PA-4T Synchronous Serial Port Adapter Installation and Configuration

Product Number: PA-4T(=)
Platforms Supported: Cisco 7200 Series, VIP in the Cisco 7500 Series

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Preface

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

Objectives

This document describes how to install and configure the PA-4T synchronous serial port adapter (PA-4T[=]), hereafter referred to as the PA-4T, which is used in the following platforms:

- Cisco 7200 series routers, consisting of the two-slot Cisco 7202, four-slot Cisco 7204, and the six-slot Cisco 7206
- VIP in Cisco 7500 series and Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI)

Organization

This document contains the following chapters:

:

Section	Title	Description
Chapter 1	Overview	Describes the PA-4T and its LED displays, cables, and receptacles.
Chapter 2	Preparing for Installation	Describes safety considerations, tools required, and procedures you should perform before the actual installation.

Section	Title	Description
Chapter 3	Removing and Installing Port Adapters	Describes the procedures for installing and removing PA-4T in the supported platforms.
Chapter 4	Configuring the PA-4T	Provides instructions for configuring the PA-4T on the supported platforms.

Related Documentation

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

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

- Cisco 7200 series routers:

  For port adapter hardware installation and memory configuration information, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines* at the following URL:

  http://www.cisco.com/univercd/cc/td/doc/product/core/7206/port_adp/config/index.htm

  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 hardware installation documents for Cisco AS5800 at the following URL:

  http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/as5800/index.htm

  For information on network processing engines or network services engines, refer to the *Network Processing Engine and Network Services Engine Installation and Configuration Guide* at the following URL:

  http://www.cisco.com/univercd/cc/td/doc/product/core/7206/fru/npense/index.htm

- Cisco 7500 series routers:

  For hardware installation and configuration information, refer to Cisco 7500 Installation and Configuration at the following URL:

  http://www.cisco.com/univercd/cc/td/doc/product/core/cis7505/cicg7500/index.htm

  For Versatile Interface Processor (VIP) hardware installation and configuration information, refer to the following URL:

  http://www.cisco.com/univercd/cc/td/doc/product/core/cis7505/vip1/index.htm

- For international agency compliance, safety, and statutory information for WAN interfaces:
  - *Regulatory Compliance and Safety Information for the Cisco 7200 Series Routers*

    http://www.cisco.com/univercd/cc/td/doc/product/core/7206/3419pnc6.htm

– *Regulatory Compliance and Safety Information for the Cisco 7500 Series Routers*
http://www.cisco.com/univercd/cc/td/doc/product/core/cis7505/4194pc75.htm

Obtaining Documentation

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Cisco.com

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

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For all customers, partners, resellers, and distributors who hold valid Cisco service contracts, Cisco Technical Support provides 24-hour-a-day, award-winning technical assistance. The Cisco Technical Support Website on Cisco.com features extensive online support resources. In addition, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not hold a valid Cisco service contract, contact your reseller.

Cisco Technical Support Website

The Cisco Technical Support Website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day, 365 days a year, at this URL:

http://www.cisco.com/techsupport

Access to all tools on the Cisco Technical Support Website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

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

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

Submitting a Service Request

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

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

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

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

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

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

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

Definitions of Service Request Severity

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

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

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operation are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

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

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

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- Cisco Marketplace provides a variety of Cisco books, reference guides, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:

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

  http://cisco.com/univercd/cc/td/doc/pcat/

- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

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- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

  http://www.cisco.com/packet

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

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

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

  http://www.cisco.com/ipj

- World-class networking training is available from Cisco. You can view current offerings at this URL:

  http://www.cisco.com/en/US/learning/index.html

Overview

This chapter describes the PA-4T port adapter and contains the following sections:

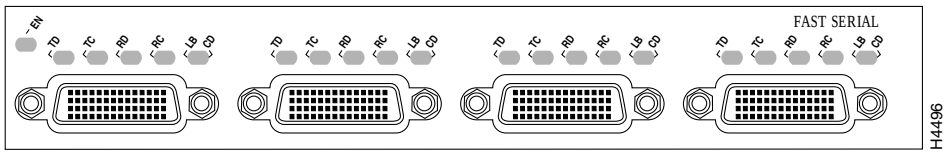
Port Adapter Overview

The PA-4T, shown in Figure 1-1, provides four channel-independent, synchronous serial ports that support full-duplex operation at T1 (1.544 Mbps) and E1 (2.048 Mbps) speeds. Each port supports any of the available interface types: Electronics Industries Association/Telecommunications Industries Association (EIA/TIA)-232, EIA/TIA-449, V.35, X.21, and EIA-530. The cable attached to each PA-4T interface port determines its type (EIA/TIA-232, and so forth) and its mode (DCE or DTE).

Note Although the VIP supports online insertion and removal (OIR), individual port adapters do not. To replace port adapters, you must first remove the VIP from the chassis, and then replace port adapters as required.

Cisco 7200 series routers support OIR of all port adapter types.

Figure 1-1 PA-4T—Faceplate View



Synchronous Serial Overview

The PA-4T supports the following interface types: EIA/TIA-232, EIA/TIA-449, V.35, X.21, and EIA-530. EIA/TIA-232, which is by far the most common interface standard in the United States, supports unbalanced circuits at signal speeds up to 64 kbps. EIA/TIA-449, which supports balanced (EIA/TIA-422) and unbalanced (EIA/TIA-423) transmissions, is a faster (up to 2 Mbps) version of EIA/TIA-232 that provides more functions and supports transmissions over greater distances. The EIA/TIA-449 standard was intended to replace EIA/TIA-232, but it was not widely adopted.

Note The EIA/TIA standards were referred to as recommended standards called RS-232 and RS-449 prior to their acceptance by the ANSI committee.

The resistance to convert to EIA/TIA-449 was due primarily to the large installed base of DB-25 hardware and to the larger size of the 37-pin EIA/TIA-449 connectors, which limited the number of connections possible (fewer than are possible with the smaller, 25-pin EIA/TIA-232 connector).

EIA-530, which supports balanced transmission, provides the increased functionality, speed, and distance of EIA/TIA-449 on the smaller, DB-25 connector used for EIA/TIA-232. The EIA-530 standard was created to support the more sophisticated circuitry of EIA/TIA-449 on the large number of existing EIA/TIA-232 (DB-25) hardware instead of the larger, 37-pin connectors used for EIA/TIA-449. Like EIA/TIA-449, EIA-530 refers to the electrical specifications of EIA/TIA-422 and EIA/TIA-423. The specification recommends a maximum speed of 2 Mbps. EIA-530 is used primarily in the United States.

The V.35 interface is most commonly used in the United States and throughout Europe, and is recommended for speeds up to 48 kbps. The X.21 interface uses a 15-pin connection for balanced circuits and is commonly used in the United Kingdom to connect public data networks. X.21 relocates some of the logic functions to the DTE and DCE interfaces and, as a result, requires fewer circuits and a smaller connector than EIA/TIA-232.

All interface types except EIA-530 can be individually configured for operation with either external (DTE mode) or internal (DCE mode) timing signals; EIA-530 operates with external timing only. In addition, all VIP serial interface types support non-return to zero (NRZ) and non-return to zero inverted (NRZI) format, and both 16-bit and 32-bit cyclic redundancy checks (CRCs). The default configuration is for NRZ format and 16-bit CRC. You can change the default settings with software commands. (For more information, see Chapter 4, “Configuring the PA-4T.”)

There is no default mode or clock rate set on the VIP serial ports, although an internal clock signal is present on all ports for DCE support. Using the internal clock, you can also perform local loopback tests without having to terminate the port or connect a cable. (All interface types except X.21 DTE support loopback.) To use the port as a DCE interface, you must set the clock rate and connect a DCE adapter cable. To use the port as a DTE interface, you need only connect a DTE adapter cable to the port. Because the serial adapter cables determine the mode and interface type, the PA-4T interface becomes a DTE when a DTE cable is connected to it.

If a DTE cable is connected to a port with a clock rate set, the DTE ignores the clock rate and uses the external clock signal that is sent from the remote DCE.

For a brief description of the **clock rate** command, see Chapter 4, “Configuring the PA-4T.” For complete command descriptions and instructions, see the publications listed in the “Related Documentation” section on page vi.

Synchronous Serial Specifications

The PA-4T provides up to four synchronous serial interfaces. Each interface allows a maximum bandwidth of 2.048 Mbps; the speed depends on the type of electrical interface used. Use EIA/TIA-232 for speeds of 64 kilobits per second (kbps) and below, and use X.21, EIA/TIA-449, V.35, or EIA-530 for higher speeds.

Serial signals can travel a limited distance at any given bit rate; generally, the slower the baud rate, the greater the distance. All serial signals are subject to distance limits beyond which a signal degrades significantly or is completely lost.

Table 1-1 lists the recommended (standard) maximum speeds and distances for each PA-4T serial interface type. The recommended maximum rate for V.35 is 2,048 Mbps.

Table 1-1 Standards for Transmission Speed Versus Distance

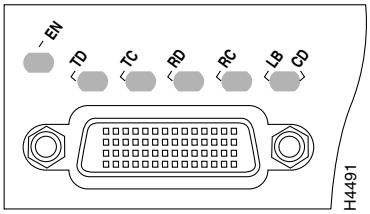
	EIA/TIA-232 Distances			EIA/TIA-449, X.21, V.35, EIA-530 Distances	
Rate (bps)	**Feet**	**Meters**		**Feet**	**Meters**
2400	200	60		4,100	1,250
4800	100	30		2,050	625
9600	50	15		1,025	312
19200	25	7.6		513	156
38400	12	3.7		256	78
56000	8.6	2.6		102	31
1544000 (T1)	–	–		50	15

Balanced drivers allow EIA/TIA-449 signals to travel greater distances than EIA/TIA-232. The recommended distance limits for EIA/TIA-449 shown in Table 1-1 are also valid for V.35, X.21, and EIA-530. EIA/TIA-449 and EIA-530 support 2.048-Mbps rates, and V.35 supports 2.048-Mbps rates without any problems; we do not recommend exceeding published specifications for transmission speed versus distance. Do so at your own risk.

LEDs

The PA-4T contains the enabled LED, standard on all port adapters, and a one status LED for each port. After system initialization, the enabled LED goes on to indicate that the PA-4T has been enabled for operation. The LEDs are shown in Figure 1-2.

Figure 1-2 LEDs on the PA-4T—Horizontal Orientation Shown



The green enabled LED on the port adapter indicates that the motherboard is enabled and receiving power, and that the port adapter is ready for operation.

The following conditions must be met before the enabled LED goes on:

- The PA-4T interface is correctly connected and receiving power
- The PA-4T-equipped card or router contains a valid microcode version that has been downloaded successfully
- The bus recognizes the PA-4T or PA-4T-equipped VIP

If any of these conditions is 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-4T LEDs

LED Label	DTE Function	DCE Function	Color and Function
TD	Transmit data out	Transmit data in	Green
TC	Transmit clock in	Transmit clock in (TXCE)	Green
RD	Receive data in	Receive data out	Green
RC	Receive clock in	Receive clock out	Green
LB/CD	–	–	Green: DTR, DSR, RTS, CTS, or DCD active Yellow: local loop or internal loop active
EN (enable)	–	–	Green: port adapter enabled

Cables, Connectors, and Pinouts

The following sections describe the serial receptacles on the PA-4T, and the cables and pinouts for the various serial interface cables.

PA-4T Port Adapter Receptacles and Cables

The PA-4T and adapter cables allow a high density of interface ports, regardless of the size of the connectors typically used with each electrical interface type. All ports use an identical 60-pin, D-shell receptacle that supports all interface types: EIA/TIA-232, V.35, EIA/TIA-449, X.21, and EIA-530. Each port requires a serial adapter cable, which provides the interface between the high-density serial port and the standard connectors that are commonly used for each electrical interface type.

Note The adapter cable determines the electrical interface type and mode of the port (DTE or DCE) to which it is connected.

The network end of the cable is an industry-standard connector for the type of electrical interface that the cable supports. For most interface types, the adapter cable for DTE mode uses a plug at the network end, and the cable for DCE mode uses a receptacle at the network end. Exceptions are V.35 adapter cables, which are available with either a V.35 plug or a receptacle for either mode, and the EIA-530 adapter cable, which is available only in DTE mode with a DB-25 plug at the network end. The mode is labeled on the molded plastic connector shell at the ends of all cables except V.35 (which uses the standard Winchester block-type connector instead of a molded plastic D-shell).

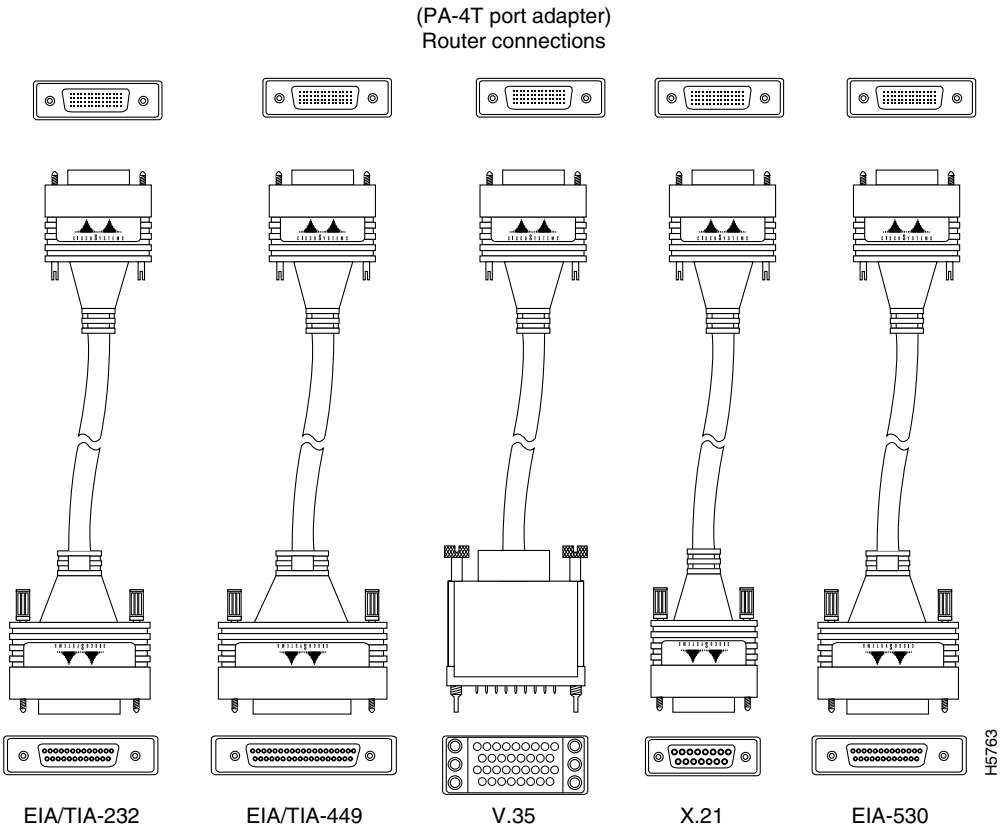
Following are the available interface cable options (and product numbers) for the mode and network-end connectors for each cable:

- EIA/TIA-232: DTE mode with a DB-25 plug (CAB-232MT=); DCE mode with a DB-25 receptacle (CAB-232FC=)
- EIA/TIA-449: DTE mode with a 37-pin D-shell plug (CAB-449MT=); DCE mode with a 37-pin D-shell receptacle (CAB-449C=)
- V.35: DTE mode or DCE mode with a 34-pin Winchester-type V.35 plug (CAB-V35MT= or CAB-V35MC=); DTE mode or DCE mode with a 34-pin Winchester-type V.35 receptacle (CAB-V35FT= or CAB-V35FC=). Also available is a cable with a male DB-60 plug on the router end and a male DB-34 shielded plug on the network end (CAB-V35MTS=).
- X.21: DTE mode with a DB-15 plug (CAB-X21MT=); DCE mode with a DB-25 receptacle (CAB-X21FC=)
- EIA-530: DTE mode with a DB-25 plug (CAB-530MT=)

Note For cable pinouts, refer to the "Cables, Connectors, and Pinouts" section on page 1-4.

Figure 1-3 shows the serial port adapter cables for connection from the PA-4T your network.

Figure 1-3 Serial Port Adapter Cables

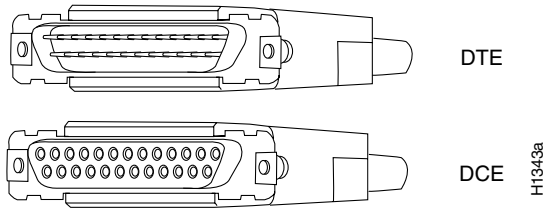


Metric (M3) thumbscrews are included with each port adapter cable to allow connections to devices that use metric hardware. Because the 4T port adapter uses a special, high-density port that requires special adapter cables for each electrical interface type, we recommend that you obtain serial interface cables from the factory.

EIA/TIA-232 Connections

The router (VIP) end of all EIA/TIA-232 adapter cables is a high-density 60-pin plug. The opposite (network) end of the adapter cable is a standard 25-pin D-shell connector (known as a DB-25) that is commonly used for EIA/TIA-232 connections. Figure 1-4 shows the connectors at the network end of the adapter cable. The system console and auxiliary ports on the Route Switch Processor (RSP) in the Cisco 7500 series also use EIA/TIA-232 connections; however, the 4T port adapter interfaces support synchronous serial connections, and the console and auxiliary ports only support asynchronous connections. Use caution when connecting EIA/TIA-232 cables to the 4T receptacles.

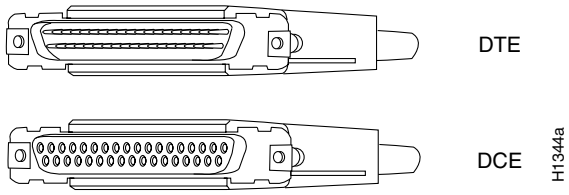
Figure 1-4 EIA/TIA-232 Adapter Cable Connectors



EIA/TIA-449 Connections

The router (VIP) end of all EIA/TIA-449 adapter cables is a high-density 60-pin plug. The opposite (network) end of the adapter cable provides a standard 37-pin D-shell connector, which is commonly used for EIA/TIA-449 connections. Figure 1-5 shows the connectors at the network end of the adapter cable. EIA/TIA-449 cables are available as either DTE (DB-37 plug) or DCE (DB-37 receptacle).

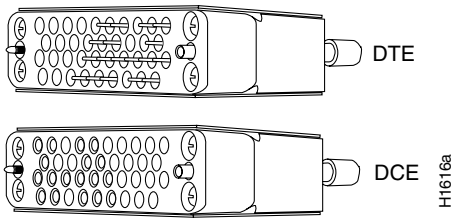
Figure 1-5 EIA/TIA-449 Adapter Cable Connectors



V.35 Connections

The router (VIP) end of all V.35 adapter cables is a high-density 60-pin plug. The opposite (network) end of the adapter cable provides a standard 34-pin Winchester-type connector commonly used for V.35 connections. Figure 1-6 shows the connectors at the network end of the V.35 adapter cable. V.35 cables are available with a standard V.35 plug for DTE mode (CAB-V35MT=) or a V.35 receptacle for DCE mode (CAB-V35FC=).

Figure 1-6 V.35 Adapter Cable Connectors

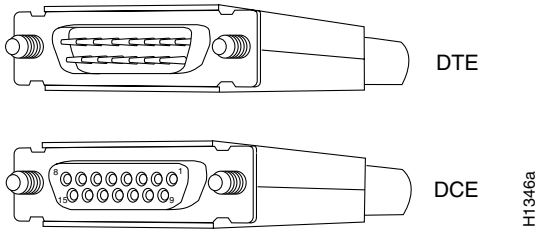


Note Also available, but not shown in Figure 1-6, are CAB-V35MC=, a V.35 cable with a plug on the network end for DCE mode, and CAB-V35FT=, a V.35 cable with a receptacle on the network end for DTE mode. These cables are used for connecting V.35-equipped systems back to back.

X.21 Connections

The router (VIP) end of all X.21 adapter cables is a high-density 60-pin plug. The opposite (network) end of the adapter cable is a standard DB-15 connector. Figure 1-7 shows the connectors at the network end of the X.21 adapter cable. X.21 cables are available as either DTE (DB-15 plug) or DCE (DB-15 receptacle).

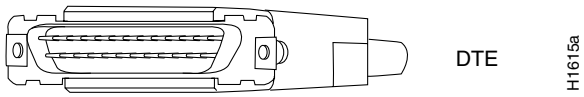
Figure 1-7 X.21 Adapter Cable Connectors



EIA-530 Connections

The EIA-530 adapter cable is available in DTE mode only. The router (VIP) end of the EIA-530 adapter cable is a high-density 60-pin plug. The opposite (network) end of the adapter cable is a standard DB-25 plug commonly used for EIA/TIA-232 connections. Figure 1-8 shows the DB-25 connector at the network end of the adapter cable.

Figure 1-8 EIA-530 Adapter Cable Connector



4T Port Adapter Cable Pinouts

The 4T port adapter supports EIA/TIA-232, EIA/TIA-449, X.21, V.35, and EIA-530 serial interfaces. All 4T ports use a a 60-pin receptacle that supports all available interface types. A special serial adapter cable, which is required for each port, determines the electrical interface type and mode of the interface. The router (VIP) end of all of the adapter cables is a 60-pin plug; the connectors at the network end are the standard connectors used for the respective interfaces.

All interface types except EIA-530 are available in DTE or DCE format: DTE with a plug connector at the network end and DCE with a receptacle at the network end. V.35 is available in either mode with either gender at the network end. EIA-530 is available in DTE only.

The tables that follow list the signal pinouts for both the DTE and DCE mode serial port adapter cables, for each of the following 4T port adapter interface types:

- EIA/TIA-232 pinouts, Table 1-3
- EIA/TIA-449 pinouts, Table 1-4
- EIA-530 pinouts, Table 1-5
- V.35 pinouts, Table 1-6
- X.21 pinouts, Table 1-7

Table 1-3 EIA/TIA-232 Adapter Cable Signals

DTE Cable (CAB-232MT=)					DCE Cable (CAB-232FC=)				
VIP End, HD[1] 60-Position Plug				Network End, DB-25 Plug	VIP End, HD 60-Position Plug				Network End, DB-25 Receptacle
Signal	**Pin**		**Pin**	**Signal**	**Signal**	**Pin**		**Pin**	**Signal**
Shield ground	46		1	Shield ground	Shield ground	46		1	Shield ground
TxD/RxD	41	—>	2	TxD	RxD/TxD	36	<—	2	TxD
RxD/TxD	36	<—	3	RxD	TxD/RxD	41	—>	3	RxD
RTS/CTS	42	—>	4	RTS	CTS/RTS	35	<—	4	RTS
CTS/RTS	35	<—	5	CTS	RTS/CTS	42	—>	5	CTS
DSR/DTR	34	<—	6	DSR	DTR/DSR	43	—>	6	DSR
Circuit ground	45		7	Circuit ground	Circuit ground	45		7	Circuit ground
DCD/LL	33	<—	8	DCD	LL/DCD	44	—>	8	DCD
TxC/NIL	37	<—	15	TxC	TxCE/TxC	39	—>	15	TxC
RxC/TxCE	38	<—	17	RxC	NIL/RxC	40	—>	17	RxC
LL/DCD	44	—>	18	LTST	DCD/LL	33	<—	18	LTST
DTR/DSR	43	—>	20	DTR	DSR/DTR	34	<—	20	DTR
TxCE/TxC	39	—>	24	TxCE	RxC/TxCE	38	<—	24	TxCE
Mode 0 Ground Mode_DCE	50 51 52			Shorting group	Mode 0 Ground	50 51			Shorting group

1. HD = high density.

Table 1-4 EIA/TIA-449 Adapter Cable Signals

DTE Cable (CAB-449MT=)					DCE Cable (CAB-449C=)				
VIP End, HD[1] 60-Position Plug				Network End, DB-37 Plug	VIP End, HD 60-Position Plug				Network End, DB-37 Receptacle
Signal	Pin		Pin	Signal	Signal	Pin		Pin	Signal
Shield ground	46		1	Shield ground	Shield ground	46		1	Shield ground
TxD/RxD+	11	—>	4	SD+	RxD/TxD+	28	<—	4	SD+
TxD/RxD–	12	—>	22	SD–	RxD/TxD–	27	<—	22	SD–
TxC/RxC+	24	<—	5	ST+	TxCE/TxC+	13	—>	5	ST+
TxC/RxC–	23	<—	23	ST–	TxCE/TxC–	14	—>	23	ST–
RxD/TxD+	28	<—	6	RD+	TxD/RxD+	11	—>	6	RD+
RxD/TxD–	27	<—	24	RD–	TxD/RxD–	12	—>	24	RD–
RTS/CTS+	9	—>	7	RS+	CTS/RTS+	1	<—	7	RS+
RTS/CTS–	10	—>	25	RS–	CTS/RTS–	2	<—	25	RS–
RxC/TxCE+	26	<—	8	RT+	TxC/RxC+	24	—>	8	RT+
RxC/TxCE–	25	<—	26	RT–	TxC/RxC–	23	—>	26	RT–
CTS/RTS+	1	<—	9	CS+	RTS/CTS+	9	—>	9	CS+
CTS/RTS–	2	<—	27	CS–	RTS/CTS–	10	—>	27	CS–
LL/DCD	44	—>	10	LL	NIL/LL	29	—>	10	LL
Circuit ground	45		37	SC	Circuit ground	30		37	SC
DSR/DTR+	3	<—	11	ON+	DTR/DSR+	7	—>	11	ON+
DSR/DTR–	4	<—	29	ON–	DTR/DSR–	8	—>	29	ON–
DTR/DSR+	7	—>	12	TR+	DSR/DTR+	3	<—	12	TR+
DTR/DSR–	8	—>	30	TR–	DSR/DTR–	4	<—	30	TR–
DCD/DCD+	5	<—	13	RR+	DCD/DCD+	5	—>	13	RR+
DCD/DCD–	6	<—	31	RR–	DCD/DCD–	6	—>	31	RR–
TxCE/TxC+	13	—>	17	TT+	RxC/TxCE+	26	<—	17	TT+
TxCE/TxC–	14	—>	35	TT–	RxC/TxCE–	25	<—	35	TT–
Circuit ground	15		19	SG	Circuit ground	15		19	SG
Circuit ground	16		20	RC	Circuit ground	16		20	RC
Mode 1 Ground	49 48			Shorting group	Mode 1 Ground	49 48			Shorting group
Ground Mode_DCE	51 52			Shorting group					

1. HD = high density.

Table 1-5 EIA-530 DTE Adapter Cable Signals (CAB-530MT=)

VIP End, HD[1] 60-Position Plug				Network End, DB-25 Plug
Signal	**Pin**		**Pin**	**Signal**
Shield ground	46		1	Shield ground
TxD/RxD+	11	—>	2	TxD+
TxD/RxD–	12	—>	14	TxD–
RxD/TxD+	28	<—	3	RxD+
RxD/TxD–	27	<—	16	RxC–
RTS/CTS+	9	—>	4	RTS+
RTS/CTS–	10	—>	19	RTS–
CTS/RTS+	1	<—	5	CTS+
CTS/RTS–	2	<—	13	CTS–
DSR/DTR+	3	<—	6	DSR+
DSR/DTR–	4	<—	22	DSR–
DCD/DCD+	5	<—	8	DCD+
DCD/DCD–	6	<—	10	DCD–
TxC/RxC+	24	<—	15	TxC+
TxC/RxC–	23	<—	12	TxC–
RxC/TxCE+	26	<—	17	RxC+
RxC/TxCE–	25	<—	9	RxC–
LL/DCD	44	—>	18	LL
Circuit ground	45		7	Circuit ground
DTR/DSR+	7	—>	20	DTR+
DTR/DSR–	8	—>	23	DTR–
TxCE/TxC+	13	—>	24	TxCE+
TxCE/TxC–	14	—>	11	TxCE–
Mode_1 Ground Mode_2	49 48 47			Shorting group
Ground Mode_DCE	51 52			Shorting group

1. HD = high density.

Table 1-6 V.35 Adapter Cable Signals

DTE Cable (CAB-V35FT= or CAB-V35MT=)					DCE Cable (CAB-V35FC= or CAB-V35MC=)				
VIP End, HD[1] 60-Position Plug				Network End, 34-Position Plug	VIP End, HD 60-Position Plug				Network End, 34-Position Receptacle
Signal	**Pin**		**Pin**	**Signal**	**Signal**	**Pin**		**Pin**	**Signal**
Shield ground	46		A	Frame ground	Shield ground	46		A	Frame ground
Circuit ground	45		B	Circuit ground	Circuit ground	45		B	Circuit ground
RTS/CTS	42	—>	C	RTS	CTS/RTS	35	<—	C	RTS
CTS/RTS	35	<—	D	CTS	RTS/CTS	42	—>	D	CTS
DSR/DTR	34	<—	E	DSR	DTR/DSR	43	—>	E	DSR
DCD/LL	33	<—	F	RLSD	LL/DCD	44	—>	F	RLSD
DTR/DSR	43	—>	H	DTR	DSR/DTR	34	<—	H	DTR
LL/DCD	44	—>	K	LT	DCD/LL	33	<—	K	LT
TxD/RxD+	18	—>	P	SD+	RxD/TxD+	28	<—	P	SD+
TxD/RxD–	17	—>	S	SD–	RxD/TxD–	27	<—	S	SD–
RxD/TxD+	28	<—	R	RD+	TxD/RxD+	18	—>	R	RD+
RxD/TxD–	27	<—	T	RD–	TxD/RxD–	17	—>	T	RD–
TxCE/TxC+	20	—>	U	SCTE+	RxC/TxCE+	26	<—	U	SCTE+
TxCE/TxC–	19	—>	W	SCTE–	RxC/TxCE–	25	<—	W	SCTE–
RxC/TxCE+	26	<—	V	SCR+	NIL/RxC+	22	—>	V	SCR+
RxC/TxCE–	25	<—	X	SCR–	NIL/RxC–	21	—>	x	SCR–
TxC/RxC+	24	<—	Y	SCT+	TxCE/TxC+	20	—>	Y	SCT+
TxC/RxC–	23	<—	AA	SCT–	TxCE/TxC–	19	—>	AA	SCT–
Mode 1 Ground	49 48			Shorting group	Mode 1 Ground	49 48			Shorting group
Mode 0 Ground Mode_DCE	50 51 52			Shorting group	Mode 0 Ground	50 51			Shorting group
TxC/NIL RxC/TxCE RxC/TxD Ground	53 54 55 56			Shorting group	TxC/NIL RxC/TxCE RxC/TxD Ground	53 54 55 56			Shorting group

1. HD = high density.

Table 1-7 X.21 Adapter Cable Signals

DTE Cable (CAB-X21MT=)					DCE Cable (CAB-X21FC=)				
VIP End, HD[1] 60-Position Plug				Network End, DB-15 Plug	VIP End, HD 60-Position Plug				Network End, DB-15 Receptacle
Signal	**Pin**		**Pin**	**Signal**	**Signal**	**Pin**		**Pin**	**Signal**
Shield ground	46		1	Shield ground	Shield ground	46		1	Shield ground
TxD/RxD+	11	—>	2	Transmit+	RxD/TxD+	11	—>	2	Transmit+
TxD/RxD–	12	—>	9	Transmit–	RxD/TxD–	12	—>	9	Transmit–
RTS/CTS+	9	—>	3	Control+	CTS/RTS+	9	—>	3	Control+
RTS/CTS –	10	—>	10	Control–	CTS/RTS –	10	—>	10	Control–
RxD/TxD+	28	<—	4	Receive+	TxD/RxD+	28	<—	4	Receive+
RxD/TxD–	27	<—	11	Receive–	TxD/RxD–	27	<—	11	Receive–
CTS/RTS+	1	<—	5	Indication+	RTS/CTS+	1	<—	5	Indication+
CTS/RTS –	2	<—	12	Indication–	RTS/CTS–	2	<—	12	Indication–
RxC/TxCE+	26	<—	6	Timing+	TxC/RxC+	26	<—	6	Timing+
RxC/TxCE–	25	<—	13	Timing–	TxC/RxC –	25	<—	13	Timing–
Circuit ground	15		8	Circuit ground	Circuit ground	15		8	Circuit ground
Ground Mode_2	48 47			Shorting group	Ground Mode_2	48 47			Shorting group
Ground Mode_DCE	51 52			Shorting group	Ground Mode_DCE	51 52			

1. HD = high density.

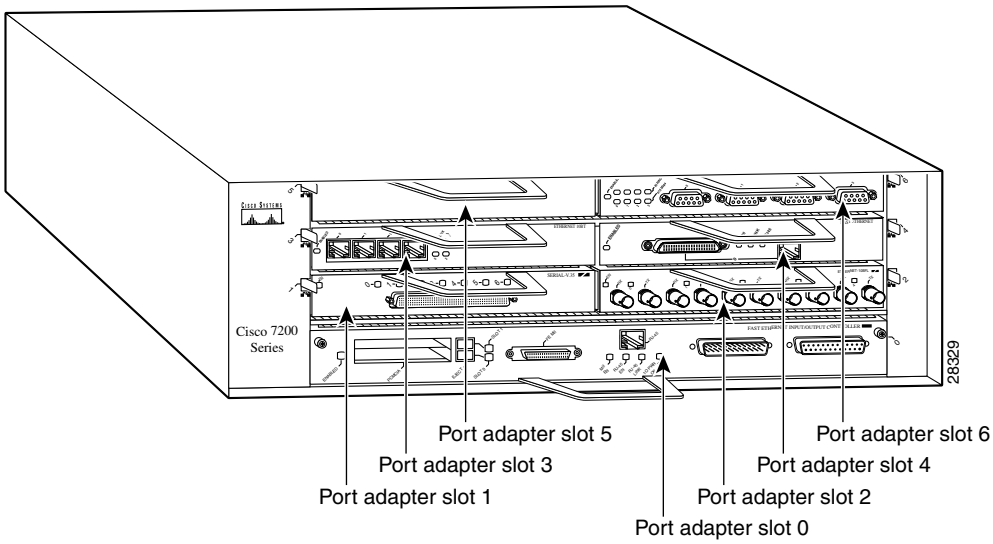
Port Adapter Slot Locations on the Supported Platforms

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

Cisco 7200 Series Router Slot Numbering

Figure 1-9 shows a Cisco 7206 with port adapters installed. In the Cisco 7206, port adapter slot 1 is in the lower left position, and port adapter slot 6 is in the upper right position. (The Cisco 7202 and Cisco 7204 are not shown; however, the PA-4T can be installed in any available port adapter slot.)

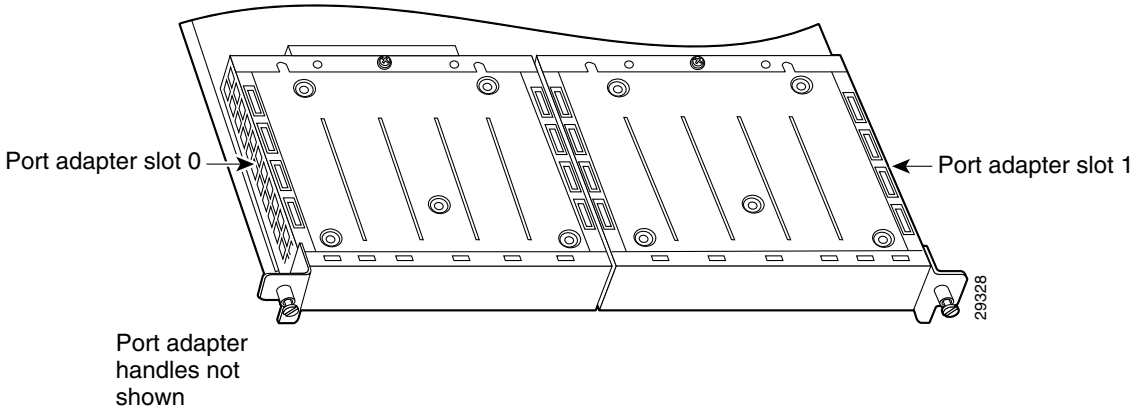
Figure 1-9 Port Adapter Slots in the Cisco 7206



VIP Slot Numbering

Figure 1-10 shows a partial view of a VIP motherboard with installed port adapters. With the motherboard oriented as shown in Figure 1-10, the left port adapter is in port adapter slot 0, and the right port adapter is in port adapter slot 1.

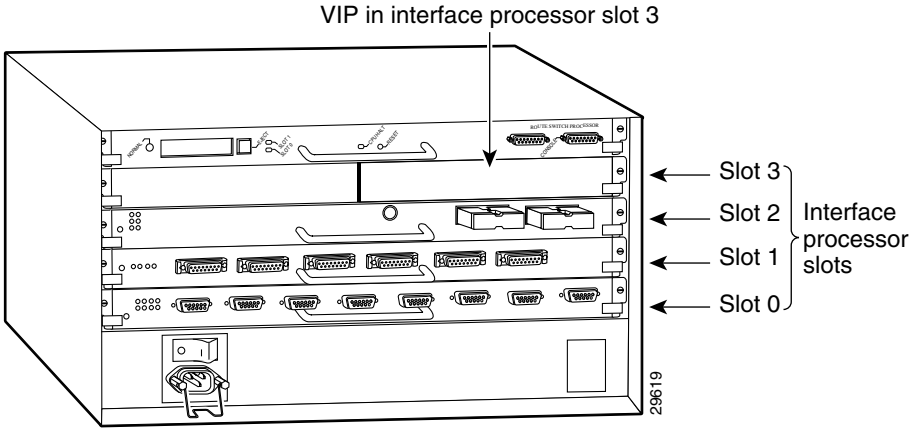
Figure 1-10 VIP Motherboard with Two Port Adapters Installed—Horizontal Orientation



Note In the Cisco 7507, and Cisco 7513 chassis, the VIP motherboard is installed vertically. In the Cisco 7505 chassis, the VIP motherboard is installed horizontally.

Interface processor slots are numbered as shown in Figure 1-11.

Figure 1-11 Interface Slot Numbers—Cisco 7505 Shown



Identifying Interface Addresses

This section describes how to identify interface addresses for the PA-4T in supported platforms. Interface addresses specify the actual physical location of each interface on a router or switch.

Interfaces on the PA-4T installed in a router 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-4T installed in a VIP maintain the same address regardless of whether other interface processors are installed or removed. However, when you move a VIP to a different slot, the interface processor slot number changes to reflect the new interface processor slot.

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

Table 1-8 explains how to identify interface addresses.

Table 1-8 Identifying Interface Addresses

Platform	Interface Address Format	Numbers	Syntax
Cisco 7200 series routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—0 through 6 (depends on the number of slots in the router)[1] Interface port—0 through 3	`1/0`
VIP in Cisco 7500 series routers	Interface-processor-slot-number/ port-adapter-slot-number/interface-port-number	Interface processor slot—0 through 12 (depends on the number of slots in the router) Port adapter slot—always 0 or 1 Interface port—0 through 3	`3/1/0`

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

Cisco 7200 Series Routers Interface Addresses

This section describes how to identify the interface addresses used for the PA-4T in Cisco 7200 series routers. The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See Table 1-8 for the interface address format.

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

The interface addresses of the interfaces on the PA-4T in port adapter slot 1 are 1/0 through 1/7 (port adapter slot 1 and interfaces 0 through 7). If the PA-4T was in port adapter slot 4, these same interfaces would be numbered 4/0 through 4/7 (port adapter slot 4 and interfaces 0 through 3).

VIP Interface Addresses

This section describes how to identify the interface addresses used for the PA-4T on a VIP in Cisco 7500 series routers.

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

See Table 1-8 for the interface address format. The interface address is composed of a three-part number in the format *interface-processor-slot-number/port-adapter-slot-number/interface-port-number*.

If the VIP is inserted in interface processor slot 3, then the interface addresses of the *PA-4T* are 3/1/0 through 3/1/3 (interface processor slot 3, port adapter slot 1, and interfaces 0 through 3). If the port adapter was in port adapter slot 0 on the VIP, these same interface addresses would be numbered 3/0/0 through 3/0/3.

Note If you remove the VIP with the PA-4T (shown in Figure 1-11) from interface processor slot 3 and install it in interface processor slot 2, the interface addresses become 2/1/0 through 2/1/3.

Preparing for Installation

This chapter describes the general equipment, safety, and site preparation requirements for installing the PA-4T. This chapter contains the following sections:

Required Tools and Equipment

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

- PA-4T(=) port adapter.
- VIP (for installation in Cisco 7500 series chassis only). For information about the specific VIP models that support the PA-4T, see the "Software and Hardware Requirements" section on page 2-1.
- Serial cables appropriate for the desired port adapter interface types and the desired modes. (See the "Cables, Connectors, and Pinouts" section on page 1-4
- Number 1 Phillips and a 3/16-inch flat-blade screwdriver (for VIP2 installation only).
- 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.

Software and Hardware Requirements

Table 2-1 lists the recommended minimum Cisco IOS software release required to use the PA-4T in supported router or switch platforms.

Table 2-1 PA-4T Software Requirements

Platform	Recommended Minimum Cisco IOS Release
Cisco 7200 series Cisco 7202, Cisco 7204 and Cisco 7206	Cisco IOS Release 11.1(472) or a later release of Cisco IOS Release 11.1 Cisco IOS Release 11.1(9)CA or a later release of Cisco IOS Release 11.1CA Cisco IOS Release 11.2(1) or a later release of Cisco IOS Release 11.2 Cisco IOS Release 11.2(5)P or a later release of Cisco IOS Release 11.2P Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2 B
VIP2 in the Cisco 7500 series[1] [2] With VIP2-15(=) or VIP2-40(=)	Cisco IOS Release 11.1(472) or a later release of Cisco IOS Release 11.1 Cisco IOS Release 11.1(9)CA or a later release of Cisco IOS Release 11.1CA Cisco IOS Release 11.2(1) or a later release of Cisco IOS Release 11.2 Cisco IOS Release 11.2(5)P or a later release of Cisco IOS Release 11.2P
With VIP2-50(=)	Cisco IOS Release 11.1(14)CA or a later release of Cisco IOS Release 11.1CA

1. The *PA-4T* can be used in the VIP2 in all Cisco 7500 series routers using a Route Switch Processor (RSP), and in Cisco 7000 series routers using the RSP7000 and RSP7000CI.
2. The specific VIP2 models recommended for the *PA-4T* in all Cisco 7500 series routers using the RSP7000 and RSP7000CI, are VIP2-15(=), which has 1MB of SRAM and 8 MB of DRAM, VIP2-20(=), which has 1 MB of SRAM and 16 MB of SDRAM, VIP2-40(=), which has 2 MB of SRAM and 32 MB of DRAM, and VIP2-50(=), which has 4 to 8 MB of SRAM and 32 to 128 MB of SDRAM.

Caution To prevent system problems, the VIP2 requires that the Cisco 7000 series router has the RSP7000 and RSP7000CI installed. The VIP2 will *not* operate properly with the Route Processor (RP), Switch Processor (SP), or Silicon Switch Processor (SSP) installed in the Cisco 7000 series router.

For configuration guidelines on port adapters in the Cisco 7200 series, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines.*

Checking Hardware and Software Compatibility

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

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

To access Software Advisor, click **Login** at Cisco.com and go to **Technical Support Help—Cisco TAC**: **Tool Index**: **Software Advisor**. You can also access the tool by pointing your browser directly to http://www.cisco.com/cgi-bin/support/CompNav/Index.pl.

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

Safety Guidelines

Following are 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, might harm you. A warning symbol precedes each warning statement.

Warning Definition

Warning **IMPORTANT SAFETY INSTRUCTIONS**

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

SAVE THESE INSTRUCTIONS

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

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

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

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

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

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

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

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

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

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

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

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

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

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

GUARDE ESTAS INSTRUÇÕES

¡Advertencia! **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

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

GUARDE ESTAS INSTRUCCIONES

Varning! **VIKTIGA SÄKERHETSANVISNINGAR**

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

SPARA DESSA ANVISNINGAR

Figyelem **FONTOS BIZTONSÁGI ELOÍRÁSOK**

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

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

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

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告 重要的安全性说明

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

请保存这些安全性说明

警告　安全上の重要な注意事項

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

これらの注意事項を保管しておいてください。

주의　중요 안전 지침

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

이 지시 사항을 보관하십시오.

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 legemesbeskadigelse. 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 لإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالإجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في أخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز.
قم بحفظ هذه الإرشادات

Upozorenje

VAŽNE SIGURNOSNE NAPOMENE

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

SAČUVAJTE OVE UPUTE

Upozornění

DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY

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

USCHOVEJTE TYTO POKYNY

Προειδοποίηση

ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

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

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

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

שמור הוראות אלה

Opomena

постои 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 ОВИЕ 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

Upozornenie **DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY**

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

USCHOVAJTE SI TENTO NÁVOD

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

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

Telephone Wiring Guidelines

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

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.

- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. 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 board component-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.
- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal carrier.

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

FCC Class B Compliance

The equipment described in this manual generates and may radiate radio-frequency energy. If it is not installed in accordance with Cisco's installation instructions, it may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in part 15 of the FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

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.)

Modifications to this product not authorized by Cisco Systems, Inc. could void the FCC approval and negate your authority to operate the product.

Removing and Installing Port Adapters

This chapter describes how to remove the PA-4T port adapter from supported platforms and also how to install a new or replacement port adapter. This chapter contains the following sections:

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

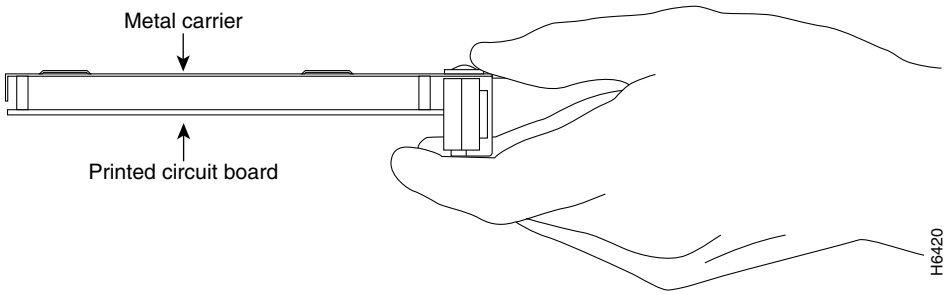
Caution When powering off the router, wait a minimum of 30 seconds before powering it on again.

Handling Port Adapters

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

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



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-4T in Cisco 7200 series routers.

Although the VIP supports online insertion and removal, individual port adapters do not. To replace port adapters, you must first remove the VIP from the chassis and then install or replace port adapters as required. If a blank port adapter is installed on the VIP on which you want to install a new port adapter, you must first remove the VIP from the chassis and then remove the blank port adapter.

Caution To prevent system problems, do not remove port adapters from the VIP motherboard or attempt to install other port adapters on the motherboard when the system is operating. To install or replace port adapters, first remove the VIP from its interface processor slot.

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

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

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

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

Each module has a bus connector that connects it to the router. The connector has a set of tiered pins in three lengths that send specific signals to the system as they make contact with the module. The system assesses the signals it receives and the order in which it receives them to determine if a module is being removed from or introduced to the system. From these signals, the system determines whether to reinitialize a new interface or to shut down a disconnected interface.

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

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

1. Rapidly scans the system for configuration changes.
2. Initializes newly inserted port adapters or administratively shuts down any vacant interfaces.
3. Brings all previously configured interfaces on the module back to their previously installed state. Any newly inserted interface is put in the administratively shutdown state, as if it was present (but not configured) at boot time. If a similar module type is reinserted into a slot, its ports are configured and brought online up to the port count of the originally installed module of that type.

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

Warnings and Cautions

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

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

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

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

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the midplane with your hand or any metal tool, or you could shock yourself.** Statement 181

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. This section contains the following illustrations:

Cisco 7200 Series—Removing and Installing a Port Adapter

Step 1

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

Step 2

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

Step 3

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

Step 4

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

Step 5

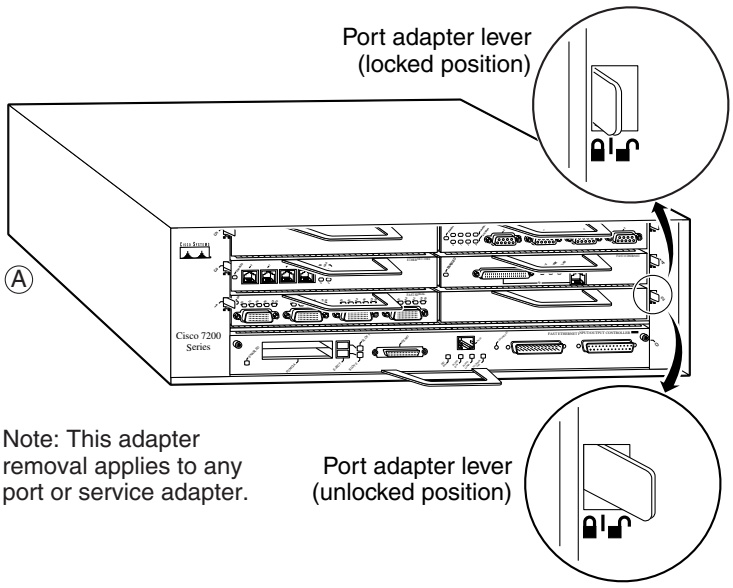
Carefully slide the new port adapter halfway into the port adapter slot. (See B.)

Step 6

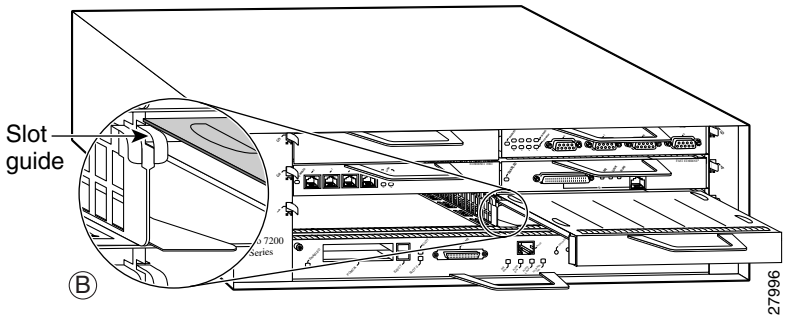
With the port adapter halfway into the slot, connect all required cables to the port adapter. After connecting all required cables, carefully slide the port adapter all the way into the slot until the port adapter is seated in the router midplane.

Step 7

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



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



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

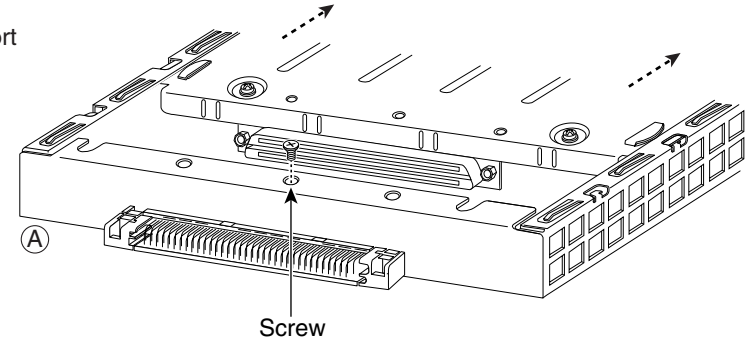
Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

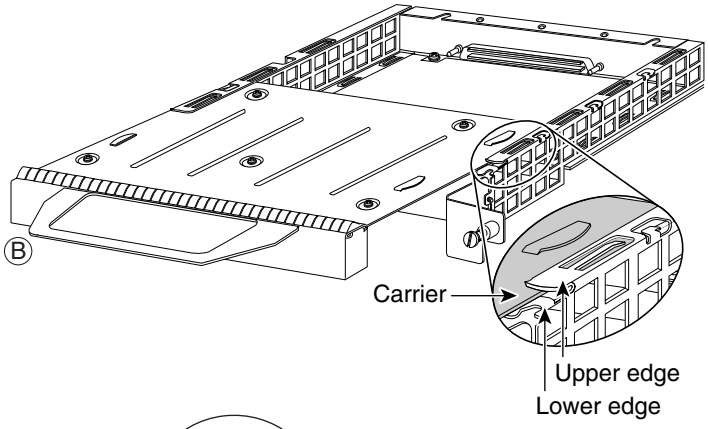
Step 5

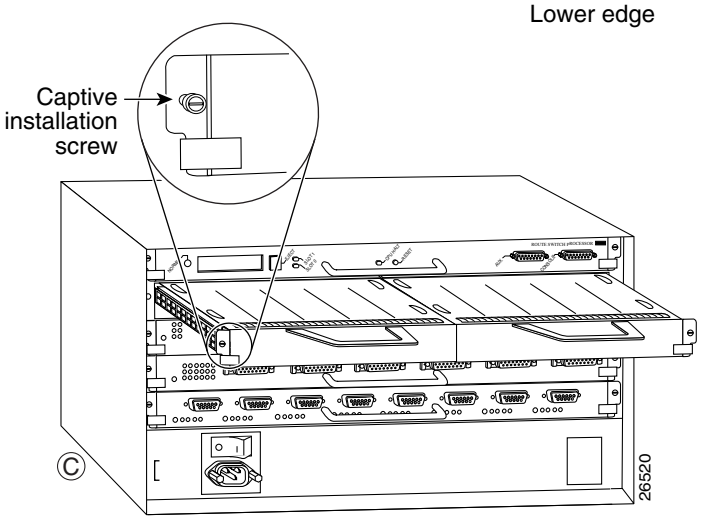
Install the screw in the rear of the port adapter slot on the VIP. Do not overtighten the screw. (See A.)

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.)







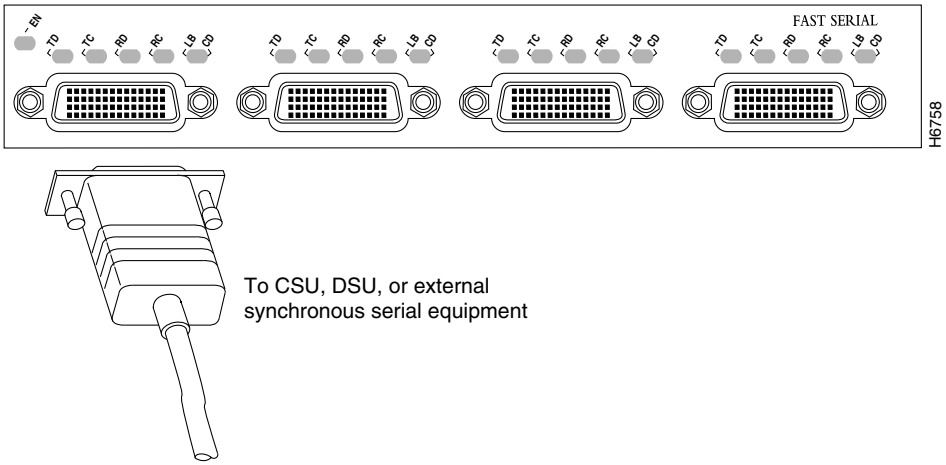
Connecting a PA-4T Interface Cable

On a single PA-4T, you can use up to four synchronous-serial connections. Port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

Use the following procedure to connect serial cables to the PA-4T:

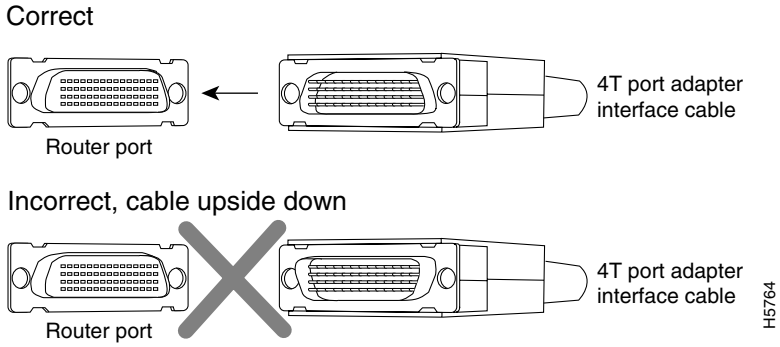
Step 1 Attach the appropriate serial cable directly to the receptacle on the PA-4T and tighten the strain-relief screws. (See Figure 3-2.)

Figure 3-2 Connecting PA-4T Serial Cables (Horizontal Orientation—Shown without Handles)



Caution Serial interface cables must be attached correctly or damage to the cable plug will result. Attempting to force a cable plug on the 60-pin receptacle can damage the plug. (See Figure 3-3.)

Figure 3-3 Connecting Serial Port Adapter Cables



Step 2 Attach the network end of your serial cable to your DSU, CSU, DTE, or other external synchronous-serial equipment and tighten the strain-relief screws.

This completes the procedure for attaching serial interface cables to the PA-4T.

Configuring the PA-4T

To continue your PA-4T installation, you must configure the *serial* interfaces. 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

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

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

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

```
Router> enable

Password:
```

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

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

```
Router#
```

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

Configuring the Interfaces

After you verify that the new PA-4T is installed correctly (the enabled LED goes on), use the privileged-level **configure** command to configure the new interfaces. Have the following information available:

- Protocols you plan to route on each new interface
- IP addresses, if you plan to configure the interfaces for IP routing
- Bridging protocols you plan to use
- *Clock timing source you plan to use for each new interface and clock speeds for external timing*

If you installed a new PA-4T or if you want to change the configuration of an existing interface, you must enter configuration mode to configure the new interfaces. If you replaced a PA-4T that was previously configured, the system recognizes the new interfaces and brings each of them up in their existing configuration.

For a summary of the configuration options available and instructions for configuring interfaces on a PA-4T, refer to the appropriate configuration publications listed in the "Related Documentation" section on page vi.

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

Before you remove an interface that you will not replace, **replace a serial cable**, or replace port adapters, use the **shutdown** command to shut down (disable) the interfaces to prevent anomalies when you reinstall the new 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 interfaces by entering the **interface serial** subcommand (followed by the interface address of the interface), and then enter the **shutdown** command. Table 4-1 shows the command syntax.

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.

Table 4-1 Syntax of the shutdown Command

Platform	Command	Example

Cisco 7200 series routers	**interface**, followed by the *type* (**serial**) and *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 and interface 1 on a port adapter in port adapter slot 6.
		`Router(config-if)# interface serial 6/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface serial 6/1`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

VIP in Cisco 7500 series routers	**interface**, followed by the *type* (**serial**) and *slot/port adapter/port* (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)	The example is for interface 1 and interface 0 on a port adapter in port adapter slot 1 of a VIP installed in interface processor slot 1.
		`Router(config-if)# interface serial 1/1/1`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface serial 1/1/0`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Note If you need to shut down additional interfaces, enter the **interface serial** command (followed by 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 interfaces are 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. Table 4-2 provides examples.

Table 4-2 Examples of the show interfaces Command

Platform	Command	Example

Cisco 7200 series routers	**show interfaces serial**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 6.
		`Router# show interfaces serial 6/0`
		`Serial 6/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

VIP in Cisco 7500 series routers	**show interfaces serial**, followed by *slot/port adapter/port* (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1 of a VIP in interface processor slot 1.
		`Router# show interfaces serial 1/1/0`
		`Serial 1/1/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

Step 6 Reenable interfaces by doing the following:

a. Repeat Step 3 to reenable an interface. Substitute the **no shutdown** command for the **shutdown** command.

b. Repeat Step 4 to write the new configuration to memory. Use the **copy running-config startup-config** command.

c. Repeat Step 5 to verify that the interfaces are in the correct state. Use the **show interfaces** command followed by the interface type and interface address of the interface.

For complete descriptions of software configuration commands, refer to the publications listed in the "Related Documentation" section on page vi.

Performing a Basic Configuration

Following are instructions for a basic configuration: enabling an interface, specifying IP routing, and **setting the clock rate**. 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 *serial* interfaces, 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 serial** subcommand, followed by the interface address of the interface you plan to configure. (The command for your port adapter may be different, for example, **interface atm**.) Table 4-3 provides examples.

Table 4-3 Examples of the interface serial Subcommand

Platform	Command	Example

Cisco 7200 series routers	**interface serial**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 6.
		`Router(config)# interface serial 6/0`
		`Router(config-if)#`

VIP in Cisco 7500 series routers	**interface serial**, followed by *slot/port adapter/port* (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 1 of a VIP in interface processor slot 1.
		`Router(config)# interface serial 1/1/0`
		`Router(config-if)#`

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.

Note If you are configuring a DTE interface, proceed to Step 6. If you are configuring a DCE interface, you need to configure the external clock signal, which is described in Step 5.

The example in Step 5 applies to all systems in which the PA-4T is supported.

Step 5 Set the clock rate using the **clock rate** command. (See the next section, "Configuring Timing [Clock] Signals.")

```
Router(config-if)# clock rate 72000
```

Step 6 Reenable the interfaces using the **no shutdown** command. (See the "Shutting Down an Interface" section on page 4-2.)

Step 7 Configure all additional port adapter interfaces as required.

Step 8 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 9 Write the new configuration to NVRAM as follows:

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

```
Router#
```

This completes the procedure for creating a basic configuration.

Configuring Timing (Clock) Signals

All EIA/TIA-232 interfaces support both DTE and DCE mode, depending on the mode of the compact serial cable attached to the port. To use a port as a DTE interface, you need only connect a DTE compact serial cable to the port. When the system detects the DTE mode cable, it automatically uses the external timing signal. To use a port in DCE mode, you must connect a DCE compact serial cable and set the clock speed with the **clock rate** configuration command. You must also set the clock rate to perform a loopback test. This section describes how to set the clock rate on a DCE port and, if necessary, how to invert the clock to correct a phase shift between the data and clock signals. Table 4-4 summarizes some of the commands used to configure the clock rate. See the specific sections that follow for further details.

Table 4-4 Clock Rate Configuration Commands

Purpose	Command	Example	Additional Information

Set standard clock rate.	**clock rate**	The example is for a serial interface with a standard clock rate of 72 kbps.
		`Router(config)# interface serial 3/0`
		`Router(config-if)# clock rate 7200`
			"Setting the Clock Rate"

Set nonstandard clock rate.	**clock rate**	The example is for a serial interface with a nonstandard clock rate of 1234567 kbps.
		`Router(config)# interface serial 3/0`
		`Router(config-if)# clock rate 1234567`
			"Setting the Clock Rate"

Remove a clock rate that has been set.	**no clock rate**	The example is for a serial interface and removes a standard clock rate of 72 kbps.
		`Router(config)# interface serial 3/0`
		`Router(config-if)# clock rate 7200`
		`Router(config-if)# no clock rate`
			"Setting the Clock Rate"

Invert the transmit clock signal.	**invert-txc**	The example inverts the transmit clock signal for a serial interface.
		`Router(config)# interface serial 3/0`
		`Router(config-if)# invert-txc`
			"Inverting the Clock Signal"

Change the clock signal back to its original phase.	**no invert-txc**	The example sets the transmit clock signal for a serial interface back to its original phase.
		`Router(config)# interface serial 3/0`
		`Router(config-if)# no invert-txc`
			"Inverting the Clock Signal"

Invert the data signal.	**invert data**	The example inverts the data stream for both transmit and receive for a serial interface:
		`Router(config)# interface serial 3/0`
		`Router(config-if)# invert data`
			"Configuring NRZI Format"

Setting the Clock Rate

The default operation on a PA-4T DCE interface is for the DCE device to generate its own clock signal (TxC) and send it to the remote DTE. The remote DTE device returns the clock signal to the DCE (the PA-4T). Set the clock rate of an interface using the **clock rate** subcommand, which specifies the clock rate as a bits-per-second value. This subcommand functions in the same way on all supported platforms.

Before you can assign a clock rate, you must use the **interface serial** command (followed by the interface address of the interface) to select the interface to which you want to assign the clock rate value.

In the following example, the clock rate is specified as 72 kbps:

```
Router(config-if)# clock rate 72000
```

The preceding command example applies to all systems in which the PA-4T is supported. Use the **no clock rate** command to remove the clock rate.

Following are the standard clock rates:

1200, 2400, 4800, 9600, 19200 38400, 56000, 64000,
72000, 125000 148000, 250000, 500000, 800000, 1000000,
1300000, 2000000, 4000000, 8000000

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 prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.

Inverting the Clock Signal

Systems that use long cables or cables that are not transmitting the TxC (clock) signal might experience high error rates when operating at higher transmission speeds. If a PA-4T DCE port is reporting a high number of error packets, a phase shift might be the problem: inverting the clock might correct this phase shift.

When the EIA/TIA-232 interface is a DTE, the **invert-transmit-clock** command inverts the TxC signal the DTE receives from the remote DCE. When the EIA/TIA-232 interface is a DCE, the **invert-transmit-clock** command inverts the clock signal to the remote DTE port. Use the **no invert-transmit-clock** command to change the clock signal back to its original phase.

Configuring NRZI Format

Table 4-5 summarizes NRZI format commands. For more information, see the remainder of this section.

Table 4-5 NRZI Format Commands

Purpose	Command	Example	Further Information

Enable NRZI encoding.	**nrzi-encoding** [**mark**][1]	The example is for a serial interface with NRZI mark encoding specified:
		`Router(config)# interface serial 3/0`
		`Router(config-if)# nrzi-encoding mark`
		The example is for a serial interface with NRZI space encoding specified:
		`Router(config)# interface serial 3/0`
		`Router(config-if)# nrzi-encoding`
			"Configuring NRZI Format"

Disable NRZI encoding.	**no nrzi-encoding**	The example disables NRZI encoding on a serial interface:
		`Router(config)# interface serial 3/0`
		`Router(config-if)# no nrzi-encoding`
			"Configuring NRZI Format"

1. *Mark* is an optional argument. When *mark* is used, it means there is no signal transition; there is data (a mark) at the beginning of a bit interval. When *mark* is not used, it means there is a signal transition; there is no data (a space) at the beginning of a bit interval.

All EIA/TIA-232 interfaces on the PA-4T support non-return-to-zero (NRZ) and non-return-to-zero inverted (NRZI) formats. Both formats use two different voltage levels for transmission. NRZ signals maintain constant voltage levels with no signal transitions—no return to a zero voltage level—during a bit interval and are decoded using absolute values: 0 and 1. NRZI uses the same constant signal levels but interprets the absence of data—a space—at the beginning of a bit interval as a signal transition and the presence of data—a mark—as no signal transition. NRZI uses relational encoding to interpret signals rather than determining absolute values.

NRZ format—the factory default on all interfaces—is more common. NRZI format is commonly used with EIA/TIA-232 connections in IBM environments.

Enable NRZI encoding on any interface using the **nrzi-encoding** [**mark**] command, where no argument after the command is interpreted as a signal transition, and **mark** is interpreted as no signal transition. This command functions in the same way on all supported platforms. Before you can enable NRZI encoding, you must use the **interface serial** command (followed by the interface address of the interface) to select the interface on which you want to enable NRZI encoding.

In the example that follows, NRZI encoding with a signal transition—no argument—is specified:

```
Router(config-if)# nrzi-encoding
```

In the example that follows, NRZI encoding with no signal transition—with argument—is specified:

```
Router(config-if)# nrzi-encoding mark
```

The preceding command examples apply to all systems in which the PA-4T is supported.
Use the **no nrzi-encoding** command to disable NRZI encoding.

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 prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.

For complete command descriptions and instructions, refer to the *Configuration Fundamentals Configuration Guide* publication. For more information, see the "Obtaining Documentation" section on page vii and the.

Configuring Cyclic Redundancy Checks

Table 4-6 summarizes cyclic redundancy check (CRC) commands. For more information, see the remainder of this section.

Table 4-6 CRC Commands

Purpose	Command	Example	Further Information

Enable 32-bit CRC.	**crc** *size*	The example enables 32-bit CRD on a serial interface:
		`Router(config)# interface serial 3/0`
		`Router(config-if)# crc 32`
			"Configuring Cyclic Redundancy Checks"

Return to default 16-bit CRC.	**no crc** *size*	The example disables 32-bit CRD on a serial interface and returns to the default 16-bit CRC:
		`Router(config)# interface serial 3/0`
		`Router(config-if)# no crc 32`
			"Configuring Cyclic Redundancy Checks"

CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. All interfaces use a 16-bit CRC (CRC-CITT) by default but also support a 32-bit CRC. The sender of a data frame calculates the frame check sequence (FCS). Before it sends a frame, the sender appends the FCS value to the message. The receiver recalculates the FCS and compares its calculation to the FCS from the sender. If there is a difference between the two calculations, the receiver assumes that a transmission error occurred and sends a request to the sender to resend the frame.

Enable 32-bit CRC using the **crc 32** command. Before you can enable 32-bit CRC, you must use the **interface serial** command (followed by the interface address of the interface) to select the interface on which you want to enable 32-bit CRC. This command functions in the same way on all supported platforms.

In the example that follows, the first serial port on a PA-4T, installed on a VIP in interface processor slot 3 is configured for 32-bit CRC:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# interface serial 3/1/0
Router(config-int)# crc 32
Ctrl-Z
Router#
```

The preceding command example applies to all systems in which the PA-4T is supported.
Use the **no crc 32** command to disable CRC-32 and return the interface to the default CRC-16 (CRC-CITT) setting.

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 prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.

For command descriptions, refer to the *Configuration Fundamentals Configuration Guide* publication. For more information, see the "Obtaining Documentation" section on page vii and the "Obtaining Technical Assistance" section on page viii.

Checking the Configuration

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

Using show Commands to Verify the New Interface Status

Table 4-7 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the *PA-4T* appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow. For complete command descriptions and examples, refer to the publications listed in the "Related Documentation" section on page vi.

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

Table 4-7 Using show Commands

Command	Function	Example
show version or **show hardware**	Displays system hardware configuration, the number of each interface type installed, Cisco IOS software version, names and sources of configuration files, and boot images	`Router# show version`
show controllers	Displays all the current interface processors and their interfaces	`Router# show controllers`
show diag *slot*	Displays types of port adapters installed in your system and information about a specific port adapter slot, interface processor slot, or chassis slot	`Router# show diag 2`
show interfaces *type port-adapter-slot-number/ interface-port-number*	Displays status information about a specific type of interface (for example, serial) in a Cisco 7200 series router	`Router# show interfaces serial 1/0`
show interfaces *type interface-processor-slot-number/port-adapter-slot-number /interface-port-number*	Displays status information about a specific type of interface (for example, serial) on a VIP in a Cisco 7500 series router	`Router# show interfaces serial 3/1/0`
show protocols	Displays protocols configured for the entire system and for specific interfaces	`Router# show protocols`
show running-config	Displays the running configuration file	`Router# show running-config`

Table 4-7 Using show Commands (continued)

Command	Function	Example
show startup-config	Displays the configuration stored in NVRAM	`Router# show startup-config`

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

- Using the show version or show hardware Commands
- Using the show diag Command
- Using the show interfaces Command

Choose the subsection appropriate for your system. Proceed to the "Using the ping Command to Verify Network Connectivity" section on page 4-15 when you have finished using the **show** commands.

Using the show version or show hardware Commands

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

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

Cisco 7200 Series Routers

Following is an example of the **show version** command from a Cisco 7200 series router with the *PA-4T*:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Version 11.1(472) [biff 105]
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Fri 06-Oct-95 12:22 by mpo
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 11.1(10979) RELEASED SOFTWARE

Router uptime is 4 hours, 22 minutes
System restarted by reload
System image file is "slot0:c7200-j-mz.960421", booted via slot0

cisco 7200 (R4700) processor with 22528K/10240K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0
Last reset from power-on
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Chassis Interface.
3 Ethernet/IEEE 802.3 interfaces.
3 Network Serial interfaces.
125K bytes of non-volatile configuration memory.
```

```
20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2
```

VIP in Cisco 7500 Series Routers

Following is an example of the **show version** command from a Cisco 7500 series router with the *PA-4T*:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-A), Version 11.1(471) [mpo 105]
Copyright (c) 1986-1995 by cisco Systems, Inc.
Compiled Fri 06-Oct-95 12:22 by mpo
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 5.3(16645) [biff 571], INTERIM SOFTWARE
ROM: GS Bootstrap Software (RSP-BOOT-M), Version 11.1(1.2), MAINTENANCE INTERIME

honda uptime is 4 hours, 22 minutes
System restarted by reload
System image file is "slot0:rsp-a111.471", booted via slot0

cisco RSP2 (R4600) processor with 32768K bytes of memory.
R4600 processor, Implementation 32, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Chassis Interface.
1 VIP2 controller (4 Ethernet)(4 Serial).
4 Ethernet/IEEE 802.3 interfaces.
4 Network Serial interfaces.
125K bytes of non-volatile configuration memory.

20480K 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 6.
Configuration register is 0x2
```

Using the show diag Command

Display the types of port adapters installed in your system (and specific information about each) using the **show diag** *slot* command, where *slot* is the *port adapter slot* in a Cisco 7200 series router and the *interface processor slot* in a Cisco 7500 series router with a VIP.

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

Cisco 7200 Series Routers

Following is an example of the **show diag** *slot* command that shows a PA-4T in port adapter slot 1 of a Cisco 7200 series router:

```
Router# show diag 1

Slot 1:
```

```
Serial port adapter, 4 ports
Port adapter is analyzed
Port adapter insertion time 2d09h ago
Hardware revision 1.1           Board revision A0
Serial number     4294967295    Part number    73-1556-04
Test history      0x0           RMA number     00-00-00
EEPROM format version 1
EEPROM contents (hex):
0x20: 01 02 01 01 FF FF FF FF 49 06 14 04 00 00 00 00
0x30: 50 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF
```

VIP in Cisco 7500 Series Routers

Following is an example of the **show diag** *slot* command that shows a PA-4T in port adapter slot 0 on a VIP in interface processor slot 9:

```
Router# show diag 9
Slot 9:
        Physical slot 9, ~physical slot 0x6, logical slot 9, CBus 0
        Microcode Status 0xC
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status: Console I/O
        EEPROM format version 1
        VIP2 controller, HW rev 2.2, board revision UNKNOWN
        Serial number: 03508066  Part number: 73-1684-02
        Test history: 0x00        RMA number: 00-00-00
        Flags: cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20: 01 15 02 02 00 35 87 62 49 06 94 02 00 00 00 00
          0x30: 12 2B 00 2A 1A 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags: 0x4      Insertion time: 0x5314 (01:20:55 ago)

        Controller Memory Size: 8 MBytes

        PA Bay 0 Information:
                Fast-Serial PA, 4 ports
                EEPROM format version 1
                HW rev 1.0, Board revision 4
                Serial number: 02827523  Part number: 73-3417-04
```

Using the show interfaces Command

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

For complete descriptions of interface subcommands and the configuration options available for Cisco 7200 series and Cisco 7500 VIP interfaces, refer to the publications listed in the "Related Documentation" section on page vi.

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

Cisco 7200 Series Routers

Following is an example of the **show interfaces** command for Cisco 7200 series routers. In this example, the four serial interfaces (0 to 3) are on a port adapter in port adapter slot 1; also, most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
Router# sh int serial 1/0
Serial1/0 is administratively down, line protocol is down
  Hardware is 4T/MC68360
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
(display text omitted]

Router# sh int serial 1/1
Serial1/1 is administratively down, line protocol is down
  Hardware is 4T/MC68360
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
(display text omitted]

Router# sh int serial 1/2
Serial1/2 is administratively down, line protocol is down
  Hardware is 4T/MC68360
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
(display text omitted]

Router# sh int serial 1/3
Serial1/3 is administratively down, line protocol is down
  Hardware is 4T/MC68360
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
(display text omitted]
```

Following is an example of the **show interfaces serial** command, which shows all of the information specific to interface port 0 on a PA-4T installed in port adapter slot 1:

```
Router# sh int serial 1/0
Serial1/0 is administratively down, line protocol is down
  Hardware is 4T/MC68360
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output 1d17h, output hang never
  Last clearing of "show interface" counters never
  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 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     24 packets output, 5137 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions     DCD=down  DSR=down  DTR=down  RTS=down  CTS=down
```

VIP in Cisco 7500 Series Routers

Following is an example of the **show interfaces** command used with the VIP. In this example, the four serial interfaces (0 to 3) are on a port adapter in port adapter slot 1 of a VIP in interface processor slot 3; also, most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
Router# sh int serial 3/1/0
Serial3/1/0 is administratively down, line protocol is down
  Hardware is cyBus Serial, address is 0000.0ca5.2300 (bia 0000.0ca5.2389)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)

Router# sh int serial 3/1/1
Serial3/1/1 is administratively down, line protocol is down
  Hardware is cyBus Serial, address is 0000.0ca5.2300 (bia 0000.0ca5.238a)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)

Router# sh int serial 3/1/2
Serial3/1/2 is administratively down, line protocol is down
  Hardware is cyBus Serial, address is 0000.0ca5.2300 (bia 0000.0ca5.238b)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)

Router# sh int serial 3/1/3
Serial3/1/3 is administratively down, line protocol is down
  Hardware is cyBus Serial, address is 0000.0ca5.2300 (bia 0000.0ca5.238b)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)
```

Following is an example of the **show interfaces serial** command, which shows all of the information specific to interface 0 on a port adapter in port adapter slot 1 of a VIP in interface processor slot 3:

```
Router# sh int serial 3/1/0
Serial3/1/0 is administratively down, line protocol is down
  Hardware is cyBus Serial, address is 0000.0ca5.2300 (bia 0000.0ca5.2388)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)
  ARP type: ARPA, ARP Timeout 4:00:00
  Last input never, output never, output hang never
  Last clearing of "show interface" counters 2:56:26
  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 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 input packets with dribble condition detected
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets, 0 restarts
     0 output buffer failures, 0 output buffers swapped out
```

Proceed to the next section, "Using the ping Command to Verify Network Connectivity," to check network connectivity of the *PA-4T* and switch or router.

Using the ping Command to Verify Network Connectivity

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

The **ping** command sends echo request packets out to a remote device at an IP address that you specify. After sending an echo request, the system waits a specified time for the remote device to reply. Each echo reply is displayed as an exclamation point (!) on the console terminal; each request that is not

returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate a bad connection.

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

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

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

Proceed to the next section, "Using loopback Commands," to finish checking network connectivity.

Using loopback Commands

With the loopback test, you can detect and isolate equipment malfunctions by testing the connection between the PA-4T interface and a remote device such as a modem or a CSU/DSU. The **loopback** subcommand places an interface in loopback mode, which enables test packets that are generated from the **ping** command to loop through a remote device or compact serial cable. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or compact serial cable in the path of the loopback test.

Note You must configure a clock rate on the port *before* performing a loopback test. However, if no cable is attached to the port, the port is administratively up, and the port is in loopback mode; you do not have to configure a clock rate on the port *before* performing a loopback test.

Depending on the mode of the port, issuing the **loopback** command checks the following path:

- When no compact serial cable is attached to the PA-4T interface port, or if a DCE cable is attached to a port that is configured as line protocol up, the **loopback** command tests the path between the network processing engine and the interface port only (without leaving the network processing engine and port adapter).
- When a DTE cable is attached to the port, the **loopback** command tests the path between the network processing engine and the near (network processing engine) side of the DSU or modem to test the PA-4T interface and compact serial cable. (The X.21 DTE interface cable does not support this loopback test; see the following Note.)

Note The X.21 interface definition does not include a loopback definition. On the 4T port adapter, the X.21 DTE interface does not support the loopback function. Because of the internal clock signal present on the PA-4T interfaces, loopback will function on an X.21 DCE interface. This completes the configuration procedure for the new 4T port adapter serial interfaces.