CISCO SYSTEMS

PA-POS-OC3 Packet OC-3 Port Adapter Installation and Configuration

Product Numbers: PA-POS-O)C3SML(=), PA-POS-OC3SMI(=), PA-POS-OC3MM(=)

Platforms Supported: Catalyst 5000 Family Switches with RSM/VIP2, Catalyst 6000 Family Switches with FlexWAN Module, Cisco 7100 Series, Cisco 7200 Series, Cisco uBR7200 Series, Cisco 7301 Router, Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 Router, Cisco 7401ASR Routers, and Cisco 7000 and 7500 Series with VIP

C O N T E N T S

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CHAPTER 3   **Removing and Installing Port Adapters**   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 chapter contains the following sections:

Objectives

This document describes how to install and configure the Cisco Packet-over-SONET (POS) OC-3 port adapter (PA-POS-OC3SML[=], PA-POS-OC3SMI[=], and PA-POS-OC3MM[=]), hereafter referred to as the PA-POS-OC3, which is used in the following platforms:

- Catalyst RSM/VIP2-40 in Catalyst 5000 family switches. (This document refers to the Catalyst RSM/VIP2-40 module as the Catalyst RSM/VIP2.)
- Catalyst 6000 family FlexWAN module in the Catalyst 6000 family switches.
- Cisco 7100 series routers—consisting of the Cisco 7120 series and Cisco 7140 series
- Cisco 7200 series routers—consisting of the two-slot Cisco 7202, four-slot Cisco 7204 and Cisco 7204VXR, and the six-slot Cisco 7206 and the Cisco 7206VXR.

> **Note** The Cisco 7206VXR and the Cisco 7206 can be used as router shelves in a Cisco AS5800 Universal Access Server. For more information about the Cisco 7206VXR and the Cisco 7206 as router shelves, see the Cisco AS5800 Universal Access Server documentation listed in the "Related Documentation" section on page viii.

- Cisco uBR7200 series universal broadband routers—consisting of the six-slot Cisco uBR7246 and Cisco uBR7246 VXR and the three-slot Cisco uBR7223.
- Cisco 7301 routers
- Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 router

- Cisco 7401ASR routers.

- Versatile Interface Processor (VIP) in Cisco 7500 series and Cisco 7000 series routers with the 7000 series Route Switch Processor (RSP7000) and 7000 series Chassis Interface (RSP7000CI).

Organization

This document contains the following chapters.

:

Section	Title	Description
Chapter 1	Overview	Describes the PA-POS-OC3 and its LEDs, cables, and receptacles.
Chapter 2	Preparing for Installation	Describes safety considerations, tools required, and procedures you should perform before the actual installation.
Chapter 3	Removing and Installing Port Adapters	Provides instructions for installing the PA-POS-OC3 in the supported platforms and for connecting cables.
Chapter 4	Configuring the PA-POS-OC3	Provides instructions for configuring your port adapter on the supported platforms.

Related Documentation

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

- Cisco IOS software:

  For configuration information and support, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

  Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

- Catalyst RSM/VIP2:

  For hardware installation and maintenance information, refer to the following publications:

  - *Route Switch Module Catalyst VIP2-15 and VIP2-40 Installation and Configuration Note*
  - *Catalyst 5000 Series Route Switch Module Installation and Configuration Note*
  - The installation and configuration guide that shipped with your Catalyst 5000 family switch

- Catalyst 6000 family FlexWAN module:

  For hardware installation and maintenance information, refer to the following publications:

  - Catalyst 6000 Family FlexWAN Module Installation and Configuration Note
  - The installation and configuration guide that shipped with your Catalyst 6000 family switch

- Cisco AS5800 Universal Access Server:

  For hardware installation and maintenance information and software configuration information, refer to the following publications:

  - *Cisco AS5800 Universal Access Server Hardware Installation and Configuration Guide*
  - *Cisco AS5800 Universal Access Server Software Installation and Configuration Guide*

- Cisco 7000 series routers:

  For hardware installation and maintenance information, refer to the following publications:

  - *Cisco 7000 Hardware Installation and Maintenance* that shipped with your router.
  - *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*
  - *Fourth-Generation Versatile Interface Processor (VIP4) Installation and Configuration*
  - *Versatile Interface Processor (VIP6-80) Installation and Configuration*

- Cisco 7100 series routers:

  - For hardware installation and maintenance information, refer to the *Cisco 7100 Series VPN Router Installation and Configuration Guide* that shipped with your Cisco 7100 series router.
  - For information on setting up a Virtual Private Network, refer to the *Cisco 7100 Series VPN Configuration Guide*.

- Cisco 7200 series routers:

  - For port adapter hardware and memory configuration guidelines, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.
  - For hardware installation and maintenance information (including the Cisco 7206 or Cisco 7206VXR as a router shelf in a Cisco AS5800 Universal Access Server), refer to the installation and configuration guide that shipped with your Cisco 7200 series router.

- Cisco 7200 VXR routers:

  For hardware installation and maintenance information, refer to the *Cisco 7200 VXR Installation and Configuration Guide* that shipped with your Cisco 7200 VXR router.

- Cisco uBR7200 series routers:

  For hardware installation and maintenance information, refer to the *Cisco uBR7200 Series Hardware Installation Guide*.

- Cisco 7301 router:

  For hardware installation and maintenance information, refer to the *Cisco 7301 Installation and Configuration Guide* or the *Cisco 7301 Router Quick Start Guide*.

- Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 routers:

  For hardware installation and maintenance information, refer to the *Cisco 7304 PCI Port Adapter Carrier Card Installation and Configuration Guide*.

- Cisco 7401AS routers:

  For hardware installation and maintenance information refer to the *Cisco 7401ASR Installation and Configuration Guide or the Cisco 7401 ASR Quick Start Guide* that shipped with your Cisco 7401ASR router.

- Cisco 7500 series routers:

    For hardware installation and maintenance information, refer to the following publications:

    – *Cisco 7500 Installation and Configuration* or the quick start guide that shipped with your router

    – *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*

    – *Fourth-Generation Versatile Interface Processor (VIP4) Installation and Configuration*

    – *Versatile Interface Processor (VIP6-80) Installation and Configuration*

- For international agency compliance, safety, and statutory information for WAN interfaces:

    – *Site Preparation and Safety Guide*

    – *Regulatory Compliance and Safety Information for the Cisco 7000 Series Routers*

    – *Regulatory Compliance and Safety Information for Cisco 7100 Series VPN Routers*

    – *Regulatory Compliance and Safety Information for the Cisco 7200 Series Routers*

    – *Regulatory Compliance and Safety Information* for the *Cisco uBR7200 Series Universal Broadband Router Hardware*

    – *Regulatory Compliance and Safety Information for the Cisco 7300 Routers*

    – *Regulatory Compliance and Safety Information for the Cisco 7401ASR Routers*

    – *Regulatory Compliance and Safety Information for the Cisco 7500 Series Routers*

- To view Cisco documentation or obtain general information about the documentation, refer to the following sources:

    – "Obtaining Documentation" section on page x.

    – "Obtaining Technical Assistance" section on page xii.

    – "Obtaining Additional Publications and Information" section on page xiii

    – Customer service at 800 553-6387 or 408 526-7208. Customer service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding Cisco-observed holidays).

    – *Cisco Information Packet* that shipped with your router or switch.

Obtaining Documentation

Cisco provides several ways to obtain documentation, technical assistance, and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

http://www.cisco.com/univercd/home/home.htm

You can access the Cisco website at this URL:

http://www.cisco.com

International Cisco websites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which may have shipped with your product. The Documentation CD-ROM is updated regularly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual or quarterly subscription.

Registered Cisco.com users can order a single Documentation CD-ROM (product number DOC-CONDOCCD=) through the Cisco Ordering tool:

http://www.cisco.com/en/US/partner/ordering/ordering_place_order_ordering_tool_launch.html

All users can order monthly or quarterly subscriptions through the online Subscription Store:

http://www.cisco.com/go/subscription

Ordering Documentation

You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpck/pdi.htm

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/en/US/partner/ordering/index.shtml

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, U.S.A.) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

Documentation Feedback

You can submit comments electronically on Cisco.com. On the Cisco Documentation home page, click **Feedback** at the top of the page.

You can e-mail your comments to bug-doc@cisco.com.

You can submit comments by using the response card (if present) behind the front cover of your document or by writing to the following address:

Cisco Systems
Attn: Customer Document Ordering
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com, which includes the Cisco Technical Assistance Center (TAC) website, as a starting point for all technical assistance. Customers and partners can obtain online documentation, troubleshooting tips, and sample configurations from the Cisco TAC website. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC website, including TAC tools and utilities.

Cisco.com

Cisco.com offers a suite of interactive, networked services that let you access Cisco information, networking solutions, services, programs, and resources at any time, from anywhere in the world.

Cisco.com provides a broad range of features and services to help you with these tasks:

- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

To obtain customized information and service, you can self-register on Cisco.com at this URL:

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

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two types of support are available: the Cisco TAC website and the Cisco TAC Escalation Center. The type of support that you choose depends on the priority of the problem and the conditions stated in service contracts, when applicable.

We categorize Cisco TAC inquiries according to urgency:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration. There is little or no impact to your business operations.
- Priority level 3 (P3)—Operational performance of the network is impaired, but most business operations remain functional. You and Cisco are willing to commit resources during normal business hours to restore service to satisfactory levels.
- Priority level 2 (P2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively impacted by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.
- Priority level 1 (P1)—An existing network is "down," or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Cisco TAC Website

The Cisco TAC website provides online documents and tools to help troubleshoot and resolve technical issues with Cisco products and technologies. To access the Cisco TAC website, go to this URL:

http://www.cisco.com/tac

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC website. Some services on the Cisco TAC website require a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

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

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC website, you can open a case online at this URL:

http://www.cisco.com/tac/caseopen

If you have Internet access, we recommend that you open P3 and P4 cases online so that you can fully describe the situation and attach any necessary files.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

Before calling, please check with your network operations center to determine the Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The *Cisco Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the *Cisco Product Catalog* at this URL:

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

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: *Internetworking Terms and Acronyms Dictionary, Internetworking Technology Handbook, Internetworking Troubleshooting Guide,* and the *Internetworking Design Guide.* For current Cisco Press titles and other information, go to Cisco Press online at this URL:

  http://www.ciscopress.com

- *Packet* magazine is the Cisco quarterly publication that provides the latest networking trends, technology breakthroughs, and Cisco products and solutions to help industry professionals get the most from their networking investment. Included are networking deployment and troubleshooting tips, configuration examples, customer case studies, tutorials and training, certification information, and links to numerous in-depth online resources. You can access *Packet* magazine at this URL:

  http://www.cisco.com/go/packet

- iQ Magazine is the Cisco bimonthly publication that delivers the latest information about Internet business strategies for executives. You can access iQ Magazine at this URL:

  http://www.cisco.com/go/iqmagazine

- Internet Protocol Journal is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

  http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training. Current offerings in network training are listed at this URL:

  http://www.cisco.com/en/US/learning/le31/learning_recommended_training_list.html

Overview

This chapter describes the Cisco PA-POS-OC3 port adapter and contains the following sections:

Port Adapter Overview

The PA-POS-OC3 interface provides a direct connection between the supported router or switch platform and external networks. You must use the appropriate optical fiber cables to connect the PA-POS-OC3 with an external OC-3 network. (See the "PA-POS-OC3 Optical Fiber Specifications" section on page 1-5 and the "Cables and Connectors" section on page 1-6 for more information on optical fiber cables.)

Three models of the PA-POS-OC3 are available:

- PA-POS-OC3MM—Multimode. (See Figure 1-1.)
- PA-POS-OC3SML—Single-mode, long reach. (See Figure 1-2.)
- PA-POS-OC3SMI—Single-mode, intermediate reach. (See Figure 1-3.)

Figure 1-1   PA-POS OC3MM—Faceplate View, Horizontal Orientation

Figure 1-2   PA-POS-OC3SML—Faceplate View, Horizontal Orientation

Figure 1-3   PA-POS-OC3SMI—Faceplate View, Horizontal Orientation

SONET/SDH Overview

The POS specification addresses the use of PPP encapsulation over SONET/Synchronous Digital Hierarchy (SDH) links. SONET is an American National Standards Institute (ANSI) standard (T1.1051988) for optical digital transmission at hierarchical rates from 51.840 Mbps (STS-1) to 2.5 Gbps (STS-48) and greater. SDH is the international standard for optical digital transmission at hierarchical rates from 155.520 Mbps (STM-1) to 2.5 Gbps (STM-16) and greater.

Because SONET/SDH is by definition a point-to-point circuit, PPP is well suited for use over these links. PPP was designed as a standard method of communicating over point-to-point links.

SONET is an octet-synchronous multiplex scheme that defines a family of standard rates and formats. The basic rate for POS is that of STS-3c/STM-1, which is 155.520 Mbps. The available information bandwidth is 149.760 Mbps, which is the STS-3c/STM-1 Synchronous Payload Envelope (SPE), the payload portion of the SONET frame into which the octet-oriented user data is mapped. (Octet boundaries are aligned with the SPE octet boundaries.) For the SPE with the PA-POS-OC3, section, line, and path overhead are removed.

The International Telecommunications Union Telecommunication Sector (ITU-T) defines a series of SDH transmission rates beginning at 155.520 Mbps, as follows:

SONET[1]	SDH Equivalent
STS-3c[2]	STM-1[2]
STS-12c	STM-4c
STS-48c	STM-16c

1. ANSI-defined SONET specifications.

2. Currently supported by the PA-POS-OC3.

Despite the name, SONET is not limited to optical links. Electrical specifications have been defined for single-mode fiber, multimode fiber, and CATV 75-ohm coaxial cable. The PA-POS-OC3 currently allows transmission over single-mode and multimode optical fiber only. Transmission rates are integral multiples of 51.840 Mbps, which can be used to carry T3/E3 bit-synchronous signals.

The following transmission multiples are currently specified and commonly used:

- STS-3c—155.520 Mbps (the PA-POS-OC3 conforms to STS-3c)

- STS-12c—622.080 Mbps

- STS-48c—2,488.320 Mbps

The following references discuss concepts and specifications of POS and PPP:

- Simpson, W., Editor, *The Point-to-Point Protocol (PPP)*, RFC 1548, Daydreamer, December 1993.

- Simpson, W., Editor, *PPP in HDLC Framing*, RFC 1662, Daydreamer, July 1994.

- Simpson, W, Editor, *PPP Over SONET/SDH*, RFC1619, May 1995.

- *American National Standard for Telecommunications - Digital Hierarchy - Optical Interface Rates and Formats Specification*, ANSI T1.105-1991.

- *American National Standard for Telecommunications - Synchronous Optical Network (SONET) Payload Mappings*, ANSI T1.105.02-1993 draft.

- ITU-T Recommendation G.707, *Synchronous Digital Hierarchy Bit Rates*, June 1992.

Features

The PA-POS-OC3 has the following features:

- Standards-compliant SONET/SDH interface; SONET/STS-3c and SDH/STM-1 framing and signaling overhead

- Full-duplex operation at 155 Mbps (half-duplex operation is not supported)

- Intermediate-reach (PA-POS-OC3SMI) and long-reach (PA-POS-OC3SML) optical interface with single-mode optical fiber

- Short-reach optical interface (PA-POS-OC3MM) with multimode optical fiber

Note   For information on the single-mode and multimode cables to use with the PA-POS-OC3, see the "PA-POS-OC3 Optical Fiber Specifications" section on page 1-5, and the "Cables and Connectors" section on page 1-6.

- Self-synchronous X^43+1 scrambling and de scrambling of packets

- Single-width port adapter for the VIP2 in all Cisco 7000 series and Cisco 7500 routers, and in Cisco 7100 series, Cisco 7200 series, Cisco uBR7200 series routers, and the Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 router.

- Online insertion and removal (OIR) in Cisco 7200 series, Cisco uBR7200 series routers, Cisco 7301 routers, and Cisco 7401ASR routers, allowing you to remove, add, or replace a PA-POS-OC3 online

Note To remove a PA-POS-OC3 from a VIP2 or VIP4 in a Cisco 7000 series or Cisco 7500 series router, or the Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 router, you must first remove the VIP or carrier card on which the PA-POS-OC3 is installed. The VIP and carrier card support OIR.

Note To remove a PA-POS-OC3 from a Catalyst RSM/VIP2 in a Catalyst 5000 family switch, you must first remove the Catalyst RSM/VIP2 on which the PA-POS-OC3 is installed. The Catalyst RSM/VIP2 supports OIR.

Note To remove a PA-POS-OC3 from a Catalyst 6000 series switch with a Catalyst 6000 family FlexWAN module, you must first remove the FlexWAN module on which the PA-POS-OC3 is installed. The FlexWAN module supports OIR.

- Support for 16-bit and 32-bit cyclic redundancy checking (CRC-16 and CRC-32)

Interface Specifications

The physical layer interface for the PA-POS-OC3 is Optical Carrier-3 (OC-3c, the specification for SONET STS-3c and SDH STM-1 transmission rates), and the PA-POS-OC3 is designed to comply with Packet-over-SONET specifications. The PA-POS-OC3 provides a single 155.520-Mbps Packet OC-3 network interface for all supported platforms.

Each PA-POS-OC3 has one duplex SC-type receptacle to allow connection to single-mode or multimode optical fiber. (For more information on the optical fiber cables you should use with this port adapter, see the "PA-POS-OC3 Optical Fiber Specifications" section on page 1-5 and the "Cables and Connectors" section on page 1-6.)

Packet data is transported using Point-to-Point Protocol (PPP) and is mapped into the STS-3c/STM-1 frame. The encapsulations used add approximately half the number of bytes of transport overhead as that involved with ATM using ATM Adaptation Layer 5 (AAL5) and line card control (LCC) Subnetwork Access Protocol (SNAP) encapsulations.

The PA-POS-OC3 interface is compliant with RFC 1619, *PPP over SONET/SDH*, and RFC 1662, *PPP in HDLC-like Framing*. The PA-POS-OC3 supports RFC 1619 PPP-over-SONET/SDH encapsulation, and provides support for SNMP agent v1 (RFC 1155-1157), and Management Information Base (MIB) II (RFC 1213).

PA-POS-OC3 Optical Fiber Specifications

The PA-POS-OC3 specification for optical fiber transmission defines two types of fiber: single-mode and multimode. Within the single-mode category, two types of transmission are defined: intermediate reach and long reach. Within the multimode category, only short reach is available.

Modes can be thought of as bundles of light rays entering the fiber at a particular angle. Single-mode fiber allows only one mode of light to propagate through the fiber, and multimode fiber allows multiple modes of light to propagate through the fiber.

Multiple modes of light propagating through the fiber travel different distances depending on the entry angles, which causes them to arrive at the destination at different times (a phenomenon called *modal dispersion*); therefore, single-mode fiber is capable of higher bandwidth and greater cable run distances than multimode fiber lists nominal OC-3 optical parameters for single-mode and multimode optical fiber transmission.

Note If the distance between two connected stations is greater than the maximum distances listed, significant signal loss can result, making transmission unreliable.

Table 1-1 lists the OC-3 optical parameters.

Table 1-1   OC-3 Optical Parameters

Transceiver Type[1]	Transmit Power	Maximum Power to Receiver[2]	Receiver Sensitivity	Loss Budgets	Nominal Distance Between Stations
Single-mode[3] long reach	–5 dBm min. to 0 dBm max. at 1280–1335 nm[4]	–10 dBm	–34 dBm	10 to 28 dB	Up to 25 mi (40 km)
Single-mode[5] intermediate reach	–15 dBm min. to –8 dBm max. at 1280–1335 nm[4]	–8 dBm	–31 dBm	0 to 12 dB	Up to 9 mi (15 km)
Multimode[6] short reach	–20 dBm min. to –14 dBm max. at 1280–1335 nm[4]	–8 dBm	–30 dBm	0 to 7 dB	Up to 1.2 mi (2 km)

1. This table gives nominal OC-3 optical parameters.
2. This value represents the maximum power to which any receiver can be exposed.
3. Complies with Bellcore GR-253-CORE Long Reach Specification (LR-1).
4. Nominal wavelength is 1310 nm.
5. Complies with Bellcore GR-253-CORE Intermediate Reach Specification (IR-1).
6. Complies with Short-Reach OC-3 Specification SR-OC-3.

To calculate link losses and dispersion losses for your application, refer to the following specifications and documents:

- EIA/TIA-IVa Dispersion Unshifted Single-Mode Fiber
- EIA-TIA- IVb Dispersion Shifted Single-Mode Fiber
- GR-20-CORE *Generic Requirements for Optical Fiber and Fiber-Optic Cable*
- ITU-T Recommendation G.957 *Optical Interfaces for Equipment and Systems Relating to the Synchronous Digital Hierarchy*

LEDs

The PA-POS-OC3 faceplate has three LEDs that indicate port adapter and interface status.
(See Figure 1-4.)

Figure 1-4   LEDs on the PA-POS OC-3—Partial Faceplate View Shown
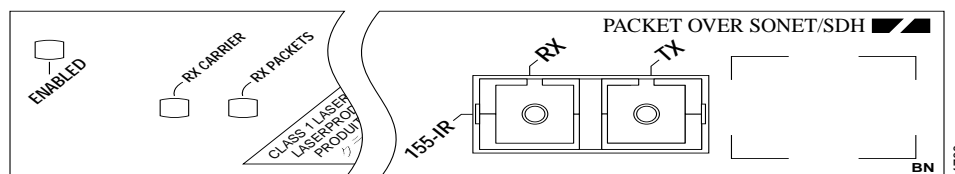
After system initialization, the enabled LED goes on to indicate that power is received and that the
PA-POS-OC3 is enabled for operation.

The following conditions must all be met before the PA-POS-OC3 is enabled:

• The PA-POS-OC3 is correctly connected and receiving power.

• The system bus recognizes the PA-POS-OC3.

• A valid version of microcode is loaded and running.

If any one of these conditions is not met, or if the initialization fails, the enabled LED does not go on.

Table 1-2 lists LED colors and indications.

Table 1-2   PA-POS-OC3 LEDs

LED Label	Color	State	Function
ENABLED	Green	On	Indicates that the PA-POS-OC3 is enabled for operation.
RX CARRIER[1]	Green	On	Indicates that valid SONET/SDH framing has been detected on the received carrier.
RX PACKETS[2]	Green	On	Indicates that the PA-POS-OC3 has received a packet.

1. This LED does not merely indicate a received signal.

2. This LED will flicker rapidly during normal operation, indicating traffic.

Cables and 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. The
PA-POS-OC3 provides 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.)

Note   For maximum cable lengths between stations, see on page 1-5. Single-mode and multimode optical fiber cables for the PA-POS-OC3 are not available from Cisco Systems; they are available from commercial cable vendors.

The PA-POS-OC3 has one duplex SC-type receptacle. For SONET/SDH single-mode and multimode optical fiber connections, use one duplex SC-type cable (see Figure 1-5) or two simplex SC-type cables (see Figure 1-6), one for transmit (TX) and one for receive (RX).

Figure 1-5   Duplex SC-Type Cable and Connector
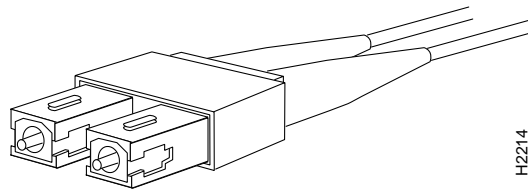
Figure 1-6   Simplex SC-Type Cable and Connector
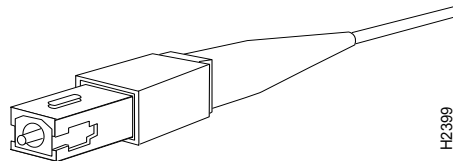
Note   For important laser and LED safety information, see the "Laser and LED Safety" section on page 2-10.

Network Management Support

Following is the protocol and MIB support for the PA-POS-OC3:

- SNMP agent v1 (RFC 1155-1157)
- MIB II (RFC 1213); POS MIB support is available with Cisco IOS Release 12.0

Encapsulation Method Support

The following encapsulation methods are supported by the PA-POS-OC3:

- RFC 1619 Point-to-Point Protocol over SONET/SDH

  We recommend that you refer to the Internet Draft *Enabling Transparency for the PPP over SONET/SDH Mapping*, which is recognized by the Internet Engineering Task Force (IETF) and Internet Engineering Steering Group (IESG) as an approved addendum to RFC 1619.

- High-Level Data Link Control (HDLC)
- Frame Relay

Using Statistics to Estimate Link Loss and Power Budget

Statistical models more accurately determine the power budget than standard worst-case methods. Determining the link loss with statistical methods requires accurate knowledge of variations in the data link components. Statistical power budget analysis is beyond the scope of this document. For further information, refer to ITU-T standards and your equipment specifications.

The following publications contain information on determining attenuation and power budget:

- T1E1.2/92-020R2 ANSI, the Draft American National Standard for Telecommunications entitled *Broadband ISDN Customer Installation Interfaces: Physical Layer Specification.*

- *Power Margin Analysis, AT&T Technical Note,* TN89-004LWP, May 1989.

Port Adapter Slot Locations on the Supported Platforms

The following sections describe the port adapter slot locations in the supported platforms. This section includes the following subsections:

- Catalyst RSM/VIP2 Slot Numbering, page 1-8
- Cisco 7100 Series Routers Slot Numbering, page 1-11
- Cisco 7200 Series and Cisco uBR7200 Series Routers Slot Numbering, page 1-12
- Cisco 7301 Router Slot Numbering, page 1-13
- Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering, page 1-13
- Cisco 7401ASR Router Slot Numbering, page 1-14
- VIP Slot Numbering, page 1-15

Catalyst RSM/VIP2 Slot Numbering

The Catalyst RSM/VIP2 can be installed in any slot except the top slots, which contain the supervisor engine modules. The Catalyst RSM/VIP2 in a Catalyst 5000 family switch does not use interface processor slot numbering; therefore, slots are not numbered in Figure 1-7. The PA-POS-OC3 can be installed into either port adapter slot 0 or 1 on a Catalyst RSM/VIP2. Figure 1-7 shows a Catalyst RSM/VIP2 with two port adapters installed.

Note   The Catalyst 5500 switch has 13 slots. Slot 1 is reserved for the supervisor engine module. If a redundant supervisor engine module is used, it must go in slot 2; otherwise, slot 2 can be used for other modules. Slot 13 is a dedicated slot, reserved for the ATM Switch Processor (ASP) module. Refer to the *Catalyst 5000 Series Route Switch Module Installation and Configuration Note* for any additional slot restrictions for the Catalyst RSM/VIP2.

Figure 1-7   Catalyst 5000 Family Switch with Port Adapters Installed on Catalyst RSM/VIP2

VIP2   Route Switch Module
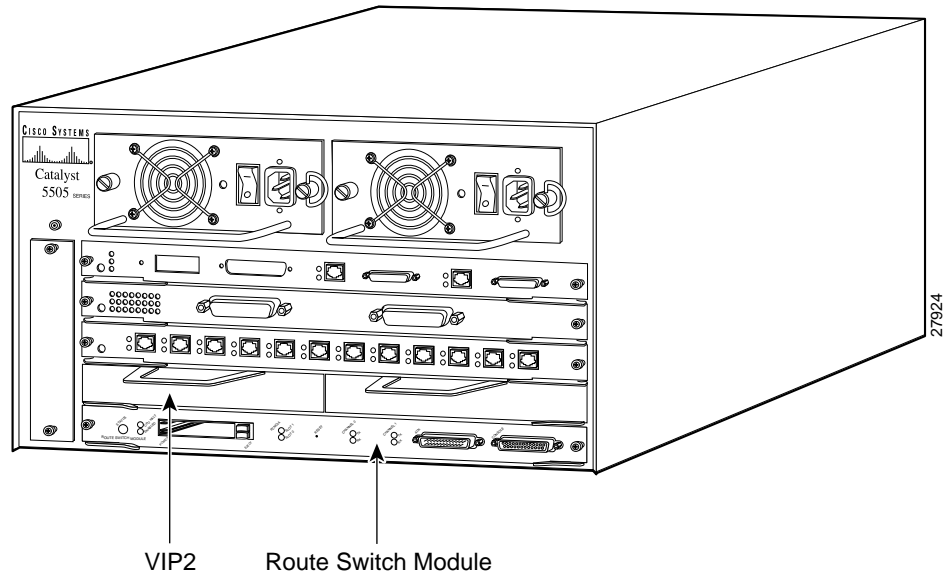
Note   For additional information, see the "Cisco 7401ASR Router Slot Numbering" section on page 1-14.

Catalyst 6000 Family FlexWAN Module Slot Numbering

The Catalyst 6000 family FlexWAN module can be installed in any slot except slot 1, which is reserved for the supervisor engine. The PA-POS-OC3 can be installed into either port adapter bay 0 or bay 1 on a FlexWAN module. Figure 1-8 shows a FlexWAN module with two blank port adapters installed.

Note   Slot 1 is reserved for the supervisor engine. If a redundant supervisor engine is used, it would go in slot 2; otherwise, slot 2 can be used for other modules.

Figure 1-8   Catalyst 6000 Family Switch with Blank Port Adapters Installed on FlexWAN Module
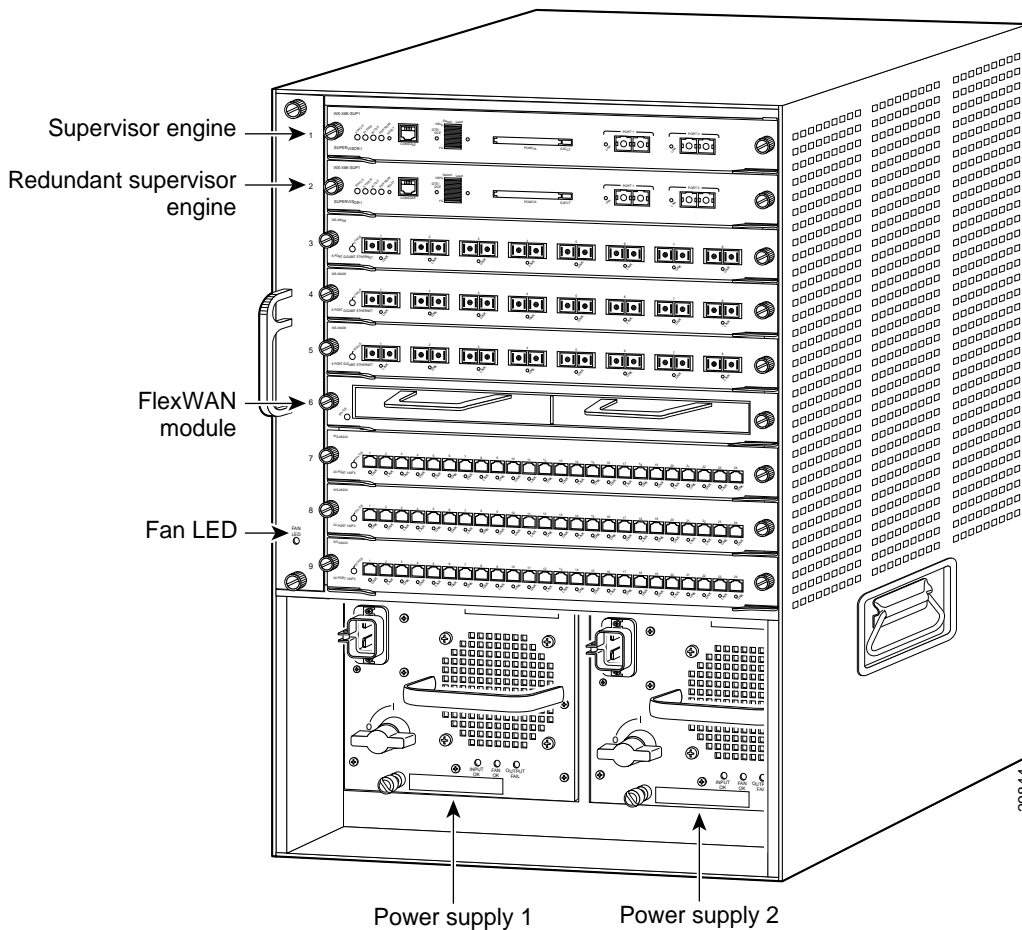
Cisco 7100 Series Routers Slot Numbering

The PA-POS-OC3 can be installed in port adapter slot 3 in Cisco 7120 series routers, and in port adapter slot 4 in Cisco 7140 series routers. Figure 1-9 shows a Cisco 7120 with a port adapter installed in slot 3. Figure 1-10 shows a Cisco 7140 with a port adapter installed in slot 4.

Figure 1-9   Port Adapter Slots in the Cisco 7100 Series Router—Cisco 7120 Series
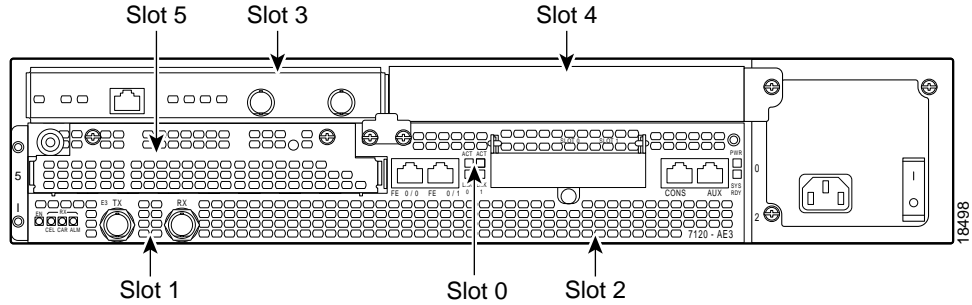
Figure 1-10   Port Adapter Slots in the Cisco 7100 Series Router—Cisco 7140 Series
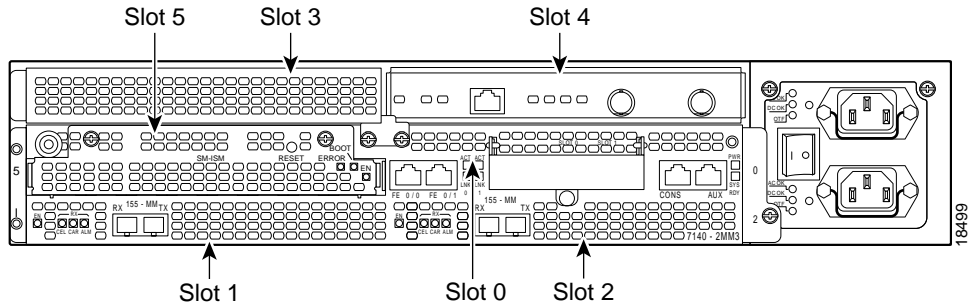
Cisco 7200 Series and Cisco uBR7200 Series Routers Slot Numbering

In the Cisco 7206 (including the Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server), port adapter slot 1 is in the lower left position, and port adapter slot 6 is in the upper right position. (The Cisco 7204 and Cisco 7204VXR are not shown; however, the PA-POS-OC3 can be installed in any available port adapter slot.)

Figure 1-11 shows a Cisco 7206 with port adapters installed.

Figure 1-11   Port Adapter Slots in the Cisco 7206

Port adapter slot 5
Port adapter slot 3
Port adapter slot 1
Port adapter slot 0
Port adapter slot 2
Port adapter slot 4
Port adapter slot 6
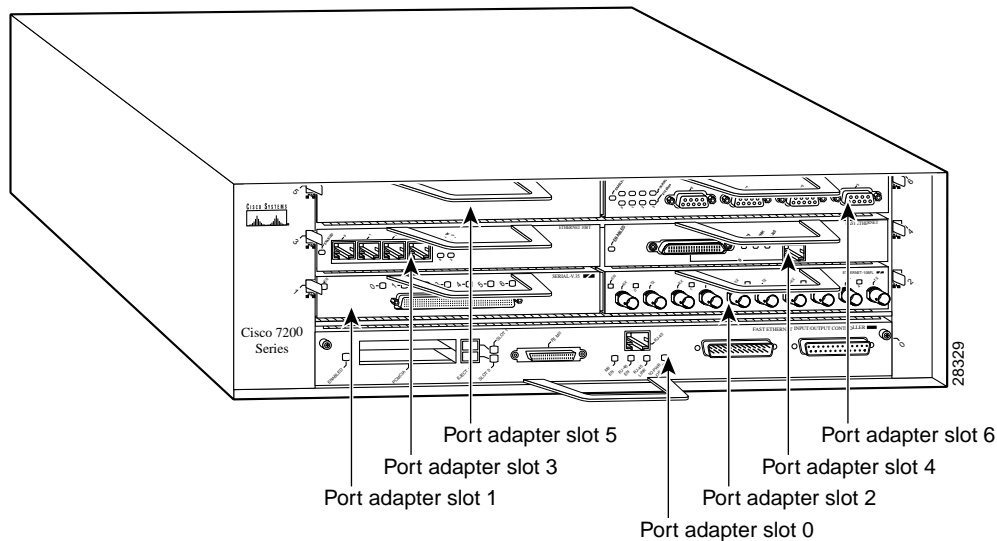
Figure 1-12 on page 1-13 shows the slot numbering of port adapters in a Cisco uBR7246 series router. The port adapter slots are numbered slot 1 and slot 2 for the Cisco uBR7246 and Cisco uBR7246 VXR and slot 1 for the Cisco uBR7223. (Slot 0 is always reserved for the Fast Ethernet port on the I/O controller—if present.)

Figure 1-12   Port Adapter Slots in the Cisco uBR7246 and Cisco uBR7246 VXR
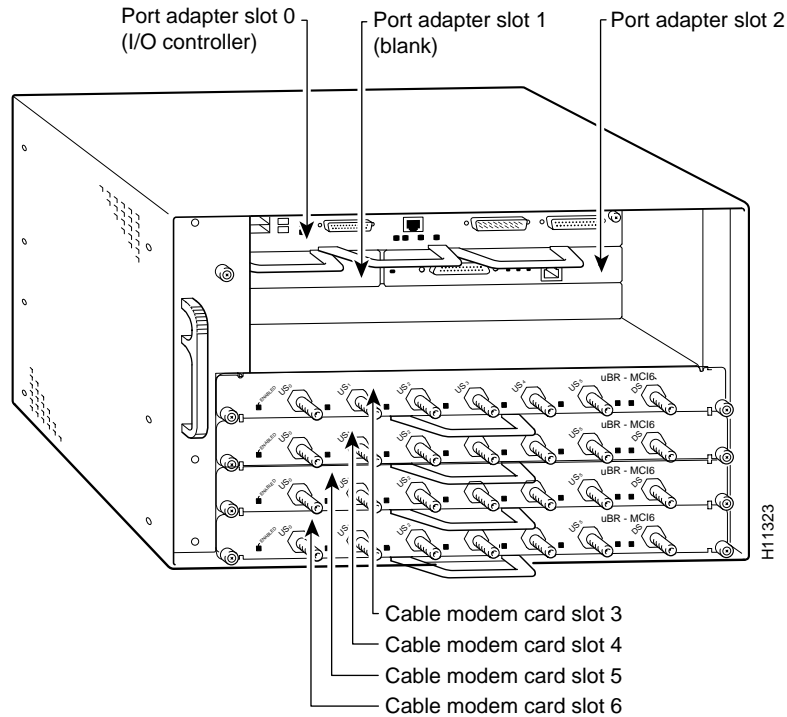
Cisco 7301 Router Slot Numbering

The Cisco 7301 router has one standard port adapter slot. See Figure 1-13.

Figure 1-13   Port Adapter Slot in the Cisco 7301 Router
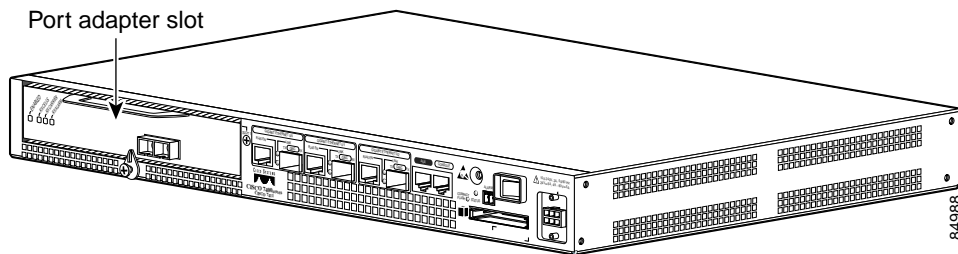
Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering

The Cisco 7304 PCI Port Adapter Carrier Card accepts one single-width port adapter. Figure 1-14 shows a Cisco 7304 PCI Port Adapter Carrier Card with a port adapter installed.

Figure 1-14   Cisco 7304 PCI Port Adapter Carrier Card—Port Adapter Installed
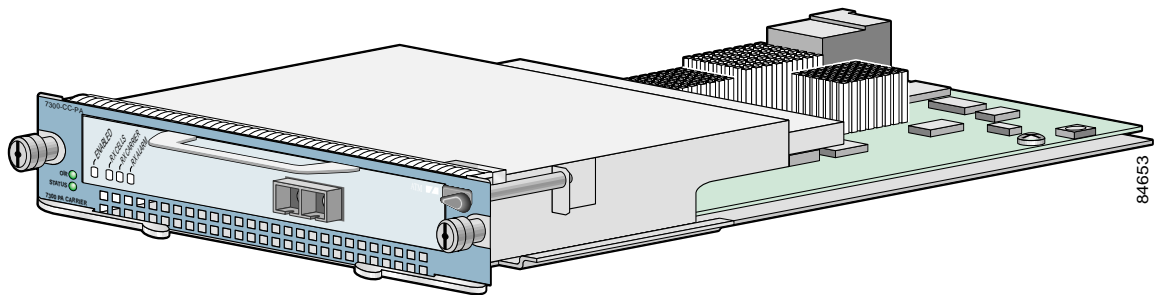
The Cisco 7304 PCI Port Adapter Carrier Card installs in Cisco 7304 router module slots 2 through 5. See Figure 1-15 for module slot numbering on a Cisco 7304 router.

Figure 1-15   Module Slots on the Cisco 7304 Router
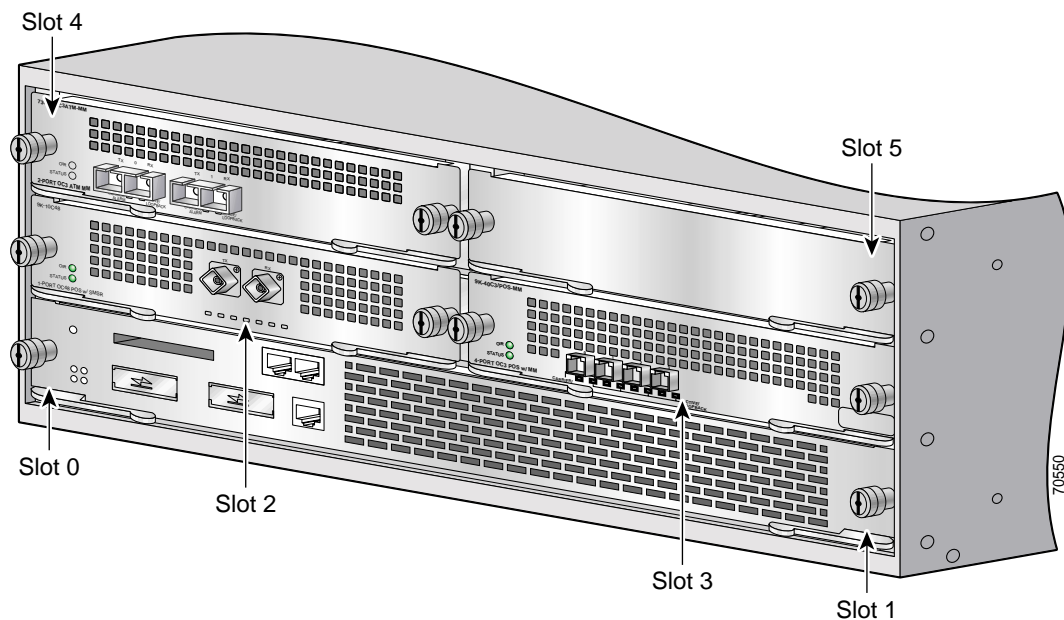
Cisco 7401ASR Router Slot Numbering

Figure 1-16 shows the front view of a Cisco 7401ASR router with a port adapter installed securely installed with the locking lever in the locked and vertical position. The port adapter slot in the Cisco 7401ASR router is numbered slot 1. Port adapter slot 0 is always reserved for: |0|100|1000 ports on the system board.

Figure 1-16   Cisco 7401ASR Routers with a Port Adapter Installed
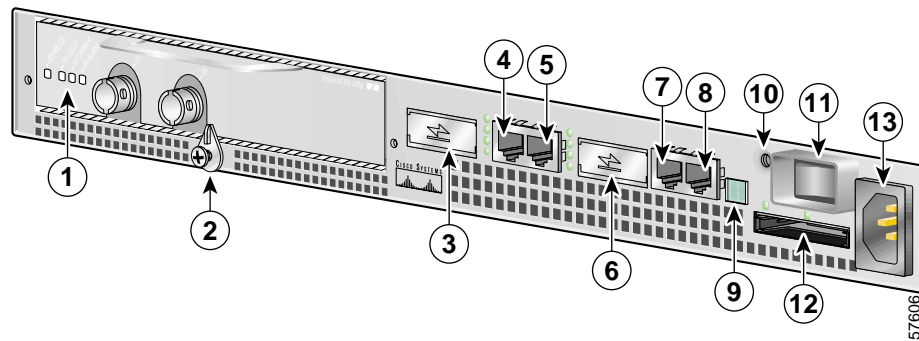
VIP Slot Numbering

Figure 1-17 shows a partial view of a VIP motherboard with installed port adapters. With the motherboard oriented as shown in Figure 1-17—with the port adapter faceplates facing you—the left port adapter is in port adapter slot 0 and the right port adapter is in port adapter slot 1. (The slot numbering is the same for the Catalyst RSM/VIP2.)

Figure 1-17   VIP Motherboard with Two Port Adapters—Partial View, Horizontal Orientation
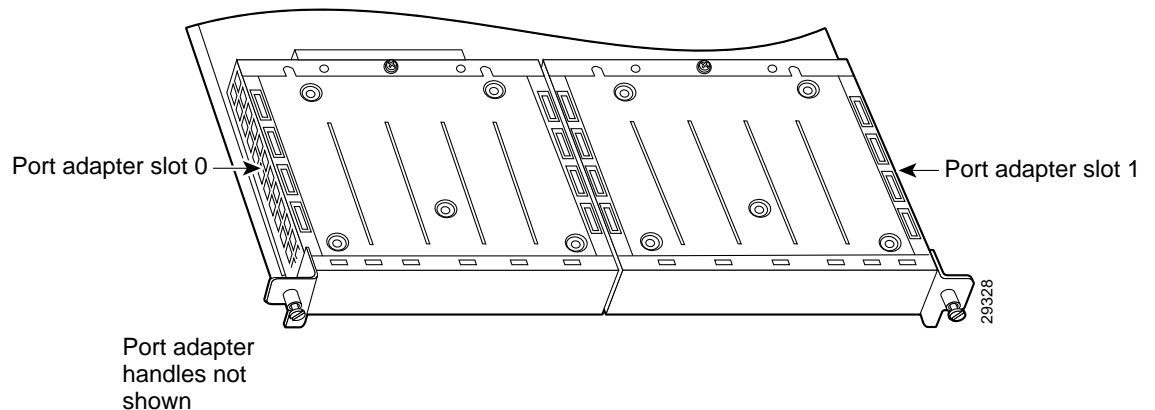
Note   In the Cisco 7000, Cisco 7507, Cisco 7513, and Cisco 7576 chassis, the VIP motherboards are installed vertically. In the Cisco 7010 and Cisco 7505 chassis, the VIP motherboards are installed horizontally.

Figure 1-18 shows a VIP2 or VIP4 installed in an interface processor slot of a Cisco 7505 router.

Figure 1-18   VIP Installed in an Interface Processor Slot Cisco 7505 Shown
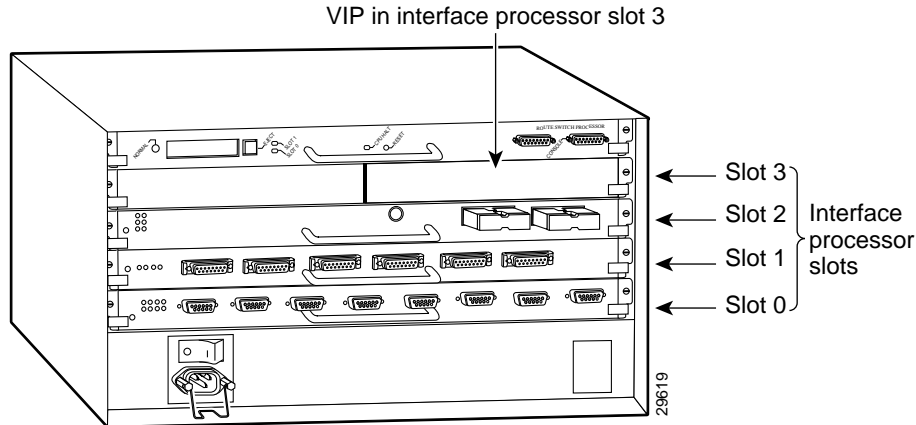
Identifying Interface Addresses

This section describes how to identify the interface address for the PA-POS-OC3 in supported platforms. Interface addresses specify the actual physical location of each interface on a router or switch.

The interface on the PA-POS-OC3 installed in a router or switch maintains the same interface address regardless of whether other port adapters are installed or removed. However, when you move a port adapter to a different slot, the first number in the interface address changes to reflect the new port adapter slot number.

The interface on a PA-POS-OC3 installed in a VIP2 or VIP4 maintains the same address regardless of whether other interface processors are installed or removed. However, when you move a VIP2 or VIP4 to a different interface processor slot, the interface processor slot number changes to reflect the new interface processor slot. This section includes the following subsections:

- Catalyst RSM/VIP2 Interface Addresses, page 1-18
- Cisco 7100 Series Routers Interface Addresses, page 1-18
- Cisco 7200 Series and Cisco uBR7200 Series Routers Interface Addresses, page 1-18
- Cisco 7301 Router Interface Addresses, page 1-19
- Cisco 7304 PCI Port Adapter Carrier Card Interface Addresses, page 1-19
- Cisco 7401ASR Router Interface Addresses, page 1-19
- VIP Interface Addresses, page 1-19

Note Interface ports are numbered from left to right starting with 0.

Table 1-3 on page 1-17 explains how to identify interface addresses.

Table 1-3   Identifying Interface Addresses

Platform	Interface Address Format	Numbers	Syntax
Catalyst RSM/VIP2 in Catalyst 5000 family switches	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 0 or 1 Interface port—0	0/0
Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches	Module-slot-number/port-adapter-bay-number/ interface-port-number	Module slot number—2[1] through 6 or 9 (depending on the number of slots in the switch) Port adapter bay—always 0 or 1 Interface port—0	3/0/0
Cisco 7120 series routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 3 Interface port—0	3/0
Cisco 7140 series routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 4 Interface port—0	4/0
Cisco 7200 series routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—0 through 6 (depends on the number of slots in the router)[2] Interface port—0	1/0
Cisco uBR7223 router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1[2] Interface port—0	1/0
Cisco uBR7246 and Cisco uBR7246 VXR routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 or 2[2] Interface port—0	1/0
Cisco 7301 routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 Interface port—0	1/0
Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—router module slot 2 through 5 Interface port—0	3/0
Cisco 7401ASR routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 Interface port—0	1/0
VIP in Cisco 7000 series or Cisco 7500 series routers	Interface-processor-slot-number/port-adapter- slot-number/interface-port-number	Interface processor slot—0 through 12 (depends on the number of slots in the router) Port adapter slot—always 0 or 1 Interface port—0	3/1/0

1.   Slot 1 is reserved for the supervisor engine. If a redundant supervisor engine is used, it must go in slot 2; otherwise, slot 2 can be used for other modules.

2.   Port adapter slot 0 is reserved for the Fast Ethernet port on the I/O controller (if present).

Catalyst RSM/VIP2 Interface Addresses

This section describes how to identify the interface address used for the PA-POS-OC3 on the Catalyst RSM/VIP2 in Catalyst 5000 family switches. The interface address is composed of a two-part number in the format *port-adapter-slot number/interface-port number*.

See Table 1-3 on page 1-17 for the interface address format.

Catalyst 6000 Family FlexWAN Module Interface Addresses

This section describes how to identify the interface addresses used for the PA-POS-OC3 on the Catalyst FlexWAN module in the Catalyst 6000 family switches.The interface address is composed of a three-part number in the format *module-number/port-adapter-bay-number/interface-port-number*.

See Table 1-3 on page 1-17 for the interface address format.

If the FlexWAN module is inserted in module slot 3, then the interface address of the PA-POS-OC3 is 3/0/0 (module slot 3, port adapter bay 0, and interface 0). If the port adapter was in port adapter bay 1 on the FlexWAN module, this same interface address would be numbered 3/1/0.

Note   If you remove the FlexWAN module with the PA-POS-OC3 from module slot 3 and install it in module slot 6, the interface addresses become 6/0/0 through 6/0/7.

Note   The FlexWAN module physical port address uses a zero- (0-) based port address, which differs from the conventional Catalyst 6000 family one- (1-) based port address.

Cisco 7100 Series Routers Interface Addresses

This section describes how to identify the interface addresses used for the PA-POS-OC3 in Cisco 7100 series routers. The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See Table 1-3 on page 1-17 for the interface address format.

Cisco 7200 Series and Cisco uBR7200 Series Routers Interface Addresses

This section describes how to identify the interface addresses used for the PA-POS-OC3 in Cisco 7200 series routers or Cisco uBR7200 series routers. The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See Table 1-3 on page 1-17 for the interface address format.

In Cisco 7200 series routers, port adapter slots are numbered from the lower left to the upper right, beginning with port adapter slot 1 and continuing through port adapter slot 2 for the Cisco 7202, slot 4 for the Cisco 7204 and Cisco 7204VXR, and slot 6 for the Cisco 7206 and Cisco 7206VXR. (Port adapter slot 0 is reserved for the optional Fast Ethernet port on the I/O controller—if present.)

The interface address of the interface on a PA-POS-OC3 in port adapter slot 1 is 1/0 (port adapter slot 1 and interface 0). If the PA-POS-OC3 was in port adapter slot 4, this same interface would be numbered 4/0 (port adapter slot 4 and interface 0).

In Cisco uBR7200 series routers, port adapter slots are numbered slot 1 and slot 2 for the Cisco uBR7246 and Cisco uBR7246 VXR routers and slot 1 for the Cisco uBR7223 router. (Slot 0 is always reserved for the Fast Ethernet port on the I/O controller—if present.) The individual interfaces always begin with 0.

The interface address of the interface on a PA-POS-OC3 in port adapter slot 2 of a Cisco uBR7246 or Cisco uBR7246 VXR is 2/0 (port adapter slot 2 and interface 0). If the PA-POS-OC3 was in port adapter slot 1, this same interface would be numbered 1/0 (port adapter slot 1 and interface 0).

Cisco 7301 Router Interface Addresses

This section describes how to identify the interface addresses used for the PA-POS-OC3 in the Cisco 7301 router. The interface address is made of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See Table 1-3 on page 1-17 for the interface address format.

Cisco 7304 PCI Port Adapter Carrier Card Interface Addresses

This section describes how to identify the interface addresses used for the PA-POS-OC3 in the Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 routers. The interface address is made of a two-part number in the format *port-adapter-slot-number/interface-port-number*.

The Cisco 7304 PCI Port Adapter Carrier Card installs into Cisco 7304 router module slots 2 through 5 (See Figure 1-15.) The port-adapter-slot-number is the Cisco 7304 router module slot number. For example, the interface address on a PA-POS-OC3, in which the Cisco 7304 PCI Port Adapter Carrier Card is installed in Cisco 7304 router module slot 3, would be numbered 3/0.

Cisco 7401ASR Router Interface Addresses

This section describes how to identify the interface addresses used for the PA-POS-OC3 in a Cisco 7401ASR router. The interface address is composed of a two-part number in the format *port-adapter-slot-number/logical-interface-number*. See Table 1-3 on page 1-17 for the interface address format.

VIP Interface Addresses

This section describes how to identify the interface addresses used for the PA-POS-OC3 on a VIP2 or a VIP4 in Cisco 7000 series and Cisco 7500 series routers.

Note   Although the processor slots in the 7-slot Cisco 7000 and Cisco 7507 and 13-slot Cisco 7513 and Cisco 7576 are vertically oriented and those in the 5-slot Cisco 7010 and Cisco 7505 are horizontally oriented, all Cisco 7000 series and Cisco 7500 series routers use the same method for slot and port numbering.

See Table 1-3 on page 1-17 for the interface address format. The interface address is composed of a three-part number in the format *interface-processor-slot number/port-adapter-slot-number/interface-port- number*.

For a PA-POS-OC3 installed in interface processor slot 3 of a Cisco 7000 series or Cisco 7500 series router, the interface address of the PA-POS-OC3 is 3/1/0 (interface processor slot 3, port adapter slot 1, and interface 0). If the PA-POS-OC3 was in port adapter slot 0 on the VIP2 or VIP4, this same interface address would be numbered 3/0/0.

Note   If you remove the VIP2 or VIP4 with the PA-POS-OC3 from interface processor slot 3 and install it in interface processor slot 2, the interface address becomes 2/1/0.

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

Preparing for Installation

This chapter provides the general equipment, safety and site preparation requirements for installing the Cisco PA-POS-OC3 port adapter. This chapter contains the following sections:

- Required Tools and Equipment, page 2-1
- Software and Hardware Requirements, page 2-2
- Checking Hardware and Software Compatibility, page 2-3
- Safety Guidelines, page 2-4
- FCC Class A Compliance, page 2-10

Required Tools and Equipment

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

- PA-POS-OC3 port adapter. (For information about the specific PA-POS-OC3 models, see the "Port Adapter Overview" section on page 1-1.)
- Catalyst RSM/VIP2 (for installation in Catalyst 5000 family switches). For information about the specific RSM/VIP2 models that support the PA-POS-OC3, see the "Software and Hardware Requirements" section on page 2-2.
- Catalyst 6000 family FlexWAN module (for installation in Catalyst 6000 family switches).
- VIP (for installation in Cisco 7000 series or Cisco 7500 series routers).
- Cisco 7304 PCI Port Adapter Carrier Card (for installation in a Cisco 7304 router).
- One SC-type duplex or two SC-type simplex, multimode or single-mode optical fiber cables to connect the interface with the network. (Single-mode and multimode optical fiber cables for the PA-POS-OC3 are not available from Cisco Systems but are available from commercial cable vendors. For information about optical fiber cables, see the "PA-POS-OC3 Optical Fiber Specifications" section on page 1-5 and the "Cables and Connectors" section on page 1-6.)
- Number 1 Phillips screwdriver.
- Number 2 Phillips screwdriver and 3/16-inch flat-blade screwdriver.
- Your own electrostatic discharge (ESD)-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares.
- Antistatic mat and antistatic container.

Software and Hardware Requirements

The table below lists the minimum Cisco IOS software release required to use the PA-POS-OC3 in supported router or switch platforms.

Table 2-1   PA-POS OC-3 Software Requirements

Platform	Recommended Minimum Cisco IOS Release
Catalyst 5000 family switches with Catalyst RSM/VIP2[1]	
Catalyst RSM/VIP2-50(=)	Cisco IOS Release 12.0(1a) or a later release of Cisco IOS Release 12.0 T Cisco IOS Release 12.0(3)T or a later release of Cisco IOS Release 12.0 T
Catalyst 6000 family switches with Catalyst 6000 family FlexWAN module	
• Catalyst 6000 family MSFC[2]	Cisco IOS Release 12.1(1)EX or later
• Supervisor engine software	Catalyst 6000 family supervisor engine software release 5.4(1) or later
Cisco 7100 series	
• Cisco 7120 series and Cisco 7140 series	Cisco IOS Release 12.0(4)XE or a later release of Cisco IOS Release 12.0 XE
Cisco 7200 series	
• Cisco 7204VXR and Cisco 7206VXR	Cisco IOS Release 12.0(3)T or a later release of Cisco IOS Release 12.0 T Cisco IOS Release 12.0(2)XE2 or a later release of Cisco IOS Release 12.0 XE Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2 B
• Cisco 7204 and Cisco 7206	Cisco IOS Release 11.1(21)CC or a later release of Cisco IOS Release 11.1 CC Cisco IOS Release 12.0(1)S or a later release of Cisco IOS Release 12.0 S Cisco IOS Release 12.0(2)T or a later release of Cisco IOS Release 12.0 T Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2 B
• Cisco 7202	Cisco IOS Release 11.1(19)CC1 or a later release of Cisco IOS Release 11.1 CC Cisco IOS Release 11.3(4)AA or a later release of Cisco IOS Release 11.3 AA Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2 B
Cisco uBR7200 series	
• Cisco uBR7246 and Cisco uBR7223	Cisco IOS Release 12.0(3)T or a later release of Cisco IOS Release 12.0 T
Cisco 7301 routers	Cisco IOS Release 12.2(11)YZ or a later release of Cisco IOS Release 12.2
Cisco 7304 routers	
• With Cisco 7304 PCI Port Adapter Carrier Card	Cisco IOS Release 12.2(14)SZ or a later release of Cisco IOS Release 12.2SZ
Cisco 7401ASR routers	Cisco IOS Release 12.2DD or a later release of the Cisco IOS Release 12.2 T Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2 B
VIP in the Cisco 7000 series and Cisco 7500series[3 4 5 6 7]	Cisco IOS Release 12.0(1)S or a later release of Cisco IOS Release 12.0 S Cisco IOS Release 12.0(2)T or a later release of Cisco IOS Release 12.0 T Cisco IOS Release 12.0(10)S or a later release of Cisco IOS Release 12.0 S

1. The specific Catalyst RSM/VIP2 model recommended for the PA-POS-OC3 is the VIP2-50, which has 4 to 8 MB of SRAM and 32 to 128 MB of DRAM.

2. MSFC = Multilayer Switch Feature Card

3. The PA-POS-OC3 can be used in the VIP2 in all Cisco 7500 series routers using the Route Switch Processor (RSP), and in Cisco 7000 series routers using the RSP7000 and RSP7000CI.

4. The specific VIP2 model recommended for the PA-POS-OC3 in all Cisco 7500 series routers, and in Cisco 7000 series routers using the RSP7000 and RSP7000CI, is the VIP2-50(=), which has 4 to 8 MB of SRAM and 32 to 128 MB of SDRAM.

5. There are no restrictions on the number of installed PA-POS-OC3 port adapters when Cisco 7000 or Cisco 7500 series routers are running Cisco IOS Release 11.1(7) or later. The PA-POS-OC3 can be installed in either port adapter slot 0 or slot 1 on the VIP2.

6. The PA-POS-OC3 can be used in the VIP4 in all Cisco 7500 series routers using the Route Switch Processors (RSPs), and in Cisco 7000 series routers using the RSP7000 and RSP7000CI.

7. The specific VIP4 model recommended for the PA-POS-OC3 in all Cisco 7500 series routers, and in Cisco 7000 series routers using the RSP7000 and RSP7000CI, is the VIP4-80(=), which has 64 to 256 MB of 100-MHz synchronous dynamic random-access memory (SDRAM) as the central processing unit (CPU) memory, and 64 or 128 MB of 100-MHz SDRAM as the packet memory.

⚠️

Caution   To prevent system problems, do not install the PA-POS-OC3 in Cisco 7000 series routers with the Route Processor (RP) and Switch Processor (SP) or Silicon Switch Processor (SSP) installed.

Note   The PA-POS-OC3 is considered a high-bandwidth port adapter. Traffic from multiple PA-POS OC3 network interfaces could theoretically exceed the bandwidth of the CxBus or CyBus. This would cause packets to be dropped. There is no physical limit to the number of PA-POS-OC3s that you can install in a Cisco 7000 series or Cisco 7500 series router; however, because of the theoretical bandwidth limit of the CxBus and Cybus, the practical limit is two PA-POS-OC3s in Cisco 7000 series routers and four PA-POS-OC3s in Cisco 7500 series routers.

For Cisco 7200 series routers, you can install up to three PA-POS OC3s in a system without a Fast Ethernet interface on the input/output (I/O) controller, and you can install up to two PA-POS OC3s in a system with a Fast Ethernet interface on the I/O controller. Further, the PA-POS-OC3 requires one of the following Network Processing Engine (NPE) models to operate:

- NPE-150 (150-MHz network processor)—up to 128 MB of DRAM
- NPE-175 (200-MHz network processor)—up to 128 MB of DRAM
- NPE-200 (200-MHz network processor)—up to 128 MB of DRAM
- NPE-225 (262-MHz network processor)—up to 128 MB of DRAM
- NPE-300 (262-MHz network processor)—up to 128 MB of DRAM

For Cisco uBR7200 series routers, you can install up to two PA-POS OC-3s in a Cisco uBR7200 series, and one PA-POS-OC3 in a Cisco uBR7223.

For all systems in which you install the PA-POS-OC3, use the **show version** command to display the current configuration of the router or switch, including the system software version that is currently loaded and running. Use the **show diag** *slot* command to view specific information about the hardware installed in your system.

Checking Hardware and Software Compatibility

To check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com. This tool does not verify whether modules within a system are compatible, but it does provide the minimum 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 and go to **Technical Support Help—Cisco TAC**: **Tool Index**: **Software Advisor**. You can also access the tool by pointing your browser directly to http://www.cisco.com/cgi-bin/Support/CompNav/Index.pl

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

Safety Guidelines

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

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

Safety Warnings

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, may 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. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device.

Note: SAVE THESE INSTRUCTIONS

Note: This documentation is to be used in conjunction with the specific product installation guide that shipped with the product. Please refer to the Installation Guide, Configuration Guide, or other enclosed additional documentation for further details.

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. Voor een vertaling van de waarschuwingen die in deze publicatie verschijnen, dient u de vertaalde veiligheidswaarschuwingen te raadplegen die bij dit apparaat worden geleverd.

Opmerking BEWAAR DEZE INSTRUCTIES.

Opmerking Deze documentatie dient gebruikt te worden in combinatie met de installatiehandleiding voor het specifieke product die bij het product wordt geleverd. Raadpleeg de installatiehandleiding, configuratiehandleiding of andere verdere ingesloten documentatie voor meer informatie.

Varoitus   TÄRKEITÄ TURVALLISUUTEEN LIITTYVIÄ OHJEITA

Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä asiakirjassa esitettyjen varoitusten käännökset löydät laitteen mukana toimitetuista ohjeista.

Huomautus SÄILYTÄ NÄMÄ OHJEET

Huomautus Tämä asiakirja on tarkoitettu käytettäväksi yhdessä tuotteen mukana tulleen asennusoppaan kanssa. Katso lisätietoja asennusoppaasta, kokoonpano-oppaasta ja muista mukana toimitetuista asiakirjoista.

Attention   IMPORTANTES INFORMATIONS DE SÉCURITÉ

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez les consignes de sécurité traduites qui accompagnent cet appareil.

Remarque CONSERVEZ CES INFORMATIONS

Remarque Cette documentation doit être utilisée avec le guide spécifique d'installation du produit qui accompagne ce dernier. Veuillez vous reporter au Guide d'installation, au Guide de configuration, ou à toute autre documentation jointe pour de plus amples renseignements.

Warnung   WICHTIGE SICHERHEITSANWEISUNGEN

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewusst. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise sind im Lieferumfang des Geräts enthalten.

Hinweis BEWAHREN SIE DIESE SICHERHEITSANWEISUNGEN AUF

Hinweis Dieses Handbuch ist zum Gebrauch in Verbindung mit dem Installationshandbuch für Ihr Gerät bestimmt, das dem Gerät beiliegt. Entnehmen Sie bitte alle weiteren Informationen dem Handbuch (Installations- oder Konfigurationshandbuch o. Ä.) für Ihr spezifisches Gerät.

Figyelem!   FONTOS BIZTONSÁGI ELŐÍRÁSOK

Ez a figyelmezető jel veszélyre utal. Sérülésveszélyt rejtő helyzetben van. Mielőtt bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található.

Megjegyzés ŐRIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Megjegyzés Ezt a dokumentációt a készülékhez mellékelt üzembe helyezési útmutatóval együtt kell használni. További tudnivalók a mellékelt Üzembe helyezési útmutatóban (Installation Guide), Konfigurációs útmutatóban (Configuration Guide) vagy más dokumentumban találhatók.

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. Per le traduzioni delle avvertenze riportate in questo documento, vedere le avvertenze di sicurezza che accompagnano questo dispositivo.

Nota CONSERVARE QUESTE ISTRUZIONI

Nota La presente documentazione va usata congiuntamente alla guida di installazione specifica spedita con il prodotto. Per maggiori informazioni, consultare la Guida all'installazione, la Guida alla configurazione o altra documentazione acclusa.

Advarsel   VIKTIGE SIKKERHETSINSTRUKSJONER

Dette varselssymbolet betyr fare. Du befinner deg i en situasjon som kan forårsake personskade. Før du utfører arbeid med utstyret, bør du være oppmerksom på farene som er forbundet med elektriske kretssystemer, og du bør være kjent med vanlig praksis for å unngå ulykker. For å se oversettelser av advarslene i denne publikasjonen, se de oversatte sikkerhetsvarslene som følger med denne enheten.

Merk TA VARE PÅ DISSE INSTRUKSJONENE

Merk Denne dokumentasjonen skal brukes i forbindelse med den spesifikke installasjonsveiledningen som fulgte med produktet. Vennligst se installasjonsveiledningen, konfigureringsveiledningen eller annen vedlagt tilleggsdokumentasjon for detaljer.

Aviso   INSTRUÇÕES IMPORTANTES DE SEGURANÇA

Este símbolo de aviso significa perigo. O utilizador encontra-se numa situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha em atenção os perigos envolvidos no manuseamento de circuitos eléctricos e familiarize-se com as práticas habituais de prevenção de acidentes. Para ver traduções dos avisos incluídos nesta publicação, consulte os avisos de segurança traduzidos que acompanham este dispositivo.

Nota GUARDE ESTAS INSTRUÇÕES

Nota Esta documentação destina-se a ser utilizada em conjunto com o manual de instalação incluído com o produto específico. Consulte o manual de instalação, o manual de configuração ou outra documentação adicional inclusa, para obter mais informações.

¡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. Vea las traducciones de las advertencias que acompañan a este dispositivo.

Nota GUARDE ESTAS INSTRUCCIONES

Nota Esta documentación está pensada para ser utilizada con la guía de instalación del producto que lo acompaña. Si necesita más detalles, consulte la Guía de instalación, la Guía de configuración o cualquier documentación adicional adjunta.

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. Se översättningarna av de varningsmeddelanden som finns i denna publikation, och se de översatta säkerhetsvarningarna som medföljer denna anordning.

OBS! SPARA DESSA ANVISNINGAR

OBS! Denna dokumentation ska användas i samband med den specifika produktinstallationshandbok som medföljde produkten. Se installationshandboken, konfigurationshandboken eller annan bifogad ytterligare dokumentation för närmare detaljer.

Предупреждение   ВАЖНЫЕ СВЕДЕНИЯ ПО БЕЗОПАСНОСТИ

Этот символ предупреждает о наличии опасности. При неправильных действиях возможно получение травм. Перед началом работы с любым оборудованием необходимо ознакомиться с ситуациями, в которых возможно поражение электротоком, и со стандартными действиями для предотвращения несчастных случаев. Переведенный текст предупреждений содержится в соответствующем документе, поставляемом вместе с устройством.

Примечание   СОХРАНЯЙТЕ ЭТУ ИНСТРУКЦИЮ
Примечание   Эта инструкция должна использоваться вместе с руководством по установке конкретного изделия, входящим в комплект поставки. Дополнительные сведения см. в руководстве по установке, руководстве по настройке и другой документации, поставляемой с изделием.

警告   有关安全的重要说明

这个警告符号指有危险。您所处的环境可能使身体受伤。操作设备前必须意识到电流的危险性，务必熟悉操作标准，以防发生事故。如果需要了解本说明中出现的警告符号的译文，请参阅本装置所附之安全警告译文。

注意   保存这些说明
注意   本文件应与本产品附带的具体安装说明一并阅读。如欲了解详情，请参阅《安装说明》、《配置说明》或所附的其他文件。

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、一般的な事故防止対策に留意してください。このマニュアルに記載されている警告の各国語版は、装置に付属の「Translated Safety Warnings」を参照してください。

注   これらの注意事項を保管しておいてください。
注   この資料は、製品に付属のインストレーション ガイドと併用してください。詳細は、インストレーション ガイド、コンフィギュレーション ガイド、または添付されているその他のマニュアルを参照してください。

Предупреждение   ВАЖНЫЕ СВЕДЕНИЯ ПО БЕЗОПАСНОСТИ

Этот символ предупреждает о наличии опасности. При неправильных действиях возможно получение травм. Перед началом работы с любым оборудованием необходимо ознакомиться с ситуациями, в которых возможно поражение электротоком, и со стандартными действиями для предотвращения несчастных случаев. Переведенный текст предупреждений содержится в соответствующем документе, поставляемом вместе с устройством.

Примечание   СОХРАНЯЙТЕ ЭТУ ИНСТРУКЦИЮ
Примечание   Эта инструкция должна использоваться вместе с руководством по установке конкретного изделия, входящим в комплект поставки. Дополнительные сведения см. в руководстве по установке, руководстве по настройке и другой документации, поставляемой с изделием.

警告   有关安全的重要说明

这个警告符号指有危险。您所处的环境可能使身体受伤。操作设备前必须意识到电流的危险性，务必熟悉操作标准，以防发生事故。如果需要了解本说明中出现的警告符号的译文，请参阅本装置所附之安全警告译文。

注意   保存这些说明
注意   本文件应与本产品附带的具体安装说明一并阅读。如欲了解详情，请参阅《安装说明》、《配置说明》或所附的其他文件。

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、一般的な事故防止対策に留意してください。このマニュアルに記載されている警告の各国語版は、装置に付属の「Translated Safety Warnings」を参照してください。

注   これらの注意事項を保管しておいてください。
注   この資料は、製品に付属のインストレーション ガイドと併用してください。詳細は、インストレーション ガイド、コンフィギュレーション ガイド、または添付されているその他のマニュアルを参照してください。

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 if potentially hazardous conditions exist.

- Never assume that power has been disconnected from a circuit; always check.

- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe. Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring Guidelines

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

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

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Port adapters and processor modules consist of 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 component board-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 megohm (Mohm).

Laser and LED Safety

The single-mode aperture port contains a Class 1 laser warning label, as shown in Figure 2-1.

Figure 2-1   Class 1 Laser Warning Label on PA-POS-OC3SMI and PA-POS-OC3SML
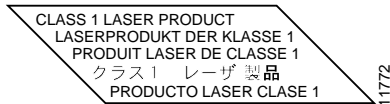
CLASS 1 LASER PRODUCT
LASERPRODUKT DER KLASSE 1
PRODUIT LASER DE CLASSE 1
クラス1　レーザ製品
PRODUCTO LASER CLASE 1

11772

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

⚠ **Warning**   **Class 1 laser product.**

The multimode aperture port contains a Class 1 LED warning label, as shown in Figure 2-2.

Figure 2-2   Class 1 LED Warning Label on PA-POS-OC3MM

CLASS 1 LED PRODUCT
PRODUKT MIT KLASSE 1 LED
PRODUIT AVEC VOYANT DEL
DE CLASSE 1
クラス1　LED製品
PRODUCTO LED DE LA CLASE 1

11773

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

⚠ **Warning**   **Class 1 LED product.**

FCC Class A Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

You can determine whether your equipment is causing interference by turning it off. If the interference stops, it was probably caused by the Cisco equipment or one of its peripheral devices. If the equipment causes interference to radio or television reception, try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.
- Move the equipment to one side or the other of the television or radio.

- Move the equipment farther away from the television or radio.

- Plug the equipment into an outlet that is on a different circuit from the television or radio. (That is, make certain the equipment and the television or radio are on circuits controlled by different circuit breakers or fuses.)

Note   The PA-POS-OC3 port adapter has been designed to meet these requirements. Modifications to this product that are not authorized by Cisco Systems, Inc., could void the various approvals and negate your authority to operate the product.

C H A P T E R

3

Removing and Installing Port Adapters

This chapter describes how to remove the Cisco PA-POS-OC3 port adapter from supported platforms, how to install a new or replacement port adapter, and how to connect cables.

This chapter contains the following sections:

- Handling Port Adapters, page 3-1
- Online Insertion and Removal, page 3-2
- Warnings and Cautions, page 3-3
- Port Adapter Removal and Installation, page 3-4
- Connecting PA-POS-OC3 Interface Cables, page 3-16

Each port adapter circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage.

Note When a port adapter slot is not in use, a blank port adapter must fill the empty slot to allow the router or switch to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the port adapters. If you plan to install a new port adapter in a slot that is not in use, you must first remove the blank port adapter.

Caution When powering off the router, wait a minimum of 30 seconds before powering it on again.

Handling Port Adapters

Caution Always handle the port adapter by the carrier edges and handle; never touch the port adapter components or connector pins. (See Figure 3-1 on page 3-2.)

Figure 3-1   Handling a Port Adapter

Metal carrier

Printed circuit board
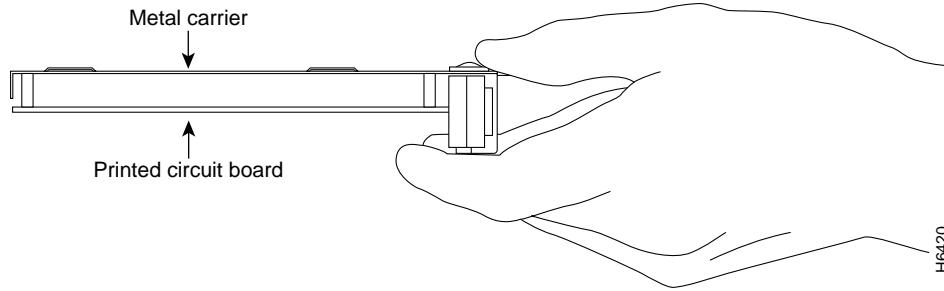
Online Insertion and Removal

Several platforms support online insertion and removal (OIR) of port adapters; therefore, you do not have to power down routers when removing and replacing a PA-POS-OC3 on Cisco 7100 series routers, Cisco 7200 series routers or Cisco uBR7200 series routers, Cisco 7301 routers, and Cisco 7401ASR routers.

Although the Cisco 7304 PCI Port Adapter Carrier Card, the VIP, the Catalyst 6000 family FlexWAN module, and the Catalyst RSM/VIP2 support online insertion and removal, individual port adapters do not. To replace port adapters, you must first remove the Cisco 7304 PCI Port Adapter Carrier Card, the VIP, the Catalyst 6000 family FlexWAN module, or Catalyst RSM/VIP2 from the chassis and then install or replace port adapters as required. If a blank port adapter is installed on the Cisco 7304 PCI Port Adapter Carrier Card, the VIP, the Catalyst 6000 family FlexWAN module, or Catalyst RSM/VIP2 on which you want to install a new port adapter, you must first remove the Cisco 7304 PCI Port Adapter Carrier Card, the VIP, the Catalyst 6000 family FlexWAN module, or Catalyst RSM/VIP2 from the chassis and then remove the blank port adapter.

⚠️

Caution To prevent system problems, do not remove port adapters from the Cisco 7304 PCI Port Adapter Carrier Card, the VIP, the Catalyst 6000 family FlexWAN module, or Catalyst RSM/VIP2 motherboard or attempt to install other port adapters on the motherboard when the system is operating. To install or replace port adapters, first remove the Cisco 7304 PCI Port Adapter Carrier Card, the VIP, the Catalyst 6000 family FlexWAN module, or Catalyst RSM/VIP2 from its interface processor slot.

It is wise to gracefully shut down the system before removing a port adapter that has active traffic moving through it. Removing a module while traffic is flowing through the ports can cause system disruption. Once the module is inserted, the ports can be brought back up.

✎

Note As you disengage the module from the router or switch, online insertion and removal (OIR) administratively shuts down all active interfaces in the module.

OIR allows you to install and replace modules while the router is operating; you do not need to notify the software or shut down the system power, although you should not run traffic through the module you are removing while it is being removed. OIR is a method that is seamless to end users on the network, maintains all routing information, and preserves sessions.

The following is a functional description of OIR for background information only; for specific procedures for installing and replacing a module in a supported platform, refer to the "Port Adapter Removal and Installation" section on page 3-4.

Each module has a bus connector that connects it to the router. The connector has a set of tiered pins in three lengths that send specific signals to the system as they make contact with the module.

The system assesses the signals it receives and the order in which it receives them to determine if a module is being removed from or introduced to the system. From these signals, the system determines whether to reinitialize a new interface or to shut down a disconnected interface.

Specifically, when you insert a module, the longest pins make contact with the module first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them.

When you remove or insert a module, the pins send signals to notify the system of changes. The router then performs the following procedure:

1. Rapidly scans the system for configuration changes.

2. Initializes newly inserted port adapters or administratively shuts down any vacant interfaces.

3. Brings all previously configured interfaces on the module back to their previously installed state. Any newly inserted interface is put in the administratively shutdown state, as if it was present (but not configured) at boot time. If a similar module type is reinserted into a slot, its ports are configured and brought online up to the port count of the originally installed module of that type.

Note   Before you begin installation, read Chapter 2, "Preparing for Installation," for a list of parts and tools required for installation.

Warnings and Cautions

Observe the following warnings and cautions when installing or removing port adapters.

Caution   Do not slide a port adapter all the way into the slot until you have connected all required cables. Trying to do so disrupts normal operation of the router or switch.

Note   If a port adapter lever or other retaining mechanism does not move to the locked position, the port adapter is not completely seated in the midplane. Carefully pull the port adapter halfway out of the slot, reinsert it, and move the port adapter lever or other mechanism to the locked position.

Caution   To prevent jamming the carrier between the upper and the lower edges of the port adapter slot, and to ensure that the edge connector at the rear of the port adapter mates with the connection at the rear of the port adapter slot, make certain that the carrier is positioned correctly, as shown in the cutaway in the following illustrations.

Caution   When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap.

⚠

Warning   **Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.**

Port Adapter Removal and Installation

In this section, the illustrations that follow give step-by-step instructions on how to remove and install port adapters in each of the following supported platforms:

- Catalyst RSM/VIP2—Removing and Installing a Port Adapter, page 3-5
- Catalyst 6000 Family FlexWAN Module—Removing and Installing a Port Adapter, page 3-6
- Cisco 7100 Series—Removing and Installing a Port Adapter, page 3-7
- Cisco 7200 Series—Removing and Installing a Port Adapter, page 3-8
- Cisco uBR7200 Series—Removing a Port Adapter, page 3-9
- Cisco uBR7200 Series—Installing a Port Adapter, page 3-10
- Cisco 7301 Series—Removing and Installing a Port Adapter, page 3-11
- Cisco 7304 PCI Port Adapter Carrier Card—Removing and Installing a Port Adapter, page 3-12
- Cisco 7401ASR Router—Removing and Installing a Port Adapter, page 3-14
- VIP—Removing and Installing a Port Adapter, page 3-15

Catalyst RSM/VIP2—Removing and Installing a Port Adapter

Note: You must first remove the Catalyst RSM/VIP2 from the chassis before removing a port adapter from the Catalyst RSM/VIP2.

Step 1

To remove the port adapter, remove the screw that secures the port adapter (or blank port adapter). (See A.)
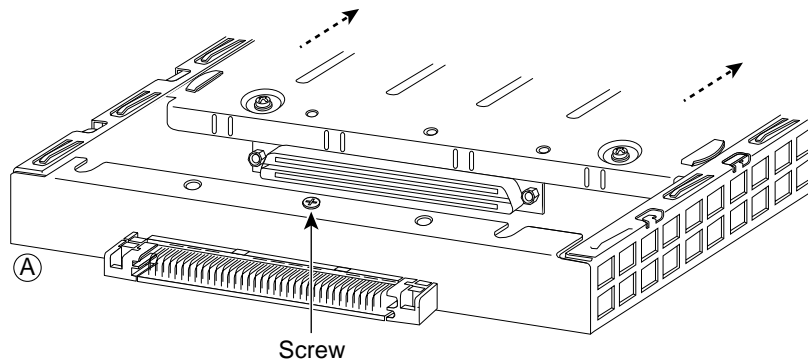
Step 2

With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See A.)
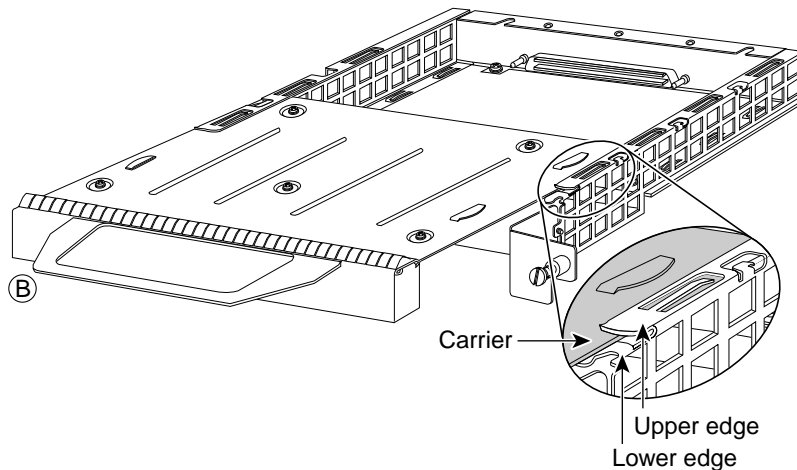
Step 3

To install the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot. (See B.)

Step 4

Install the screw in the rear of the port adapter slot. Do not overtighten the screw. (See A.)

Step 5

Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

Step 6

Reinstall the Catalyst RSM/VIP2 motherboard in the chassis and tighten the captive installation screw on each side of the Catalyst RSM/VIP2 faceplate. (See C.)

Screw

Carrier

Upper edge
Lower edge

Slot guide

5505 series

26521

Catalyst 6000 Family FlexWAN Module—Removing and Installing a Port Adapter

Note: You must first remove the Catalyst 6000 FlexWAN module from the chassis before removing a port adapter from the Catalyst 6000 FlexWAN module.

Step 1

To remove the port adapter, remove the screw that secures the port adapter (or blank port adapter). (See A.)
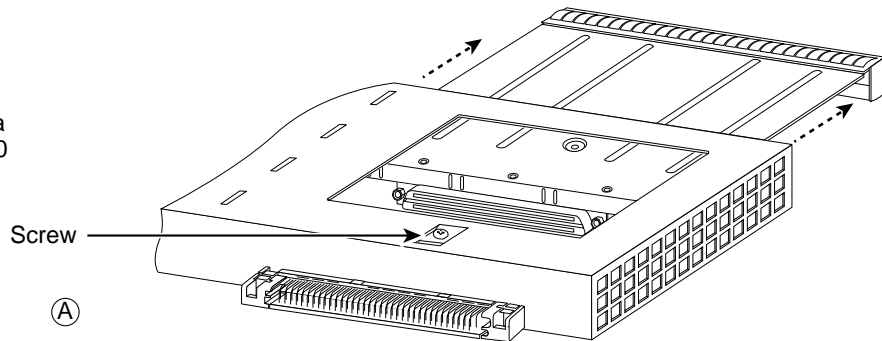
Step 2

With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its bay, away from the edge connector at the rear of the bay. (See A.)

Step 3

To install the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter bay. (See B.)
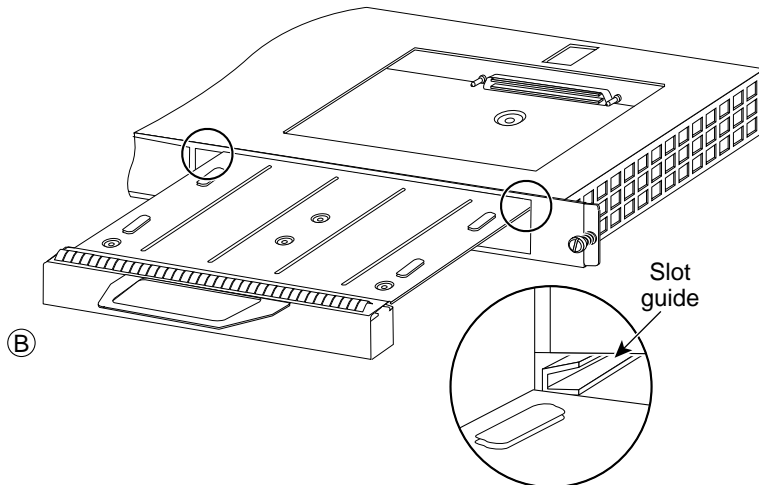
Step 4

Carefully slide the new port adapter into the port adapter bay until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

Step 5

Install the screw in the rear of the port adapter bay. Do not overtighten the screw. (See A.)

Step 6

Reinstall the Catalyst 6000 FlexWAN module in the chassis, and tighten the captive installation screw on each side of the Catalyst 6000 FlexWAN module faceplate. (See C.)
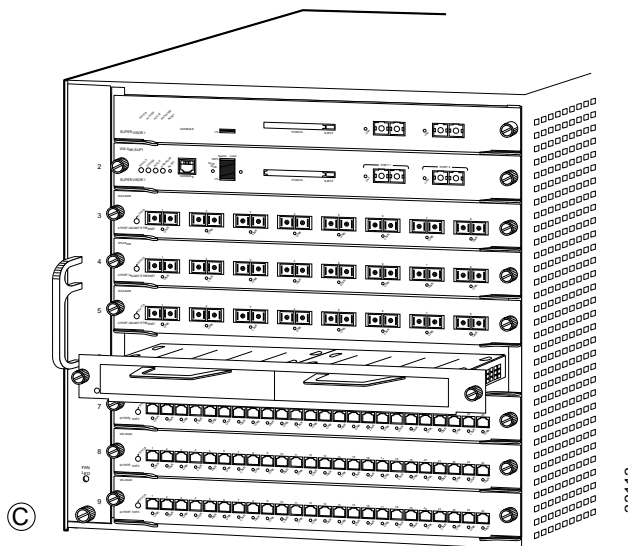
Cisco 7100 Series—Removing and Installing a Port Adapter

Step 1

To remove the port adapter, use a number 2 Phillips screwdriver
to loosen the screws on the locking tab. Then slide the tab down
to the unlocked position.
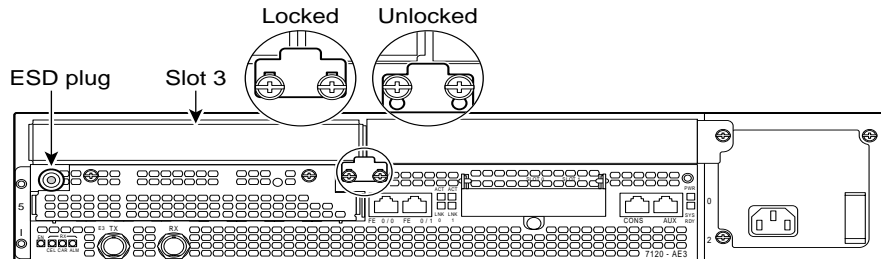
Step 2

Grasp the handle of the port adapter and pull the port adapter
from the router, about halfway out of its slot. If you are removing
a blank port adapter, pull the blank port adapter completely out
of the chassis slot.

Step 3

With the port adapter halfway out of the slot, disconnect all
cables from the port adapter.

Step 4

After disconnecting the cables, pull the port adapter from its
chassis slot.

Step 5

To insert the port adapter, carefully align the port adapter carrier
between the upper and the lower edges of the port adapter slot.
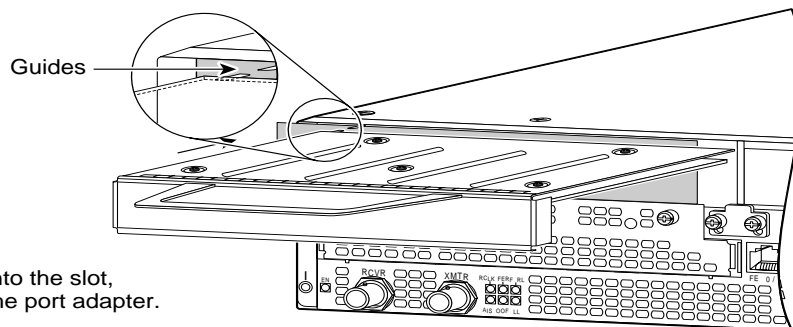
Step 6

With the port adapter halfway into the slot,
connect all required cables to the port adapter.

Step 7

After connecting all required cables, carefully slide the port
adapter all the way into the slot until the port adapter is seated in
the router midplane.

Step 8

After the port adapter is properly seated, lock the port adapter
retaining mechanism.

Cisco 7200 Series—Removing and Installing a Port Adapter

Step 1

To remove the port adapter, place the port adapter lever in the unlocked position. (See A.) The port adapter lever remains in the unlocked position.

Step 2

Grasp the handle of the port adapter and pull the port adapter from the router, about halfway out of its slot. If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

Step 3

With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter from its chassis slot.

Step 4

To insert the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot. (See B.)

Step 5

Carefully slide the new port adapter halfway into the port adapter slot. (See B.)
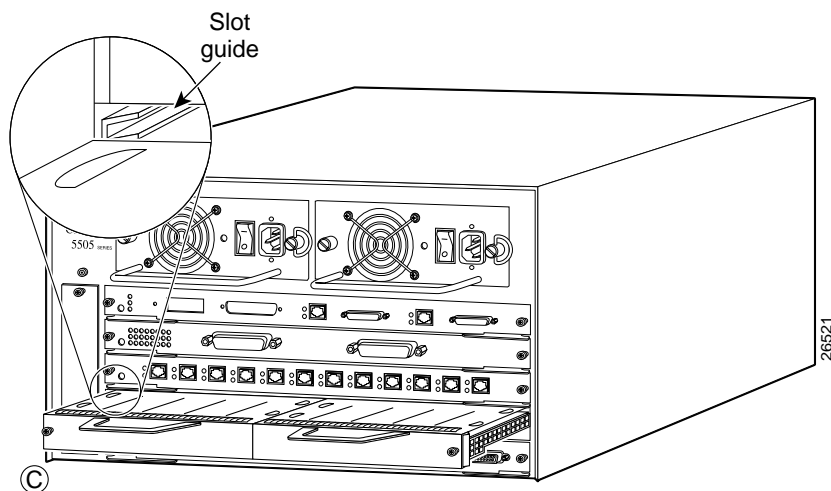
Step 6

With the port adapter halfway into the slot, connect all required cables to the port adapter. After connecting all required cables, carefully slide the port adapter all the way into the slot until the port adapter is seated in the router midplane.

Step 7

After the port adapter is properly seated, lock the port adapter lever. (See A.)

Port adapter lever
(locked position)

A

Note: This adapter removal applies to any port or service adapter.

Port adapter lever
(unlocked position)

Slot
guide

B

27996
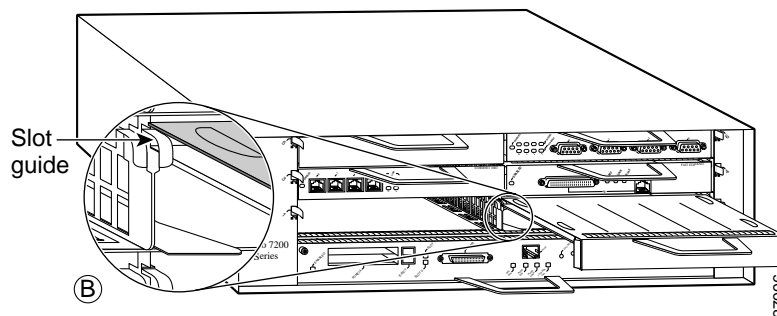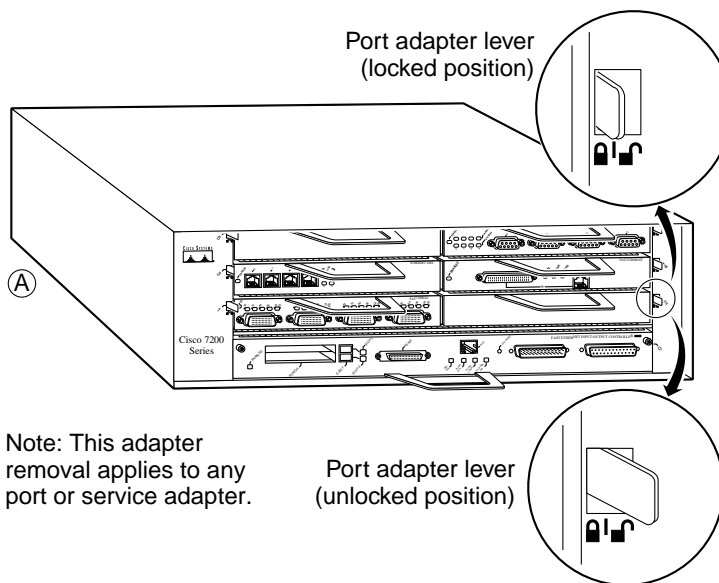
Cisco uBR7200 Series—Removing a Port Adapter

Step 1

To remove the port adapter, unlock the port adapter retaining mechanism. The port adapter lever remains in the unlocked position.

Port adapters

Port adapter lever (locked position)

Ⓐ

Place the port adapter lever (Cisco uBR7223, see A), or the port adapter retention clip (Cisco uBR7246 and Cisco uBR7246 VXR, see B) in the unlocked position. Either mechanism remains in the unlocked position.

Note: This adapter removal applies to any port or service adapter.

Port adapter lever (unlocked position)

Port adapter retention clip (locked position)

Port adapters

Step 2

Grasp the handle of the port adapter and pull the port adapter from the router, about halfway out of its slot.
If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

Step 3

With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter from its chassis slot.

Port adapter retention clip (unlocked position)

Ⓑ

26523
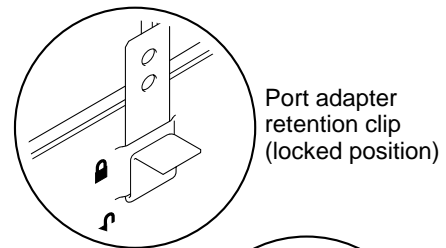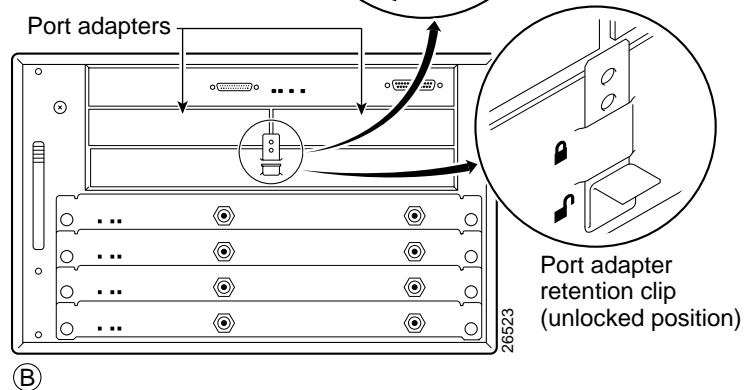
Cisco uBR7200 Series—Installing a Port Adapter

Step 1

To insert the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot.


Metal carrier

Inside slot guide

PC board

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Step 2

Carefully slide the new port adapter halfway into the port adapter slot.

Step 3

With the port adapter halfway into the slot, connect all required cables to the port adapter. After connecting all required cables, carefully slide the port adapter all the way into the slot until the port adapter is seated in the router midplane.

Step 4

After the port adapter is properly seated, lock the port adapter lever or retention clip, depending on your system. (See illustration on preceding page.)

Cisco 7301 Series—Removing and Installing a Port Adapter

Step 1
Use an ESD wrist strap to ground yourself to the router.

Step 2
To remove a port adapter, use a Phillips screwdriver to turn the screw holding the port adapter latch. The screw should be loose enough to allow the latch to rotate to an unlocked position. (See A.) The latch can rotate 360˚.

Step 3
Grasp the handle and pull the port adapter from the router, about halfway out of its slot. (See B.) If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

Step 4
With the port adapter halfway out of the slot, diconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter from its chassis slot.

Caution
The port adapter must slide into the slot guides close to the chassis lid. (See C.) Do not allow the port adapter components to come in contact with the system board or the port adapter could be damaged.
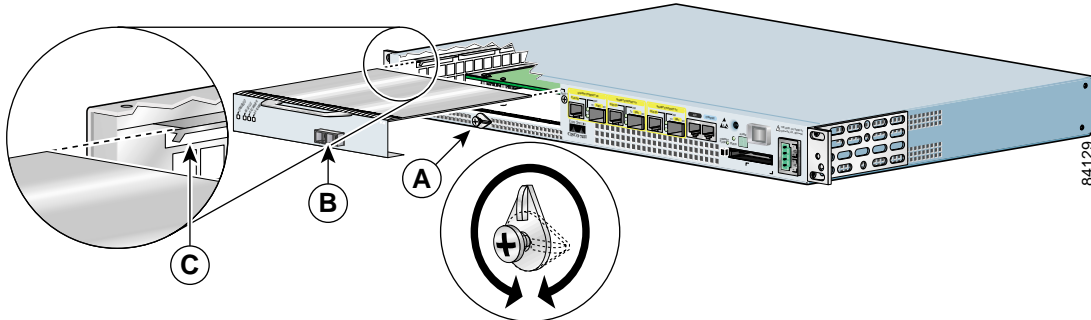
Step 5
To insert the port adapter, carefully align the port adapter carrier in the slot guides. (See C.) Slide the new port adapter halfway into the chassis.

Step 6
Connect all required cables to the port adapter. After connecting all required cables, carefully slide the port adapter all the way into the slot until the port adapter is seated in the midplane.

Step 7
After the port adapter is properly seated, turn and secure the port adapter latch in the upright, locked position. (See A.) Tighten the screw to ensure the port adapter remains firmly in place.

Cisco 7304 PCI Port Adapter Carrier Card—Removing and Installing a Port Adapter

You can install one single-width port adapter in a Cisco 7304 PCI Port Adapter Carrier Card. This section provides step-by-step instructions for removing and installing a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card.

⚠ **Warning**   **When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the Cisco 7304 PCI Port Adapter Carrier Card. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the midplane or backplane with your hand or any metal tool, or you could shock yourself.**

To remove and install a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card, refer to Figure 3-2 and do the following:

Step 1   If the Cisco 7304 PCI Port Adapter Carrier Card is still in the router, you must remove the Cisco 7304 PCI Port Adapter Carrier Card before removing a port adapter.

Step 2   To remove the port adapter from the Cisco 7304 PCI Port Adapter Carrier Card, turn the port adapter lock from its locked and horizontal position shown in A of Figure 3-2 to its unlocked and vertical position shown in B of Figure 3-2.
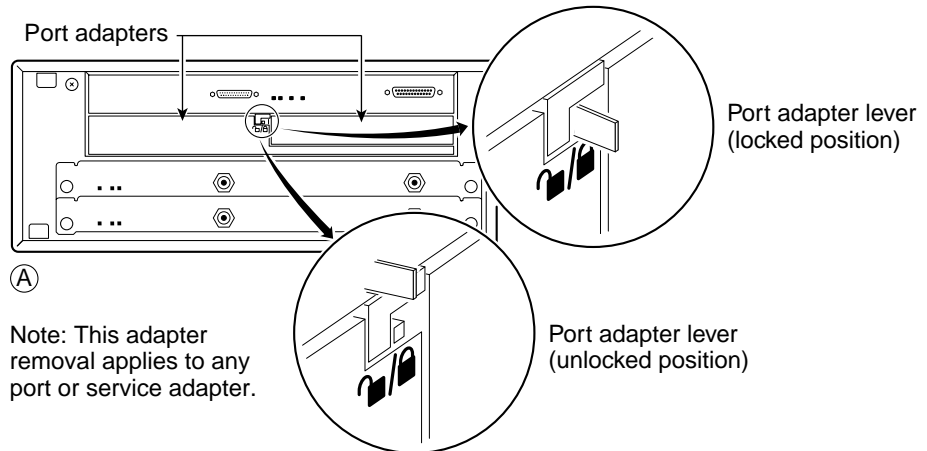
Step 3   Grasp the handle of the port adapter and pull the port adapter from the Cisco 7304 PCI Port Adapter Carrier Card. (You have already disconnected the cables from the port adapter when removing the Cisco 7304 PCI Port Adapter Carrier Card).

Step 4   To insert the port adapter in the Cisco 7304 PCI Port Adapter Carrier Card, locate the guide rails inside the Cisco 7304 PCI Port Adapter Carrier Card that hold the port adapter in place. They are at the top left and top right of the port adapter slot and are recessed about an inch, as shown in C of Figure 3-2.

Step 5   Carefully slide the port adapter in theCisco 7304 PCI Port Adapter Carrier Card until the port adapter makes contact with the port adapter interface connector. When fully seated, the port adapter front panel should be flush with the face of the Cisco 7304 PCI Port Adapter Carrier Card.

Step 6   After the port adapter is properly seated, turn the port adapter lock to its locked and horizontal position, as shown in A of Figure 3-2.

Figure 3-2 illustrates how to remove and install a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card.

Figure 3-2   Cisco 7304 PCI Port Adapter Carrier Card—Port Adapter Removal and Installation
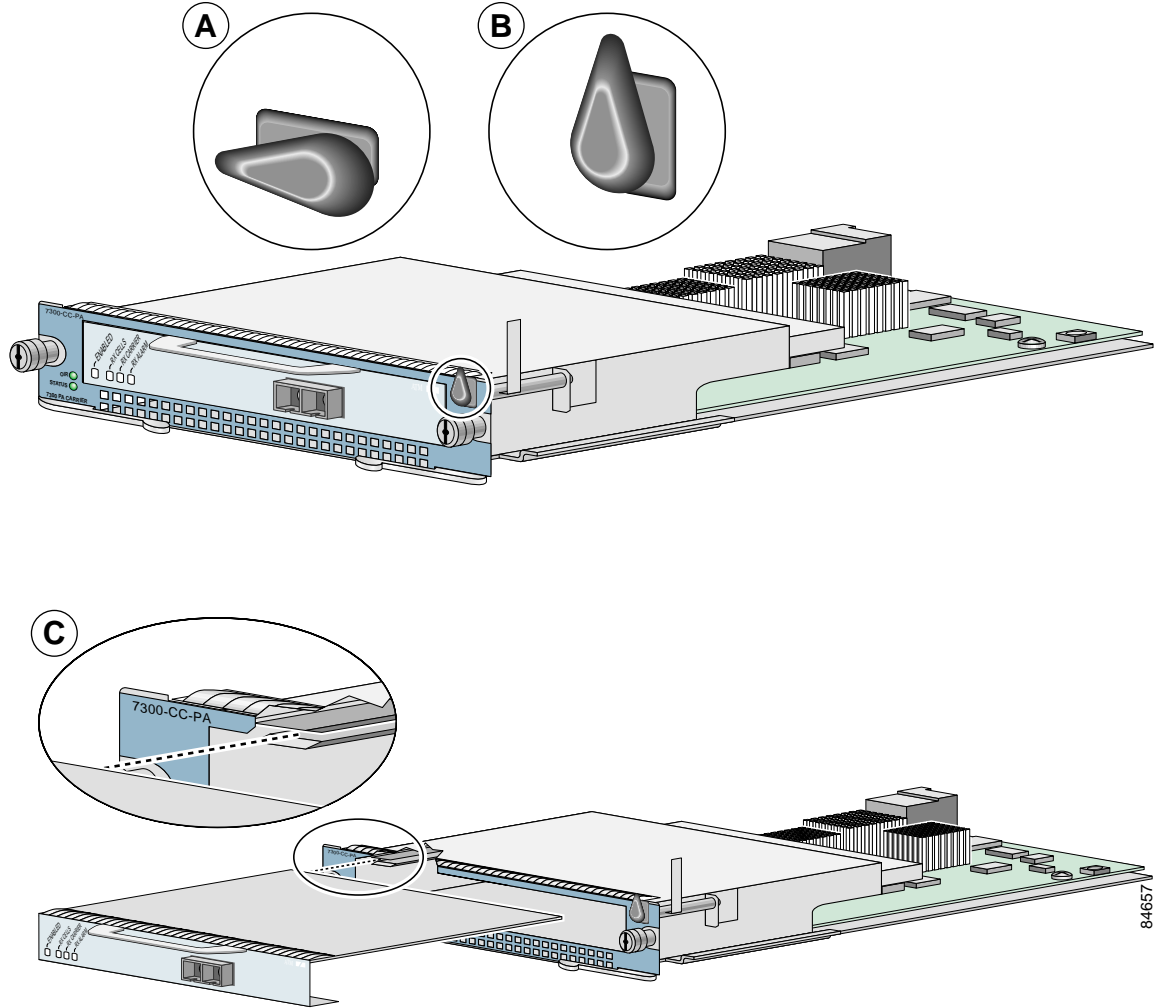
Cisco 7401ASR Router—Removing and Installing a Port Adapter

Step 1
To remove the port adapter, use a number 2 Phillips screwdriver to loosen the screw on the port adapter latch. Rotate the port adapter latch until it clears the faceplate of the port adapter. (See A.) The latch can rotate 360˚.
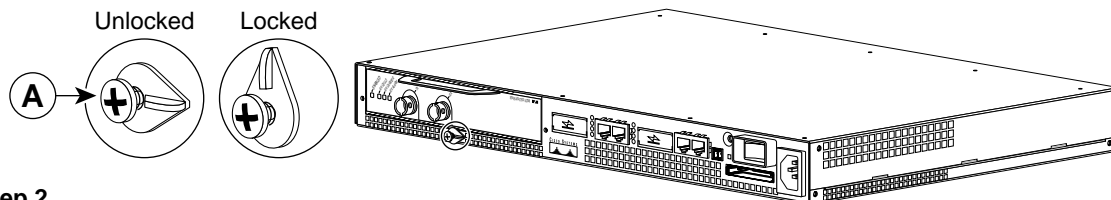
Step 2
Pull the port adapter from the router, about halfway out of its slot. (If you remove a blank port adapter, keep the blank port adapter for use in the router if you should ever remove the port adapter. The port adapter slot must always be filled.)
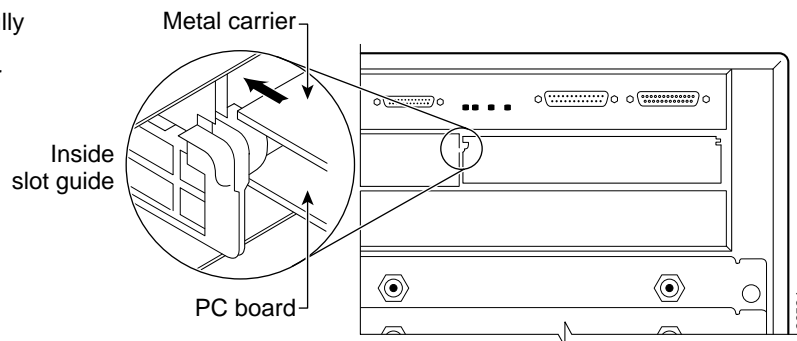
Step 3
With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter completely out of the chassis slot.

Step 4
To insert the port adapter, locate the port adapter slot guides inside the Cisco 7401ASR router. They are near the top, and are recessed about 1/2 inch. (See B.)

Caution
The port adapter must slide into the slot guides under the chassis lid. Do not allow the port adapter components to come in contact with the system board, or the port adapter could be damaged.
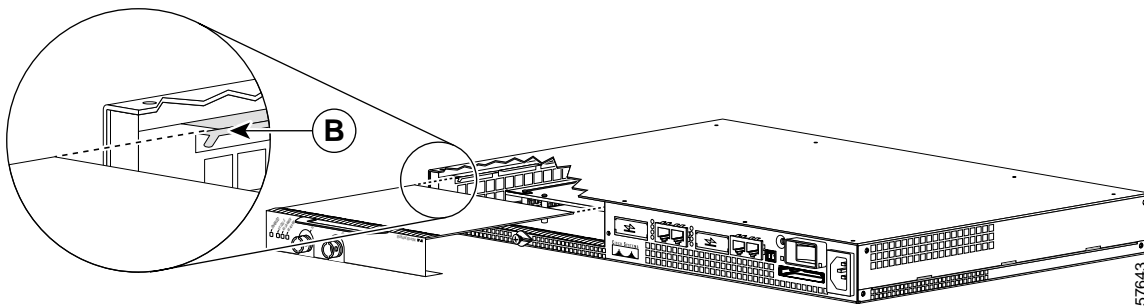
Step 5
Insert the port adapter in the slot guides halfway, and then reconnect the port adapter cables.

Step 6
After the cables are connected, carefully slide the port adpater all the way into the slot until the port adapter is seated in the router midplane. When installed, the port adapter input/output panel should be flush with the face of the router.

Step 7
After the port adapter is properly seated, rotate the port adapter latch to the upright locked position and use a number 2 Phillips screwdriver to tighten the latch screw. If needed, loosen the latch screw to rotate the latch over the port adapter. Finish the installation by tightening the latch screw.

VIP—Removing and Installing a Port Adapter

Note: You must first remove the VIP from the chassis before removing a port adapter from the VIP.

Step 1

To remove the port adapter, remove the screw that secures the port adapter (or blank port adapter). (See A.)
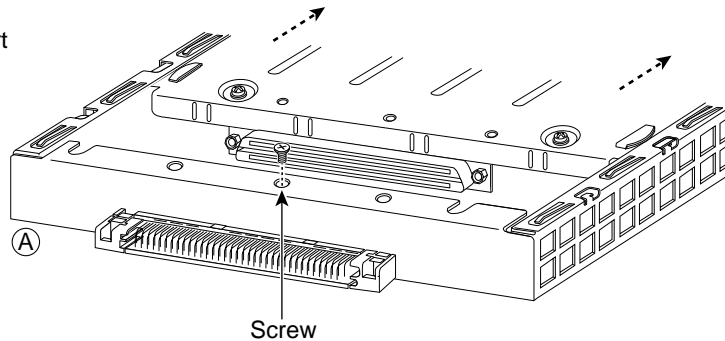
Step 2

With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See A.)

Step 3

To insert the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot. (See B.)
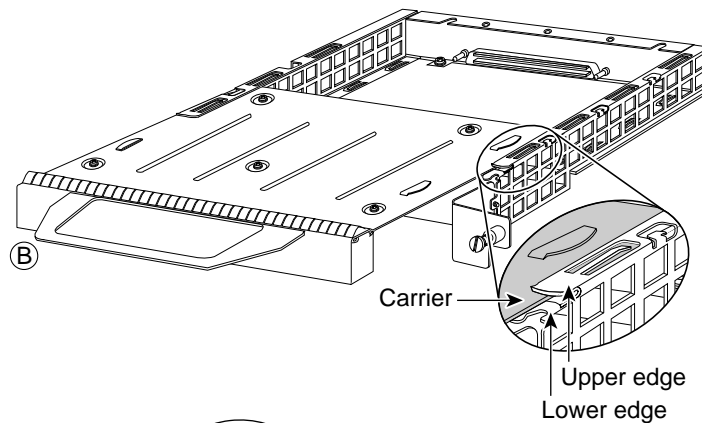
Step 4

Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

Step 5

Install the screw in the rear of the port adapter slot on the VIP. Do not overtighten the screw. (See A.)
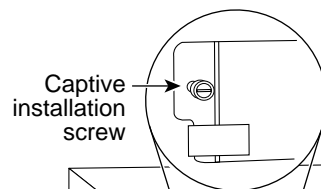
Step 6

Carefully slide the VIP motherboard into the interface processor slot until the connectors at the rear of the VIP are completely seated in the connectors at the rear of the interface processor slot. Use the ejector levers to seat the VIP in the interface processor slot. Tighten the captive installation screws on the VIP. (See C.)
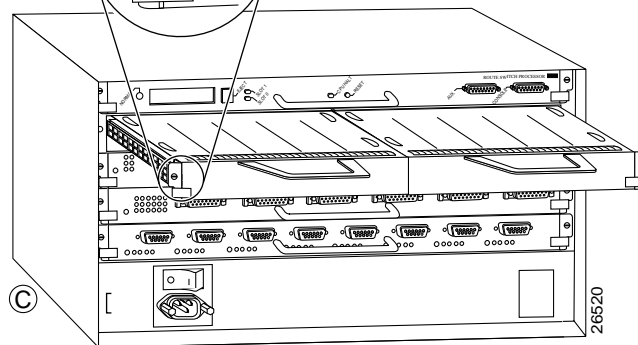
Connecting PA-POS-OC3 Interface Cables

To continue your PA-POS-OC3 port adapter installation, you must connect the interface cables. The instructions that follow apply to all supported platforms.

Note   Optical fiber cables are not available from Cisco Systems; they are available from outside commercial cable vendors. (For more information on the cables you should use with this port adapter, see the "PA-POS-OC3 Optical Fiber Specifications" section on page 1-5 and the "Cables and Connectors" section on page 1-6.)

To connect cables to the PA-POS-OC3, attach either one duplex optical fiber cable or two simplex optical fiber cables between the PA-POS-OC3 interface port on your PA-POS-OC3 and your network. (See Figure 3-3.)

Ensure that you observe the proper relationship of receive (RX) cable to RX SC-type receptacle and transmit (TX) cable to TX SC-type receptacle on the PA-POS-OC3.

Figure 3-3   Connecting Simplex or Duplex Optical Fiber Cables to the PA-POS-OC3
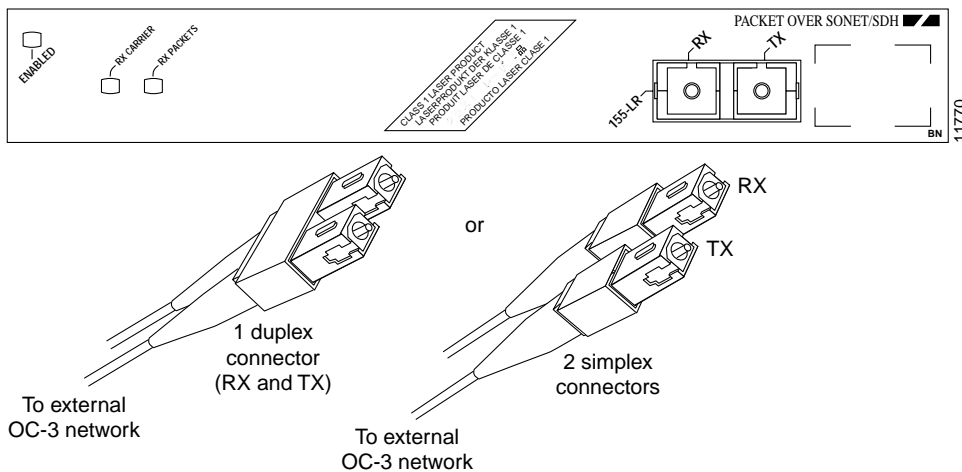
Warning   **Because invisible laser radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

Warning   **Class 1 laser product.**

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

Warning   **Class 1 LED product.**

C H A P T E R 4

Configuring the PA-POS-OC3

To continue your Cisco PA-POS-OC3 port adapter installation, you must configure the OC-3 interface. The instructions that follow apply to all supported platforms. The instructions that follow apply to all supported platforms. Minor differences among the platforms—with Cisco IOS software commands—are noted. This chapter contains the following sections:

Using the EXEC Command Interpreter

You modify the configuration of your router through the software command interpreter called the *EXEC* (also called enable mode). You must enter the privileged level of the EXEC command interpreter with the **enable** command before you can use the **configure** command to configure a new interface or change the existing configuration of an interface. The system prompts you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, use the following procedure to enter the privileged level:

Step 1 At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password as follows:

```
Router> enable

Password:
```

Step 2 Enter the password (the password is case sensitive). For security purposes, the password is not displayed.

When you enter the correct password, the system displays the privileged-level system prompt (#):

```
Router#
```

To configure the new interfaces, proceed to the "Configuring the Interfaces" section on page 4-2.

Configuring the Interfaces

After you verify that the new PA-POS-OC3 is installed correctly (the enabled LED goes on), use the privileged-level **configure** command to configure the new interface. Have the following information available:

- IP address, if you plan to configure the interface for IP routing
- MTU size
- Framing mode
- Transmit clock source
- Loopback modes (if testing is required)

If you installed a new PA-POS-OC3 or if you want to change the configuration of an existing interface, you must enter configuration mode to configure the new interfaces. If you replaced a PA-POS-OC3 that was previously configured, the system recognizes the new interfaces and brings each of them up in their existing configuration.

For a summary of the configuration options available and instructions for configuring the interface on a PA-POS-OC3, refer to the appropriate configuration publications listed in the "Related Documentation" section on page viii.

You execute configuration commands from the privileged level of the EXEC command interpreter, which usually requires password access. Contact your system administrator, if necessary, to obtain password access. (See the "Using the EXEC Command Interpreter" section on page 4-1 for an explanation of the privileged level of the EXEC.)

On power up, the OC-3 interface on a new PA-POS-OC3 is shut down. To enable the interface, you must enter the **no shutdown** command in configuration mode. When the OC-3 interface is enabled (taken out of shutdown) with no additional arguments, the default interface configuration file parameters are as listed in Table 4-1.

Table 4-1   PA-POS-OC3 Configuration Default Values

Parameter[1]	Configuration Commands	Default Value
MTU	**mtu** *bytes* (**no mtu** *bytes*)	4470 bytes
Framing	**pos framing-sdh** (**no pos framing-sdh**)	SONET framing
Loopback internal	**loop internal** (**no loop internal**)	No internal loopback
Loopback line	**loop line** (**no loop line**)	No line loopback
Transmit clocking source	**clock source internal** **clock source line**	Loop timing
Cyclic redundancy checks	**crc 16** **crc 32**	crc 16
SONET payload scrambling	**pos scramble-atm** (**no pos scramble-atm**)	No scrambling

1.   These default parameters apply to the PA-POS-OC3 in all supported platforms.

Note   The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Performing a Basic Configuration

This section describes the procedures for performing a basic configuration: enabling an interface (with the **no shutdown** command) and specifying IP routing. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration and the protocols you plan to route on the interface.

In the following procedure, press the **Return** key after each step unless otherwise noted. At any time you can exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable

Router>
```

Step 1   Enter configuration mode and specify that the console terminal will be the source of the configuration subcommands as follows:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 2   Specify the new interface to configure by entering the **interface pos** command, followed by the interface address of the interface you plan to configure. Table 4-2 gives examples.

Table 4-2   Examples of the interface pos Subcommand

Platform	Command	Example

Catalyst RSM/VIP2 in Catalyst 5000 family switches	**interface pos**, followed by *slot/0* or **1/0** (port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 0.
		
		`Router(config)# interface pos 0/0`
		`Router(config-if)#`

Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches	**interface**, followed by the *type* (**pos**) and *mod_num/bay/port* (module-slot-number/ port-adapter-bay-number/ interface-port-number)	The example is for interface 0 and interface 1 on a port adapter in port adapter bay 0 of a FlexWAN module installed in slot 3.
		
		`Router(config-if)# interface pos 3/0/0`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Cisco 7120 series routers	**interface pos**, followed by **3/0** (port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 3.
		
		`Router(config)# interface pos 3/0`
		`Router(config-if)#`

Cisco 7140 series routers	**interface pos**, followed by **6/0** (port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 6.
		
		`Router(config)# interface pos 6/0`
		`Router(config-if)#`

Table 4-2   Examples of the interface pos Subcommand (continued)

Platform	Command	Example

Cisco 7200 series routers[1]	**interface pos**, followed by *slot*/**0** (port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 6.
		
		`Router(config)# interface pos 6/0`
		`Router(config-if)#`

Cisco uBR7223 router	**interface pos**, followed by **1/0** (port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 1.
		
		`Router(config)# interface pos 1/0`
		`Router(config-if)#`

Cisco uBR7246 and Cisco uBR7246 VXR routers	**interface pos**, followed by **1** or **2/0** (port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 2.
		
		`Router(config)# interface pos 2/0`
		`Router(config-if)#`

Cisco 7301 router	**interface pos**, followed by **1/0** (port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 1.
		
		`Router(config)# interface pos 1/0`
		`Router(config-if)#`

Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	**interface pos**, followed by *slot/port* (module-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router.
		
		`Router(config-if)# interface pos 3/0`
		`Router(config-if)#`

Cisco 7401ASR router	**interface pos**, followed by **1/0** (port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 1.
		
		`Router(config)# interface pos 1/0`
		`Router(config-if)#`

VIP in Cisco 7000 series or Cisco 7500 series routers	**interface pos**, followed by *slot*/**0** or **1/0** (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)	The example is for the OC-3 interface of a PA-POS-OC3 in port adapter slot 1 of a VIP in interface processor slot 1.
		
		`Router(config)# interface pos 1/1/0`
		`Router(config-if)#`

1. For the Cisco 7206VXR and Cisco 7206 router shelves, the interface specified in the above example would include a shelf number. For example, the command **interface pos 5/3/0** specifies the OC-3 interface of the PA-POS-OC3 in port adapter slot 3 of router shelf 5.

Step 3   Assign an IP address and subnet mask to the interface (if IP routing is enabled on the system) with the **ip address** configuration subcommand, as in the following example:

`Router(config-if)# ip address 10.0.0.10 255.255.255.255`

Step 4   Change the shutdown state to up and enable the interface as follows:

`Router(config-if)# no shutdown`

The **no shutdown** command passes an **enable** command to the interface and causes the PA-POS-OC3 to configure itself based on the previous configuration commands sent.

Step 5   Add any additional configuration subcommands required to enable routing protocols and adjust the interface characteristics.

Step 6 After including all of the configuration subcommands to complete your configuration, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.

Step 7 Write the new configuration to NVRAM as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

This completes the procedure for creating a basic configuration.

Customizing the Configuration

You can change the default values of all configuration parameters to match your network environment. Use the interface subcommands in the following sections if you need to customize the PA-POS-OC3 configuration:

- Setting the MTU Size, page 4-5
- Configuring Framing, page 4-5
- Setting the Source of the Transmit Clock, page 4-6
- Configuring Cyclic Redundancy Checks, page 4-6
- Configuring SONET Payload Scrambling, page 4-6

Note The interface subcommands that follow function the same regardless of the platform in which your PA-POS-OC3 is installed; however, all of these commands require that you first enter the **interface pos** command to select the interface that you want to configure.

In all of the configuration examples that follow, the interface address argument for the **interface pos** command is for a Cisco 7200 series router: 3/0 (port adapter slot 3, interface 0).

For the appropriate **interface pos** command syntax to use for your particular platform, see Table 4-2.

Setting the MTU Size

The default maximum transmission unit (MTU) size is 4470 bytes. To set the MTU size, enter the **mtu** *bytes* command, where *bytes* is a value in the range of 64 through 4470. (The value 4470 bytes exactly matches the MTU of FDDI and HSSI interfaces for autonomous switching.)

```
Router(config)# interface pos 3/0
Router(config-if)# mtu 3000
```

To restore the default of 4470 bytes, enter the **no mtu** command.

Configuring Framing

The default framing setting is SONET STS-3c. To configure for SDH STM-1, enter the **pos framing-sdh** command:

```
Router(config)# interface pos 3/0
Router(config-if)# pos framing-sdh
```

To change back to SONET STS-3c, enter the **no pos framing-sdh** command.

Setting the Source of the Transmit Clock

The clocking default specifies that the PA-POS-OC3 uses the recovered receive (RX) clock to provide transmit (TX) clocking (called *loop timing*). To specify that the PA-POS-OC3 generates the transmit clock internally, enter the **clock source internal** command:

```
Router(config)# interface pos 3/0
Router(config-if)# clock source internal
```

To restore loop timing, enter the **no clock source internal** command or the **clock source line** command.

Configuring Cyclic Redundancy Checks

The cyclic redundancy check (CRC) default is for a 16-bit CRC (CRC-CITT). The CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. The PA-POS-OC3 also supports a 32-bit CRC. The sender of a data frame calculates the frame check sequence (FCS). The sender appends the FCS value to outgoing messages. The receiver recalculates the FCS and compares it to the FCS from the sender. If a difference exists, the receiver assumes that a transmission error occurred and sends a request to the sender to resend the frame. To configure an interface for a 32-bit CRC, enter the **crc 32** command:

```
Router(config)# interface pos 3/0
Router(config-if)# crc 32
```

To disable the 32-bit CRC and return the interface to the default 16-bit CRC, enter the **no crc 32** command.

Configuring SONET Payload Scrambling

The default is for SONET payload scrambling disabled. SONET payload scrambling applies a self-synchronous scrambler $(x^{43}+1)$ to the Synchronous Payload Envelope (SPE) of the OC-3 interface to ensure sufficient bit-transition density.

Note   Both ends of the connection must use the same scrambling algorithm.

You enable SONET payload scrambling using the **pos scramble-atm** command. (This command has no keywords or arguments.)

To enable SONET payload scrambling, use the following command sequence:

```
Router(config)# interface pos 3/0
Router(config-if)# pos scramble-atm
Router(config-if)# no shutdown
Router(config-if)# end
```

To verify that SONET payload scrambling is enabled on an interface, enter the **show startup-config** command. If scrambling is enabled, the following line is displayed in the configuration:

```
pos scramble-atm
```

To disable SONET payload scrambling, use the **no pos scramble-atm** command.

Checking the Configuration

After configuring the new interface, use the **show** commands to display the status of the new interface or all interfaces, and use the **ping** command to check connectivity. This section includes the following subsections:

Using show Commands to Verify the New Interface Status

Table 4-3 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the PA-POS-OC3 appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow. For complete command descriptions and examples, refer to the publications listed in the "Related Documentation" section on page viii.

> ✎
> **Note**   The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Table 4-3   Using show commands

Command	Function	Example
show version or **show hardware**	Displays system hardware configuration, the number of each interface type installed, Cisco IOS software version, names and sources of configuration files, and boot images	Router# **show version**
show diag *slot* **Note** The *slot* argument is not required with Catalyst 5000 family switches.	Displays types of port adapters installed in your system and information about a specific port adapter slot, interface processor slot, or chassis slot	Router# **show diag 2**
show interfaces pos 0 or **1/0**	Displays status information about the OC-3 interface on a Catalyst RSM/VIP2	Router# **show interfaces pos 0/0**
show interfaces pos *module-slot-number/port-adapter-bay-number/interface-port-number*	Displays status information about the OC-3 interface on a Catalyst 6000 family FlexWAN module	Router# **show interfaces pos 3/0/0**
show interfaces pos *port-adapter-slot-number/***0**	Displays status information about the OC-3 interface in a Cisco 7120 series router	Router# **show interfaces pos 3/0**

Table 4-3   Using show commands (continued)

Command	Function	Example
show interfaces pos *port-adapter-slot-number/***0**	Displays status information about the OC-3 interface in a Cisco 7140 series router	`Router# `**`show interfaces pos 4/0`**
show interfaces pos *port-adapter-slot-number/***0**	Displays status information about the OC-3 interface in a Cisco 7200 series router	`Router# `**`show interfaces pos 3/0`**
show interfaces pos 1/0	Displays status information about the OC-3 interface in a Cisco uBR7223 router	`Router# `**`show interfaces pos 1/0`**
show interfaces pos 1 or **2/0**	Displays status information about the OC-3 interface in a Cisco uBR7246 or Cisco uBR7246 VXR router	`Router# `**`show interfaces pos 1/0`**
show interfaces pos 1/0	Displays status information about the OC-3 interface in a Cisco 7301 router	`Router# `**`show interfaces pos 1/0`**
show interfaces pos *module-slot-number/ interface-port-number*	Displays status information about the OC-3 interface on a Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	`Router# `**`show interfaces pos 3/0`**
show interfaces pos 1/0	Displays status information about the OC-3 interface in a Cisco 7401ASR router	`Router# `**`show interfaces pos 1/0`**
show interfaces pos *interface-processor-slot***-***number***/0** or **1/0**	Displays status information about the OC-3 interface on a VIP in a Cisco 7000 series or Cisco 7500 series router	`Router# `**`show interfaces pos 3/0/0`**
show controllers	Displays all the current interface processors and their interfaces	`Router# `**`show controllers`**
show protocols	Displays protocols configured for the entire system and for specific interfaces	`Router# `**`show protocols`**
show running-config	Displays the running configuration file	`Router# `**`show running-config`**
show startup-config	Displays the configuration stored in NVRAM	`Router# `**`show startup-config`**

If an interface is shut down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the interface is properly connected and terminated. If you still have problems bringing up the interface, contact a service representative for assistance. This section includes the following subsections:

Choose the subsection appropriate for your system. Proceed to the "Using the ping Command to Verify Network Connectivity" section on page 4-21 when you have finished using the **show** commands.

Using the show version or show hardware Commands

Display the configuration of the system hardware, the number of each interface type installed, the Cisco IOS software version, the names and sources of configuration files, and the boot images, using the **show version** (or **show hardware**) command.

Note   The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Catalyst RSM/VIP2 in Catalyst 5000 Family Switches

Following is an example of the **show version** command from a Catalyst 5000 family switch with the PA-POS-OC3:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) C5RSM Software (C5RSM-JSV-M), Version 12.0(3)T
Copyright (c) 1986-1997 by cisco Systems, Inc.
Compiled Tue 24-Jun-97 17:09 by biff
Image text-base: 0x600108E0, data-base: 0x6095E000

ROM: System Bootstrap, Version 11.2(15707)
BOOTFLASH: C5RSM Software (C5RSM-JSV-M), Version 11.2

Router uptime is 17 hours, 17 minutes
System restarted by reload
System image file is "c5rsm-jsv-mz.7P", booted via tftp

cisco RSP2 (R4700) processor with 32768K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0
Last reset from power-on
G.703/E1 software, Version 1.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software.

[Additional display text omitted from this example]

1 VIP2 controller (1 POS).
1 Packet over SONET network interface(s)

[Additional display text omitted from this example]
```

```
123K bytes of non-volatile configuration memory.

16384K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
   Configuration register is 0x100
```

Catalyst 6000 Family FLexWAN Module

Following is an example of the **show version** command for a Catalyst 6000 family FlexWAN module:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) MSFC Software (C6MSFC-JSV-M), Experimental Version 12.1(20000209:134547)
[amcrae-cosmos_e_nightly 163]
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Wed 09-Feb-00 07:10 by
Image text-base: 0x60008900, data-base: 0x6140E000

ROM: System Bootstrap, Version 12.0(3)XE, RELEASE SOFTWARE

const-uut uptime is 5 minutes
System returned to ROM by reload
System image file is "bootflash:c6msfc-jsv-mz.Feb9"

cisco Cat6k-MSFC (R5000) processor with 122880K/8192K bytes of memory.
Processor board ID SAD03457061
R5000 CPU at 200Mhz, Implementation 35, Rev 2.1, 512KB L2 Cache
Last reset from power-on
Channelized E1, Version 1.0.
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
Primary Rate ISDN software, Version 1.1.
6 FlexWAN controllers (13 Serial)(8 E1)(8 T1)(2 HSSI)(2 ATM)(1 Channelized T3)(1
Channelized E3)(2 POS).
1 Virtual Ethernet/IEEE 802.3  interface(s)
17 Serial network interface(s)
2 HSSI network interface(s)
2 ATM network interface(s)
2 Packet over SONET network interface(s)
1 Channelized T3 port(s)
1 Channelized E3 port(s)
123K bytes of non-volatile configuration memory.
4096K bytes of packet SRAM memory.

16384K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x1
```

Cisco 7100 Series Routers

Following is an example of the **show version** command from a Cisco 7140 series router with the PA-POS-OC3:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) EGR Software (C7100-JS56I-M), Version 12.1(4)E,
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Tue 18-Jul-00 17:33 by leposo
Image text-base:0x60008950, data-base:0x61AB0000

ROM:System Bootstrap, Version 12.0(19991025:205336)
```

```
[tkam-v120_5_xe_throttle_p23411 104]
BOOTFLASH:EGR Software (C7100-BOOT-M), Version 12.0(5)XE2, EARLY DEPLOYMENT RELEASE
SOFTWARE (fc1)

Router uptime is 24 minutes
System restarted by power-on
System image file is "disk0:c7100-is-mz.121-4.E"

cisco 7140-2MM3 (EGR) processor (revision A) with 253952K/73728K bytes of memory.
Processor board ID 15054452
R7000 CPU at 262Mhz, Implementation 39, Rev 1.0, 256KB L2, 2048KB L3 Cache
Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
Channelized E1, Version 1.0.
2 FastEthernet/IEEE 802.3 interface(s)
2 ATM network interface(s)
1 Packet over SONET network interface(s)
125K bytes of non-volatile configuration memory.

40960K bytes of ATA PCMCIA card at slot 1 (Sector size 512 bytes).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

Cisco 7200 Series and Cisco uBR7200 Series Routers

Following is an example of the **show version** command from a Cisco 7200 series router with the
PA-POS-OC3:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Version 11.1(21)CC [biff 105]
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Sun 04-Aug-96 06:00 by biff
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 11.1(7)CA RELEASED SOFTWARE

Router uptime is 4 hours, 22 minutes
System restarted by reload
System image file is "c7401ASR-j-mz", booted via slot0
cisco 7401ASR processor with 12288K/4096K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV INC).
Chassis Interface.

[Additional display text omitted from this example]

1 Packet over SONET network interface(s)

[Additional display text omitted from this example]

125K bytes of non-volatile configuration memory.
1024K bytes of packet SRAM memory.
20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
```

```
8192K bytes of Flash internal SIMM (Sector size 256K).
   Configuration register is 0x2
```

Cisco 7301 Routers

Following is an example of the **show version** command from a Cisco 7301 router:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7301 Software (C7300-JS-M), Experimental Version 12.2(20020904:004736) [biff 107]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Mon 09-Sep-02 18:02 by biff
Image text-base:0x600088F8, data-base:0x61A94000

ROM:System Bootstrap, Version 12.2(20020730:200705) [biff-TAZ2_QA_RELEASE_16B 101],
DEVELOPMENT SOFTWARE
BOOTLDR:7301 Software (C7301-BOOT-M), Experimental Version 12.2(20020813:014224)
[biff-TAZ2_QA_RELEASE_17B 101]

7301p2b uptime is 0 minutes
System returned to ROM by reload at 00:01:51 UTC Sat Jan 1 2000
System image file is "tftp://10.1.8.11/tazii/images/c7301-js-mz"

cisco 7301 (NPE-G1) processor (revision A) with 491520K/32768K bytes of memory.
Processor board ID 0
BCM1250 CPU at 700Mhz, Implementation 1, Rev 0.2, 512KB L2 Cache
1 slot midplane, Version 2.0

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
3 Gigabit Ethernet/IEEE 802.3 interface(s)
509K bytes of non-volatile configuration memory.

62976K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x102
```

Cisco 7401ASR Routers

Following is an example of the **show version** command from a Cisco 7401ASR router with the PA-POS-OC3:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7401ASR Software (C7401ASR-J-M), Version 11.1(21)CC [biff 105]
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Sun 04-Aug-96 06:00 by biff
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 11.1(7)CA RELEASED SOFTWARE

Router uptime is 4 hours, 22 minutes
System restarted by reload
System image file is "c7401ASR-j-mz", booted via slot0
cisco 7401ASR processor with 12288K/4096K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
```

```
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV INC).
Chassis Interface.

[Additional display text omitted from this example]

1 Packet over SONET network interface(s)

[Additional display text omitted from this example]

125K bytes of non-volatile configuration memory.
1024K bytes of packet SRAM memory.
20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
   Configuration register is 0x2
```

VIP in Cisco 7000 Series and Cisco 7500 Series Routers

Following is an example of the **show version** command from a Cisco 7500 series router with the
PA-POS-OC3:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-A), Version 12.0(8)S [biff 125]
                     Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Wed 06-Oct-99 14:30 by biff
Image text-base: 0x600108A0, data-base: 0x60952000

ROM: System Bootstrap, Version 11.1(2) [biff], RELEASE SOFTWARE
BOOTFLASH:RSP Software (RSP-BOOT-M) RELEASE SOFTWARE (fc1)

Router uptime is 5 days, 4 minutes
System restarted by reload
System image file is "rsp-jv-mz", booted via slot0
cisco RSP2 (R4600) processor with 16384K bytes of memory.
R4600 processor, Implementation 32, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
Chassis Interface.

[Additional display text omitted from this example]

1 VIP4 RM7000 controller (1 POS).
1 Packet over SONET network interface(s)

[Additional display text omitted from this example]

125K bytes of non-volatile configuration memory.
8192K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
   Configuration register is 0x0
```

Using the show diag Command

Display the types of port adapters installed in your system (and specific information about each) using the **show diag** *slot* command, where *slot* is the *port adapter slot* in a Cisco 7100 series, Cisco 7200 series, Cisco uBR7200 series router, Cisco 7301 router, and a Cisco 7401ASR router, and the *interface processor slot* in a Cisco 7000 series or Cisco 7500 series router with a VIP. (The slot argument is not required for the PA-POS-OC3 installed on the Catalyst RSM-VIP2 in Catalyst 5000 family switches.)

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Catalyst RSM/VIP2 in Catalyst 5000 Family Switches

Following is an example of the **show diag** command for a PA-POS-OC3 on a Catalyst RSM/VIP2:

```
Router# show diag
Slot 3:
Physical slot 0, ~physical slot 0xF, logical slot 0, CBus 0
        Microcode Status 0x4
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status: None
        EEPROM format version 1
        VIP2 R5K controller, HW rev 2.01, board revision B0
        Serial number: 06747824  Part number: 73-2167-03
        Test history: 0x00        RMA number: 00-00-00
        Flags: cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20: 01 1E 02 01 00 66 F6 B0 49 08 77 03 00 00 00 00
          0x30: 58 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags: 0x4      Insertion time: 0x245C (00:06:51 ago)

        Controller Memory Size: 128 MBytes DRAM, 4096 KBytes SRAM

        PA Bay 0 Information:
                POS PA, 1 port, PA-POSSW-MM
                EEPROM format version 1
                HW rev 2.00, Board revision A0
                Serial number: 012345  Part number: 73-3192-02
```

Catalyst 6000 Family FlexWAN Module

Following is an example of the **show diag** command that shows a PA-POS-OC3 in port adapter bay 0 on a Catalyst 6000 family FlexWAN module in module slot 4:

```
Router# show diag 4
Slot 4: Logical_index 9
    Board is analyzed ipc ready FlexWAN controller

    Slot database information:
    Flags: 0x2004Insertion time: unknown

    CWAN Controller Memory Size: Unknown

    PA Bay 1 Information:
        POS PA, 1 port
```

```
EEPROM format version 0
        HW rev 0.00, Board revision UNKNOWN
        Serial number: 00000000  Part number: 00-0000-00
```

For complete command descriptions and examples for the Catalyst 6000 family FlexWAN module, refer to the publications listed in the "Related Documentation" section on page viii. Proceed to the "Using the ping Command to Verify Network Connectivity" section on page 4-21.

Cisco 7100 Series Routers

Following is an example of the **show diag** *slot* command for a PA-POS-OC3 in port adapter slot 4 of a Cisco 7140 series router:

```
Router# show diag 4
Slot 4:
POS Single Width, Multi Mode Port adapter, 1 port
Port adapter is analyzed
Port adapter insertion time 00:03:16 ago
EEPROM contents at hardware discovery:
Hardware revision 2.0          Board revision A0
Serial number    11563673      Part number    73-3192-02
Test history      0x0           RMA number     00-00-00
EEPROM format version 1
EEPROM contents (hex):
0x20:01 96 02 00 00 B0 72 99 49 0C 78 02 00 00 00 00
0x30:50 00 00 00 99 01 14 00 00 00 FF FF FF FF FF FF
```

Note To use the **show diag** command with the Cisco 7120 series router, replace the slot argument **4** with **3**.

Cisco 7200 Series and Cisco uBR7200 Series Routers

Following is an example of the **show diag** *slot* command for a PA-POS-OC3 in port adapter slot 3 of a Cisco 7200 series router:

```
Router# show diag 3
Slot 3:
        OC3-POS (multimode) port adapter, 1 port
        Port adapter is analyzed
        Port adapter insertion time 00:09:13 ago
        Hardware revision 2.0           Board revision A0
        Serial number     012340        Part number    73-3192-02
        Test history      0x0           RMA number      00-00-00
        EEPROM format version 1
        EEPROM contents (hex):
          0x20: 01 96 02 00 00 92 71 38 49 0C 78 02 00 00 00 00
          0x30: 02 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF
```

Cisco 7301 Routers

Note Input/output data for the console port, auxiliary port, Gigabit Ethernet ports, and CompactFlash Disk are listed in the output of the **show c7300** command, rather than in the output of the **show diag** command. Use the **show diag** command for port adapter information.

```
Router# sh diag

Slot 1:
        POS Single Width, Multi Mode Port adapter, 1 port
```

```
                         Port adapter is analyzed
                         Port adapter insertion time 01:38:29 ago
                         EEPROM contents at hardware discovery:
                         Hardware revision 2.2          Board revision A0
                         Serial number    28672741      Part number    73-3192-06
                         FRU Part Number:PA-POS-OC3MM=

                         Test history      0x0          RMA number     00-00-00
                         EEPROM format version 1
                         EEPROM contents (hex):
                           0x20:01 96 02 02 01 B5 82 E5 49 0C 78 06 00 00 00 00
                           0x30:50 00 00 00 02 08 19 00 00 00 FF FF FF FF FF FF
```

Cisco 7401ASR Routers

Following is an example of the **show diag** *slot* command for a PA-POS-OC3 in port adapter slot 1of a
Cisco 7401ASR router:

```
Router# show diag 1
Slot 3:
        OC3-POS (multimode) port adapter, 1 port
        Port adapter is analyzed
        Port adapter insertion time 00:09:13 ago
        Hardware revision 2.0          Board revision A0
        Serial number    012340        Part number    73-3192-02
        Test history      0x0          RMA number     00-00-00
        EEPROM format version 1
        EEPROM contents (hex):
          0x20: 01 96 02 00 00 92 71 38 49 0C 78 02 00 00 00 00
          0x30: 02 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF
```

VIP in Cisco 7000 Series and Cisco 7500 Series Routers

Following is an example of the **show diag** *slot* command for a PA-POS-OC3 in port adapter slot 0 of a
VIP4 in interface processor slot 8:

```
Router# show diag 8
Slot 8:
        Physical slot 8, ~physical slot 0x7, logical slot 8, CBus 0
        Microcode Status 0x4
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status:None
        EEPROM format version 2
        VIP4 RM7000 controller, HW rev 2.01, board revision A0
        Serial number:11500489  Part number:211-18700-71
        Test history:0x02         RMA number:00-00-00
        Flags: unknown flags 0x7F; 7500 compatible

        EEPROM contents (hex):
          0x20:02 22 02 01 00 AF 7B C9 D3 49 0C 47 02 00 00 00
          0x30:02 3A 0C FF FF FF FF FF FF FF FF FF FF FF FF FF

        Slot database information:
        Flags:0x4     Insertion time:0x3E39D4C (00:00:48 ago)

        Controller Memory Size:64 MBytes DRAM, 65536 KBytes SRAM

        PA Bay 0 Information:
                POS PA, 1 port, PA-POSSW-MM
                EEPROM format version 1
```

```
                          HW rev 2.00, Board revision A0
                          Serial number:123451  Part number:73-3192-02
```

Using the show interfaces Command

The **show interfaces** command displays status information (including the physical slot and interface address) for the interfaces you specify. All of the examples that follow specify POS interfaces.

For complete descriptions of interface subcommands and the configuration options available for interfaces on the Catalyst RSM/VIP2, Cisco 7100 routers, Cisco 7200 routers, Cisco uBR7200 series routers,Cisco 7301 routers, Cisco 7401ASR routers, and VIP, refer to the publications listed in the "Related Documentation" section on page viii.

Note   The ouputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Catalyst RSM/VIP2 in Catalyst 5000 Family Switches

Following is an example of the **show interfaces** PA-POS-OC3 in port adapter slot 1 of a Catalyst RSM/VIP2:

```
Router# show interfaces pos 1/0
POS1/0 is administratively down, line protocol is down
  Hardware is cyBus Packet over Sonet
  MTU 4470 bytes, BW 155000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants 0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffers copied, 0 interrupts, 0 failures, 0 carrier transitions
```

Catalyst 6000 Family FlexWAN Module

Following is an example of the show interfaces command for a PA-POS-OC3 in port adapter bay 1 of a Catalyst 6000 family FlexWAN module in module slot 4:

```
Router# show interfaces pos 4/1/0
POS4/1/0 is up, line protocol is up
  Hardware is Packet over Sonet
  MTU 4470 bytes, BW 155000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Scramble disabled
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
```

```
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
            0 parity
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  6 packets output, 1998 bytes, 0 underruns
  0 output errors, 0 applique, 1 interface resets
  0 output buffer failures, 0 output buffers swapped out
  1 carrier transitions
```

Display the configuration of the system hardware, the number of each interface type installed, the Cisco IOS software version, the names and sources of configuration files, and the boot images, using the **show version** (or **show hardware**) command.

Cisco 7100 Series Routers

Following is an example of the **show interfaces** command for a PA-POS-OC3 in port adapter slot 4 of a Cisco 7140 series router:

```
Router# show interfaces pos 4/0
POS4/0 is up, line protocol is up
Hardware is Packet over Sonet
Internet address is 1.1.1.2/8
MTU 4470 bytes, BW 155000 Kbit, DLY 100 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation HDLC, crc 16, loopback not set
Keepalive not set
Scramble disabled
Last input 00:00:16, output never, output hang never
Last clearing of "show interface" counters never
Queueing strategy:fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
7 packets input, 1158 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 parity
10 input errors, 10 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
7 packets output, 1158 bytes, 0 underruns
0 output errors, 0 applique, 1 interface resets
0 output buffer failures, 0 output buffers swapped out
0 carrier transitions
```

Note To use the **show interfaces** command with the Cisco 7120 series router, replace the slot argument **4** with **3**.

Cisco 7200 Series and Cisco uBR7200 Series Routers

Following is an example of the **show interfaces** command for a PA-POS-OC3 in port adapter slot 3 of a Cisco 7200 series router:

```
Router# show interfaces pos 3/0
POS3/0 is administratively down, line protocol is down
  Hardware is Packet over Sonet
  MTU 4470 bytes, BW 155000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
```

```
       5 minute output rate 0 bits/sec, 0 packets/sec
          0 packets input, 0 bytes, 0 no buffer
          Received 0 broadcasts, 0 runts, 0 giants
                  0 parity
          0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
          10 packets output, 234 bytes, 0 underruns
          0 output errors, 0 applique, 0 interface resets
          0 output buffers copied, 0 interrupts, 0 failures
          0 carrier transitions
```

Note For the Cisco 7206VXR and Cisco 7206 router shelves, the **show interfaces pos** command requires a shelf number in the format **show interfaces pos** *shelf-number/port-adapter-slot-number/interface-port*. (For example the command **show interfaces pos 5/3/0** specifies the OC-3 interface of a PA-POS-OC3 in port adapter slot 3 of router shelf 5.)

Cisco 7301 Router

Following is an example of the `show interfaces` command for Cisco 7301 routers. Most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
outer# show interfaces
GigabitEthernet0/0 is up, line protocol is up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c1b (bia 0005.dd2c.7c1b)
  Internet address is 10.1.3.153/16
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 100Mb/s, media type is RJ45
  output flow-control is off, input flow-control is off
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 00:00:01, output 00:00:07, output hang never
  Last clearing of "show interface" counters 19:00:50
  Input queue:0/75/63658/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)

GigabitEthernet0/1 is up, line protocol is up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c1a (bia 0005.dd2c.7c1a)
  Internet address is 192.18.1.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 5/255, rxload 6/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s, link type is autonegotiation, media type is SX
  output flow-control is off, input flow-control is off
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 18:56:46, output 00:00:09, output hang never
  Last clearing of "show interface" counters 19:00:52
  Input queue:0/75/16176489/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)

GigabitEthernet0/2 is up, line protocol is up
  Hardware is BCM1250 Internal MAC, address is 0005.dd2c.7c19 (bia 0005.dd2c.7c19)
  Internet address is 1.1.1.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 5/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
```

```
    Full-duplex, 1000Mb/s, link type is autonegotiation, media type is SX
    output flow-control is off, input flow-control is off
    ARP type:ARPA, ARP Timeout 04:00:00
    Last input 00:04:42, output 00:00:01, output hang never
    Last clearing of "show interface" counters 19:00:54
    Input queue:0/75/22087/0 (size/max/drops/flushes); Total output drops:0

(display text omitted)
```

Cisco 7401ASR Routers

Following is an example of the **show interfaces** command for a PA-POS-OC3 in port adapter slot 1of a
Cisco 7401ASR router:

```
Router# show interfaces pos 1/0
POS1/0 is administratively down, line protocol is down
  Hardware is Packet over Sonet
  MTU 4470 bytes, BW 155000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
            0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     10 packets output, 234 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffers copied, 0 interrupts, 0 failures
     0 carrier transitions
```

VIP in Cisco 7000 Series and Cisco 7500 Series Routers

Following is an example of the **show interfaces** command for PA-POS-OC3 in port adapter slot 0 of a
VIP4 in interface processor slot 8 of a Cisco 7500 series router:

```
Router# show interfaces 8/0/0
POS8/0/0 is administratively down, line protocol is down
  Hardware is cyBus Packet over Sonet
  MTU 4470 bytes, BW 155000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Scramble disabled
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy:fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles, 0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

Proceed to the next section "Using the ping Command to Verify Network Connectivity," to check
network connectivity between your network and the PA-POS-OC3 and router or switch.

Using the ping Command to Verify Network Connectivity

Using the **ping** command, you can verify that an interface port is functioning properly. This section provides a brief description of this command. Refer to the publications listed in the "Related Documentation" section on page viii for detailed command descriptions and examples.

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

Following is an example of a successful **ping** command to a remote server with the address 10.0.0.10:

```
Router# ping 10.0.0.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.0.0.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

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

Using loopback Commands

The loopback test allows you to troubleshoot, detect, and isolate equipment malfunctions by testing the connection between the OC-3 interface and a remote device. The **loopback** command places an interface in internal loopback (also called *local loopback*) or line loopback mode, which enables test packets that are generated from the **ping** command to loop through a remote device or a cable. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or the cable in the path of the loopback test.

Configuring an Interface for Internal Loopback

The default loopback setting is for no loopback. With internal (or local) loopback, packets from the router are looped back in the framer. Outgoing data gets looped back to the receiver without actually being transmitted. Internal loopback is useful for checking that the PA-POS-OC3 is working.
To configure an interface for internal loopback, enter the **loop internal** command:

```
Router(config)# interface pos 3/0
Router(config-if)# loop internal
```

To disable internal loopback, enter the **no loop internal** command.

Configuring an Interface for Line Loopback

The default loopback setting is for no loopback. With line loopback, the receive (RX) fiber is logically connected to the transmit (TX) optical fiber cable so that packets from the remote router are looped back to it. Incoming data gets looped around and retransmitted without actually being received. To configure an interface for line loopback, enter the **loop line** command:

```
Router(config)# interface pos 3/0
Router(config-if)# loop line
```

To disable line loopback, enter the **no loop line** command.

For complete descriptions of interface subcommands and the configuration options available for Cisco 7200, Cisco uBR7200 series, a Cisco 7401ASR router, and VIP interfaces, refer to the publications listed in the "Related Documentation" section on page viii.

PA-POS OC-3 Statistics Counters

The PA-POS-OC3 maintains counts of certain errors. Each error counter is 16 bits. Errors include the following:

- CRC errors—Packet corrupted in reception
- Giants received—Packet length too large (greater than 16 KB)
- Runts—Packet length too small (less than or equal to 4 bytes)
- Ignores—No receive buffers available; receive buffers full

PA-POS-OC3 Error Messages

The only error messages you should see are of the following type and format:

```
%POS-0-MSG:%DEBUGGER-0-STACK_DATA8: 00E0  FFFFFFFF 80057F50 00000000 00000000  FFFFFFFF
80032CD4 00000000 00000000
```

Note Contact the Technical Assistance Center (TAC) for assistance with this error message. To contact the TAC, see the "Obtaining Technical Assistance" section on page xii.

Back-to-Back Connection

This section provides an example of two sample configuration files from two Cisco 7200 series routers or two Cisco 7000 series or Cisco 7500 series routers (with a VIP) connected back-to-back through their OC-3 interfaces.

First router:

```
interface POS 3/0 <for a PA-POS-OC3 in a Cisco 7200 series router>
interface POS 3/0/0 <for a PA-POS-OC-3 on a VIP2 or VIP4>
ip address 10.0.0.10
no keepalive
pos internal-clock
```

Second router:

```
interface POS 3/0 <for a PA-POS-OC3 in a Cisco 7200 series router>
interface POS 3/0/0 <for a PA-POS-OC3 on a VIP2 or VIP4>
ip address 10.0.0.20
no keepalive
```

To connect two PA-POS-OC3-equipped routers back to back, attach the appropriate cable between the OC-3 interface port on each PA-POS-OC3.

By default, the PA-POS-OC3 uses loop-timing mode. To specify that the PA-POS-OC3 generates the transmit clock internally, add the **clock source internal** command to your configuration (see the first router example above: *pos internal-clock*).

Note   For back-to-back operation, at least one of the OC-3 interfaces *must* be configured to supply its internal clock to the line.