Catalyst 6500 Series Switch SIP, SSC, and SPA Hardware Installation Guide

November 2008

C O N T E N T S

CHAPTER 3   **Catalyst 6500 Series Switch SPA Overview**   **3-1**

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:

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- Document Revision History, page x
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- Conventions, page xi
- Related Documentation, page xvii
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Objectives

This document describes the SPA interface processors (SIPs), SPA services cards (SSCs), and shared port adapters (SPAs) that are supported on the Catalyst 6500 Series switch. This document also describes how to install the supported SIPs, SSCs, and SPAs and how to troubleshoot the installation.

Document Revision History

Table 1 records technical changes to this document. The table shows the Cisco IOS software release number and document revision number for the change, the date of the change, and a brief summary of the change.

Table 1   Document Revision History

Release No.	Revision	Date	Change Summary

12.2(33)SXI	OL-9041-04	October 31, 2008	The following modifications were made:
			• Support was restored for the Cisco 7600 SIP-600.
			• Support was restored for the ATM SPAs.
			• Support was added for the following SPAs on the Cisco 7600 SIP-200:
			  – 2-Port and 4-Port OC-3c/STM-1 ATM SPA
			• Support was added for the following SPAs on the Cisco 7600 SIP-400:
			  – 2-Port and 4-Port Clear Channel T3/E3 SPA
			  – 2-Port and 4-Port Channelized T3 SPA
			  – 8-Port Channelized T1/E1 SPA
			  – 2-Port and 4-Port OC-3c/STM-1 ATM SPA
			  – 1-Port OC-12c/STM-4 ATM SPA
			  – 5-Port Gigabit Ethernet SPA (V2)
			• Support was added for the following SPAs on the Cisco 7600 SIP-600:
			  – 2-Port OC-48 POS/RPR SPA

12.2(33)SXH	OL-9041-03	August 20, 2007	The following modifications were made:
			• Support was removed for the Cisco 7600 SIP-600.
			• Support was removed for the ATM SPAs.
			• Support was added for the following SPAs on the Cisco 7600 SIP-200:
			  – 1-Port Channelized OC-3/STM-1 SPA
			  – 4-Port and 8-Port Fast Ethernet SPA
			• Support was added for the following SPA on the Cisco 7600 SIP-400:
			  – 2-Port Channelized T3 SPA

Table 1 **Document Revision History (continued)**

| 12.2(18)SXF10 | OL-9041-02 | July 13, 2007 | Support was introduced for the 1-Port OC-48c/STM-16 POS SPA on the Cisco 7600 SIP-400. |
| 12.2(18)SXF2 | OL-9041-01 | January 30, 2006 | First release. |

Organization

This document contains the following chapters:

Chapter	Title	Description
Chapter 1	SIP, SSC, and SPA Product Overview	Provides an introduction to SPA interface processors (SIPs) and shared port adapters (SPAs).
Chapter 2	Catalyst 6500 Series Switch SIPs and SSCs Overview	Provides a SIP/SPA compatibility summary. For each supported SIP, provides a summary of SIP characteristics and a SIP overview.
Chapter 3	Catalyst 6500 Series Switch SPA Overview	For each supported SPA, provides a summary of SPA characteristics and a SPA overview.
Chapter 4	Preparing to Install a SIP, SSC, or SPA	Describes the required tools, equipment, and safety guidelines for installing SIPs and SPAs.
Chapter 5	Installing and Removing a SIP or SSC	Describes the procedures for installing and removing a SIP on a Catalyst 6500 Series switch.
Chapter 6	Installing and Removing a Shared Port Adapter	Describes the procedures for installing and removing a SPA on a Catalyst 6500 Series switch. It also describes how to verify the SIP and SPA installation.
Chapter 7	Troubleshooting the Installation	Provides information for troubleshooting the installation of SIPs and SPAs. It also describes helpful debug commands and error messages.

Conventions

This document uses the following conventions:

Convention	Description
boldface font	Commands, command options, and keywords are in **boldface**.
italic font	Arguments for which you supply values are in *italics*.
[ ]	Elements in square brackets are optional.
{ x	y	z }	Alternative keywords are grouped in braces and separated by vertical bars.
[x	y	z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.

Convention	Description
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
screen font	Terminal sessions and information the system displays are in screen font.
boldface screen font	Information you must enter is in **boldface screen** font.
italic screen font	Arguments for which you supply values are in *italic screen* font.
⟶	This pointer highlights an important line of text in an example.
^	The symbol ^ represents the key labeled Control—for example, the key combination ^D in a screen display means hold down the Control key while you press the D key.
< >	Nonprinting characters, such as passwords are in angle brackets.

Notes use the following conventions:

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the publication.

Cautions use the following conventions:

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warnings use the following conventions:

Statement 1071—Warning Definition

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

Warning   **IMPORTANT SAFETY INSTRUCTIONS**

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

SAVE THESE INSTRUCTIONS

Waarschuwing   **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

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

BEWAAR DEZE INSTRUCTIES

Varoitus   **TÄRKEITÄ TURVALLISUUSOHJEITA**

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

SÄILYTÄ NÄMÄ OHJEET

Attention   **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

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

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

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

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

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

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

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

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

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

GUARDE ESTAS INSTRUÇÕES

¡Advertencia! **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

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

GUARDE ESTAS INSTRUCCIONES

Varning!   **VIKTIGA SÄKERHETSANVISNINGAR**

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

SPARA DESSA ANVISNINGAR

FONTOS BIZTONSÁGI ELOÍRÁSOK

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

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение   **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

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

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告   重要的安全性说明

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

请保存这些安全性说明

警告   安全上の重要な注意事項

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

これらの注意事項を保管しておいてください。

주의   중요 안전 지침

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

이 지시 사항을 보관하십시오.

تحذير   إرشادات الأمان الهامة

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

Upozorenje   VAŽNE SIGURNOSNE NAPOMENE

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

SAČUVAJTE OVE UPUTE

Upozornění   DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY

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

USCHOVEJTE TYTO POKYNY

Προειδοποίηση   ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

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

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה **הוראות בטיחות חשובות**

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

שמור הוראות אלה

Ostrzeżenie WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

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

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY

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

USCHOVAJTE SI TENTO NÁVOD

Related Documentation

The documentation listed below is available online and on the Documentation DVD.

Your router, switch, or gateway and the Cisco IOS software running on it contain extensive features, which are documented in the following resources:

- *Catalyst 6500 Series Switch SIP, SSC, and SPA Software Configuration Guide*
- Cisco IOS software:
  - For Cisco IOS configuration information and support, refer to the configuration guide or command reference for a Cisco IOS mainline release. You can also refer to the specific Cisco IOS software document for a particular feature.
  - To see if a feature is supported by a Cisco IOS release, to locate the software document for that feature, or to check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com. You must be a registered user on Cisco.com to access this tool. To access Software Advisor, click **Login** at Cisco.com, type "Software Advisor" in the SEARCH box, and click **GO**. Click the link for the Software Advisor tool.

> **Note** You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at http://www.cisco.com. Translated documentation is available at the following URL: http://www.cisco.com/public/countries_languages.shtml.

- For international agency compliance, safety, and statutory information for WAN interfaces:
  - *Regulatory Compliance and Safety Information for the Catalyst 6500 Series Switch.*
  - *Site Preparation and Safety Guide*

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.

C H A P T E R **1**

SIP, SSC, and SPA Product Overview

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

- Introduction to SIPs and SPAs, page 1-1
- SIP, SSC, and SPA Compatibility, page 1-3
- Modular Optics Compatibility, page 1-5
- Power Management, page 1-8

For software details for the specific SIPs, SSCs, and SPAs that are supported on the Catalyst 6500 Series switch, refer to the companion publication, *Catalyst 6500 Series Switch SIP, SSC, and SPA Software Configuration Guide*.

Introduction to SIPs and SPAs

SIPs, SSCs, and SPAs constitute a new carrier card and port adapter architecture that increases modularity, flexibility, and density across Cisco Systems switches for network connectivity. This section describes the SIPs, SSCs, 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 inserts into a switch slot like a line card. It provides no network connectivity on its own.
- A SIP contains one or more subslots, which are used to contain one or more SPAs. The SPA provides interface ports for network connectivity.
- During normal operation, the SIP should reside in a switch that is 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) with SPAs inserted in their subslots. SPAs also support OIR and can be inserted or removed independently from the SIP.

SPA Services Cards

The following list describes some of the general characteristics of an SSC:

- An SSC is a carrier card that inserts into a switch slot like a line card. It provides no network connectivity.

- An SSC provides one or more subslots, which are used to contain one or more SPAs. The supported SPAs do not provide interface ports for network connectivity, but provide certain services.

- During normal operation, the SSC should reside in a switch that is fully populated either with functional SPAs in all subslots or with a blank filler plate (SPA-BLANK=) inserted in all empty subslots.

- SSCs support online insertion and removal (OIR) with SPAs inserted in their subslots. SPAs also support OIR and can be inserted or removed independently from the SSC.

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.

- Some SPAs provide services rather than network connectivity, and they insert into subslots of compatible SSCs. For example, the IPSec VPN SPA provides services such as IP Security (IPSec) encryption and decryption, generic routing encapsulation (GRE), and Internet Key Exchange (IKE) key generation.

- SPAs are available in the following sizes, as shown in Figure 1-1 and Figure 1-2:

    - Single-height SPA—Inserts into one SIP subslot.
    - Double-height SPA—Inserts into two single, vertically aligned SIP subslots.

Figure 1-1   Single-Height and Double-Height SPA Sizes

Front of SIP

| Single-height SPA | |
| Double-height SPA |

116886
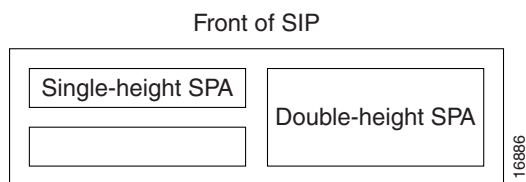
Figure 1-2   Horizontal and Vertical Chassis Slot Orientation for SPAs
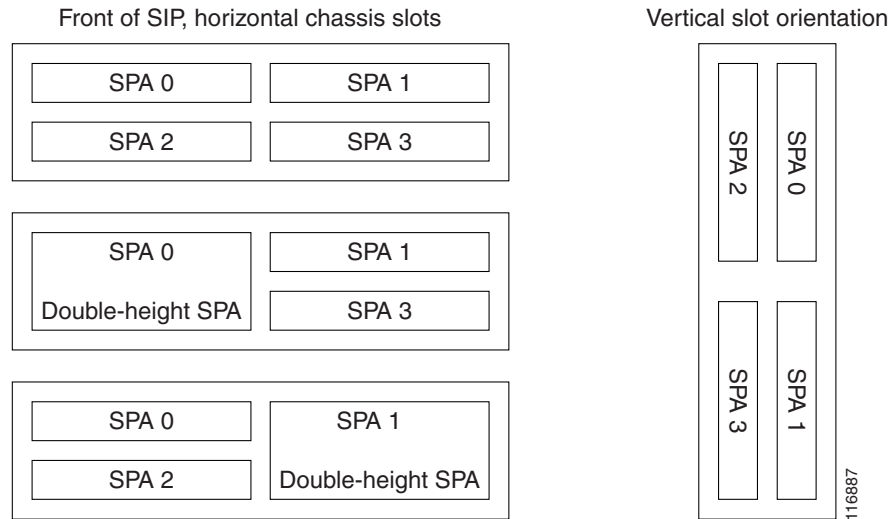
- Each SPA provides a certain number of connectors, or ports, that are the interfaces to one or more networks. These interfaces can be individually configured using the Cisco IOS command-line interface (CLI).

- Either a blank filler plate or a functional SPA should reside in every subslot of an SIP during normal operation to maintain cooling integrity. Blank filler plates are available in single-height form only.

- SPAs support online insertion and removal (OIR). They can be inserted or removed independently from the SIP. SIPs also support online insertion and removal (OIR) with SPAs inserted in their subslots.

SIP, SSC, and SPA Compatibility

The following tables show SIP, SSC, and SPA compatibility by SPA technology area on the Catalyst 6500 Series switch.

Note   For more information about the introduction of support for different SIPs, SSCs, and SPAs, refer to the "Release History" sections in the overview chapters of the *Catalyst 6500 Series Switch SIP, SSC, and SPA Software Configuration Guide*.

Table 1-1   SIP, SSC, and SPA Compatibility Table for ATM SPAs

SPA	Product ID	SIP Type			
		Cisco 7600 SIP-200	Cisco 7600 SIP-400	Cisco 7600 SIP-600	Cisco 7600 SSC-400
2-Port and 4-Port OC-3c/STM-1 ATM SPA	SPA-2XOC3-ATM SPA-4XOC3-ATM	Yes	Yes	No	No
1-Port OC-12c/STM-4 ATM SPA	SPA-1XOC12-ATM	No	Yes	No	No
1-Port OC-48c/STM-16 ATM SPA	SPA-1XOC48-ATM	No	Yes	No	No

Table 1-2   SIP, SSC, and SPA Compatibility Table for Ethernet SPAs

SPA	Product ID	SIP Type			
		Cisco 7600 SIP-200	Cisco 7600 SIP-400	Cisco 7600 SIP-600	Cisco 7600 SSC-400
1-Port 10-Gigabit Ethernet SPA	SPA-1XTENGE-XENPK SPA-1XTENGE-XFPSPA -1X10GE-L-V2	No	No	Yes	No
2-Port Gigabit Ethernet SPA	SPA-2X1GE	No	Yes	No	No
5-Port Gigabit Ethernet SPA	SPA-5X1GESPA-5X1GE -V2	No	Yes	Yes	No
10-Port Gigabit Ethernet SPA	SPA-10X1GE SPA-10X1GE-V2	No	No	Yes	No
4-Port and 8-Port Fast Ethernet SPA	SPA-4X1FE-TX-V2 SPA-8X1FE-TX-V2	Yes	No	No	No

Table 1-3   SIP, SSC, and SPA Compatibility Table for the IPSec VPN SPA

SPA	Product ID	SIP Type			
		Cisco 7600 SIP-200	Cisco 7600 SIP-400	Cisco 7600 SIP-600	Cisco 7600 SSC-400
IPSec VPN SPA	SPA-IPSEC-2G	No	No	No	Yes

Table 1-4   SIP, SSC, and SPA Compatibility Table for POS SPAs

SPA	Product ID	SIP Type			
		Cisco 7600 SIP-200	Cisco 7600 SIP-400	Cisco 7600 SIP-600	Cisco 7600 SSC-400
2-Port and 4-Port OC-3c/STM-1 POS SPA	SPA-2XOC3-POS SPA-4XOC3-POS	Yes	Yes	No	No
1-Port OC-12c/STM-4 POS SPA	SPA-1XOC12-POS	No	Yes	No	No
1-Port OC-48c/STM-16 POS SPA	SPA-1XOC48-POS/RPR	No	Yes	No	No
2-Port OC-48 POS/RPR SPA	SPA-2XOC48-POS/RPR	No	No	Yes	No
1-Port OC-192c/STM-64 POS/RPR SPA	SPA-OC192POS-LR SPA-OC192POS-VSR SPA-OC192POS-XFP	No	No	Yes	No

Table 1-5   SIP, SSC, and SPA Compatibility Table for Serial SPAs

SPA	Product ID	SIP Type			
		Cisco 7600 SIP-200	Cisco 7600 SIP-400	Cisco 7600 SIP-600	Cisco 7600 SSC-400
1-Port Channelized OC-3/STM-1 SPA	SPA-1XCHSTM1/OC3	Yes	No	No	No

Table 1-5   SIP, SSC, and SPA Compatibility Table for Serial SPAs (continued)

SPA	Product ID	SIP Type			
2-Port and 4-Port Channelized T3 SPA	SPA-2XCT3/DS0 SPA-4XCT3/DS0	Yes	No	No	No
2-Port and 4-Port Clear Channel T3/E3 SPA	SPA-2XT3/E3 SPA-4XT3/E3	Yes	No	No	No
8-Port Channelized T1/E1 SPA	SPA-8XCHT1/E1	Yes	No	No	No

Table 1-6   SIP, SSC, and SPA Compatibility Table for CEoP SPAs

SPA	Product ID	SIP Type			
		Cisco 7600 SIP-200	**Cisco 7600 SIP-400**	**Cisco 7600 SIP-600**	**Cisco 7600 SSC-400**
24-Port Channelized T1/E1 ATM CEoP SPA	SPA-24CHT1-CE-ATM	No	Yes	No	No

Modular Optics Compatibility

Some SPAs implement small form-factor pluggable (SFP) optical transceivers to provide network connectivity. An SFP module is a transceiver device that mounts into the front panel to provide network connectivity.

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

Note   The SPAs will only accept the SFP modules listed as supported in this document. An SFP check is run every time an SFP module is inserted into a SPA, and only SFP modules that pass this check will be usable.

Table 1-7 shows the types of optics modules that have been qualified for use with a SPA.

Table 1-7   SPA Optics Compatibility

SPA	Qualified Optics Modules (Cisco Part Numbers)
2-Port and 4-Port OC-3c/STM-1 ATM SPA	• SFP-OC3-MM • SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2
1-Port OC-12c/STM-4 ATM SPA	• SFP-OC12-MM • SFP-OC12-SR • SFP-OC12-IR1 • SFP-OC12-LR1 • SFP-OC12-LR2

Table 1-7   SPA Optics Compatibility (continued)

SPA	Qualified Optics Modules (Cisco Part Numbers)
1-Port OC-48c/STM-16 ATM SPA	• SFP-OC48-IR1 • SFP-OC48-SR
1-Port 10-Gigabit Ethernet SPA	• XFP-10GLR-OC192SR • XFP-10GER-OC192IR • SFP-GE-T
2-Port Gigabit Ethernet SPA	• SFP-GE-S • SFP-GE-L • SFP-GE-Z • SFP-GE-T
5-Port Gigabit Ethernet SPA	• SFP-GE-S • SFP-GE-L • SFP-GE-Z • SFP-GE-T
10-Port Gigabit Ethernet SPA	• SFP-GE-S • SFP-GE-L • SFP-GE-Z • SFP-GE-T
2-Port and 4-Port OC-3c/STM-1 POS SPA	• SFP-OC3-MM • SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2
1-Port OC-12c/STM-4 POS SPA	• SFP-OC12-MM • SFP-OC12-SR • SFP-OC12-IR1 • SFP-OC12-LR1 • SFP-OC12-LR2
1-Port OC-48c/STM-16 POS SPA	• SFP-OC48-SR • SFP-OC48-IR1 • SFP-OC48-LR2
2-Port and 4-Port OC-48c/STM-16 POS SPA	• SFP-OC48-SR • SFP-OC48-IR1 • SFP-OC48-LR2
1-Port OC-192c/STM-64 POS/RPR XFP SPA	• XFP-10GLR-OC192SR • XFP-10GER-OC192IR

Table 1-7   SPA Optics Compatibility (continued)

SPA	Qualified Optics Modules (Cisco Part Numbers)
1-Port Channelized OC-3/STM-1 SPA	• SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2
1-Port Channelized OC-3 STM1 ATM CEoP SPA	• SFP-OC3-MM • SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2

Power Management

SPAs and SIPs consume chassis power, and, you must make sure the chassis is within the power budget on a Catalyst 6500 Series switch.

Table 1-8   SIP and SPA Power Consumption

SIP	Power Consumption (Maximum in Watts)
Cisco 7600 SIP-200	240.0[1]
Cisco 7600 SIP-400	265.0[1]
Cisco 7600 SIP-600	341.0[2]
Cisco 7600 SSC-400	235.0[3]
SPA	
2-Port Channelized T3 SPA	11.24
4-Port Channelized T3 SPA	13.14
8-Port Channelized T1/E1 SPA	9.4
2-Port OC-3c/STM-1 ATM SPA	24.6
4-Port OC-3c/STM-1 ATM SPA	24.8
1-Port OC-12c/STM-4 ATM SPA	25.1
1-Port OC-48c/STM-16 ATM SPA	38.13
1-Port OC-192c/STM-64 POS/RPR SPA	23.8[4]
1-Port OC-192c/STM-64 POS/RPR XFP SPA	11.0[5]
1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA	11.0
2-Port OC-3c/STM-1 POS SPA	13.07
4-Port OC-3c/STM-1 POS SPA	13.82
1-Port OC-12c/STM-4 POS SPA	12.75
1-port OC-48/STM-16 ATM SPA	38.0
2-Port Clear Channel T3/E3 SPA	7.8
4-Port Clear Channel T3/E3 SPA	8.5
IPSec VPN SPA	40.0
1-Port 10-Gigabit Ethernet SPA	17.4[5]
2-Port Gigabit Ethernet SPA	12.9
5-Port Gigabit Ethernet SPA	13.1[5]
10-Port Gigabit Ethernet SPA	15.0[5]

1.   Maximum with four SPAs installed

2.   Maximum with one SPA installed

3.   Maximum with two IPSec VPN SPAs installed

4.   Includes LR optics as they are fixed on the board

5.   In addition to SFP or XFP optics power

If the power limit is exceeded, the SIP and SPA is not powered up and an error message is displayed.

```
Router#%C7KPWR-SP-4-POWERDENIED:insufficient power, module in slot 3 power denied.
```

On a Catalyst 6500 Series switch, use the **show power** command on the Route Processor to determine how much power you have available in the chassis and how much is being used or reserved by line cards, supervisor engines, and fan trays.

The following example shows the **show power** command on a Catalyst 6500 Series switch:

```
Router# show power

system power redundancy mode = combined
system power redundancy operationally = non-redundant
system power total = 1869.42 Watts (44.51 Amps @ 42V)
system power used = 1302.42 Watts (31.01 Amps @ 42V)
system power available = 567.00 Watts (13.50 Amps @ 42V)
Power-Capacity PS-Fan Output Oper
PS Type Watts A @42V Status Status State
---- ----------------- ------- ------ ------ ------ -----
1 PWR-1900-AC/6 1869.42 44.51 OK OK on
2 none
Pwr-Allocated Oper
Fan Type Watts A @42V State
---- ----------------- ------- ------ -----
1 FAN-MOD-6HS 180.18 4.29 OK
Pwr-Requested Pwr-Allocated Admin Oper
Slot Card-Type Watts A @42V Watts A @42V State State
---- ----------------- ------- ------ ------- ------ ----- -----
3 7600-SIP-400 265.02 6.31 265.02 6.31 on on
4 7600-SIP-200 200.34 4.77 200.34 4.77 on on
5 unknown 328.44 7.82 328.44 7.82 on on
```

C H A P T E R **2**

Catalyst 6500 Series Switch SIPs and SSCs Overview

This chapter describes the SPA interface processors (SIPs) and SPA services cards (SSCs) that are supported on the Catalyst 6500 Series switch and contains the following sections:

SIP and SSC Support

Table 2-1 lists the SIPs and SSCs that are supported on the Catalyst 6500 Series switch.

Note The Description column indicates the aggregate bandwidth supported by the SIP across all subslots, not per SPA subslot.

Table 2-1   SIP Support

SIP	Product Number	Description	Maximum Number of SPAs	Minimum Cisco IOS Release
Cisco 7600 SIP-200	7600-SIP-200	622-Mbps SPA interface processor	4	12.2(18)SXE
Cisco 7600 SIP-400	7600-SIP-400	2.5-Gbps SPA interface processor	4	12.2(18)SXE
Cisco 7600 SIP-600	7600-SIP-600	1 x 10-Gbps SPA Interface Processor	1	12.2(18)SXF[1]
Cisco 7600 SSC-400	7600-SSC-400	SPA services carrier	2	12.2(18)SXE2

1. Support for the Cisco 7600 SIP-600 was removed in Cisco IOS Release 12.2(33)SXH and restored in Cisco IOS Release 12.2(33)SXI and later releases.

Checking For Hardware and Software Compatibility

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

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

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

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

Identifying Slots and Subslots for SIPs, SSCs, and SPAs

This section describes how to specify the physical location of a SIP, SSC, or SPA on the Catalyst 6500 Series switch using the command-line interface (CLI) to configure or monitor those devices.

Note   For simplicity, any reference to "SIP" in this section also applies to the SSC.

Specifying the Slot Location for a SIP or SSC

The Catalyst 6500 Series switch supports different chassis models, each of which supports a certain number of chassis slots.

Note   The Catalyst 6500 Series switch SIPs are not supported with a Supervisor Engine 1, Supervisor Engine 1A, Supervisor Engine 2, or Supervisor Engine 720-3A.

Figure 2-1 shows an example of a SIP installed in slot 6 on a Catalyst 6509 switch. The Catalyst 6509 switch has nine horizontally-oriented chassis slots, which are numbered 1 to 9 from right to left.

Figure 2-1   ***SIP and SPA Installed in a Catalyst 6509 Switch***
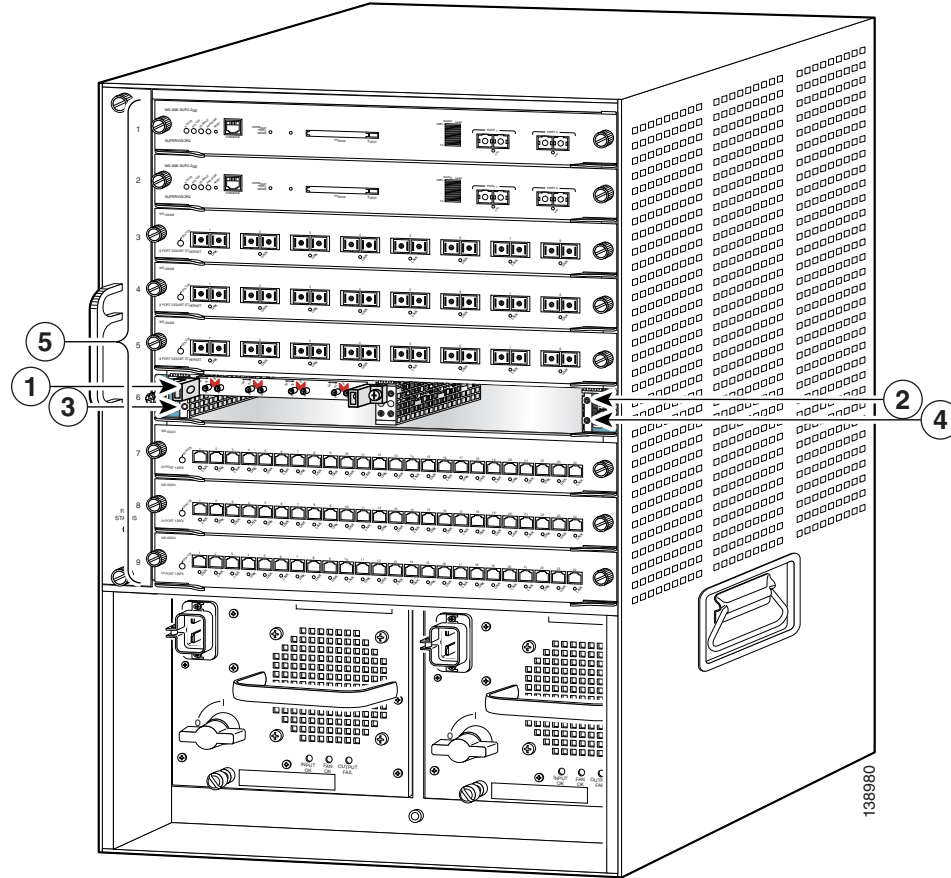
1	SIP subslot 0	**4**	SIP subslot 3
2	SIP subslot 1	**5**	Chassis slots 1–9 (numbered from top to bottom)
3	SIP subslot 2		

Some commands allow you to display information about the SIP itself, such as the **show module**, **show sip-disk**, **show idprom module**, **show hw-module slot**, and **show diagbus** commands. These commands require you to specify the chassis slot location where the SIP that you want information about is installed.

For example, to display status and information about the SIP installed in slot 6 as shown in Figure 2-1, enter the following command:

```
Router# show module 6
```

For more information about SIP commands, refer to the *Cisco IOS Software Releases 12.2SX Command References*.

Specifying the SIP or SSC Subslot Location for a SPA

SIP subslots begin their numbering with 0 and have a horizontal or vertical orientation depending on the orientation of the SIP in the router chassis slot, as shown in the "SIP, SSC, and SPA Product Overview" chapter of the *Catalyst 6500 Series Switch SIP, SSC, and SPA Software Configuration Guide*.

Figure 2-1 shows an example of a Cisco 7600 SIP-200 installed with a vertical orientation on a Cisco 7609 router. The Cisco 7600 SIP-200 supports four subslots for the installation of SPAs. In this example, the subslot locations are oriented vertically as follows:

- SIP subslot 0—Top–right subslot
- SIP subslot 1—Bottom–right subslot
- SIP subslot 2—Top–left subslot
- SIP subslot 3—Bottom–left subslot

Figure 2-2 shows the faceplate for the Cisco 7600 SIP-200 in a horizontal orientation.

Figure 2-2   Cisco 7600 SIP-200 Faceplate
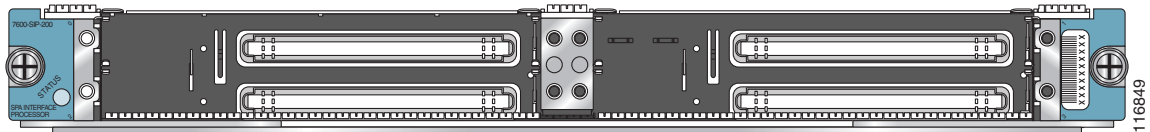
In this view, the subslot locations in a horizontal orientation are as follows:

- SIP subslot 0—Top–left subslot
- SIP subslot 1—Top–right subslot
- SIP subslot 2—Bottom–left subslot
- SIP subslot 3—Bottom–right subslot

The SIP subslot numbering is indicated by a small numeric label beside the subslot on the faceplate.

Some commands, such as the **show idprom module** and **show hw-module subslot** commands, allow you to display information about the SPA itself. These commands require you to specify both the physical location of the SIP and SPA in the format *slot*/*subslot*.

- *slot*—Specifies the chassis slot number in the Catalyst 6500 Series switch where the SIP is installed.
- *subslot*—Specifies the secondary slot of the SIP where the SPA is installed.

For example, to display the operational status for the SPA installed in the first subslot of the SIP in chassis slot 6 shown in Figure 2-1, enter the following command:

```
Router# show hw-module subslot 6/0 oir
```

For more information about SIP commands, refer to the *Cisco IOS Software Releases 12.2SX Command References*.

Cisco 7600 SIP-200 Overview

The following sections describe the 7600-SIP-200:

- Cisco 7600 SIP-200 Processor, page 2-5

Cisco 7600 SIP-200 Processor

Table 2-2 describes the processor on a 7600-SIP-200.

Table 2-2   7600-SIP-200 Processor

Type	Speed	Description
CPU	800 megahertz (MHz) internal operating frequency	Broadcom 1125 MIPS-based design

Cisco 7600 SIP-200 LEDs

The 7600-SIP-200 has one LED as shown in Figure 2-3.

Figure 2-3   7600-SIP-200 Faceplate

Table 2-3 describes the 7600-SIP-200 LED.

Table 2-3   7600-SIP-200 LED

LED Label	Color	State	Meaning
STATUS	Red	On	The 7600-SIP-200 has encountered an error.
	Green	On	The 7600-SIP-200 is online.
	Yellow	On	The 7600-SIP-200 is loading.
	Off	Off	The 7600-SIP-200 is powered off.

Cisco 7600 SIP-200 Physical Specifications

Table 2-4 describes the 7600-SIP-200 physical specifications.

Table 2-4   *7600-SIP-200 Physical Specifications*

Description	Specifications
Physical dimensions	The SIP occupies one module slot and can be operated in Cisco 7600 series routers.
Shipping weight	8 lb (3.64 kg)
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

Cisco 7600 SIP-200 Memory Options

Table 2-5 lists the memory available for the 7600-SIP-200.

Table 2-5   *SIP Memory Options*

SIP	Memory Options
7600-SIP-200	512 MB and 1 GB (2 x 256-MB or 2 x 512-MB DIMMs)

Note The SIP DIMMs must be a matched set. A warning message will appear on the console if the DIMMs on the SIP are different sizes. If the sizes are not the same, the following message will appear at bootup/OIR:

```
C7600_SIP200-3-MEM_MODULE_MISMATCH: Memory modules are not identical
```

Cisco 7600 SIP-200 Memory Installation and Removal

Figure 2-4 shows the location of the DIMMs on a 7600-SIP-200.

To install a DIMM, slide the DIMM into the slot. The retaining clips will secure the DIMM in place.

To remove a DIMM, separate the two retaining clips and pull the DIMM from the slot.

Figure 2-4   SIP DIMM Location
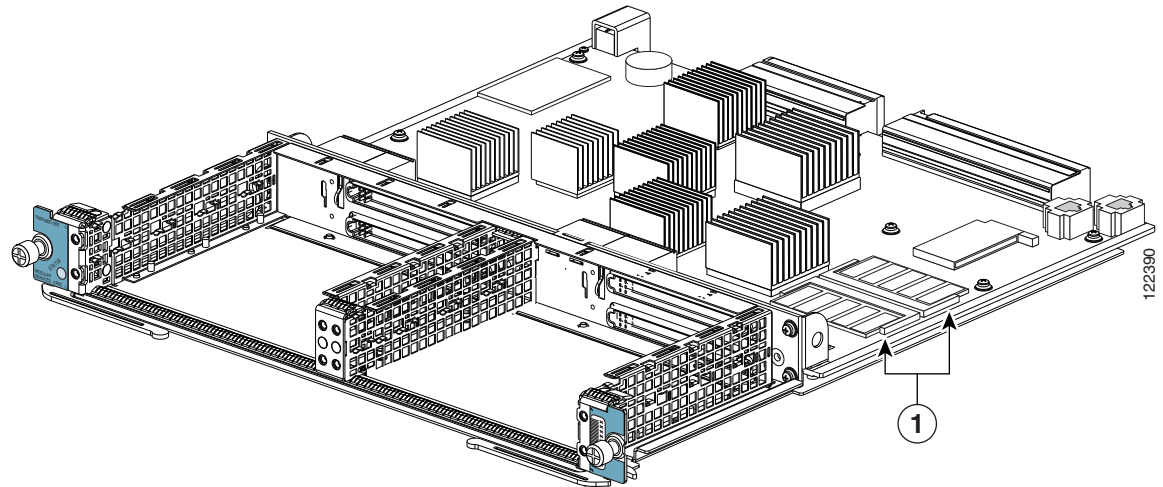
1	DIMMs

Cisco 7600 SIP-200 Default DIP Switch Settings

If SW3 and SW10 switches are present on the board, make sure that they are set to the default settings, as shown in Table 2-6. See Figure 2-5 for the location of the switches.

The switches are set to their defaults during manufacture. However, the switch settings may get inadvertently changed during handling.

Note   If the switches are not set to their default settings, there may be momentary packet drops during OIR of the board.

Table 2-6   7600-SIP-200 Default DIP Settings

Switch	Default Position
SW3	Up
SW10	Down

Figure 2-5   ***7600-SIP-200 DIP Switch Locations***

\
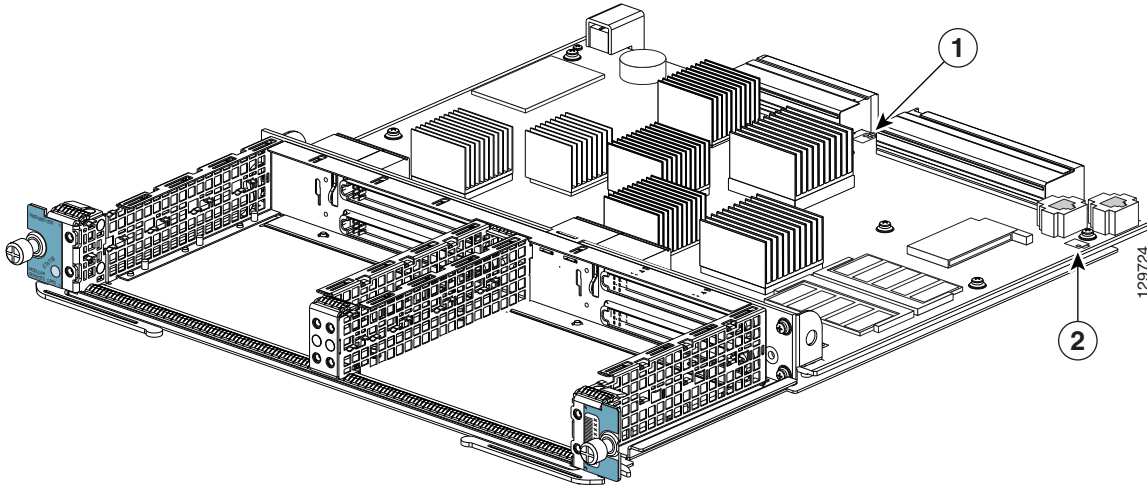
1	SW3	**2**	SW10

Cisco 7600 SIP-400 Overview

The following sections describe the 7600-SIP-400:

- Cisco 7600 SIP-400 Processor, page 2-8
- Cisco 7600 SIP-400 LEDs, page 2-9
- Cisco 7600 SIP-400 Physical Specifications, page 2-9

Cisco 7600 SIP-400 Processor

Table 2-7 describes the processor on a 7600-SIP-400.

Table 2-7   ***7600-SIP-400 Processor***

Type	Speed	Description
CPU	400 megahertz (MHz) internal operating frequency	Broadcom 1125 MIPS-based design

Cisco 7600 SIP-400 LEDs

The 7600-SIP-400 has one LED as shown in Figure 2-6.

Figure 2-6   7600-SIP-400 Faceplate
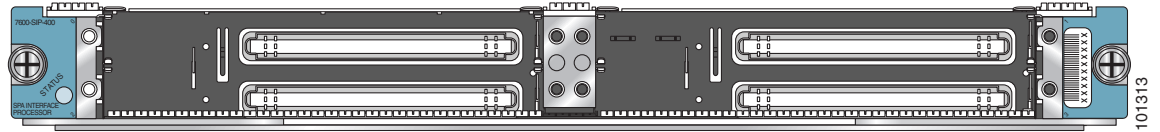
Table 2-8 describes the 7600-SIP-400 LED.

Table 2-8   7600-SIP-400 LED

LED Label	Color	State	Meaning
STATUS	Red	On	The 7600-SIP-400 has encountered an error.
	Green	On	The 7600-SIP-400 is online.
	Yellow	On	The 7600-SIP-400 is loading.
	Off	Off	The 7600-SIP-400 is powered off.

Cisco 7600 SIP-400 Physical Specifications

Table 2-9 describes the 7600-SIP-400 physical specifications.

Table 2-9   7600-SIP-400 Physical Specifications

Description	Specifications
Physical dimensions	The SIP occupies one module slot and can be operated in Cisco 7600 series routers.
Shipping weight	8 lb (3.64 kg)
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

Cisco 7600-SIP-600 Overview

Note   Support for the Cisco 7600 SIP-600 was removed in Cisco IOS Release 12.2(33)SXH and restored in Cisco IOS Release 12.2(33)SXI and later releases.

The following sections describe the 7600-SIP-600:

- 7600-SIP-600 Processor, page 2-10
- 7600-SIP-600 LEDs, page 2-10

7600-SIP-600 Processor

Table 2-13 describes the processor on a 7600-SIP-600.

Table 2-10   7600-SIP-600 Processor

Type	Speed	Description
CPU	400 megahertz (MHz) internal operating frequency	Broadcom 1125 MIPS-based design

7600-SIP-600 LEDs

The 7600-SIP-600 has one LED as shown in Figure 2-7.

Figure 2-7   7600-SIP-600 Faceplate
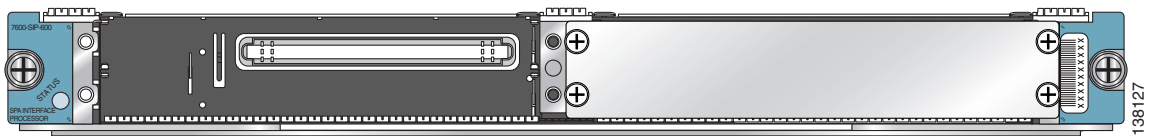
Table 2-11 describes the 7600-SIP-600 LED.

Table 2-11   7600-SIP-600 LED

LED Label	Color	State	Meaning
STATUS	Red	On	The 7600-SIP-600 has encountered an error.
	Green	On	The 7600-SIP-600 is online.
	Yellow	On	The 7600-SIP-600 is loading.
	—	Off	The 7600-SIP-600 is powered off.

7600-SIP-600 Physical Specifications

Table 2-12 describes the 7600-SIP-600 physical specifications.

Table 2-12   7600-SIP-600 Physical Specifications

Description	Specifications
Physical dimensions	The SIP occupies one module slot and can be operated in Cisco 7600 series routers. The Cisco 7600-SIP-600 supports installation of only a single SPA in the first subslot.
Shipping weight	8 lb (3.64 kg)
Operating temperature	32 to 104°F (0 to 40°C)

Table 2-12   7600-SIP-600 Physical Specifications (continued)

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

Cisco 7600-SSC-400 Overview

The following sections describe the SPA services carrier, 7600-SSC-400:

- Cisco 7600 SSC-400 Processor, page 2-11
- Cisco 7600 SSC-400 LED, page 2-11
- Cisco 7600 SSC-400 Physical Specifications, page 2-12

Cisco 7600 SSC-400 Processor

Table 2-13 describes the processor on a 7600-SSC-400.

Table 2-13   7600-SSC-400 Processor

Type	Speed	Description
CPU	400 megahertz (MHz) internal operating frequency	Broadcom 1125 MIPS-based design

Cisco 7600 SSC-400 LED

The 7600-SSC-400 has one LED as shown in Figure 2-8.
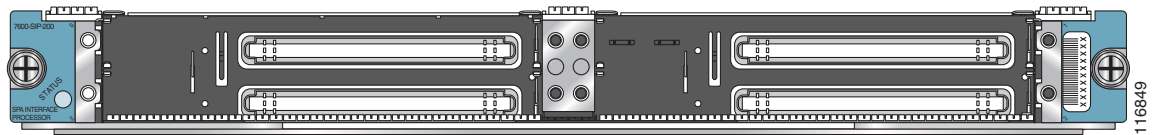
Figure 2-8   7600-SSC-400 Faceplate
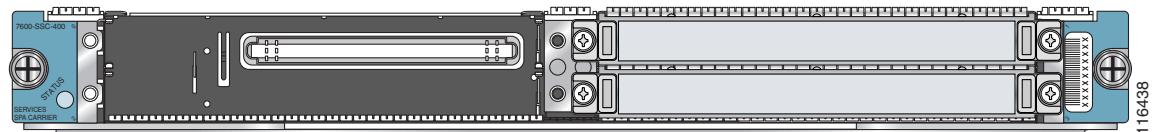
Table 2-14 describes the 7600-SSC-400 LED.

Table 2-14   7600-SSC-400 LED

LED Label	Color	State	Meaning
STATUS	Red	On	The 7600-SSC-400 has encountered an error.
	Green	On	The 7600-SSC-400 is online.
	Yellow	On	The 7600-SSC-400 is loading.
	Off	Off	The 7600-SSC-400 is powered off.

Cisco 7600 SSC-400 Physical Specifications

Table 2-15 describes the 7600-SSC-400 physical specifications.

Table 2-15   7600-SSC-400 Physical Specifications

Description	Specifications
Physical dimensions	The Cisco 7600 SSC-400 occupies one module slot and can be operated in Cisco 7600 series routers.
Shipping weight	8 lb (3.64 kg)
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

C H A P T E R 3

Catalyst 6500 Series Switch SPA Overview

This chapter describes the shared port adapters (SPAs) that are supported on the Catalyst 6500 Series switch and contains the following sections:

SPA Support

Table 3-1 shows the SPAs that are supported on the Catalyst 6500 Series switch.

Table 3-1   *SPA Support*

SPA	Product Number	Number of Ports	Minimum Cisco IOS Release
2-Port Channelized T3 SPA	SPA-2XCT3/DS0	2	12.2(18)SXE
4-Port Channelized T3 SPA	SPA-4XCT3/DS0	4	12.2(18)SXE
8-Port Channelized T1/E1 SPA	SPA-8XCHT1/E1	8	12.2(18)SXE
2-Port OC-3c/STM-1 ATM SPA	SPA-2XOC3-ATM	2	12.2(18)SXE
4-Port OC-3c/STM-1 ATM SPA	SPA-4XOC3-ATM	4	12.2(18)SXE
1-Port Channelized STM-1/OC-3 SPA	SPA-1XOC12-ATM	1	12.2(18)SXE
1-Port OC-48c/STM-16 ATM SPA	SPA-1XOC48-ATM	1	12.2(18)SXF
2-Port OC-3c/STM-1 POS SPA	SPA-2XOC3-POS	2	12.2(18)SXE
4-Port OC-3c/STM-1 POS SPA	SPA-4XOC3-POS	4	12.2(18)SXE
1-Port OC-12c/STM-4 POS SPA	SPA-1XOC12-POS	1	12.2(18)SXE
1-Port OC-192c/STM-64 POS/RPR SPA	(SPA-OC192RPR-SR, SPA-OC192RPR-IR, SPA-OC192RPR-LR)	1	12.2(18)SXF
1-Port OC-192c/STM-64 POS/RPR XFP SPA	SPA-OC192RPR-LR, SPA-OC192RPR-XFP	1	12.2(18)SXF
2-Port Clear Channel T3/E3 SPA	SPA-2XT3/E3	2	12.2(18)SXE
4-Port Clear Channel T3/E3 SPA	SPA-4XT3/E3	4	12.2(18)SXE
IPSec VPN SPA	SPA-IPSEC-2G	0	12.2(18)SXE2
1-Port 10-Gigabit Ethernet SPA	SPA-1XTENGE-XFP=	1	12.2(18)SXF
2-Port Gigabit Ethernet SPA	SPA-2X1GE=	2	12.2(18)SXF
2-Port Gigabit Ethernet SPA	SPA-2x1GE	2	12.2(18)SXF
5-Port Gigabit Ethernet SPA	SPA-5X1GE=	5	12.2(18)SXF
10-Port Gigabit Ethernet SPA	SPA-10X1GE	10	12.2(18)SXF

Checking For Hardware and Software Compatibility

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

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

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

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

Bandwidth Oversubscription

Oversubscribing the bandwidth limit recommendations of a router can result in decreased or degraded performance. For this reason, it is important to determine the amount of bandwidth used by the SPAs on the router and verify that the total bandwidth used by all SPAs does not exceed the recommended bandwidth limit of the router. It is also important not to exceed the bandwidth of the SIP. For information on SIP bandwidth, see Chapter 2, "SIP and SSC Support."

Table 3-2 provides information about the bandwidth for each port (per-port bandwidth) on a SPA, as well as the cumulative bandwidth (total bandwidth) for all ports available on the SPA.

Table 3-2   SPA Bandwidth Capacity

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
2-Port Channelized T3 SPA	44.736 Mbps	2	89.47 Mbps
4-Port Channelized T3 SPA	44.736 Mbps	4	178.94 Mbps
8-Port Channelized T1/E1 SPA	1.544 Mbps (T1) 2.048 Mbps (E1)	8	12.35 Mbps (T1) 16.38 Mbps (E1)
2-Port OC-3c/STM-1 ATM SPA	155.52 Mbps	2	311.04 Mbps
4-Port OC-3c/STM-1 ATM SPA	155.52 Mbps	4	622.08 Mbps
1-Port Channelized STM-1/OC-3 SPA	155 Mbps	1	155 Mbps
1-Port OC-48c/STM-16 ATM SPA	2488 Mbps	1	2488 Mbps
2-Port OC-3c/STM-1 POS SPA	155.52 Mbps	2	311.04 Mbps
4-Port OC-3c/STM-1 POS SPA	155.52 Mbps	4	622.08 Mbps
1-Port OC-12c/STM-4 POS SPA	622.08 Mbps	1	622.08 Mbps
1-Port OC-192c/STM-64 POS/RPR SPA	9.95 Gbps	1	9.95 Gbps
1-Port OC-192c/STM-64 POS/RPR XFP SPA	9.95 Gbps	1	9.95 Gbps
1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA	9.95 Gbps	1	9.95 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)
1-Port 10-Gigabit Ethernet SPA	10 Gbps	1	10 Gbps
2-Port Gigabit Ethernet SPA	10 Gbps	2	20 Gbps

Table 3-2   SPA Bandwidth Capacity (continued)

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
2-Port Gigabit Ethernet SPA	1000 Mbps	2	2000 Mbps
5-Port Gigabit Ethernet SPA	1000 Mbps	5	5000 Mbps
10-Port Gigabit Ethernet SPA	1000 Mbps	10	10,000 Mbps

Cisco 7600 SIP-400 Oversubscription Guidelines

As of Cisco IOS Release 12.2(18)SXF, when using the Cisco 7600 SIP-400 with the 2-Port Gigabit Ethernet SPA or the 1-Port OC-48c/STM-16 ATM SPA, consider the following oversubscription guidelines:

- The 7600-SIP-400 only supports installation of one 1-Port OC-48c/STM-16 ATM SPA without any other SPAs installed in the SIP.

- The 7600-SIP-400 supports installation of up to two 2-Port Gigabit Ethernet SPAs without any other SPAs installed in the SIP.

- The 7600-SIP-400 supports installation of any combination of a OC-3, OC-12 POS, CEoP, or ATM SPAs, up to a combined ingress bandwidth of OC-48 rates.

- The 7600-SIP-400 supports installation of any combination of OC-3, OC-12 POS, CEoP, or ATM SPAs up to a combined ingress bandwidth of OC-24 rates, when installed with a single 2-Port Gigabit Ethernet SPA.

- The 7600-SIP-400 supports installation of a single 1-Port 10-Gigabit Ethernet SPA without any other SPAs installed in the 7600-SIP-400.

Note   A 1-Port 10-Gigabit Ethernet SPA on a 7600-SIP-400 provides 4 Gbps of bandwidth.

2-Port and 4-Port Channelized T3 SPA Overview

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

- 2-Port and 4-Port Channelized T3 SPA LEDs, page 3-5

- 2-Port and 4-Port Channelized T3 SPA Interface Specifications, page 3-5

- 2-Port and 4-Port Channelized T3 SPA Cables and Connectors, page 3-6

2-Port and 4-Port Channelized T3 SPA LEDs

The 2-Port and 4-Port Channelized T3 SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 3-1 shows an example of these LEDs on a 4-Port Channelized T3 SPA.

Figure 3-1   *4-Port Channelized T3 SPA Faceplate*
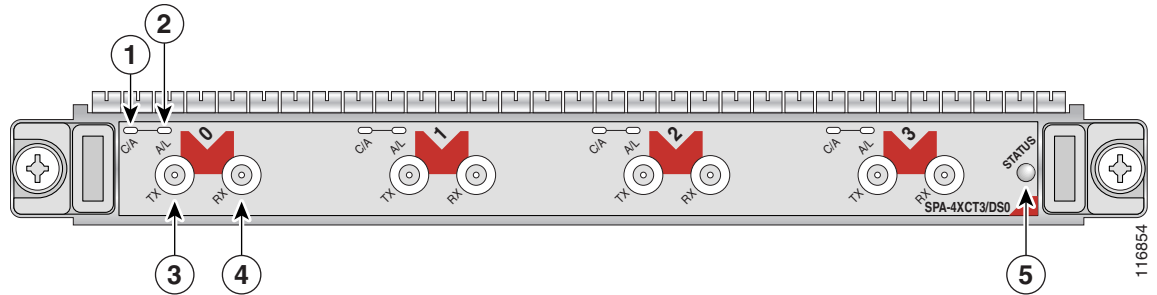
1	C/A (Carrier/Alarm) LED	4	RX (Receive) connector
2	A/L (Active Loopback) LED	5	STATUS LED
3	TX (Transmit) connector		

Table 3-3 describes the 2-Port and 4-Port Channelized T3 SPA LEDs.

Table 3-3   *2-Port and 4-Port Channelized T3 SPA LEDs*

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

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

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

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

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

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

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

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

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

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

Figure 3-1 shows the Siemax connectors on the 2-Port and 4-Port Channelized T3 SPA, and Table 3-4 provides the signal descriptions for these connectors.

Table 3-4   2-Port and 4-Port Channelized T3 SPA Connectors

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

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. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 3-2 shows an example of these LEDs on a 4-Port Clear Channel T3/E3 SPA.

Figure 3-2   4-Port Clear Channel T3/E3 SPA Faceplate
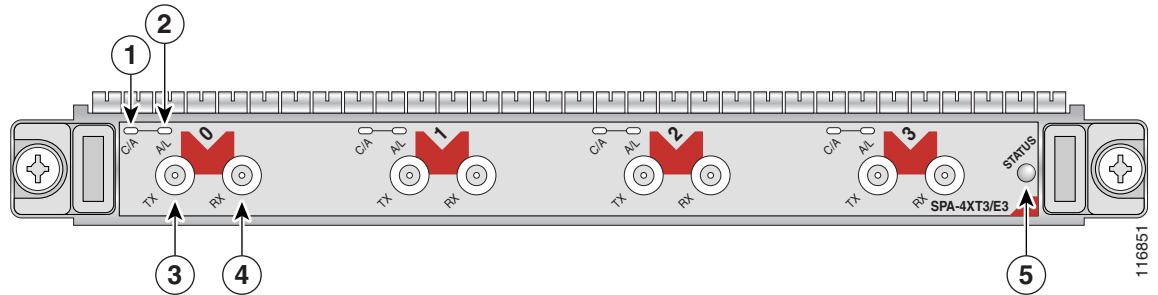
1	C/A (Carrier/Alarm) LED	**4**	RX (Receive) connector
2	A/L (Active Loopback) LED	**5**	STATUS LED
3	TX (Transmit) connector		

Table 3-5 describes the 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs.

Table 3-5   2-Port and 4-Port Clear Channel T3/E3 SPA LEDs

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

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

The framer processes incoming and outgoing T3 (cbit, m13/m23, and unframe) and E3 (g751, g832, and unframe) frames. The framer operates at T3/E3 line rates (44.2/34.0 Mbps) depending on which mode it is configured in.

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

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

2-Port and 4-Port 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 on one end and the Siemax connectors on the other.

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

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

Figure 3-2 shows the connectors on the 4-Port Clear Channel T3/E3 SPA, and Table 3-6 describes the signal descriptions for these connectors.

Table 3-6   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.

8-Port Channelized T1/E1 SPA Overview

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

- 8-Port Channelized T1/E1 SPA LEDs, page 3-9
- 8-Port Channelized T1/E1 SPA Interface Specifications, page 3-9
- 8-Port Channelized T1/E1 SPA Cables, Connectors, and Pinouts, page 3-10

8-Port Channelized T1/E1 SPA LEDs

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

Figure 3-3   *8-Port Channelized T1/E1 SPA Faceplate*
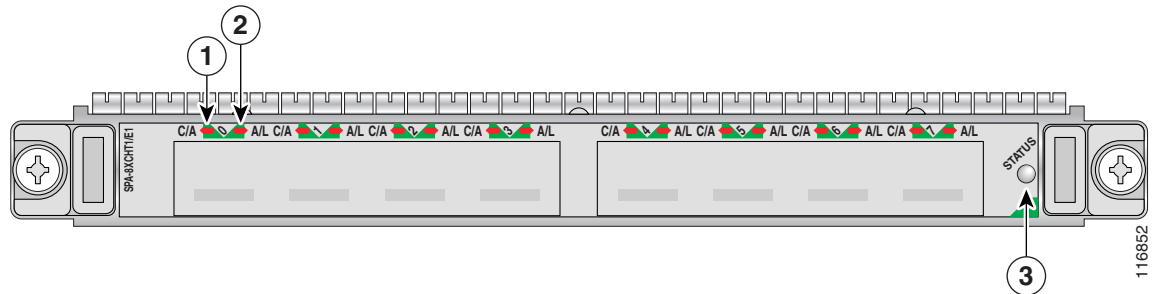
1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

Table 3-7 describes the 8-Port Channelized T1/E1 SPA LEDs.

Table 3-7   *8-Port Channelized T1/E1 SPA LEDs*

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

8-Port Channelized T1/E1 SPA Interface Specifications

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

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

Figure 3-4 shows an RJ-45 connector.

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

Figure 3-4   **RJ-45 Connector**
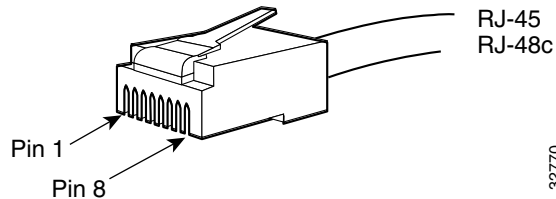
Table 3-8 describes the signals and connector pinouts for RJ-45 cable connectors.

Table 3-8   **RJ-45 Connector Pinouts**

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

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

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

- 1-Port Channelized STM-1/OC-3 SPA LEDs, page 3-10
- 1-Port Channelized STM-1/OC-3 SPA Interface Specifications, page 3-11
- 1-Port Channelized STM-1/OC-3 SPA Cables and Connectors, page 3-12

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

The 1-Port Channelized STM-1/OC-3 SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in Figure 3-5.

Figure 3-5 *1-Port Channelized STM-1/OC-3 SPA Faceplate*
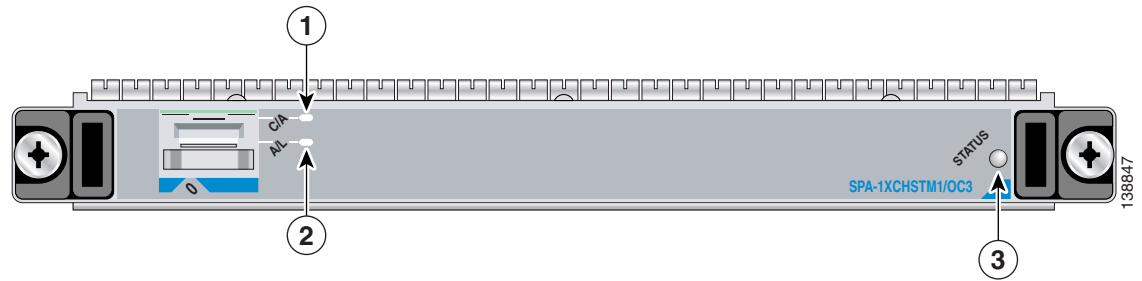
1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

Table 3-9 describes the 1-Port Channelized STM-1/OC-3 SPA LEDs.

Table 3-9 *1-Port Channelized STM-1/OC-3 SPA LEDs*

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

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

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

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

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

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

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

The 1-Port Channelized STM-1/OC-3 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 3-6).

Figure 3-6   SFP Optics Module
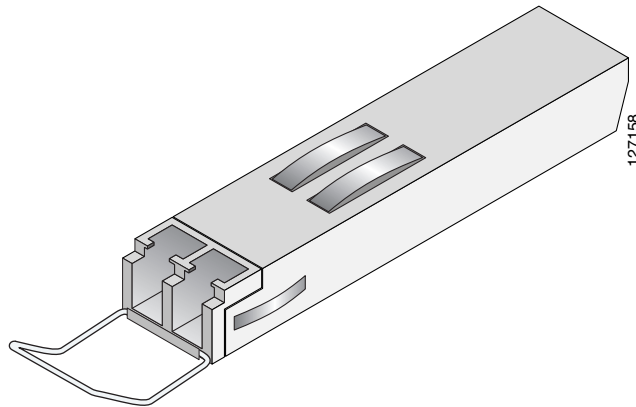
The SFP optical transceiver modules used with the 1-Port Channelized STM-1/OC-3 SPA provide the following optical fiber options:

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

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

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

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

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 3-7) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

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

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

Figure 3-7   LC Type Cables
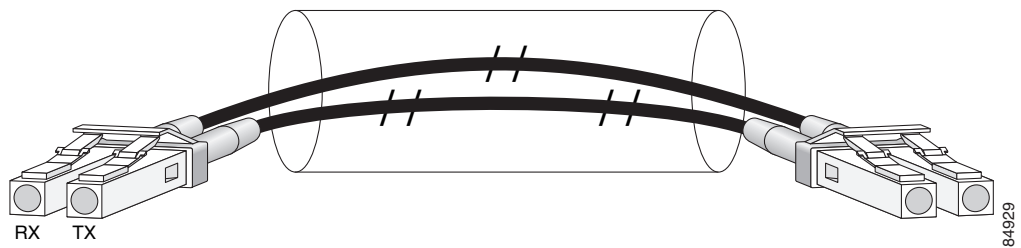
2-Port and 4-Port OC-3c/STM-1 ATM SPA Overview

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

- 2-Port and 4-Port OC-3c/STM-1 ATM SPA LEDs, page 3-13
- 2-Port and 4-Port OC-3c/STM-1 ATM SPA Interface Specifications, page 3-14
- 2-Port and 4-Port OC-3c/STM-1 ATM SPA Cables and Connectors, page 3-14

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

The 2-Port and 4-Port OC-3c/STM-1 ATM SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 3-8 shows an example of these LEDs on a 4-Port OC-3c/STM-1 ATM SPA.

Figure 3-8   4-Port OC-3c/STM-1 ATM SPA Faceplate
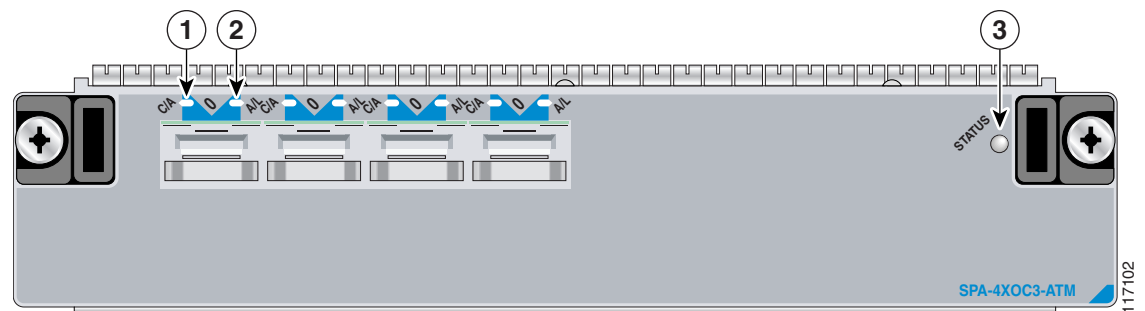
1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

Table 3-10 describes the 2-Port and 4-Port OC-3c/STM-1 ATM SPA LEDs.

Table 3-10   2-Port and 4-Port OC-3c/STM-1 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, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

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

The physical layer interface for the 2-Port and 4-Port OC-3c/STM-1 ATM SPA is Optical Carrier-3 (OC-3), and the data link layer is designed to comply with ATM specifications. The 2-Port and 4-Port OC-3c/STM-1 ATM SPA provides up to four 155-Mbps OC-3 network interfaces 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.

2-Port and 4-Port OC-3c/STM-1 ATM SPA Cables and Connectors

The 2-Port and 4-Port OC-3c/STM-1 ATM SPAs provide the following optical fiber options:

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

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

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

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

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 3-9) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 3-9   Duplex Patch Cable with LC-Type Connectors
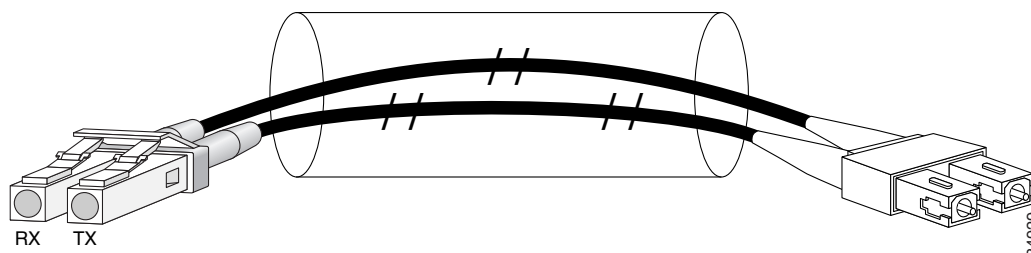
Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two OC-3-equipped routers back-to-back.

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

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

The 2-Port and 4-Port OC-3c/STM-1 POS SPAs are single-height SPAs that install into one SIP subslot. The OC-3c/STM-1 POS SPAs with small form-factor pluggable (SFP) optical transceiver modules provide 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 on page 3-3. For more information about SPAs and their compatibility with SIPs and modular optics, see the "SIP, SSC, and SPA Compatibility" section on page 1-3.

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

OC-3c/STM-1 POS SPA LEDs

The 2-Port and 4-Port OC-3c/STM-1 POS SPAs have three types of LEDs. There are two LEDs for each port on the SPA, and one Status LED. Figure 3-10 shows an example of these LEDs on a 4-Port OC-3c/STM-1 POS SPA.

Figure 3-10   *4-Port OC-3c/STM-1 POS SPA Faceplate*
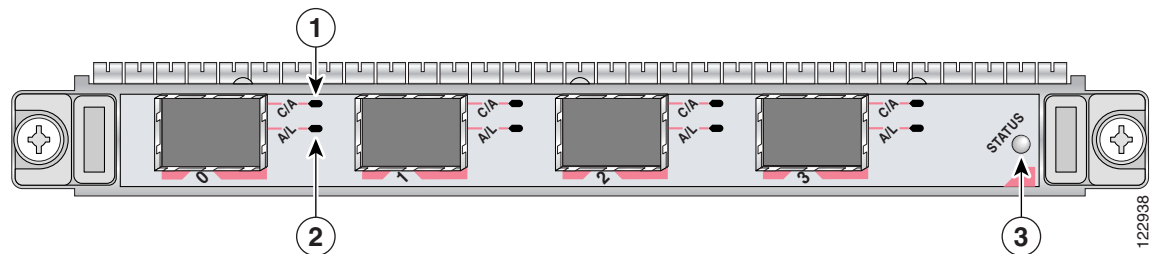
1	C/A (Carrier/Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

Table 3-11 describes the 2-Port and 4-Port OC-3c/STM-1 POS SPA LEDs.

Table 3-11   *2-Port and 4-Port OC-3c/STM-1 POS SPA LEDs*

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

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 (155.52 Mbps) line rates.

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

OC-3c/STM-1 POS SPA SFP Optical Transceiver Modules and Cables

The POS SPA uses a small form-factor pluggable (SFP) optical transceiver module (see Figure 3-11) installed in each port for SONET and SDH single-mode and multimode optical fiber connection.

Figure 3-11   SFP Optics Module
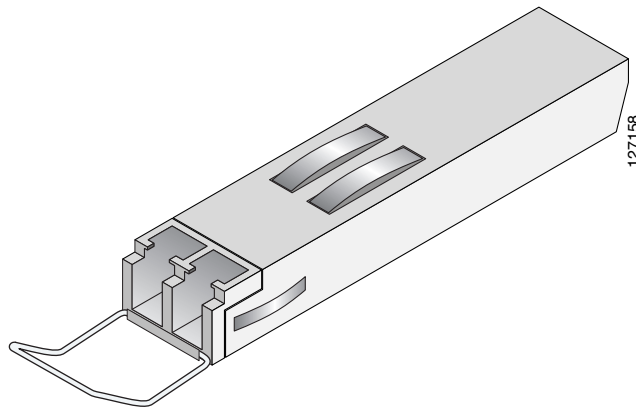
The SFP optical transceiver modules used with the POS SPAs provide the following optical fiber options:

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

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

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

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

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 3-12) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

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

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

Figure 3-12   LC Type Cables
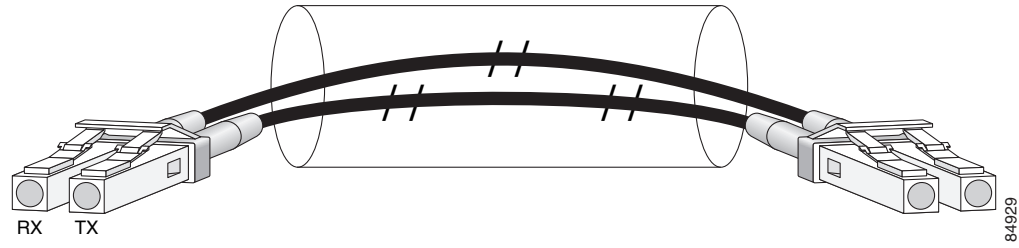
1-Port OC-12c/STM-4 ATM SPA Overview

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

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

The 1-Port OC-12c/STM-4 ATM SPA has three types of LEDs. There are two LEDs for the port on the SPA, and one STATUS LED as shown in Figure 3-13.

Figure 3-13   1-Port OC-12c/STM-4 ATM SPA Faceplate
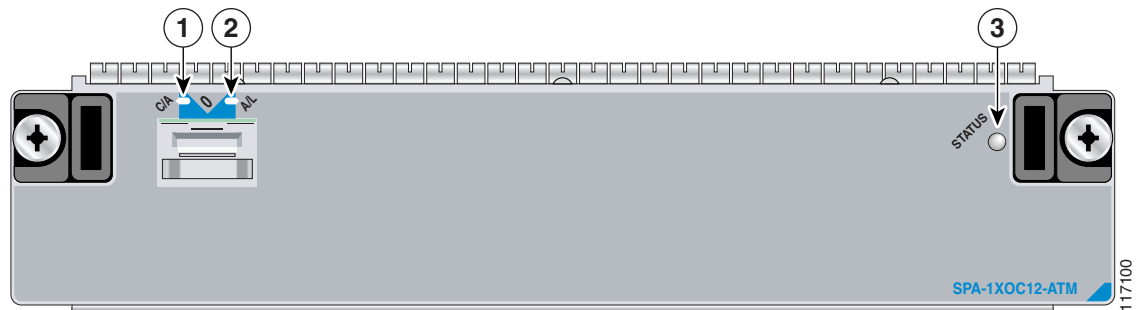
1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

Table 3-12 describes the 1-Port OC-12c/STM-4 ATM SPA LEDs.

Table 3-12   1-Port OC-12c/STM-4 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 ATM signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

1-Port OC-12c/STM-4 ATM SPA Interface Specifications

The physical layer interface for the 1-Port OC-12c/STM-4 ATM SPA is Optical Carrier-12 (OC-12), and the 1-Port OC-12c/STM-4 ATM SPA is designed to comply with ATM specifications. The 1-Port OC-12c/STM-4 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 OC-12c/STM-4 ATM SPA Cables and Connectors

The 1-Port OC-12c/STM-4 ATM SPA provides the following optical fiber options:

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

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

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

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

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 3-14) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 3-14   *Duplex Patch Cable with LC-Type Connectors*
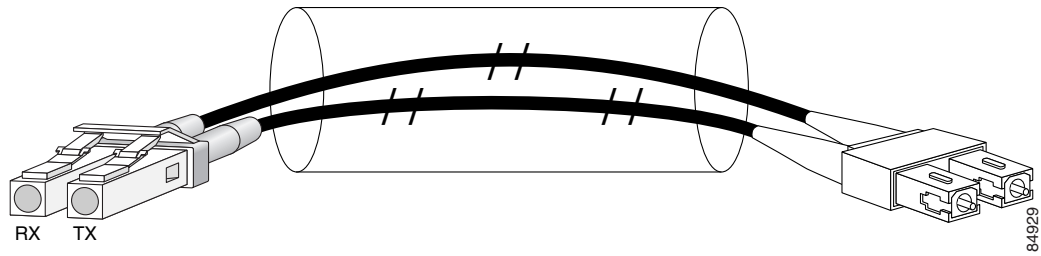
1-Port OC-12c/STM-4 POS SPA Overview

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

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

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

- 1-Port OC-12c/STM-4 POS SPA LEDs, page 3-21
- 1-Port OC-12c/STM-4 POS SPA Interface Specifications, page 3-22
- 1-Port OC-12c/STM-4 POS SPA SFP Optical Transceiver Modules and Cables, page 3-22

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

The 1-Port OC-12c/STM-4 POS SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 3-15 shows an example of these LEDs on a 1-Port OC-12c/STM-4 POS SPA.

Figure 3-15   1-Port OC-12c/STM-4 POS SPA Faceplate
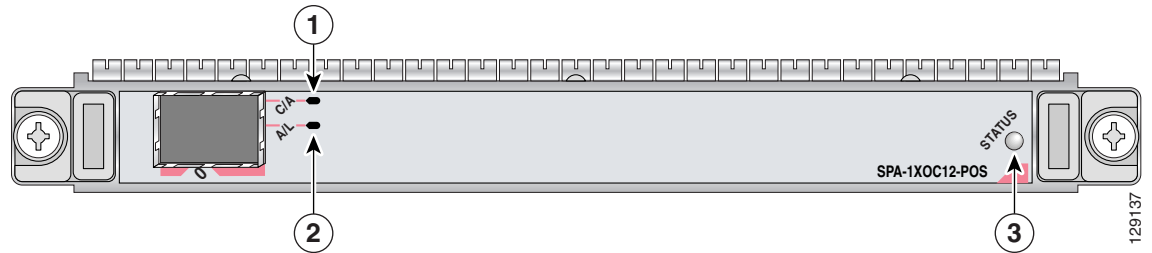
1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

Table 3-13 describes the 1-Port OC-12c/STM-4 POS SPA LEDs.

Table 3-13   1-Port OC-12c/STM-4 POS SPA LEDs

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

Table 3-13   1-Port OC-12c/STM-4 POS SPA LEDs (continued)

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

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

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

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

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

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

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

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

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

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

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

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

Figure 3-16   *SFP Optics Module*
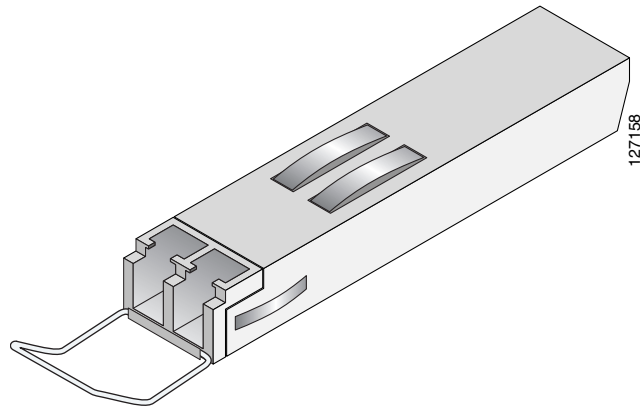
The SFP optical transceiver modules used with the POS SPAs provide the following optical fiber options:

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

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

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

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

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 3-17) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

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

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

Figure 3-17   *LC-Type Cable*
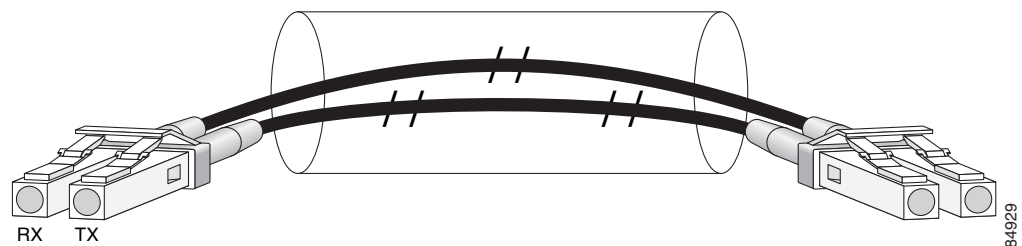
1-Port OC-48c/STM-16 ATM SPA Overview

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

- 1-Port OC-48c/STM-16 ATM SPA LEDs, page 3-24
- 1-Port OC-48c/STM-16 ATM SPA Interface Specifications, page 3-25
- 1-Port OC-48c/STM-16 ATM SPA Cables and Connectors, page 3-25

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

The 1-Port OC-48c/STM-16 ATM SPA has three LEDs, as shown in Figure 3-18.

Figure 3-18   1-Port OC-48c/STM-16 ATM SPA Faceplate
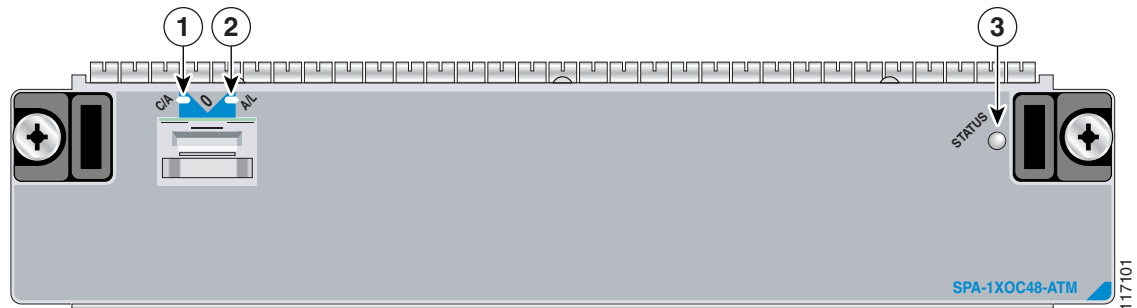
1	C/A (Carrier Alarm) LED	3	STATUS LED
2	A/L (Active Loopback) LED		

Table 3-14 describes the 1-Port OC-48c/STM-16 ATM SPA LEDs.

Table 3-14   1-Port OC-48c/STM-16 ATM SPA LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid ATM signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
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 OC-48c/STM-16 ATM SPA Interface Specifications

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

Each 1-port OC-48 ATM SPA has one duplex LC-type receptacle that allows connection to single-mode optical fiber.

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

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

The SPA-OC48 accepts an SFP module with a duplex LC-type receptacle that allows connection to single-mode optical fiber. For single-mode optical fiber connections, you can use either a duplex LC-type cable (see Figure 3-19) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 3-19   Duplex Patch Cable with LC-Type Connectors

2-Port OC-48 POS/RPR SPA Overview

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

- 2-Port OC48-POS/RPR SPA LEDs, page 3-26
- 2-Port OC48-POS/RPR SPA Interface Specifications, page 3-27
- 2-Port OC48-POS/RPR SPA Cables, Optical Transceiver Modules, and Connectors, page 3-27

2-Port OC48-POS/RPR SPA LEDs

The 2-Port OC48-POS/RPR SPA has five LEDs, as shown in Figure 3-20.

Figure 3-20   2-Port OC48-POS/RPR SPA Faceplate
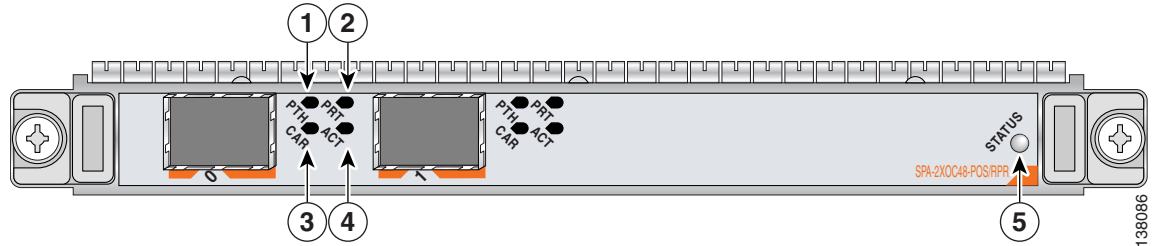
1	PTH (Pass-Through) LED	**4**	ACT (Active Loopback) LED
2	PRT (Protect) LED	**5**	STATUS LED
3	CAR (Carrier/Alarm) LED		

Table 3-15 describes the 2-Port OC48-POS/RPR SPA LEDs.

Table 3-15   2-Port OC48-POS/RPR SPA LEDs

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

2-Port OC48-POS/RPR SPA Interface Specifications

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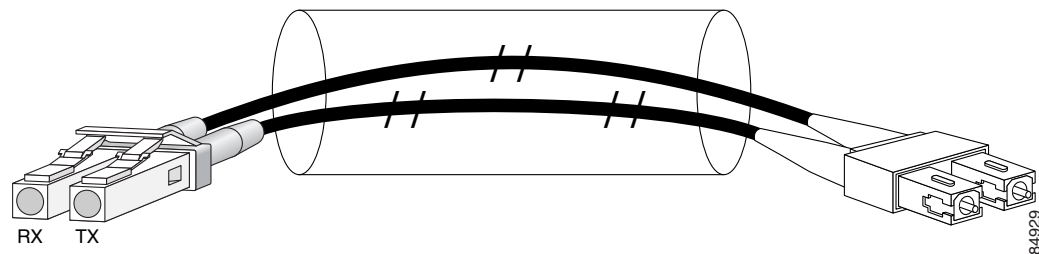
2-Port OC48-POS/RPR SPA Cables, Optical Transceiver Modules, and Connectors

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

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

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

Each port on the 2-Port OC48-POS/RPR SPA has one duplex LC-type receptacle. For single-mode optical fiber connections, you can use either a duplex LC-type cable (see Figure 3-21) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

**Figure 3-21   Duplex Patch Cable with LC-Type Connectors**
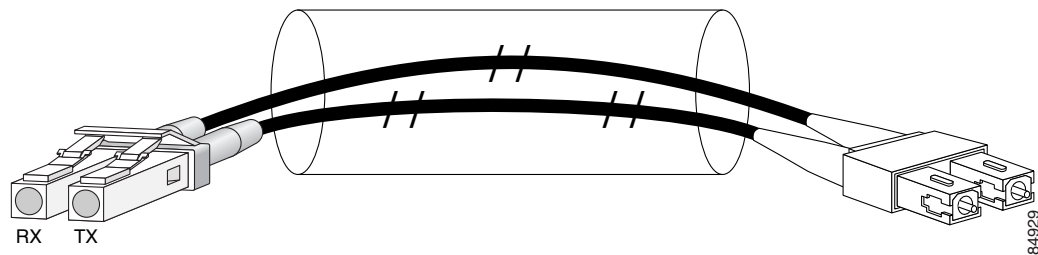
1-Port OC-192c/STM-64 POS/RPR SPA Overview

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

For more information about SPA bandwidth, see the "Bandwidth Oversubscription" section on page 3-3. For more information about SPAs and their compatibility with SIPs and modular optics, see the "SIP, SSC, and SPA Compatibility" section on page 1-3.

The 1-Port OC-192c/STM-64 POS/RPR SPA uses a single,10-Gbps fixed optical receptacle allowing a connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the "1-Port OC-192c/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables" section on page 3-29.

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

- 1-Port OC-192c/STM-64 POS/RPR SPA LEDs, page 3-28
- 1-Port OC-192c/STM-64 POS/RPR SPA Interface Specifications, page 3-29
- 1-Port OC-192c/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables, page 3-29

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

The 1-Port OC-192c/STM-64 POS/RPR SPA has six LEDs, as shown in Figure 3-22.

Figure 3-22   1-Port OC-192c/STM-64 POS/RPR SPA Faceplate
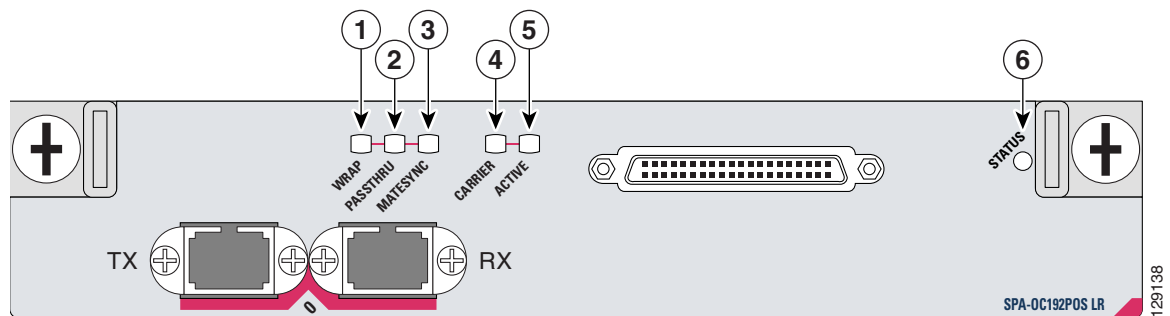
1	WRAP LED	4	CARRIER LED
2	PASSTHRU LED	5	ACTIVE LED
3	MATESYNC LED	6	STATUS LED

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

Table 3-16 describes the 1-Port OC-192c/STM-64 POS/RPR SPA LEDs.

Table 3-16   1-Port OC-192c/STM-64 POS/RPR SPA LEDs

LED Label	Color	State	Meaning
WRAP	Off	Off	Port is not in wrap mode.
	Green	On	Port is in wrap mode somewhere on the ring.
	Amber	On	Port is in wrap mode locally.
PASSTHRU	Off	Off	Port is not in pass-thru mode.
	Amber	On	Port is in pass-thru mode.
MATESYNC	Off	Off	Mate port is not synchronized.
	Green	On	Mate port is synchronized.
CARRIER	Off	Off	Port is not enabled by software.

Table 3-16   1-Port OC-192c/STM-64 POS/RPR SPA LEDs (continued)

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

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

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

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

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

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

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

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

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

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

Cisco Systems qualifies the optics that are approved for use with its SPAs. Check the product overview section of this guide to determine which optical transceiver modules are qualified for use.

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

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

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

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

Note   The 40-pin connector on the 1-Port OC-192c/STM-64 POS/RPR SPA is used for resilient packet ring (RPR) connections. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature using SPA datasheets or by contacting your Cisco representative.

Figure 3-23 shows the cable type for use with the fixed optical transceiver module on the 1-Port OC-192c/STM-64 POS/RPR SPA.

Figure 3-23   SC-Type Connectors for the Fixed Optical Transceivers
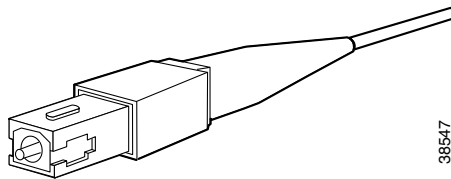
Mate Interface Cables

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

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

Two 1-Port OC-192c/STM-64 POS/RPR SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 3-24 shows the mate cables used to connect the SPAs.

Figure 3-24   SPA Mate Cables
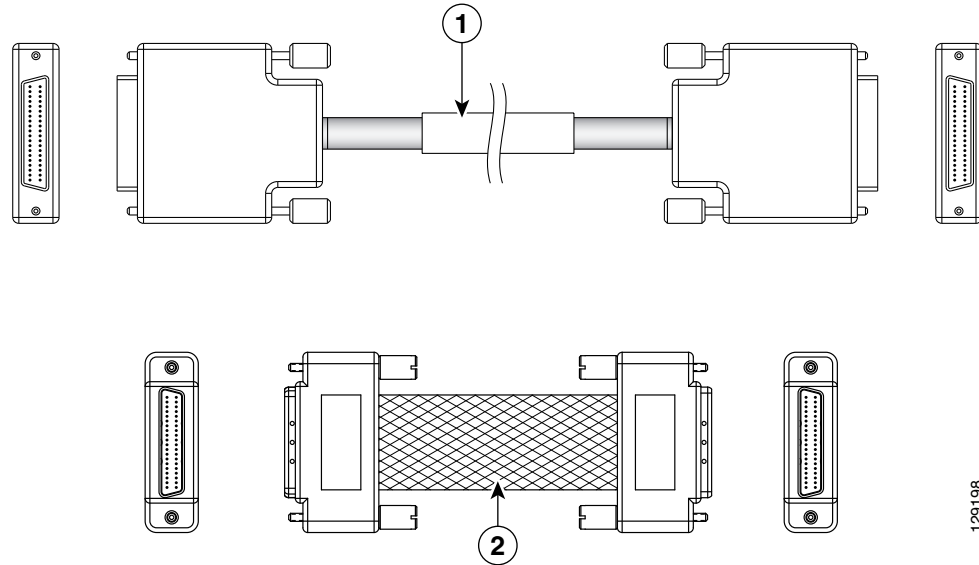
1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC192-L)	**2**	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC192-S)

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 on page 3-3. 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 "OC-3c/STM-1 POS SPA SFP Optical Transceiver Modules and Cables" section on page 3-16.

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, page 3-32
- 1-Port OC-192c/STM-64 POS/RPR XFP SPA Interface Specifications, page 3-33
- 1-Port OC-192c/STM-64 POS/RPR XFP SPA Optical Transceiver Modules, Connectors, and Cables, page 3-33

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

The 1-Port OC-192c/STM-64 POS/RPR XFP SPA has six LEDs, as shown in Figure 3-25.

Figure 3-25   *1-Port OC-192c/STM-64 POS/RPR XFP SPA Faceplate*
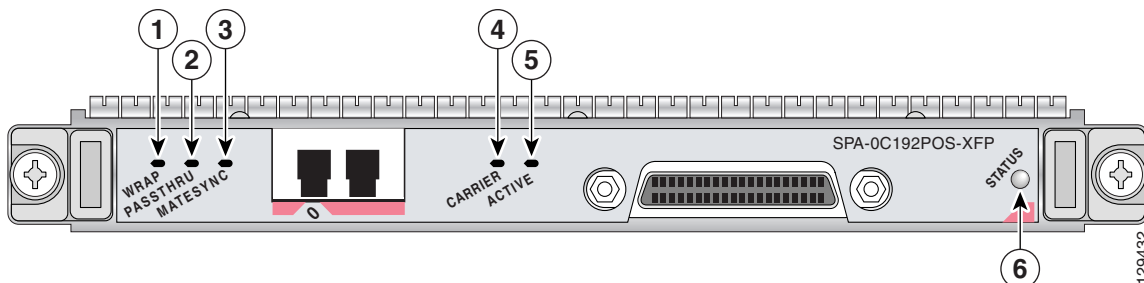
1	WRAP LED	4	CARRIER LED
2	PASSTHRU LED	5	ACTIVE LED
3	MATESYNC LED	6	STATUS LED

Note   The WRAP, PASSTHRU, and MATESYNC LEDs apply to the SPA in RPR/SRP mode only. Support for the RPR/SRP feature is dependent on the platform software release feature content. Verify support for the RPR/SRP feature using SPA datasheets or by contacting your Cisco representative.

Table 3-17 describes the 1-Port OC-192c/STM-64 POS/RPR XFP SPA LEDs.

Table 3-17   *1-Port OC-192c/STM-64 POS/RPR XFP SPA LEDs*

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

Table 3-17   *1-Port OC-192c/STM-64 POS/RPR XFP SPA LEDs (continued)*

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

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

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

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

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

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

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. Check the product overview section of this guide to determine which optical transceiver modules are qualified for use.

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

Figure 3-26 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 3-26   LC-Type Cable for the XFP Optical Transceiver Modules

RX   TX

84929
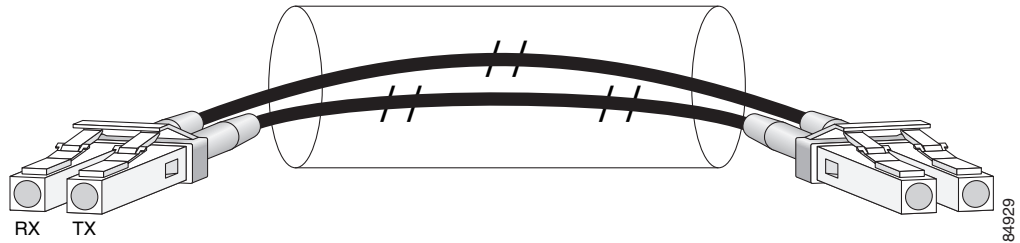
> **Note**   The 40-pin connector on the 1-Port OC-192c/STM-64 POS/RPR XFP SPA is used for resilient packet ring (RPR) connections. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature using SPA datasheets or by contacting your Cisco representative.

OC-192 Module Connections

Table 3-18 shows the OC-192 specifications for use with the 1-Port OC-192c/STM-64 POS/RPR XFP SPA.

Table 3-18   OC-192 Specifications

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

Table 3-18   OC-192 Specifications (continued)

Specification	Description
RX Overload	OC-192 SR-1: –1 dBm OC-192 IR-2: +2 dBm OC-192 LR-2: –7.0 dBm
Maximum Receiver Power Damage	OC-192 SR-1: +5 dBm OC-192 IR-2: +5 dBm OC-192 LR-2: +5 dBm

Mate Interface Cables

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

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

Two 1-Port OC-192c/STM-64 POS/RPR XFP SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 3-27 shows the mate cables used to connect the SPAs.

Figure 3-27   SPA Mate Cables
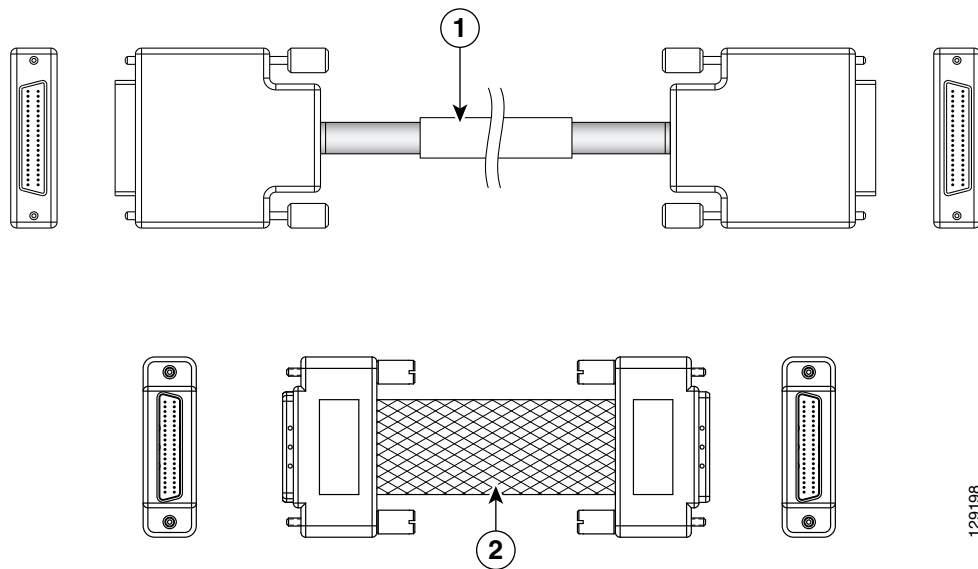
1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC192-L)	2	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC192-S)

Note   The RPR mate cable is only necessary when the SPA is to be used in RPR mode. It is not needed in POS mode. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature 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 "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, 40-Pin Connector, and Cables" section on page 3-38.

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, page 3-36
- 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA Interface Specifications, page 3-37
- 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables, page 3-38

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 Figure 3-28.

Figure 3-28   1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA Faceplate
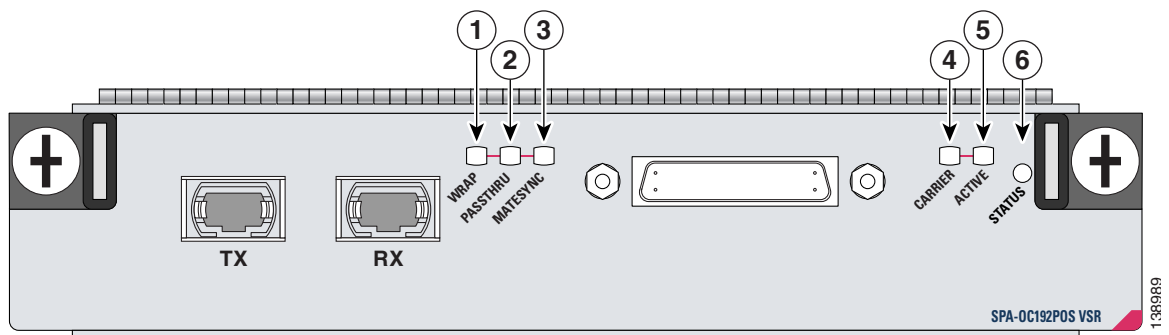
1	WRAP LED	4	CARRIER LED
2	PASSTHRU LED	5	ACTIVE LED
3	MATESYNC LED	6	STATUS LED

Note The WRAP, PASSTHRU, and MATESYNC LEDs apply to the SPA in RPR/SRP mode only. Support for the RPR/SRP feature is dependent on the platform software release feature content. Verify support for the RPR/SRP feature using SPA datasheets or by contacting your Cisco representative.

Table 3-19 describes the 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA LEDs.

Table 3-19   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.
	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.
	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*

1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA Fixed Optical Transceiver, 40-Pin 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.

Figure 3-29 shows the cable type for use with the fixed optic transceiver module on the 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA.

Figure 3-29   Simplex MTP Cable Connector (Multimode—VSR Only)
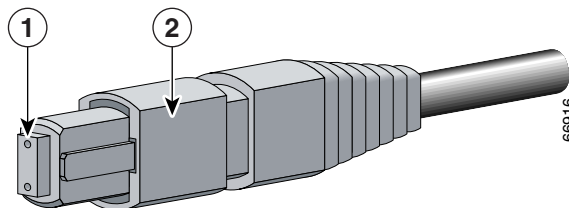
1	MTP female connector	2	Spring-action disconnect latch

Note The 40-pin connector on the 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPA is used for resilient packet ring (RPR) connections. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature using SPA datasheets or by contacting your Cisco representative.

Mate Interface Cables

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

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

Two 1-Port OC-192c/STM-64 POS/RPR VSR Optics SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 3-30 shows the mate cables used to connect the SPAs.

Figure 3-30   SPA Mate Cables

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

4-Port and 8-Port Fast Ethernet SPA Overview

The following sections describe the 4-Port and 8-Port Fast Ethernet SPA:

- 4-Port and 8-Port Fast Ethernet SPA LEDs, page 3-39
- Cables, Connectors, and Pinouts, page 3-40

4-Port and 8-Port Fast Ethernet SPA LEDs

The 4-Port and 8-Port Fast Ethernet SPA has two types of LEDs. There is a port number Active/Link LED for each individual port and one STATUS LED. Figure 3-31 shows the 8-Port FastEthernet SPA ports and LEDs.

Figure 3-31   8-Port FastEthernet SPA Faceplate
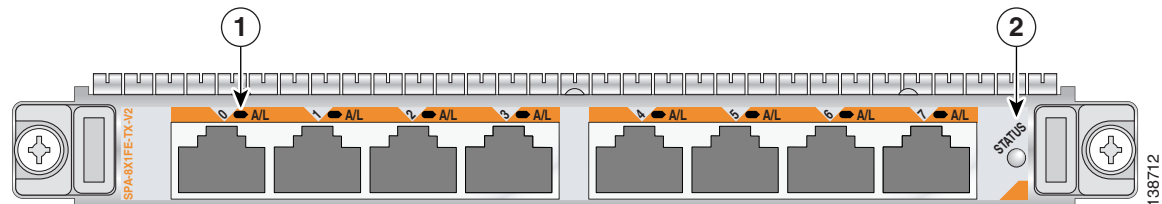
1	A/L (Active/Link) LED	**2**	STATUS LED

Table 3-20 describes the 8-Port FastEthernet SPA LEDs.

Table 3-20   8-Port FastEthernet SPA LEDs

LED Label	Color	State	Meaning
A/L (Active/Link) (0, 1, 2, 3, 4, 5, 6 or 7)[1]	Green	On	The port is enabled and the link is up.
	Amber	On	The port is enabled and the link is down.
	Off	Off	The port is disabled.
STATUS	Green	On	The SPA is online.
	Amber	On	The SPA is receiving power and bootstrapping.
	Off	Off	The SPA is offline and deactivated.

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

Cables, Connectors, and Pinouts

The interface connectors on the 4-Port and 8-Port Fast Ethernet SPA are four or eight individual RJ-45 receptacles. You can use all interface connectors simultaneously. Each connection supports IEEE 802.3 and Ethernet 10/100BASE-T interfaces compliant with appropriate standards. Cisco Systems does not supply Category 5 unshielded twisted-pair (UTP) RJ-45 cables; these cables are available commercially.

Figure 3-32 shows the RJ-45 connector. Table 3-21 lists the pinouts and signals for the RJ-45 connector.

Figure 3-32   RJ-45 Connections, Plug, and Receptacle
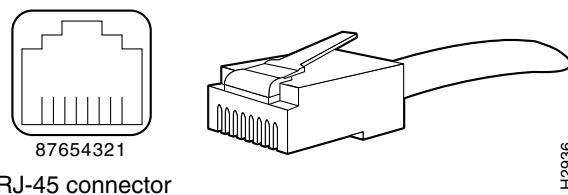
RJ-45 connector

Table 3-21   RJ-45 Connector Pinout

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

Note   Referring to the RJ-45 pinout in Table 3-21, proper common-mode line terminations should be used for the unused Category 5 UTP cable pairs 4/5 and 7/8. Common-mode termination reduces the contributions to electromagnetic interference (EMI) and susceptibility to common-mode sources. Wire pairs 4/5 and 7/8 are actively terminated in the RJ-45 port circuitry in the 4-Port and 8-Port Fast Ethernet SPA.

The 4-Port and 8-Port Fast Ethernet SPA supports automatic MDI/MDIX crossover at all speeds of operation allowing the SPA to work with straight-through and crossover Ethernet cables. Depending on your RJ-45 interface cabling requirements, use the pinouts in Figure 3-33 and Figure 3-34.

Figure 3-33   *Straight-Through Cable Pinout, RJ-45 Connection to a Hub or Repeater*

Hub or LAN switch   Ethernet port

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

1 RxD+ —————— 1 TxD+
2 RxD– —————— 2 TxD–   H7101
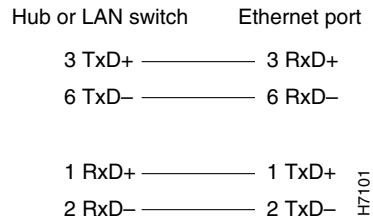
Figure 3-34   *Crossover Cable Pinout, RJ-45 Connections Between Routers*

Router   Router

3 TxD+   3 TxD+
6 TxD–   6 TxD–

1 RxD+   1 RxD+
2 RxD–   2 RxD–   101929
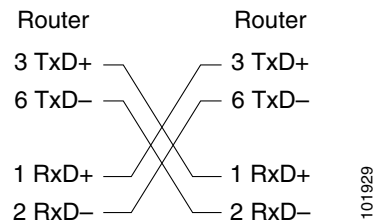
1-Port 10-Gigabit Ethernet SPA Overview

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

- 1-Port 10-Gigabit Ethernet SPA LEDs, page 3-42
- 1-Port 10-Gigabit Ethernet SPA Cables, Connectors, and Pinouts, page 3-42
- XFP Connections, page 3-42
- XFP Port Cabling Specifications, page 3-43

1-Port 10-Gigabit Ethernet SPA LEDs

The 1-Port 10-Gigabit Ethernet SPA has two types of LEDs. There is an ACTIVE/LINK LED for the port and the STATUS LED as shown in Figure 3-35.

Figure 3-35   1-Port 10-Gigabit Ethernet SPA Faceplate
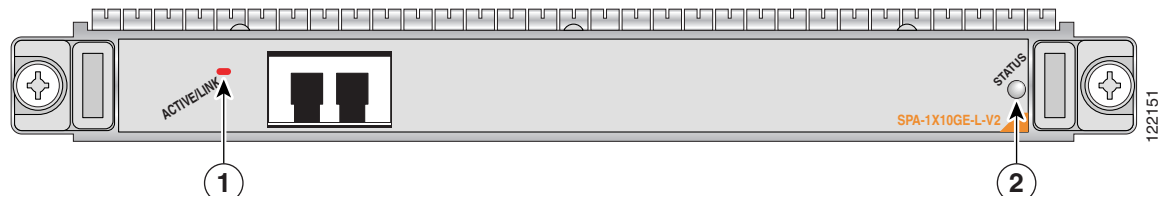
1	ACTIVE/LINK LED	2	STATUS LED

Table 3-22 describes the 1-Port 10-Gigabit Ethernet SPA LEDs.

Table 3-22   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.
	Amber	On	SPA power is on and the SPA is being configured.
	Green	On	SPA is ready and operational.

1-Port 10-Gigabit Ethernet SPA Cables, Connectors, and Pinouts

The interface connector on the 1-Port 10-Gigabit Ethernet SPA is a fiber optic receiver that supports one small form factor pluggable (XFP) module.

XFP Connections

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

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

The XFP module dimensions are as follows:

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

The XFP module temperature range is 0° to 70^oC (32° to 158^oF). Figure 3-36 shows an XFP module.

Figure 3-36   XFP Module
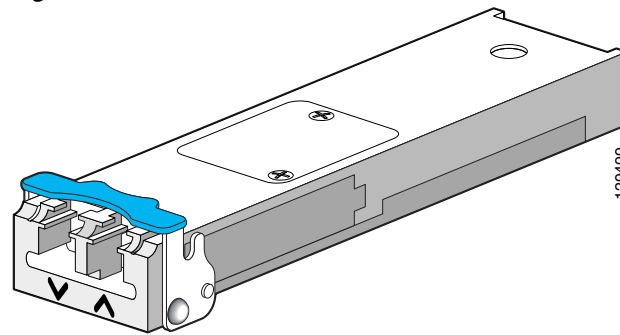
XFP Port Cabling Specifications

Table 23   XFP Port Cabling Specifications

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

2-Port Gigabit Ethernet SPA Overview

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

2-Port Gigabit Ethernet SPA LEDs

The 2-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in Figure 3-37.

Figure 3-37   2-Port Gigabit Ethernet SPA Faceplate
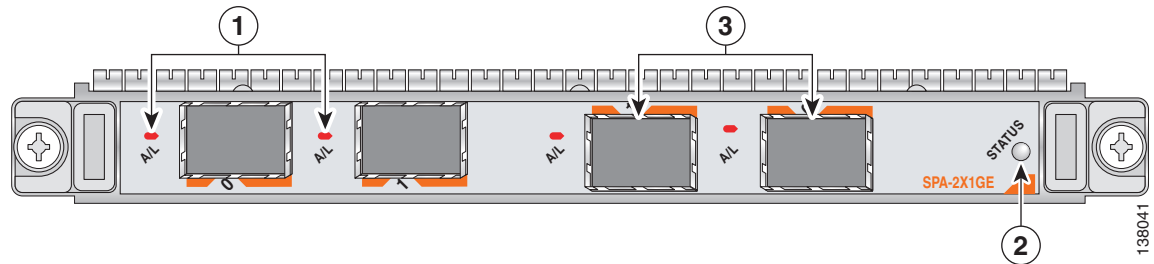
| 1 | A/L (Active/Link) LED | 2 | STATUS LED |

Table 3-24 describes the 2-Port Gigabit Ethernet SPA LEDs.

Table 3-24   2-Port Gigabit Ethernet SPA LEDs

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

2-Port Gigabit Ethernet SPA (Version 2) LEDs

The 2-Port Gigabit Ethernet SPA (Version 2) has two types of LEDs: an A/L LED for each port (SFP and RJ45) and a STATUS LED, as shown in Figure 3-38.

Figure 3-38   2-Port Gigabit Ethernet SPA (Version 2) Faceplate
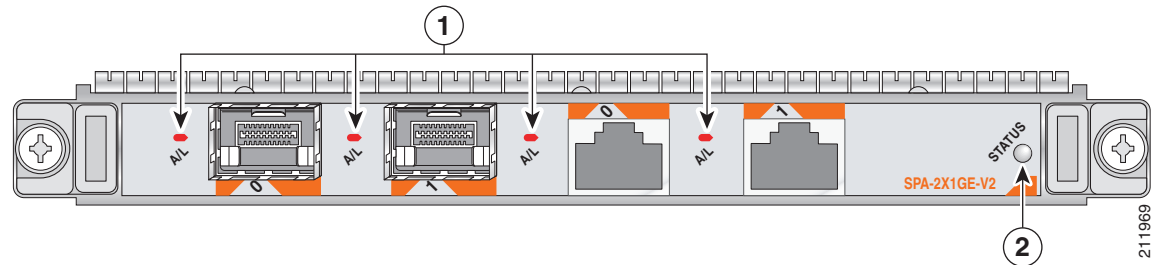
1	A/L (Active/Link) LED	**2**	STATUS LED

Table 3-25 describes the 2-Port Gigabit Ethernet SPA (Version 2) LEDs.

Table 3-25   2-Port Gigabit Ethernet SPA (Version 2) LEDs

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

The valid configuration of the SFP and RJ45 ports for the 2-Port Gigabit Ethernet SPA (Version 2) are as follows:

- Port 0 (SFP) and Port 1 (SFP)
- Port 0 (SFP) and Port 1 (RJ45)
- Port 0 (RJ45) and Port 1 (SFP)
- Port 0 (RJ45) and Port 1 (RJ45)

or any single port

2-Port Fast Ethernet SPA Cables, Connectors, and Pinouts

The interface connectors on the 2-Port Fast Ethernet SPA are two individual RJ-45 receptacles. You can use both the interface connectors simultaneously. Each connection supports IEEE 802.3 and Ethernet 10/100BASE-T interfaces compliant with appropriate standards. Cisco Systems does not supply Category 5 unshielded twisted pair (UTP) RJ-45 cables; these cables are available commercially. The RJ-45 connectors are shown in Figure 3-39.

Figure 3-39 **2-Port Fast Ethernet RJ-45 Connections, Plug, and Receptacle**
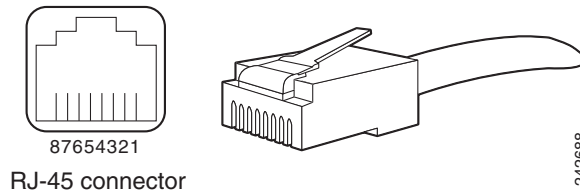
RJ-45 connector

Table 3-26 lists the pinouts and signals for the RJ-45 connector.

Table 3-26 **2-Port Fast Ethernet RJ-45 Connector Pinouts**

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

2-Port Gigabit Ethernet SPA Cables and Connectors

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

SFP Module Connections

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

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

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 3-27 and Table 3-28 provide SFP module information and specifications.

Table 3-27   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 3-28   SFP Module Specifications

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

SFP-GE-S Modules

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

SFP-GE-L Modules

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

SFP-GE-Z Modules

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

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

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

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

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

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

SFP-GE-T Modules

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

SFP Module Cabling and Connection Equipment

Table 3-29 provides cabling specifications for the SFP modules that can be installed on the 2-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

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

Table 3-29   SFP Module Port Cabling Specifications

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

1. Multimode fiber (MMF) only.

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

3. Dispersion-shifted single-mode fiber-optic cable.

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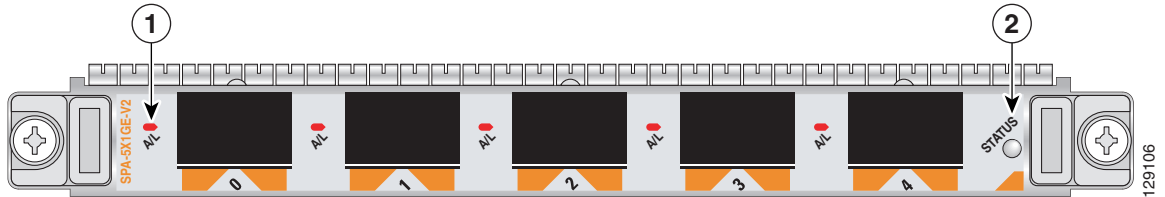
5-Port Gigabit Ethernet SPA Overview

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

5-Port Gigabit Ethernet SPA LEDs

The 5-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each individual port and a STATUS LED for the SPA, as shown in Figure 3-40.

Figure 3-40   5-Port Gigabit Ethernet SPA Faceplate

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

Table 3-30 describes the 5-Port Gigabit Ethernet SPA LEDs.

Table 3-30   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 the SPA is being configured.

5-Port Gigabit Ethernet SPA Cables and Connectors

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

SFP Module Connections

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

Note   The 5-Port Gigabit Ethernet SPA accepts only the SFP modules listed as supported in this document. An SFP module check is run every time an SFP module is inserted into the 5-Port Gigabit Ethernet SPA, and only SFP modules that pass this check can be used by the 5-Port Gigabit Ethernet SPA.

SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 5-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 5-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 3-31 and Table 3-32 provide SFP module information and specifications.

Table 3-31   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 3-32   SFP Module Specifications

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

SFP-GE-S Modules

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

SFP-GE-L Modules

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

SFP-GE-Z Modules

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

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

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

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

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

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

SFP Module Cabling and Connection Equipment

Table 3-33 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 3-33   SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	MMF[2] and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)

Table 3-33   SFP Module Port Cabling Specifications (continued)

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF[3]	8	—	62.1 miles (100 km)

1. Multimode fiber (MMF) only.

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

3. Dispersion-shifted single-mode fiber-optic cable.

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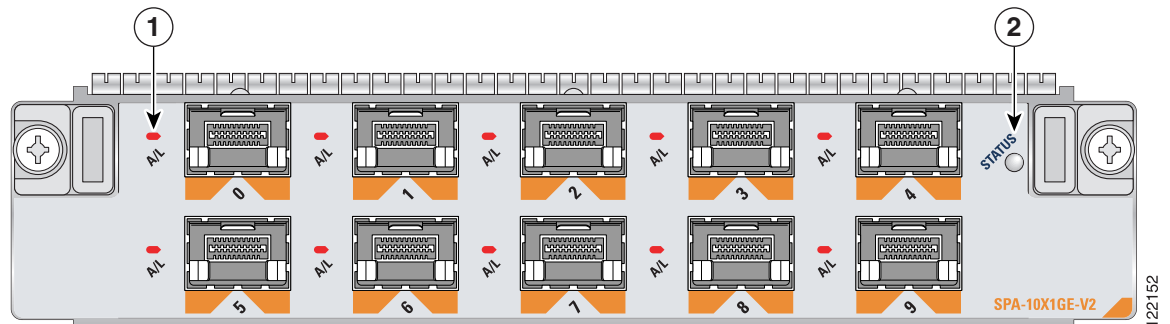
10-Port Gigabit Ethernet SPA Overview

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

10-Port Gigabit Ethernet SPA LEDs

The 10-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each individual port and a STATUS LED for the SPA, as shown in Figure 3-41.

Figure 3-41   10-Port Gigabit Ethernet SPA Faceplate

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

Table 3-34 describes the 10-Port Gigabit Ethernet SPA LEDs.

Table 3-34   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 the SPA is being configured.

10-Port Gigabit Ethernet SPA Cables and Connectors

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

SFP Module Connections

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

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

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 3-35 and Table 3-36 provide SFP information and specifications.

Table 3-35   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 3-36   10-Port Gigabit Ethernet SFP Module Specifications

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

SFP-GE-S Modules

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

SFP-GE-L Modules

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

SFP-GE-Z Modules

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

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

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

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

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

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

SFP Module Cabling and Connection Equipment

Table 3-37 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 3-37   SFP Module Port Cabling Specifications

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

Table 3-37   SFP Module Port Cabling Specifications (continued)

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

1. Multimode fiber (MMF) only.

2. Dispersion-shifted single-mode fiber-optic cable.

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

IPSec VPN SPA Overview

The following sections describe the IPSec VPN SPA:

IPSec VPN SPA LEDs

The IPSec VPN SPA has one LED, as shown in Figure 3-42.

Figure 3-42   IPSec VPN SPA Faceplate
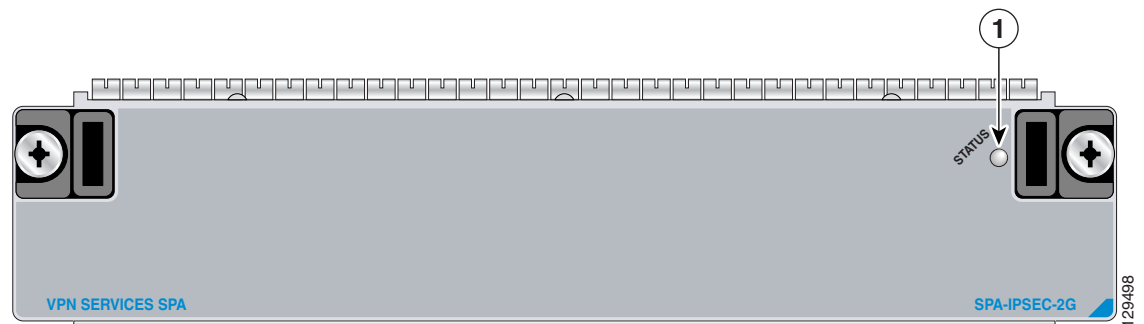
1	STATUS LED		

Table 3-38 describes the IPSec VPN SPA LED.

Table 3-38   IPSec VPN SPA LED

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

C H A P T E R 4

Preparing to Install a SIP, SSC, or SPA

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

- Required Tools and Equipment, page 4-1
- Safety Guidelines, page 4-1
- Laser/LED Safety, page 4-3

Required Tools and Equipment

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

- Shared port adapter interface processor (SIP)
- Shared port adapter (SPA)
- SPA Services Card (SSC)
- Number 1 Phillips and a 3/16-inch flat-blade screwdriver
- Number 2 Phillips screwdriver
- Torque screwdriver with range from 8 to 12 inch-pounds (90 to 135 Newton-centimeters)
- Your own electrostatic discharge (ESD)-prevention equipment or the disposable grounding wrist strap supplied with the SIP or SPA
- Antistatic mat
- Antistatic container

Safety Guidelines

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

- Safety Warnings, page 4-2
- Electrical Equipment Guidelines, page 4-2
- Telephone Wiring Guidelines, page 4-2
- Preventing Electrostatic Discharge Damage, page 4-3

Catalyst 6500 Series Switch SIP, SSC, and SPA Hardware Installation Guide

OL-9041-04

4-1

Safety Warnings

Safety warnings appear throughout this publication in procedures that may harm you if performed incorrectly. A warning symbol precedes each warning statement. The warnings below are general warnings that are applicable to the entire publication.

⚠
Warning   **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

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

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.

⚠
Caution   This equipment is suitable for intrabuilding wiring only.

Telephone Wiring Guidelines

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

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

Preventing Electrostatic Discharge Damage

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

Following are guidelines for preventing ESD damage:

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

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

Laser/LED Safety

An optical single-mode transmitter uses a small laser to transmit the light signal to the network ring. Keep the transmit port covered whenever a cable is not connected to it. Although multimode transceivers typically use LEDs for transmission, it is good practice to keep open ports covered and avoid staring into open ports or apertures. The single-mode aperture port contains a laser warning label, as shown in Figure 4-1. The multimode aperture contains a Class 1 LED warning label, as shown in Figure 4-1. These warnings apply to SPAs and SFP modules that transmit signals via an optical carrier signal.

Figure 4-1   Class 1 Laser Warning Labels for Single-Mode Port

CLASS 1 LASER PRODUCT
LASERPRODUKT DER KLASSE 1

PRODUIT LASER DE CLASSE 1
クラス１　レーザ製品
PRODUCTO LASER CLASE 1

H6655

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Installing and Removing a SIP or SSC

This chapter describes how to install or remove SIPs or SSCs on the Catalyst 6500 Series switch. This chapter contains the following sections:

Handling SIPs or SSCs

Each SIP or SSC circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage. Before you begin installation, read Chapter 4, "Preparing to Install a SIP, SSC, or SPA," for a list of parts and tools required for installation.

⚠ **Caution** Always handle the SIP or SSC by the carrier edges and handle; never touch the components or connector pins. (See Figure 5-1.)

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

Figure 5-1   Handling a SIP
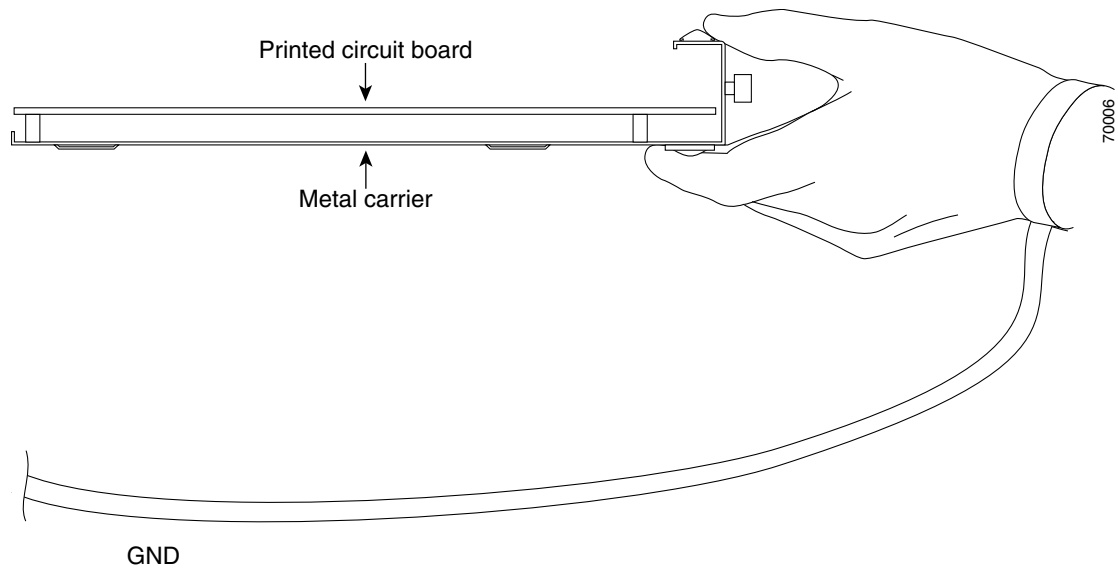
Online Insertion and Removal

The Catalyst 6500 Series switch supports online insertion and removal (OIR) of the SPA interface processor (SIP) or SPA services card (SSC), in addition to each of the shared port adapters (SPAs). Therefore, you can remove a SIP or SSC with its SPAs still intact, or you can remove a SPA independently from the SIP or SSC, leaving the SIP or SSC installed in the switch.

This section includes the following topics on OIR support:

- Preparing for Online Removal of a SIP or SSC, page 5-2
- Verifying Deactivation and Activation of a SIP or SSC, page 5-3
- Preparing for Online Removal of a SPA, page 5-4
- Verifying Deactivation and Activation of a SPA, page 5-6
- Deactivation and Activation Configuration Examples, page 5-6

> **Note**   For simplicity, any reference to "SIP" in this section also applies to the SSC.

Preparing for Online Removal of a SIP or SSC

The Catalyst 6500 Series switch supports OIR of the SIP and the SSC. To do this, you can power down a SIP (which automatically deactivates any installed SPAs) and remove the SIP with the SPAs still intact.

Although graceful deactivation of a SIP is preferred using the **no power enable module** command, the Catalyst 6500 Series switch does support removal of the SIP without deactivating it first. If you plan to remove a SIP, you can deactivate the SIP first, using the **no power enable module** global configuration command. When you deactivate a SIP using this command, it automatically deactivates each of the SPAs that are installed in that SIP. Therefore, it is not necessary to deactivate each of the SPAs prior to deactivating the SIP.

Either a blank filler plate or a functional SPA should reside in every subslot of a SIP during normal operation.

For more information about the recommended procedures for physical removal of the SIP, refer to the *Catalyst 6500 Series Switch SIP, SSC, and SPA Hardware Installation Guide*.

Deactivating a SIP or SSC

To deactivate a SIP or SSC and its installed SPAs prior to removal of the SIP, use the following command in global configuration mode:

Command	Purpose
Router(config)# **no power enable module** *slot*	Shuts down any installed interfaces, and deactivates the SIP in the specified slot, where: • *slot*—Specifies the chassis slot number where the SIP is installed.

For more information about chassis slot numbering, refer to the "Identifying Slots and Subslots for SIPs, SSCs, and SPAs" section in this guide.

Reactivating a SIP or SSC

Once you deactivate a SIP or SSC, whether or not you have performed an OIR, you must use the **power enable module** global configuration command to reactivate the SIP.

If you did not issue a command to deactivate the SPAs installed in a SIP, but you did deactivate the SIP using the **no power enable module** command, then you do not need to reactivate the SPAs after an OIR of the SIP. The installed SPAs automatically reactivate upon reactivation of the SIP in the switch.

For example, consider the case where you remove a SIP from the switch to replace it with another SIP. You reinstall the same SPAs into the new SIP. When you enter the **power enable module** command on the switch, the SPAs will automatically reactivate with the new SIP.

To activate a SIP and its installed SPAs after the SIP has been deactivated, use the following command in global configuration mode:

Command	Purpose
Router(config)# **power enable module** *slot*	Activates the SIP in the specified slot and its installed SPAs, where: • *slot*—Specifies the chassis slot number where the SIP is installed.

For more information about chassis slot numbering, refer to the "Identifying Slots and Subslots for SIPs, SSCs, and SPAs" section in this guide.

Verifying Deactivation and Activation of a SIP or SSC

To verify the deactivation of a SIP or SSC, enter the **show module** command in privileged EXEC configuration mode. Observe the Status field associated with the SIP that you want to verify.

The following example shows that the Cisco 7600 SIP-400 located in slot 13 is deactivated. This is indicated by its "PwrDown" status.

```
Router# show module 13
Mod Ports Card Type                                   Model             Serial No.
--- ----- ------------------------------------- ------------------ -----------

 13    0  4-subslot SPA Interface Processor-400  7600-SIP-400      JAB0851042X


Mod MAC addresses                      Hw     Fw           Sw           Status
--- ---------------------------------- ------ ------------ ------------ -------
 13 00e0.aabb.cc00 to 00e0.aabb.cc3f   0.525 12.2(PP_SPL_ 12.2(PP_SPL_ Ok

Mod Online Diag Status
--- -------------------
 13 PwrDown
```

To verify activation and proper operation of a SIP, enter the **show module** command and observe "Ok" in the Status field as shown in the following example:

```
Router# show module 2
Mod Ports Card Type                                   Model             Serial No.
--- ----- ------------------------------------- ------------------ -----------
  2    0 4-subslot SPA Interface Processor-200   7600-SIP-200      JAB074905S1


Mod MAC addresses                      Hw     Fw           Sw           Status
--- ---------------------------------- ------ ------------ ------------ -------
  2 0000.0000.0000 to 0000.0000.003f   0.232 12.2(2004082 12.2(2004082 Ok

Mod Online Diag Status
--- -------------------
  2 Pass
```

Preparing for Online Removal of a SPA

The Catalyst 6500 Series switch supports OIR of a SPA independently of removing the SIP or SSC. This means that a SIP can remain installed in the switch with one SPA remaining active, while you remove another SPA from one of the SIP subslots. If you are not planning to immediately replace a SPA into the SIP, then be sure to install a blank filler plate in the subslot. The SIP should always be fully installed with either functional SPAs or blank filler plates.

The interface configuration is retained (recalled) if a SIP or SPA is removed and then replaced with one of the same type. This is not the case if you replace a Cisco 7600-SIP-200 with a Cisco 7600-SIP-400 or vice-versa.

If you are planning to remove a SIP along with its SPAs, then you do not need to follow the instructions in this section. To remove a SIP, see the

Deactivating a SPA

Although graceful deactivation of a SPA is preferred using the **hw-module subslot shutdown** command, the Catalyst 6500 Series switch does support removal of the SPA without deactivating it first. Before deactivating a SPA, ensure that the SIP is seated securely into the slot before pulling out the SPA itself.

✎
Note If you are preparing for an OIR of a SPA, it is not necessary to independently shut down each of the interfaces prior to deactivation of the SPA. The **hw-module subslot shutdown** command automatically stops traffic on the interfaces and deactivates them along with the SPA in preparation for OIR. In similar fashion, you do not need to independently restart any interfaces on a SPA after OIR of a SPA or SIP.

To deactivate a SPA and all of its interfaces prior to removal of the SPA, use the following command in global configuration mode:

Command	Purpose
Router(config)# **hw-module subslot** *slot/subslot* **shutdown** [**powered** | **unpowered**]	Deactivates the SPA in the specified slot and subslot of the SIP, where: • *slot*—Specifies the chassis slot number where the SIP is installed. • *subslot*—Specifies subslot number on a SIP where a SPA is installed. • **powered**—(Optional) Shuts down the SPA and all of its interfaces, and leaves them in an administratively down state with power enabled. This is the default state. • **unpowered**—(Optional) Shuts down the SPA and all of its interfaces, and leaves them in an administratively down state without power.

For more information about chassis slot and SIP subslot numbering, refer to the "Identifying Slots and Subslots for SIPs, SSCs, and SPAs" section in this guide.

Reactivating a SPA

✎
Note You do not need to reactivate a SPA after an OIR of either the SIP or a SPA if you did not deactivate the SPA prior to removal. If the switch is running, then the SPAs automatically start upon insertion into the SIP or with insertion of a SIP into the switch.

If you deactivate a SPA using the **hw-module subslot shutdown** global configuration command and need to reactivate it without performing an OIR, you need to use the **no hw-module subslot shutdown** global configuration command to reactivate the SPA and its interfaces.

To activate a SPA and its interfaces after the SPA has been deactivated, use the following command in global configuration mode:

Command	Purpose
Router(config)# **no hw-module subslot** *slot/subslot* **shutdown**	Activates the SPA and its interfaces in the specified slot and subslot of the SIP, where: • *slot*—Specifies the chassis slot number where the SIP is installed. • *subslot*—Specifies subslot number on a SIP where a SPA is installed.

Verifying Deactivation and Activation of a SPA

When you deactivate a SPA, the corresponding interfaces are also deactivated. This means that these interfaces will no longer appear in the output of the **show interface** command.

To verify the deactivation of a SPA, enter the **show hw-module subslot all oir** command in privileged EXEC configuration mode. Observe the Operational Status field associated with the SPA that you want to verify.

In the following example, the SPA located in subslot 1 of the SIP in slot 2 of the switch is administratively down from the **hw-module subslot shutdown** command:

```
Router# show hw-module subslot all oir
Module         Model              Operational Status
-------------- ------------------ ------------------------
subslot 2/0    SPA-4XOC3-POS      ok
subslot 2/1    SPA-4XOC3-ATM      admin down
```

To verify activation and proper operation of a SPA, enter the **show hw-module subslot all oir** command and observe "ok" in the Operational Status field as shown in the following example:

```
Router# show hw-module subslot all oir
Module         Model              Operational Status
-------------- ------------------ ------------------------
subslot 2/0    SPA-4XOC3-POS      ok
subslot 2/1    SPA-4XOC3-ATM      ok
```

Deactivation and Activation Configuration Examples

This section provides the following examples of deactivating and activating SIPs and SPAs:

Deactivation of a SIP Configuration Example

Deactivate a SIP when you want to perform OIR of the SIP. The following example deactivates the SIP that is installed in slot 5 of the switch, its SPAs, and all of the interfaces. The corresponding console messages are shown:

```
Router# configure terminal
Router(config)# no power enable module 5
1w4d: %OIR-6-REMCARD: Card removed from slot 5, interfaces disabled
1w4d: %C6KPWR-SP-4-DISABLED: power to module in slot 5 set off (admin request)
```

Activation of a SIP Configuration Example

Activate a SIP if you have previously deactivated it. If you did not deactivate the SPAs, the SPAs automatically reactivate with reactivation of the SIP.

The following example activates the SIP that is installed in slot 5 of the switch, its SPA, and all of the interfaces (as long as the **hw-module subslot shutdown** command was not issued to also deactivate the SPA):

```
Router# configure terminal
Router(config)# power enable module 5
```

Notice that there are no corresponding console messages shown with activation. If you re-enter the **power enable module** command, a message is displayed indicating that the module is already enabled:

```
Router(config)# power enable module 5
% module is already enabled
```

Deactivation of a SPA Configuration Example

Deactivate a SPA when you want to perform OIR of that SPA. The following example deactivates the SPA (and its interfaces) that is installed in subslot 0 of the SIP located in slot 2 of the switch and removes power to the SPA. Notice that no corresponding console messages are shown:

```
Router# configure terminal
Router(config)# hw-module subslot 2/0 shutdown unpowered
```

Activation of a SPA Configuration Example

Activate a SPA if you have previously deactivated it. If you have not deactivated a SPA and its interfaces during OIR of a SIP, then the SPA is automatically reactivated upon reactivation of the SIP.

The following example activates the SPA that is installed in slot 2 of the switch and all of its interfaces. The corresponding console message is shown:

```
Router# configure terminal
Router(config)# no hw-module subslot 2/0 shutdown
Router#
```

SIP or SSC Installation and Removal

This section provides step-by-step instructions for installing and removing a SIP or SSC.

Note   For simplicity, any reference to "SIP" in this section also applies to the SSC.

Note   To ensure compliance with electromagnetic interference (EMI) approvals by providing a tight EMI-preventive seal for the Catalyst 6500 Series switch, we recommend that you first install SIPs in the slots closest to the supervisor engine slots, and then work out to the slots furthest from the supervisor engine slots.

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

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

Step 1   To insert the SIP, carefully align the edges of the SIP between the upper and lower edges of the module slot, as shown in C of Figure 5-2.

Step 2   Carefully slide the SIP halfway into the module slot and connect all cables to the SPA.

Step 3   With the cables connected, carefully slide the SIP into the module slot until the SIP makes contact with the backplane.

✎
Note   The SIP ejector levers must be positioned at a 45-degree angle before the SIP makes contact with the backplane.

Step 4   Push the SIP ejector levers in until the SIP is fully seated in the router backplane.

✎
Note   When the chassis is fully populated, seating a SIP can be difficult. To properly seat the SIP and avoid physical damage, loosen the locking thumbscrews on the neighboring SIPs or line cards.

⚠
Caution   Use of excessive force can damage the router or SIP.

Step 5   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.

Step 6   To remove the SIP, loosen the locking thumbscrews on both sides of the SIP, as shown in A of Figure 5-2.

Step 7   Pull out the SIP ejector levers, as shown in B of Figure 5-2, and carefully slide the SIP halfway out of the module slot. If you are removing a blank filler plate, pull the blank filler plate completely out of the module slot.

Step 8   With the SIP halfway out of the module slot, disconnect all cables from the SPA. After disconnecting the cables, pull the SIP out of the module slot.

Figure 5-2 illustrates how to install and remove a SIP:

Figure 5-2　　　　***SIP Installation and Removal***
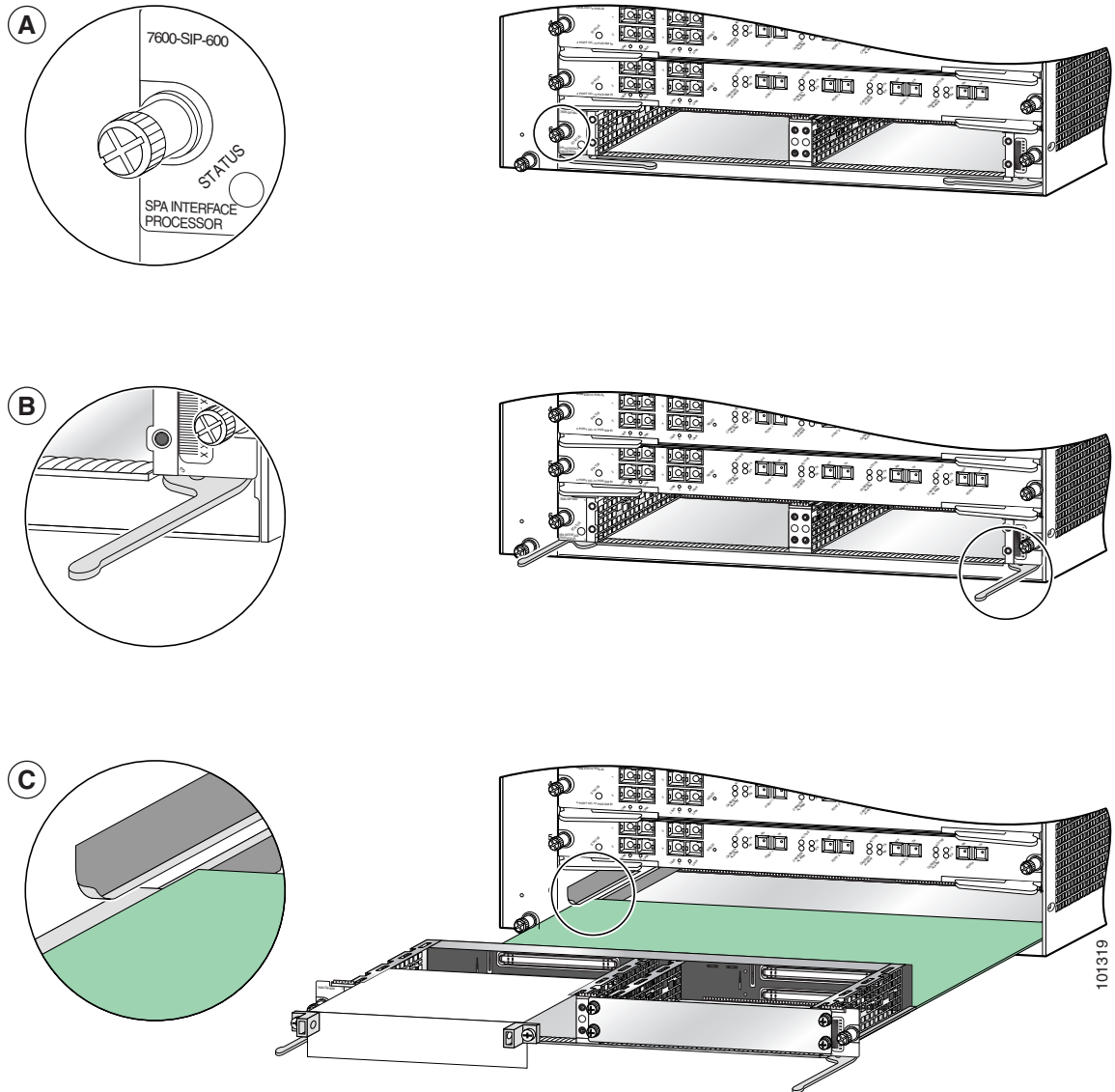
C H A P T E R **6**

Installing and Removing a Shared Port Adapter

This chapter describes how to install or remove SPAs on the Catalyst 6500 Series switch. This chapter contains the following sections:

Handling SPAs

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

⚠️

Caution   Always handle the SPA by the carrier edges and handle; never touch the SPA components or connector pins. (See Figure 6-1.)

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

Figure 6-1   *Handling a SPA*
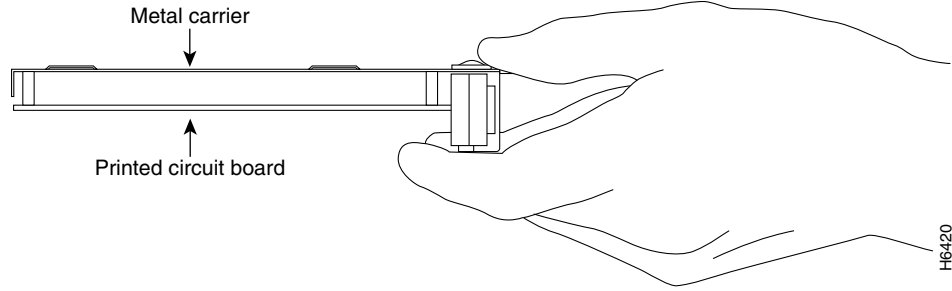
Metal carrier

Printed circuit board

H6420

SPA Installation and Removal

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

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

Figure 6-2 illustrates how to install and remove a SPA in a SIP.

Figure 6-2   *SPA Installation and Removal*

129105
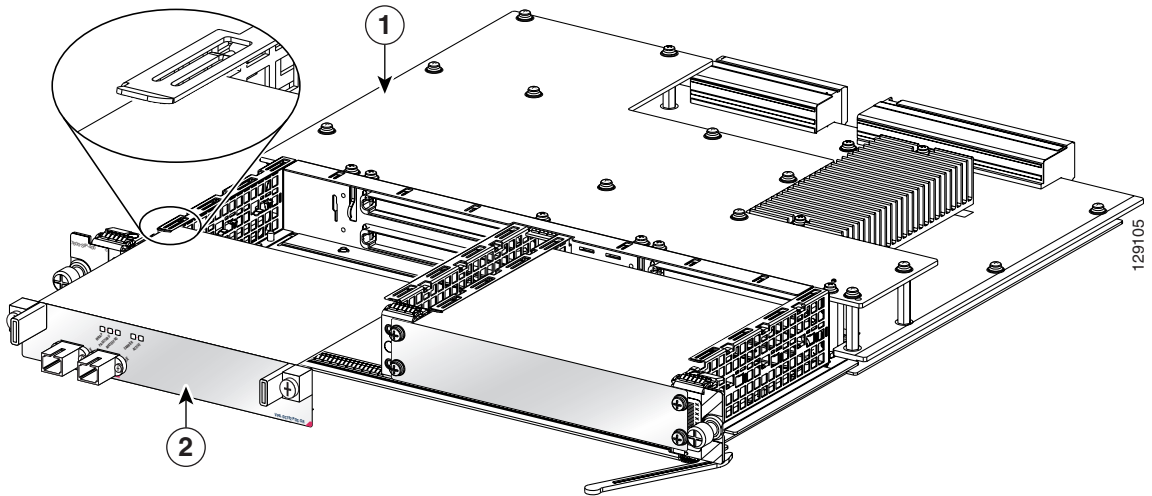
1	SIP	2	SPA

Installing a SPA in a SIP

To install a SPA in a SIP, refer to Figure 6-2 and do the following:

Step 1   To insert the SPA in the SIP, locate the guide rails inside the SIP that hold the SPA in place. They are at the top left and top right of the SPA slot and are recessed about an inch, as shown in Figure 6-2.

Step 2   Carefully slide the SPA all the way in the SIP until the SPA is firmly seated in the SPA interface connector. When fully seated, the SPA might be slightly behind the SIP faceplate.

Step 3   After the SPA is properly seated, fasten the SPA in place with the captive installation screws.

Step 4   Tighten the screws to a torque of between 8.3 and 11 inch-pounds (94 to 124 N-cm). Do not overtighten.

⚠

Caution   Overtightening the captive installation screws may result in misoperation or damage.

Removing a SPA from a SIP

To remove a SPA from a SIP, refer to Figure 6-2 and do the following:

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

Step 2   To remove the SPA from the SIP, unfasten the captive installation screws on the SPA.

Step 3   Grasp the handles of the SPA and pull the SPA from the SIP. (You have already disconnected the cables from the SPA when removing the SIP).

Online Insertion and Removal

Cisco 7600 series router SIPs and SPAs support online insertion and removal (OIR). SPAs can be inserted or removed independently from the SIP. OIR of a SIP with installed SPAs is also supported.

For more information about performing OIR, refer to the "Preparing for Online Removal of a SPA" section on page 5-4.

Optical Device Maintenance

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

Cleaning Optical Devices

See *Inspection and Cleaning Procedures for Fiber-Optic Connections* for information on cleaning optical devices.

Checking the Installation

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

- Verifying the Installation, page 6-4
- Using show Commands to Verify SIP and SPA Status, page 6-5
- Using show Commands to Display SPA Information, page 6-6

Verifying the Installation

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

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

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

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

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

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

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

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

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

- As a SIP is initialized, the STATUS LED will first be amber, indicating that power is on, but the SIP is being configured. When the SIP is active, the STATUS LED will illuminate green.

- SPAs will follow the same sequence once the SIP has completed its initialization. The SPA STATUS LEDs will illuminate amber, turning to green when the SPAs become active.

- When the SIP and SPA STATUS LEDs are green, all associated interfaces are configurable.

Refer to the *Catalyst 6500 Series Switch SIP, SSC, and SPA Software Configuration Guide* for configuration instructions.

- If a SIP or SPA is replaced with a module of the same type (as in an OIR or hardware swap), the previous configuration will be reinstated when the SIP or SPA becomes active.

- If a SIP or SPA has not been previously installed in the same slot or subslot, then the configuration for all associated interfaces will be empty.

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

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

- If a SIP or SPA is undergoing an FPD upgrade, then console messages will indicate that the FPD process has been initiated. The upgrade process might take several minutes. Use the **show upgrade fpd progress** command to obtain information about the FPD process. SIPs or SPAs that undergo an FPD upgrade will automatically be rebooted. Return to Step 1.

- If there is no indication that an FPD upgrade is under way, see Chapter 7, "Troubleshooting the Installation."

Using show Commands to Verify SIP and SPA Status

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

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

Step 2   Display all of the current SPAs and a summary of their status using the **show hw-module subslot all oir** command.

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

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

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

For more information about FPD upgrades, refer to the "Upgrading Field-Programmable Devices" chapter of the *Catalyst 6500 Series Switch SIP, SSC, and SPA Software Configuration Guide*.

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

Using show Commands to Display SPA Information

Table 6-1 describes the **show** commands you can use to display SPA information.

Table 6-1   *show Commands to Display SPA Information*

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

SPA Blank Filler Plates

SPA blank filler plates are available to fill an unused SPA subslot.

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

SPA Cable-Management Brackets

SPAs are shipped with an accessory kit that includes cable-management brackets. Figure 6-3 shows cable-management brackets installed in a SPA, as well as cable routing.

Figure 6-3   SPA Cable-Management Brackets
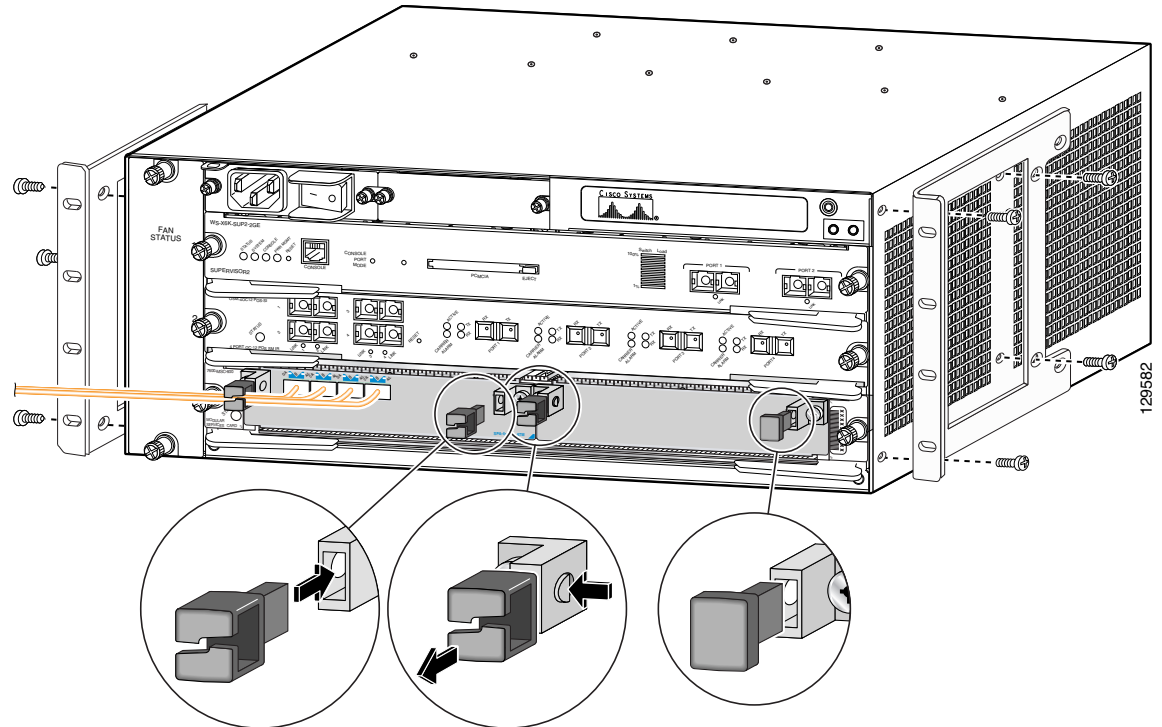
To install cable-management brackets on a SPA, perform the following steps:

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

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

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

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

C H A P T E R **7**

Troubleshooting the Installation

This chapter describes how to troubleshoot the installation of SIPs and SPAs on the Catalyst 6500 Series switch. This chapter contains the following sections:

- Troubleshooting, page 7-1
- Using debug Commands, page 7-2
- Interpreting Console Error Messages, page 7-3
- Packing a SPA for Shipment, page 7-3
- Packing a SIP for Shipment, page 7-4

Troubleshooting

This section describes troubleshooting the installation of the SIPs and SPAs. Possible problems, observations and comments, and solutions are indicated for the following troubleshooting symptoms:

- SIP transitions repeatedly from on to off
- SIP is deactivated
- SPA is down and the line protocol is down

SIP Transitions Repeatedly From On to Off

Possible Problem	Observations and Comments	Solutions
SIP is booting up; this is normal operation	SIP STATUS LED alternates green, amber, or off	Wait 30 seconds until the boot process completes and the STATUS LED stays on.
SIP does not go beyond the bootup stage	SIP STATUS LED transitions continue and alternates green, amber, or off	Follow the recommended action for the displayed error message.
SIP FPGA is not up to date	During SIP unitization, the need to update the FPGA is automatically detected	Follow the system prompts to update the FPGA image.
		If the SIP is cycling because of an FPD problem, the most likely cause is a FPD failure or that the FPD package file is not present.
		For more information about performing FPD upgrades, refer to the "Upgrading Field-Programmable Devices" chapter in the *Catalyst 6500 Series Switch SIP, SSC, and SPA Software Configuration Guide*.

SIP Is Deactivated

Possible Problem	Observations and Comments	Solutions
SPA is not fully seated in the SIP	Output of the **show diag** *slot* command SPA STATUS LED is off	Follow this procedure: • Remove the SPA from the SIP. • Inspect the SIP and the SPA. Verify there are no bent pins or parts and that there is nothing lodged in the two devices that could prevent a good connection. • Insert the SPA in the SIP by sliding the SPA all the way into the SIP until the SPA is firmly seated in the SPA interface connector. When fully seated in the SIP, the SPA might be slightly behind the SIP faceplate.
SPA is not supported on the SIP	Error message indicating the SPA is not supported Output of the **show diag** *slot* command SIP STATUS LED is off	Install a SPA supported on the SIP.
SPA is not at the minimum hardware revision level	Error message indicating the SPA is not at the minimum FPGA revision level Output of the **show hw-module subslot fpd** command Output of the **show diag slot** command SPA STATUS LED is off	Follow the FPD upgrade process to update the FPGA. For more information about performing FPD upgrades, refer to the "Upgrading Field-Programmable Devices" chapter in the *Catalyst 6500 Series Switch SIP, SSC, and SPA Software Configuration Guide*.
SPA is misconfigured		Refer to the configuration section of the specific SPA installation and configuration guide, or use the Cisco IOS software configuration documentation listed in the "Obtaining Documentation and Submitting a Service Request" section on page xviii.

Using debug Commands

Along with the other **debug** commands supported on the Catalyst 6500 Series switch, you can obtain specific debug information for modules and carrier cards using the **debug hw-module** privileged EXEC command. For more information about the **debug hw-module** command and other **debug** commands specific to the Cisco IOS software release 12.2SX, see the *Cisco IOS Master Command List, Release 12.2SX* at this URL:

http://www.cisco.com/en/US/docs/ios/mcl/122sxmcl/12_2sx_mcl_book.html

The **debug hw-module** command is intended for use by Cisco Systems technical support personnel.

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

For more information about other **debug** commands that can be used on a Catalyst 6500 Series switch, see the *Cisco IOS Debug Command Reference, Release 12.2* at this URL:

http://www.cisco.com/en/US/docs/ios/12_2/debug/command/reference/122debug.html

Interpreting Console Error Messages

To view the explanations and recommended actions for Catalyst 6500 Series switch error messages, including messages related to SIPs, SSCs, and SPAs, see the following documents:

- *Cisco IOS Release 12.2SX System Message Guide* at this URL:

    http://www.cisco.com/en/US/docs/ios/12_2sx/system/messages/122sxsms.html

- *System Messages for 12.2S* (for error messages in Release 12.2S) at this URL:

    http://www.cisco.com/en/US/docs/ios/12_2s/system/messages/122sdebu.html

Packing a SPA for Shipment

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

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

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

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

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

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

Step 1   Open the Thermoform container and place the SPA and each of the cable-management brackets into the appropriate cavities.

⚠

Caution   Always handle the SPA by the carrier edges and handle; never touch the SPA components or connector pins.

Step 2   Close the Thermoform container. Be sure to lock the snaps securely.

Step 3   Check that the Thermoform container is fully closed. Apply tape or a label closure over the opening to ensure the container stays closed during shipping.

Step 4   Place the Thermoform container into the carton.

Step 5   Close the carton.

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

Packing a SIP for Shipment

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

- Static shielding bag
- Smaller inner carton
- Larger exterior carton
- Two foam packing cushions

⚠

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

⚠

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

✎

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

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

Step 1   Insert the SIP into the static shielding bag.

Step 2   Insert the bagged SIP into the smaller inner carton. Be careful to position the SIP so that the bottom motherboard lip is held by the packaging cutout.

Step 3   Close the smaller inner carton and tape the sides closed.

Step 4   Place the sealed smaller inner carton containing the SIP into the two foam packing cushions (they only fit one way).

Step 5   Place the sealed smaller inner carton and packing cushions into the larger exterior carton, and seal the larger exterior carton with tape for shipment.

I N D E X

Catalyst 6500 Series Switch SIP, SSC, and SPA Hardware Installation Guide