



## PA-A3 Enhanced ATM Port Adapter Installation and Configuration

Product Number: PA-A3-E3, PA-A3-OC3MM, PA-A3-OC3SMI, PA-A3-OCSML, PA-A3-T3

Platforms Supported: Catalyst 5000 Family Switches with RSM/VIP2, Catalyst 6000 Family Switches with Catalyst 6000 Family FlexWAN Module, Cisco 7100 Series Routers, Cisco 7200 Series Routers, Cisco 7200 VXR Routers, Cisco uBR7200 Series Routers, Cisco 7201 Router, Cisco 7301 Router, Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 Router, Cisco 7401ASR Router, and VIP in the Cisco 7000 Series Routers and Cisco 7500 Series Routers

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## Preface

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

- [Document Revision History, page vii](#)
- [Audience, page vii](#)
- [Objectives, page viii](#)
- [Organization, page ix](#)
- [Related Documentation, page ix](#)
- [Obtaining Documentation, Obtaining Support, and Security Guidelines, page xiii](#)

## Document Revision History

The Document Revision History table below, beginning with version OL-5117-02, records technical changes to this document.

Document Version	Date	Change Summary
OL-5117-02	April, 2007	Adds Cisco 7201 router information.

## Audience

This guide is intended for system installers and technicians who physically install and connect the Cisco PA-A3 Enhanced ATM port adapters and associated equipment. System installers and technicians should be familiar with their plant's base operating parameters and service offerings.



**Warning**

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

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Statement numbers (Statement 1030) at the end of a Warning refer to specific warnings and their translations in the *Regulatory Compliance and Safety Information for Cisco uBR7200 Series Universal Broadband Routers* document.



Note

This document replaces OL-3069-02.

## Objectives

This document describes how to install and configure the Cisco PA-A3 Enhanced ATM port adapters (PA-A3-E3, PA-A3-OC3MM, PA-A3-OC3SMI, PA-A3-OCSML, and PA-A3-T3), hereafter referred to as the PA-A3, which are supported on the following platforms:

- Catalyst 5000 family switches with the Route Switch Module (RSM)/second-generation Versatile Interface Processor (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 and Cisco 7200 VXR routers, consisting of the two-slot Cisco 7202, the four-slot Cisco 7204 and Cisco 7204VXR, and the six-slot Cisco 7206 and Cisco 7206VXR



Note

The Cisco 7206VXR and the Cisco 7206 routers can be used as router shelves in a Cisco AS5800 Universal Access Server. For more information about the Cisco 7206VXR and the Cisco 7206 routers as router shelves, see the Cisco AS5800 Universal Access Server documentation listed in the [“Related Documentation” section on page ix](#).

- Cisco uBR7200 series routers, consisting of the three-slot (two cable modem card slots and one port adapter slot) Cisco uBR7223, and the six-slot (four cable modem card slots and two port adapter slots) Cisco uBR7246 and Cisco uBR7246 VXR.



Note

Currently, the Cisco uBR7246 VXR supports only the PA-A3-OC3MM, PA-A3-OC3SMI, and PA-A3-OC3SML port adapters. In the future, however, the Cisco uBR7246 VXR will support both the PA-A3-E3 and PA-A3-T3 port adapters.

- Cisco 7201 router
- Cisco 7301 router
- Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 router
- Cisco 7401ASR router
- Second-generation Versatile Interface Processor (VIP2) in Cisco 7500 series routers and in Cisco 7000 series routers using the Cisco 7000 Series Router Switch Processor (RSP7000) and Cisco 7000 Series Chassis Interface (RSP7000CI)
- Fourth-generation Versatile Interface Processor (VIP4) in Cisco 7500 series routers and in Cisco 7000 series routers using the Cisco 7000 Series Route Switch Processor (RSP7000) and Cisco 7000 Series Chassis Interface (RSP7000CI)



# Organization

This hardware installation guide is organized into the following chapters:

Chapter Title	Description
<a href="#">Chapter 1, “PA-A3 Overview”</a>	Describes the PA-A3 port adapter, its LEDs cables, connectors, and its fiber-optic transmission specifications.
<a href="#">Chapter 2, “Preparing for Installation”</a>	Describes safety considerations, tools required, and procedures you should perform before the actual installation.
<a href="#">Chapter 3, “Removing and Installing Port Adapters”</a>	Provides instructions for installing the PA-A3 in supported platforms and for connecting cables.
<a href="#">Chapter 4, “Configuring the PA-A3”</a>	Describes how to configure the PA-A3 on supported platforms.

## Related Documentation

Your router 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 5000 family switches with RSM/VIP2:
  - For an online directory to quickly access documents for Cisco Catalyst 5000 series switches, refer to the *Cisco Catalyst 5000 Series Switches Install and Upgrade Guides* index at the following URL:  
[http://www.cisco.com/en/US/products/hw/switches/ps679/prod\\_installation\\_guides\\_list.html](http://www.cisco.com/en/US/products/hw/switches/ps679/prod_installation_guides_list.html)
  - For hardware installation and maintenance information, refer to the following documents:
    - *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 and quick start for your Cisco Catalyst 5000 series 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*
- Catalyst 6000 family switches with FlexWAN module:
  - For an online directory to quickly access documents for Cisco Catalyst 6000 family switches, refer to the *Cisco Catalyst 6500 Series Switches Documentation Roadmaps* index at the following URL:  
[http://www.cisco.com/en/US/products/hw/switches/ps708/products\\_documentation\\_roadmaps\\_list.html](http://www.cisco.com/en/US/products/hw/switches/ps708/products_documentation_roadmaps_list.html)
  - For hardware installation and maintenance information, refer to the following documents:
    - *Catalyst 6000 Family FlexWAN Module Installation and Configuration Note*
    - The hardware and software publications for your Catalyst 6000 family switch
- Cisco 7000 series routers:
  - For an online directory to quickly access documents for Cisco 7000 series routers, refer to the *Cisco 7000 Series Routers Introduction* index at the following URL:  
[http://www.cisco.com/en/US/products/hw/routers/ps332/tsd\\_products\\_support\\_eol\\_series\\_home.html](http://www.cisco.com/en/US/products/hw/routers/ps332/tsd_products_support_eol_series_home.html)
  - For hardware installation and maintenance information, refer to the following documents:
    - *Cisco 7000 Hardware Installation and Maintenance* for 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 Guide*
- Cisco 7100 series routers:
  - For an online directory to quickly access documents for Cisco 7100 series routers, refer to the *Cisco 7100 Series Documentation* roadmap at the following URL:  
[http://www.cisco.com/en/US/products/hw/vpndevc/ps333/products\\_product\\_index09186a00800fa142.html](http://www.cisco.com/en/US/products/hw/vpndevc/ps333/products_product_index09186a00800fa142.html)
  - For hardware installation and configuration information refer to the *Cisco 7100 Series VPN Router Installation and Configuration Guide*.
  - For information on setting up a Virtual Private Network, refer to the *Cisco 7100 Series VPN Configuration Guide*.

- Cisco 7200 series routers:
  - For an online directory to quickly access documents for Cisco 7200 series routers, refer to the *Cisco 7200 Series Routers Documentation Roadmap* at the following URL:  
[http://www.cisco.com/en/US/products/hw/routers/ps341/products\\_documentation\\_roadmap09186a00801c0915.html](http://www.cisco.com/en/US/products/hw/routers/ps341/products_documentation_roadmap09186a00801c0915.html)
  - For hardware installation and configuration information (including the Cisco 7206 or Cisco 7206VXR as a router shelf in a Cisco AS5800 Universal Access Server), refer to the online installation and configuration guide and quick start for your Cisco 7200 series router.
  - For port adapter hardware and memory configuration guidelines, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.
  - For information on network processing engines or network services engines, refer to the *Network Processing Engine and Network Services Engine Installation and Configuration* document.
- Cisco 7200 VXR routers:
  - For an online directory to quickly access documents for Cisco 7200 VXR routers, refer to the *Cisco 7200 Series Routers Documentation Roadmap* at the following URL:  
[http://www.cisco.com/en/US/products/hw/routers/ps341/products\\_documentation\\_roadmap09186a00801c0915.html](http://www.cisco.com/en/US/products/hw/routers/ps341/products_documentation_roadmap09186a00801c0915.html)
  - For hardware installation and maintenance information, refer to the *Cisco 7200 VXR Installation and Configuration Guide* or the *Cisco 7200 VXR Routers Quick Start Guide*.
- Cisco uBR7200 series routers:
  - For an online directory to quickly access documents for Cisco uBR7200 Universal Broadband routers, refer to the *Cisco uBR7200 Universal Broadband Router Documentation Roadmap* at the following URL:  
[http://www.cisco.com/en/US/products/hw/cable/ps2217/products\\_documentation\\_roadmap09186a00805e0d0c.html](http://www.cisco.com/en/US/products/hw/cable/ps2217/products_documentation_roadmap09186a00805e0d0c.html)
- Cisco 7201 router:
  - For an online directory to quickly access documents for the Cisco 7201 router, refer to the *Cisco 7201 Router Documentation Roadmap* at the following URL:  
[http://www.cisco.com/en/US/customer/products/hw/routers/ps341/products\\_documentation\\_roadmap09186a00807f635a.html](http://www.cisco.com/en/US/customer/products/hw/routers/ps341/products_documentation_roadmap09186a00807f635a.html)
  - For hardware installation and maintenance information, refer to the *Cisco 7201 Installation and Configuration Guide* or the *Cisco 7201 Router Quick Start Guide*.
- Cisco 7301 router:
  - For an online directory to quickly access documents for the Cisco 7301 router, refer to the *Cisco 7301 Internet Router Documentation Roadmap* at the following URL:  
[http://www.cisco.com/en/US/products/hw/routers/ps352/products\\_documentation\\_roadmap09186a00801c0f21.html](http://www.cisco.com/en/US/products/hw/routers/ps352/products_documentation_roadmap09186a00801c0f21.html)
  - 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 router:
  - For an online directory to quickly access documents for the Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7301 router, refer to the *Cisco 7304 Router Line Card, Carrier Card, Port Adapter, Modular Services Card, and Shared Port Adapter Documentation Roadmap* at the following URL:
   
[http://www.cisco.com/en/US/products/hw/routers/ps352/products\\_documentation\\_roadmap09186a00801c0f5e.html](http://www.cisco.com/en/US/products/hw/routers/ps352/products_documentation_roadmap09186a00801c0f5e.html)
  - For hardware installation and maintenance information, refer to the *Cisco 7304 PCI Port Adapter Carrier Card Installation and Configuration Guide*.
- Cisco 7401ASR router:
  - For an online directory to quickly access documents for the Cisco 7401ASR router, refer to the *Cisco 7401ASR Router Documentation Roadmap* at the following URL:
   
[http://www.cisco.com/en/US/products/hw/routers/ps354/products\\_documentation\\_roadmap09186a00801c0fd5.html](http://www.cisco.com/en/US/products/hw/routers/ps354/products_documentation_roadmap09186a00801c0fd5.html)
  - For hardware installation and maintenance information, refer to the *Cisco 7401ASR Installation and Configuration Guide* or the *Cisco 7401ASR Router Quick Start Guide*.
- Cisco 7500 series routers:
  - For an online directory to quickly access documents for the Cisco 7500 series routers, refer to the *Cisco 7500 Series Routers Documentation Roadmap* at the following URL:
   
[http://www.cisco.com/en/US/products/hw/routers/ps359/products\\_documentation\\_roadmap09186a00801c0f9b.html](http://www.cisco.com/en/US/products/hw/routers/ps359/products_documentation_roadmap09186a00801c0f9b.html)
  - For hardware installation and maintenance information, refer to the following documents:
    - *Cisco 7500 Series Installation and Configuration Guide* or the quick start for your Cisco 7500 series 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 Guide*
- For international agency compliance, safety, and statutory information for WAN interfaces, refer to the following documents. Use the documentation roadmap for your particular router to link to the appropriate documents for your router:
  - *Regulatory Compliance and Safety Information for the Catalyst 5000 Family Switches*
  - *Regulatory Compliance and Safety Information for the Catalyst 6000 Family Switches*
  - *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 Routers*
  - *Regulatory Compliance and Safety Information for the Cisco 7301 Internet Router*
  - *Regulatory Compliance and Safety Information for the Cisco 7304 Internet Router*
  - *Regulatory Compliance and Safety Information for the Cisco 7401ASR Internet Router*
  - *Regulatory Compliance and Safety Information for the Cisco 7500 Series Routers*

# Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and also recommended aliases and general Cisco documents, see the monthly What's New in Cisco Product Documentation, which also lists all new and revised technical documentation at:

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





# CHAPTER 1

## PA-A3 Overview

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This chapter describes the PA-A3 Enhanced ATM port adapter and contains the following sections:

- [Port Adapter Overview, page 1-1](#)
- [LEDs, page 1-4](#)
- [Cables and Connectors, page 1-5](#)
- [Port Adapter Slot Locations on the Supported Platforms, page 1-12](#)
- [Identifying Interface Addresses, page 1-21](#)

## Port Adapter Overview

The PA-A3 is a series of single-width, single-port, ATM port adapters that provide advanced ATM hardware and software features for the Catalyst 5000 family switches with RSM/VIP2, Catalyst 6000 family switches with FlexWAN module, Cisco 7100 series routers, Cisco 7200 series routers, Cisco 7200 VXR routers, Cisco uBR7200 series routers, Cisco 7201 router, Cisco 7301 router, Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 router, Cisco 7401ASR router, and Cisco 7000 series routers and Cisco 7500 series routers with VIP.

The PA-A3 includes five hardware versions that support the following standards-based physical interfaces:

- E3—PA-A3-E3 (See [Figure 1-1 on page 1-2.](#))
- OC-3c/STM-1 (See [Figure 1-2 on page 1-2.](#))
  - Multimode—PA-A3-OC3MM
  - Single-mode intermediate reach—PA-A3-OC3SMI
  - Single-mode long reach—PA-A3-OC3SML
- T3—PA-A3-T3; supports the digital signal level 3 (DS-3) framing specification (See [Figure 1-3 on page 1-2.](#))



**Note**

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To allow a full view of the port adapter faceplate detail, port adapter handles are not shown.

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Figure 1-1 PA-A3-E3

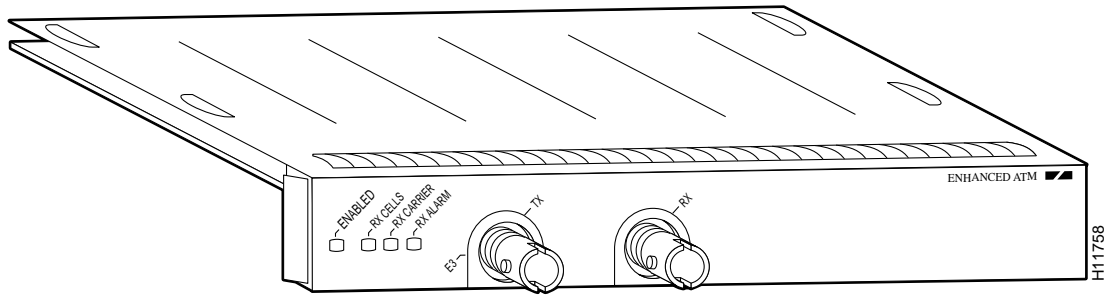
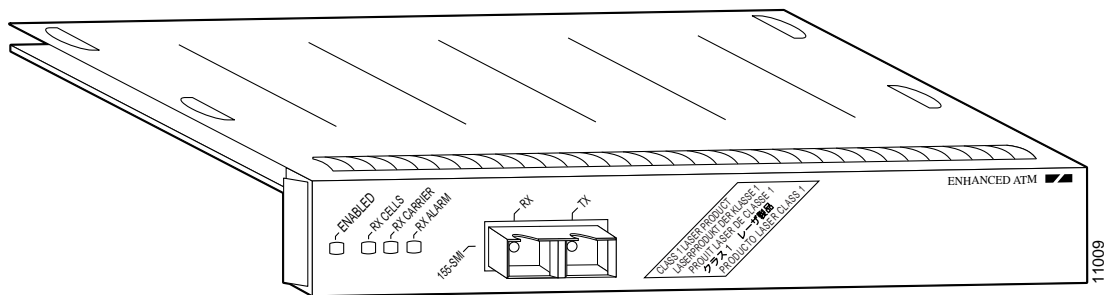
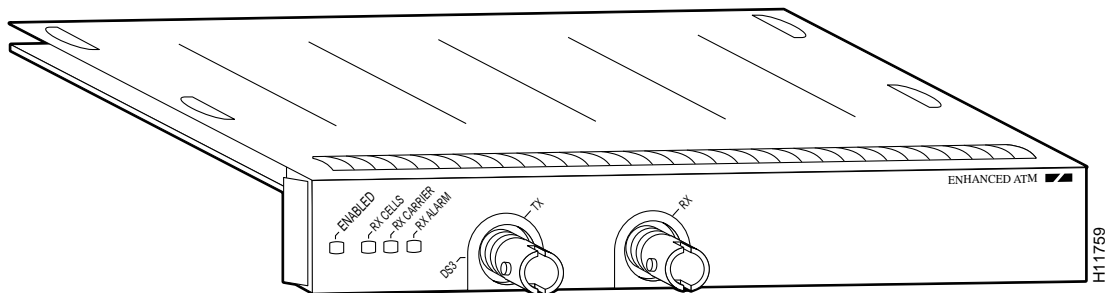


Figure 1-2 PA-A3-OC3SMI

**Note**

The PA-A3-OC3MM and the PA-A3-OC3SML have faceplates identical to that of the PA-A3-OC3SMI shown in [Figure 1-2](#).

Figure 1-3 PA-A3-T3

**Note**

Traffic from multiple ATM network interfaces could exceed the bandwidth of the CyBus (Catalyst RSM/VIP2, Catalyst 6000 family FlexWAN module, and VIP only), causing packets to be dropped. There is no physical limit on the number of VIP and ATM PA-A3 combinations that can be installed in the same Cisco 7500 series router up to the total that the chassis supports. (For example, a Cisco 7513 can physically have up to 11 VIPs.) However, the Cisco 7500 series backplane bandwidth is finite; if you install three or more VIP and ATM PA-A3 combinations, you need be aware of the Cisco 7500 series bandwidth characteristics. See the [“Related Documentation” section on page ix](#) for documentation related to bandwidth information.



## Features

The PA-A3 supports the following features:

- Up to 4096 simultaneously available virtual circuits (VCs)



---

**Note** On the Catalyst 6000 family FlexWAN module, each PA-A3 supports up to 1024 VCs.

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- Up to 1024 simultaneous segmentations and reassemblies (SARs)
- ATM adaptation layer 5 (AAL5) for data traffic
- Physical interfaces: DS-3 and E3 electrical coaxial cable (models PA-A3-T3 and PA-A3-E3 respectively) ITU G.703; SONET/SDH (software selectable) optical fiber (OC-3c or STM-1)
- Traffic shaping on a per-VC basis
- IP-to-ATM class of service (CoS)
- Non-real-time variable bit rate (nrt-VBR), unspecified bit rate (UBR), and available bit rate (ABR) quality of service (QoS)
- Operation, Administration, and Maintenance alarm indication signal (OAM AIS) cells
- Online insertion and removal (OIR) on the Cisco 7100 series routers, Cisco 7200 series routers, Cisco 7200 VXR routers, Cisco uBR7200 series routers, Cisco 7201 router, Cisco 7301 router, and Cisco 7401ASR router.
- LAN Emulation (LANE)



---

**Note** LANE is not supported on the PA-A3 when installed Catalyst 6000 family FlexWAN module.

---

The PA-A3 supports the following protocols, services, and ATM-specific software:

- User-Network Interface (UNI) signaling
- Integrated Local Management Interface (ILMI)
- RFC 1483



**Tip**

The FlexWAN supports hardware bridging of RFC 1483. For configuration information, go to the following URL:

[http://www.cisco.com/en/US/products/hw/routers/ps368/products\\_configuration\\_guide\\_chapter09186a00801e5c05.html](http://www.cisco.com/en/US/products/hw/routers/ps368/products_configuration_guide_chapter09186a00801e5c05.html)

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- RFC 1577

The PA-A3 complies with the environmental specifications listed in [Table 1-1](#).

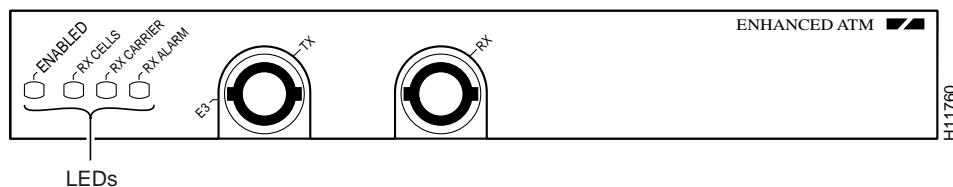
**Table 1-1 PA-A3 Environmental Specifications**

Specification	Description
Environmental	
Operating temperature	50 to 104°F (10 to 40°C)
Humidity	0 to 90%, noncondensing

## LEDs

The PA-A3, shown in [Figure 1-4](#), has one row of three status LEDs and one ENABLED LED.

**Figure 1-4 PA-A3 LEDs—Front Panel View**



After system initialization, the ENABLED LED goes on, indicating that the port adapter has been enabled for operation.

The following conditions must be met before the PA-A3 is enabled:

- The PA-A3 is correctly connected and is receiving power.
- A valid system software image for the port adapter has been downloaded successfully.
- The system recognizes the PA-A3.

If any of these conditions are not met, or if the initialization fails for other reasons, the ENABLED LED does not go on.

[Table 1-2](#) lists LED colors and indications.

**Table 1-2 PA-A3 Port LEDs**

LED Label	Color	State	Function
ENABLED	Green	On	Indicates that the PA-A3 is enabled for operation.
RX CELLS	Green	On	Indicates that the PA-A3 has received an ATM cell.
RX CARRIER	Green	On	Indicates that the PA-A3 has detected a carrier on the receiver cable. For a fiber-optic interface, this means that light is detected, and a valid frame is detected.
RX ALARM	Red	On	Indicates that the PA-A3 has detected an alarm condition.

# Cables and Connectors

The PA-A3 interfaces are full duplex. You must use the appropriate ATM interface cable to connect the PA-A3 with an external ATM network.

Table 1-3 summarizes the PA-A3 interface types, connectors, and cables.

**Table 1-3 PA-A3 Interface Cable Specifications**

Interface	Rate (Mbps)	Conn Type	Cable Type	TU-T G.957 Standard	Bellcore GR-253 Standard	Wavelength	Maximum Distance
T3	44.736	BNC	Coaxial	—	—	—	450 ft (137.2 m)
E3	34.368	BNC	Coaxial	—	—	—	1250 ft (381 m)
OC-3c/STM-1 multimode	155.52	SC	62.5/125 microns multimode	Intra-office STM-1 I-1	Short-reach OC-3c	1310 nm	1.2 mi (2 km)
OC-3c/STM-1 single-mode intermediate reach	155.52	SC	9 microns single-mode	Short-haul STM-1 S-1.1	Intermediate-reach OC-3c	1310 nm	9.3 mi (15 km)
OC-3c/STM-1 single-mode long reach	155.52	SC	9 microns single-mode	Long-haul STM-1 L-1.1	Long-reach OC-3c	1310 nm	24.8 mi (40 km)

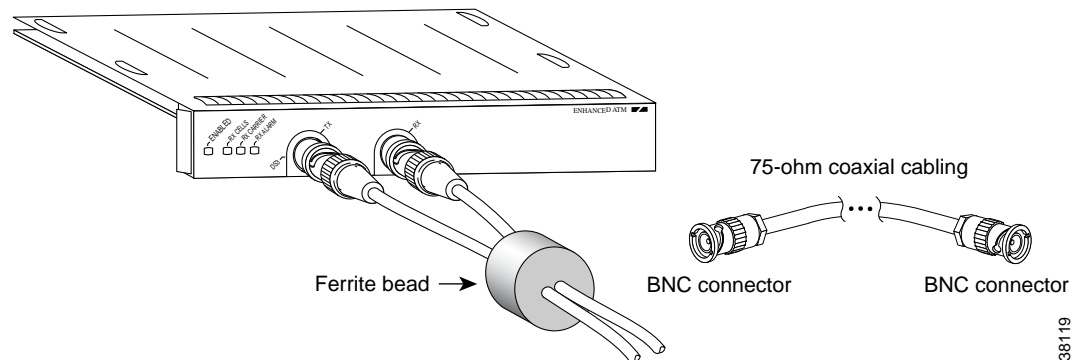


**Note** The PA-A3 is considered an ATM end-point device.

## T3 and E3 Cables and Connectors

The PA-A3-T3 and PA-A3-E3 port adapters use a 75-ohm coaxial interface cable to connect your router to an ATM T3 or E3 network. The coaxial cables (see Figure 1-5) conform to EIA/TIA-612 and EIA/TIA-613 specifications, and they have BNC connectors.

**Figure 1-5 PA-A3-T3 and PA-A3-E3 Cables**



38119

A single PA-A3-T3 or PA-A3-E3 contains one ATM T3 or E3 port that consists of two connectors: receive and transmit. The Cisco 75-ohm coaxial cable has two BNC connectors that attach to the T3 or E3 port receptacles.

The T3/E3 75-ohm coaxial cable, which comes with attached ferrite bead (see [Figure 1-5](#)), is available from Cisco in 10 foot (3.04 meters) lengths. The typical maximum distance between stations for T3 transmissions is 450 feet (137.2 meters) and for E3 transmissions is 1300 feet (396 meters).

**Note**

To ensure compliance with electromagnetic interference (EMI) and European certification standards for emission control (EN55022/CISPR22 Class B for radiated emission levels), the TX and RX cables should be tied together along their entire length, and ferrite beads should be installed on each cable near the TX and RX connectors.

The PA-A3-T3 and PA-A3-E3 provide an interface to ATM switching fabrics for the bidirectional transmission and reception of data at rates of up to 45 Mbps (for T3) and 34 Mbps (for E3).

## OC-3c Multimode and Single-Mode Cables and Connectors

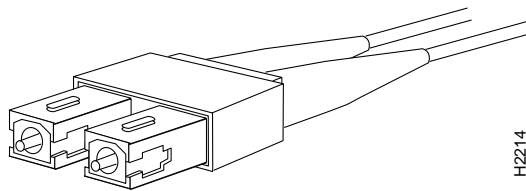
The PA-A3-OC3 port adapters provide an interface to ATM switching fabrics for transmitting and receiving data at rates of up to 155 Mbps bidirectionally. The PA-A3-OC3 port adapters connect to the SONET/SDH 155-Mbps multimode or single-mode optical fiber. The OC-3c port on the PA-A3 is considered a DTE device.

For SONET/SDH multimode and SONET/SDH single-mode connections, use one duplex SC connector (see [Figure 1-6](#)) or two simplex SC connectors (see [Figure 1-7](#)). The SC connector is shipped with removable dust covers on each connector.

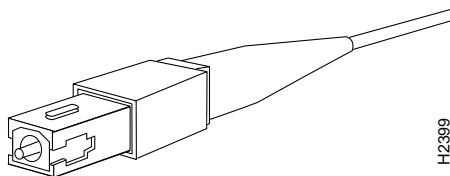
**Note**

For information on SONET specifications for fiber-optic transmissions, understanding power budget, and assistance with approximating the power margin for multimode and single-mode transmissions, see the [“Additional Information”](#) section on page 1-7.

**Figure 1-6 Duplex SC Connector**



**Figure 1-7 Simplex SC Connector**



An appropriate fiber optic cable must be used to connect the PA-A3-OC3 to the ATM switch or circuit. These cables are available from Cisco as well as from commercial vendors.

Single-mode and multimode cables should perform to the specifications listed in [Table 1-4](#).



**Note** A single fiber link should not mix 62.5- and 50-micron cable.

**Table 1-4** *Fiber-Optic Cable Specifications*

Standard	Maximum Path Length	Cabling
ISO/IEC 9314-3	1.2 miles (2 km) all cables in a connection, end to end	62.5-micron core with an optical loss of 0–9 dB, or 50-micron core with an optical loss of 7 dB
IEC 793-2	24.8 miles (40 km) for SML and 9.3 mi (15 km) for SMI	9-micron core
ANSI/TIA/EIA-492CAAA	24.8 miles (40 km) for SML and 9.3 miles (15 km) for SMI	9-micron core

## Additional Information

This section describes the SONET specifications for fiber-optic transmissions, defines the power budget, and helps you approximate the power margin for multimode and single-mode transmissions. This section includes the following subsections:

- [SONET Distance Limitations, page 1-7](#)
- [SONET Frame Fundamentals, page 1-8](#)
- [Power Budget, page 1-9](#)
- [Approximating the PA-A3 Power Margin, page 1-10](#)
- [Multimode Power Budget Example with Sufficient Power for Transmission, page 1-11](#)
- [Multimode Power Budget Example of Dispersion Limit, page 1-11](#)
- [Single-Mode Transmission, page 1-11](#)
- [Using Statistics to Estimate the Power Budget, page 1-12](#)
- [References on Determining Attenuation and Power Budget, page 1-12](#)

## SONET Distance Limitations

The SONET specification for fiber-optic transmission defines two types of fiber: single mode and multimode. 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, whereas multimode fiber allows multiple modes of light to propagate through the fiber. Because multiple modes of light propagating through the fiber travel different distances depending on the entry angles, causing them to arrive at the destination at different times (a phenomenon called modal dispersion), single-mode fiber is capable of higher bandwidth and greater cable run distances than multimode fiber.

The typical maximum distances for single-mode and multimode transmissions, as defined by SONET, are in [Table 1-5](#). If the distance between two connected stations is greater than this maximum distance, significant signal loss can result, making transmission unreliable.

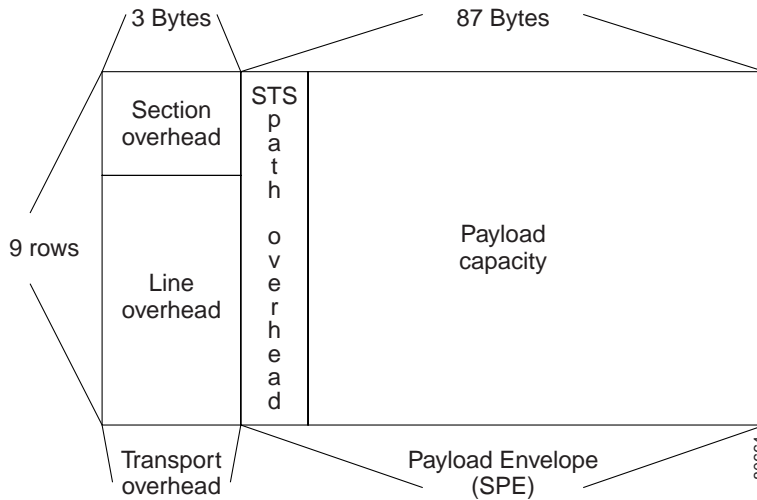
**Table 1-5** SONET Maximum Fiber-Optic Transmission Distances

Transceiver Type	Maximum Distance Between Stations
Single-mode long reach (SML)	Up to 24.8 miles (40 kilometers)
Single-mode intermediate reach (SMI)	Up to 9.3 miles (15 kilometers)
Multimode (MM)	Up to 1.2 miles (2 kilometers)

## SONET Frame Fundamentals

SONET is a Layer 1 protocol that uses a layered architecture. The following illustration shows SONET's three layers: section, line, and path. The Section OverHead (SOH) and Line OverHead (LOH) form the Transport OverHead (TOH), while the Path OverHead (POH) and actual payload form the Synchronous Payload Envelope (SPE). (See [Figure 1-8](#).)

**Figure 1-8** Three SONET Layers of a SONET Frame



Each layer adds some number of overhead bytes to the SONET frame.

Table 1-6 illustrates the overhead bytes of the SONET frame.

**Table 1-6 Overhead Bytes of the SONET Frame**

				Path Overhead
<b>Section Overhead</b>	A1 Framing	A2 Framing	A3 Framing	J1 Trace
	B1 BIP-8	E1 Orderwire	E1 User	B3 BIP-8
	D1 Data Com	D2 Data Com	D3 Data Com	C2 Signal Label
	H1 Pointer	H2 Pointer	H3 Pointer	G1 Path Status
<b>Line Overhead</b>	B2 BIP-8	K1	K2	F2 User Channel
	D4 Data Com	D5 Data Com	D6 Data Com	H4 Indicator
	D7 Data Com	D8 Data Com	D9 Data Com	Z3 Growth
	D10 Data Com	D11 Data Com	D12 Data Com	Z4 Growth
	S1/Z1 Sync Status/Growth	M0 or M1/Z2 REI-L Growth	E2 Orderwire	Z5 Tandem Connection

## Power Budget

To design an efficient optical data link, evaluate the power budget. The power budget is the amount of light available to overcome attenuation in the optical link and to exceed the minimum power that the receiver requires to operate within its specifications. Proper operation of an optical data link depends on modulated light reaching the receiver with enough power to be correctly demodulated.

Attenuation, caused by the passive media components (cables, cable splices, and connectors), is common to both multimode and single-mode transmission.

The following variables reduce the power of the signal (light) transmitted to the receiver in multimode transmission:

- Chromatic dispersion (spreading of the signal in time because of the different speeds of light wavelengths)
- Modal dispersion (spreading of the signal in time because of the different propagation modes in the fiber)

Attenuation is significantly lower for optical fiber than for other media. For multimode transmission, chromatic and modal dispersion reduce the available power of the system by the combined dispersion penalty. The power lost over the data link is the sum of the component, dispersion, and modal losses.

Table 1-7 lists the factors of attenuation and dispersion for typical fiber-optic cable.

**Table 1-7 Typical Fiber-Optic Link Attenuation and Dispersion Limits**

Limits	Single Mode	Multimode
Attenuation	0.5 dB/km	1.0 dB/km
Dispersion	No limit	500 MHz/km <sup>1</sup>

1. The product of bandwidth and distance must be less than 500 MHz/km.

## Approximating the PA-A3 Power Margin

The LED used for a multimode transmission light source creates multiple propagation paths of light, each with a different path length and time requirement to cross the optical fiber, causing signal dispersion (smear). Higher-order mode loss (HOL) results from light from the LED entering the fiber and being radiated into the fiber cladding. A worst-case estimate of power margin (PM) for multimode transmissions assumes minimum transmitter power (PT), maximum link loss (LL), and minimum receiver sensitivity (PR). The worst-case analysis provides a margin of error; not all of the parts of an actual system will operate at the worst-case levels.

The power budget (PB) is the maximum possible amount of power transmitted. The following equation lists the calculation of the power budget:

$$\begin{aligned} PB &= PT - PR \\ PB &= -20 \text{ dBm} - (-30 \text{ dBm}) \\ PB &= 10 \text{ dBm} \end{aligned}$$

The power margin calculation is derived from the power budget minus the link loss, as follows:

$$PM = PB - LL$$

If the power margin is positive, as a rule, the link will work.

Table 1-8 lists the factors that contribute to link loss and the estimate of the link loss value attributable to those factors.

**Table 1-8** Link Loss Factors and Values

Link Loss Factor	Estimate of Link Loss Value
Higher-order mode losses	0.5 dB
Clock recovery module	1 dB
Modal and chromatic dispersion	Dependent on fiber and wavelength used
Connector	0.5 dB
Splice	0.5 dB
Fiber attenuation	1 dB/km

After you calculate the power budget minus the data link loss, the result should be greater than zero. Circuits with results that are less than zero may have insufficient power to operate the receiver.

The SONET specification requires that the signal must meet the worst-case parameters listed in Table 1-9.

**Table 1-9** PA-A3 Port Adapter SONET Signal Requirements

	Single Mode (SML)	Single Mode (SMI)	Multimode
PT	-5 dBm	-15 dBm	-20 dBm
PR	-34 dBm	-31 dBm	-30 dBm
PB	29 dBm	16 dBm	10 dBm



## Multimode Power Budget Example with Sufficient Power for Transmission

The following is a sample multimode power budget calculated based on the following variables:

Length of multimode link = 3 kilometers (km)

Four connectors

Three splices

Higher-order mode loss (HOL)

Clock recovery module (CRM)

Estimate the power budget as follows:

$$PB = 10 \text{ dB} - 3 \text{ km} (1.0 \text{ dB/km}) - 4 (0.5 \text{ dB}) - 3 (0.5 \text{ dB}) - 0.5 \text{ dB (HOL)} - 1 \text{ dB (CRM)}$$

$$PB = 10 \text{ dB} - 3 \text{ dB} - 2 \text{ dB} - 1.5 \text{ dB} - 0.5 \text{ dB} - 1 \text{ dB}$$

$$PB = 2 \text{ dB}$$

The positive value of 2 dB indicates that this link would have sufficient power for transmission.

## Multimode Power Budget Example of Dispersion Limit

Following is an example with the same parameters as the previous example, but with a multimode link distance of 4 km:

$$PB = 10 \text{ dB} - 4 \text{ km} (1.0 \text{ dB/km}) - 4 (0.5 \text{ dB}) - 3 (0.5 \text{ dB}) - 0.5 \text{ dB (HOL)} - 1 \text{ dB (CRM)}$$

$$PB = 10 \text{ dB} - 4 \text{ dB} - 2 \text{ dB} - 1.5 \text{ dB} - 0.5 \text{ dB} - 1 \text{ dB}$$

$$PB = 1 \text{ dB}$$

The value of 1 dB indicates that this link would have sufficient power for transmission. But due to the dispersion limit on the link (4 km x 155.52 MHz > 500 MHz/km), this link would not work with multimode fiber. In this case, single-mode fiber would be the better choice.

## Single-Mode Transmission

The single-mode signal source is an injection laser diode. Single-mode transmission is useful for longer distances, because there is a single transmission path within the fiber and smear does not occur. In addition, chromatic dispersion is also reduced because laser light is essentially monochromatic.

The receiver for single-mode intermediate reach (SMI) cannot be overloaded by the SMI transmitter and does not require a minimum fiber cable length or loss. The maximum receive power for single-mode long reach (SML) is -10 dBm, and the maximum transmit power is 0 dBm. The SML receiver can, therefore, be overloaded when short lengths of fiber are used. Overloading the receiver will not damage the receiver but can cause unreliable operation. To prevent overloading an SML receiver connected with short fiber links, insert a minimum 10-dB attenuator on the link between any single-mode long-reach transmitter and the receiver.

## Using Statistics to Estimate the Power Budget

Statistical models more accurately determine the power budget than the worst-case method. 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 UNI Forum specifications, ITU-T standards, and your equipment specifications.

## References on Determining Attenuation and Power Budget

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

This section discusses port adapter slot locations on the supported platforms. The illustrations that follow summarize slot location conventions on each platform:

- [Catalyst RSM/VIP2 Slot Numbering, page 1-13](#)
- [Catalyst 6000 Family FlexWAN Module Slot Numbering, page 1-14](#)
- [Cisco 7100 Series Routers Slot Numbering, page 1-15](#)
- [Cisco 7200 Series Routers and Cisco 7200 VXR Routers Slot Numbering, page 1-15](#)
- [Cisco uBR7200 Series Router Slot Numbering, page 1-16](#)
- [Cisco 7201 Router Slot Numbering, page 1-17](#)
- [Cisco 7301 Router Slot Numbering, page 1-18](#)
- [Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering, page 1-19](#)
- [Cisco 7401ASR Router Slot Numbering, page 1-20](#)
- [Cisco 7000 Series Routers and Cisco 7500 Series Routers VIP Slot Numbering, page 1-20](#)

## Catalyst RSM/VIP2 Slot Numbering

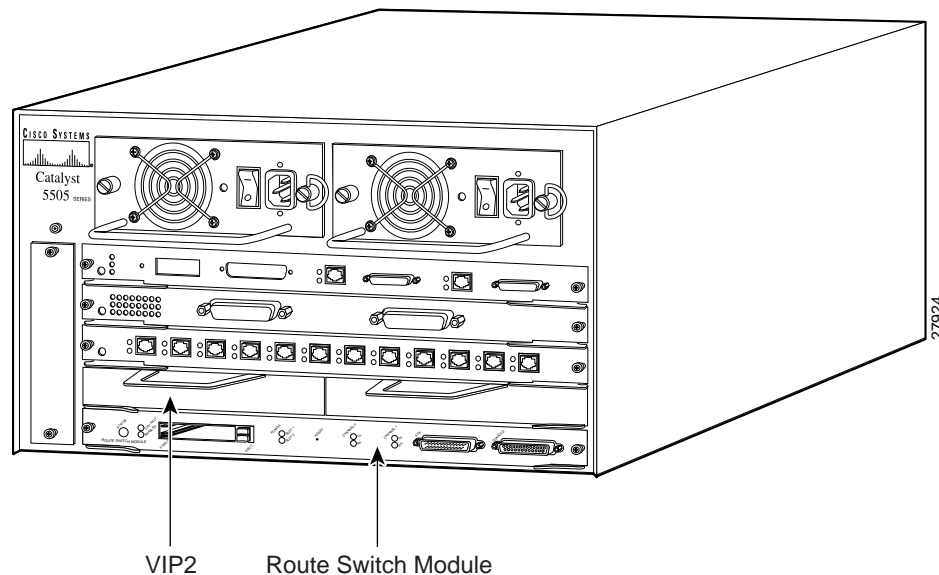
The Catalyst RSM/VIP2 can be installed in any slot in a Catalyst 5000 family switch except the top slots, which contain the supervisor engine modules. The Catalyst RSM/VIP2 does not use interface processor slot numbering; therefore, slots are not numbered. The PA-A3 can be installed into either port adapter slot 0 or 1 on a Catalyst RSM/VIP2. [Figure 1-9](#) 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 would 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 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 1-9** Catalyst 5000 Family Switch with Port Adapters Installed on Catalyst RSM/VIP2



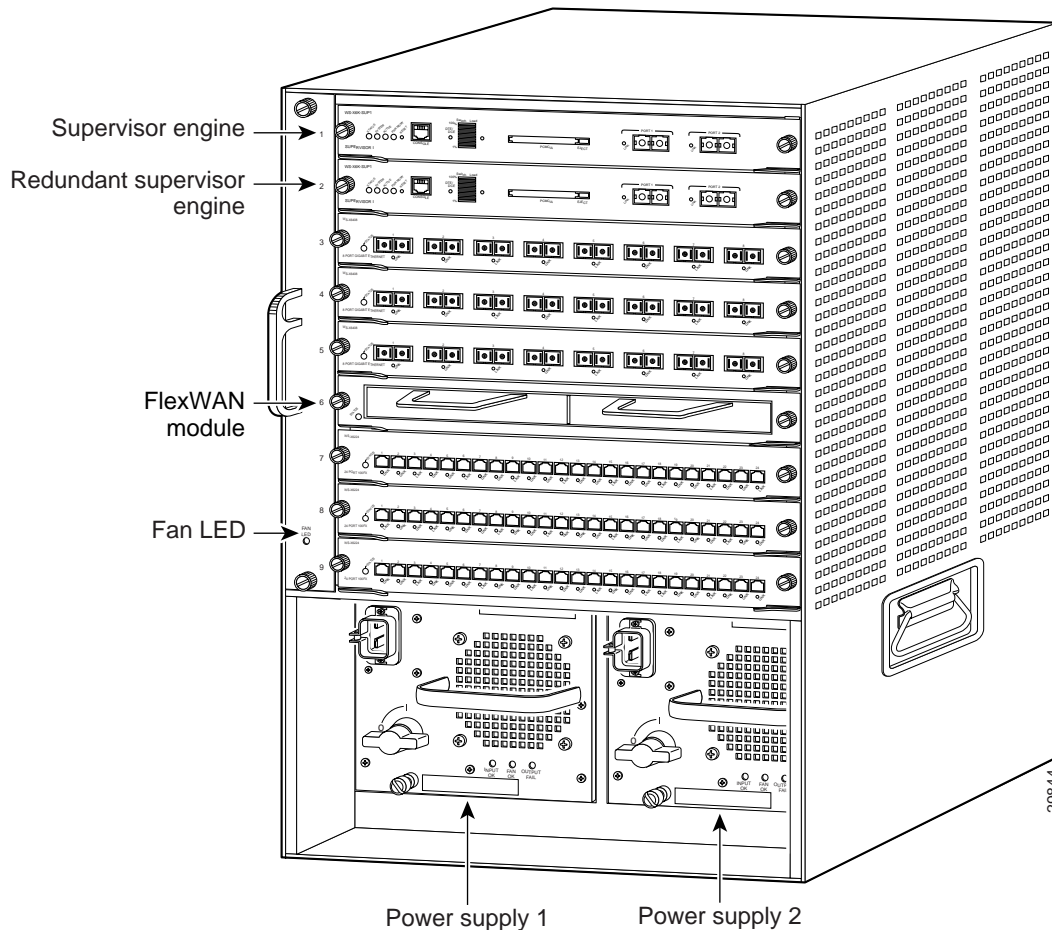
## Catalyst 6000 Family FlexWAN Module Slot Numbering

The Catalyst 6000 family FlexWAN module can be installed in any slot in a Catalyst 6000 family switch except slot 1, which is reserved for the supervisor engine. The PA-A3 can be installed into either port adapter bay 0 or bay 1 on a FlexWAN module. [Figure 1-10](#) 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.

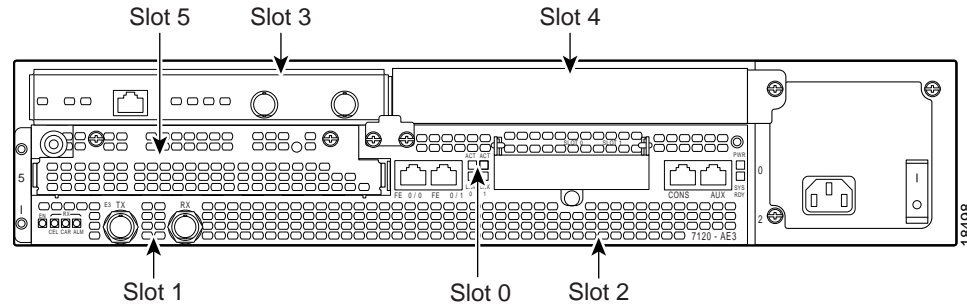
**Figure 1-10** Catalyst 6000 Family Switch with Port Adapters Installed on FlexWAN Module



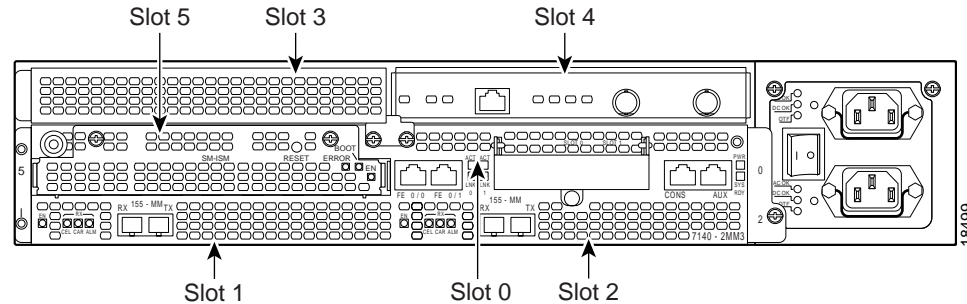
## Cisco 7100 Series Routers Slot Numbering

The PA-A3 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 1-11](#) shows the slot numbering on a Cisco 7120 series router. [Figure 1-12](#) shows the slot numbering on a Cisco 7140 series router.

**Figure 1-11** Port Adapter Slots in the Cisco 7120 Series Router



**Figure 1-12** Port Adapter Slots in the Cisco 7140 Series Router



## Cisco 7200 Series Routers and Cisco 7200 VXR Routers Slot Numbering

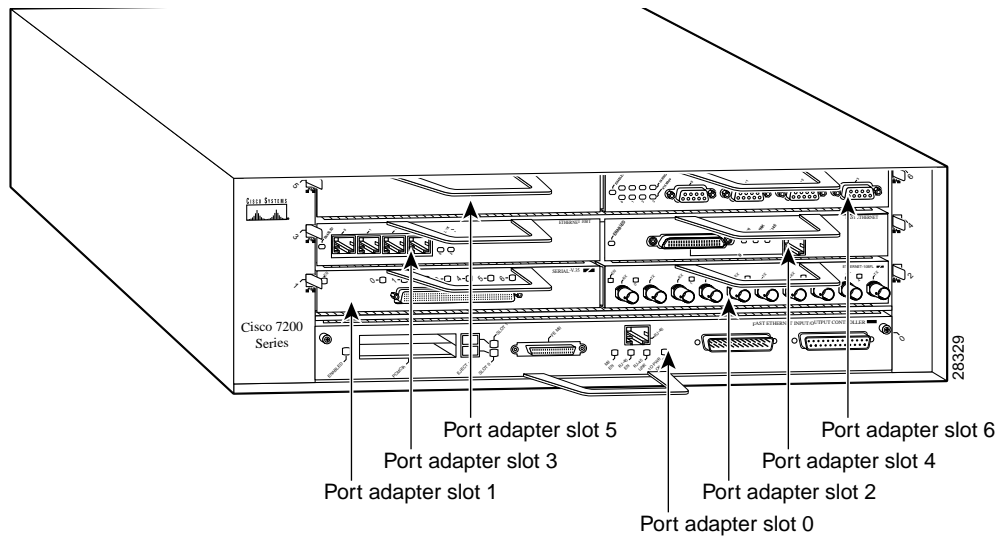
Cisco 7202 routers have two port adapter slots. The slots are numbered from left to right, slot 1 and slot 2. You can place the port adapters in either of the slots (slot 1 or slot 2).

Cisco 7204 routers and Cisco 7204VXR routers have four slots for port adapters, and one slot for an input/output (I/O) controller. The slots are numbered from the lower left to the upper right, beginning with slot 1 and continuing through slot 4. You can place the port adapters in any of the slots (slot 1 through slot 4). Slot 0 is always reserved for the I/O controller. The Cisco 7204 routers and Cisco 7204VXR routers are not shown.

Cisco 7206 routers and Cisco 7206VXR routers (including the Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server) have six slots for port adapters, and one slot for an input/output (I/O) controller. The slots are numbered from the lower left to the upper right, beginning with slot 1 and continuing through slot 6. You can place the port adapters in any of the six slots (slot 1 through slot 6). Slot 0 is always reserved for the I/O controller.

Figure 1-13 shows the slot numbering on a Cisco 7206 router.

**Figure 1-13** Port Adapter Slots in the Cisco 7206 Router



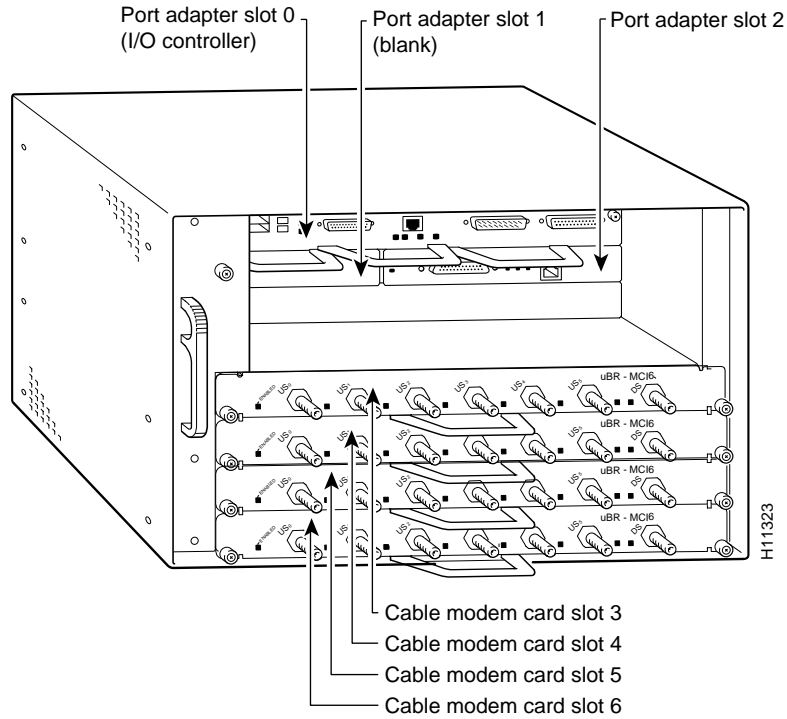
## Cisco uBR7200 Series Router Slot Numbering

The Cisco uBR7223 router has one port adapter slot (slot 1). Slot 0 is always reserved for the I/O controller—if present. The Cisco uBR7223 router is not shown.

The Cisco uBR7246 router and Cisco uBR7246VXR router have two port adapter slots (slot 1 and slot 2). Slot 0 is always reserved for the I/O controller—if present.

Figure 1-14 shows the slot numbering of port adapters on a Cisco uBR7246 router or Cisco uBR7246VXR router.

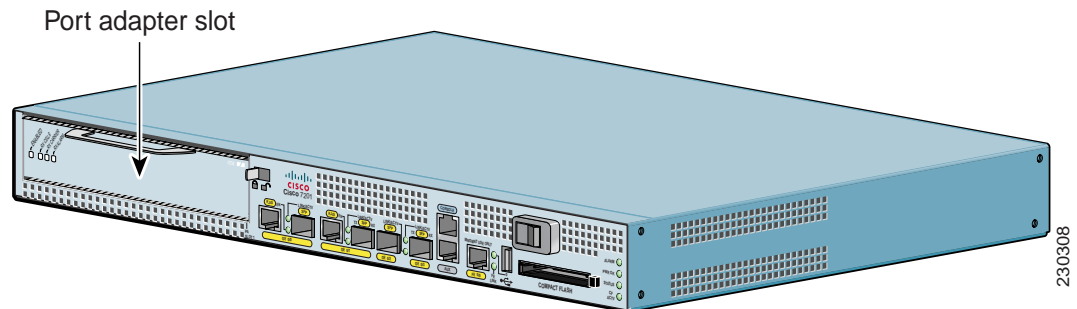
**Figure 1-14** Port Adapter Slots in the Cisco uBR7246 and Cisco uBR7246 VXR Routers



## Cisco 7201 Router Slot Numbering

Figure 1-15 shows the front view of a Cisco 7201 router with a port adapter installed. There is only one port adapter slot (slot 1) in a Cisco 7201 router.

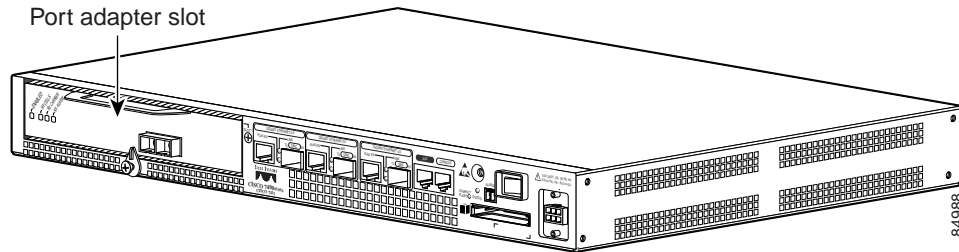
**Figure 1-15** Port Adapter Slot in the Cisco 7201 Router



## Cisco 7301 Router Slot Numbering

Figure 1-16 shows the front view of a Cisco 7301 router with a port adapter installed. There is only one port adapter slot (slot 1) in a Cisco 7301 router.

**Figure 1-16** Port Adapter Slot in the Cisco 7301 Router



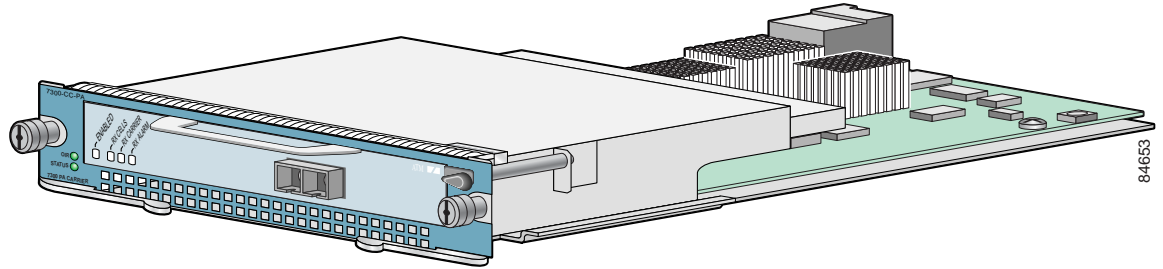


## Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering

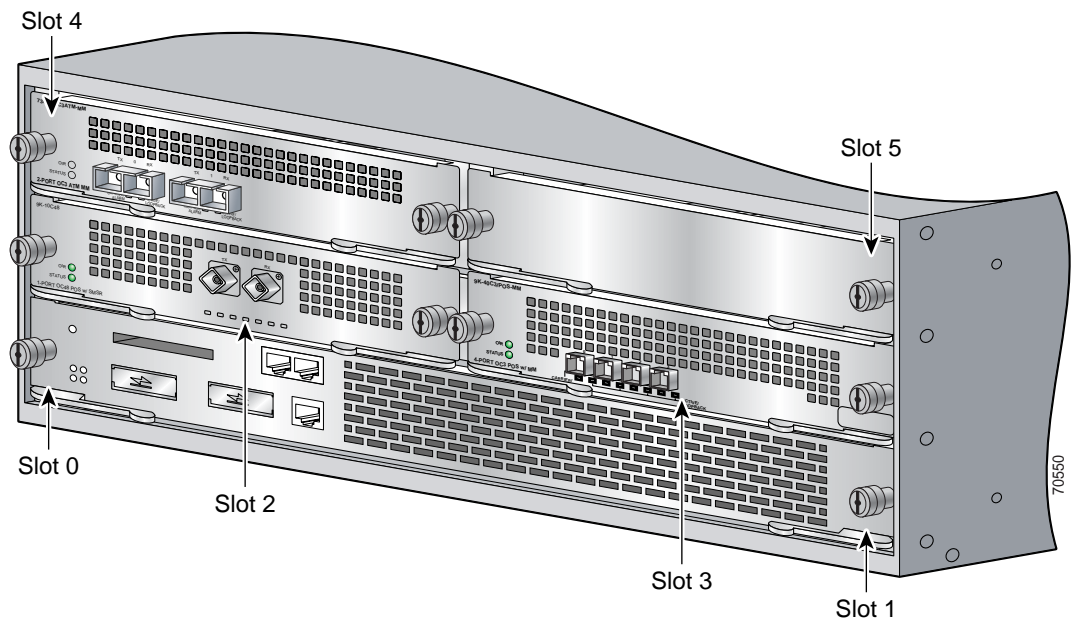
The Cisco 7304 PCI port adapter carrier card installs into Cisco 7304 router module slots 2 through 5. [Figure 1-17](#) shows a Cisco 7304 PCI port adapter carrier card with a port adapter installed. The Cisco 7304 PCI port adapter carrier card accepts one single-width port adapter.

[Figure 1-18](#) shows the module slot numbering on a Cisco 7304 router. The port adapter slot number is the same as the module slot number. Slot 0 and slot 1 are reserved for the NPE module or NSE module.

**Figure 1-17** Cisco 7304 PCI Port Adapter Carrier Card—Port Adapter Installed



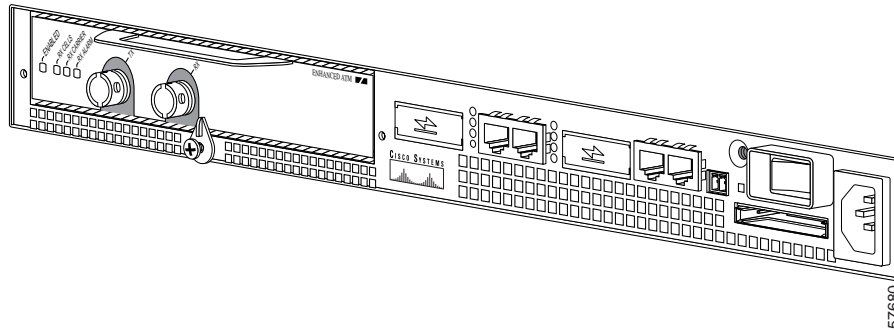
**Figure 1-18** Module Slots on the Cisco 7304 Router



## Cisco 7401ASR Router Slot Numbering

Figure 1-19 shows the front view of a Cisco 7401ASR router with a port adapter installed. There is only one port adapter slot (slot 1) in a Cisco 7401ASR router.

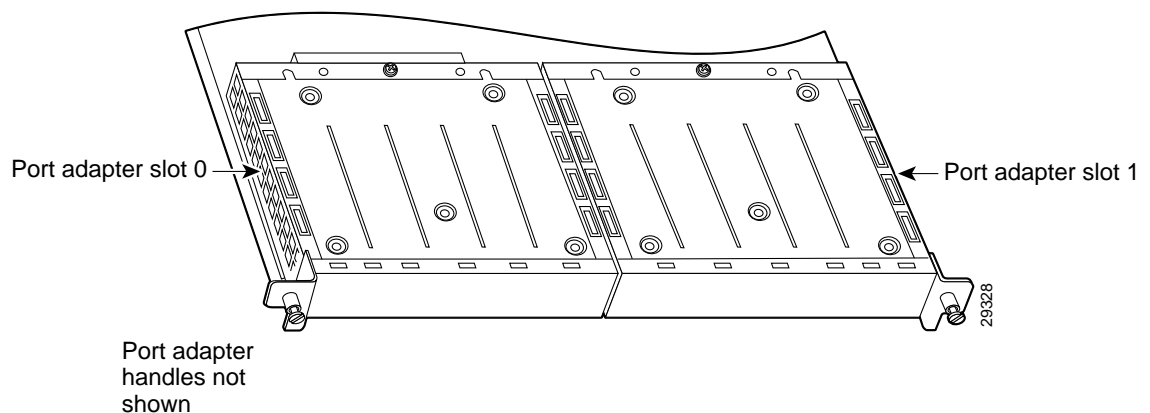
**Figure 1-19** Port Adapter Slot in the Cisco 7401ASR Router



## Cisco 7000 Series Routers and Cisco 7500 Series Routers VIP Slot Numbering

Port adapters are supported on the VIPs (versatile interface processors) used in Cisco 7000 series and Cisco 7500 series routers. In the Cisco 7010 router and Cisco 7505 router, the VIP motherboard is installed horizontally in the VIP slot. In the Cisco 7507 router and Cisco 7513 router, the VIP motherboard is installed vertically in the VIP slot. A port adapter can be installed in either bay (port adapter slot 0 or 1) on the VIP. The bays are numbered from left to right on the VIP. Figure 1-20 shows the slot numbering on a VIP.

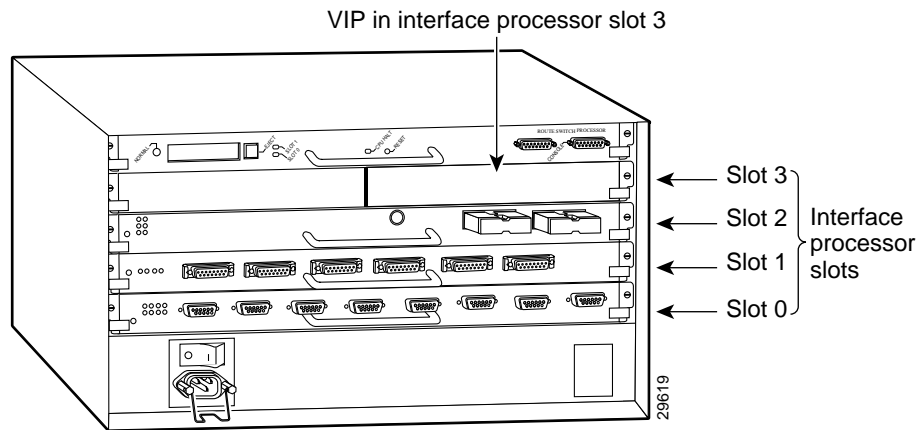
**Figure 1-20** VIP Slot Locations—Partial View, Horizontal Orientation



Cisco 7010 routers have three slots for port adapters, and two slots for Route Switch Processors (RSPs). The slots are numbered from bottom to top. You can place a port adapter in any of the VIP interface slots (slot 0 through 2). Slots 3 and 4 are always reserved for RSPs. The Cisco 7010 router is not shown.

Cisco 7505 routers have four slots for port adapters, and one slot for an RSP. The slots are numbered from bottom to top. You can place a port adapter in any of the VIP interface slots (slot 0 through 3). One slot is always reserved for the RSP. [Figure 1-21](#) shows the slot numbering on a Cisco 7505 router.

**Figure 1-21** VIP Slots in the Cisco 7505 Router



Cisco 7507 routers have five slots for port adapters, and two slots for RSPs. The slots are numbered from left to right. You can place a port adapter in any of the VIP interface slots (slot 0, 1, 4, 5, or 6). Slots 2 and 3 are always reserved for RSPs. The Cisco 7507 router is not shown.

Cisco 7513 routers have eleven slots for port adapters, and two slots for RSPs. The slots are numbered from left to right. You can place a port adapter in any of the VIP interface slots (slots 0 through 5, or slots 9 through 12). Slots 6 and 7 are always reserved for RSPs. The Cisco 7513 router is not shown.

## Identifying Interface Addresses

This section describes how to identify the interface address of the PA-A3 in supported platforms. Interface addresses specify the actual physical location of each interface on a router or switch.

Interfaces on a PA-A3 installed in a router or switch maintain the same 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.

Interfaces on a PA-A3 installed in a VIP or FlexWAN module maintain the same address regardless of whether other interface processors or modules are installed or removed. However, when you move a VIP or FlexWAN module to a different slot, the interface processor or module slot number changes to reflect the new interface processor or module slot.



### Note

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

The following subsections describe the interface address formats for the supported platforms:

- [Catalyst RSM/VIP2 Interface Addresses, page 1-23](#)
- [Catalyst 6000 Family FlexWAN Module Interface Addresses, page 1-23](#)
- [Cisco 7100 Series Routers Interface Addresses, page 1-24](#)
- [Cisco 7200 Series Routers and Cisco 7200 VXR Routers Interface Addresses, page 1-24](#)
- [Cisco 7201 Router Slot Numbering, page 1-17](#)
- [Cisco 7201 Router Interface Addresses, page 1-24](#)
- [Cisco 7301 Router Interface Addresses, page 1-25](#)
- [Cisco 7304 PCI Port Adapter Carrier Card Interface Addresses, page 1-25](#)
- [Cisco 7401ASR Router Interface Addresses, page 1-25](#)
- [Cisco 7000 Series Routers and Cisco 7500 Series Routers VIP Interface Addresses, page 1-25](#)

Table 1-10 summarizes the interface address formats for the supported routers.

**Table 1-10 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—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 —2 <sup>1</sup> through 13 (depends on the number of slots in the switch) Port adapter bay—0 or 1 Interface port—0	3/0/0
Cisco 7120 series router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 3 Interface port—0	3/0
Cisco 7140 series router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 4 Interface port—0	4/0
Cisco 7200 series routers and Cisco 7200 VXR routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—1 through 6 (depends on the number of slots in the router) <sup>2</sup> Interface port—0	1/0
Cisco 7201 router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 Interface port—0	1/0
Cisco uBR7223 router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 <sup>2</sup> Interface port—0	1/0
Cisco uBR7246 and Cisco uBR7246 VXR routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—1 or 2 <sup>2</sup> 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

**Table 1-10** Identifying Interface Addresses (continued)

Platform	Interface Address Format	Numbers	Syntax
Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 routers	Module-slot-number/interface-port-number	Module slot—2 through 5 Interface port—0	3/0
Cisco 7401ASR router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 Interface port—0	1/0
VIP in Cisco 7000 series routers 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— or 1 Interface port—0	3/1/0

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

## Catalyst RSM/VIP2 Interface Addresses

In Catalyst 5000 family switches, 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, the slots in which it is installed are not numbered. A port adapter can be installed into either port adapter slot 0 or slot 1 on a Catalyst RSM/VIP2. See [Figure 1-9](#).

The interface address is composed of a two-part number in the format *port-adapter-slot number/interface-port number*. See [Table 1-10](#). For example, if the single-port PA-A3 is installed in port adapter slot 1 of a Catalyst RSM/VIP2 in a Catalyst 5000 family switch, the interface address would be 1/0.

## Catalyst 6000 Family FlexWAN Module Interface Addresses

In Catalyst 6000 family switches, the Catalyst 6000 family FlexWAN module can be installed in module slots 2 through 13 (depending on the number of slots in the router). Slot 1 is reserved for the supervisor engine. A port adapter can be installed into either port adapter bay 0 or bay 1 on a FlexWAN module. See [Figure 1-10](#).

The interface address is composed of a three-part number in the format *module-number/port-adapter-bay-number/interface-port-number*. See [Table 1-10](#).

The first number identifies the module slot of the chassis in which the FlexWAN module is installed (slot 2 through slot 3, 6, 9, or 13 depending on the number of slots in the chassis). These module slots are generally numbered from top to bottom, starting with 1.

The second number identifies the bay of the FlexWAN module in which the port adapter is installed (0 or 1). The bays are numbered from left to right on the FlexWAN module.

The third number identifies the physical port number on the port adapter. The PA-A3 is a single-port port adapter, therefore the port is always 0.

For example, if the single-port PA-A3 is installed in a FlexWAN module in module slot 3, port adapter bay 0, then the interface address is 3/0/0 (module slot 3, port adapter bay 0, and interface 0).

**Note**

The FlexWAN module physical port address begins with slot 0, which differs from the conventional Catalyst 6000 family port address, which begins with slot 1.

## Cisco 7100 Series Routers Interface Addresses

In Cisco 7120 series router, port adapters are installed in port adapter slot 3. See [Figure 1-11](#). In the Cisco 7140 series router, port adapters are installed in port adapter slot 4. See [Figure 1-12](#).

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-10](#). For example, if the single-port PA-A3 is installed on a Cisco 7120 router, the interface address would be 3/0. If the single-port PA-A3 is installed on a Cisco 7140 router, the interface address would be 4/0.

## Cisco 7200 Series Routers and Cisco 7200 VXR Routers Interface Addresses

In Cisco 7200 series routers and Cisco 7200 VXR routers, port adapter slots are numbered from the lower left to the upper right, beginning with slot 1 and continuing through 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 adapters can be installed in any available port adapter slot from 1 through 6 (depending on the number of slots in the router). (Slot 0 is reserved for the I/O controller.) See [Figure 1-13](#).

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-10](#). For example, if the single-port PA-A3 is installed in slot 1 of a Cisco 7200 series router, the interface address would be 1/0.

## Cisco uBR7200 Series Routers Interface Addresses

In the Cisco uBR7223 router, only one slot accepts port adapters and it is numbered slot 1.

In the Cisco uBR7246 router and Cisco uBR7246VXR router, port adapters can be installed in two port adapter slots (slot 1 and slot 2). Slot 0 is always reserved for the I/O controller—if present. See [Figure 1-14](#).

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-10](#). For example, if the single-port PA-A3 is installed in slot 1 of a Cisco uBR7223 series router, the interface address would be 1/0. If the single-port PA-A3 were installed in slot 2 of a Cisco uBR7246 or Cisco uBR7246VXR router, the interface address would be 2/0.

## Cisco 7201 Router Interface Addresses

In the Cisco 7201 router, only one slot accepts port adapters and it is numbered as slot 1. See [Figure 1-15](#).

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-10](#). For example, if the single-port PA-A3 is installed in a Cisco 7201 router, the interface address would be 1/0.

## Cisco 7301 Router Interface Addresses

In the Cisco 7301 router, only one slot accepts port adapters and it is numbered as slot 1. See [Figure 1-16](#).

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-10](#). For example, if the single-port PA-A3 is installed in a Cisco 7301 router, the interface address would be 1/0.

## Cisco 7304 PCI Port Adapter Carrier Card Interface Addresses

In the Cisco 7304 router, port adapters are installed in a Cisco 7304 PCI port adapter carrier card, which installs in Cisco 7304 router module slots 2 through 5. The port adapter slot number is the same as the module slot number. See [Figure 1-17](#) and [Figure 1-18](#).

The interface address is composed of a two-part number in the format *module-slot-number/interface-port-number*. See [Table 1-10](#). For example, if the single-port PA-A3 is installed in the Cisco 7304 PCI port adapter carrier card in Cisco 7304 router module slot 3, the interface address would be 3/0.

## Cisco 7401ASR Router Interface Addresses

In the Cisco 7401ASR router, only one slot accepts port adapters and it is numbered as slot 1. See [Figure 1-19](#).

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-10](#). For example, if the single-port PA-A3 is installed in a Cisco 7401ASR router, the interface address would be 1/0.

## Cisco 7000 Series Routers and Cisco 7500 Series Routers VIP Interface Addresses

In Cisco 7000 series routers and Cisco 7500 series routers, port adapters are installed on a versatile interface processor (VIP), which installs in interface processor slots 0 through 12 (depending on the number of slots in the router). The port adapter can be installed in either bay (port adapter slot 0 or 1) on the VIP. See [Figure 1-20](#) and [Figure 1-21](#).

The interface address for the VIP is composed of a three-part number in the format *interface-processor-slot-number/port-adapter-slot-number/interface-port-number*. See [Table 1-10](#).

The first number identifies the slot in which the VIP is installed (slot 0 through 12, depending on the number of slots in the router).

The second number identifies the bay (port adapter slot) on the VIP in which the port adapter is installed (0 or 1). The bays are numbered from left to right on the VIP.

The third number identifies the physical port number (interface port number) on the port adapter. The port numbers always begin at 0 and are numbered from left to right. The number of additional ports depends on the number of ports on the port adapter. The PA-A3 is a single-port port adapter, therefore the port is always 0.

For example, if the single-port PA-A3 is installed in a VIP in interface processor slot 3, port adapter slot 1, the interface address would be 3/1/0 (interface processor slot 3, port adapter slot 1, and interface 0).

**Note**

---

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

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## CHAPTER 2

# Preparing for Installation

---

This chapter describes the general equipment, safety, and site preparation requirements for installing the PA-A3 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 2-9](#)
- [75-Ohm In-Line Coaxial Attenuator, page 2-9](#)
- [Safety Guidelines, page 2-9](#)
- [Laser/LED Safety Guidelines, page 2-16](#)
- [FCC Class A Compliance, page 2-17](#)

## Required Tools and Equipment

You need the following tools and equipment to install a PA-A3. If you need additional equipment, contact your service representative for ordering information.

- PA-A3 port adapter
- Catalyst RSM/VIP2 (for installation in Catalyst 5000 family switches). For information about the specific VIP2 models that support the PA-A3, see the [“Software and Hardware Requirements” section on page 2-2](#).
- Catalyst 6000 family FlexWAN module (for installation in the Catalyst 6000 family switches)
- VIP (for installation in Cisco 7000 series or Cisco 7500 series routers). For information about the specific VIP models that support the PA-A3, see the [“Software and Hardware Requirements” section on page 2-2](#).
- Cisco 7304 PCI Port Adapter Carrier Card (for installation in the Cisco 7304 router)
- ATM interface cable to connect the PA-A3 to the ATM network. (For cable information, see the [“Cables and Connectors” section on page 1-5](#).)
- Number 2 Phillips screwdriver
- Number 1 Phillips screwdriver (for port adapter installation) and a 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

- Antistatic container
- Attenuator kit (optional)

## Software and Hardware Requirements

This section describes the hardware and software requirements for the PA-A3, and includes the following subsections:

- [Software Requirements, page 2-2](#)
- [Hardware Requirements, page 2-5](#)

## Software Requirements

This section describes the software requirements for the PA-A3 on the supported platforms.

[Table 2-1](#) lists the minimum Cisco IOS software release required to use the PA-A3 in supported router and switch platforms.

**Table 2-1 PA-A3 Port Adapter Software Requirements**

Platforms	Minimum Cisco IOS Release Required	Recommended Minimum Cisco IOS Release
<b>Catalyst 5000 family switches with Catalyst RSM/VIP2<sup>1</sup></b> <ul style="list-style-type: none"> <li>• With Catalyst RSM/VIP2-40(=)</li> </ul>	Cisco IOS Release 12.0(1)	Cisco IOS Release 12.0(4) or a later release of Cisco IOS Release 12.0
<b>Catalyst 6000 family switches with Catalyst 6000 family FlexWAN module</b> <ul style="list-style-type: none"> <li>• Catalyst 6000 family MSFC</li> <li>• Supervisor engine software</li> </ul>	Cisco IOS Release 12.1(1)EX or a later release of Cisco IOS Release 12.1 EX Catalyst 6000 family supervisor engine software release 5.4(1) or later	Cisco IOS Release 12.1(1)EX or a later release of Cisco IOS Release 12.1EX Catalyst 6000 family supervisor engine software release 5.4(1) or later
<b>Cisco 7100 series routers</b> <ul style="list-style-type: none"> <li>• Cisco 7120 series and Cisco 7140 series</li> </ul>	Cisco IOS Release 12.0(1)	Cisco IOS Release 12.0(4) or a later release of Cisco IOS Release 12.0
<b>Cisco 7200 series routers and Cisco 7200 VXR routers</b> <ul style="list-style-type: none"> <li>• Cisco 7204VXR and Cisco 7206VXR</li> <li>• Cisco 7202, Cisco 7204, and Cisco 7206</li> </ul>	Cisco IOS Release 12.0(4)XE2 or a later release of Cisco IOS Release 12.0 XE Cisco IOS Release 11.1(22)CC	Cisco IOS Release 12.0(3)T or a later release of Cisco IOS Release 12.0T Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2B Cisco IOS Release 11.1(24)CC or a later release of Cisco IOS Release 11.1CC Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2B

Table 2-1 PA-A3 Port Adapter Software Requirements (continued)

Platforms	Minimum Cisco IOS Release Required	Recommended Minimum Cisco IOS Release
Cisco uBR7200 series routers		
<ul style="list-style-type: none"> <li>Cisco uBR7246 and Cisco uBR7223</li> </ul>	Cisco IOS Release 12.0(3)T or a later release of Cisco IOS Release 12.0T	Cisco IOS Release 12.0(4)T or a later release of Cisco IOS Release 12.0T
<ul style="list-style-type: none"> <li>Cisco uBR7246 VXR<sup>2</sup></li> </ul>	Cisco IOS Release 12.0(7)T or a later release of Cisco IOS Release 12.0T  Cisco IOS Release 12.0(7)SC or a later release of Cisco IOS Release 12.0SC  Cisco IOS Release 12.0(7)XR or a later release of Cisco IOS Release 12.0XR	Cisco IOS Release 12.0(7)T or a later release of Cisco IOS Release 12.0T  Cisco IOS Release 12.0(7)SC or a later release of Cisco IOS Release 12.0SC  Cisco IOS Release 12.0(7)XR or a later release of Cisco IOS Release 12.0XR
Cisco 7201 router	Cisco IOS Release 12.4(4)XD7 or a later release of Cisco IOS Release 12.4XD  Cisco IOS Release 12.2(31)SB5 or a later release of Cisco IOS Release 12.2SB	Cisco IOS Release 12.4(4)XD7 or a later release of Cisco IOS Release 12.4XD  Cisco IOS Release 12.2(31)SB5 or a later release of Cisco IOS Release 12.2SB
Cisco 7301 router	Cisco IOS Release 12.2(11)YZ or later release of Cisco IOS Release 12.2YZ	Cisco IOS Release 12.2(11)YZ or later release of Cisco IOS Release 12.2YZ
Cisco 7304 router		
<ul style="list-style-type: none"> <li>With Cisco 7304 PCI Port Adapter Carrier Card</li> </ul>	Cisco IOS Release 12.2(11)YZ or a later release of Cisco IOS Release 12.2YZ	Cisco IOS Release 12.2(11)YZ or a later release of Cisco IOS Release 12.2YZ
Cisco 7401ASR router	Cisco IOS Release 12.2(1)DX or later release of Cisco IOS Release 12.2DX	Cisco IOS Release 12.2(1)DX or later release of Cisco IOS Release 12.2DX  Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2B
Cisco 7000 series routers and Cisco 7500 series routers		
<ul style="list-style-type: none"> <li>With VIP2-40</li> </ul>	Cisco IOS Release 12.0(1)	Cisco IOS Release 12.2(2)T or a later release of Cisco IOS Release 12.2T
<ul style="list-style-type: none"> <li>With VIP2-50</li> </ul>	Cisco IOS Release 12.0(1)	Cisco IOS Release 12.2(2)T or a later release of Cisco IOS Release 12.2T
<ul style="list-style-type: none"> <li>With VIP4-50</li> </ul>	Cisco IOS Release 12.2(1)	Cisco IOS Release 12.2(2)T or a later release of Cisco IOS Release 12.2T
<ul style="list-style-type: none"> <li>With VIP4-80</li> </ul>	Cisco IOS Release 12.2(1)	Cisco IOS Release 12.2(2)T or a later release of Cisco IOS Release 12.2T
<ul style="list-style-type: none"> <li>With VIP6-80</li> </ul>	Cisco IOS Release 12.0(22)S	Cisco IOS Release 12.1(12)E or a later release of Cisco IOS Release 12.1E

1. The Catalyst RSM/VIP2 model recommended for the PA-A3 is the VIP2-40, which has 2 MB of SRAM and 32 MB of DRAM. The PA-A3 is *not* supported by the VIP2-15.

2. Currently, the Cisco uBR7246 VXR router supports only the PA-A3-OC3MM, PA-A3-OC3SMI, and PA-A3-OC3SML port adapters. In the future, however, the Cisco uBR7246 VXR will support both the PA-A3-E3 and PA-A3-T3 port adapters.

**Caution**

All PA-A3 port adapters shipped after November 1998 require Cisco IOS Release 11.1(22)CC or a later release of Cisco IOS Release 11.1CC to operate; they do not function on any software release before Release 11.1(22)CC.

**Note**

Although PA-A3 port adapters purchased or received before November 1998 and installed on the VIP2 might continue to function properly in Cisco 7000 series routers, Cisco 7500 series routers, and Cisco 7200 series software releases before Cisco IOS Release 11.1(22)CC, you must upgrade to Cisco IOS Release 11.1(22)CC. This release can be ordered as Release 11.1(22)R to ensure software release consistency throughout your network and to prevent problems when you add new PA-A3 port adapters to your existing network.

You must use Cisco IOS Release 12.0(1) or later on the Catalyst RSM/VIP2.

**Note**

When you upgrade your Cisco IOS software to the minimum required software release, we recommend you also upgrade your boot image.

The boot image for your upgraded Cisco IOS software release is available at Cisco.com. Instructions for downloading the boot image from a TFTP server are described in the [“Upgrading Your Boot Flash Image” section on page 4-37](#).

To determine which revision of the PA-A3 is installed, use the **show diag** command. PA-A3 port adapters identified with board revision B0 require a minimum software release of Cisco IOS Release 11.1(22)CC for Cisco 7500 series routers and Cisco 7200 series routers.

The following example shows the new board revision number (B0) for a PA-A3-OC3MM installed in slot 1:

```
router# show diag 1
Slot 1:
      ATM WAN OC3 (MM) port adapter, 1 port
      Port adapter is analyzed
      Port adapter insertion time 22:36:49 ago
      Hardware revision 1.0           Board revision B0
```

To determine if your router is compatible with the PA-A3, use the **show version** command to display the current hardware configuration of the router, including the system software version that is currently loaded and running. The **show controllers** command lists all interfaces (VIP and Catalyst RSM/VIP2 only) and gives the currently loaded and running microcode version for each. You can check the version of the default ROM image by either removing the board and checking the ROM labels, or by configuring the interface or system software to boot from ROM, restarting the system, and using these same commands to check the running version.

If a display indicates that the running system software is an earlier version than Cisco IOS Release 11.1(22)CC on Cisco 7500 series routers, Cisco 7000 series routers, or Cisco 7200 series routers, check the contents of Flash memory to determine whether the required images are available on your system. (Use the **show flash** command to display a list of all files stored in Flash memory.)

The following example of the **show version** command displays information about a Cisco 7200 series router running Cisco IOS Release 11.1(22)CC:

```
Router> show version
IOS (tm) GS Software (GS7), Version 11.1(22)CC
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 30-Dec-97 21:02
```

(additional displayed text omitted from this example)

The following example of the **show controllers** command displays VIP and ROMMON version information:

```
router# show controllers
MEMD at 40000000, 2097152 bytes (unused 3360, recarves 1, lost 0)
  RawQ 48000100, ReturnQ 48000108, EventQ 48000110
  BufhdrQ 48000128 (2900 items), LovltrQ 48000140 (5 items, 2016 bytes)
  IpcbufQ 48000150 (16 items, 4096 bytes)
  IpcbufQ_classic 48000148 (8 items, 4096 bytes)
  3570 buffer headers (48002000 - 4800FF10)
  pool0: 9 buffers, 256 bytes, queue 48000130
  pool1: 344 buffers, 1536 bytes, queue 48000138
  pool2: 284 buffers, 4544 bytes, queue 48000158
  pool3: 4 buffers, 4576 bytes, queue 48000160
  slot2: VIP2, hw 2.4, sw 22.20, ccb 5800FF40, cmdq 48000090
    software loaded from flash slot0:vip2_22-20.atmdx.191897
    IOS (tm) VIP Software (SVIP-DW-M), Experimental Version 11.3
  ROM Monitor version 17.0
  ATM2/0/0, applique is DS3 (45Mbps)
    gfreeq 48000158, lfreeq 48000168 (4544 bytes), throttled 0
    rxlo 4, rxhi 284, rxcurr 1, maxrxcurr 5
    txq 48001A00, txacc 48001A02 (value 284), txlimit 284
```

(additional displayed text omitted from this example)

## Hardware Requirements

This section describes the hardware requirements for the PA-A3 on the various supported platforms, and contains the following subsections:

- [Catalyst RSM/VIP2 in Catalyst 5000 Family Switches Hardware Requirements, page 2-6](#)
- [Cisco 7100 Series Routers Hardware Requirements, page 2-6](#)
- [Cisco 7200 Series Routers, Cisco 7200 VXR Routers, and Cisco uBR7200 Series Routers, page 2-6](#)
- [Cisco 7201 Router Hardware Requirements, page 2-8](#)
- [Cisco 7301 Router Hardware Requirements, page 2-8](#)
- [Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 Routers Hardware Requirements, page 2-8](#)
- [Cisco 7401ASR Router Hardware Requirements, page 2-8](#)
- [VIP in Cisco 7000 Series Routers and Cisco 7500 Series Routers Hardware Requirements, page 2-8](#)

## Catalyst RSM/VIP2 in Catalyst 5000 Family Switches Hardware Requirements

Following are the hardware requirements for the PA-A3 in Catalyst 5000 family switches:

- The PA-A3 can be installed on the Catalyst RSM/VIP2-40 with the Route Switch Processor 2 (RSP2). The Catalyst RSM/VIP2-15 *does not* support the PA-A3.
- On a Catalyst RSM/VIP2-40, you can have two PA-A3-T3 or PA-A3-E3 port adapters installed in adjacent slots or a port adapter of any other type installed in the adjacent slot with the exception of the PA-A3-OC3MM, PA-A3-OC3SMI, or PA-A3-OC3SML port adapters. You can have only *one* PA-A3-OC3 port adapter per Catalyst RSM/VIP2-40; no other port adapter can reside in the other port adapter slot.
- The PA-A3 supports the DRAM and static RAM (SRAM) configurations used in the Catalyst RSM/VIP2-40 with 2 MB of SRAM and 32 MB of DRAM.

## Cisco 7100 Series Routers Hardware Requirements

Following are the hardware requirements for the PA-A3 in Cisco 7100 series routers:

- The OC-3c versions of the PA-A3 are high-bandwidth and must conform to the system configuration guidelines for Cisco 7100 series routers. (Port adapters are rated by data-carrying capacity as high, medium, or low bandwidth. Cisco 7100 series routers have certain data-carrying capacity [or bandwidth] restrictions that affect the number of high-, medium-, and low-bandwidth port adapters you can install.) Refer to the *Cisco 7100 Series VPN Router Installation and Configuration Guide* for more information on port adapter installation restrictions.
- The T3 version of the PA-A3 (PA-A3-T3) is a high-bandwidth port adapter, and the E3 version PA-A3-E3 is a medium-bandwidth port adapter. Both versions must follow the system configuration guidelines for Cisco 7100 series routers. Refer to the *Cisco 7100 Series VPN Router Installation and Configuration Guide*.

## Cisco 7200 Series Routers, Cisco 7200 VXR Routers, and Cisco uBR7200 Series Routers

Following are the hardware requirements for the PA-A3 in Cisco 7200 series routers, Cisco 7200 VXR routers, and Cisco uBR7200 series routers:

- The OC-3c versions of the PA-A3 port adapters are high-bandwidth and must conform to the system configuration guidelines for Cisco 7200 series routers. (Port adapters are rated by data-carrying capacity as high, medium, or low bandwidth. Cisco 7200 series routers have certain data-carrying capacity [or bandwidth] restrictions that affect the number of high-, medium-, and low-bandwidth port adapters you can install.) Refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines* for more information on port adapter installation restrictions.
- The T3 version of the PA-A3 port adapter (PA-A3-T3) is a high-bandwidth port adapter, and the E3 version of the PA-A3 port adapter (PA-A3-E3) is a medium-bandwidth port adapter. They must follow the system configuration guidelines for Cisco 7200 series routers. Refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.
- Your Cisco 7200 series router must have an installed NPE-150, NPE-175, NPE-200, NPE-225, or NPE-300 to support the PA-A3 port adapters. The NPE-100 *does not* support the PA-A3 in Cisco 7200 series routers.

Cisco 7200 series routers support up to three PA-A3 port adapters in the same chassis using an NPE-150 or NPE-200 with no Fast Ethernet interface on the I/O controller. If a Fast Ethernet interface is installed on the I/O controller, the Cisco 7200 series supports up to two PA-A3 port adapters.

To configure the number of PA-A3 port adapters supported in a Cisco 7200 VXR router using the NPE-300, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.

- Your Cisco uBR7246 or Cisco uBR7223 router must have an installed NPE-150 or NPE-200 to support the PA-A3 port adapters. Your Cisco uBR7246VXR router must have an installed NPE-300 to support the PA-A3 port adapters.



**Note** Currently, the Cisco uBR7246VXR router supports only the PA-A3-OC3MM, PA-A3-OC3SMI, and PA-A3-OC3SML. In the future, however, the Cisco uBR7246VXR router will support both the PA-A3-E3 and PA-A3-T3.



**Note**

PA-A3 port adapters used in the Cisco 7200 VXR routers require the correct base hardware revision to function. An error message such as the following will occur on bootup if the incorrect hardware revision is used:

```
PA-3-REVNOTSUPPORTED:PA in slot 1 (ATM WAN OC3 (SML)) requires base h/w revision of (2.0)
for this npe cpu card
```



**Tip**

The **show diag** command displays the hardware revision. See the [“Using the show diag Command” section on page 4-22](#)

- The Cisco uBR7246 and Cisco uBR7246 VXR router support up to two PA-A3 port adapters and the Cisco uBR7223 router supports one PA-A3 port adapter.
- All of the PA-A3 receive buffers are allocated from static random-access memory (SRAM). As a result, during bootup, if the PA-A3 cannot find enough *contiguous* SRAM for its use, the system stops bringing up the PA-A3 and displays an error message such as the following:

```
%ATMPA-3-PCIMEMNOTENOUGH: Not Enough PCI memory (0x19874) to support ATM PA on bay 5
```

After you replace port adapters several times using online insertion and removal (OIR), SRAM on Cisco 7200 series routers becomes fragmented. When this happens, the system might not be able to find enough contiguous SRAM to complete initialization at bootup, and you might get an error message that there is not enough memory. If you have been using the OIR feature numerous times and you get a memory error message during initialization of a PA-A3, we recommend that you power off and restart the system.

The PA-A3 and Cisco 7200 routers and Cisco uBR7200 series routers' network processor memory configurations include the following:

- NPE-150 (150-MHz network processing engine) with 1 MB of SRAM and up to 128 MB of DRAM
- NPE-200 (200-MHz network processing engine) with 4 MB of SRAM and up to 128 MB of DRAM
- NPE-300 (262-MHz network processing engine) with 32 to 256 MB SDRAM



**Note** For port adapter hardware and memory configuration guidelines for Cisco 7200 series routers and for Cisco 7200 VXR routers using the NPE-300 and other Cisco 7200 series routers, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.

Refer to the Cisco IOS software release notes for the version of Cisco IOS software you are running.

## Cisco 7201 Router Hardware Requirements

The PA-A3 can be installed in the single port adapter slot of the Cisco 7201 router.

## Cisco 7301 Router Hardware Requirements

The PA-A3 can be installed in the single port adapter slot of the Cisco 7301 router.

## Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 Routers Hardware Requirements

One PA-A3 can be installed in the Cisco 7304 PCI Port Adapter Carrier Card. The Cisco 7304 PCI Port Adapter Carrier Card installs in Cisco 7304 router module slots 2 through 5.

## Cisco 7401ASR Router Hardware Requirements

The PA-A3 can be installed in the single port adapter slot of the Cisco 7401ASR router.

## VIP in Cisco 7000 Series Routers and Cisco 7500 Series Routers Hardware Requirements

Following are the hardware requirements for the PA-A3 in Cisco 7000 series routers and Cisco 7500 series routers:

- The PA-A3 port adapters can be installed on the VIP2-40 and the VIP2-50 with either the Route Switch Processor 2 (RSP2) or the RSP4. The VIP2-15 *does not* support the PA-A3.
- On a VIP2-40, you can have two PA-A3-T3 or PA-A3-E3 port adapters installed in adjacent slots or a port adapter of any other type installed in the adjacent slot with the exception of the PA-A3-OC3MM, PA-A3-OC3SMI, or PA-A3-OC3SML. You can have only *one* PA-A3-OC3 per VIP2-40; no other port adapter can reside in the other port adapter slot.
- On a VIP2-50, VIP4-50, VIP4-80, or VIP6-80 you can have any two PA-A3 port adapters (including the PA-A3-OC3MM, PA-A3-OC3SMI, and PA-A3-OC3SML) or a port adapter of another type installed in the adjacent slot.



**Note** The PA-A3 port adapters are designed to provide maximum switching performance when a single port adapter is installed in a single VIP2-50. If you install two port adapters in the same VIP2-50, you might exceed the aggregate bandwidth capacity of the VIP2-50 and consequently lower the performance speeds of the port adapters.



There is no physical limit to the number of VIPs and ATM PA-A3 combinations that can be installed in the same Cisco 7500 series router, up to the total number of VIPs that the chassis supports. However, the Cisco 7500 series router backplane is finite; if you install three or more VIP and ATM PA-A3 combinations, you need be aware of the Cisco 7500 series bandwidth characteristics.

See the “[Related Documentation](#)” section on page ix for documentation related to bandwidth information.

## 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.

## 75-Ohm In-Line Coaxial Attenuator

A 75-ohm in-line coaxial attenuator may be required to tune the signal between the PA-A3 and the far-end equipment, if the port adapter is experiencing line code violations (LCVs). LCVs occur when the far-end equipment transmit signal saturates the front-end receiver of the PA-A3.

Cisco offers an attenuator kit (ATTEN-KIT-PA that contains five attenuators with fixed values ranging from 3 dB to 20 dB. For more information on the attenuator kit, go to the following website:

[http://www.cisco.com/en/US/products/hw/modules/ps2033/prod\\_module\\_installation\\_guide09186a00800a85c0.html](http://www.cisco.com/en/US/products/hw/modules/ps2033/prod_module_installation_guide09186a00800a85c0.html)

## 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

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

## Warning Definition



Warning

### IMPORTANT SAFETY INSTRUCTIONS

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

### SAVE THESE INSTRUCTIONS

Waarschuwing

### BELANGRIJKE VEILIGHEIDSINSTRUCTIES

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

### BEWAAR DEZE INSTRUCTIES

Varoitus

### TÄRKEITÄ TURVALLISUUSOHJEITA

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

### SÄILYTÄ NÄMÄ OHJEET

Attention

### IMPORTANTES INFORMATIONS DE SÉCURITÉ

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

### CONSERVEZ CES INFORMATIONS

<b>Warnung</b>	<p><b>WICHTIGE SICHERHEITSHINWEISE</b></p> <p>Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.</p> <p><b>BEWAHREN SIE DIESE HINWEISE GUT AUF.</b></p>
<b>Avvertenza</b>	<p><b>IMPORTANTI ISTRUZIONI SULLA SICUREZZA</b></p> <p>Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.</p> <p><b>CONSERVARE QUESTE ISTRUZIONI</b></p>
<b>Advarsel</b>	<p><b>VIKTIGE SIKKERHETSINSTRUKSJONER</b></p> <p>Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.</p> <p><b>TA VARE PÅ DISSE INSTRUKSJONENE</b></p>
<b>Aviso</b>	<p><b>INSTRUÇÕES IMPORTANTES DE SEGURANÇA</b></p> <p>Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.</p> <p><b>GUARDE ESTAS INSTRUÇÕES</b></p>
<b>¡Advertencia!</b>	<p><b>INSTRUCCIONES IMPORTANTES DE SEGURIDAD</b></p> <p>Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.</p> <p><b>GUARDE ESTAS INSTRUCCIONES</b></p>

**Varning! VIKTIGA SÄKERHETSANVISNINGAR**

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

**SPARA DESSA ANVISNINGAR****Figyelem FONTOS BIZTONSÁGI ELOÍRÁSOK**

Ez a figyelmeztető 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; a fordítás az egyes figyelmeztetések végén látható szám alapján kereshető meg.

**ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!****Предупреждение ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

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

**СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ****警告 重要的安全性说明**

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

请保存这些安全性说明

**警告 安全上の重要な注意事項**

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

これらの注意事項を保管しておいてください。

**주의**      **중요 안전 지침**

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

이 지시 사항을 보관하십시오.

**Aviso**      **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.

**GUARDE ESTAS INSTRUÇÕES****Advarsel**      **VIGTIGE SIKKERHEDSANVISNINGER**

Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemeskade. Før du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnummeret efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.

**GEM DISSE ANVISNINGER****تحذير****إرشادات الأمان الهامة**

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

**Upozorenje**      **VAŽNE SIGURNOSNE NAPOMENE**

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

**SAČUVAJTE OVE UPUTE**

**Upozornění DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

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

**USCHOVEJTE TYTO POKYNY****επικίνδυνη τάση ή ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ**

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

**ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ****אזהרה****זרואות בטיחות חשובות**

אימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד לשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים מניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כדי לאתר את התרגום: אזהרות הבטיחות המתורגמות שמצורפות להתקן.

**שמור הוראות אלה****Опoмена**

пoстoи кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.  
ЧУВАЈТЕ ГИ ОБИЕ НАПАТСТВИЈА

**Ostrzeżenie WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA**

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

**NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ**

## Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

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

## Telephone Wiring Guidelines

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

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

## Preventing Electrostatic Discharge Damage

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

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help to ensure that bus connectors are properly seated.
- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.

- Place a removed 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**

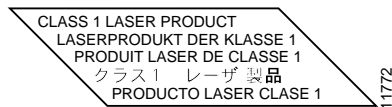
For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms (Mohms).

## Laser/LED Safety Guidelines

The single-mode transmitter in the PA-A3-OC3SMI and PA-A3-OC3SML uses a small laser to transmit the light signal to the network ring. Keep the transmit port covered whenever a cable is not connected to it. Although multimode transceivers typically use LEDs for transmission, it is good practice to keep open ports covered and avoid staring into open ports or apertures.

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

**Figure 2-1** Class 1 Laser Warning Label on PA-A3-OC3SMI and PA-A3-OC3SML



**Warning**

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

The multimode aperture contains a Class 1 LED warning label, as shown in [Figure 2-2](#).

**Figure 2-2** Class 1 LED Warning Label on PA-A3-OC3MM



**Warning**

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



**Warning**

**Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard.** Statement 1056



## 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.)



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**Caution**

This product 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.

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# CHAPTER 3

## Removing and Installing Port Adapters

This chapter describes how to remove the PA-A3 from supported platforms, how to install a new or replacement PA-A3, and how to connect interface 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 3-10](#)
- [“Connecting Port Adapter Cables” section on page 3-23](#)

## Handling Port Adapters

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



**Note**

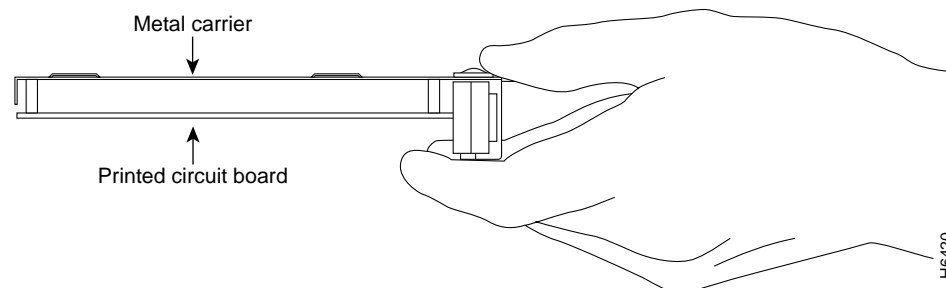
When a port adapter slot is not in use, a blank port adapter must be installed in the empty slot to allow the router or switch to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the port adapters.



**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](#).)

**Figure 3-1** Handling a Port Adapter



H6420

## 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-A3 in Cisco 7200 series routers, Cisco 7200 VXR routers, Cisco uBR7200 series routers, the Cisco 7201 router, the Cisco 7301 router, or the Cisco 7401ASR router.

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

**Caution**

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

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

**Note**

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

OIR allows you to install and replace port adapters and service adapters 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 port adapter 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 PA-A3 in a supported platform, refer to the [“Port Adapter Removal and Installation”](#) section on page 3-10.

Each PA-A3 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 port adapter. The system assesses the signals it receives and the order in which it receives them to determine if a port adapter 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 port adapter, the longest pins make contact with the port adapter 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 port adapter, 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.

Brings all previously configured interfaces on the port adapter 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 port adapter type is reinserted into a slot, its ports are configured and brought online up to the port count of the originally installed port adapter of that type.

## 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.



Caution

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 cutaways in the following illustrations.

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

## Equipment Installation



Warning

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

Waarschuwing

**Deze apparatuur mag alleen worden geïnstalleerd, vervangen of hersteld door bevoegd geschoold personeel.**

Varoitus

**Tämän laitteen saa asentaa, vaihtaa tai huoltaa ainoastaan koulutettu ja laitteen tunteva henkilökunta.**

Attention

**Il est vivement recommandé de confier l'installation, le remplacement et la maintenance de ces équipements à des personnels qualifiés et expérimentés.**

Warnung	Das Installieren, Ersetzen oder Bedienen dieser Ausrüstung sollte nur geschultem, qualifiziertem Personal gestattet werden.
Avvertenza	Questo apparato può essere installato, sostituito o mantenuto unicamente da un personale competente.
Advarsel	Bare opplært og kvalifisert personell skal foreta installasjoner, utskiftninger eller service på dette utstyret.
Aviso	Apenas pessoal treinado e qualificado deve ser autorizado a instalar, substituir ou fazer a revisão deste equipamento.
¡Advertencia!	Solamente el personal calificado debe instalar, reemplazar o utilizar este equipo.
Varning!	Endast utbildad och kvalificerad personal bör få tillåtelse att installera, byta ut eller reparera denna utrustning.
Aviso	Somente uma equipe treinada e qualificada tem permissão para instalar, substituir ou dar manutenção a este equipamento.
Advarsel	Kun uddannede personer må installere, udskifte komponenter i eller servicere dette udstyr.
Figyelem	<b>A berendezést csak szakképzett személyek helyezhetik üzembe, cserélhetik és tarthatják karban.</b>
Предупреждение	Установку, замену и обслуживание этого оборудования может осуществлять только специально обученный квалифицированный персонал.
警告	只有经过培训且具有资格的人员才能进行此设备的安装、更换和维修。
警告	この装置の設置、交換、保守は、訓練を受けた相応の資格のある人が行ってください。
주의	교육을 받고 자격을 갖춘 사람만 이 장비를 설치, 교체, 또는 서비스를 수행해야 합니다.
Aviso	Somente uma equipe treinada e qualificada tem permissão para instalar, substituir ou dar manutenção a este equipamento.
Advarsel	Kun uddannede personer må installere, udskifte komponenter i eller servicere dette udstyr.
تحذير	يسمح للفنيين المتخصصين فقط بتركيب المعدة أو استبدالها أو إجراء الصيانة عليها.
Upozorenje	Uređaj smije ugrađivati, mijenjati i servisirati samo za to obučeno i osposobljeno servisno osoblje.
Upozornění	Instalaci, výměnu nebo opravu tohoto zařízení smějí provádět pouze proškolené a kvalifikované osoby.

επικίνδυνη τάση ή	Η τοποθέτηση, η αντικατάσταση και η συντήρηση του εξοπλισμού επιτρέπεται να γίνονται μόνο από καταρτισμένο προσωπικό με τα κατάλληλα προσόντα.
אזהרה	רק עובדים מיומנים ומוסמכים רשאים להתקין, להחליף, או לטפל בציוד זה.
Оророна	Местењето, заменувањето и сервисирањето на оваа опрема треба да му биде дозволено само на обучен и квалификуван персонал.
Ostrzeżenie	<b>Do instalacji, wymiany i serwisowania tych urządzeń mogą być dopuszczone wyłącznie osoby wykwalifikowane i przeszkolone.</b>
Upozornenie	<b>Inštalácii, výmenu alebo opravy tohto zariadenia smú vykonávať iba vyškolené a kvalifikované osoby.</b>

## Blank Faceplates and Cover Panels



### Warning

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.  
Statement 1029

### Waarschuwing

Legе vlakplaten en afdekpanelen vervullen drie belangrijke functies: ze voorkomen blootstelling aan gevaarlijke voltages en stroom binnenin het frame, ze bevatten elektromagnetische storing (EMI) hetgeen andere apparaten kan verstoren en ze leiden de stroom van koellucht door het frame. Het systeem niet bedienen tenzij alle kaarten, vlakplaten en afdekkingen aan de voor- en achterkant zich op hun plaats bevinden.

### Varoitus

Tyhjillä tasolaikoilla ja suojapaneeleilla on kolme tärkeää käyttötarkoitusta: Ne suojaavat asennuspohjan sisäisille vaarallisille jännitteille ja sähkövirralle altistumiselta; ne pitävät sisälläan elektromagneettisen häiriön (EMI), joka voi häiritä muita laitteita; ja ne suuntaavat tuuletusilman asennuspohjan läpi. Järjestelmää ei saa käyttää, elleivät kaikki tasolaikat, etukannet ja takakannet ole kunnolla paikoillaan.

### Attention

Ne jamais faire fonctionner le système sans que l'intégralité des cartes, des plaques métalliques et des panneaux avant et arrière ne soient fixés à leur emplacement. Ceux-ci remplissent trois fonctions essentielles : ils évitent tout risque de contact avec des tensions et des courants dangereux à l'intérieur du châssis, ils évitent toute diffusion d'interférences électromagnétiques qui pourraient perturber le fonctionnement des autres équipements, et ils canalisent le flux d'air de refroidissement dans le châssis.

Warnung	Blanke Faceplates und Abdeckungen haben drei wichtigen Funktionen: (1) Sie schützen vor gefährlichen Spannungen und Strom innerhalb des Chassis; (2) sie halten elektromagnetische Interferenzen (EMI) zurück, die andere Geräte stören könnten; (3) sie lenken den kühlenden Luftstrom durch das Chassis. Das System darf nur betrieben werden, wenn alle Karten, Faceplates, Vorder- und Rückabdeckungen an Ort und Stelle sind.
Avvertenza	Le piattaforme bianche e i pannelli di protezione hanno tre funzioni importanti: Evitano l'esposizione a voltaggi e correnti elettriche pericolose nello chassis, trattengono le interferenze elettromagnetiche (EMI) che potrebbero scombussolare altri apparati e dirigono il flusso di aria per il raffreddamento attraverso lo chassis. Non mettete in funzione il sistema se le schede, le piattaforme, i pannelli frontali e posteriori non sono in posizione.
Advarsel	Blanke ytterplater og deksler sørger for tre viktige funksjoner: de forhindrer utsettelse for farlig spenning og strøm inni kabinettet; de inneholder elektromagnetisk forstyrrelse (EMI) som kan avbryte annet utstyr, og de dirigerer luftavkjølingsstrømmen gjennom kabinettet. Betjen ikke systemet med mindre alle kort, ytterplater, frontdeksler og bakdeksler sitter på plass.
Aviso	As faces furadas e os painéis de protecção desempenham três importantes funções: previnem contra uma exposição perigosa a voltagens e correntes existentes no interior do chassis; previnem contra interferência electromagnética (EMI) que poderá danificar outro equipamento; e canalizam o fluxo do ar de refrigeração através do chassis. Não deverá operar o sistema sem que todas as placas, faces, protecções anteriores e posteriores estejam nos seus lugares.
¡Advertencia!	Las placas frontales y los paneles de relleno cumplen tres funciones importantes: evitan la exposición a niveles peligrosos de voltaje y corriente dentro del chasis; reducen la interferencia electromagnética (EMI) que podría perturbar la operación de otros equipos y dirigen el flujo de aire de enfriamiento a través del chasis. No haga funcionar el sistema a menos que todas las tarjetas, placas frontales, cubiertas frontales y cubiertas traseras estén en su lugar.
Varning!	Tomma framplattor och skyddspaneler har tre viktiga funktioner: de förhindrar att personer utsätts för farlig spänning och ström som finns inuti chassit; de innehåller elektromagnetisk interferens (EMI) som kan störa annan utrustning; och de styr riktningen på kylflödet genom chassit. Använd inte systemet om inte alla kort, framplattor, fram- och bakskydd är på plats.
Figyelem	<b>Az előlapok és burkolópanelek három fontos funkciót töltenek be: biztosítják a veszélyes feszültségű és áramerősségű területek érintésvédelmét; elnyelik a más berendezések működésében működési zavarokat okozó elektromágneses interferenciát (EMI); a gépházon belül terelik a hűtőlevegőt. Csak úgy működtesse a rendszert, ha minden kártya, lemez, elülső és hátulsó burkolat a helyén van.</b>
Предупреждение	Заглушки передней панели и защитные панели выполняют три важные функции: помогают избежать поражения электротоком высокого напряжения при прикосновении к внутренним элементам, экранируют электромагнитное излучение, которое может нарушить работу другого оборудования, а также направляют охлаждающий воздушный поток внутри корпуса. Не пользуйтесь устройством со снятыми крышками, заглушками, передними и задними защитными панелями.
警告	空白面板和盖板具有三个重要的功能：它们可以防止接触到底盘内危险的电压和电流；它们将可能破坏其它设备的电磁干扰 (EMI) 封闭起来；它们可以使冷气流从底盘通过。请勿在全部卡、面板、前盖和后盖未安装完毕时操作系统。



警告	<p>ブランクの前面プレートおよびカバー パネルは、3つの重要な役割を果たします。シャーシ内部の危険な電圧および電流に接触しないように防御の役割を果たします。他の機器に悪影響を与えるEMI(電磁波干渉)を外に出しません。さらに、シャーシ全体に冷却用の空気を流します。カード、前面プレート、前面カバー、および背面カバーがすべて取り付けられてから、システムを稼働させてください。</p>
주의	<p>비어있는 전면케이스 커버와 커버 패널은 다음과 같은 세가지 중요한 역할을 합니다. 새시 내부의 위험한 전압 및 전류에 노출되는 것을 방지, 기타 장비에 영향을 끼칠 수 있는 전자파 간섭(EMI)을 포함, 냉각 공기를 새시로 유입. 모든 카드, 전면케이스 커버, 전면 및 후면 커버가 장착되어 있지 않은 경우, 시스템을 작동하지 마십시오.</p>
Aviso	<p><b>Plaquetas vazias e painéis de proteção têm três funções importantes: impedem a exposição a tensões e correntes elétricas perigosas dentro do chassi; apresentam interferência eletromagnética (EMI) que pode danificar outros equipamentos; direcionam o fluxo do ar refrigerado pelo chassi. Não opere o sistema a menos que todas as placas, plaquetas, tampas frontais e tampas traseiras estejam em seu devido lugar.</b></p>
Advarsel	<p><b>Blanke frontplader og sidepaneler tjener tre vigtige formål: de forhindrer udsættelse for farlig spænding og strøm inde i chassiset, de isolerer elektromagnetisk interferens (EMI), der kan forstyrre andet udstyr, og de leder en strøm af kølig luft gennem chassiset. Betjen ikke systemet medmindre alle kort, frontplader, sidepaneler og bagpaneler er på plads.</b></p>
تحذير	<p>تؤدي كل من الواجهات الفارغة ولوحات التغطية ثلاث وظائف هامة: الحيلولة دون التعرض للجهد الكهربائي الخطير والتيارات الموجودة في الهيكل المعدني، حيث يحتوي كلاً منهما على واجهة كهرومغناطيسية ( ) والتي قد تعيق عمل الأجهزة الأخرى كما يقوم بتوجيه تيار التبريد داخل الهيكل المعدني. لا تحاول تشغيل النظام إلا إذا كانت كافة البطاقات والواجهات والأغطية الأمامية والخلفية موضوعة في مكانها.</p>
Upozorenje	<p><b>Prazna prednja ploča i pokrovne ploče imaju tri važne funkcije: sprječavaju izlaganje opasnome visokom naponu i struji unutar kućišta, proizvode elektromagnetnu interferenciju koja može ometati rad ostalih uređaja, te usmjeravaju protok rashladnog zraka kroz kućište. Sustav nemojte koristiti ako sve kartice, te prednje, pokrovne i stražnje ploče nisu pravilno ugrađene.</b></p>
Upozornění	<p><b>Prázdné lícové desky a krycí panely mají tři důležité funkce: zabraňují odkrytí nebezpečného napětí a proudu uvnitř skříně; obsahují elektromagnetické rušení, které může rušit jiná zařízení; směřují proud chladícího vzduchu skříní. Nepoužívejte systém, pokud nejsou všechny karty, lícové desky, přední kryty a zadní kryty na svém místě.</b></p>
επικίνδυνη τάση ή	<p>Οι κενές προσόψεις και τα κενά πλαίσια καλύμματος χρησιμεύουν για τρεις σημαντικές λειτουργίες: Αποκλείουν την έκθεση σε επικίνδυνες τάσεις και ρεύματα στο εσωτερικό του σασί, περικλείουν τις ηλεκτρομαγνητικές παρεμβολές (EMI) που ενδέχεται να προκαλέσουν προβλήματα σε άλλο εξοπλισμό και κατευθύνουν τη ροή του αέρα ψύξης μέσα στο σασί. Μην θέτετε το σύστημα σε λειτουργία αν δεν βρίσκονται στη θέση τους όλες οι κάρτες, οι μπροστινές πλάκες, οι προσόψεις και οι πλάτες.</p>

אזהרה	לוחות כיסוי ריקים ולוחות כיסוי משמשים לשלוש פונקציות חשובות: הם מונעים חשיפה למתחים מסוכנים ולזרם בתוך התושבת; הם מכילים הפרעות אלקטרומגנטיות (EMI) העלולות לשבש ציוד נחר; והם מכוונים את זרימת האוויר המצנן דרך התושבת. אל תפעיל את המערכת אלא אם כל זכרטיסים, לוחות הכיסוי, הלוחות הקדמיים והכיסויים האחוריים נמצאים במקומם.
Opomena	Празните предни плочи и плочите за покривање служат за три важни функции: го спречуваат изложувањето на ризични напони и струи во куќиштето; содржат електромагнетни интерференции (EMI) што можат да попречуваат друга опрема; и го насочуваат протокот на воздухот за разладување низ куќиштето. Не работете со системот ако сите картички, предни плочи, предни капаци и задни капаци не се на своите места.
Ostrzeżenie	<b>Zaślepki i panele osłonowe pełnią trzy ważne funkcje: zapobiegają kontaktowi użytkownika z niebezpiecznymi napięciami i prądami występującymi wewnątrz obudowy; pochłaniają zakłócenia elektromagnetyczne, które mogłyby negatywnie wpływać na działanie innych urządzeń; kierują przepływem powietrza chłodzącego wewnątrz obudowy. System można eksploatować wyłącznie wtedy, gdy zamontowane są wszystkie karty, zaślepki oraz przednie i tylne osłony.</b>
Upozornenie	<b>Prázdne lícne dosky a krycie panely majú tri dôležité funkcie: zabraňujú odkrytiu nebezpečného napätia a prúdu vnútri skrine; obsahujú elektromagnetické rušenie, ktoré môže rušiť iné zariadenia; smerujú prúd chladiaceho vzduchu cez skriňu. Nepoužívajte systém, pokiaľ nie sú všetky karty, lícne dosky, predné kryty a zadné kryty na svojom mieste.</b>

## WAN Port Static Shock



### Warning

Hazardous network voltages are present in WAN ports regardless of whether power to the unit is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the unit first. Statement 1026

### Waarschuwing

Er is gevaarlijke netwerkspanning aanwezig in WAN poorten ongeacht of de stroom naar de router INGESCHAKELD of UITGESCHAKELD is. Om elektrische schokken te vermijden, dient u voorzichtig te werk te gaan wanneer u in de nabijheid van WAN poorten werkt. Wanneer u kabels losmaakt, dient u eerst het uiteinde dat zich het verst van de eenheid vandaan bevindt, te verwijderen.

### Varoitus

WAN-porteissa on vaarallisia verkkojännitteitä riippumatta siitä, onko yksikön virta kytketty vai ei. Välttyäksesi sähköiskulta ole varovainen työskennellessäsi WAN-porttien lähetyvillä. Kun irrotat kaapeleita, irrota yksiköstä kauimpana sijaitseva pää ensiksi.

### Attention

Les ports de réseau longue distance (WAN) gèrent des tensions de réseau dangereuses, que l'unité soit sous tension ou pas. Pour éviter tout risque d'électrocution, prenez toutes les précautions nécessaires avant de travailler à proximité des ports WAN. Pour déconnecter les câbles, commencez par débrancher l'extrémité la plus éloignée du routeur.

Warnung	In WAN-Ports sind gefährliche Netzspannungen vorhanden, auch wenn der Strom zur Einheit abgeschaltet wurde. Zur Vermeidung von Elektroschock Vorsicht bei der Arbeit in der Nähe von WAN-Ports. Beim Abtrennen von Kabeln zuerst das vom Router entfernte Ende lösen.
Avvertenza	Nelle porte WAN sono presenti tensioni di rete pericolose, sia che il sistema sia acceso o meno (ON od OFF). Per evitare scosse elettriche, fare attenzione quando si lavora in prossimità di porte WAN. Quando si scollegano cavi, staccare per primo il connettore collegato al router.
Advarsel!	Det er livsfarlig nettverksspenning i WAN-utganger, uavhengig av om strømmen til enheten er slått av (OFF) eller på (ON). Vær forsiktig når du jobber nær WAN-utganger slik at du unngår elektrisk støt. Hvis du skal løsne kabler, må du først løsne den enden som er lengst borte fra fordelingsenheten.
Aviso	Existem sempre tensões de rede perigosas nas portas WAN, independentemente da corrente para a unidade estar desligada (OFF) ou ligada (ON). Para evitar choques eléctricos, tenha o devido cuidado ao trabalhar junto das portas WAN. Ao desconectar os cabos, separe primeiro a extremidade do cabo que se encontra ligada à unidade.
¡Advertencia!	En los puertos de redes de área extendida (WAN) existen tensiones de red peligrosas, tanto si la unidad está conectada como si está desconectada. Para evitar descargas eléctricas, proceda con precaución cuando trabaje cerca de los puertos WAN. Para desconectar los cables, desconecte primero el extremo que va a la unidad.
Varning!	Farlig nätverksspänning föreligger i WAN-portarna oavsett om strömförsörjningen till enheten är bruten eller ej. För att undvika elektriska stötar ska du vara försiktig vid arbete i närheten av dessa portar. När du kopplar bort en kabel ska du först koppla bort den ände som inte är ansluten till enheten.
Figyelem	<b>A WAN portokban veszélyes hálózati feszültség van jelen, függetlenül attól, hogy a készülék KI vagy BE van kapcsolva. Az áramütés elkerülése érdekében óvatosan járjon el a WAN portok közelében történő munkavégzés során. Először mindig a készülék felőli végükön szüntesse meg a kábelek csatlakozását.</b>
Предупреждение	В портах WAN присутствует опасное напряжение вне зависимости от того, включено устройство или выключено. Будьте внимательны при работе с портами WAN, чтобы избежать поражения электрическим током. Отключение кабеля начинайте с разъема, подключенного к устройству.
警告	无论连接到此部件的电源是开还是关，WAN 端口都会有很危险的电压。为了避免电击，在靠近 WAN 端口处操作时请务必小心。断开此部件的电缆时，请先断开电缆的另一端。
警告	装置の電源がOFFまたはONのどちらであっても、WANポート内部には危険なネットワーク電圧がかかっています。感電事故を防ぐため、WANポートの付近で作業する場合は十分に注意してください。ケーブルを取り外す場合は、装置側から先にケーブルを切り離してください。

# 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:

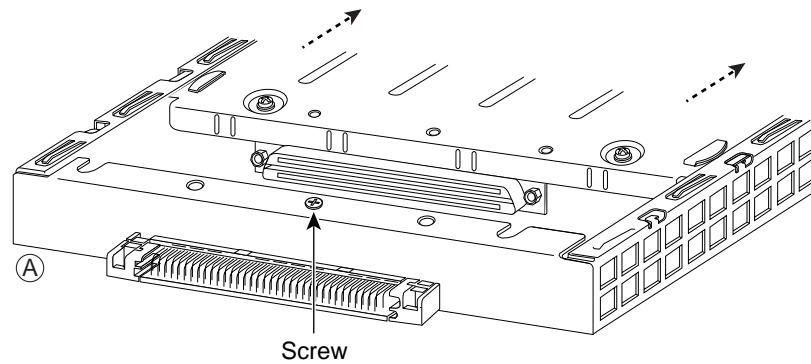
- [Catalyst RSM/VIP2—Removing and Installing a Port Adapter, page 3-11](#)
- [Catalyst 6000 Family FlexWAN Module—Removing and Installing a Port Adapter, page 3-12](#)
- [Cisco 7100 Series Routers—Removing and Installing a Port Adapter, page 3-13](#)
- [Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Removing and Installing a Port Adapter, page 3-14](#)
- [Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Removing and Installing a Port Adapter, page 3-14](#)
- [Cisco uBR7200 Series Routers—Removing a Port Adapter, page 3-15](#)
- [Cisco 7201 Router—Removing and Installing a Port Adapter, page 3-17](#)
- [Cisco 7301 Router—Removing and Installing a Port Adapter, page 3-18](#)
- [Cisco 7304 PCI Port Adapter Carrier Card—Removing and Installing a Port Adapter, page 3-19](#)
- [Cisco 7401ASR Router—Removing and Installing a Port Adapter, page 3-21](#)
- [Cisco 7000 Series Routers and Cisco 7500 Series Routers VIP—Removing and Installing a Port Adapter, page 3-22](#)

## 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.)

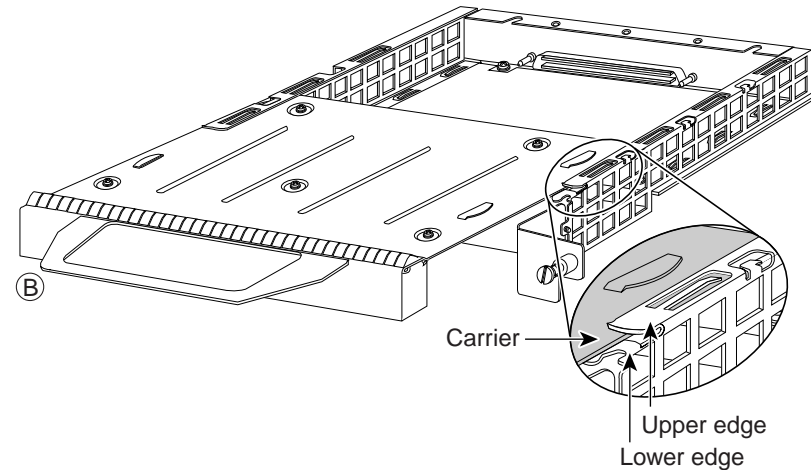


### Step 2

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

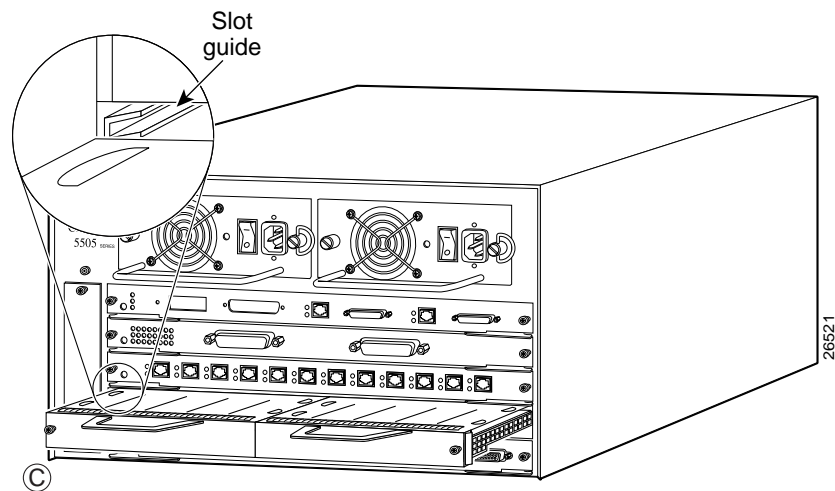
Install the screw in the rear of the port adapter slot. Do not overtighten the screw. (See A.)

### 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.)

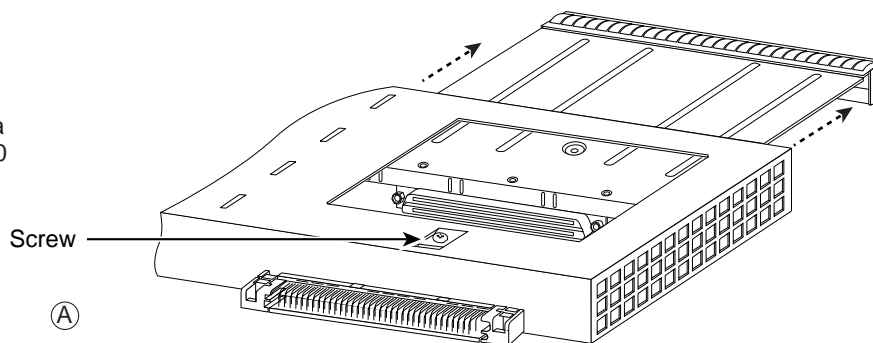


## Catalyst 6000 Family FlexWAN Module—Removing and Installing a Port Adapter

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

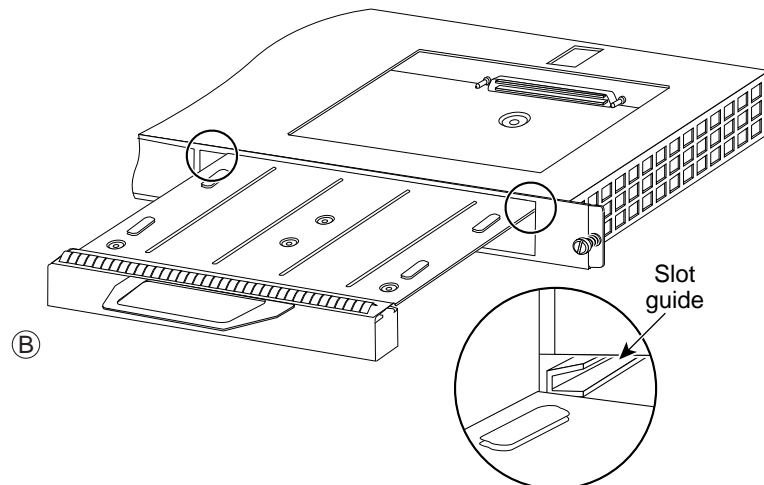
### Step 1

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

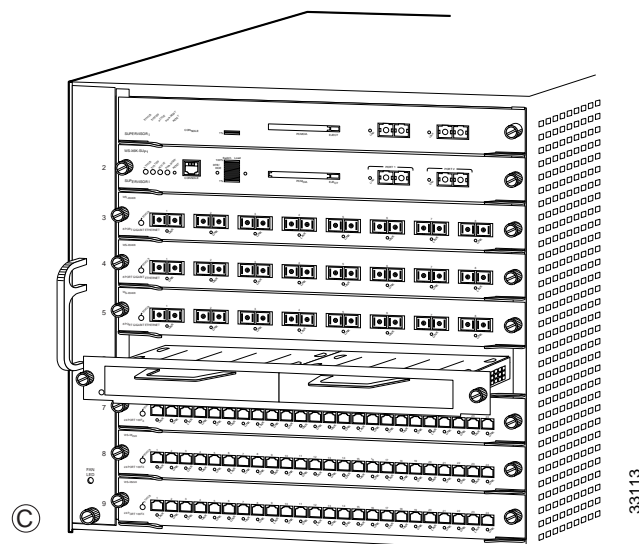
Carefully slide the new port adapter into the port adapter bay until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

### Step 5

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

### Step 6

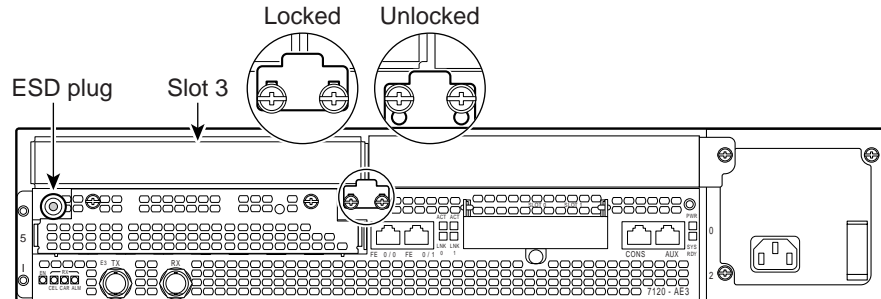
Reinstall the Catalyst 6000 FlexWAN module in the chassis, and tighten the captive installation screw on each side of the Catalyst 6000 FlexWAN module faceplate. (See C.)



# Cisco 7100 Series Routers—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

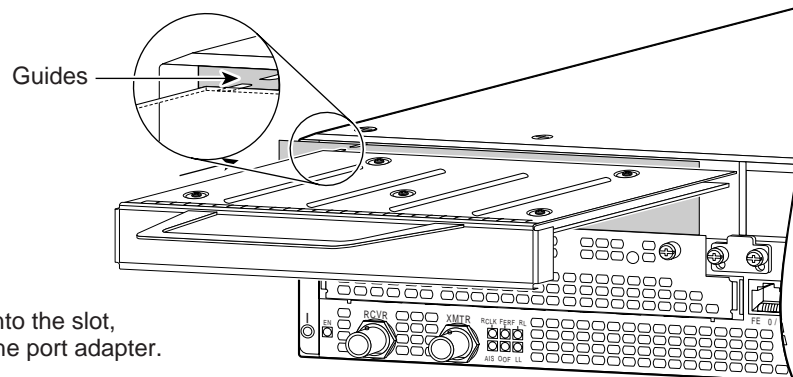
With the port adapter halfway out of the slot, disconnect all cables from the port adapter.

## 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.

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## Cisco 7200 Series Routers and Cisco 7200 VXR Routers—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

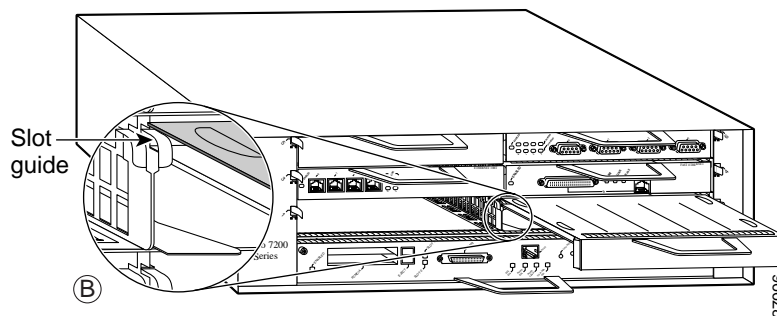
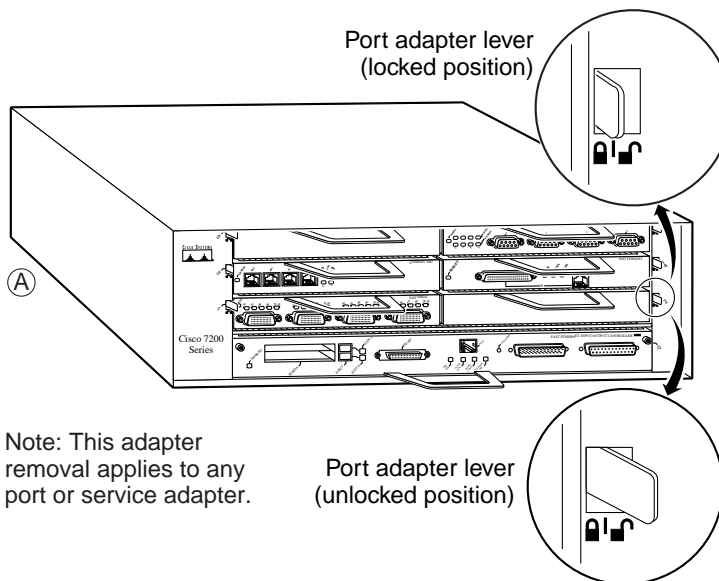
Carefully slide the new port adapter halfway into the port adapter slot. (See B.)

### 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.)

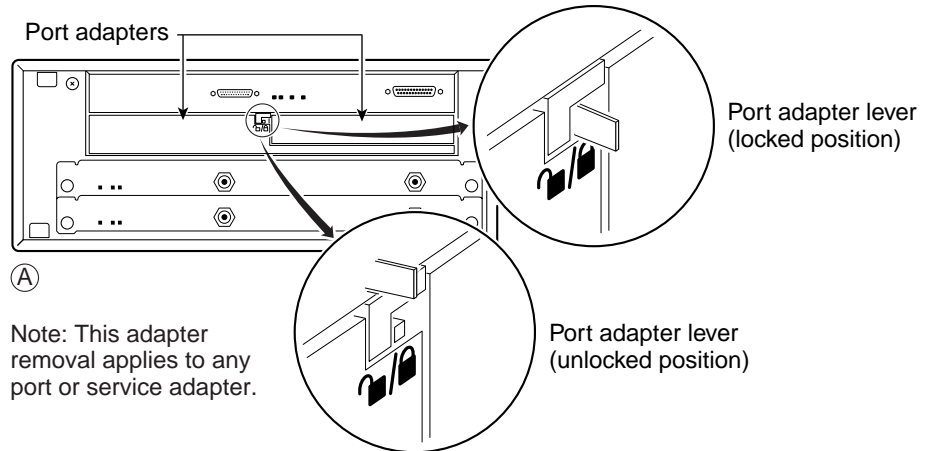




## Cisco uBR7200 Series Routers—Removing a Port Adapter

### Step 1

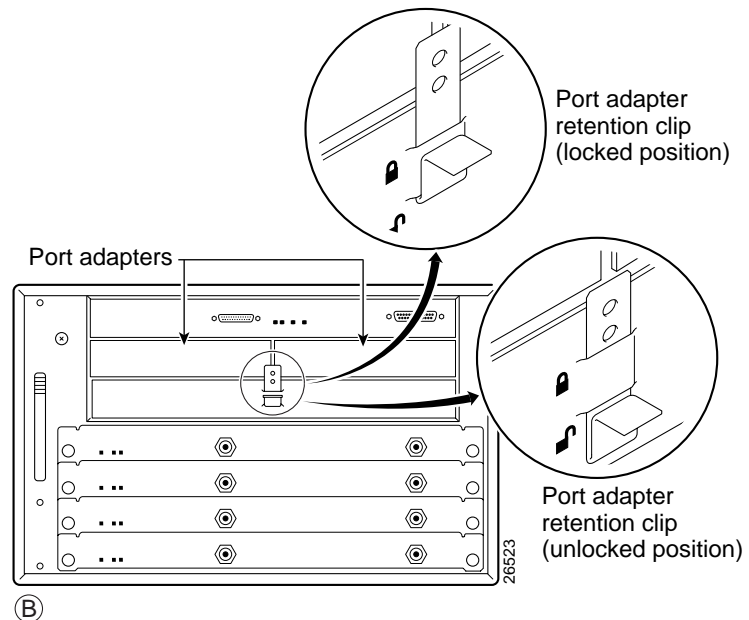
To remove the port adapter, unlock the port adapter retaining mechanism. The port adapter lever remains in the unlocked position.



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.

### 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.



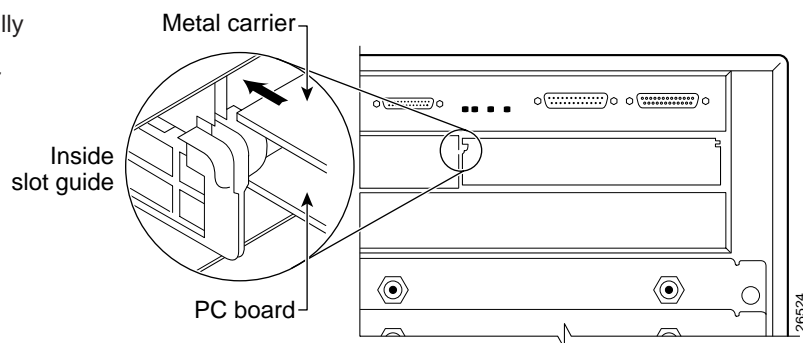
### Step 3

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.

## Cisco uBR7200 Series Routers—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.



### 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 7201 Router—Removing and Installing a Port Adapter

### Step 1

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

### Step 2

To remove the port adapter, place the port adapter lever in the unlocked position. The port adapter lever remains in the unlocked position.

### Step 3

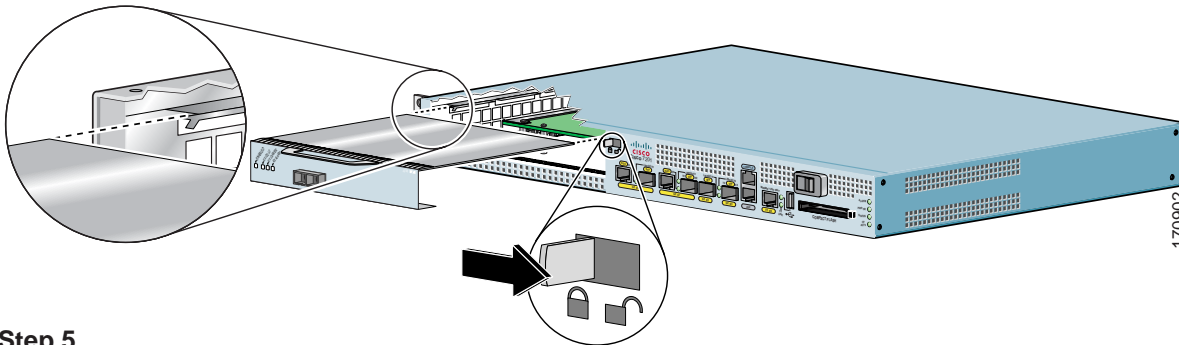
Grasp the handle of the port adapter and pull the port adapter about halfway out of its slot. If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

### Step 4

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 the chassis slot.

### Caution

The port adapter must slide into the slot guides close to 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

To insert the port adapter, carefully align the port adapter carrier in the slot guides. Slide the new port adapter halfway into the chassis.

### Step 6

Connect all the 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, lock the port adapter lever.

## Cisco 7301 Router—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

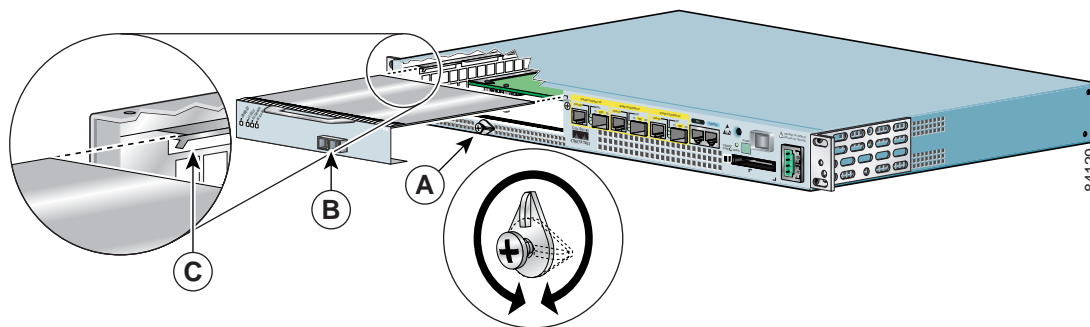
Grasp the handle and pull the port adapter from the router, about halfway out of its slot. (See B.) If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

### Step 4

With the port adapter halfway out of the slot, disconnect 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.

**Caution**

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.

To remove and install a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card, refer to [Figure 3-2 on page 3-20](#) and do the following:

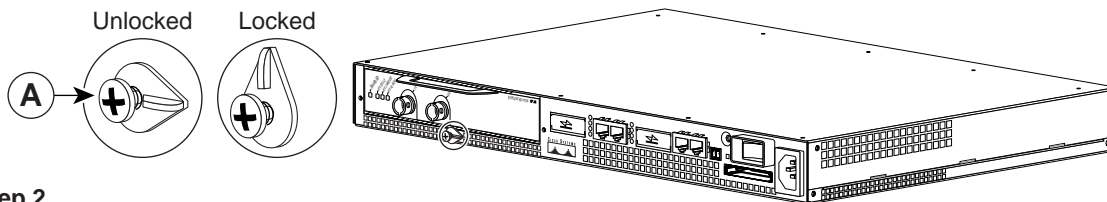
- Step 1** If the Cisco 7304 PCI Port Adapter Carrier Card is still in the router, you must remove the Cisco 7304 PCI Port Adapter Carrier Card before removing a port adapter.
- Step 2** To remove the port adapter from the Cisco 7304 PCI Port Adapter Carrier Card, turn the port adapter lock from its 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 the Cisco 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 on page 3-20](#).



## 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

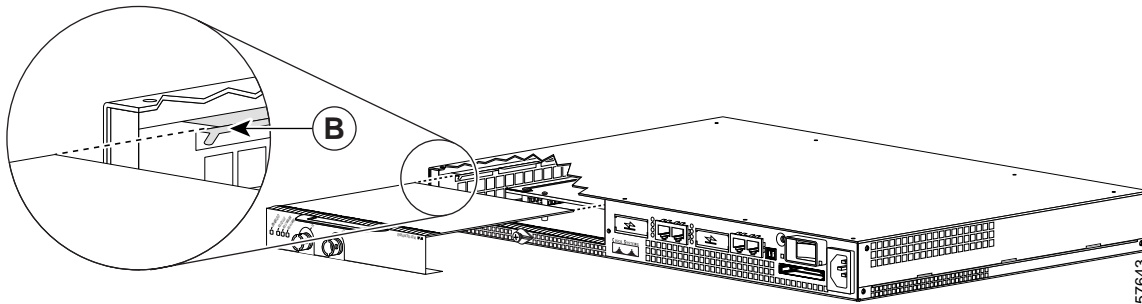
With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter completely out of the chassis slot.

### 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 adapter 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

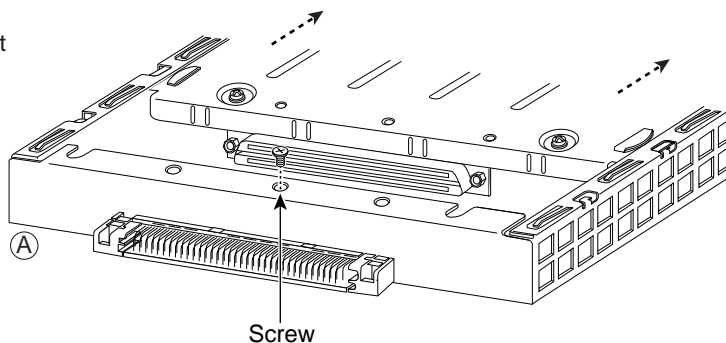
After the port adapter is properly seated, rotate the port adapter latch to the upright locked position and use a number 2 Phillips screwdriver to tighten the latch screw. If needed, loosen the latch screw to rotate the latch over the port adapter. Finish the installation by tightening the latch screw.

## Cisco 7000 Series Routers and Cisco 7500 Series Routers 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.)

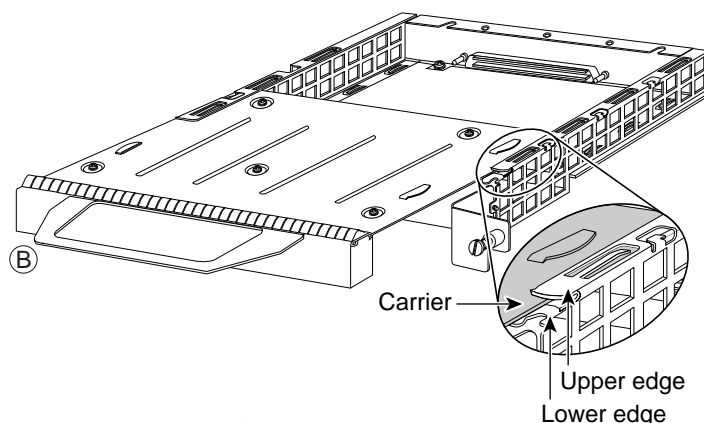


### Step 2

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.)

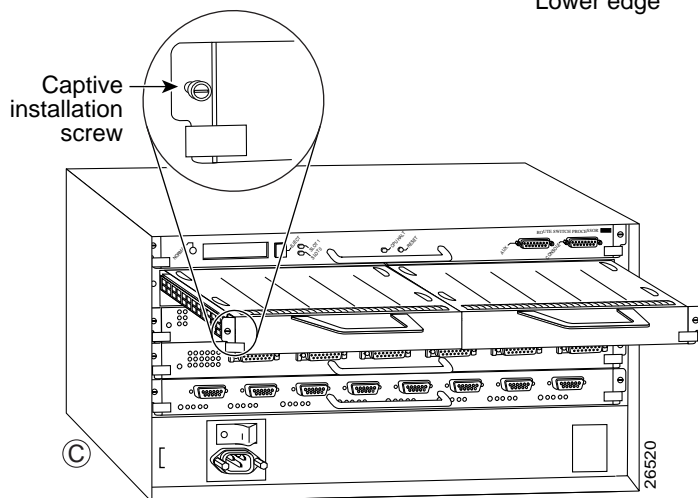


### Step 4

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 Port Adapter Cables

The PA-A3 interfaces provide an interface to ATM switching fabrics for transmitting and receiving data. The single-mode intermediate reach and multimode interfaces connect to the SONET/SDH, multimode or single-mode optical fiber.

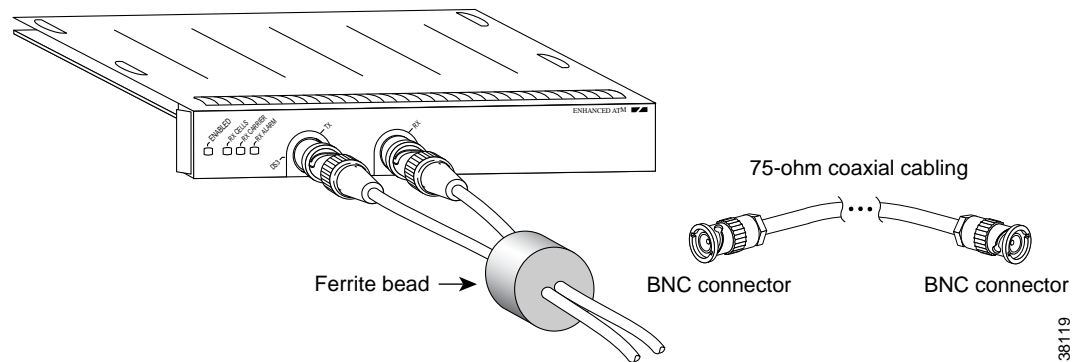
For SONET/SDH multimode and single-mode connections, use one duplex SC connector or two simplex SC connectors. Be sure to remove the dust covers from each connector before installing new cables.

## E3 or T3 Connections

To connect an ATM E3 or T3 port to the network, use the following procedure:

- Step 1** Attach the appropriate coaxial cable directly to the receptacle on the router. (See [Figure 3-3](#).) For cable information, see the “[Cables and Connectors](#)” section on page 1-5.
- Step 2** Attach the network end of the coaxial cable to the external E3 or T3 equipment.

**Figure 3-3** Attaching an E3 or T3 cable



## OC-3 Connections

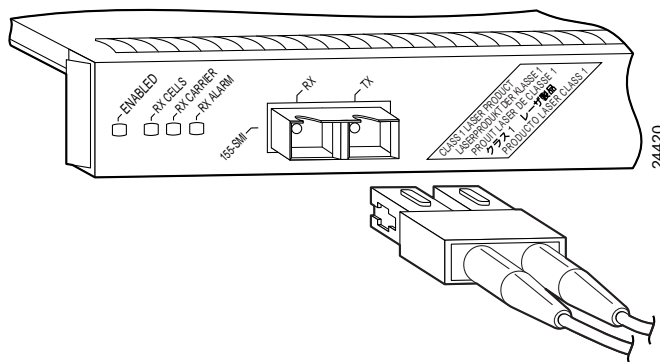
The PA-A3-OC3SMI (OC-3c/STM-1 single-mode intermediate reach) and PA-A3-OC3MM (OC-3c/STM-1 multimode) interfaces provide an interface to ATM switching fabrics for transmitting and receiving data at rates of up to 155 Mbps bidirectionally. The single-mode intermediate reach and multimode interfaces connect to the SONET/SDH, 155-Mbps multimode or single-mode optical fiber.

For SONET/SDH multimode and single-mode connections, use one duplex SC connector or two simplex SC connectors. The simplex and duplex SC connectors are shipped with removable dust covers on each connector. These cables are not available from Cisco.

To connect an ATM OC-3c/STM-1 port to the network, use the following procedure:

- 
- Step 1** Attach the appropriate optical fiber cable directly to the receptacle on the router. (See [Figure 3-4 on page 3-24](#).) For cable information, “[Cables and Connectors](#)” section on [page 1-5](#).
- Step 2** Attach the network end of the cable to an external DSU (an ATM network).

**Figure 3-4** Attaching a PA-A3 Interface Cable—Duplex Cable Connector Shown



**Note** [Figure 3-4](#) shows a cable with one duplex SC connector; however, you could also use two cables with one simplex SC connector on each. If you do use separate cables with single SC connectors, you must observe the proper relationship between the transmit (TX) and receive (RX) receptacles on the PA-A3.

---



## CHAPTER 4

# Configuring the PA-A3

---

To continue your PA-A3 installation, you must configure the PA-A3 interface. The instructions that follow apply to all supported platforms. Minor differences between the platforms—with Cisco IOS software commands—are noted.

This chapter contains the following sections:

- [Using the EXEC Command Interpreter, page 4-1](#)
- [PA-A3 Configurations, page 4-2](#)
- [Customizing the PA-A3, page 4-15](#)
- [Checking the Configuration, page 4-16](#)
- [Traffic Management, page 4-32](#)
- [Troubleshooting the PA-A3 Installation and Configuration, page 4-32](#)
- [ATM Configuration, page 4-36](#)
- [Upgrading Your Boot Flash Image, page 4-37](#)
- [Port Adapter Error Messages, page 4-38](#)

## 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#
```
- 

## PA-A3 Configurations

After you verify that the new PA-A3 is installed correctly (the ENABLED LED goes on), use the privileged-level **configure** command to configure the new interface. Have the following information available:

- Protocols you plan to route on the new interface
- IP addresses, if you plan to configure the interface for IP routing
- Bridging protocols you plan to use

If you installed a new PA-A3 or if you want to change the configuration of an existing interface, you must enter configuration mode to configure the new interface. If you replaced a PA-A3 that was previously configured, the system recognizes the new interface and brings it up in its existing configuration.

For a summary of the configuration options available and instructions for configuring the interface on a PA-A3, refer to the appropriate configuration publications listed in the [“Related Documentation” section on page -ix](#).

When an interface is enabled (taken out of shutdown mode) with no additional arguments, the default interface configuration file parameters are functional.

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.)

This section contains the following subsections:

- [Shutting Down an Interface](#), page 4-3
- [Performing a Basic Interface Configuration](#), page 4-4
- [Configuring the PA-A3 for T3](#), page 4-5
- [Configuring the PA-A3 for E3](#), page 4-6
- [Configuring the PA-A3 for OC-3](#), page 4-6
- [Configuring VCs](#), page 4-7
- [Configuring PVCs](#), page 4-8
- [Configuring SVCs](#), page 4-10
- [Configuring Classical IP and ARP over ATM](#), page 4-13
- [Classes of Service and Transmit Priority on the PA-A3](#), page 4-13

## Shutting Down an Interface

Before you remove an interface that you will not replace, replace interface cables, or replace port adapters, use the **shutdown** command to shut down (disable) the interfaces to prevent anomalies when you reinstall the new port adapter or reconfigured port adapter. When you shut down an interface, it is designated administratively down in the **show** command displays.

Follow these steps to shut down an interface:

---

**Step 1** Enter the privileged level of the EXEC command interpreter (also called enable mode). (See the [“Using the EXEC Command Interpreter”](#) section on page 4-1 for instructions.)

**Step 2** At the privileged-level prompt, enter configuration mode and specify that the console terminal is the source of the configuration subcommands, as follows:

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

**Step 3** Shut down the interface by entering the **interface** command (followed by the interface address of the interface), and then enter the **shutdown** command. See the [“Using the show interfaces Command”](#) section on page 4-26.

When you have finished, 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.



---

**Note** If you need to shut down additional interfaces, enter the **interface** command (followed by the interface type and the interface address of the interface) for each of the interfaces on your port adapter. Use the **no shutdown** command to enable the interface.

---

**Step 4** Write the new configuration to NVRAM as follows:

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

The system displays an OK message when the configuration has been stored in NVRAM.

- Step 5** Verify that new interface is now in the correct state (shut down) using the **show interfaces** command (followed by the interface type and interface address of the interface) to display the specific interface. See the [“Using the show interfaces Command” section on page 4-26](#).
- Step 6** Re-enable the interface by doing the following:
- Repeat Step 3 to re-enable an interface. Substitute the **no shutdown** command for the **shutdown** command.
  - Repeat Step 4 to write the new configuration to memory. Use the **copy running-config startup-config** command.
  - Repeat Step 5 to verify that the interface is in the correct state. Use the **show interfaces** command followed by the interface address of the interface.
- 

For descriptions of software configuration commands, refer to the publications listed in the [“Related Documentation” section on page -ix](#).

## Performing a Basic Interface Configuration

Following are instructions for a basic configuration, which include enabling an interface 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. For complete descriptions of configuration subcommands and the configuration options available for the interfaces of your port adapter, refer to the appropriate software documentation.

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 is 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 first interface to configure by entering the **interface** command, followed by the type of interface and the interface address of the interface you plan to configure. (The command for your port adapter will be specific to the technology of your interface.) The [“Using the show interfaces Command” section on page 4-26](#) provides examples.
- Step 3** Assign an IP address and subnet mask to the interface (if IP routing is enabled on the system) by using the **ip address** subcommand, as in the following example:
- ```
Router(config-if)# ip address 10.0.0.0 10.255.255.255
```
- Step 4** Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.
- Step 5** Re-enable the interfaces using the **no shutdown** command. (See the [“Shutting Down an Interface” section on page 4-3](#).)

**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#
```

---

The system displays an OK message when the configuration has been stored in NVRAM.



**Note**

If you are going to disconnect or reconfigure the ATM interface cable, use the **shutdown** command before doing so. After reattaching the ATM interface cable, use the **no shutdown** command to bring up the ATM interface.

---

## Configuring the PA-A3 for T3

To configure the PA-A3 for T3, perform the following tasks in interface configuration mode:

**Step 1** Specify an ATM interface configuration. See “[Identifying Interface Addresses](#)” section on page 1-21 for the appropriate interface address for your system.

```
Router# interface atm slot/port or slot/port-adapter/port
```

**Step 2** Set the line build-out length (0 to 50 feet is **short** and greater than 50 feet is **long**). Use the **no** form of this command to return to the default, which is **short**.

```
Router(config-if)# lbo {short | long}
```

**Step 3** Select the transmit clock source. This can be internal or derived from the receive clock through use of the **no** form of the command. By default, the receive clock source is used for the transmit clock.

```
Router(config-if)# clock internal
```

**Step 4** Enable DS-3 scrambling. Use the **no** form of the command to restore the default value.

```
Router(config-if)# DS3-scramble
```

**Step 5** Specify DS-3 framing: **m23plcp**, **cbitplcp**, **m23adm**, or **cbitadm**. Use the **no** form of the command to return to the default, which is **cbitadm**.

```
Router(config-if)# framing {m23plcp | cbitplcp | m23adm | cbitadm}
```

---

## Configuring the PA-A3 for E3

To configure the PA-A3 for E3, perform the following tasks in interface configuration mode:

- Step 1** Specify an ATM interface configuration. See the [“Identifying Interface Addresses”](#) section on page 1-21 for the appropriate interface address for your system.

```
Router# interface atm slot/port or slot/port-adapter/port
```

- Step 2** Select the transmit clock source. This can be internal or derived from the receive clock through use of the **no** form of this command. By default, the receive clock source is used for the transmit clock.

```
Router(config-if)# clock internal
```

- Step 3** Enable E3 scrambling. Use the **no** form of the command to restore the default value.

```
Router(config-if)# e3-scramble
```

- Step 4** Specify DS-3 framing: **g832adm**, **g751adm**, or **g751plcp**. Use the **no** form of the command to return to the default, which is **g832adm**.

```
Router(config-if)# framing {g832adm | g751adm | g751plcp}
```

## Configuring the PA-A3 for OC-3

To configure the PA-A3 for OC-3, perform the following tasks in interface configuration mode:

- Step 1** Specify an ATM interface configuration. See [“Identifying Interface Addresses”](#) section on page 1-21 for the appropriate interface address for your system.

```
Router# interface atm slot/port or slot/port-adapter/port
```

- Step 2** Select the transmit clock source. This can be internal or derived from the receive clock through use of the **no** form of this command. By default, the receive clock source is used for the transmit clock.

```
Router(config-if)# clock internal
```

- Step 3** Specify SONET framing by using the **sonet stm-1** command. Use the **no** form of this command to return to the default, STS-3c framing.

```
Router(config-if)# sonet stm-1
```



### Note

In ATM environments, the key difference between SONET and SDH framing modes is the type of cell transmitted when no user or data cells are available. The ATM forum specifies use of idle cells if unassigned cells are not generated. More specifically, in Synchronous Transport Module-X (STM-X) mode, an ATM interface sends idle cells for cell-rate decoupling. In Synchronous Transport Signal-Xc (STS-Xc) mode, the ATM interface sends unassigned cells for cell-rate decoupling.



## Configuring VCs

A virtual circuit (VC) is a point-to-point connection between remote hosts and routers. A VC is established for each ATM end node with which the router communicates. The characteristics of the VC are established when the VC is created and include the following:

- Class of service category:
  - Constant bit rate (CBR)
  - Non-real-time variable bit rate (nrt-VBR)
  - Real-time variable bit rate (rt-VBR)
  - Available bit rate (ABR)
  - Unspecified bit rate (UBR)
- ATM adaptation layer 5 (AAL5)
- Encapsulation type:
  - Logical link control Subnetwork Address Protocol (AAL5SNAP)
  - Multiplexer (AAL5MUX)
  - Network Layer Protocol ID (AAL5NLPID)
  - Integrated Local Management Interface (ILMI)
  - Switched Multimegabit Data Service (SMDS)
  - ITU/Q.2931 Signaling ATM Adaptation Layer (QSAAL)
  - Cisco AUTO PPP over AAL5 (aal5autopp)
  - Cisco PPP over AAL5 (aal5ciscopp)

**Note**

See the ATM virtual circuit configuration commands in the example output of the [“Classes of Service and Transmit Priority on the PA-A3”](#) section on page 4-13.

Each VC supports the following router functions:

- Multiprotocol
- Fast switching of IP packets
- Flow, and Cisco Express Forwarding (CEF) switching of IP packets
- Pseudobroadcast support for multicast packets

By default, CEF switching is enabled on all PA-A3 interfaces. These switching features can be turned off with interface configuration commands. Flow must be explicitly enabled for each interface.

## Configuring PVCs

To use a permanent virtual circuit (PVC), configure the PVC in both the router and the ATM switch. PVCs remain active until the circuit is removed from either configuration. When a PVC is configured, all of the configuration options are passed on to the PA-A3. You can write these PVCs into nonvolatile RAM (NVRAM); they are used when the system image is reloaded.

Some ATM switches might have point-to-multipoint PVCs that do the equivalent of broadcasting. If a point-to-multipoint PVC exists, it can be used as the sole broadcast PVC for all multicast requests.

Like Frame Relay, ATM supports two types of interface: point-to-point and multipoint. The one you choose determines whether you need to use the configuration commands that ensure IP to ATM mappings.

To configure a PVC, refer to the following sections:

- [Configuring a PVC on a Point-to-Point Subinterface, page 4-8](#)
- [Configuring a PVC on a Multipoint Subinterface, page 4-9](#)

### Configuring a PVC on a Point-to-Point Subinterface

With point-to-point subinterfaces, each pair of routers has its own subnet. If you put the PVC on a point-to-point subinterface, the router assumes that there is only one point-to-point PVC configured on the subinterface. Therefore, any IP packets with a destination IP address in the same subnet are forwarded on this VC.

To configure a point-to-point PVC, perform the following tasks from configuration mode:

- 
- Step 1** Enter interface configuration mode and specify an ATM interface using the **interface atm** command. Specify the creation of a point-to-point interface by using the **point** command.
- ```
Router(config)# interface atm5/0.200 point
```
- Step 2** You can list the VPI and VCI values using the **pvc ?** command.
- ```
Router(config-if)# pvc ?
<0-255>   Enter VPI/VCI value(slash required)
<1-65535> Enter VCI value
WORD      Optional handle to refer to this connection
```
- Step 3** Create the PVC. Notice the output telling you that the circuit has been configured on a specific interface.
- ```
Router(config-if)# pvc 1/1
Configuring vc 1/1 on interface ATM5/0.200

Router(config-if-atm-vc)#
```
- 



#### Note

Static map statements are not required for point-to-point subinterfaces.

---

## Configuring a PVC on a Multipoint Subinterface

Multipoint networks generally have three or more routers in the same subnet. If you put the PVC in a point-to-multipoint subinterface or in the main interface (which is multipoint by default), you need to either configure a static mapping or enable inverse Address Resolution Protocol (InARP) for dynamic mapping.

The following output example shows a PVC 2/200 on ATM interface 1/1/0.200. It uses the global default AAL5SNAP encapsulation. The local interface IP address is 2.2.2.1, and the remote interface IP address is 2.2.2.2.

```
Router# show interfaces atm 1/1/0.200
interface ATM1/1/0.200 multipoint
ip address 2.2.2.1 255.255.255.0
no ip directed-broadcast
pvc 2/200
protocol ip 2.2.2.2 broadcast
```

InARP is enabled on multipoint links by default. The following example, creates a multipoint subinterface. By using the **show atm map** command, you can see that InARP builds a dynamic mapping between the Layer 3 IP address and the Layer 2 VPI/VCI:

```
Router# show atm map
Map list ATM1/1/0.100_ATM_INARP : DYNAMIC
ip 1.1.1.2 maps to VC 19, VPI 2, VCI 100, ATM1/1/0.100
Map list ATM1/1/0.200_ATM_INARP : DYNAMIC
ip 2.2.2.2 maps to VC 20, VPI 2, VCI 200, ATM1/1/0.200
```

You can check the mapping using the **show atm map** command. In the following example, you can see the mapping of Layer 3 to Layer 2 addresses is dynamic. Such mapping is dynamic using InARP as illustrated in the previous **show atm map** command example.

```
Router# show atm map
Map list ATM1/1/0.100_ATM_INARP : DYNAMIC
ip 1.1.1.2 maps to VC 19, VPI 2, VCI 100, ATM1/1/0.100
Map list ATM1/1/0.200pvc20 : PERMANENT
ip 2.2.2.2 maps to VC 20, VPI 2, VCI 200, ATM1/1/0.200, broadcast
```

You can use the **inarp** command to change the frequency of transmitting a new ATM InARP packet in order to reconfirm the mapping:

```
Router(config-subif)# pvc 2/200
Router(config-if-atm-vc)# inarp ?
    <1-60> InARP Frequency in minutes
    <cr>
Router(config-if-atm-vc)# inarp 5
Router(config-if-atm-vc)# end
```

Use the **show atm vc** command to confirm your configured value:

```
Router# show atm vc
5d10h: ATMARP:Sending first PVC INARP
5d10h: ATMARP(ATM1/1/0.200)O: INARP_REQ to VCD#20 2/200 for link 7(IP)
5d10h: ATMARP(ATM1/1/0.200)I: INARP Reply VCD#20 2/200 from 2.2.2.2
ATM1/1/0.200: VCD: 20, VPI: 2, VCI: 200
UBR, PeakRate: 44209
AAL5-LLC/SNAP, etype:0x0, Flags: 0xC20, VCmode: 0x0
OAM frequency: 0 second(s)
InARP frequency: 5 minutes(s)
Transmit priority 4
InPkts: 10, OutPkts: 11, InBytes: 680, OutBytes: 708
InPRoc: 10, OutPRoc: 5, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 6
```

```

InPktDrops: 0, OutPktDrops: 0
CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0
OAM cells received: 0
OAM cells sent: 0
Status: UP

```

## Configuring SVCs

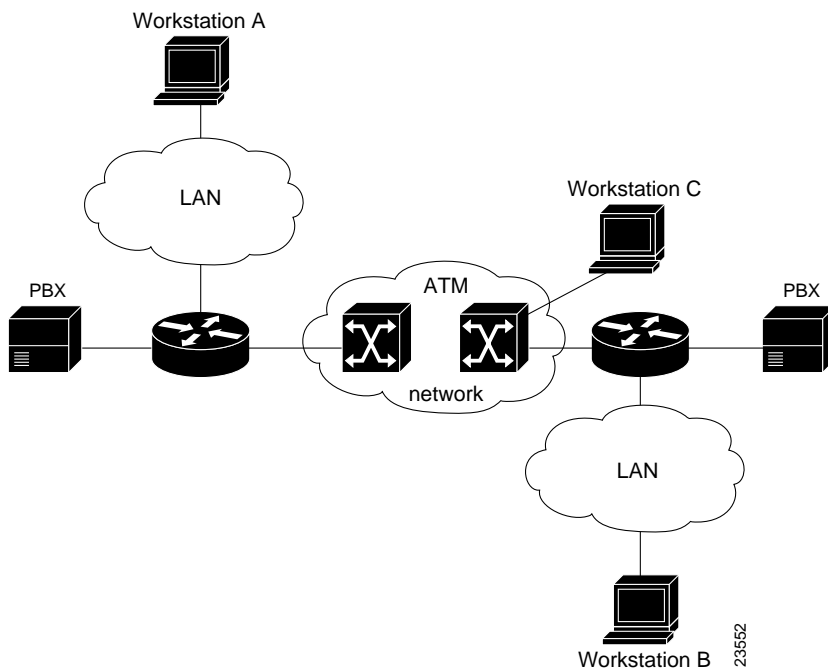
ATM switched virtual circuits (SVCs) are created and released dynamically, providing user bandwidth on demand. This service requires a signaling protocol between the router and the switch.

The ATM signaling software provides a method of dynamically establishing, maintaining, and clearing ATM connections at the User-Network Interface (UNI). The ATM signaling software conforms to the ATM Forum UNI 4.0 specification.

In UNI mode, the user is the router, and the network is an ATM switch. This is an important distinction. The Cisco router does not perform ATM-level call routing. Instead, the ATM switch does the ATM call routing, and the router routes packets through the resulting circuit. The router is viewed as the user and the LAN interconnection device at the end of the circuit, and the ATM switch is viewed as the network.

Figure 4-1 on page 4-10 illustrates the router position in a basic ATM environment. The router is used primarily to interconnect LANs through an ATM network. Workstation C in Figure 4-1 on page 4-10 is connected directly to the destination ATM switch. You can connect not only routers to ATM switches, but also any network device with an ATM interface that conforms to the ATM Forum UNI specification.

**Figure 4-1 Basic ATM Environment**



To use SVCs, complete the required tasks in the following sections:

- [Configuring the PVC That Performs SVC Call Setup, page 4-11](#)
- [Configuring the Network Service Access Point Address, page 4-12](#)

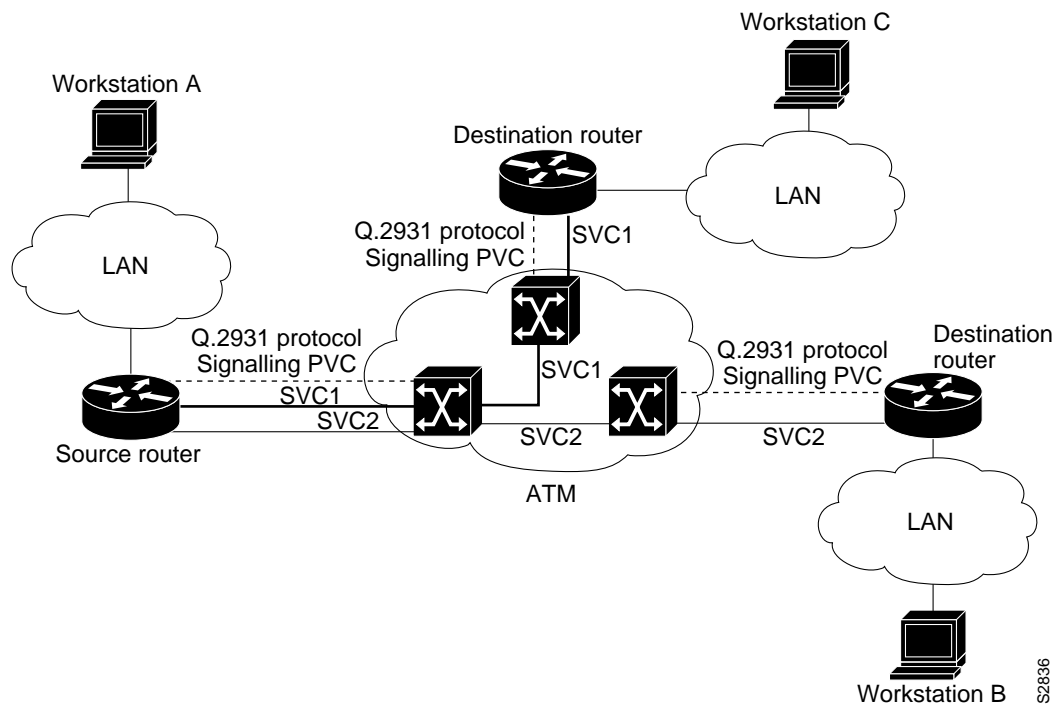
For further information on configuring the PA-A3 port adapter for SVCs, see the *Wide-Area Networking Configuration Guide*.

## Configuring the PVC That Performs SVC Call Setup

ATM uses out-of-band signaling. One dedicated PVC exists between the router and the ATM switch, over which all SVC call establishment and call termination requests flow. After the call is established, data transfer occurs over the SVC, from router to router. The signaling that accomplishes the call setup and teardown is called *Layer 3 signaling* or the *Q.2931 protocol*.

For out-of-band signaling, a signaling PVC must be configured before any SVCs can be set up. In [Figure 4-2](#), a signaling PVC from the source router to the ATM switch is used to set up two SVCs. This is a fully meshed network; workstations A, B, and C can all communicate with one another.

**Figure 4-2** One or More SVCs Require a Signaling PVC



To configure the signaling PVC for all SVC connections, enter the `pvc vcd vpi vci qsaal` command in interface configuration mode.



### Note

This signaling PVC can be set up on a major interface only, not on the subinterfaces.

The VPI and VCI values must be configured consistently with the local switch. The standard value of VPI is 0, and the range of VPI values is 0 through 255. The standard value of VCI is 5, and the range of VCI values is 0 through 65535.



Note

VCI values 0 through 31 are reserved and do not carry data traffic.

## Configuring the Network Service Access Point Address

Every ATM interface involved with signaling must be configured with a network service access point (NSAP) address. The NSAP address is the ATM address of the interface and must be unique across the network.

To configure an NSAP address, complete the tasks in the following sections:

- [Configuring the Complete NSAP Address Manually, page 4-12](#)
- [Configuring the ESI and Selector Fields, page 4-13](#)

To configure the ESI and Selector fields, you must also configure a PVC to communicate with the switch through ILMI:

```
Router(config-if)# pvc 0/16 ilmi
```

The switch then provides the Prefix field of the NSAP address.

## Configuring the Complete NSAP Address Manually

When you configure the NSAP address manually, you must enter the entire address in hexadecimal format; that is, each digit entered represents a hexadecimal digit. To represent the complete NSAP address, you must enter 40 hexadecimal digits in the following format:

```
XX.XXXX.XX.XXXXXX.XXXX.XXXX.XXXX.XXXX.XXXX.XXXX.XX
```



Note

All NSAP addresses must be entered in the dotted hexadecimal format shown, which conforms to the UNI specification.

Because the interface has no default NSAP address, you must configure the NSAP address for SVCs. To set the ATM interface source NSAP address, enter the `nsap-address nsap-address` command in interface configuration mode.

The following is an example of an NSAP address assigned to ATM interface 4/0 on a Cisco 7200 series, Cisco uBR7200 series, or Cisco 7100 series router:

```
Router(config)# interface atm 4/0
Router(config-if)# nsap-address AB.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12
```

You can display the ATM address for the interface by executing the `show interfaces atm` command.

## Configuring the ESI and Selector Fields

You can configure the router to get the NSAP address prefix from the switch; however, the switch must be capable of delivering the NSAP address prefix to the router through ILMI, and the router must be configured with a PVC for communication with the switch through ILMI.

To configure the router to get the NSAP prefix from the switch and use locally entered values for the remaining fields of the address, complete the following tasks in interface configuration mode:

- Step 1** Specify an ATM interface to configure.

```
Router(config)# interface atm slot/port or slot/port-adapter/port
```

- Step 2** Enter the ESI and Selector fields of the NSAP address.

```
Router(config-if)# esi-address esi.selector
```

In the **esi-address** command, the *esi* argument is 6 hexadecimal bytes long (12 digits), and the *selector* argument is 1 hexadecimal byte long (2 digits).

In the following example on a Cisco 7200 series router, the ESI and Selector field values are assigned, and the ILMI PVC is set up:

```
Router(config)# interface atm 4/0  
Router(config-if)# esi-address 345678901234.12
```

## Configuring Classical IP and ARP over ATM

Cisco implements both the ATM Address Resolution Protocol (ARP) server and ATM ARP client functions described in RFC 1577. RFC 1577 models an ATM network as a logical IP subnetwork on a LAN.

The tasks required to configure classical IP and ARP over ATM depend on whether there are SVCs or PVCs present in the environment. For further information, refer to the *Wide-Area Networking Configuration Guide, Release 12.2* at the following URL:

[http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products\\_configuration\\_guide\\_book09186a0080080f69.html](http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products_configuration_guide_book09186a0080080f69.html)

## Classes of Service and Transmit Priority on the PA-A3

The transmit priority determines which queued cell is chosen to be transmitted out of an interface during a cell time slot and ensures that real-time ATM service classes, which typically offer more robust QoS and traffic guarantees, have a higher likelihood of access to the next cell time slot. [Table 4-1](#) lists the ATM service classes and their default transmit priorities on the PA-A3.



### Note

Refer to the Feature Module documentation and Technical Tips on Cisco.com for detailed information about classes of service, configuration features, and the Cisco IOS releases that support specific features.

**Table 4-1 ATM Classes of Service and Default Transmit Priorities on the PA-A3**

| Service Category                             | Transmit Priority |
|----------------------------------------------|-------------------|
| CBR, OAM cells and signaling                 | 0                 |
| AAL5 or AAL2 VoATM VC (any service category) | 1                 |
| rt-VBR                                       | 2                 |
| nrt-VBR                                      | 3                 |
| ABR                                          | 4                 |
| UBR                                          | 5                 |

**Caution**

Transmit priority 0 is reserved for control traffic such as OAM and signaling.

You can use the **transmit-priority** command in VC configuration mode to change the priority value. The following example shows a customized prioritization scheme with the transmit priority value of a VC changed from 4 to 2.

- Step 1** First, view the characteristics of the existing configuration using the **show atm vc {vcd#}** command. Note how the router has assigned a default transmit priority value of 5 to the UBR PVC:

```
Router# show atm vc 2
ATM5/0: VCD: 2, VPI: 1, VCI: 100
UBR, PeakRate: 10000
AAL5-LLC/SNAP, etype:0x0, Flags: 0x20, VCmode: 0x0
OAM frequency: 0 second(s)
PA TxRingLimit: 0 paritcles
PA Rx Limit: 0 particles
InARP frequency: 15 minute(s)
Transmit priority 5
InPkts: 0, OutPkts: 0, InBytes: 0, OutBytes: 0
InPRoc: 0, OutPRoc: 0, Broadcasts: 0
InPktsDrops: 0, OutPktDrops: 0
CrcErrors: 0, SarTimeOuts: 0. OverSizedSDUs: 0
OAM cells received: 0
OAM cells sent:0
Status: ACTIVE
```

- Step 2** Next, customize the transmit priority value from VC configuration mode.

```
Router(config)# interface atm 5/0
Router(config-if)# pvc x/100
Router(config-if-atm-vc)# transmit-priority 2
```

- Step 3** The final action is to confirm your settings. Note how the router indicates the changed transmit priority level. It is now at level 2.

```
Router# show atm vc 2
ATM5/0: VCD: 2, VPI: 1, VCI: 100
UBR, PeakRate: 10000
AAL5-LLC/SNAP, etype:0x0, Flags: 0x20, VCmode: 0x0
OAM frequency: 0 second(s)
PA TxRingLimit: 0 paritcles
PA Rx Limit: 0 particles
InARP frequency: 15 minute(s)
Transmit priority 2
```



```
InPkts: 0, OutPkts: 0, InBytes: 0, OutBytes: 0
InPRoc: 0, OutPRoc: 0, Broadcasts: 0
InPktsDrops: 0, OutPktDrops: 0
CrcErrors: 0, SarTimeOuts: 0. OverSizedSDUs: 0
OAM cells received: 0
OAM cells sent:0
Status: ACTIVE
```

## Customizing the PA-A3

You can customize the PA-A3. The features you can customize have default values that will probably suit your environment and not need to be changed. However, you might need to enter configuration commands, depending on the requirements for your system configuration and the protocols you plan to route on the interface. Perform the tasks in the following sections if you need to customize the PA-A3:

- [Setting the MTU Size, page 4-15](#)
- [Configuring an ATM Interface for Local Loopback, page 4-15](#)
- [Configuring an ATM Interface for External Loopback, page 4-16](#)



### Note

For the commands that follow, you need to be in interface configuration mode. To enter interface configuration mode, use the **interface atm** command, followed by the interface address of the ATM interface you plan to configure.

## Setting the MTU Size

Each ATM interface has a default maximum packet size or maximum transmission unit (MTU) size. On the PA-A3, this number defaults to 4470 bytes, the range being 64 through 9188 bytes. To set the maximum MTU size, enter the following command in interface configuration mode:

```
Router(config-if)# mtu bytes
```



### Note

This command is documented in the *Cisco IOS Configuration Fundamentals Command Reference, Release 12.2* at the following URL:

[http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products\\_command\\_reference\\_book09186a00800811e0.html](http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products_command_reference_book09186a00800811e0.html)

## Configuring an ATM Interface for Local Loopback

To configure an ATM interface for local loopback (useful for checking that the PA-A3 is working by looping the transmit data back to the receive data), use the following command:

```
Router(config-if)# loopback diagnostic
Router(config-if)# loopback diagnostic
```

The **no** form of the command turns off local loopback:

```
Router(config-if)# no loopback diagnostic
```

## Configuring an ATM Interface for External Loopback

To configure an ATM interface for external loopback (useful for checking that the PA-A3 is working by looping the receive data back to the transmit data), use the following command:

```
Router(config-if)# loopback line
```

The **no** form of the command turns off external loopback:

```
Router(config-if)# no loopback line
```

## Checking the Configuration

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

- [Using show Commands to Verify the New Interface Status, page 4-16](#)
- [Using the ping Command to Verify Network Connectivity, page 4-30](#)
- [Using loopback Commands, page 4-30](#)

## Using show Commands to Verify the New Interface Status

This section demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the port adapter appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow.

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:

- [Using the show version or show hardware Commands, page 4-16](#)
- [Using the show diag Command, page 4-22](#)
- [Using the show interfaces Command, page 4-26](#)

## 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.

The following sections provide platform-specific output examples using the **show version** command:

- [Catalyst RSM/VIP2 in Catalyst 5000 Family Switches—Example Output of the show version Command, page 4-17](#)
- [Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches—Example Output of the show version Command, page 4-18](#)
- [Cisco 7100 Series Routers—Example Output of the show version Command, page 4-18](#)
- [Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show version Command, page 4-19](#)
- [Cisco 7201 Router—Example Output of the show version Command, page 4-20](#)
- [Cisco 7401ASR Router—Example Output of the show version Command, page 4-20](#)
- [VIP in Cisco 7000 Series Routers and Cisco 7500 Series Routers—Example Output of the show version Command, page 4-21](#)

### Catalyst RSM/VIP2 in Catalyst 5000 Family Switches—Example Output of the show version Command

Following is an example of the **show version** command from a Catalyst 5000 family switch with a PA-A3 installed:

```
Switch# show version
Cisco Internetwork Operating System Software
IOS (tm) C5RSM Software (C5RSM-JV-M), Version 12.0(1)
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Mon 10-May-99 06:02 by biff
Image text-base: 0x60010910, data-base: 0x60A62000

ROM: System Bootstrap, Version 11.1(2), RELEASE SOFTWARE (fc1)
ROM: GS Software (RSP-JV-M), Version 11.1(6), RELEASE SOFTWARE (fc1)

Switch uptime is 2 days, 2 hours, 59 minutes
System restarted by reload
System image file is "c5rsm-jv-mz", booted via tftp from 10.10.10.10

cisco RSP2 (R4700) processor with 32768K/2072K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0
Last reset from power-on
G.703/E1 software, Version 1.0.
G.703/JT2 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 VIP2 R5K controller (1 ATM).
1 ATM 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).
No slave installed in slot 3.
Configuration register is 0x0
```

## Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches—Example Output of the show version Command

Following is an example of the **show version** command from a Catalyst 6000 family switch with a Catalyst 6000 family FlexWAN module with a PA-A3 installed:

```
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—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7120 router with a PA-A3 installed:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) EGR Software (c7100-IS-M), Version 12.0(4)XE, EARLY DEPLOYMENT RELEASE
TAC:Home:SW:IOS:Specials for info
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Thu 10-Jun-99 15:32 by linda
Image text-base: 0x60008900, data-base: 0x60D8E000

ROM: System Bootstrap, Version 12.0(5r)XE, RELEASE SOFTWARE (fc1)
BOOTFLASH: EGR Software (C7100-BOOT-M), Version 12.0(5)XE5, EARLY DEPLOYMENT RE

Router uptime is 14 minutes
System restarted by power-on
Running default software
```

```

cisco 7120-4T1 (EGR) processor with 61440K/69632K bytes of memory.
R527x CPU at 225Mhz, Implementation 40, Rev 10.0, 2048KB L2 Cache
Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
2 FastEthernet/IEEE 802.3 interface(s)
4 Serial network interface(s)
1 ATM network interface(s)
125K bytes of non-volatile configuration memory.

40960K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x102

```

### Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7200 series router with a PA-A3 installed:

```

Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Version 12.0(3)T
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Mon 10-May-99 06:02 by biff
Image text-base: 0x600088E0, data-base: 0x6083C000

ROM: System Bootstrap, Version 11.1(5), RELEASE SOFTWARE (fc1)
ROM: 7200 Software (C7200-BOOT-M), Released Version 11.3

Router uptime is 22 hours, 57 minutes
System restarted by reload at 15:56:03 UTC Tue Apr 28 1998
System image file is "c7200-j-mz", booted via tftp from 10.10.10.10

cisco 7206 (NPE150) processor with 57344K/8192K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (512KB 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).

(Additional display text omitted from this example)

1 ATM network interface(s)

(Additional display text omitted from this example)

125K bytes of non-volatile configuration memory.
1024K bytes of packet SRAM memory.

8192K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
20480K bytes of Flash PCMCIA card at slot 1 (Sector size 128K).
4096K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0

```

## Cisco 7201 Router—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7201 router:

```
Router# show version
Cisco IOS Software, 7200 Software (C7200P-ADVENTERPRISEK9-M), Version
12.4(biffDEV.061001), INTERIM SOFTWARE Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Sun 01-Oct-06 23:42 by biff
ROM: System Bootstrap, Version 12.4(4r)XD5, RELEASE SOFTWARE (fc1)
BOOTLDR: Cisco IOS Software, 7200 Software (C7200P-KBOOT-M), Version 12.4(TAZ3DEV.060927),
INTERIM SOFTWARE
c7201alpha uptime is 5 days, 18 hours, 32 minutes System returned to ROM by power-on
System image file is "disk0:c7200p-adventerprisek9-mz.2006-10-01.biffdev"
This product contains cryptographic features and is subject to United States and local
country laws governing import, export, transfer and use. Delivery of Cisco cryptographic
products does not imply third-party authority to import, export, distribute or use
encryption.
Importers, exporters, distributors and users are responsible for compliance with U.S. and
local country laws. By using this product you agree to comply with applicable laws and
regulations. If you are unable to comply with U.S. and local laws, return this product
immediately.
A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
If you require further assistance please contact us by sending email to export@cisco.com.
Cisco 7201 (c7201) processor (revision A) with 917504K/65536K bytes of memory.
Processor board ID 222222222222
MPC7448 CPU at 1666Mhz, Implementation 0, Rev 2.2
1 slot midplane, Version 2.255
Last reset from power-on
1 FastEthernet interface
4 Gigabit Ethernet interfaces
2045K bytes of NVRAM.
62443K bytes of USB Flash usbflash0 (Read/Write)
250880K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
65536K bytes of Flash internal SIMM (Sector size 512K).
Configuration register is 0x2
```

## Cisco 7401ASR Router—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7401ASR router:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7401ASR Software (C7401ASR-J-M), Version 12.0(3)T
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Mon 10-May-99 06:02 by biff
Image text-base: 0x600088E0, data-base: 0x6083C000

ROM: System Bootstrap, Version 11.1(5), RELEASE SOFTWARE (fc1)
ROM: 7401ASR Software (C7401ASR-BOOT-M), Released Version 11.3

Router uptime is 22 hours, 57 minutes
System restarted by reload at 15:56:03 UTC Tue Apr 28 1998
System image file is "c7401ASR-j-mz", booted via tftp from 10.10.10.10

cisco 7401ASR processor with 57344K/8192K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (512KB 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).
```

(Additional display text omitted from this example)

1 ATM network interface(s)

125K bytes of non-volatile configuration memory.  
 1024K bytes of packet SRAM memory.  
 8192K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).  
 20480K bytes of Flash PCMCIA card at slot 1 (Sector size 128K).  
 4096K bytes of Flash internal SIMM (Sector size 256K).  
 Configuration register is 0x0

## VIP in Cisco 7000 Series Routers and Cisco 7500 Series Routers—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7500 series router with a PA-A3 installed on a VIP4:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-JV-M), Version 12.0(10)S1
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Mon 10-May-99 06:02 by biff
Image text-base: 0x60010910, data-base: 0x60A62000

ROM: System Bootstrap, Version 11.1(2), RELEASE SOFTWARE (fc1)
ROM: GS Software (RSP-JV-M), Version 11.1(6), RELEASE SOFTWARE (fc1)

router uptime is 2 days, 2 hours, 59 minutes
System restarted by reload
System image file is "rsp-jv-mz", booted via tftp from 10.10.10.10

cisco RSP2 (R4700) processor with 32768K/2072K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0
Last reset from power-on
G.703/E1 software, Version 1.0.
G.703/JT2 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 ATM).  
 1 ATM 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).  
 No slave installed in slot 3.  
 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, *slot* is the *port adapter slot* in a Catalyst 5000 family switch, Cisco 7100 series router, Cisco 7200 series router, Cisco 7200 VXR router, Cisco uBR7200 series router Cisco 7201 router, Cisco 7301 router, or Cisco 7401ASR router, the *module slot* in a Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router, and the *interface processor slot* in a Cisco 7000 series or Cisco 7500 series router with a VIP. In the FlexWAN module, the **show diag** command is used without the *slot* designation.



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.



Note

The *slot* argument is not required for Catalyst 5000 family switches.

The following sections provide platform-specific output examples using the **show diag** command:

- [Catalyst RSM/VIP2 in Catalyst 5000 Family Switches—Example Output of the show interfaces Command, page 4-26](#)
- [Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches—Example Output of the show diag Command, page 4-23](#)
- [Cisco 7100 Series Routers—Example Output of the show diag Command, page 4-23](#)
- [Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show diag Command, page 4-24](#)
- [Cisco 7201 Router—Example Output of the show diag Command, page 4-24](#)
- [Cisco 7401ASR Router—Example Output of the show diag Command, page 4-25](#)
- [VIP in Cisco 7000 Series Routers and Cisco 7500 Series Routers—Example Output of the show diag Command, page 4-25](#)

### Catalyst RSM/VIP2 in Catalyst 5000 Family Switches—Example Output of the show diag Command

Following is an example of the **show diag** command from a Catalyst 5000 family switch:

```
Switch# show diag
Slot 0:
Physical slot 0, ~physical slot 0xD, 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 2.00, board revision UNKNOWN
Serial number: 0123455 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 00 00 45 1F 73 49 08 77 03 00 00 00 00
0x30: 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Slot database information:
Flags: 0x4 Insertion time: 0x1544 (01:18:59 ago)
```



```
Controller Memory Size: 128 MBytes DRAM, 4096 KBytes SRAM
```

```
PA Bay 0 Information:
ENHANCED ATM E3 PA, 1 ports
EEPROM format version 1
HW rev 2.00, Board revision 90
Serial number:0123457 Part number:73-2434-02
```

### Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches—Example Output of the show diag Command

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

```
Router# show diag

(additional displayed text omitted from this example)

Slot 8: Logical_index 16
Board is analyzed ipc ready FlexWAN controller

Slot database information:
Flags: 0x2004Insertion time: unknown

CWAN Controller Memory Size: Unknown

PA Bay 0 Information:
ENHANCED ATM DS3 PA, 1 ports
EEPROM format version 0
HW rev 0.00, Board revision UNKNOWN
Serial number: 00000000 Part number: 00-0000-00
```

### Cisco 7100 Series Routers—Example Output of the show diag Command

Following is an example of the **show diag** command from a Cisco 7120 series router:

```
Router# show diag 3
Slot 3:
ATM WAN E3 Port adapter, 1 port
Port adapter is analyzed
Port adapter insertion time 00:19:48 ago
EEPROM contents at hardware discovery:
Hardware revision 2.1 Board revision B0
Serial number 15225284 Part number 73-2434-04
Test history 0x0 RMA number 00-00-00
EEPROM format version 1
EEPROM contents (hex):
0x20: 01 5D 02 01 00 E8 51 C4 49 09 82 04 00 00 00 00
0x30: 58 00 00 00 99 10 16 00 FF FF FF FF FF FF FF FF
```



#### Note

To use the **show diag** command with the Cisco 7140 series router, replace the slot argument **3** with **4**.

## Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show diag Command

Following is an example of the **show diag** command from a Cisco 7200 series router:

```
Router# show diag 2
Slot 2:
  ENHANCED ATM DS3 port adapter, 1 port
  Port adapter is analyzed
  Port adapter insertion time 03:54:58 ago
  Hardware revision 1.0           Board revision A0
  Serial number 0123456          Part number 73-2432-02
  Test history 0x0              RMA number 00-00-00
  EEPROM format version 1
  EEPROM contents (hex):
    0x20: 01 5B 01 00 00 66 33 80 49 09 80 02 00 00 00 00
    0x30: 06 00 00 00 97 10 31 00 FF FF FF FF FF FF FF FF
```

## Cisco 7201 Router—Example Output of the show diag Command

Following is an example of the **show diag** command from a Cisco 7201 router:

```
Router# show diag 1
Slot 1:
  Dual OC3 POS Port adapter, 2 ports
  Port adapter is analyzed
  Port adapter insertion time 00:02:19 ago
  EEPROM contents at hardware discovery:
  Hardware Revision : 1.0
  PCB Serial Number : JAE07520DYL
  Part Number : 73-8220-02
  Board Revision : A0
  RMA Test History : 00
  RMA Number : 0-0-0-0
  RMA History : 00
  Deviation Number : 0
  Product (FRU) Number : PA-POS-2OC3
  Top Assy. Part Number : 800-21857-02
  EEPROM format version 4
  EEPROM contents (hex):
    0x00: 04 FF 40 03 E3 41 01 00 C1 8B 4A 41 45 30 37 35
    0x10: 32 30 44 59 4C 82 49 20 1C 02 42 41 30 03 00 81
    0x20: 00 00 00 00 04 00 88 00 00 00 00 CB 94 50 41 2D
    0x30: 50 4F 53 2D 32 4F 43 33 20 20 20 20 20 20 20 20
    0x40: 20 C0 46 03 20 00 55 61 02 FF FF FF FF FF FF FF
    0x50: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

### Cisco 7401ASR Router—Example Output of the show diag Command

Following is an example of the **show diag** command from a Cisco 7401ASR router:

```
Router# show diag 1
Slot 1:
  ENHANCED ATM DS3 port adapter, 1 port
  Port adapter is analyzed
  Port adapter insertion time 03:54:58 ago
  Hardware revision 1.0           Board revision A0
  Serial number 0123456           Part number 73-2432-02
  Test history 0x0                RMA number 00-00-00
  EEPROM format version 1
  EEPROM contents (hex):
    0x20: 01 5B 01 00 00 66 33 80 49 09 80 02 00 00 00 00
    0x30: 06 00 00 00 97 10 31 00 FF FF FF FF FF FF FF FF
```

### VIP in Cisco 7000 Series Routers and Cisco 7500 Series Routers—Example Output of the show diag Command

Following is an example of the **show diag** command from a VIP4 in interface processor slot 8 of a Cisco 7500 series router:

```
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:0123459 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:0x322708 (21:41:44 ago)

  Controller Memory Size:64 MBytes DRAM, 65536 KBytes SRAM

  PA Bay 0 Information:
    ENHANCED ATM E3 PA, 1 ports
    EEPROM format version 1
    HW rev 2.00, Board revision 90
    Serial number:0123457 Part number:73-2434-02
```

## Using the show interfaces Command

Display status information (including the physical slot and interface address) for the interfaces you specify using the **show interfaces** command.

For a description of the interface subcommands and configuration options available for specific interfaces, refer to “[Related Documentation](#)” section on page -ix.



### 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.

The following sections offer output examples using the **show interfaces** command for some of the platforms that support the PA-A3:

- [Catalyst RSM/VIP2 in Catalyst 5000 Family Switches—Example Output of the show interfaces Command, page 4-26](#)
- [Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches—Example Output of the show interfaces Command, page 4-27](#)
- [Cisco 7100 Series Routers—Example Output of the show interfaces Command, page 4-27](#)
- [Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show interfaces Command, page 4-28](#)
- [Cisco 7201 Router—Example Output of the show interfaces Command, page 4-28](#)
- [Cisco 7401ASR Router—Example Output of the show interfaces Command, page 4-29](#)
- [VIP in Cisco 7000 Series and Cisco 7500 Series Routers—Example Output of the show interfaces Command, page 4-29](#)

### Catalyst RSM/VIP2 in Catalyst 5000 Family Switches—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command used with a Catalyst RSM/VIP2 in a Catalyst 5000 family switch. In this example, the PA-A3 is installed in port adapter slot 0 on the Catalyst RSM/VIP2:

```
Switch# show interfaces atm 0/0
ATM0/0 is up, line protocol is up
  Hardware is cyBus ENHANCED ATM PA
  Internet address is 10.10.10.1/24
  MTU 4470 bytes, sub MTU 1500, BW 149760 Kbit, DLY 80 usec, rely 255/255, load 2/255
  Encapsulation ATM, loopback not set, keepalive not set
  Encapsulation(s): AAL5 AAL3/4
  4096 maximum active VCs, 11 current VCCs
  VC idle disconnect time: 300 seconds
  Signalling vc = 1, vpi = 0, vci = 5
  UNI Version = 3.0, Link Side = user
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters 18:51:06
  Queueing strategy: fifo
  Output queue 0/40, 307 drops; input queue 0/75, 316274481 drops
  30 second input rate 33637000 bits/sec, 87606 packets/sec
  30 second output rate 1665000 bits/sec, 4336 packets/sec
  2629255419 packets input, 1649955763 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants
  181187605 packets output, 106941585 bytes, 0 underruns
  0 output errors, 0 collisions, 1 interface resets
  0 output buffers copied, 0 interrupts, 0 failures
```

## Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command used with a Catalyst 6000 family FlexWAN module in module slot 8, port adapter bay 0:

```
Router# show interfaces atm 8/0/0
ATM8/0/0 is administratively down, line protocol is down
Hardware is ENHANCED ATM PA
MTU 4470 bytes, sub MTU 4470, BW 10000000 Kbit, DLY 0 usec,
  reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ATM, loopback not set
Keepalive not supported
Encapsulation(s): AAL5
1024 maximum active VCs, 0 current VCCs
VC idle disconnect time: 300 seconds
0 carrier transitions
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations 0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
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 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
  0 output buffer failures, 0 output buffers swapped out
```

## Cisco 7100 Series Routers—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command used with a Cisco 7120 series router installed in port adapter slot 3:

```
Router# show interfaces atm 3/0
ATM3/0 is administratively down, line protocol is down
Hardware is ENHANCED ATM PA
MTU 4470 bytes, sub MTU 4470, BW 34013 Kbit, DLY 100 usec,
  reliability 0/255, txload 1/255, rxload 1/255
Encapsulation ATM, loopback not set
Keepalive not supported
Encapsulation(s): AAL5
4096 maximum active VCs, 0 current VCCs
VC idle disconnect time: 300 seconds
0 carrier transitions
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 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets
  0 output buffer failures, 0 output buffers swapped out
```

## Cisco 7200 Series Routers and Cisco7200 VXR Routers—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command used with a Cisco 7200 series router or Cisco 7200 VXR router. In this example, the PA-A3 is installed in port adapter slot 6 of a Cisco 7206 router:

```
Router# show interfaces atm 6/0
ATM6/0 is up, line protocol is up
  Hardware is ENHANCED ATM PA
  Internet address is 10.10.10.2/8
  MTU 4470 bytes, sub MTU 4470, BW 44209 Kbit, DLY 190 usec, rely 0/255, load 1/255
  Encapsulation ATM, loopback not set, keepalive set (10 sec)
  Encapsulation(s): AAL5
  4096 maximum active VCs, 2 current VCCs
  VC idle disconnect time: 300 seconds
  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
  30 second input rate 0 bits/sec, 0 packets/sec
  30 second output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 output buffer failures, 0 output buffers swapped out
```

## Cisco 7201 Router—Example Output of the show interfaces Command

Following is an example of the **show interfaces** command for the Cisco 7201 router:

```
Router# show interfaces
GigabitEthernet0/0 is up, line protocol is up
  Hardware is MV64460 Internal MAC, address is 0019.56c5.2adb (bia
0019.56c5.2adb)
  Internet address is 209.165.200.225
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 45/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s, media type is RJ45
  output flow-control is XON, input flow-control is XON
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:07:03, output 00:00:07, output hang never
  Last clearing of "show interface" counters 00:00:04
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 180240000 bits/sec, 430965 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    2222975 packets input, 133378500 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog, 0 multicast, 0 pause input
    0 input packets with dribble condition detected
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier, 0 pause output
    0 output buffer failures, 0 output buffers swapped out
```

## Cisco 7401ASR Router—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command used with a Cisco 7401ASR router:

```
Router# show interfaces atm 1/0
ATM1/0 is up, line protocol is up
  Hardware is ENHANCED ATM PA
  Internet address is 10.10.10.2/8
  MTU 4470 bytes, sub MTU 4470, BW 44209 Kbit, DLY 190 usec, rely 0/255, load 1/255
  Encapsulation ATM, loopback not set, keepalive set (10 sec)
  Encapsulation(s): AAL5
  4096 maximum active VCs, 2 current VCCs
  VC idle disconnect time: 300 seconds
  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
  30 second input rate 0 bits/sec, 0 packets/sec
  30 second output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 output buffer failures, 0 output buffers swapped out
```

## VIP in Cisco 7000 Series and Cisco 7500 Series Routers—Example Output of the show interfaces Command

Following is an example of the **show interfaces** command used with the VIP. In this example, the PA-A3 is installed on a VIP4 in interface processor slot 8 of a Cisco 7513 router:

```
Router# show interfaces atm 8/0/0
ATM8/0/0 is administratively down, line protocol is down
  Hardware is cyBus ENHANCED ATM PA, address is 0060.3e47.5800 (bia 0060.3e47.5800)
  MTU 4470 bytes, sub MTU 4470, BW 34013 Kbit, DLY 100 usec, rely 0/255, load 1/255
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s):AAL5
  4096 maximum active VCs, 0 current VCCs
  VC idle disconnect time:300 seconds
  0 carrier transitions
  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 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 output buffer failures, 0 output buffers swapped out
```

You have completed a basic interface configuration. Depending on your version of the PA-A3, you might need to specify configuration for T3 (DS-3), E3, or OC-3c.

**Note**

To verify your network connectivity, see the [“Using the ping Command to Verify Network Connectivity” section on page 4-30](#), for a brief description of the **ping** command.

For a description of the interface subcommands and configuration options available for ATM interfaces, refer to the [“Related Documentation” section on page -ix](#).

## 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.

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** command places an interface in loopback mode, which enables test packets that are generated from the **ping** command to loop through a remote device. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device in the path of the loopback test.

The **loopback diagnostic** command on an ATM interface of a Cisco router causes traffic going out of the interface to come back to the router.

If loopback is not set on the ATM interface, traffic will not be looped back. Traffic will go out but will not return. Apply the **loopback diagnostic** command, and then use the **show interfaces atm** command to show that loopback is indeed set:

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

Router(config)# interface atm 1/0
Router(config-if)# loopback diagnostic
Router(config-if)# atm clock internal
Router(config-if)# ^Z

Router# show interface atm 1/0
ATM1/0 is up, line protocol is up
Hardware is A3 ATM
MTU 4470 bytes, sub MTU 4470, BW 155520 Kbit, DLY 80 usec,
```



```

reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ATM, loopback set
Keepalive not supported
Encapsulation(s): AAL5, PVC mode
256 TX buffers, 256 RX buffers,
2048 maximum active VCs, 1024 VCs per VP, 1 current VCCs
VC idle disconnect time: 300 seconds
Last input 00:03:16, output 00:03:16, 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
163861 packets input, 3164940 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
33 input errors, 33 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
144191 packets output, 2138298 bytes, 0 underruns
0 output errors, 0 collisions, 1 interface resets
0 output buffer failures, 0 output buffers swapped out

```

**Note**

To ensure proper clocking, set the router as the clock source by specifying the **atm clock internal** command in the main interface configuration.

The **loopback line** command on an ATM interface of a Cisco router causes incoming traffic to be sent back to the network. Apply the **loopback line** command, and then use the **show interfaces atm** command to show that loopback is indeed set:

```

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

Router(config)# interface atm 2/0
Router(config-if)# loopback line
Router(config-if)# ^Z

Router# config show interfaces atm 2/0
ATM2.0 is up, line protocol is up
Hardware is A3 ATM
MTU 4470 bytes, sub MTU 4470, BW 155520 kbit, DLY 80 usec,
reliability 255/255, txload 1/255, rxload 1/255

Encapsulation ATM, loopback set
Keepalive not supported
Encapsulation(s): AAL5, PVC mode
2048 maximum active VCs, 1024 VCs per VP, 1 current VCCs
VC idle disconnect time: 300 seconds
Last input 00:02:45, output 00:02:45, output hang never
Last clearing of "show interface" counter 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
94917 packets input, 1638383 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
102898 packets output, 2042785 bytes, 0 underruns
0 output errors, 0 collisions, 5 interface resets
0 output buffer failures, 0 output buffers swapped out

```

**Note**

For more information on understanding loopback modes on Cisco routers, refer to *Understanding Loopback Modes on Cisco Routers* on Cisco.com at the following URL:

[http://www.cisco.com/en/US/tech/tk39/tk48/technologies\\_tech\\_note09186a00800c93c4.shtml](http://www.cisco.com/en/US/tech/tk39/tk48/technologies_tech_note09186a00800c93c4.shtml)

## Traffic Management

The PA-A3 supports the traffic-shaping parameters defined in Table 4-2. These parameters ensure that generated traffic conforms to the ATM Forum Traffic Management Specification Version 4.0. Shaping values are configured using the **vbr-nrt** command in VC configuration mode.

**Table 4-2** Traffic-Shaping Parameters and Ranges

| Traffic Parameter  | Range                                      | Default                                                                                                                                 |
|--------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| T3                 | 56 kbps to 45 Mbps                         | If the peak rate is not defined, each new VC is set to the maximum physical layer rate. The VC is assigned to the UBR service category. |
| E3                 | 56 kbps to 34 Mbps                         | If the peak rate is not defined, each new VC is set to the maximum physical layer rate. The VC is assigned to the UBR service category. |
| OC-3c Peak Rate    | 56 kbps to 155 Mbps                        | If the peak rate is not defined, each new VC is set to the maximum physical layer rate. The VC is assigned to the UBR service category. |
| Average Rate       | $0 < \text{average} \leq \text{peak rate}$ | Average = peak rate at the maximum physical layer rate.                                                                                 |
| Maximum Burst Size | 1 to 64,000 cells                          | Equal to the PA-A3 MTU size.                                                                                                            |

**Note**

For more information about traffic management specific to the various class of service categories, refer to ATM Traffic Management technology support on Cisco.com at the following URL:

[http://www.cisco.com/en/US/tech/tk39/tk51/tsd\\_technology\\_support\\_protocol\\_home.html](http://www.cisco.com/en/US/tech/tk39/tk51/tsd_technology_support_protocol_home.html)

## Troubleshooting the PA-A3 Installation and Configuration

The following sections provide suggested guidelines for troubleshooting the PA-A3. Use the **ping** command to verify network connectivity, the **debug** commands to help solve network problems, and the **show** commands to display the current state of the network.

**Note**

For more information about troubleshooting ATM port adapters and understanding the output from the **debug** commands, refer to Troubleshooting TechNotes on Cisco.com at the following URL:

[http://www.cisco.com/en/US/products/hw/modules/ps2033/prod\\_tech\\_notes\\_list.html#9](http://www.cisco.com/en/US/products/hw/modules/ps2033/prod_tech_notes_list.html#9)

The following topics are covered within this section:

- [PA-A3 Statistics, page 4-33](#)
- [Using the debug atm Commands, page 4-34](#)
- [Displaying ATM Information, page 4-35](#)

## PA-A3 Statistics

The PA-A3 maintains a count of certain errors and tracks the ATM facility performance. In addition to keeping a count of these errors, the PA-A3 also takes snapshots of the last VCI/VPI that caused the error. Each PA-A3 error counter is made up of 16 bits. Errors counted include the following:

- Cyclic Redundancy Check (CRC) errors
- Giants received
- No buffers available
- Framing errors
- Application layer or physical layer errors
- Packet timeout errors on receive

The PA-A3 provides port adapter-specific error statistics through the **show interfaces atm** command.



Note

For examples of the **show interfaces atm** command for all supported platforms, see the [“Using the show interfaces Command”](#) section on page 4-26.

The **show controllers atm** command displays the ATM framing information and ATM facility performance statistics. The statistics report section includes up to 96 15-minute interval reports, as well as the current interval level. Only those intervals with non-zero data are displayed.

The following is an example of the **show controllers atm** command from a Cisco 7200 series router:

```
Router# show controllers atm 6/0
Interface ATM6/0 is up
Hardware is ENHANCED ATM PA Plus - OC3 (155000Kbps)
Framer is PMC PM5346 S/UNI-155-LITE, SAR is LSI ATMIZER II
Firmware rev: X101, Framer rev: 0, ATMIZER II rev: 4
  idb=0x62EB7C74, ds=0x62EBF0A0, vc=0x62F41080
  slot 6, unit 1, subunit 0, fci_type 0x03A7, ticks 9790
  5200 rx buffers: size=512, encap=64, trailer=28, magic=4
Curr Stats:
VCC count: current=1, peak=1
AAL2 VCC count: 0
AAL2 TX no buffer count: 0
AAL2 RX no buffer count: 0
SAR crashes: Rx SAR=0, Tx SAR=0
rx_cell_lost=0, rx_no_buffer=0, rx_crc_10=0, rx_no_mem=0
rx_cell_len=0, rx_no_vcd=0, rx_cell_throttle=0, tx_aci_err=0
Rx Free Ring status:
  base=0x3F2EE040, size=8192, write=40
Rx Compl Ring status:
  base=0x7E6AFF80, size=8192, read=3083
Tx Ring status:
  base=0x3F723A00, size=12288, write=255
Tx Compl Ring status:
  base=0x0E6BF0C0, size=8192, read=6271
BFD Cache status:
```

```

base=0x62F35000, size=12288, read=12286
Rx Cache status:
  base=0x62F265C0, size=16, write=11
Tx Shadow status:
  base=0x62F28F80, size=12288, read=239, write=255
Control data:
  rx_max_spins=9, max_tx_count=50, tx_count=16
  rx_threshold=3467, rx_count=11, tx_threshold=9216
  tx bfd write indx=0x451, rx_pool_info=0x62F26660
Control data base address:
  rx_buf_base = 0x0E3ABEE0 rx_p_base = 0x62ECAD80
    rx_pak = 0x62DDE7F8 cmd = 0x62ECA7A0
    framer = 0x603F75C0 framer_cb = 0x62ECABA0
  framer_base = 0x3F100000 pci_pa_stats = 0x7E1B6840
  device_base[0] = 0x3F000000 device_base[1] = 0x3F400000
  ssram_base[0] = 0x3F200000 ssram_base[1] = 0x3F600000
  sdram_base[0] = 0x3F300000 sdram_base[1] = 0x3F700000
  pa_cmd_buf[0] = 0x3F2FFC00 pa_cmd_buf[1] = 0x3F6FFC00
  vcd_base[0] = 0x3F200000 vcd_base[1] = 0x3F630000
  chip_dump[0] = 0x0E1B6868 chip_dump[1] = 0x0E1B6958
  sar_buf_base[0] = 0x3F334000 sar_buf_base[1] = 0x3F730000
  bfd_base[0] = 0x3F2BE000 bfd_base[1] = 0x3F600000
  acd_base[0] = 0x3F240080 acd_base[1] = 0x3F670240
Framer Information:
  Framing mode: SONET OC3 STM-1
  No alarm detected

```

**Note**

For more information about CRC errors, using the **show interfaces** command, and using the **show controllers** command, refer to the *CRC Troubleshooting Guide for ATM Interfaces* on Cisco.com at the following URL:

[http://www.cisco.com/en/US/tech/tk39/tk48/technologies\\_tech\\_note09186a00800c93ef.shtml](http://www.cisco.com/en/US/tech/tk39/tk48/technologies_tech_note09186a00800c93ef.shtml)

## Using the debug atm Commands

The following **debug** commands help to solve ATM network problems:

- Use the **debug atm packet** command to create a dump of all protocol packets. The command displays the contents of the SNAP/NLPID/SMDS header followed by the first 40 bytes of a packet in hexadecimal format.

```
Router# debug atm packet
```

- Use the **debug atm errors** command to display errors. The command displays information from all detected ATM errors. This includes such errors as encapsulation failures and errors during ATM configuration.

```
Router# debug atm errors
```

- Use the **debug atm events** command to display ATM events. The command displays event changes to the PA-A3; reset, VC configurations, and PA-A3 configurations are displayed.

```
Router# debug atm events
```

- Use the **debug atm oam** command to display information about OAM cells. The command displays the contents of OAM cells as they arrive from the network.

```
Router# debug atm oam
```

- Use the **no debug** command to turn off debugging after using a **debug** command.

```
Router# no debug atm packet
```

## Displaying ATM Information

You can use **show atm** commands to display the current state of the ATM network and the connected VCs.

- Use the **show atm vc** [*vcd*] command to show current VCs and traffic information. Specifying a VCD displays specific information about that VCD.

```
Router# show atm vc [vcd]
```

- Use the **show atm interfaces** command to show current information about an ATM interface. The command displays ATM-specific information about an interface.

```
Router# show atm interfaces
```

- Use the **show atm traffic** command to show current ATM traffic. The command displays global information about traffic to and from all ATM networks connected to the router.

```
Router# show atm traffic
```

- Use the **show atm map** command to show the current ATM mapping. The command displays the active list of ATM static maps to remote hosts on an ATM network.

```
Router# show atm map
```

- Use the **show sscop** command to display SSCOP details for the ATM interface.

```
Router# show sscop
```

- Use the **show version** command to display the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images.



### Note

For examples of the **show version** command for all supported platforms, see the “Using the show interfaces Command” section on page 4-26.

The following **show atm vc** command example displays statistics for all PVCs:

```
Router# show atm vc
VCD/
Interface Name VPI VCI Type Encaps SC Peak Avg/Min Burst
Kbps Kbps Cells Status
6/0 1 10 100 PVC SNAP VBR 33920 0 0 UP
6/0.300 4 8 88 PVC SNAP VBR 30000 30000 20000 UP
```

The following **show atm vc vcd** command example displays statistics for a given PVC:

```
Router# show atm vc 4
ATM6/0.300: VCD:4, VPI:8, VCI:88
VBR-NRT, PeakRate:30000, Average Rate:30000, Burst Cells:20000
AAL5-LLC/SNAP, etype:0x0, Flags:0x20, VCmode:0x0
OAM frequency: 0 second(s)
VC TxRingLimit: 1179 particles
InARP frequency: 15 minute(s)
Transmit priority: 4
InPkts: 0, OutPkts: 0, InBytes: 0, OutBytes: 0
InPProc: 0, OutPProc: 0, Broadcasts: 0
```

```
InFast: 0, OutPktDrops: 0/0/0 (holdq/outputq/total)
CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0, Length Violation: 0, CPIErrors: 0
Out CLP=1 Pkts: 0
OAM cells received: 0
OAM cells sent: 0
Status: UP
```

The following **show atm interface atm slot/port** command example displays the currently running PA-A6 configuration in RAM:

```
Router# show interfaces atm 3/0
interface ATM 3/0
 ip address 10.10.10.2 255.255.255.0
 map-group atm1
 pvc 1 0 1 aal5snap
```

**Note**

For examples of the **show interfaces atm** command for all supported platforms, see the [“Using the show interfaces Command”](#) section on page 4-26.

## ATM Configuration

Cisco IOS Release 11.3T introduced the ATM VC command mode, which, in turn, introduced several new ATM commands that allow you to configure ATM parameters more easily. The new VC configuration mode uses **protocol ip** and other statements (replace **ip** with **ipx**, **decnet**, and so on) to configure static mappings. The protocol statement takes the place of the **map-list** and **map-group** statements used in versions prior to Cisco IOS Release 11.3T.

The following example shows how to create a PVC AAL5SNAP on a Cisco IOS version earlier than Cisco IOS Release 11.3T. The interface is at IP address 10.0.0.1, with 10.0.0.2 at the other end of the connection.

**First Router**

```
interface ATM 3/0
 ip address 10.0.0.1 255.0.0.0
 no keepalive
 map-group atm-in
 atm clock internal
 atm pvc 1 1 5 aal5snap
 !
 map-list atm-in
 ip 10.0.0.2 atm-vc 1 broadcast
```

**Second Router**

```
interface ATM 3/0
ip address 10.0.0.2 255.0.0.0
no keepalive
map-group atm-in
atm pvc 1 1 5 aal5snap
!
map-list atm-in
ip 10.0.0.1 atm-vc 1 broadcast
```

The following example shows how to create a PVC AAL5SNAP on Cisco IOS Release 11.3T or later. The interface is at IP address 10.0.0.1, with 10.0.0.2 at the other end of the connection.

**First Router**

```
interface ATM1/1/0.200 multipoint
ip address 10.0.0.1 255.255.255.0
no ip directed-broadcast
pvc 2/200
protocol ip 10.0.0.2 broadcast
```

**Second Router**

```
interface ATM1/1/0.200 multipoint
ip address 10.0.0.2 255.255.255.0
pvc 2/200
protocol ip 10.0.0.1 broadcast
atm clock internal
```

## Upgrading Your Boot Flash Image

The boot image contains a subset of the Cisco IOS software. This image is used to perform network booting or to load Cisco IOS images onto the router. This image is also used if the system cannot find a valid system image. When you upgrade your Cisco IOS software to the minimum required software release, we recommend that you also upgrade your boot image. To upgrade your boot image, you can copy the new boot image from a network server to flash memory on your router.

To copy a boot image from a Trivial File Transfer Protocol (TFTP) server to flash memory, complete the following procedure:

- 
- Step 1** Enter configuration mode.
- ```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```
- Step 2** Display and note the exact spelling of the system image filename in flash memory.
- ```
Router(config)# show flash all
```
- Step 3** Make a backup copy of the current boot image.
- ```
Router(config)# copy flash tftp
```
- Step 4** Copy a boot image to flash memory.
- ```
Router(config)# copy tftp flash
```

**Step 5** When prompted, enter the IP address or domain name of the server.

```
Router(config)# ip-address or name
```

---

For further information, such as how to set up the TFTP server, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide, Release 12.2* at the following URL:

[http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products\\_configuration\\_guide\\_book09186a0080080ff9.html](http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products_configuration_guide_book09186a0080080ff9.html)

## Port Adapter Error Messages

All of the PA-A3 receive buffers are allocated from static random-access memory (SRAM). As a result, during bootup, if the PA-A3 cannot find enough *contiguous* SRAM for its use, the system stops bringing up the PA-A3 and displays an error message such as the following:

```
%ATMPA-3-PCIMEMNOTENOUGH: Not Enough PCI memory (0x19874) to support ATM PA on  
bay 5
```