- Software Forced Crash (SIG=23)
- Bus Error (SIG=10)
- Cache Parity Exception (SIG=20)

In the example above, the SIP has failed and has caused a reload because of a *software forced crash* exception. Once you have determined the cause and collected the necessary output, you can check for any caveats in your Cisco IOS software release using the Bug Toolkit (available to registered Cisco.com users only).

Checking the Current Status of the SIP

Once you have determined if the problems are caused by system errors in the log or an actual crash, it is important to check the current status of the SIP to see if it has recovered from the failure. The status of individual SIPs can be identified by using the **show led** command.

show led Output

```
Router# show led
SLOT 1 : RUN IOS
SLOT 6 : DNLD FABL
SLOT 7 : RP ACTV
SLOT 10 : RUN IOS
SLOT 11 : RUN IOS
SLOT 13 : RUN IOS
SLOT 14 : RUN IOS
```

Note The LED label may appear reversed in the **show led** command output. For example, IOS RUN may be displayed as RUN IOS.

If the **show led** command on the SIP displays anything other than IOS RUN, or the RP is neither the active Master/Primary nor the Slave/Secondary, there is a problem and the SIP has not fully loaded correctly. Before replacing the SIP, try fixing the problem by following these steps:

Step 1 Reload the microcode using the global configuration **microcode reload** *slot* command.

Step 2 Reload the SIP using the **hw-module slot** reload command. This causes the SIP to reset and download the MBus and fabric downloader software modules before attempting to download the Cisco IOS software.

or

Reset the SIP manually. This may rule out any problems that are caused by a bad connection to the MBus or switching fabric.

Fabric Ping Failure

Fabric ping failures occur when either a SIP or the secondary RP fails to respond to a fabric ping request from the primary RP over the switch fabric. Such failures are a problem symptom that should be investigated. They are indicated by the following error messages:

```
%GRP-3-FABRIC_UNI: Unicast send timed out (1)
%GRP-3-COREDUMP: Core dump incident on slot 1, error: Fabric ping failure
%LCINFO-3-CRASH: Line card in slot 1 crashed
```

You can find more information about this issue on Cisco.com in the *Troubleshooting Fabric Ping Timeouts and Failures on the Cisco 12000 Series Internet Router* document.

Error Messages

If you receive any error message related to a SIP, you can use the Error Message Decoder Tool (on Cisco.com) to find the meaning of this error message. Some errors point to a hardware issue, while others indicate a Cisco IOS software caveat or a hardware issue on another part of the router. This document does not cover all these messages.

Note Some messages related to Cisco Express Forwarding (CEF) and Inter Process-Communication (IPC) are explained on Cisco.com in the *Troubleshooting CEF-Related Error Messages* document.

FPGA Error Messages

If the SIP does not boot and you receive an error message indicating that there is a problem with the Field-Programmable Gate Array (FPGA) image (or if the **show led** command display remains frozen in IOS STRT state, you need to upgrade the FPGA image using the **update-fpga** option in the **diag** command.

Note The **diag** command and the **update-fpga** option are documented in the *Field Diagnostics for the Cisco 12000 Series Internet Router* document.

When the Cisco IOS image boots, it verifies that a compatible FPGA image is running on the router. The major version number of the FPGA image must be the same as that expected by the Cisco IOS image; the minor version number on the FPGA image must be the same as or greater than the minor version number expected by the Cisco IOS image. For example, if the Cisco IOS image expects a minimum FPGA image of 03.02, the software will verify that the actual major version number of the FPGA image in the SIP bootflash is 03, and that the minor version number is 02 or above.

Example error messages indicating an FPGA problem appear as follows:

Error Message `No FPGA image available for slot0. Please run field diagnostics image on slot0 to upgrade the FPGA image.`

Explanation There is currently no valid FPGA image in the bootflash of the SIP. You must load a valid FPGA image to the SIP bootflash.

Error Message `FPGA image not appropriate or corrupted for slot0. Please run field diagnostics on slot0 to upgrade the FPGA image.`

Explanation The FPGA image currently loaded in the SIP bootflash is not compatible with the Cisco IOS software release currently running on the router or is corrupted. Upgrade the FPGA image to the correct version.

Note Do not confuse the SIP bootflash with the route processor (RP) bootflash. FPGA images are loaded only to the SIP bootflash.

SIP Diagnostics

Note Output from this procedure will vary slightly depending on which SIP you are using, but the basic information will be the same.

SIP field diagnostic software is designed to identify any faulty SIP within a Cisco 12000 series router. Before Cisco IOS Release 12.0(22)S, the field diagnostic software was imbedded within the Cisco IOS software. Starting with Cisco IOS Release 12.0(22)S, this software is unbundled from the main image and must be downloaded from Cisco.com using the IOS Upgrade Planner.

Cisco initiated this change to accommodate users with 20-MB Flash memory cards. Field diagnostics are now stored and maintained as a separate image under the following name:

c12k-fdiagsbflc-mz-xxx-xx.s (where xxx-xx is the version number)

This image must be available on a separate Flash memory card, Flash disk, or TFTP boot server in order to load SIP field diagnostics. The latest version is always available on Cisco.com. RP and fabric tests remain embedded within the main Cisco IOS software image.

While the diagnostic test is running, the SIP does not function normally and cannot pass any traffic for the duration of the testing (5 to 20 minutes depending upon the complexity of the SIP). Without the **verbose** keyword, the command provides a truncated output message. When communicating with the Cisco TAC, the verbose mode is helpful in identifying specific problems. The output of the diagnostic test without the verbose command appears like the following example:

```
Router# diag 7 tftp://223.255.254.254/diagnostic/award/c12k.fdiagsbflc.mz.120-25.s
Running DIAG config check
Fabric Download for Field Diags chosen: If timeout occurs, try 'mbus' option.
Runnning Diags will halt ALL activity on the requested slot. [confirm]
Launching a Field Diagnostic for slot 7
Downloading diagnostic tests to slot 7 via fabric (timeout set to 300 sec.)
5d20h: %GRP.4.RSTSLOT: Resetting the card in the slot: 7,Event:
EV_ADMIN_FDIAGLoading diagnostic/award/c12k.fdiagsbflc.mz.120-25.s from 223.255.254.254
(via Ethernet0): !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
5d20h: Downloading diags from tftp file tftp://223.255.254.254/diagnostic/award/
c12k.fdiagsbflc.mz.120-25.s
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK . 13976524 bytes]
FD 7> **************************************************
FD 7> GSR Field Diagnostics V6.05
FD 7> Compiled by award on Tue Jul 30 13:00:41 PDT 2002
FD 7> view: award.conn_isp.FieldDiagRelease
FD 7> **************************************************
Executing all diagnostic tests in slot 7
(total/indiv. timeout set to 2000/600 sec.)
FD 7> BFR_CARD_TYPE_OC12_4P_POS testing...
FD 7> Available test types 2
FD 7> 1
FD 7> Completed f_diags_board_discovery() (0x1)
FD 7> Test list selection received: Test ID 1, Device 0
FD 7> running in slot 7 (30 tests from test list ID 1)
FD 7> Skipping MBUS_FDIAG command from slot 2
FD 7> Just into idle state
Field Diagnostic ****PASSED**** for slot 7
Shutting down diags in slot 7
Board will reload
(remainder of output omitted)
```

The SIP reloads automatically only after passing the test. If the SIP fails the test, it will not reload automatically. You can manually reload the SIP by using the **hw-module slot** *slot* **reload** command.

Field diagnostic results are stored in an electrically erasable programmable read-only memory (EEPROM) on the SIP. It is possible to view the results of the last diagnostic test performed on the SIP by executing the **diag** *slot* **previous** command.

There are some caveats that exist that cause diagnostic tests to fail, even though the SIP is not faulty. As a precaution, if the SIP fails and had been replaced previously, you should review this output with the Cisco TAC.

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 Use Cisco Systems original packaging 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.**

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, follow these 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.

GLOSSARY

D

double height Describes the dimension of a SPA that occupies two, vertically-aligned SIP subslots.

F

FPD Field-programmable device. General term for any hardware component implemented on router cards that supports separate software upgrades. SIPs and SPAs must have the right FPD version to function properly; an FPD incompatibility will disable all interfaces on the SPA or all SPAs within the SIP.

FPD image package An FPD image package is used to upgrade FPD images. Whenever a Cisco IOS image is released that supports SPAs, a companion SPA FPD image package is also released for that Cisco IOS software release.

O

OIR Online insertion and removal. Feature supported by SIPs and SPAs allowing removal of the cards while the router and the cards are activated, without affecting the operation of other cards or the router. Although this removal can be done while the SIP or SPA is activated, it is generally recommended that you gracefully deactivate the hardware using the appropriate commands for your platform prior to removal of the hardware.

S

SFP Small form-factor pluggable optical transceiver. A type of fiber optic receptacle device that mounts flush with the front panel to provide network connectivity.

single height Describes the dimension of a SPA that occupies a single SIP subslot, or half of the SIP.

SIP SPA interface processor. A SIP is a platform-specific carrier card that inserts into a router slot like a line card. A SIP can hold one or more SPAs in its subslots, depending on the SIP type. The SPA provides the network interface. The SIP provides the connection between the route processor (RP) and the SPA.

SPA Shared port adapter. A SPA is a modular, platform-independent port adapter that inserts into a subslot of a compatible SIP carrier card to provide network connectivity and increased interface port density. The SPA provides the interface between the network and the SIP.

subslot Secondary slot on a SIP where a SPA is installed. The primary slot is the chassis slot on the router.

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