Cisco CRS SIP and SPA Hardware Installation Guide

First Published: 2011-01-31

Last Modified: 2013-11-11

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CONTENTS

Preface

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

Objective

This document describes the SPA interface processor (SIPs) and shared port adapters (SPAs) that are supported on the Cisco CRS-1 and Cisco CRS-3 Carrier Routing Systems. This document also describes how to install the supported SIPs and SPAs and how to troubleshoot the installation.

Changes to This Document

The table lists the technical changes made to this document since it was first printed.

Table 1: Changes to This Document

Date	Change Summary
September 2013	Information was added to the *Overview: Cisco CRS Shared Port Adapters* chapter about the following SPAs: • 2-Port OC-48c/STM-16 POS SPA • 4-Port OC-3c/STM-1 POS SPA • 1-Port 10-Gigabit Ethernet SPA • 10-Port Gigabit Ethernet SPA These SPAs are now supported on the Cisco CRS-3 Flexible PLIM.
May 2013	Information was added to *Overview: Cisco CRS Shared Port Adapters* about the following SPAs: • 4-Port OC-12c/STM-4 POS SPA • 8-Port OC-3c/STM-1 POS SPA The 4-Port and 8-Port OC-3c/STM-1 POS SPA and the 4-Port and 8-Port OC-12c/STM-4 POS SPA are now supported on the Cisco CRS-3 Flexible PLIM
December 2012	Information about the new Cisco CRS-3 Flexible PLIM was added, and a new chapter, *Overview: Cisco CRS-3 Flexible PLIM* was created. Supported SPA types were added to *Overview: Cisco CRS Shared Port Adapters*.
March 2009	Information about the 1-Port Clear Channel OC-3 ATM SPA was added to the chapter *SIP and SPA Product Overview* and the chapter *Overview: Cisco CRS Shared Port Adapters*. Information about Dynamic Packet Transport (DPT) support for 2-Port and 4-Port OC-48c/STM-16 POS SPA and 1-Port OC-192c/STM-64 POS/RPR XFP SPA was added to the chapter *Overview: Cisco CRS Shared Port Adapters*
June 2008	Information was added to “Overview: Cisco CRS Shared Port Adapters,” about the following SPAs: • 3-Port Clear Channel OC-3 ATM SPA • 1-Port Clear Channel OC-12 ATM SPA
November 2007	Information was added to the chapter *Overview: Cisco CRS Shared Port Adapters* about the SPA-1X10GE-WL-V2, 1-Port 10-Gigabit Ethernet SPA.

Date	Change Summary
June 2007	Information was added to "Overview: Cisco CRS Shared Port Adapters," about the very-long reach XFP module, XFP-10GZR-OC192LR. Cautions were added to the chapter *Installing and Removing a SPA* regarding the time necessary between installing SPAs. Illustrations were updated to represent changes in the ejector lever on the Cisco CRS-1 SIP-800.
January 2006	Information was added to "Overview: Cisco CRS Shared Port Adapters," about the following SPAs: • 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA • 2-Port and 4-Port Clear Channel T3/E3 SPA Port number information for these SPAs was updated in the chapter *Overview: Cisco CRS-1 SPA Interface Processor*. Troubleshooting information for oversubscription of the SIP was added to the chapter *Troubleshooting the Installation*.
October 2006	Information was added to "Overview: Cisco CRS Shared Port Adapters," about the following SPAs: • 2-Port and 4-Port OC-48c/STM-16 POS SPA • 5-Port Gigabit Ethernet SPA • 10-Port Gigabit Ethernet SPA • 1-Port 10-Gigabit Ethernet SPA Port number information for these SPAs was updated in the chapter *Overview: Cisco CRS-1 SPA Interface Processor*. Optics and compatibility information for these SPAs was updated in the chapter *SIP and SPA Product Overview.*
April 2006	Information about the 8-Port OC-12c/STM-4 Multirate POS SPA was added to the chapter *Overview: Cisco CRS Shared Port Adapters*. The *Packing a SIP for Shipment* section in the *Troubleshooting the Installation* chapter was added.
July 2005	Initial release of the document.

Organization

This document contains the following chapters:

Title	Description
SIP and SPA Product Overview	Provides a brief introduction to the SPA interface processors (SIPs) and shared port adapters (SPAs).
Cisco CRS-1 SPA Interface Processor	Provides a SIP and SPA compatibility summary. For each supported SIP, it provides a summary of SIP characteristics and a SIP overview.
Overview: Cisco CRS-3 Flexible PLIM	Provides a PLIM and SPA compatibility summary. For each supported PLIM, it provides a summary of PLIM characteristics and a PLIM overview.
Overview: Cisco CRS Shared Port Adapters	For each supported SPA, provides a summary of SPA characteristics and a SPA overview.
Preparing to Install a SIP or a SPA	Describes the required tools, equipment, and safety guidelines for installing SIPs and SPAs.
Installing and Removing a SIP	Describes the procedures for installing and removing a SIP on the Cisco CRS-1 router.
Installing and Removing a SPA	Describes the procedures for installing and removing a SPA on the Cisco CRS-1 router. It also describes how to verify the SIP and SPA installation.
Troubleshooting the Installation	Provides information for troubleshooting the installation of SIPs and SPAs. It also describes helpful debug commands and error messages.

Related Documentation

For complete planning, installation, and configuration information, refer to the following documents:

- Cisco CRS Carrier Routing System 16-Slot Line Card Chassis Site Planning Guide
- Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Site Planning Guide
- Cisco CRS Carrier Routing System Multishelf System Site Planning Guide
- Cisco CRS Carrier Routing System 16-Slot Line Card Chassis System Description
- Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description
- Cisco CRS Carrier Routing System Multishelf System Description
- Cisco CRS Carrier Routing System 16-Slot Line Card Chassis Installation Guide
- Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Installation Guide
- Cisco CRS Carrier Routing System Fabric Card Chassis Installation Guide
- Cisco CRS Carrier Routing System Multishelf System Interconnection and Cabling Guide

- Cisco CRS Carrier Routing System 16-Slot Line Card Chassis Hardware Operations and Troubleshooting Guide
- Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System
- Cisco CRS Carrier Routing System Fiber-Optic Cleaning Guide
- Gigabit Interface Converter (GBIC) Module and Small Form-Factor Pluggable (SFP) GBIC Module Installation Information and Specifications

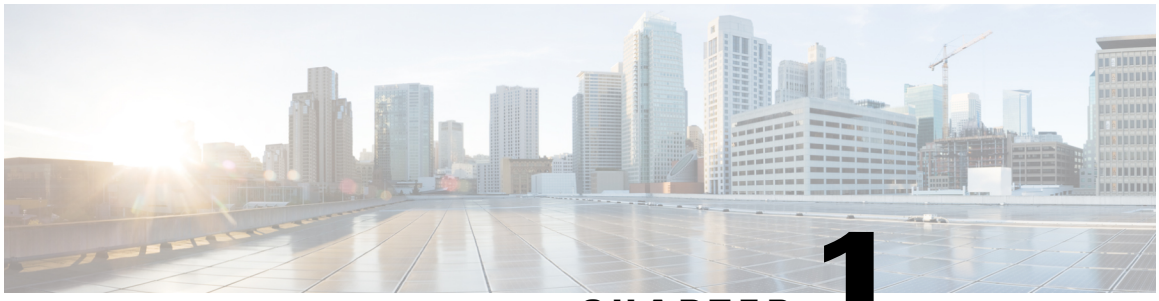
For a complete listing of software documentation available, refer to *About Cisco IOS XR Software Documentation* , available online at

http://www.cisco.com/c/en/us/support/routers/carrier-routing-system/tsd-products-support-series-home.html

Obtaining Documentation and Submitting a Service Request

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

Subscribe to *What's New in Cisco Product Documentation*, which lists all new and revised Cisco technical documentation as an RSS feed and delivers content directly to your desktop using a reader application. The RSS feeds are a free service.



CHAPTER 1

SIP and SPA Product Overview

This chapter provides an introduction to SPA interface processors (SIPs) and shared port adapters (SPAs). It includes the following sections:

For software configuration information for the various SIPs and SPAs that are supported on the Cisco CRS router, refer to *Cisco IOS XR Interface and Hardware Component Configuration Guide* at the following URL:

http://www.cisco.com/c/en/us/support/ios-nx-os-software/ios-xr-software/products-installation-and-configuration-guides-list.html

For information on specific Cisco IOS XR software commands, refer to *Cisco IOS XR Interface and Hardware Component Command Reference* at the following URL: http://www.cisco.com/c/en/us/support/ios-nx-os-software/ios-xr-software/products-command-reference-list.html

Introduction to SIPs and SPAs

SIPs and SPAs comprise a carrier card and port adapter architecture that increases modularity, flexibility, and density across Cisco Systems routers for network connectivity. This section describes the SIPs and SPAs and provides some guidelines for their use.

SPA Interface Processors

The following list describes some of the general characteristics of a SIP:

- A SIP is a carrier card that is similar to a physical layer interface module (PLIM)s and inserts into a line card chassis slot like any other PLIM. Unlike PLIMs, SIPs provide no network connectivity on their own.
- A SIP contains one or more subslots, which are used to house one or more SPAs. The SPA provides interface ports for network connectivity.

- During normal operation, the SIP should reside in the router fully populated, either with functional SPAs in all subslots or with a blank filler plate (SPA-BLANK=) inserted in all empty subslots.
- SIPs support online insertion and removal (OIR).

Shared Port Adapters

The following list describes some of the general characteristics of a SPA:

- A SPA is a modular type of port adapter that inserts into a subslot of a compatible SIP carrier card to provide network connectivity and increased interface port density. A SIP can hold one or more SPAs, depending on the SIP type and the SPA size.
- SPAs are available in the following sizes, as shown in Figure 2: Subslot Numbering for SPAs, on page 3 and the figure below:
  - Single-width SPA—Inserts into one SIP subslot.

- Double-width SPA—Inserts into two single, horizontally aligned SIP subslots.

Figure 1: Single-Width and Double-Width SPA Sizes

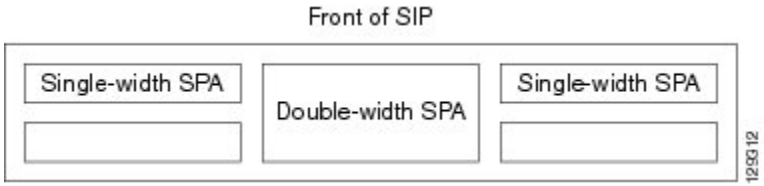
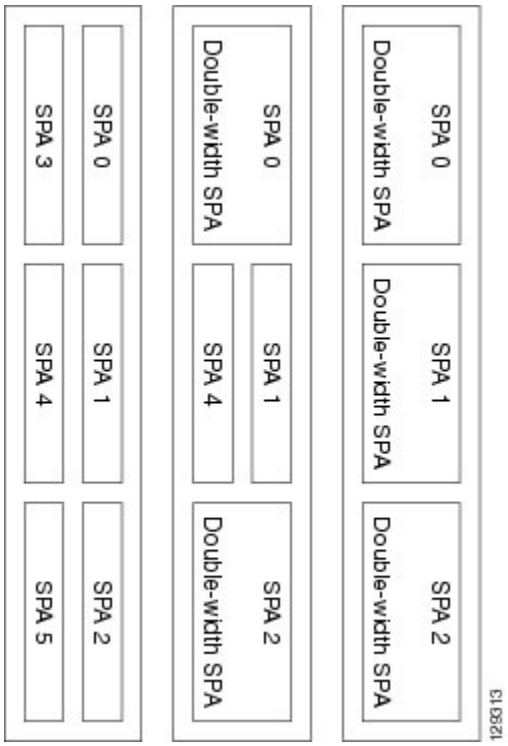


Figure 2: Subslot Numbering for SPAs



- Each SPA provides a certain number of connectors, or ports, that are the interfaces to one or more networks. These interfaces can be individually configured using the Cisco IOS XR software command-line interface (CLI).
- Either a blank filler plate (SPA-BLANK=) or a functional SPA should reside in every subslot of a SIP during normal operation to maintain cooling integrity. Blank filler plates are available in single-width form only.
- SPAs support online insertion and removal (OIR). They can be inserted or removed independently from the SIP. SIPs also support OIR.

SIP and SPA Compatibility

For a list of the SPAs supported in the Cisco CRS router, see the *SPA Summary* section in the *Cisco CRS-1 Shared Port Adapters* chapter.

Note For more information about the introduction of support for different SIPs and SPAs, refer to *Cisco IOS XR Interface and Hardware Component Configuration Guide* .

Modular Optics Compatibility

Some SPAs implement small form-factor pluggable (SFP or XFP[1]) optical transceivers to provide network connectivity. An SFP module is a fiber-optic transceiver device that mounts in the front panel to provide network connectivity.

Cisco Systems qualifies the SFP modules that can be used with SPAs.

Note The SPAs accept only the optics modules listed as supported in this document. A check is run every time an SFP or XFP module is inserted into a SPA, and only those modules that pass this check are usable.

The table below shows the types of optics modules that have been qualified for use with the SPAs supported on the Cisco CRS router, and the first software release that supports these optics:

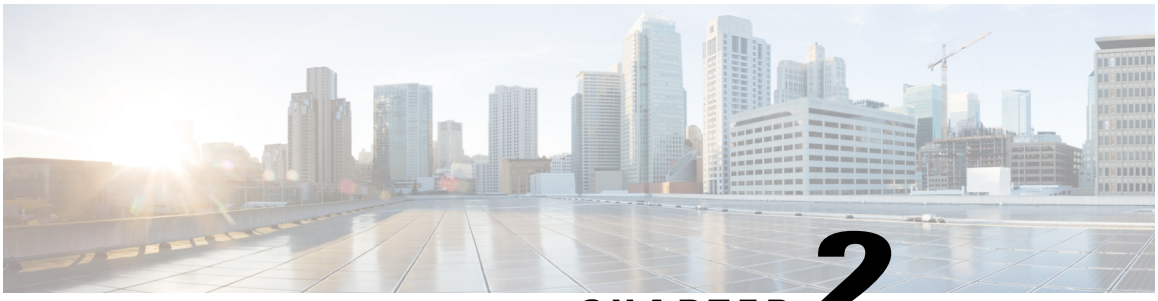
Table 2: SPA Optics Compatibility

SPA	Qualified Optics Modules (Cisco Part Numbers)	Minimum Cisco IOS XR Software
1-Port Clear Channel OC-3 ATM SPA	• SFP-OC3-MM • SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2	Release 3.8.0
3-Port Clear Channel OC-3 ATM SPA	• SFP-OC3-MM • SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2	Release 3.7.0

1 SFP modules are optics modules with speeds lower than 10 Gbps; XFP modules are optics modules with speeds equal to or greater than 10 Gbps.

SPA	Qualified Optics Modules (Cisco Part Numbers)	Minimum Cisco IOS XR Software
1-Port Clear Channel OC-12 ATM SPA	• SFP-OC12-MM • SFP-OC12-SR • SFP-OC12-IR1 • SFP-OC12-LR1 • SFP-OC12-LR2	Release 3.7.0
4-Port OC-3c/STM-1 POS SPA	• SFP-OC3-MM • SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2	Release 3.2
8-Port OC-12c/STM-4 Multirate POS SPA	• SFP-OC3-MM • SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2	Release 3.2
	• SFP-OC12-MM • SFP-OC12-SR • SFP-OC12-IR1 • SFP-OC12-LR1 • SFP-OC12-LR2	Release 3.3.0
2-Port and 4-Port OC-48c/STM-16 POS SPA	• SFP-OC48-SR OC48/STM16c • SFP-OC48-IR1 OC48/STM16c • SFP-OC48-LR2 OC48/STM16c	Release 3.4.0

SPA	Qualified Optics Modules (Cisco Part Numbers)	Minimum Cisco IOS XR Software
1-Port OC-192c/STM-64 POS/RPR XFP SPA	• XFP-10GLR-OC192SR • XFP-10GER-OC192IR	Release 3.2
	• XFP-10GZR-OC192LR	Release 3.4.0
5-Port Gigabit Ethernet SPA	• SFP-GE-S • SFP-GE-L • SFP-GE-Z	Release 3.2
8-Port Gigabit Ethernet SPA	• SFP-GE-S • SFP-GE-L • SFP-GE-Z	Release 3.2
10-Port Gigabit Ethernet SPA	• SFP-GE-S • SFP-GE-L • SFP-GE-Z	Release 3.2
1-Port 10-Gigabit Ethernet SPA	• XFP-10GLR-OC192SR • XFP-10GER-OC192IR	Release 3.2
	• XFP-10GZR-OC192LR2	Release 3.4.0
	• XFP-10G-MM-SR - (Multi-mode Short-reach (SR) XFP module)	Release 3.7.0



CHAPTER 2

Cisco CRS-1 SPA Interface Processor

This chapter describes the SPA interface processor (SIP) that is supported on the Cisco CRS-1 router and contains the following sections:

SIP Summary

A SIP is a type of PLIM that provides data interfaces for the routing system through the installed shared port adapters (SPAs). The SIP mates with its associated modular services card (MSC) through the chassis midplane. Each available SPA provides different interface types and port densities, as described in the chapter *Overview: Cisco CRS Shared Port Adapters*.

The below table shows a summary description of the SIP that is supported on the Cisco CRS-1 router.

Note The Description column indicates the aggregate bandwidth supported by the SIP across all subslots—not for each SPA subslot.

Table 3: SIP Summary

SIP	Product Number	Description	Maximum Number of SPAs	Minimum Cisco IOS XR Software	Minimum Hardware Revision
Cisco CRS-1 SIP-800	CRS1-SIP-800	40-gigabit SPA interface processor	6 single-width	Release 3.2	1.0

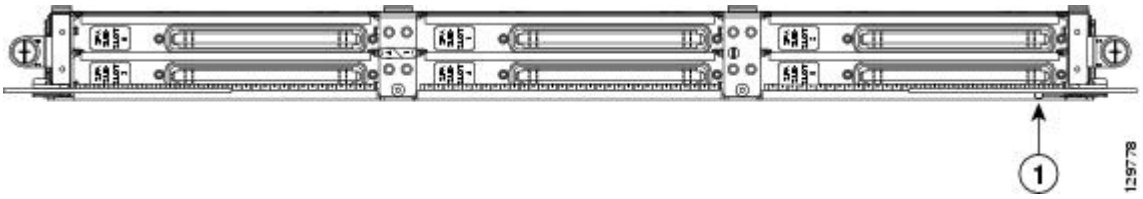
Cisco CRS-1 SIP-800 Overview

The following sections describe the Cisco CRS-1 SIP-800:

LEDs

The Cisco CRS-1 SIP-800 has one LED, as shown in the figure below.

Figure 3: Cisco CRS-1 SIP-800 Faceplate



1	Status LED

The table below describes the Cisco CRS-1 SIP-800 LED.

Table 4: Cisco CRS-1 SIP-800 LED

LED Label	Color	State	Meaning
—	Green	On	The SIP is online and standing by.
	Amber	On	The SIP has failed and needs to be replaced.
	Off	Off	The SIP is offline and deactivated.

Physical Specifications

The table below shows the Cisco CRS-1 SIP-800 physical specifications.

Table 5: Cisco CRS-1 SIP-800 Physical Specifications

Description	Specifications
Physical dimensions(H x W x D)	20.6 x 1.8 x 11.2 in. (52.32 x 4.57 x 28.4 cm)Occupies one physical layer interface module (PLIM) slot on the Cisco CRS-1 router
Weight	• Minimum, without any SPAs: 5.8 lb (2.6 kg) • Maximum, with 6 SPAs: 15 lb (6.8 kg)

Description	Specifications
Shipping weight	27 lb (12.25 kg)
Operating temperature	• Normal: 41 to 104°F (5 to 40°C) • Short term[2]: 23 to 122°F (–5 to 50°C)
Storage temperature	–40 to 158°F (–40 to 70°C)
Relative humidity	• Normal: 5 to 85% • Short term[3]: 5 to 90% but not to exceed 0.024 kg of water per kg of dry air

2 Short term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in one year. (This refers to a total of 360 hours in any given year, but no more than 15 occurrences during that one-year period.)

3 Short term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in one year. (This refers to a total of 360 hours in any given year, but no more than 15 occurrences during that one-year period.)

Identifying Slots and Subslots for SIPs and SPAs

The following sections describe SIP, SPA, and interface numbering:

SIP Slot Locations on the Cisco CRS-1 Router

A SIP can be installed in PLIM slots 0 through 15 on the Cisco CRS-1 router 16-slot line card chassis and PLIM slots 0 through 7 on the Cisco CRS-1 router 8-slot line card chassis. Figure 5: 8-Slot Line Card Chassis

Slot Numbers—Front (PLIM) View, on page 10 and the figure below show the slot numbering on the front (PLIM side) of the line card chassis.

Figure 4: 16-Slot Line Card Chassis Slot Numbers—Front (PLIM) View

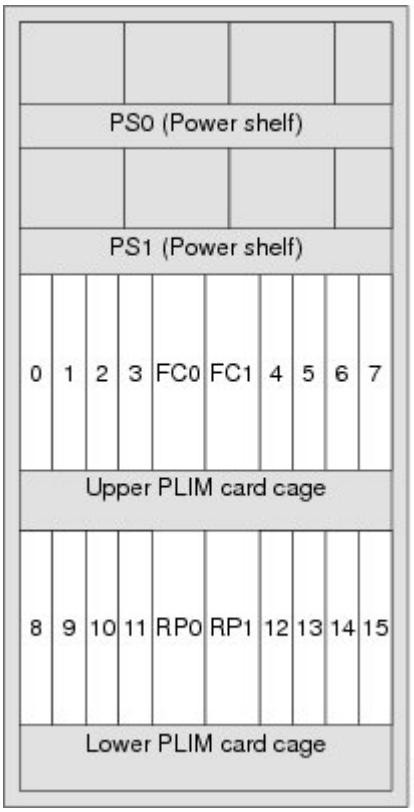
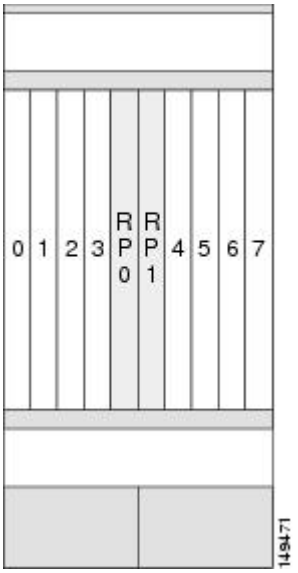


Figure 5: 8-Slot Line Card Chassis Slot Numbers—Front (PLIM) View



For additional information about the slot locations of PLIMs and their associated modular services cards (MSCs), see *Cisco CRS Carrier Routing System 16-Slot Line Card Chassis System Description* or *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description* . Both documents are available online from the specific chassis hardware documentation links at the following URL:

http://www.cisco.com/c/en/us/support/routers/carrier-routing-system/products-installation-guides-list.html

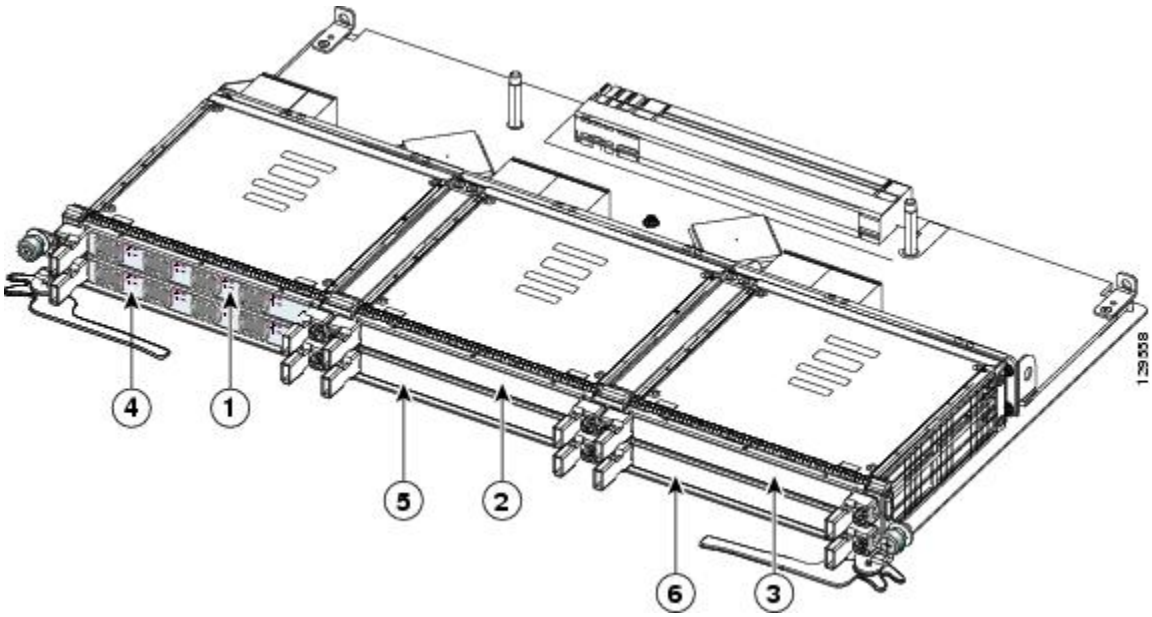
SPA Slot Numbering on the Cisco CRS-1 SIP-800

The Cisco CRS-1 SIP-800 accepts six single-width SPAs. The figure below shows a Cisco CRS-1 SIP-800 with two 4-Port OC-3c/STM-1 POS SPAs installed in subslots 0 and 3.

Note Subslots 0, 1, and 3 can provide up to 20 Gbps of capacity, as can subslots 2, 4, and 5. Take care not to install SPAs that require more than 20 Gbps of capacity in each group of subslots so as not to oversubscribe the card. See the *Bandwidth Oversubscription* section in the *Overview: Cisco CRS-1 Shared Port Adapters* chapter for more information.

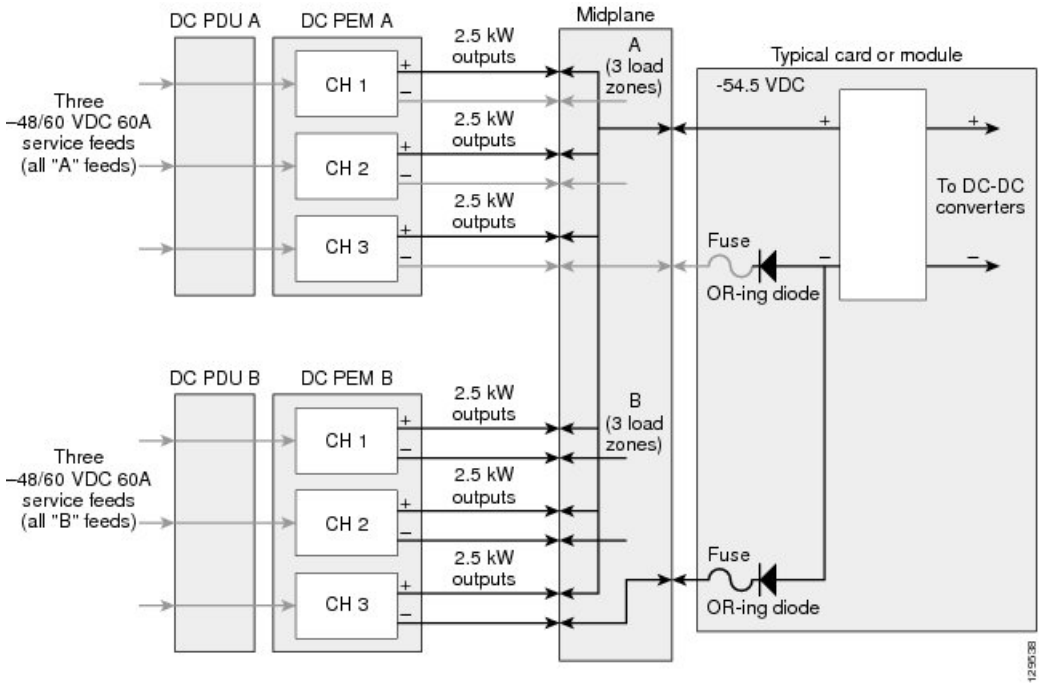
The figure below and Figure 7: Cisco CRS-1 SIP-800 Subslot Locations, on page 12 illustrate the SPA subslot locations on the Cisco CRS-1 SIP-800. The subslot labels are located inside the SPA subslot and are only visible when the SPA is not installed.

Figure 6: Cisco CRS-1 SIP-800—SPAs Installed



1	SPA subslot 0	4	SPA subslot 3
2	SPA subslot 1	5	SPA subslot 4
3	SPA subslot 2	6	SPA subslot 5

Figure 7: Cisco CRS-1 SIP-800 Subslot Locations

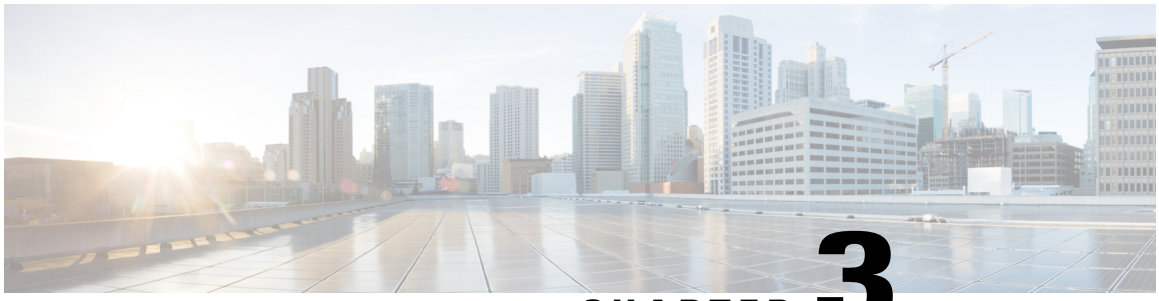


SPA Interface Addresses on SIPs

SPAs in the Cisco CRS-1 router running Cisco IOS XR Software Release 3.4.1 use an addressing format that specifies the physical location of the SIP, SPA, and interface. The interface address format is *rack* /*slot* /*subslot* /*port* , where:

- *rack* —Specifies the rack number, 0 in a single-chassis system.
- *slot* —Specifies the slot number in the Cisco CRS-1 router in which the SIP that contains the SPA is installed:
  - For the 8-slot line card chassis—0 through 7
  - For the 16-slot line card chassis—0 through 15
- *subslot* — Specifies the secondary slot on the SIP in which the SPA that you want to select is installed: for the Cisco CRS-1 SIP-800—0 through 5
- *port* —Specifies the interface number that you want to select on the SPA:
  - For the 1-Port Clear Channel OC-3 ATM SPA—0 is the only option
  - For the 3-Port Clear Channel OC-3 ATM SPA—0 through 2
  - For the 1-Port Clear Channel OC-12 ATM SPA —0 is the only option
  - For the 4-Port OC-3c/STM-1 POS SPA—0 through 3

- For the 8-Port OC-12c/STM-4 Multirate POS SPA—0 through 7
- For the 2-Port OC-48c/STM-16 POS/RPR SPA—0 through 1
- For the 4-Port OC-48c/STM-16 POS/RPR SPA—0 through 3
- For the 1-Port OC-192c/STM-64 POS/RPR XFP SPA—0 is the only option
- For the 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA—0 is the only option
- For the 5-Port Gigabit Ethernet SPA—0 through 4
- For the 8-Port Gigabit Ethernet SPA—0 through 7
- For the 10-Port Gigabit Ethernet SPA—0 through 9
- For the 1-Port 10-Gigabit Ethernet SPA—0 is the only option
- For the 2-Port Clear Channel T3/E3 SPA—0 through 1
- For the 4-Port Clear Channel T3/E3 SPA—0 through 3



CHAPTER 3

Overview: Cisco CRS-3 Flexible PLIM

This chapter describes the flexible PLIM that is supported on the Cisco CRS-3 router and contains the following sections:

Flexible PLIM Summary

The Cisco CRS-3 Flexible PLIM supports SPAs and has four SPA bays available. The Cisco CRS-3 Flexible PLIM has six integrated, 10 GE ports. These ports support multiple framing options, including WAN, LAN, and OTN. These ports also support Tunable DWDM optics, turning the 6-ports into 10 GE IP over DWDM (IPoDWDM) interfaces.

The PLIM mates with its associated modular services card (MSC) through the chassis midplane. Each available SPA provides different interface types and port densities. For a description of the SPAs supported on the Cisco CRS-3 Flexible PLIM, see Chapter 4, "Overview: Cisco CRS Shared Port Adapters."

Note The total throughput on the MSC is 107 Mpps. The Cisco CRS-3 Flexible PLIM uses 64 Mpps (60%) for the fixed 10 GE ports, and 43 Mpps (40%) for the SPA (flex) ports. Depending on the traffic, you may experience uneven packet drops between the fixed ports and the flex ports on the PLIM.

Table 6: PLIM Summary, on page 15 shows a summary description of the PLIM supported on the Cisco CRS-3 router.

Table 6: PLIM Summary

PLIM	Product Number	Description	Maximum Number of SPAs	Minimum Cisco IOS XR Software	Minimum Hardware Revision

Cisco CRS-3 Flexible PLIM	6-10GE-WLO-FLEX	Cisco CRS Series 6x10GbE OTU2 Flex Interface Module	4 single-width	Release 4.3.0	1.0

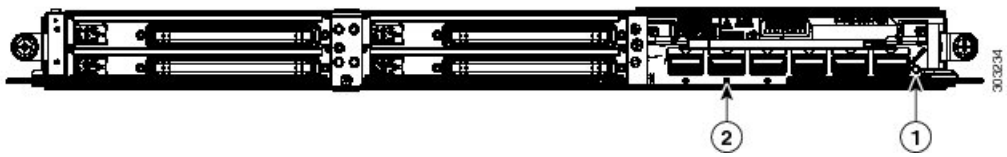
Cisco CRS-3 Flexible PLIM Overview

The following sections describe the Cisco CRS-3 Flexible PLIM:

LEDs

The Cisco CRS-3 Flexible PLIM has two LEDs, as shown in the fugure below.

Figure 8: Cisco CRS-3 Flexible PLIM Faceplate



1	PLIM Status LED
2	Port Status LEDs

The table below describes the Cisco CRS-3 Flexible PLIM LEDs.

Table 7: Cisco CRS-3 Flexible PLIM LED

LED Label	Color	State	Meaning
PLIM Status LED	Green	On	The PLIM is powered on and operational.
	Amber	On	The PLIM has a problem or is disabled by software.
	Off	Off	The PLIM is powered off.
Port Status LED	Green	On	The port is enabled by software and there is a valid link.

LED Label	Color	State	Meaning
	Amber	On	The port is disabled by software or there is a problem with the link.
	Off	Off	The PLIM is powered off.

Identifying Slots and Subslots for PLIMs and SPAs

The following sections describe PLIM, SPA, and interface numbering:

PLIM Slot Locations on the Cisco CRS-3 Router

A PLIM can be installed in slots 0 through 15 on the Cisco CRS-3 router 16-slot line card chassis and in slots 0 through 7 on the Cisco CRS-3 router 8-slot line card chassis. The figures below show the slot numbering on the front (PLIM side) of the line card chassis.

Figure 9: 16-Slot Line Card Chassis Slot Numbers—Front (PLIM) View

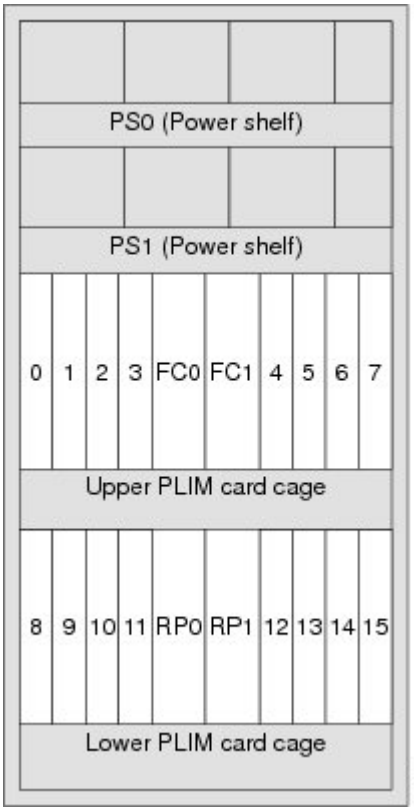
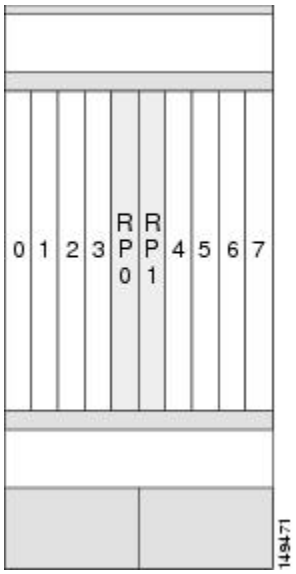


Figure 10: 8-Slot Line Card Chassis Slot Numbers—Front (PLIM) View



For additional information about the slot locations of PLIMs and their associated modular services cards (MSCs), see *Cisco CRS Carrier Routing System 16-Slot Line Card Chassis System Description* or *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description* . Both documents are available online from the specific chassis hardware documentation links at the following URL:

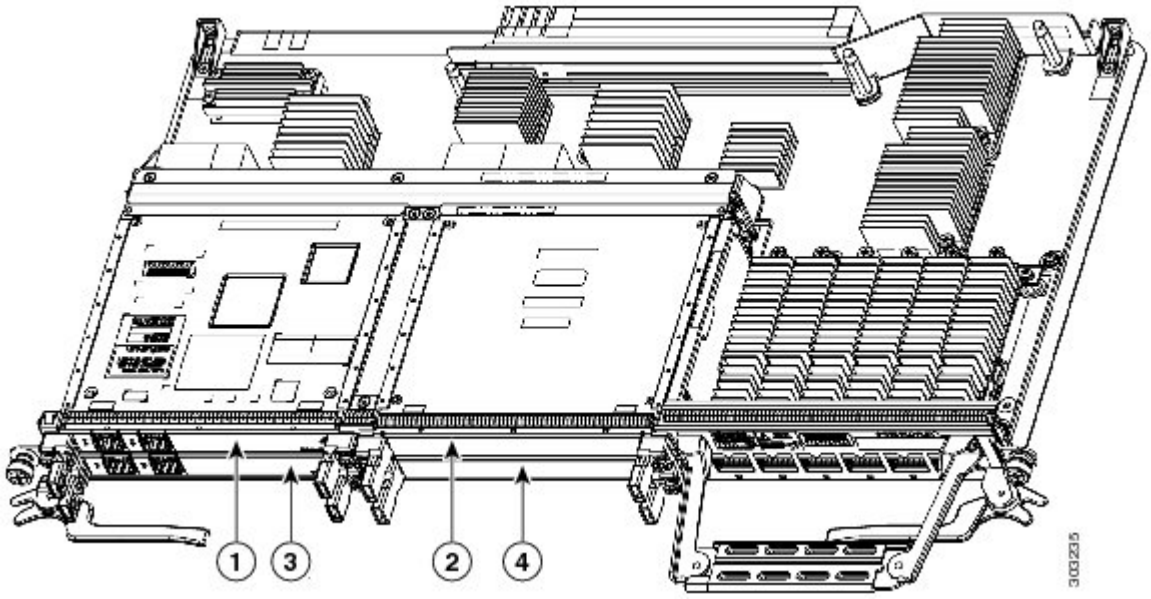
http://www.cisco.com/en/US/products/ps5763/prod_installation_guides_list.html

SPA Slot Numbering on the Cisco CRS-3 Flexible PLIM

The Cisco CRS-3 Flexible PLIM accepts four single-width SPAs. The figure below shows a Cisco CRS-3 Flexible PLIM with two 4-Port OC-48c/STM-16 POS/RPR SPAs installed in subslots 1 and 3.

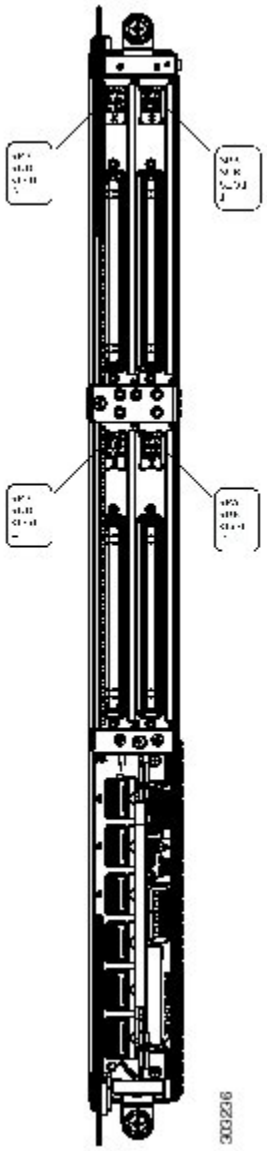
The figures below illustrate the SPA subslot locations on the Cisco CRS-3 Flexible PLIM. The subslot labels are located inside the SPA subslot and are only visible when the SPA is not installed.

Figure 11: Cisco CRS-3 Flexible PLIM—SPAs Installed



1	SPA subslot 1	3	SPA subslot 3
2	SPA subslot 2	4	SPA subslot 4

Figure 12: Cisco CRS-3 Flexible PLIM Subslot Locations



SPA Interface Addresses on PLIMs

SPAs in the Cisco CRS-3 Flexible PLIM running Cisco IOS XR Software Release 4.3.0 use an addressing format that specifies the physical location of the PLIM, SPA, and interface. The interface address format is *rack* /*slot* /*subslot* /*port* , where:

- *rack* —Specifies the rack number, 0 in a single-chassis system.
- *slot* —Specifies the slot number in which the Cisco CRS-3 Flexible PLIM is inserted:

- For the 8-slot line card chassis—0 through 7
- For the 16-slot line card chassis—0 through 15

- *subslot* — Specifies the slot in which the SPA is inserted —1 through 4
- *port* —Specifies the interface number that you want to select on the SPA:
  - For the 1-Port OC-192c/STM-64 POS/RPR XFP SPA—0 is the only option
  - For the 4-Port OC-48c/STM-16 POS/RPR SPA—0 through 3
  - For the 8-Port Gigabit Ethernet (V2) SPA—0 through 7

Restrictions

Thermal and high-powered restrictions:

- 4-slot chassis—No slot restrictions.
- 8-slot chassis—No slot restrictions.
- 16-slot chassis (for non-VE chassis)—The Cisco CRS-3 Flexible PLIM is a high-powered PLIM. Cisco CRS high-powered PLIMs are subject to slot placement restrictions on the legacy 16-slot chassis. The following error message appears if these restrictions are not followed:

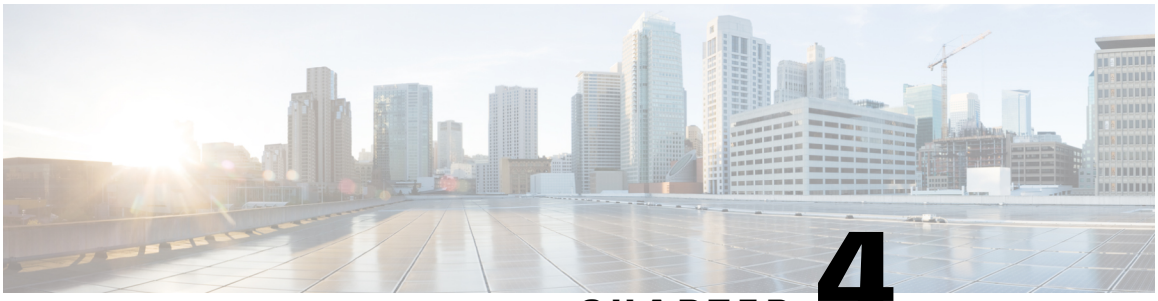
PLATFORM-SHELFMGRV2-4-HIGH_POWERED_PLIM_NOT_POWERED_ON_IN_LOWER_BAY

The following PLIMs are high-powered PLIMs:

- CRS-CGSE-PLIM—Cisco CRS Carrier Grade Services Engine (CGSE) PLIM
- 1OC768-DPSK/C-O—Cisco CRS-1 1xOC768 (C-band) DPSK+ DWDM PLIM (Offset TDC)
- 6-10GE-WLO-FLEX—Cisco CRS Flexible PLIM
- 4-40GE-L/OTN—Cisco CRS 4-Port 40 GE LAN/OTN Interface Module

The rules for placement of high-powered PLIMs are:

1. A FLEX PLIM (6-10GE-WLO-FLEX) in the lower shelf cannot be placed under a CGSE PLIM directly above in the upper shelf.
2. High-powered PLIMs may only be placed in lower slots if a high-powered PLIM is in the slot directly above or if the slot above is empty.
3. 16-slot enhanced chassis—No slot restrictions.



CHAPTER 4

Overview: Cisco CRS-1 Shared Port Adapters

This chapter describes the shared port adapters (SPAs) that are supported on the Cisco CRS-1 SIP-800 and the Cisco CRS-3 Flexible PLIM.

This chapter contains the following sections:

SPA Summary

Refer the below tables for summary descriptions of SPAs supported on the Cisco CRS-1 SIP-800 and SPAs supported on the Cisco CRS-3 Flexible PLIM.

Table 8: SPAs Supported on the Cisco CRS-1 SIP-800

SPA	SPA Part Number	Number of Ports	Minimum Cisco IOS XR Software	Minimum Hardware Revision
1-Port Clear Channel OC-3 ATM SPA	SPA-1XOC3-ATM-V2	1	Release 3.8.0	1.0
3-Port Clear Channel OC-3 ATM SPA	SPA-3XOC3-ATM-V2	3	Release 3.7.0	1.0
1-Port Clear Channel OC-12 ATM SPA	SPA-1XOC12-ATM-V2	1	Release 3.7.0	1.0
4-Port OC-3c/STM-1 POS SPA	SPA-4XOC3-POS	4	Release 3.2	1.0
8-Port OC-12c/STM-4 Multirate POS SPA	SPA-8XOC12-POS	8	Release 3.3.0	1.0
2-Port OC-48c/STM-16 POS/RPR SPA	SPA-2XOC48POS/RPR	2	Release 3.4.0	1.0
4-Port OC-48c/STM-16 POS/RPR SPA	SPA-4XOC48POS/RPR SPA-4XOC3-POS-V2	4	Release 3.4.0 Release 3.4.0	1.0
1-Port OC-192c/STM-64 POS/RPR XFP SPA	SPA-OC192POS-XFP	1	Release 3.2	1.0
1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA	SPA-OC192POS-VSR	1	Release 3.4.1	1.0
5-Port Gigabit Ethernet SPA	SPA-5X1GE-V2	5	Release 3.4.0	1.0
8-Port Gigabit Ethernet SPA	SPA-8X1GE SPA-8X1GE-V2	8	Release 3.2 Release 3.4.0	1.0
10-Port Gigabit Ethernet SPA	SPA-10X1GE-V2	10	Release 3.4.0	1.0
1-Port 10-Gigabit Ethernet SPA	SPA-1X10GE-L-V2 SPA-1X10GE-WL-V2	1	Release 3.4.0 Release 3.5.0	1.0
2-Port Clear Channel T3/E3 SPA	SPA-2XT3/E3	2	Release 3.4.1	1.0
4-Port Clear Channel T3/E3 SPA	SPA-4XT3/E3	4	Release 3.4.1	1.0

Table 9: SPAs Supported on the Cisco CRS-3 Flexible PLIM

SPA	SPA Part Number	Number of Ports	Minimum Cisco IOS XR Software	Minimum Hardware Revision
1-Port OC-192c/STM-64 POS/RPR XFP SPA	SPA-OC192POS-XFP	1	Release 4.3.0	1.0
2-Port OC-48c/STM-16 POS SPA	SPA-2XOC48-POS	2	Release 4.3.2	1.0
4-Port OC-3c/STM-1 POS SPA	SPA-4XOC3-POS-V2	4	Release 4.3.2	1.0
4-Port OC-48c/STM-16 POS/RPR SPA	SPA-4XOC48POS/RPR	4	Release 4.3.0	1.0
1-Port 10-Gigabit Ethernet SPA	SPA-1X10GE-L-V2 SPA-1X10GE-WL-V2	1	Release 4.3.2 Release 4.3.2	1.0
8-Port Gigabit Ethernet SPA	SPA-8X1GE-V2	8	Release 4.3.0	1.0
10-Port Gigabit Ethernet SPA	SPA-10X1GE-V2	10	Release 4.3.2	1.0
4-Port OC-3c/STM-1 POS SPA	SPA-4XOC3-POS	4	Release 4.3.1	1.0
4-Port OC-12c/STM-4 Multirate POS SPA	SPA-4XOC12-POS	4	Release 4.3.1	1.0
8-Port OC-12c/STM-4 Multirate POS SPA	SPA-8XOC12-POS	8	Release 4.3.1	1.0
8-Port OC-3c/STM-1 POS SPA	SPA-8XOC3-POS	8	Release 4.3.1	1.0

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. It is also important not to exceed the bandwidth of the SIP. For information on SIP bandwidth, see the SIP Summary, on page 7.

Cisco CRS-1 SIP-800

The processing on the Cisco CRS-1 SIP-800 is performed by two PLIM ASICs, each of which can process up to 20 Gbps of traffic. SPA subslots 0, 1, and 3 are associated with one PLIM ASIC, while SPA subslots 2, 4, and 5 are associated with the second PLIM ASIC. See the figure below for subslot locations.

1	Subslots controlled by one PLIM ASIC	2	Subslots controlled by second PLIM ASIC

If you are using only Gigabit Ethernet SPAs on the Cisco CRS-1 SIP-800, then the SIP can be oversubscribed. The Cisco CRS-1 SIP-800 can pass a maximum of 40 Gbps of traffic, so if you have six 8-Port Gigabit Ethernet SPAs operating at almost full capacity, the SIP is oversubscribed.

If you are using any Packet Over Sonet (POS) SPAs in the Cisco CRS-1 SIP-800, regardless of the bandwidth of the SPA interfaces (OC-3c/STM-1, OC-12c/STM-4, OC-48c/STM-16, or OC-192c/STM-64), no oversubscription of either PLIM ASIC is allowed, nor can the total bandwidth of the SIP exceed 40 Gbps. For this reason, you can install a maximum of four OC-192c/STM-64 POS SPAs in the Cisco CRS-1 SIP-800. Two of them must be installed in subslots 0, 1, or 3; the other two must be installed in subslots 2, 4, or 5. The following arrangement of SPAs within the SIP indicates a valid configuration that optimizes the use of the available PLIM ASIC bandwidth:

Subslot 0: OC-192c/STM-64 POS SPA	**Subslot 1:** OC-192c/STM-64 POS SPA	**Subslot 2:** 8-Port Gigabit Ethernet SPA
Subslot 3: Empty	**Subslot 4:** 8-Port Gigabit Ethernet SPA	**Subslot 5:** 4-Port OC-3c/STM-1 POS SPA

In this example, because at least one OC-192c/STM-64 POS SPA is installed, the maximum bandwidth allowed on the first PLIM ASIC (associated with subslots 0, 1, and 3) is 20 Gbps, and the total capacity of the SIP is controlled to be 40 Gbps or less. The total bandwidth usage required in this example is 36 Gbps.

The ingress oversubscription of Cisco CRS-1 SIP-800 with ATM SPA is supported in the following conditions:

- The ATM SPAs are allowed to come up even when the total ingress traffic from all the Gigabit Ethernet SPAs exceeds 40-Gbps capacity when a combination of Gigabit Ethernet SPAs and ATM SPAs is used.
- Traffic is restricted to 40 Gbps per MSC when even a single POS SPA is inserted. In this case, the newly inserted ATM SPA is not allowed to come up.
- Overall traffic to a single PLIM ASIC does not exceed 20 Gbps while sending policed traffic on the Gigabit Ethernet.
- If oversubscription occurs, then the excess ingress traffic might be dropped.

If you attempt to install a SPA that oversubscribes the SIP, the SPA does not power up, and you receive an error message similar to the following:

```
LC/0/2/CPU0:Jan 31 11:52:57.335 : jacket[159]: %JACKET-3-RULES_FATAL_ERROR
: SPA subslot 4: FAILED: Not enough bandwidth for 1xOC192 POS/RPR HHSPA with XFP
```

Cisco CRS-3 Flexible PLIM

For the Cisco CRS-3 Flexible PLIM, none of the SPAs supported as of 4.3.0 exceed 10G in capacity. Therefore, it is theoretically impossible to oversubscribe the two PLIM ASICs. However, there is an additional datapath bridge FPGA in the Cisco CRS-3 Flexible PLIM which can handle traffic only up to 61 million packets per second. If this limitation is breached, packet drops will be observed in the SPA path of the Cisco CRS-3 Flexible PLIM.

SPA Bandwidth Capacity

The table below provides information about the bandwidth for each port (per-port bandwidth) on a SPA and the cumulative bandwidth (total bandwidth) for all ports available on the SPA.

Table 10: SPA Bandwidth Capacity

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
1-Port Clear Channel OC-3 ATM SPA	155.52 Mbps	1	155.52 Mbps
3-Port Clear Channel OC-3 ATM SPA	155.52 Mbps	3	466.56 Mbps
1-Port Clear Channel OC-12 ATM SPA	622.08 Mbps	1	622.08 Mbps
4-Port OC-3c/STM-1 POS SPA	155.52 Mbps	4	622.08 Mbps
8-Port OC-12c/STM-4 Multirate POS SPA	155.52 Mbps or 622.08 Mbps	8	4.976 Gbps[4]
2-Port OC-48c/STM-16 POS/RPR SPA	2.488 Gbps	2	5 Gbps
4-Port OC-48c/STM-16 POS/RPR SPA	2.488 Gbps	4	10 Gbps
1-Port OC-192c/STM-64 POS/RPR XFP SPA	9.953 Gbps	1	10 Gbps
1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA	9.953 Gbps	1	10 Gbps
5-Port Gigabit Ethernet SPA	1 Gbps	5	5 Gbps
8-Port Gigabit Ethernet SPA	1 Gbps	8	8 Gbps
10-Port Gigabit Ethernet SPA	1 Gbps	10	10 Gbps

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
1-Port 10-Gigabit Ethernet SPA	10 Gbps	1	10 Gbps
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)

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

Note If you oversubscribe the SIP, and the SPA subslot is locked in the failed state, refer to the *Troubleshooting in SPA* section for instructions on how to enable the SPA.

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

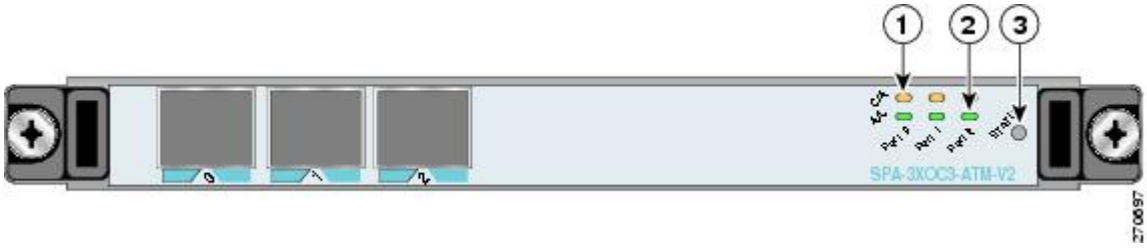
The 1-Port and 3-Port Clear Channel OC-3 ATM SPA is a single-height SPA that installs into one SIP subslot. The Clear Channel OC-3 ATM SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity with a per-port bandwidth of 155.52 Mbps. For more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

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

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

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. The figure below shows an example of these LEDs on a 3-Port Clear Channel OC-3 ATM SPA.

Figure 13: 3-Port Clear Channel OC-3 ATM SPA Faceplate



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

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs are described in the table below.

Table 11: 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs

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

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

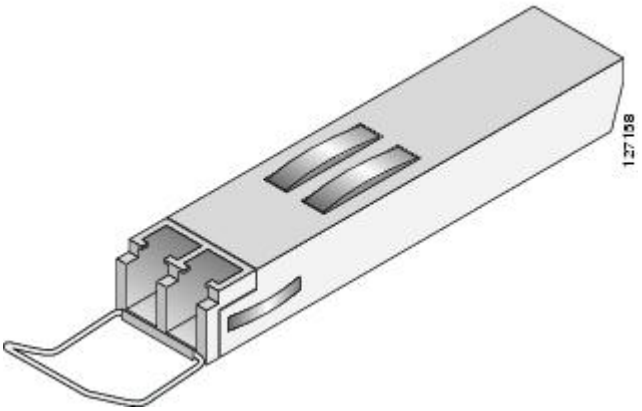
The physical layer interface for the 1-Port and 3-Port Clear Channel OC-3 ATM SPA is Optical Carrier-3 (OC-3), and the data link layer is designed to comply with ATM specifications. The 1-Port and 3-Port Clear Channel OC-3 ATM SPA provides up to one and three 155-Mbps OC-3 network interfaces, respectively,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

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

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

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

Figure 14: SFP Optics Module



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

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

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

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

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

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

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

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

Figure 15: Duplex Patch Cable with LC-Type Connectors

1-Port Clear Channel OC-12 ATM SPA Overview

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

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

1-Port Clear Channel OC-12 ATM SPA LEDs

The 1-Port Clear Channel OC-12 ATM SPA has three types of LEDs. There are two LEDs for the port on the SPA, and one STATUS LED, as shown in the figure below.

Figure 16: 1-Port Clear Channel OC-12 ATM SPA Faceplate

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

The 1-Port Clear Channel OC-12 ATM SPA LEDs are described in the table below.

Table 12: 1-Port Clear Channel OC-12 ATM SPA LEDs

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

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

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

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

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

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

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

Multimode (MM) SFP module—SFP-OC12-MM

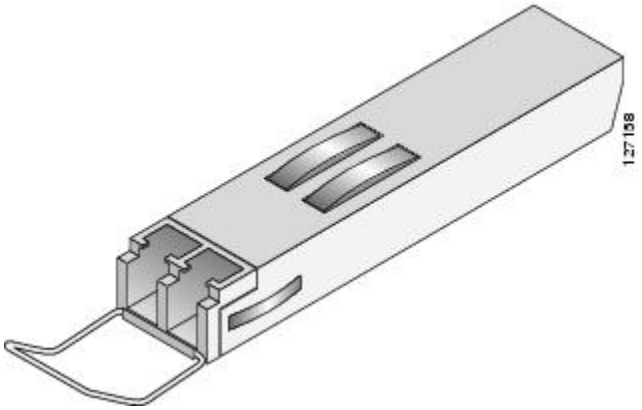
Short-reach (SR) SFP module—SFP-OC12-SR

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

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

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

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



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

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

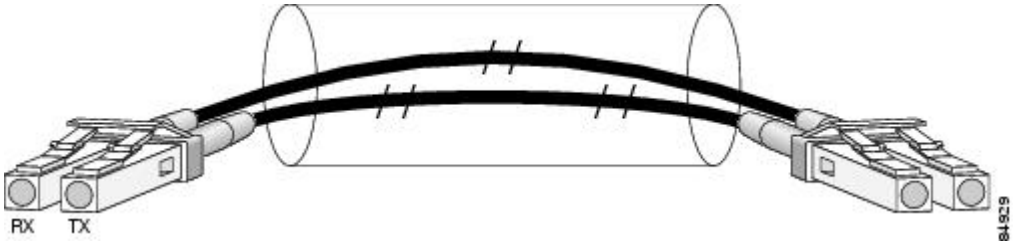
Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.

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

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

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

Figure 17: Duplex Patch Cable with LC-Type Connectors



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

The 4-Port and 8-Port OC-3c/STM-1 POS SPA is a single-width SPA that installs into one SIP subslot. The OC-3c/STM-1 POS SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity with a per-port bandwidth of 155.52 Mbps. The 4-Port and 8-Port OC-3c/STM-1 POS SPA operates at quarter rate.

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

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

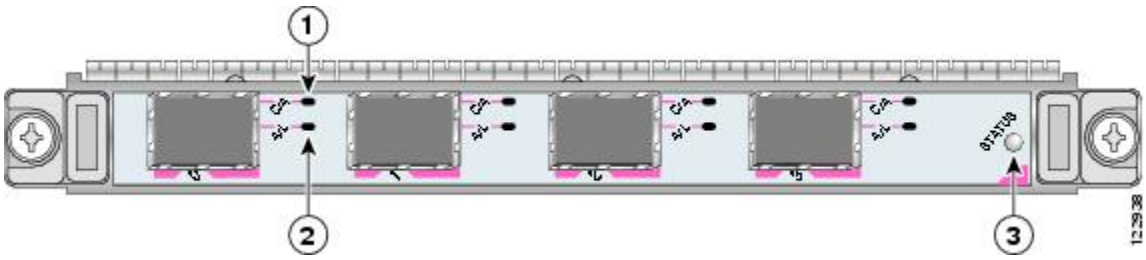
The following sections describe the 4-Port OC-3c/STM-1 POS SPA:

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

The 4-Port and 8-Port OC-3c/STM-1 POS SPA has three types of LEDs: two LEDs for each port on the SPA and one STATUS LED. The table below shows the 4-Port OC-3c/STM-1 POS SPA.

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

Figure 18: 4-Port OC-3c/STM-1 POS SPA Faceplate



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

The below table describes the 4-Port and 8-Port OC-3c/STM-1 POS SPA LEDs.

Table 13: 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, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.

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

4-Port 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-3c/STM-1 line rates (155.52 Mbps).

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

The 4-Port and 8-Port OC-3c/STM-1 POS SPA interfaces comply with the following RFCs:

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

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

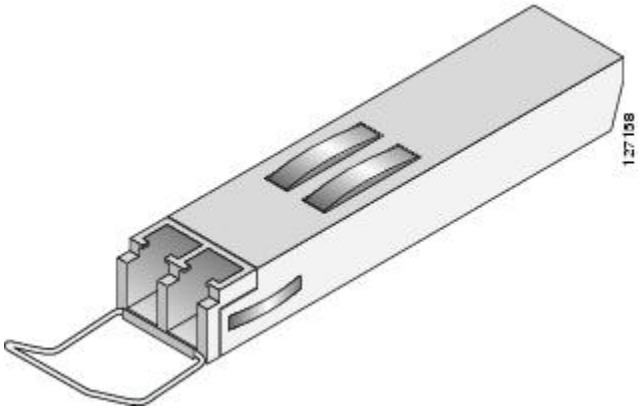
The 4-Port and 8-Port OC-3c/STM-1 POS SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see the figure below).

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

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

- Long-reach (LR) SFP module (80 km)—SFP-OC3-LR2

Figure 19: SFP Optics Module



The SFP optical transceiver modules used with the 4-Port and 8-Port OC-3c/STM-1 POS SPA provide the following optical fiber options:

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

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

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

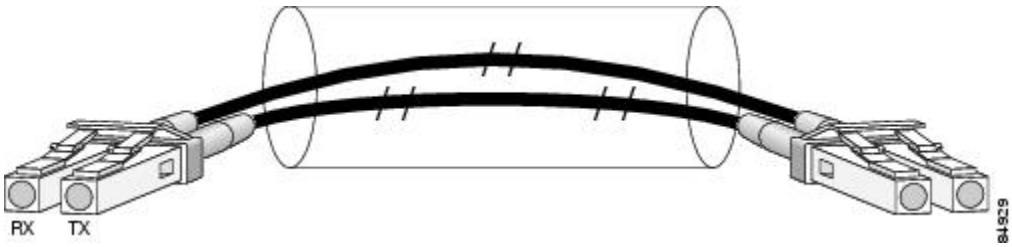
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

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

Use single-mode (for intermediate-reach or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 4-Port or 8-Port OC-3c/STM-1 POS SPA-equipped routers back-to-back.

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

Figure 20: LC-Type Cable



OC-3 Module Connections

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

Table 14: OC-3 Specifications

Specification	Description
Wavelength	OC-3 MM: 1270 nm to 1380 nm OC-3 SR: 1260 nm to 1360 nm OC-3 IR-1: 1261 nm to 1360 nm OC-3 LR-1: 1263 nm to1360 nm OC-3 LR-2: 1480 nm to 1580 nm
Cabling distance (maximum)	OC-3 MM: 2 km (1.2 miles) OC-3 SR: 2 km (1.2 miles) OC-3 IR-1: 15 km (9.3 miles) OC-3 LR-1: 40 km (24.8 miles) OC-3 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-3 MM: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 SR: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 IR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-2: 23 to 185 degrees F (–5 to 85 degrees C)
TX power	OC-3 MM: (not supported) OC-3 SR: –15 to –8 dBm OC-3 IR-1: –15 to –8 dBm OC-3 LR-1: –5 to 0 dBm OC-3 LR-2: –5 to 0 dBm
Receiver sensitivity (maximum)	OC-3 MM: –30 dBm OC-3 SR: –23 dBm OC-3 IR-1: –28 dBm OC-3 LR-1: –34 dBm OC-3 LR-2: –34 dBm

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

4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA Overview

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

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

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

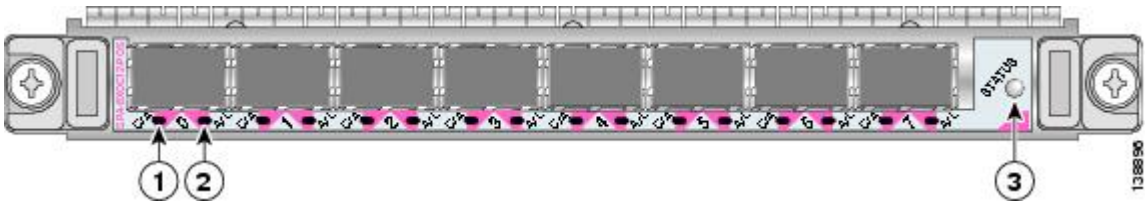
The following sections describe the 4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA:

4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA LEDs

The 4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA has three types of LEDs: two LEDs for each port on the SPA and one STATUS LED.The figure below shows the 8-Port OC-12c/STM-4 Multirate POS SPA faceplate.

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

Figure 21: 8-Port OC-12c/STM-4 Multirate POS SPA Faceplate



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

The table below describes the 4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA LEDs.

Table 15: 4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA LEDs

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

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.

4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA Interface Specifications

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

The 4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA interface complies with the following RFCs:

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

4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA Optical Transceiver Modules and Cables

The 4-Port and 8-Port OC-12c/STM-4 Multirate POS SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connections (see the figure below).

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

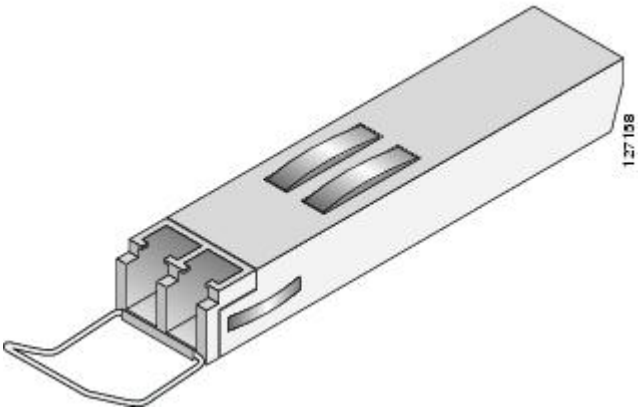
- Multimode (MM) SFP module—SFP-OC3-MM
- Short-reach (SR) SFP module—SFP-OC3-SR
- Intermediate-reach (IR) SFP module (15 km)—SFP-OC3-IR1
- Long-reach (LR) SFP module (40 km)—SFP-OC3-LR1
- Long-reach (LR) SFP module (80 km)—SFP-OC3-LR2

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

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

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

Figure 22: SFP Optics Module



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

- Multimode—155.52-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)

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

- Single-mode—155.52-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)

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

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

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

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

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

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

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

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

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

Figure 23: LC-Type Cable

OC-3 Module Connections

The table below shows the OC-3 specifications of the optics on the 8-Port OC-12c/STM-4 Multirate POS SPA.

Table 16: OC-3 Specifications

Specification	Description
Wavelength	OC-3 MM: 1270 nm to 1380 nm OC-3 SR: 1260 nm to 1360 nm OC-3 IR-1: 1261 nm to 1360 nm OC-3 LR-1: 1263 nm to1360 nm OC-3 LR-2: 1480 nm to 1580 nm
Operating case temperature range	OC-3 MM: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 SR: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 IR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-2: 23 to 185 degrees F (–5 to 85 degrees C)
Cabling distance (maximum)	OC-3 MM: 2 km (1.2 miles) OC-3 SR: 2 km (1.2 miles) OC-3 IR-1: 15 km (9.3 miles) OC-3 LR-1: 40 km (24.8 miles) OC-3 LR-2: 80 km (49.7 miles)

Specification	Description
TX power	OC-3 MM: (not supported) OC-3 SR: –15 to –8 dBm OC-3 IR-1: –15 to –8 dBm OC-3 LR-1: –5 to 0 dBm OC-3 LR-2: –5 to 0 dBm
Receiver sensitivity (maximum)	OC-3 MM: –30 dBm OC-3 SR: –23 dBm OC-3 IR-1: –28 dBm OC-3 LR-1: –34 dBm OC-3 LR-2: –34 dBm
RX overload	OC-3 MM: –5 dBm OC-3 SR: –8 dBm OC-3 IR-1: –8 dBm OC-3 LR-1: –10 dBm OC-3 LR-2: –10 dBm
Maximum receiver power damage	OC-3 MM: +5 dBm OC-3 SR: +5 dBm OC-3 IR-1: +5 dBm OC-3 LR-1: +5 dBm OC-3 LR-2: +5 dBm

OC-12 Module Connections

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

Table 17: OC-12 Specifications

Specification	Description
Wavelength	OC-12 MM: 1270 nm to 1380 nm OC-12 SR: 1261 nm to 1360 nm OC-12 IR-1: 1293 nm to 1334 nm OC-12 LR-1: 1280 nm to 1335 nm OC-12 LR-2: 1480 nm to 1580 nm

Specification	Description
Cabling distance (maximum)	OC-12 MM: 0.5 km (0.3 miles) OC-12 SR: 2 km (1.2 miles) OC-12 IR-1: 15 km (9.3 miles) OC-12 LR-1: 40 km (24.8 miles) OC-12 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-12 MM: 23 to 185 degrees F (–5 to 85 degrees C) OC-12 SR: 23 to 185 degrees F (–5 to 85 degrees C) OC-12 IR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-12 LR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-12 LR-2: 23 to 185 degrees F (–5 to 85 degrees C)
TX power	OC-12 MM: (not supported) OC-12 SR: –15 to –8 dBm OC-12 IR-1: –15 to –8 dBm OC-12 LR-1: –3 to 2 dBm OC-12 LR-2: –3 to 2 dBm
Receiver sensitivity (maximum)	OC-12 MM: –26 dB OC-12 SR: –23 dBm OC-12 IR-1: –28 dBm OC-12 LR-1: –28 dBm OC-12 LR-2: –28 dBm
RX overload	OC-12 MM: –6 dBm OC-12 SR: –8 dBm OC-12 IR-1: –8 dBm OC-12 LR-1: –8 dBm OC-12 LR-2: –8 dBm

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

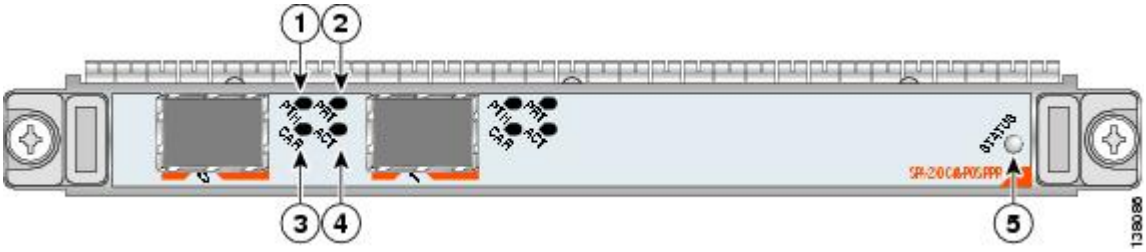
2-Port and 4-Port OC-48c/STM-16 POS/RPR SPA Overview

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

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

The 2-Port and 4-Port OC-48c/STM-16 POS/RPR SPA has five types of LEDs: four LEDs for each port on the SPA and one STATUS LED, as shown in the figure below.

Figure 24: 2-Port OC-48c/STM-16 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 table below describes the 2-Port and 4-Port OC-48c/STM-16 POS/RPR SPA LEDs.

Table 18: 2-Port and 4-Port OC-48c/STM-16 POS/RPR SPA LEDs

LED Label	Color	State	Meaning
PTH	Off	Off	Port is not in pass-through mode.

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

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

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

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

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

Note For Cisco IOS XR Software Release 3.8.0, the 2-Port and 4-Port OC-48c/STM-16 POS/RPR SPA supports Dynamic Packet Transport (DPT) feature. Cisco DPT family of products delivers scalable Internet service, reliable IP-aware optical transport, and simplified network operations. The Spatial Reuse Protocol (SRP) is a MAC-layer protocol developed by Cisco and is used in conjunction with Cisco DPT products, which utilizes a pair of counter-rotating rings in an optimum fashion to provide improved bandwidth utilization over an equivalent SONET network.

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

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

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

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

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

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

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

Figure 25: LC-Type Cable

OC-48 Module Connections

The table below shows the OC-48 specifications for use with the 2-Port and 4-Port OC-48c/STM-16 POS/RPR SPA.

Table 19: OC-48 Specifications

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

Specification	Description
RX overload	OC-48 SR: –3 dBm OC-48 IR-1: 0 dBm OC-48 LR-2: –9 dBm
Maximum receiver power damage	OC-48 SR: +5 dBm OC-48 IR-1: +5 dBm OC-48 LR-2: +5 dBm

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.

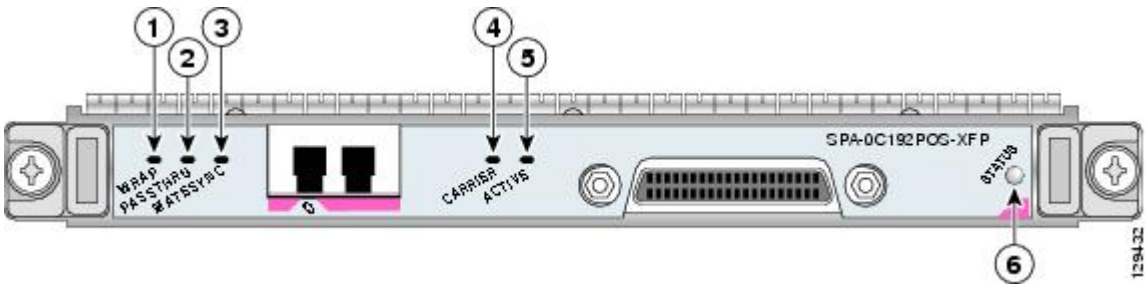
The 1-Port OC-192c/STM-64 POS/RPR XFP SPA uses a 10-Gbps small form-factor pluggable optical receptacle for each port allowing connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the 1-Port OC-192c/STM-64 POS/RPR XFP SPA Optical Transceiver Modules, Connectors, and Cables, on page 53.

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 the figure below.

Figure 26: 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

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

Table 20: 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-through mode.
	Amber	On	Port is in pass-through mode.
MATESYNC	Off	Off	Mate port is not synchronized.
	Green	On	Mate port is synchronized.
CARRIER	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm (LOS, LOF, RDI, and so on).
		Blinking	SRP mode mismatch alarm is indicated.

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*

For information on SNMP MIB support, see the *Implementing SNMP on Cisco IOS XR Software* chapter in *Cisco IOS XR System Management Configuration Guide*

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

1-Port OC-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:

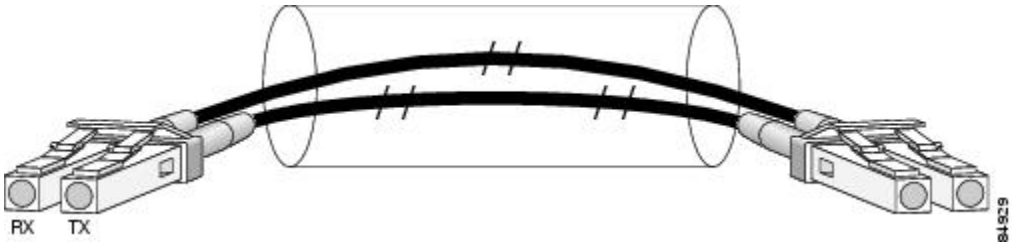
- Single-mode short-reach (SR) XFP module—XFP-10GLR-OC192SR
- Single-mode intermediate-reach (IR) XFP module—XFP-10GER-OC192IR
- Single-mode very-long reach XFP module—XFP-10GZR-OC192LR

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

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

The figure below 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 27: LC-Type Cable for the XFP Optical Transceiver Modules



OC-192 Module Connections

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

Table 21: 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

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

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

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

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

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

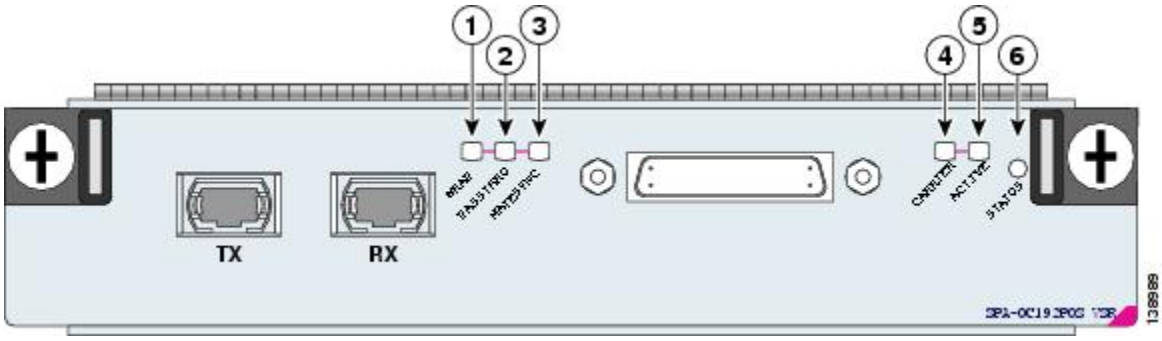
The 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA uses a single, 10-Gbps fixed optical receptacle, allowing a connection to multimode optical fiber. For more information on the optical fiber cables used with this SPA, see the 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA Fixed Optical Transceiver, Connector, and Cables, on page 57.

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

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

The 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA has six LEDs, as shown in the figure below.

Figure 28: 1-Port OC-192c/STM-64 POS/RPR VSR Optics 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.

The table below describes the 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA LEDs.

Table 22: 1-Port OC-192c/STM-64 POS/RPR VSR Optics 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.

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

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

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

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

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

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

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

The 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA uses fixed optical transceivers, one for receive (RX) and one for transmit (TX), for SONET and SDH connection to the network. Only Very Short Reach (VSR) optics are supported.

The 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA uses multimode MTP-type connectors:

Multimode—9.95 Gbps, OC-192 optical fiber (SONET STS-192c or SDH STM-64c). Use a multimode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

Use a multimode optical fiber cable to connect your router to a network.

The figure below shows the cable type for use with the fixed optical transceiver module on the 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA.

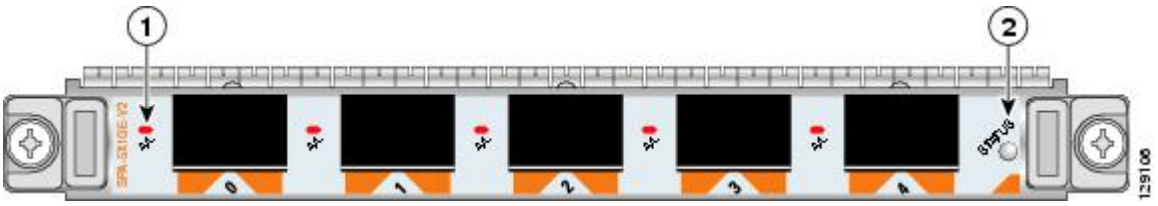
5-Port Gigabit Ethernet SPA Overview

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 the table below.

Figure 29: 5-Port Gigabit Ethernet SPA Faceplate



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

The table below describes the 5-Port Gigabit Ethernet SPA LEDs.

Table 23: 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. The tables below provide SFP module information and specifications.

Table 24: 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 25: 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

Specification	Description
Cabling distance (maximum)	SFP-GE-S: 500 m on 50/125um MMF; 300 m on 62.5/125um MMFSFP-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 VSFP-GE-L: 3.1 to 3.5 VSFP-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 theIEEE 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

The table below 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 26: SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	MaximumCable Distance
SFP-GE-S	850	MMF **Note** Multimode fiber (MMF) only.	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	SMF	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 Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	MaximumCable Distance
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF **Note** Dispersion-shifted single-mode fiber-optic cable.	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

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.

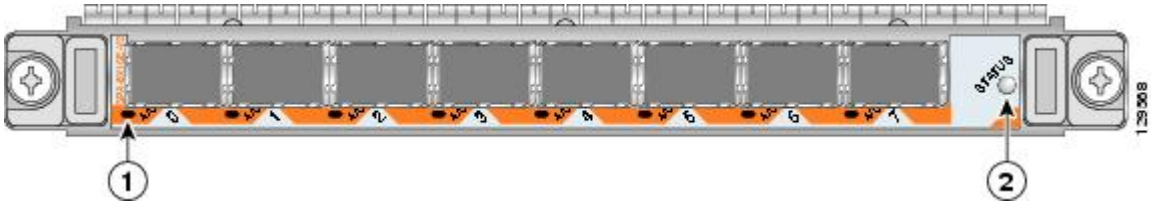
8-Port Gigabit Ethernet SPA Overview

The following sections describe the 8-Port Gigabit Ethernet SPA:

8-Port Gigabit Ethernet SPA LEDs

The 8-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 the figure below.

Figure 30: 8-Port Gigabit Ethernet SPA Faceplate



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

The table below describes the 8-Port Gigabit Ethernet SPA LEDs.

Table 27: 8-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.

8-Port Gigabit Ethernet SPA Cables and Connectors

The interface connectors on the 8-Port Gigabit Ethernet SPA are eight 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 8-Port Gigabit Ethernet SPA, linking the port with a fiber-optic network.

Note The 8-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 8-Port Gigabit Ethernet SPA, and only SFP modules that pass this check can be used by the 8-Port Gigabit Ethernet SPA. SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 8-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 8-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. The tables below provide SFP module information and specifications.

Table 28: SFP Module Options

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

Table 29: SFP Module Specifications

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

SFP-GE-S Modules

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

SFP-GE-L Modules

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

SFP-GE-Z Modules

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

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

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

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

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

SFP Module Cabling and Connection Equipment

The below table provides cabling specifications for the SFP modules that can be installed on the 8-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 30: SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	MaximumCable Distance
SFP-GE-S	850	MMF[5]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	SMF	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[6]	8	—	62.1 miles (100 km)

5 Multimode fiber (MMF) only.
6 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.

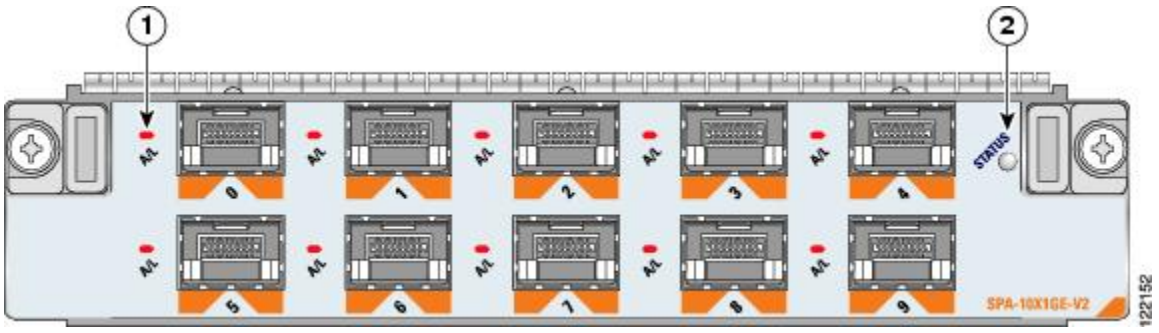
10-Port Gigabit Ethernet SPA Overview

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 each individual port and a STATUS LED for the SPA, as shown in the figure below:

Figure 31: 10-Port Gigabit Ethernet SPA Faceplate



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

The table below describes the 10-Port Gigabit Ethernet SPA LEDs.

Table 31: 10-Port Gigabit Ethernet SPA LEDs

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

10-Port Gigabit Ethernet SPA Cables and Connectors

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

SFP Module Connections

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

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

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. The tables below provide SFP information and specifications.

Table 32: 10-Port Gigabit Ethernet SFP Module Options

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

Table 33: 10-Port Gigabit Ethernet SFP Module Specifications

Specification	Description
Wavelength	SFP-GE-S: 770 to 860 nm SFP-GE-L: 1270 to 1355 nm SFP-GE-Z: 1500 to 1580 nm

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

SFP-GE-S Modules

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

SFP-GE-L Modules

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

SFP-GE-Z Modules

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

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

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

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

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

SFP Module Cabling and Connection Equipment

The table below 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 34: SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	MaximumCable Distance
SFP-GE-S	850	MMF[7]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	SMF	9/10	—	49.7 miles (80 km)
SFP-GE-Z	1500	SMF	9/10	—	49.7 miles (80 km)
		SMF **Note** Dispersion-shifted single-mode fiber-optic cable.	8	—	62.1 miles (100 km)

7 Multimode fiber (MMF) only.

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 10-Gigabit Ethernet SPA Overview

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

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 the figure below.

Figure 32: 1-Port 10-Gigabit Ethernet SPA Faceplate

1	ACTIVE/LINK LED	2	STATUS LED

The table below describes the 1-Port 10-Gigabit Ethernet SPA LEDs.

Table 35: 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.

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

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

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

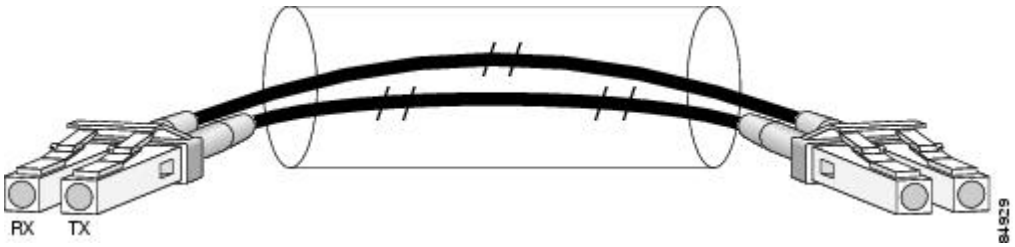
- Single-mode short-reach (SR) XFP module—XFP-10GLR-OC192SR
- Single-mode intermediate-reach (IR) XFP module—XFP-10GER-OC192IR
- Single-mode very-long-reach (ZR) XFP module—XFP-10GER-OC192LR
- Multi-mode short reach (SR) XFP module—XFP-10G-MM-SR

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

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

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

Figure 33: LC-Type Cable for the XFP Optical Transceiver Modules



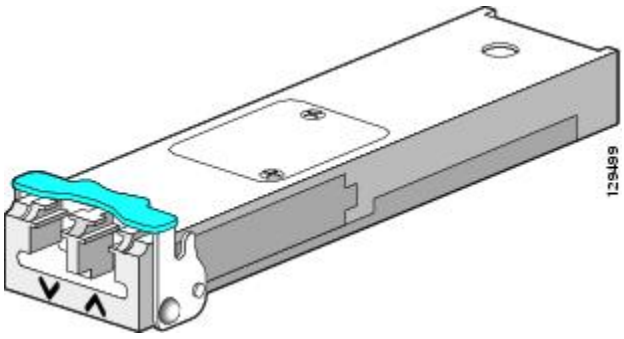
Note The 40-pin connector on the 1-Port 10-Gigabit Ethernet SPA is used for resilient packet ring (RPR) connections. This feature is not supported inCisco IOS XR Release 3.4.1.

XFP Connections

The 10GLR, 10GER, and 10GZR XFP modules include an optical transmitter and receiver pair integrated with Clock and Data Recovery (CDR) integrated circuits. The XFP modules provide high-speed serial links at the rate of 10.3125 Gbps (10 Gigabit Ethernet) on single-mode fiber (SMF). The transmit side recovers and retimes the 10-Gbps serial data and passes it to a laser driver. The laser driver biases and modulates a 1310-nm, 850 nm or 155-nm laser, enabling data transmission over SMF through an LC connector. The receive side recovers and retimes the 10-Gbps optical data stream from a photo detector transimpedance amplifier and passes it to an output driver.

See the label on the XFP module for technology type and model. The figure below shows an XFP module and the table below shows the XFP module specifications.

Figure 34: XFP Module



XFP module dimensions are:

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

Table 36: XFP Module Specifications for 10-Gigabit Ethernet SPA

Specification	Description
Wavelength (TX)	10GLR SR-1: 1260 nm to 1355 nm 10GER IR-2: 1530 nm to 1565 nm 10GZR LR-2: 1530 nm to 1565 nm 10G-MM-SR: 840 nm to 860 nm
Cabling distance (maximum)	10GLR SR-1: 6.2 miles (10 km) 10GER IR-2: 24.8 miles (40 km) 10GZR LR-2: 50 miles (80 km) 10G-MM-SR: 26m, 33m, 66m, 82m, 300m

Specification	Description
Operating case temperature range	10GLR SR-1: 23 to 158 degrees F (–5 to 70 degrees C) 10GER IR-2: 23 to 158 degrees F (–5 to 70 degrees C) 10GZR LR-2: 23 to 158 degrees F (–5 to 70 degrees C) 10G-MM-SR: 32 to 158 degrees F (0 to 70 degrees C)
Storage temperature range	10GLR SR-1: –40 to 185 degrees F (–40 to 85 degrees C) 10GER IR-2: –40 to 185 degrees F (–40 to 85 degrees C) 10GZR LR-2: –40 to 185 degrees F (–40 to 85 degrees C) 10G-MM-SR: –40 to 185 degrees F (–40 to 85 degrees C)
TX power	10GLR SR-1: –8.2 to 0.5 dBm 10GER IR-2: –4.7 to 4 dBm 10GZR LR-2: 0 to 4 dBm 10G-MM-SR: 3dBm,-1.5dBm,-1dBm
Receiver sensitivity (maximum)	10GLR SR-1: –12.6 dBm 10GER IR-2: –14.1 dBm 10GZR LR-2: –24 dBm 10G-MM-SR: -11.1dBm
RX overload	10GLR SR-1: 0.5 dBm 10GER IR-2: –1.0 dBm 10GZR LR-2: –7.0 dBm 10G-MM-SR: 1.0 dBm
Maximum receiver power damage	10GLR SR-1: +5 dBm 10GER IR-2: +5 dBm 10GZR LR-2: +5 dBm 10G-MM-SR: -1dBm

XFP Port Cabling Specifications

The table below shows the port cabling specifications for an XFP module.

Table 37: XFP Port Cabling Specifications

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

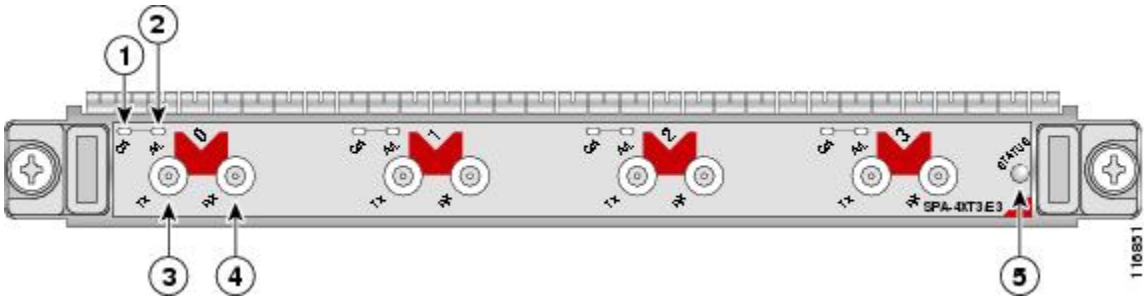
2-Port and 4-Port Clear Channel T3/E3 SPA Overview

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

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

The 2-Port and 4-Port Clear Channel T3/E3 SPA has three types of LEDs: two LEDs for each port on the SPA, and one STATUS LED, as shown in the figure below.

Figure 35: 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 table below describes the 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs.

Table 38: 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs

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

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

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

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

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

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

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

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

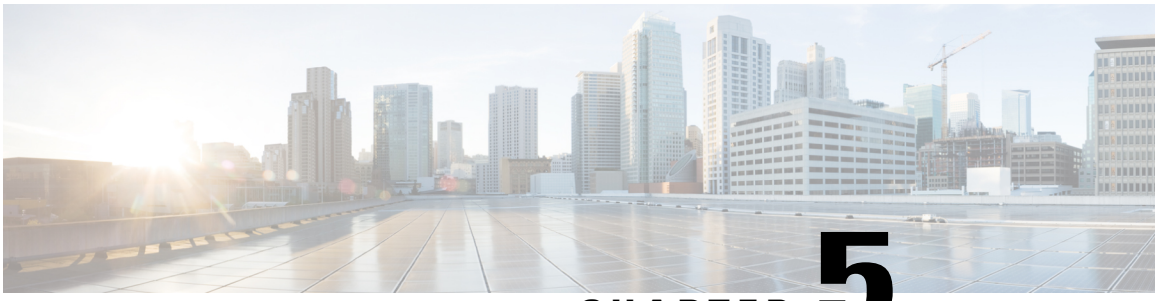
- CAB-T3E3-RF-BNC-M (T3 or E3 Cable, 1.0/2.3 RF to BNC-Male, 10 feet)
- CAB-T3E3-RF-BNC-F (T3 or E3 Cable, 1.0/2.3 RF to BNC-Female, 10 feet)
- CAB-T3E3-RF-OPEN (T3 or E3 Cable, 1.0/2.3 RF to BNC-Open end, 10 feet)

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

SFP Module Connections, on page 68 shows the connectors on the 4-Port Clear Channel T3/E3 SPA, and the table below describes the signal descriptions for these connectors.

Table 39: 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.



CHAPTER 5

Preparing to Install a SIP or Shared Port Adapter

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.

- SPA interface processor (SIP)
- Shared port adapters (SPAs)
- Medium 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.

Safety Warnings

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

Review the safety warnings listed in the Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System before installing, configuring, or troubleshooting any SIP or SPA.

General Guidelines

Before you perform any procedure in this document, review the following safety guidelines to avoid injuring yourself or damaging the equipment. These guidelines are for your safety. The guidelines do not include all hazards. Be alert.

- Never attempt to lift an object that might be too heavy for you to lift by yourself.
- Keep the work area clear and dust free during and after installation.
- Do not allow dirt or debris to enter into any laser-based components.
- Keep tools and router components away from walk areas.
- Do not wear loose clothing, jewelry, and other items that could get caught in the router while working with line cards, PLIMs, and SIPs.
- Use Cisco equipment in accordance with its specifications and product-usage instructions.
- Do not work alone if potentially hazardous conditions exist.
- Make sure your installation follows national and local electrical codes: in the United States, National Fire Protection Association (NFPA) 70, United States National Electrical Code; in Canada, Canadian Electrical Code, part I, CSA C22.1; in other countries, International Electrotechnical Commission (IEC) 60364, part 1 through part 7.
- Connect only a DC power source that follows the safety extra-low voltage (SELV) requirements in UL/CSA/IEC/EN 60950-1 and AS/NZS 60590 to the FCC DC-input power system.
- Make sure that you have a readily accessible two-poled disconnect device incorporated in the fixed wiring of a line card chassis (LCC) configured with the DC-input power system. The LCC requires short-circuit (overcurrent) protection to be provided as part of the building installation.

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.

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 and 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. These warnings apply to SPAs and SFP modules that transmit signals through an optical carrier signal. The single-mode aperture port contains a laser warning label, as shown in the figure below.

Figure 36: Class 1 Laser Warning Labels for Single-Mode Port

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

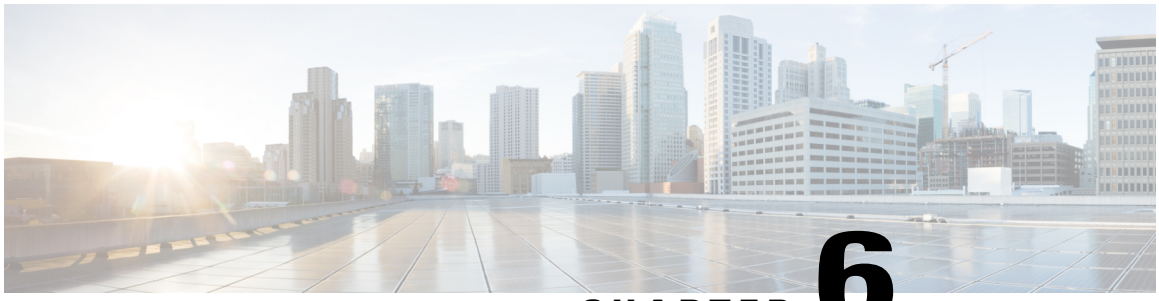
Danger Class 1 laser product. Statement 1008

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

Figure 37: Class 1 LED Warning Label for Multimode Port

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

Danger Class 1 LED product. Statement 1027



CHAPTER 6

Installing and Removing a SIP

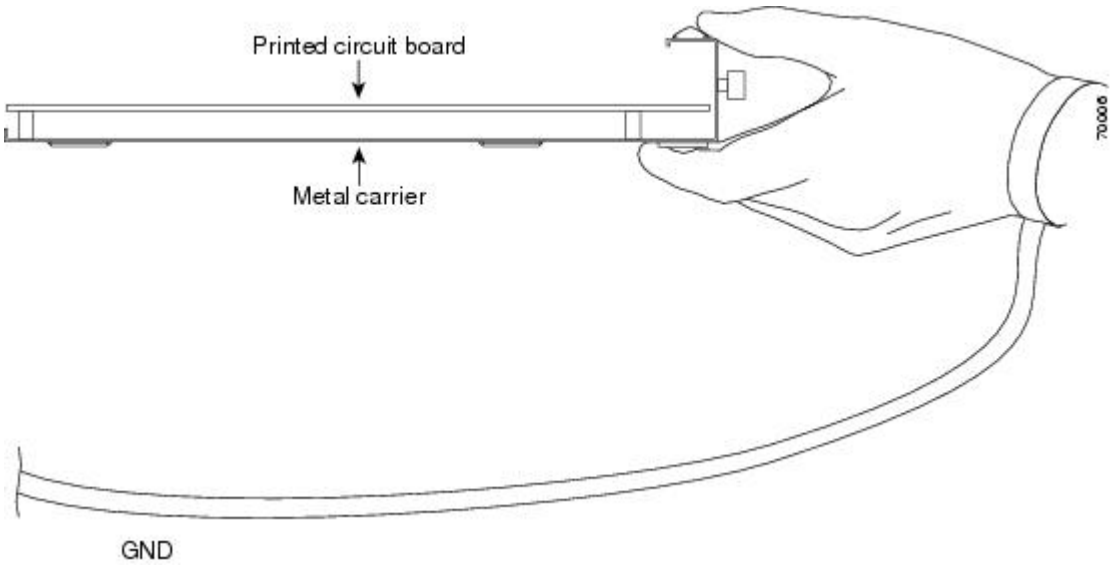
This chapter describes how to install or remove SIPs on the Cisco CRS-1 router. This chapter contains the following sections:

Handling SIPs

Each SIP is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage. Before you begin installation, read the *Preparing to Install a SIP or a SPA.* for a list of parts and tools required for installation.

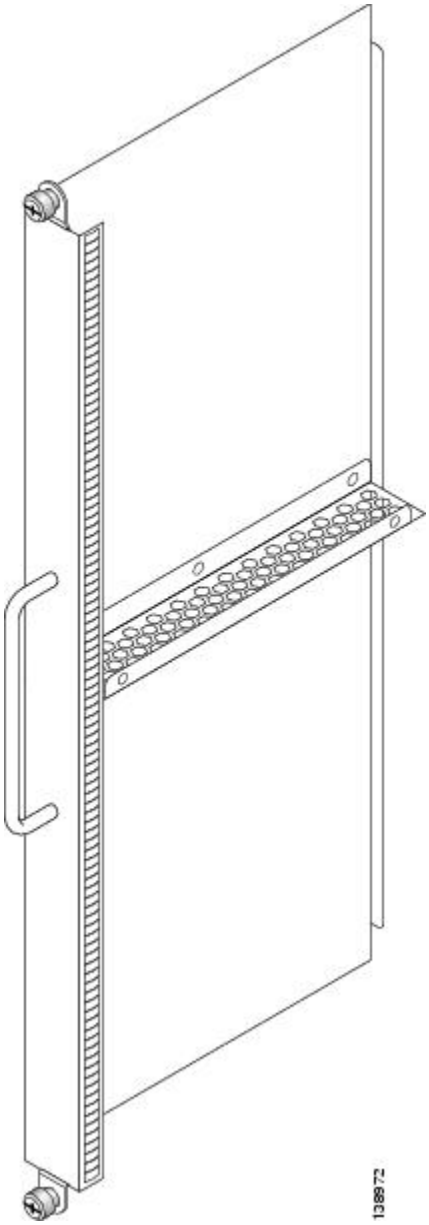
Caution Always handle the SIP by the carrier edges and handle; never touch the SIP components or connector pins (see the figure below).

Figure 38: Handling a SIP



A PLIM impedance carrier must be installed in each empty PLIM slot in the Cisco CRS-1 router chassis (see see the figure below). The impedance carrier preserves the integrity of the chassis and is required for EMI compliance and proper cooling in the chassis.

Figure 39: PLIM Impedance Carrier

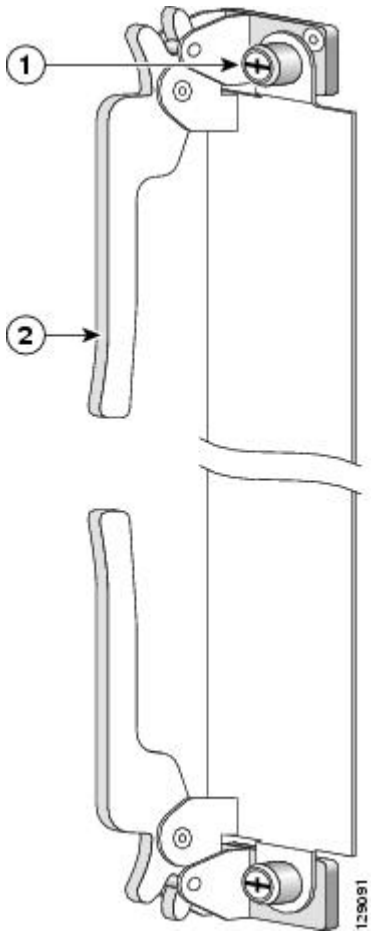


Guidelines for SIP Installation and Removal

Guidelines for SIP installation and removal include the following:

- Online insertion and removal (OIR) is supported, enabling you to remove and install SIPs and SPAs while the router is running. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation. Notifying the software or resetting the power is not required. However, you have the option of using the **shutdown** command before removing a card.
- Each SIP and its corresponding modular services card (MSC) function as a pair. If either card is removed, the other card is essentially powered down (although the router can still identify and inventory the cards).
- SIPs are attached to the chassis through a pair of ejector levers and captive screws. The two ejector levers are used to release the SIP from its midplane connector. The ejector levers and captive screws are located on the upper and bottom ends of the faceplate of the card (see the figure below).

Figure 40: Ejector Levers and Captive Screws



1	Captive screw	2	Ejector lever

Caution When you remove a SIP, always use the ejector levers to ensure that the connector pins disconnect from the midplane in the sequence expected by the router.

Caution The router can indicate a hardware failure if you do not follow proper procedures. Remove or install only one SIP or PLIM at a time. Wait at least 15 seconds before removing or installing another SIP or PLIM.

SIP Installation and Removal

This section contains the following procedures:

Note Refer to the *Installing and Removing a SPA* for information on removing and installing SPAs.

Removing a SIP

To remove a SIP from the line card chassis, the figure below and follow these steps:

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

Step 2 Identify the card to be replaced and unplug the interface cables connected to the card. Be sure to note the current connections of the cables to the ports on the SPAs installed in the SIP.

Danger Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures. Statement 125

Note You can also keep the dust caps or covers on the laser optical bores to avoid radiation exposure.

Step 3 Remove the SPAs from the SIP and set them aside.

Step 4 Loosen the two captive screws holding the SIP in place.

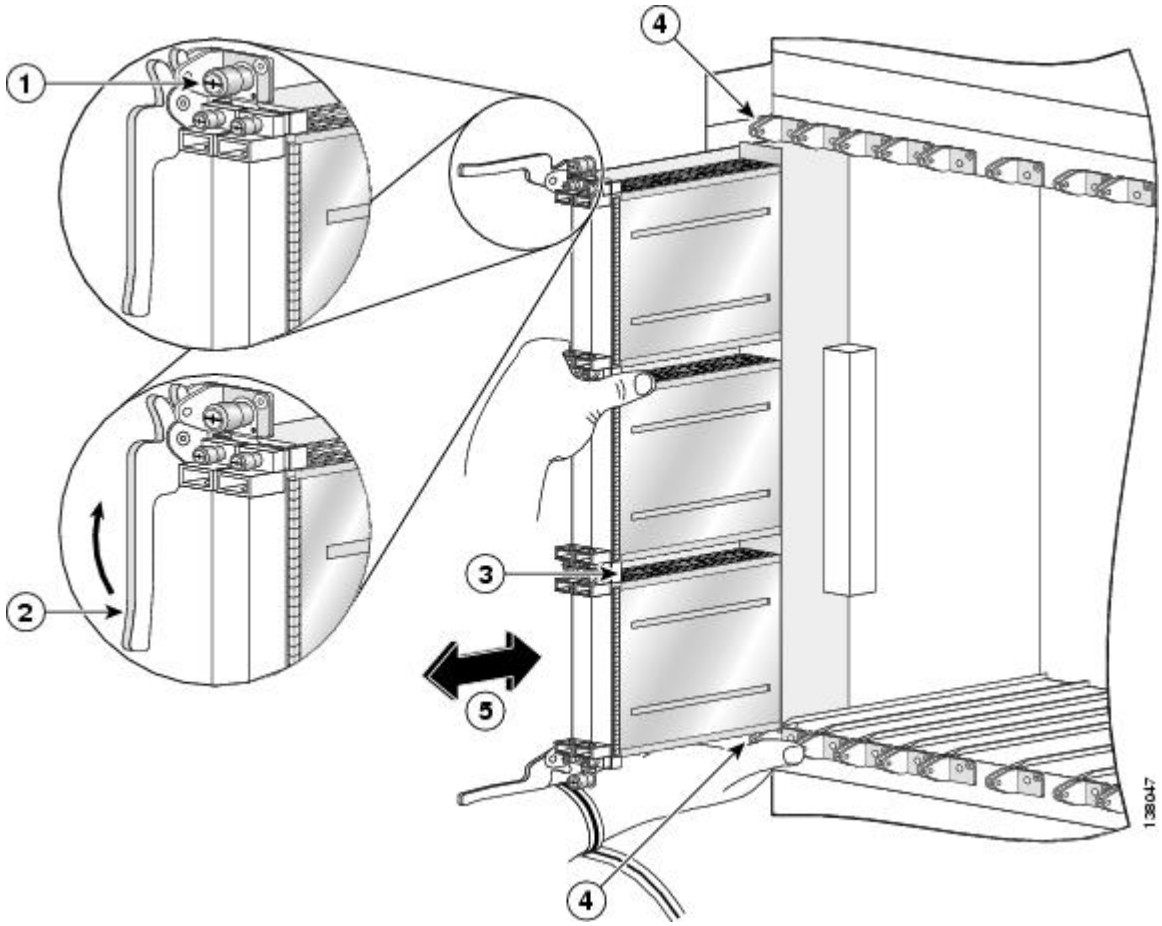
Step 5 Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees away from the front edge of the card carrier to unseat the SIP from the backplane.

Step 6 Touching only the metal card carrier, slide the SIP from the slot and place it directly into an antistatic sack or other ESD-preventive container.

Step 7 Insert another SIP, PLIM, or a PLIM impedance carrier into the empty card slot.

What to Do Next

Figure 41: Removing or Installing a SIP



1	Captive screw	4	Guide pins
2	Ejector lever	5	Direction of installation or removal
3	Septum		

Installing a SIP

This section provides step-by-step instructions for installing a SIP. You can install a SIP in any slot not occupied by a Route Processor (RP) card (or a fan controller card on the 16-slot chassis only). If you install a new MSC or SIP, you must first remove the PLIM impedance carrier card from the available slot.

Caution The system can indicate a hardware failure if you do not follow proper procedures. Remove or install only one SIP or PLIM at a time. Allow at least 15 seconds for the system to complete the preceding tasks before removing or installing another SIP or PLIM.

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

To install a SIP, follow these steps:

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

Step 2 Remove the SIP from its antistatic packaging.

Step 3 Remove the PLIM or PLIM impedance carrier from the slot you need to fill and set it aside.

Note Remove only one PLIM impedance carrier and install one SIP at a time. Be sure to verify that each SIP is fully installed and secured before installing another card.

Step 4 Grasp one of the septums that separate the SPA slots or one of the ejector levers with one hand and place your other hand under the SIP to support and guide it into the correct slot. Slide the card halfway into the correct slot. Avoid touching the card circuitry or any connectors.

Step 5 Pivot both card ejector levers so the openings on the card ejector cams at the top and bottom of the SIP pass over the tabs on each side of the card cage slot.

Caution Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers might bind when you attempt to close the ejector levers, thereby damaging or breaking one or both ejector levers.

Step 6 Continue sliding the SIP into the card cage slot until the openings on the card ejector cams engage the tabs on each side of the card cage slot.

Note Guide pins exist that make initial contact with the backplane connector as you slide a SIP into its slot. After the guide pins make contact, continue pushing on the SIP until the card ejector levers begin pivoting forward, toward the front panel on the SIP.

Step 7 To seat the card in the midplane connector, grasp both card ejector levers and pivot them inward toward the handle in the card carrier until they are flush against the front edge of the card carrier.

Step 8 Engage both captive screws on the PLIM, and then tighten the screws. Tighten the locking thumbscrews on both sides of the SIP to a torque of between 8.3 and 11 inch-pounds (94 to 124 N-cm). Do not overtighten.

Caution Be sure to engage both captive screws on the SIP before you begin to tighten the screws; otherwise, the SIP might not seat properly.

Caution To ensure adequate space for additional PLIMs or SIPs, always tighten the captive screws on each newly installed PLIM or SIP *before* you insert another one. These screws also prevent accidental removal and provide proper grounding and EMI shielding for the system.

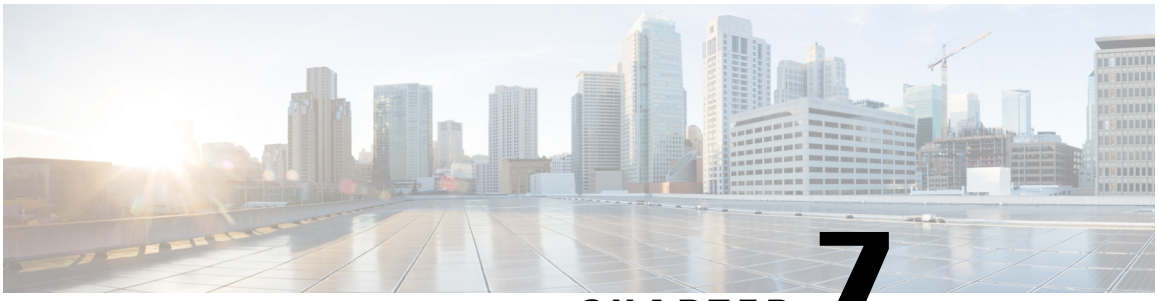
Step 9 Install the SPAs. See the *SPA Installation and Removal section*.

Step 10 Install the interface cables. We recommend that you clean the fiber-optic connections before attaching the cables. See http://www.cisco.com/c/en/us/td/docs/routers/crs/maintenance/optics/maintenance/guide/crs_opt.html for cleaning instructions.

Step 11 If this SIP is new, configure it for operation. For instructions, see *Cisco IOS XR Interface and Hardware Component Configuration Guide* for your software release. For command syntax, refer to *Cisco IOS XR Interface and Hardware Component Command Reference*.

Danger Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures. Statement 125

Note You can also keep the dust caps or covers on the laser optical bores to avoid radiation exposure.



CHAPTER 7

Troubleshooting the Installation

This chapter describes how to troubleshoot the installation of SIPs and SPAs on the Cisco CRS-1 router.

Troubleshooting the SIP

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

- Make sure that the SIP is seated firmly in the line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the SIP is even with the fronts of the other PLIMs installed in the card cage.
- Make sure that the corresponding MSC is installed and operating correctly.
- Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the SIP.
- Determine whether there are any active alarms by looking at the alarm LEDs on the alarm module (16-slot) or the route processor (8-slot). See *Cisco CRS-1 Carrier Routing System 8-Slot Line Card Chassis System Description* or *Cisco CRS-1 Carrier Routing System 8-Slot Line Card Chassis System Description* for more information about alarms.
- Examine the power shelves (16-slot chassis) or power distribution units (PDUs) (8-slot chassis) to see whether the chassis, as a whole, is receiving power.
- Use the LED on the SIP to verify the correct installation and operation of the card. The STATUS LED indicates whether the card is properly seated and operating correctly:
- Green—The SIP is properly installed and operating correctly.
- Amber—A problem exists on the SIP.

- Off (dark)—Verify that the SIP is installed correctly. Also verify that there is power to the SIP by looking at the indicators on the power shelf (16-slot) or PDU (8-slot).

Troubleshooting the SPA

If you attempt to install a SPA that oversubscribes the SIP, the SPA does not power up, and you receive an error message similar to the following:

```
LC/0/2/CPU0:Jan 31 11:52:57.335 : jacket[159]: %JACKET-3-RULES_FATAL_ERROR
: SPA subslot 4: FAILED: Not enough bandwidth for 1xOC192 POS/RPR HHSPA with XFP
```

When this happens, the SPA subslot is locked in the failed state. To enable the use of the SPA subslot, perform the following procedure.

Note Before you perform this procedure, you must resolve the oversubscription of the SIP by removing one of the SPAs that is causing the oversubscription.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**hw-module subslot** *node-id* **shutdown** **Example:** `RP/0/RP0/CPU0:router(config)# hw-module subslot 0/1/0 shutdown`	Administratively shuts down the specific shared port adapter (SPA) subslot. The *node-id* argument is entered in the *rack/slot/modul*e notation.
Step 3	**commit** **Example:** `RP/0/RP0/CPU0:router(config)# commit`	Saves the configuration changes to the running configuration file and remains within the configuration session.
Step 4	**no hw-module subslot** *node-id* **shutdown** **Example:** `RP/0/RP0/CPU0:router(config)# no hw-module subslot 0/1/0 shutdown`	Returns the SPA to the up state. The *node-id* argument is entered in the *rack/slot/modul*e notation.
Step 5	Do one of the following:	Saves configuration changes.

	Command or Action	Purpose

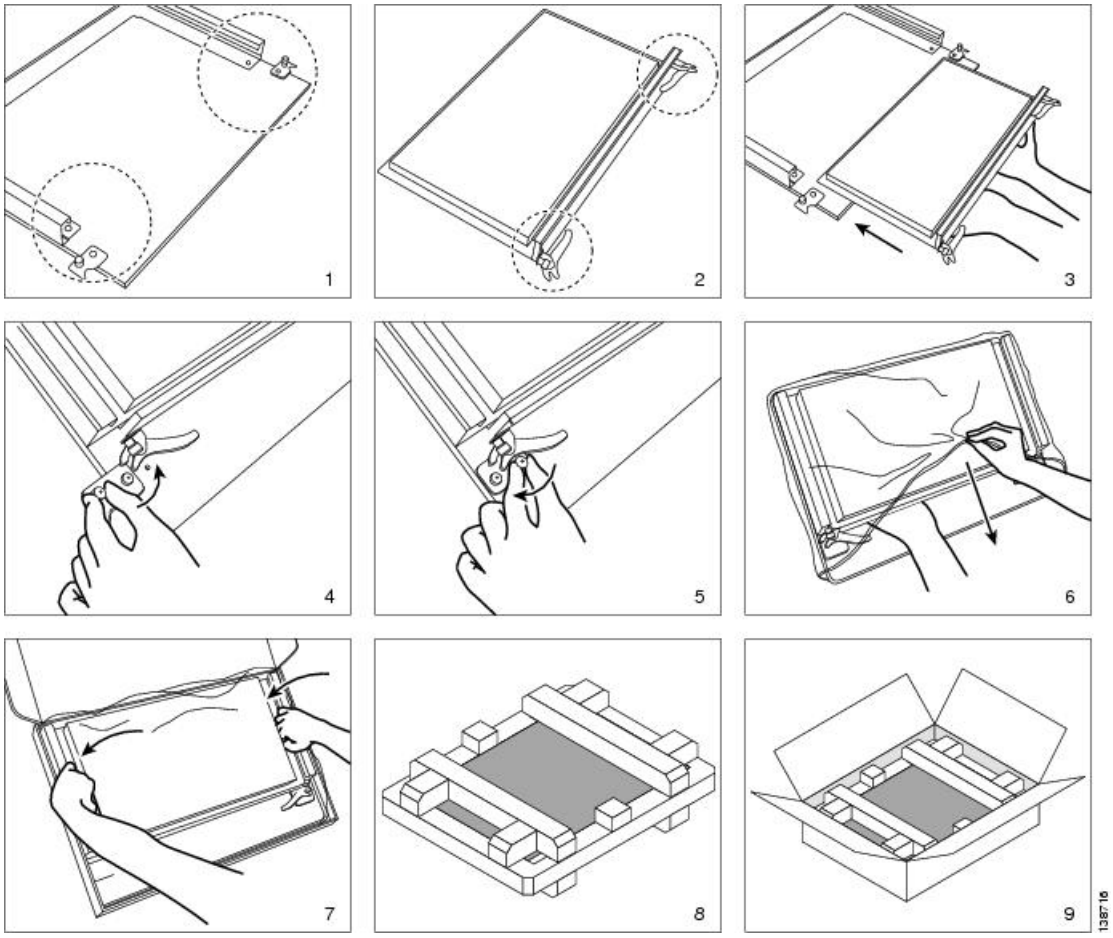
	• **end**
	• **commit**
	
	Example:
	`RP/0/RP0/CPU0:router(config)# end`
	
	Example:
	`RP/0/RP0/CPU0:router(config)# commit`
		• When you issue the **end** command, the system prompts you to commit changes:
		
		`Uncommitted changes found, commit them before exiting(yes/no/cancel)?[cancel]:`
		
		• ◦ Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		◦ Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		◦ Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Using debug Commands

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

Debugging output is assigned high priority in the CPU process and, therefore, can affect system performance. For more information about the impact on system performance when using **debug** commands, refer to *Using Debug Commands on Cisco IOS XR Software* .

Packing a SIP 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.

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

Note These instructions assume that the 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.

What to Do Next