PA-T3/E3-EC Port Adapter Installation and Configuration

PA-T3/E3-EC=, PA-2T3/E3-EC=

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CONTENTS

Preface

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

Document Revision History

The Document Revision History table below records technical changes to this document.

Document Version	Date	Change Summary
OL-11362-01	July, 2007	This is the first version of this document.

Objectives

This document describes how to install and configure 1-port PA-T3/E3-EC port adapter and the 2-port PA-2T3/E3-EC port adapter, hereafter referred to as the PA-T3/E3-EC port adapter, which is used in the Cisco 7204VXR router, the Cisco 7206VXR router, the Cisco 7201 router, and the Cisco 7301 router.

Note The Cisco 7206VXR router can be used as a router shelf in a Cisco AS5800 universal access server. For more information about the Cisco 7206VXR as a router shelf, see the Cisco AS5800 Universal Access Server documentation listed in the "Related Documentation" section on page iv.

Organization

This document contains the following chapters:

:

Section	Title	Description
Chapter 1	Overview	Describes the PA-T3/E3-EC port adapter and its LEDs and cables. Provides supporting information about addressing and networks.
Chapter 2	Preparing for Installation	Describes safety considerations, tools required, and hardware and software requirements.
Chapter 3	Removing and Installing Port Adapters	Provides instructions for installing a port adapter in the supported platform and for connecting cables.
Chapter 4	Configuring the T3 Mode	Provides instructions for configuring your port adapter in the T3 mode.
Chapter 5	Configuring the E3 Mode	Provides instructions for configuring your port adapter in the E3 mode.

Related Documentation

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

- Cisco IOS software:

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

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

- The Cisco 7200 VXR router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:
  - For a list of all Cisco 7200 series routers documentation and troubleshooting tools and information, see the *Cisco 7200 Series Routers Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps341/products_documentation_roadmap09186a00801c0915.html
  - 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/en/US/products/hw/modules/ps2033/products_configuration_guide_book09186a00801056ef.html

  - *Regulatory Compliance and Safety Information for Cisco 7200 Series Routers is* at the following URL:

    http://www.cisco.com/en/US/docs/routers/7200/install_and_upgrade/regulatory_compl_safety_7200/3419pnc6.html

- The Cisco 7201 Router contains extensive features and functionality, which are documented in the following resources:
  - *Cisco 7201 Router Documentation Roadmap* contains a linked list of all documents pertaining to the Cisco 7201 router.
  - *Cisco 7201 Router Port Adapter Documentation Roadmap* contains a linked list of all port adapter documents pertaining to the Cisco 7201 router.
  - *Cisco 7201 Router Troubleshooting Documentation Roadmap* contains a linked list of all troubleshooting documents pertaining to the Cisco 7201 router.
  - *Regulatory Compliance and Safety Information for Cisco 7200 Series Routers* at the following URL:

    http://www.cisco.com/en/US/docs/routers/7200/install_and_upgrade/regulatory_compl_safety_7200/3419pnc6.html
- The Cisco 7301R router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:
  - For a list of all Cisco 7301 documentation and troubleshooting tools and information, see the *Cisco 7301 Router Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps352/products_documentation_roadmap09186a00801c0f21.html
  - *Regulatory Compliance and Safety Information for Cisco 7200 Series Routers is* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps352/products_regulatory_approvals_and_compliance09186a00801d1c80.html
- Cisco AS5800 Universal Access Servers:

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

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

  Cisco AS5800 Universal Access Server Regulatory Compliance and Safety Information at the following URL:

  http://www.cisco.com/en/US/docs/routers/access/as5800/software/notes/5800rcns.html

Obtaining Documentation and Submitting a Service Request

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

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

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

CHAPTER 1

Overview

This chapter describes the Cisco PA-T3/E3-EC port adapter and contains the following sections:

Port Adapter Overview

The PA-T3/E3-EC provides one T3 interface connection using BNC connectors. (See Figure 1-1.) The PA-2T3/E3-EC is a single-width port adapter that provides two T3 interface connections using BNC connectors. (See Figure 1-2.) Hereafter, both versions of this port adapter will be referred to as the PA-T3/E3-EC.

Figure 1-1 PA-T3/E3-EC—Front Panel

Figure 1-2 PA-2T3/E3-EC—Front Panel

Serial network interfaces reside on modular port adapters, which provide a direct connection between the high-speed bus in the router and the external networks. The PA-T3/E3-EC provides a full-duplex synchronous serial E3 interface for transmitting and receiving data at rates of up to 34 megabits per second (Mbps).

The T3 link provides a single high-speed user data channel that appears to the system as a serial interface that may be configured to use the full T3 bandwidth or a smaller portion of the T3 bandwidth. No industry standards exists for subdividing the T3 bandwidth, but the PA-T3/E3-EC is compatible with the proprietary formats of five vendors of T3 DSUs, when used at the far end of the T3 link.

The T3 connection supports the maintenance data link (MDL) channel when using c-bit parity framing as well as local and network loopbacks. Bit error rate testing (BERT) is supported on the T3 link. The PA-T3/E3-EC supports Cisco High-Level Data Link Control (HDLC), Frame Relay, PPP, and Switched Multimegabit Data Service (SMDS) data exchange interface (DXI) encapsulations over the serial interface.

The E3 connection supports both 16- and 32-bit cyclic redundancy checks (CRCs). The default is 16-bit CRCs. To enable 32-bit CRCs, you use a configuration command. For a description of the CRC function, see the "Configuring Cyclic Redundancy Checks" section on page 5-7.

The PA-T3/E3-EC has the following features and physical characteristics:

- The PA-T3/E3-EC transmits and receives data bidirectionally at the T3 rate of 44.736 Mbps.
- The PA-T3/E3-EC conforms to relevant specifications for Digital Signal Level 3 (DS3) circuits.
- The T3 connection, provided by two female BNC connectors for transmit (TX) and receive (RX), requires 734A coaxial cable that has an impedance of 75 ohms.
- The PA-T3/E3-EC supports RFC 1406 and RFC 1407 (CISCO-RFC-1407-CAPABILITY.my). For RFC 1406, Cisco supports all tables except the FarEnd table. For RFC 1407, Cisco does not support FarEnd or Fractional tables. (For information on accessing Cisco MIB files, refer to the *Cisco MIB User Quick Reference* publication.)
- PA-T3/E3-EC microcode is loaded at initialization and is bundled into Cisco IOS software.
- Single- or double-port E3 rate (34 Mbps) connectivity
- Full-duplex synchronous serial E3 interface
- High-speed High-Level Data Link Control (HDLC) data
- Integrated data service unit (DSU) functionality
- Support for 16- and 32-bit cyclic redundancy checks (CRCs)
- Support for G.751 framing or bypass framing
- Support for ATM-DXI, Frame Relay, HDLC, Switched Miltimegabit Data Service (SMDS), and PPP serial encapsulations
- Support for national service bits
- Support for remote and local loopback
- HDB3 line coding
- Scrambling and bandwidth reduction
- Online insertion and removal (OIR)
- The one-port PA-T3/E3-EC provides one high-speed interface on the Cisco 7200 VXR routers and the Cisco 7301 router.
- The two-port PA-2T3/E3-EC provides two high-speed interfaces on the Cisco 7200 VXR routers and the Cisco 7301 router.

T3 Port Specifications

The PA-T3/E3-EC T3 port is designed to receive and transmit at the DSX-3 level while driving and receiving from 75-ohm coaxial cables (ATT 734A or equivalent quality coaxial cable). The T3 port connects directly to any equipment with DSX-3-level BNC connectors.

Table 1-1 lists the specifications that the T3 front end is designed to meet.

Table 1-1 Specifications for the T3 Front End

Parameter	Specification
Line rate	44.736 Mbps (±20 ppm)
Line code	B3ZS (bipolar with three-zero substitution)
Impedance	75 ohms
Output pulse shape	ANSI T1.102, pulse amplitude is between 0.36 and 0.85 volts peak
Input signal	0.035-1.1 volts peak
Output signal	Able to drive 450 feet (135 meters) of 75-ohm coaxial cable (734A or equivalent) and meet pulse shape template

Note The coaxial shield side of the T3 BNC connectors is connected to the router chassis ground.

E3 Cable Specifications

The serial interface cable for the PA-T3/E3-EC, which is a 75-ohm coaxial cable, is used to connect your router to a serial E3 network. Serial cables conform to EIA/TIA-612 and EIA/TIA-613 specifications. The serial ports on the PA-T3/E3-EC are considered to be DTE devices.

Caution To prevent problems when long cable lengths are required, you *must* ensure that your 75-ohm coaxial cables meet or exceed 734A specifications.

Unchannelized Interoperabity Guidelines for DSUs

The PA-T3/E3-EC supports several types of integrated data service units (DSUs). Table 1-2 lists the feature compatibilities of PA-T3/E3-EC DSUs.

Table 1-2 Unchannelized DSU Feature Compatibilities of PA-T3/E3-EC

Vendor	DSU Model	Full Rate Support	Scrambling Support	Subrate Support
Digital Link	DL3100	Yes	Yes	Yes
ADC Kentrox	T3/E3 IDSU	Yes	Yes	Yes
Larscom	Access T45	Yes	Yes	Yes

Table 1-2 Unchannelized DSU Feature Compatibilities of PA-T3/E3-EC (continued)

Vendor	DSU Model	Full Rate Support	Scrambling Support	Subrate Support
Adtran	T3SU 300	Yes	Yes	Yes
Verilink	HDM2182	Yes	Yes	Yes

E3 Interoperability Guidelines for DSUs

The PA-T3/E3-EC supports several types of integrated DSUs. Table 1-3 lists the feature compatibilities of the PA-T3/E3-EC DSUs.

Table 1-3 E3 DSU Feature Compatibilities of PA-T3/E3-EC

DSU	Full Rate Support	Scrambling Support	Subrate Support
DL3100E	Yes	No[1]	Yes[1]
Kentrox	Yes	Yes[2]	Yes[2]

1. DL3100E does not support scrambling. However, the PA-T3/E3-EC can turn on scrambling in DSU mode 0 for connecting to another PA-T3/E3-EC. The PA-T3/E3-EC supports either scrambling (in mode 0) or DL3100E subrate, not both at the same time.
2. The PA-T3/E3-EC supports either scrambling or Kentrox subrate, not both at the same time.

LEDs

The PA-T3/E3-EC has three status LEDs located on its faceplate: one ENABLED LED, and an A/L (active/loopback) LED and C/A (carrier/alarm) LED for each port.

Figure 1-3 PA-2T3/E3-EC Status LEDs—Partial Horizontal View

LED Label	Color	State	Meaning
ENABLE	Green	On	After system initialization, the port is enabled for operation.
	—	Off	The port is not enabled for operation.
A/L (active/loopback)	Green	On	Port is enabled, loopback is off.
	Amber	On	Port is enabled, loopback is on.
	—	Off	Port is not enabled.
C/A (carrier/alarm)	Green	On	Port is enabled, valid signal without alarms.

LED Label	Color	State	Meaning
	Amber	On	Port is enabled, valid signal with alarms.
	—	Off	Port is not enabled.

In addition to the interface status information provided by the LEDs, you can also retrieve detailed interface status information either through the router console port or through Telnet or Simple Network Management Protocol (SNMP).

Management Information Base

Management Information Base (MIB) attributes are readable and writable across the Integrated Local Management Interface (ILMI) through use of Simple Network Management Protocol (SNMP).

- The one-port PA-T3/E3-EC supports MIB-II (RFC 1213) and the E3 interface MIB (RFC 1407).
- The two-port PA-2T3/E3-EC supports MIB-II (RFC 1213) and the E3 interface MIB (RFC 1407).

Port Adapter Slot Locations on the Supported Platforms

The following sections provides port adapter slot locations and related information:

- Cisco 7200 VXR Routers Slot Numbering, page 1-5
- Cisco 7301 Router Slot Numbering, page 1-7

Cisco 7200 VXR Routers Slot Numbering

Figure 1-4 shows a Cisco 7206VXR with port adapters installed. This illustration also shows the Port Adapter Jacket Card installed in the I/O controller slot. The Cisco 7204VXR router is not shown; however, the PA-T3/E3-EC can be installed in any available port adapter (slot 1 through 5.)

In the Cisco 7206VXR as a router shelf in a Cisco AS5800 Universal Access Server), port adapter slot 1 is in the lower left position, and port adapter slot 6 is in the upper right position.

Figure 1-4 Port Adapter Slots in the Cisco 7206 XR Router with the Port Adapter Jacket Card

1	Slot 5	**5**	Slot 6
2	Slot 3	**6**	Slot 4
3	Slot 1	**7**	Slot 2
4	Slot 7 for the port adapter; Slot 0 for the Jacket Card		

Figure 1-4 shows the slot number of port adapters in a Cisco 7200 VXR router with the Port Adapter Jacket Card installed. Port adapter slots in the Cisco 7200 VXR routers are numbered from left to right. With an NPE-G1 or NPE-G2 installed, port adapter slot 0 can accept the Port Adapter Jacket Card. The Port Adapter Jacket Card resides in port adapter lot 0. The port adapter in the Port Adapter Jacket Card resides in port adapter slot 5 on the Cisco 7204 VXR router, or port adapter slot 7 on the Cisco 7206VXR router.

Cisco 7201 Router Slot Numbering

Figure 1-5 shows the front view of a Cisco 7201 router with a port adapter installed. There is only one port adapter slot (slot 1) in a Cisco 7201 router.

Figure 1-5 Port Adapter Slot in the Cisco 7201 Router

Cisco 7301 Router Slot Numbering

The Cisco 7301 router has one port adapter slot. See Figure 1-6.

Figure 1-6 Port Adapter Slot in the Cisco 7301 Router

Identifying Interface Addresses

This section describes how to identify the interface addresses used for the PA-T3/E3-EC in Cisco 7200 VXR routers. Interface addresses specify the actual physical location of each interface on a router or switch. The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number.*

Interfaces on the PA-T3/E3-EC 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.

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

Table 1-4 explains how to identify interface addresses

Table 1-4 Identifying Interface Addresses

Platform	Interface Address Format	Numbers	Syntax
Cisco 7200 VXR 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 and 1	`1/0`
Port Adapter Jacket Card with the Cisco 7200 VXR router[2]	Port-adapter-slot-number/interface-port-number	Port adapter slot—0 through 7 (depends on the number of slots in the router)[3] Interface port—0 and 1	`1/0`

Table 1-4 Identifying Interface Addresses (continued)

Platform	Interface Address Format	Numbers	Syntax
Cisco 7201 router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 Interface port—0 or 1	`1/0`
Cisco 7301 routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 Interface port—0 or 1	`1/0`

1. Port adapter slot 0 is reserved for the Fast Ethernet port on the I/O controller (if present).
2. Port adapter slot 0 can accept the Port Adapter Jacket Card if an NPE-G1 or NPE-G2 is installed.
3. Port adapter slot 0 is reserved for the Fast Ethernet port on the I/O controller (if present).

In Cisco 7200 VXR 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 4 for the Cisco 7204VXR, and slot 6 for the Cisco 7206VXR. (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-2T3/E3-EC in port adapter slot 1 are 1/0 and 1/1 (port adapter slot 1 and interfaces 0 and 1). If the PA-2T3/E3-EC was in port adapter slot 4, these same interfaces would be numbered 4/0 and 4/1 (port adapter slot 4 and interfaces 0 and 1).

CHAPTER 2

Preparing for Installation

This chapter describes the general equipment, safety, and site preparation requirements for installing the Cisco PA-T3/E3-EC port adapter. 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.

- Cisco PA-T3/E3-EC(=) or the Cisco PA-2T/E3-EC(=) port adapter
- Number 2 Phillips screwdriver
- Your own electrostatic discharge (ESD)-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares
- Antistatic mat
- Antistatic container
- Cisco 7200 VXR routers Port Adapter Jacket Card for installation of a port adapter in the I/O controller slot (requires an NPE-G1 or NPE-G2) (optional)
- Attenuator kit (optional)
- Cables (See the "T3 Port Specifications" section on page 1-3, "E3 Cable Specifications" section on page 1-3 and "Cables and Connectors" section on page 3-7.)

Software and Hardware Requirements

The PA-T3/E3-EC and PA-2T/E3-EC require Cisco IOS Release 12.4(15)T1 or a later release of Cisco IOS Release 12.4T.

The PA-T3/E3-EC and PA-2T/E3-EC are supported on the Cisco 7301 router, the Cisco 7201 router, and the Cisco 7204VXR and Cisco 7206 VXR routers with the NPE-400, NPE-G1, and NPE-G2.

Additionally, the PA-T3/E3-EC and PA-2T/E3-EC are supported on the Port Adapter Jacket Card in the Cisco 7204 VXR and Cisco 7206 VXR routers.

For configuration guidelines on port adapters in the Cisco 7200 VXR routers, 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 Cisco IOS requirements for individual hardware modules or components.

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

To access Software Advisor, click **Login** at Cisco.com and go to **Support > Tools and Resources > Software Advisor**. You can also access the tool by pointing your browser directly to http://www.cisco.com/en/US/support/tsd_most_requested_tools.html.

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

75-Ohm In-Line Coaxial Attenuator

A 75-ohm in-line coaxial attenuator may be required to tune the signal between the PA-T3/E3-EC and the far-end equipment if the port adapter is experiencing line code violations (LCVs). LCVs occur when the far-end equipment transmit signal saturates the front-end receiver of the PA-T3/E3-EC.

Cisco offers an attenuator kit (ATTEN-KIT-PA=) that contains five attenuators with fixed values ranging from 3 dB to 20 dB. For more information on the attenuator kit, see the *Installing the 75-Ohm In-line Coaxial Attenuator on Cisco Port Adapters* at http://www.cisco.com/en/US/docs/interfaces_modules/port_adapters/install_upgrade/cables_and_attenuator/75ohm_coax_atten_install/12884att.html

Safety Guidelines

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

Safety Warnings

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

Warning **IMPORTANT SAFETY INSTRUCTIONS**

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

SAVE THESE INSTRUCTIONS

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

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

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

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

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

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

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

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

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

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

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

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

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

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

GUARDE ESTAS INSTRUÇÕES

¡Advertencia! **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

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

GUARDE ESTAS INSTRUCCIONES

Varning! **VIKTIGA SÄKERHETSANVISNINGAR**

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

SPARA DESSA ANVISNINGAR

FONTOS BIZTONSÁGI ELOÍRÁSOK

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

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

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

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告 重要的安全性说明

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

请保存这些安全性说明

警告 安全上の重要な注意事項

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

これらの注意事項を保管しておいてください。

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

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

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

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. 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 A Compliance

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

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

- Turn the television or radio antenna until the interference stops.
- Move the equipment to one side or the other of the television or radio.
- Move the equipment farther away from the television or radio.
- Plug the equipment into an outlet that is on a different circuit from the television or radio. (That is, make certain the equipment and the television or radio are on circuits controlled by different circuit breakers or fuses.)

Note The Cisco PA-T3/E3-EC port adapter has been designed to meet these requirements. Modifications to this product that are not authorized by Cisco Systems, Inc. could void the various approvals and negate your authority to operate the product.

CHAPTER 3

Removing and Installing Port Adapters

This chapter describes how to remove the Cisco PA-T3/E3-EC port adapters from the supported platform 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 port adapter blank panel 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 port adapter blank panel.

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

1	Printed circuit board	**2**	Metal carrier

Online Insertion and Removal

The Cisco 7200 VXR and Cisco 7301 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-T3/E3-EC in Cisco 7200 VXR routers or the Cisco 7301 router.

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.

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 After removing a PA-T3/E3-EC, wait 3 minutes before reinstalling or reinserting a PA-T3/E3-EC.

Note Online insertion and removal (OIR) is not supported on the Port Adapter Jacket Card. OIR is supported on the port adapter. You must have the chassis powered off to install or remove the Port Adapter Jacket Card.

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

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

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

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

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

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

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

Warnings and Cautions

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

Note If a port adapter locking 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 locking lever or other mechanism to the locked position.

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

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

Port Adapter Removal and Installation

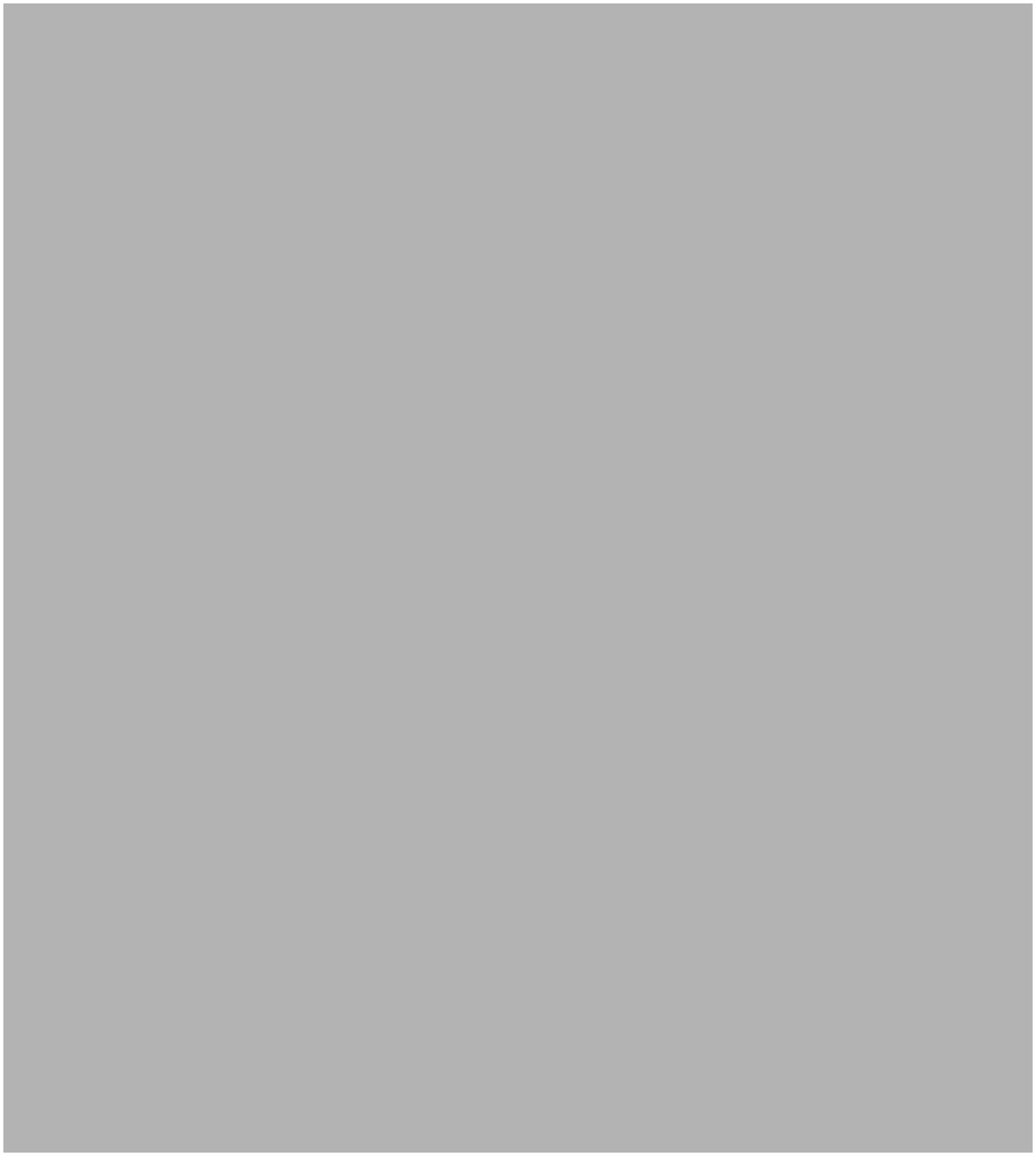
In this section, the illustrations that follow give step-by-step instructions on how to remove and install port adapters. This section contains the following illustrations:

Warning **Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034

Note After removing a PA-T3/E3-EC, wait 3 minutes before reinstalling or reinserting a PA-T3/E3-EC.

Cisco 7200 VXR Routers—Removing and Installing a Port Adapter

Figure 3-2 Installing a Port Adapter in a Cisco 7200 VXR Router



Cisco 7201 Router—Removing and Installing a Port Adapter

Cisco 7301 Router—Removing and Installing a Port Adapter

Figure 3-3 Installing a Port Adapter in a Cisco 7301 Router

Cables and Connectors

The interface connectors on the PA-T3/E3-EC are coaxial BNC types, with one connector for transmit (TX) and one for receive (RX). The BNC connectors are transformer-coupled to the PA-T3/E3-EC line interface unit (LIU), which is the analog physical interface on the PA-T3/E3-EC.

The pinout and signal descriptions for the BNC connectors on the PA-T3/E3-EC are as follows:

- Transmit (TX)—Transmitted signals appear on the center contact, and the outer shield is grounded for the 75-ohm 734A coaxial cable you attach to the TX BNC connector.
- Receive (RX)—Received signals appear on the center contact, and the outer shield is grounded for the 75-ohm 734A coaxial cable you attach to the RX BNC connector.

Caution To prevent problems when long cable lengths are required, you *must* ensure that your 75-ohm coaxial cables meet or exceed 734A specifications.

Figure 3-4 shows the typical 75-ohm 734A coaxial cable pair recommended for use with the PA-T3/E3-EC. Use one 75-ohm coaxial cable for each PA-T3/E3-EC connection: RX and TX.

Note Cisco Systems does not supply cables with the PA-T3/E3-EC. You must supply your own cables.

Figure 3-4 75-Ohm 734A Coaxial Cable Pair

1	TX	**4**	To DS3 equipment
2	RX	**5**	TX (out)
3	To PA-T3/E3-EC	**6**	RX (in)

Connecting Cables

This section describes the procedure for attaching 75-ohm 734A coaxial cables between the PA-T3/E3-EC port adapter and your external DS3 equipment. To continue your PA-T3/E3-EC port adapter installation, you must install the port adapter cables. The instructions that follow apply to all supported platforms. On a PA-T3/E3-EC you use only one coaxial cable, and on a PA-2T3/E3-EC you can use one or two

Connect the 75-ohm coaxial cables to the PA-T3/E3-EC port adapter as follows:

Step 1 Attach the 75-ohm coaxial cables directly to the BNC ports on the PA-T3/E3-EC. Attach one end of a cable to the port labeled TX and one end of a second cable to the port labeled RX. (See Figure 3-5 on page 3-9.)

Figure 3-5 Attaching 75-Ohm, 734A Coaxial Cables to a PA-2T3/E3-EC Port Adapter

1	To RX port on external T3 equipment	**3**	BNC cables
2	To TX port on external T3 equipment		

Step 2 Attach the network ends of your two 75-ohm coaxial cables to your external T3 equipment as follows:

- Attach the coaxial cable from the PA-T3/E3-EC TX port to the RX port on your external T3 equipment.
- Attach the coaxial cable from the PA-T3/E3-EC RX port to the TX port on your external T3 equipment.

Step 3 Pass the cables through the router cable-management bracket.

This completes the procedure for 75-ohm coaxial cable attachment on PA-T3/E3-EC port adapters.

CHAPTER 4

Configuring the T3 Mode

To continue your Cisco PA-T3/E3-EC port adapter installation, you must configure the PA-T3/E3-EC interface. The instructions that follow apply to all supported platforms. Minor differences between the platforms—with Cisco IOS software commands—are noted.

This chapter contains the following sections:

Upgrading the Field-Programmable Device Before Configuring the T3 Mode

Before you can configure the T3 mode, you must upgrade the field-programmable device (FPD), if an upgrade is required. An FPD upgrade requirement message appears when the hardware is installed and it is recognized. The FPD upgrade is first available in Cisco IOS Release 12.4(15)T and is available in future releases of Cisco IOS Release 12.4T.

You can perform the upgrade automatically or manually. The automatic upgrade method is preferred.

See the *Field-Programmable Device Upgrades* document for complete information at http://www.cisco.com/en/US/docs/routers/7200/configuration/feature_guides/fpd.html

Use the following FPD packages for your product:

- c7200p-fpd-pkg for NPE-G2
- c7301-fpd-pkg for Cisco 7301
- c7200-fpd-pkg for NPE-G1 and NPE-400

To upgrade the FPD automatically, follow these instructions:

Step 1 At the command prompt, enter the following command:

```
Router(config)# upgrade fpd auto
```

The following is example text of what is displayed:

```
Router(config)# upgrade fpd path ?
bootflash: Locate FPD image package from bootflash:
disk2: Locate FPD image package from disk2:
ftp: Locate FPD image package from ftp:
http: Locate FPD image package from http:
https: Locate FPD image package from https:
pram: Locate FPD image package from pram:
rcp: Locate FPD image package from rcp:
scp: Locate FPD image package from scp:
tftp: Locate FPD image package from tftp:
Router(config)# upgrade fpd path tftp://0.0.0.0/biff
```

Step 2 Reload the router or do a OIR of the port adapter with the FPD upgrade image at the /tftpboot/xxxxx location, or place it in some other location such as mentioned in the example.

To manually upgrade the FPD, use the following CLI:

```
Router# upgrade hw-module slot slotno fpd file tftp://0.0.0.0/biff/[c7200p-fpd-pkg |
c7301-fpd-pkg |  c7200-fpd-pkg]
```

See the *Field-Programmable Device Upgrades* document for complete information at http://www.cisco.com/en/US/docs/routers/7200/configuration/feature_guides/fpd.html

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#
```

Replacing an Existing Port Adapter

Before you remove or replace a port adapter, use the **shutdown** command to disable the port adapter to prevent anomalies when you remove and reinstall the 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 4-2 for instructions.)

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

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

Step 3 Shut down the T3 controller on the PA-T3/E3-EC with the **shutdown** command.

This command sends a DS3 idle signal toward the network. You can bring the T3 controller back up with the **no shutdown** controller command.

The example that follows is for a port adapter in slot 1 of a Cisco 7200 VXR router:

```
Router(config)# interface serial 1/0
Router(config-controller)# shutdown

Router(config)# interface serial 1/1
Router(config-controller)# shutdown
```

Note Both T3 ports of the PA-T3/E3-EC should be shut down before removing the port adapter.

Step 4 Verify that the two T3 ports are now shut down using the **show controller T3** command.

The following example is for a PA-T3/E3-EC in port adapter slot 6 of a Cisco 7200 VXR router:

```
Router(config-controller)# end
Router# interface serial 6/0
T3 6/0 is administratively down.

Router# interface serial 6/1
6/1 is administratively down.
```

Step 5 Save the shutdown configuration to nonvolatile memory.

```
Router# copy running-config startup-config
```

Step 6 Replace the port adapter in the slot. See the "Removing and Installing Port Adapters" section on page 3-1 for more information.

Step 7 Re-enable the port adapter by doing the following:

a. Repeat Step 3 to re-enable an interface, but substitute the **no shutdown** command for the **shutdown** command.

b. Repeat Step 4 to verify that the interfaces are in the correct state and no longer shut down. Use the **show controller T3** command.

c. Repeat Step 5 to write the new configuration to memory. Use the **copy running-config startup-config** command.

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

Configuring the Card Type

Use the **card type** command to configure or change the card type to T3 or E3 when the card is first inserted into the router. You must use this command before you can proceed with any other configuration tasks.

To enable the card type, issue the command **card type** {**t3** | **e3**} *slot*

Note If you change the card type, you must reboot the router for the configuration to take effect.

Configuring an Unchannelized T3 Link

If you installed a new PA-T3/E3-EC or if you want to change the configuration of an existing PA-T3/E3-EC link, you must enter the privileged level of the EXEC command interpreter and then use the **configure** command. If you replace a PA-T3/E3-EC that was previously configured, the system recognizes the new PA-T3/E3-EC link and brings it up in its existing configuration.

After you verify that the new PA-T3/E3-EC is installed correctly (the ENABLED LED goes on), use the privileged-level **configure** command to configure the new interface. Be prepared with the information you need, such as the following:

- Protocols you plan to route on each new interface
- IP addresses, if you plan to configure the interfaces for IP routing

The **configure** command requires privileged-level access to the EXEC command interpreter, which usually requires a password. Contact your system administrator if necessary to obtain EXEC-level access.

Setting the Framing Type for the Serial Interface

In interface configuration mode, specify T3 framing by entering the **framing** {**c-bit** | **m13**} configuration command where:

- **c-bit** is —c-bit parity DS3 framing.
- **m13 is** —M13 Multiplex DS3 framing.

Use the **no** form of this command to return to the default, c-bit framing.

Specifying the Cable Length for the Serial Interface

At the prompt, specify the cable length using the **cablelength** *feet* interface command**,** where:

- *feet* is a numeral from 0 to 450.

- The default value is 10 feet.

An example follows:

```
Router(config-if)# cablelength 40
```

Note For the **cablelength** *feet* command, user-specified T3 cable lengths are structured into ranges: 0–49 and 50–450 to represent short and long cables.

If the numerical value entered by the user falls within the lower range, then the PA-T3/E3-EC T3 port is set for short cable output levels. If the value falls into higher range, the long cable output levels will be used.

In the preceding example, a cable length of 40 is specified, which means that the 0–49 range is used. If you change the cable length to 45, then the 0–49 range still applies. Further, if you specify a cable length of 100 or 200, the 50–450 range applies in both cases. Only moving from one range (0–49) to the other range (50–450) has an effect. The actual cable-length number you enter is stored in the configuration file. It is recommended that the actual cable length be entered to ensure future compatibility.

Setting the Clock Source for the Serial Interface

At the prompt, set the internal or line clock source for the selected T3 controller with the **clock source** {**line** | **internal**} interface command, where:

- **line** selects a network clock source.
- **internal** selects an internal clock source.

The default is clock source internal.

Examples follow:

- Instruct the PA-T3/E3-EC to use a line clock source.

  The example that follows is for a port adapter in slot 1 of a Cisco 7200 VXR router:

  ```
  Router(config)# interface serial 1/0
  Router(config-if)# clock source line
  ```

- Instruct the PA-T3/E3-EC to use an internal clock source.

  The example that follows is for a port adapter in slot 1 of a Cisco 7200 VXR router:

  ```
  Router(config)# interface serial 1/0
  Router(config-if)# clock source internal
  ```

Configuring MDL Messages for the Serial Interface

You can configure maintenance data link (MDL) messages (which are defined in the ANSI T1.107a-1990 specification) on the PA-T3/E3-EC.

Note MDL messages are only supported when the T3 framing is set for c-bit parity. (See the "Setting the Framing Type for the Serial Interface" section on page 4-4.)

To configure MDL messages, use the **mdl** {**transmit** {**path** | **idle-signal** | **test-signal**} | **string** {**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **generator**} *string*} interface commands, where :

- **eic** is the equipment identification code (up to 10 characters).

- **lic** is the location identification code (up to 11 characters).
- **fic** is the frame identification code (up to 10 characters).
- **unit** is the unit identification code (up to 6 characters).
- **pfi** is the facility identification code to send in the MDL path message (up to 38 characters).
- **port** is the equipment port, which initiates the idle signal, to send in the MDL idle signal message (up to 38 characters).
- **generator** is the generator number to send in the MDL test signal message (up to 38 characters).

Use the **no** form of this command to remove MDL messages. The default is that no MDL message is configured.

Examples of MDL Message Configuration

Examples of configuring MDL messages follow:

- Enter interface configuration mode first.

  The example that follows is for a port adapter in slot 1 ofa Cisco 7200 VXR router:

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

- Enable the MDL path message transmission as follows:

```
Router(config-controller)# mdl transmit path
```

- Enable the MDL idle signal message transmission as follows:

```
Router(config-if)# mdl transmit idle-signal
```

- Enable the MDL test signal message transmission as follows:

```
Router(config-if)# mdl transmit test-signal
```

- Enter the equipment identification code as follows:

```
Router(config-if)# mdl string eic router A
```

- Enter the location identification code as follows:

```
Router(config-if)# mdl string lic tst network
```

- Enter the frame identification code as follows:

```
Router(config-if)# mdl string fic building b
```

- Enter the unit identification code as follows:

```
Router(config-if)# mdl string unit abc
```

- Enter the facility identification code to send in the MDL path message as follows:

```
Router(config-if)# mdl string pfi string
```

- Enter the port number to send in the MDL idle signal message as follows:

```
Router(config-if)# mdl string port string
```

- Enter the generator number to send in the MDL test signal message as follows:

```
Router(config-if)# mdl string generator string
```

Setting the DSU Mode for the Serial Interface

In interface configuration mode, define the digital service unit (DSU) interoperability mode by entering the **dsu mode [0 | 1 | 2 | 3 | 4]** configuration command, as in the following example:

```
Router(config-if)# dsu mode 1
```

Use the **no** form of this command to return to the default, 0.

The local DSU mode must match the remote DSU or T3 port configuration. For example, if an ADC Kentrox DSU is at the remote end of the T3 link, then the local T3 port must be configured for mode 1.

You need to know what type of DSU is at the remote T3 end to find out if it interoperates with the PA-T3/E3-EC. Specify mode 0 for connection from a PA-T3/E3-EC to another PA-T3/E3-EC or a Digital Link DSU (DL3100). Specify mode 1 for connection from a PA-T3/E3-EC to a Kentrox DSU. Specify mode 2 for connection from a PA-T3/E3-EC to a Larscom DSU. See Table 4-1 for a list of DSUs and their corresponding bandwidth ranges.

Also see the Table 1-2 on page 1-3 for information regarding DSU feature compatibilities.

Table 4-1 DSU Mode Bandwidth Ranges

Mode	DSU	Bandwidth Range
0	PA-T3/E3-EC, PA-2T3/E3-EC Other Cisco subrate T3 equipment	22–44210 kbps
0	Digital Link 3100	300–44210 kbps
1	ADC Kentrox T3/E3 IDSU	1500–35000, 44210 kbps
2	Larscom Access T45	3100–44210 kbps
3	Adtran T3SU 300	75–44210 kbps
4	Verilink HDM 2182	1500–44210 kbps

Note If the far-end DSU has more than one DTE (HSSI) port, connect to and configure only DTE#1. See Caution below for Verilink DSUs.

Caution Always connect to and configure HSSI port B on the Verilink HDM 2182. Port A is not supported by the PA-T3/E3-EC.

Caution The PA-T3/E3-EC does not support the Kentrox DSU bandwidth setting of 1.0 mbps. The Kentrox DSU speed must be set to 1.5 mbps or greater.

Caution For all DSU modes, the DSU must be configured for the same transmit and receive speeds. Asymmetrical transmit and receive speeds are not supported.

Setting the Bandwidth for the Serial Interface

In interface configuration mode, set the bandwidth to be used by the serial interface on the T3 link by entering the **dsu bandwidth** *bandwidth* configuration command, as in the following example:

```
Router(config-if)# dsu bandwidth 16000
```

The allowable bandwidth range is 1 to 44210 kbps. Use the **no** form of this command to return to the default, 44210.

The local DSU bandwidth value must match the remote DSU or T3 port bandwidth exactly. For example, if you set the DSU bandwidth to 16000 on the local port, you must do the same on the remote DSU or T3 port.

Setting Scrambling for the Serial Interface

In interface configuration mode, enable serial interface scrambling by entering the **scramble** configuration command, as in the following example:

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

Use the **no** form of this command to restore the default value, disabled.

The local port configuration must match the remote DSU or T3 port configuration. For example, if you enable scrambling on the local port, you must do the same on the remote DSU or T3 port.

Configuring Loopback Mode for the Serial Interface

With loopbacks, you can detect and isolate equipment malfunctions by testing the connection between the PA-T3/E3-EC interface and a remote device such as a CSU/DSU. Remote loopback sends a command to loop the T3 line at the far end. It can be used to diagnose problems with cables from the port adapter to the switching office. Network loopback loops the PA-T3/E3-EC T3 port back to the network, allowing the remote end to test the connection to the PA-T3/E3-EC.

Local loopback loops the PA-T3/E3-EC T3 port back to itself, allowing it to be tested in isolation from the T3 cables and remote T3 equipment.

The **loopback** command places an interface in loopback mode, which enables test packets that are generated from the **ping** command to loop through a remote device and cables. If the packets complete the loop, the connection is good.

The default is no loopback.

To return the serial interface to its default unlooped condition, use the **no** form of the command.

Table 4-2 provides examples of the **loopback** {**local** | **network** {**line** | **payload**} | **remote** {**line** | **payload**} command. You can configure the serial interface for loopback modes using the **loopback** [**local** | **network** | **remote**] interface command.

Table 4-2 Using loopback Commands

loopback local	Sets the interface into local loopback mode. Local loopback loops the router output data back toward the router at the framer.	`Router(config)# interface serial 10/0/0` `Router(config-if)# loopback local`
loopback network line	Sets the interface into network line loopback mode. Network line loopback loops the data back toward the network (before the framer).	`Router(config)# interface serial 10/0/0` `Router(config-if)# loopback network line`
loopback network payload	Sets the interface into network payload loopback mode. Network payload loopback loops just the payload data back toward the network at the T3 framer.	`Router(config)# interface serial 10/0/0` `Router(config-if)# loopback network payload`
loopback remote[1]	Sends a command to the remote T3 device instructing it to loop itself back toward the network (before the framer at the remote T3 device).	`Router(config)# interface serial 10/0/0` `Router(config-if)# loopback remote`
loopback remote line[2]	Sends a command to the remote Kentrox DSU to loop itself back toward the network before the framer.	`Router(config)# interface serial 10/0/0` `Router(config-if)# loopback remote line`
loopback remote payload[2]	Sends a command to the remote Kentrox DSU to loop only the payload after the framer back toward the network.	`Router(config)# interface serial 10/0/0` `Router(config-if)# loopback remote payload`

1. Remote loopback mode works with c-bit framing only. The other loopback modes listed above work with c-bit and M13 framing. Refer to the "Setting the Framing Type for the Serial Interface" section on page 4-4 for information on configuring c-bit framing.
2. These loopback commands are only available when the DSU mode is set to 1, Kentrox mode.

Shutting Down the Serial interface

You can shut down the serial interface on the PA-T3/E3-EC with the **shutdown** controller command.

This command sends a DS3 idle signal toward the network. You can bring the serial interface back up with the **no shutdown** command.

The example that follows is for a port adapter in slot 1 of a Cisco 7200 VXR router:

```
Router(config)# interface serial 1/0
Router(config-controller)# shutdown
```

Configuring a BER Test on the Serial Interface

Bit error rate test (BERT) circuitry is built into the PA-T3/E3-EC. With BER tests, you can test cable and signal problems in the field.

There are two categories of test patterns that can be generated by the onboard BER test circuitry: pseudorandom and repetitive. The former test patterns are polynomial-based numbers and conform to the CCITT/ITU O.151 and O.153 specifications; the latter test patterns are zeros or ones, or alternating zeros and ones.

A list of the available test patterns follows:

- Pseudorandom test patterns:
  - 2^15 (per CCITT/ITU O.151)
  - 2^20 (per CCITT/ITU O.151 non-QRSS)
  - 2^23 (per CCITT/ITU O.151)
- Repetitive test patterns:
  - All zeros (0s)
  - All ones (1s)
  - Alternating zeros (0s) and ones (1s)

Both the total number of error bits received and the total number of bits received are available for analysis. You can set the testing period from 1 minute to 14,400 minutes (240 hours), and you can also retrieve the error statistics anytime during the BER test.

When running a BER test, your system expects to receive the same pattern that it is transmitting. To accomplish this, two common options are available:

- Use a loopback somewhere in the link or network.
- Configure remote testing equipment to transmit the same BER test pattern at the same time.

Sending a BER Test Pattern on the T3 Line

You can send a BERT pattern on the T3 line with the **bert pattern** *pattern* **interval** *time* command in controller configuration mode, where:

- *pattern* is one of the following:
  - 0s, repetitive test pattern of all zeros (as 00000...)
  - 1s, repetitive test pattern of all ones (as 11111...)
  - 2^15, pseudorandom O.151 test pattern (32,768 bits long)
  - 2^20, pseudorandom O.151 non-QRSS test pattern (1,048,575 bits long)
  - 2^23, pseudorandom O.151 test pattern (8,388,607 bits long)
  - alt-0-1, repetitive alternating test pattern of zeros (0s) and ones (1s) (as 01010101)
- *time* is 1 to 14400 minutes.

Examples follow:

- Send a BERT pseudorandom pattern of 2^23 for 5 minutes.

  The example that follows is for a port adapter in slot 1 of a Cisco 7200 VXR router:

```
Router(config)# interface serial 1/0
Router(config-controller)# bert pattern 2^23 interval 5
```

- Send a repetitive pattern of all ones for 14400 minutes (240 hours).

  The example that follows is for a port adapter in slot 1 of a Cisco 7200 VXR router:

```
Router(config)# interface esrial 1/0
Router(config-controller)# bert pattern 1s interval 14400
```

Note You can terminate a BER test during the specified test period with the **no bert** command.

Viewing the Results of a BER Test

You can view the results of a BER test using the **show controllers T3** *slot/t3-port* controller command.

You can view the results of a BER test at the following times:

- After you terminate the test using the **no bert** command
- After the test runs completely
- Anytime during the test (in real time)

The example that follows is for a port adapter in slot 5 of a Cisco 7200 VXR router:

```
Router# show controllers serial 6/0

G2-CC#sh controllers ser 6/0
Framing is c-bit, Clock Source is Line
Bandwidth limit is 44210, DSU mode 0, Cable length is 0
rx FEBE since last clear counter 0, since reset 0
Data in current interval (167 seconds elapsed):
4 Line Code Violations, 4 P-bit Coding Violation
2 C-bit Coding Violation
2 P-bit Err Secs, 0 P-bit Sev Err Secs
2 Sev Err Framing Secs, 2 Unavailable Secs
2 Line Errored Secs, 1 C-bit Errored Secs, 0 C-bit Sev Err Secs
Receiver has no alarms.
```

```
Configured not to accept remote request to reset subrate
BERT test result (running)
Test Pattern : All 1's, Status : Sync, Sync Detected : 1
Interval : 1 minute(s), Time Remain : 1 minute(s)
Bit Errors (since BERT started): 0 bits,
Bits Received (since BERT started): 264 Mbits
Bit Errors (since last sync): 0 bits
Bits Received (since last sync): 264 Mbits
```

The following table explains the output of the preceding command, line by line:

Output Display Line	Explanation
`BERT test result (running)`	This line indicates the current state of the test. In this case, "running" indicates that the BER test is still in process. After a test is completed, "done" is displayed.
`Test Pattern : 2^15, Status : Sync, Sync Detected : 1`	This line indicates the test pattern you selected for the test (2^15), the current synchronization state (sync), and the number of times synchronization has been detected during this test (1).
`Interval : 5 minute(s), Time Remain : 5 minute(s)`	This line indicates the time the test takes to run and the time remaining for the test to run.
`Interval : 5 minute(s), Time Remain : 2 minute(s) (unable to complete)`	For a BER test that you terminate, this line indicates the time the test would have taken to run and the time remaining for the test to run had you not terminated it; "unable to complete" signifies that you interrupted the test.

`Bit Errors(since BERT started): 6 bits,`
`Bits Received(since BERT started): 8113 Kbits`
`Bit Errors(since last sync): 6 bits`
`Bits Received(since last sync): 8113 Kbits`
	These four lines show the bit errors that have been detected versus the total number of test bits that have been received since the test started and since the last synchronization was detected. Bits and errors are only counted when the test status is "sync".

Terminating a BER Test

You can terminate a BER test with the **no bert** controller command.

The following example terminates the BER test running on T3 line 0.

The example that follows is for a port adapter in slot 1 of a Cisco 7200 VXR router:

```
Router(config)# interface serial 1/0
Router(config-controller)# no bert
```

To check your configurations using **show** commands, proceed to the "Checking the Configuration" section on page 4-14; otherwise, proceed to the "Performing a Basic Serial Interface Configuration" section on page 4-13.

Performing a Basic Serial Interface Configuration

Following are instructions for a basic configuration: enabling an interface and specifying IP routing. You might also need to enter other configuration commands, depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration commands 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 commands, as follows:

```
Router# configuration 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** command, followed by the interface address of the interface you plan to configure. See the "Port Adapter Slot Locations on the Supported Platforms" section on page 1-5 and the "Identifying Interface Addresses" section on page 1-7.

This example is for the serial interface of T3 port 0 in port adapter slot 6 of a 7200 router.

```
Router(config)# interface serial 6/0
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** command, as in the following example:

```
Router(config-if)# ip address 10.0.0.0 10.255.255.255
```

Step 4 Add any additional configuration commands required to enable routing protocols and set the interface characteristics.

Step 5 Re enable the interfaces using the **no shutdown** command. (See the "Replacing an Existing Port Adapter" section on page 4-3.)

Step 6 Configure all additional port adapter interfaces as required.

Step 7 After including all of the configuration commands 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 8 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.

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 4-3 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the PA-T3/E3-EC 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 iv.

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

Table 4-3 Using show Commands

Command	Function	Example
show version or **show hardware**	Displays system hardware configuration, the number of each interface type installed, Cisco IOS software version, names and sources of configuration files, and boot images	`Router# show version`
show 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`
For Cisco 7200 VXR routers: **show interfaces serial** *port-adapter/t3-port*	Displays status information about a specific type of interface	`Router# show interfaces serial 3/1/`
For Cisco 7201 and Cisco 7301 routers: **show interfaces serial** *port-adapter/t3-port*	Displays status information about a specific type of interface	`Router# show interfaces serial 3/1`

Table 4-3 Using show Commands (continued)

Command	Function	Example
show protocols	Displays protocols configured for the entire system and for specific interfaces	`Router# show protocols`
show running-config	Displays the running configuration file	`Router# show running-config`
show startup-config	Displays the configuration stored in NVRAM	`Router# show startup-config`

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

- Using the show version or show hardware Commands, page 4-15
- Using the show diag Command, page 4-17
- Using the show interfaces Command, page 4-17
- Using the show controllers Command, page 4-19

Choose the subsection appropriate for your system. Proceed to the "Using the ping Command to Verify Network Connectivity" section on page 4-20 when you have finished using the **show** commands.

Using the show version or show hardware Commands

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

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

Following is an example of the **show version** command from a Cisco 7200 VXR router with the PA-T3/E3-EC:

```
Router# show version
Cisco IOS Software, 7200 Software (C7200P-JS-M), Experimental Version 12.4(xxx)
[biff-cf-CSCsf09954 102]
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Thu 24-Aug-06 22:55 by biff
ROM: System Bootstrap, Version 12.4(4r)XD3, RELEASE SOFTWARE (fc1)
G2_feature1 uptime is 2 days, 22 hours, 14 minutes
System returned to ROM by power-on
System restarted at 23:04:08 UTC Sun May 21 2000
System image file is "disk2:c7200p-js-mz.DTHO20060825"
Cisco 7206VXR (NPE-G2) processor (revision B) with 917504K/65536K bytes of memory.
Processor board ID 777888888
MPC7448 CPU at 1666Mhz, Implementation 0, Rev 2.1
6 slot VXR midplane, Version 2.9
Last reset from power-on
PCI bus mb1 (Slots 1, 3 and 5) has a capacity of 600 bandwidth points.
```

```
Current configuration on bus mb1 has a total of 450 bandwidth points.
This configuration is within the PCI bus capacity and is supported.
PCI bus mb2 (Slots 2, 4 and 6) has a capacity of 600 bandwidth points.
Current configuration on bus mb2 has a total of 180 bandwidth points.
This configuration is within the PCI bus capacity and is supported.
Please refer to the following document "Cisco 7200 Series Port Adaptor
Hardware Configuration Guidelines" on Cisco.com <http://www.cisco.com>
for c7200 bandwidth points oversubscription and usage guidelines.
1 FastEthernet interface
3 Gigabit Ethernet interfaces
3 Serial interfaces
4 Channelized T3 ports
2 Subrate T3/E3 ports
2045K bytes of NVRAM.
250368K bytes of ATA PCMCIA card at slot 2 (Sector size 512 bytes).
65536K bytes of Flash internal SIMM (Sector size 512K).
Configuration register is 0x100 (will be 0x0 at next reload)
G2_feature1#
```

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

```
Router# show version
Cisco IOS Software, 7200 Software (C7200P-ADVENTERPRISEK9-M), Version
12.4(biffDEV.061001), INTERIM SOFTWARE Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Sun 01-Oct-06 23:42 by biff
ROM: System Bootstrap, Version 12.4(4r)XD5, RELEASE SOFTWARE (fc1)
BOOTLDR: Cisco IOS Software, 7200 Software (C7200P-KBOOT-M), Version 12.4(TAZ3DEV.060927),
INTERIM SOFTWARE
c7201alpha1 uptime is 5 days, 18 hours, 32 minutes System returned to ROM by power-on
System image file is "disk0:c7200p-adventerprisek9-mz.2006-10-01.biffdev"
This product contains cryptographic features and is subject to United States and local
country laws governing import, export, transfer and use. Delivery of Cisco cryptographic
products does not imply third-party authority to import, export, distribute or use
encryption.
Importers, exporters, distributors and users are responsible for compliance with U.S. and
local country laws. By using this product you agree to comply with applicable laws and
regulations. If you are unable to comply with U.S. and local laws, return this product
immediately.
A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
If you require further assistance please contact us by sending email to export@cisco.com.
Cisco 7201 (c7201) processor (revision A) with 917504K/65536K bytes of memory.
Processor board ID 2222222222222
MPC7448 CPU at 1666Mhz, Implementation 0, Rev 2.2
1 slot midplane, Version 2.255
Last reset from power-on
1 FastEthernet interface
4 Gigabit Ethernet interfaces
2045K bytes of NVRAM.
62443K bytes of USB Flash usbflash0 (Read/Write)
250880K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
65536K bytes of Flash internal SIMM (Sector size 512K).
Configuration register is 0x2
```

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 VXR router.

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.

Following is an example of the **show diag** slot command that shows a PA-2T3/E3-EC port adapter in slot 2 of a Cisco 7200 VXR router:

```
Router#sh diag 2
Slot 2:
        Enhanced 2 port clear channel Port adapter, 2 ports
        Port adapter is analyzed
        Port adapter insertion time 22:01:44 ago
        EEPROM contents at hardware discovery:
        PCB Serial Number         : JAE1223K71S
        Hardware Revision         : 1.2
        Part Number               : 73-10788-01
        Board Revision            : B0
        RMA Test History          : 00
        RMA Number                : 0-0-0-0
        RMA History               : 00
        Deviation Number          : 0
        Product (FRU) Number      : PA-2T3/E3-EC
        Version Identifier        : V01
        Top Assy. Part Number     : 68-2769-01
        CLEI Code                 : COUIAKYCAA
        EEPROM format version 4
        EEPROM contents (hex):
          0x00: 04 FF C1 8B 4A 41 45 31 32 32 33 4B 37 31 53 40
          0x10: 05 46 41 01 02 82 49 2A 24 01 42 42 30 03 00 81
          0x20: 00 00 00 00 04 00 88 00 00 00 00 CB 94 50 41 2D
          0x30: 32 54 33 2F 45 33 2D 45 43 20 20 20 20 20 20 20
          0x40: 20 89 56 30 31 20 D9 03 C1 40 CB 87 44 0A D1 01
          0x50: C6 8A 43 4F 55 49 41 4B 59 43 41 41 FF FF FF FF
          0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

Using the show interfaces Command

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

For complete descriptions of interface commands and the configuration options available for Cisco 7200 VXR routers, refer to the publications listed in the "Related Documentation" section on page iv.

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.

Following is an example of the **show interfaces serial** command that shows a PA-T3/E3-EC in port adapter slot 4 of a Cisco 7200 VXR router:

```
Router# show interfaces serial 5/0

Serial5/0 is up, line protocol is up
```

```
Hardware is PA-MC-2T3-EC
MTU 4470 bytes, BW 44210 Kbit/sec, DLY 200 usec,
   reliability 255/255, txload 1/255, rxload 1/255
Encapsulation FRAME-RELAY, crc 16, loopback not set
Keepalive set (5 sec)
LMI enq sent  0, LMI stat recvd 0, LMI upd recvd 0
LMI enq recvd 177, LMI stat sent  177, LMI upd sent  0, DCE LMI up
LMI DLCI 1023  LMI type is CISCO  frame relay DCE
FR SVC disabled, LAPF state down
Broadcast queue 0/256, broadcasts sent/dropped 0/0, interface broadcasts 0
Last input 00:00:01, output never, output hang never
Last clearing of "show interface" counters 00:15:12
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
   177 packets input, 2301 bytes, 0 no buffer
   Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
            0 parity
   185 input errors, 12 CRC, 101 frame, 0 overrun, 0 ignored, 72 abort
   177 packets output, 2301 bytes, 0 underruns
   0 output errors, 0 applique, 1 interface resets
   0 unknown protocol drops
   0 output buffer failures, 0 output buffers swapped out
   1 carrier transitions no alarm present
DSU mode 0, bandwidth 44210 Kbit, scramble 0, VC 0
```

Using the show controllers Command

You can display information for the T3 controller within a PA-T3/E3-EC in Cisco 7200 VXR routers with the **show controllers t3** *port-adapter/t3-port* [**brief** | **tabular**] command, where:

- **brief** displays a list of configurations only.
- **tabular** displays a list of configurations and MIB data in a tabular format.

Note If you use the **show controllers T3** *port-adapter/t3port* command without either of the optional arguments (**brief** or **tabular**), all information is displayed for the T3 controller you specified; therefore, the resulting display output can be extensive.

If you use the **show controllers T3** command without specifying a port address (*port-adapter/t3port*), all information is displayed for all T3 port adapters in the router; therefore, the resulting display output can be extensive.

Following is an example of the **show controllers T3** command that shows a PA-T3/E3-EC in port adapter slot 4 of a Cisco 7200 VXR router:

```
Router# show controllers t3 5/0

T3 5/0 is up.
  Applique type is Subrate T3
  No alarms detected.
  MDL transmission is disabled

  FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Clock Source is Line
  Equipment customer loopback
  Configured not to accept remote request to reset subrate
  Data in current interval (48 seconds elapsed):
     145 Line Code Violations, 5 P-bit Coding Violation
     3 C-bit Coding Violation, 1 P-bit Err Secs
     0 P-bit Severely Err Secs, 1 Severely Err Framing Secs
     0 Unavailable Secs, 1 Line Errored Secs
     1 C-bit Errored Secs, 0 C-bit Severely Errored Secs
     1 Severely Errored Line Secs
     1 Far-End Errored Secs, 1 Far-End Severely Errored Secs
     0 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 0 Far-end path failures
     0 Far-end code violations, 0 FERF Defect Secs
     0 AIS Defect Secs, 0 LOS Defect Secs
  Data in Interval 1:
     157 Line Code Violations, 17 P-bit Coding Violation
     12 C-bit Coding Violation, 4 P-bit Err Secs
     0 P-bit Severely Err Secs, 4 Severely Err Framing Secs
     2 Unavailable Secs, 2 Line Errored Secs
     3 C-bit Errored Secs, 0 C-bit Severely Errored Secs
     1 Severely Errored Line Secs
     4 Far-End Errored Secs, 1 Far-End Severely Errored Secs
     11 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 1 Far-end path failures
     12 Far-end code violations, 11 FERF Defect Secs
     0 AIS Defect Secs, 0 LOS Defect Secs
  Total Data (last 1 15 minute intervals):
     157 Line Code Violations, 17 P-bit Coding Violation,
     12 C-bit Coding Violation, 4 P-bit Err Secs,
     0 P-bit Severely Err Secs, 4 Severely Err Framing Secs,
     2 Unavailable Secs, 2 Line Errored Secs,
     3 C-bit Errored Secs, 0 C-bit Severely Errored Secs
```

```
1 Severely Errored Line Secs
4 Far-End Errored Secs, 1 Far-End Severely Errored Secs
11 CP-bit Far-end Unavailable Secs
0 Near-end path failures, 1 Far-end path failures
12 Far-end code violations, 11 FERF Defect Secs
0 AIS Defect Secs, 0 LOS Defect Secs
```

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 iv 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 Troubleshoot Network Problems," to finish checking network connectivity.

Using loopback Commands to Troubleshoot Network Problems

If you have difficulty with the PA-T3/E3-EC configuration or installation, you can troubleshoot the port adapter using the **loopback** command. Refer to the "Configuring Loopback Mode for the Serial Interface" section on page 4-8 for instructions on setting loopbacks.

If the **ping** command to the remote IP address failed, then use loopbacks to troubleshoot the T3 connection using the following steps:

Step 1 Use the **show controller T3** and **show interfaces serial** commands to confirm that the T3 controller, serial interface, and line protocol are up.

Step 2 Place the serial interface of the PA-T3/E3-EC in local loopback using the **loopback local** command.

Step 3 Repeat the ping command using the IP address of the local serial interface. Using the previous example where the remote server's IP address was 10.0.0.10, if the local IP address is 10.0.0.5, then use the command:

```
ping 10.0.0.5
```

If the ping is successful, proceed to Step 4. A failure indicates a configuration problem or a hardware problem with the PA-T3/E3-EC.

Step 4 Remove the local loop with the **no loopback** command and place the remote server or DSU in network loopback with the **loopback remote** command.

Note The **loopback remote** command is only available when the framing is set to c-bit parity. If the framing is not set to c-bit parity, the remote server will have to be placed into network loopback by someone at the remote site.

Step 5 Repeat Step 3. If the ping is successful, then the PA-T3/E3-EC and the T3 link to the remote site is functioning correctly. The problem is probably in the remote DSU or server configuration or hardware. If the ping fails, then one of the following has a problem: the T3 link to the remote site, the remote server or DSU configuration, or the hardware .

CHAPTER 5

Configuring the E3 Mode

To continue your PA-T3/E3-EC port adapter installation, you must configure the serial interfaces. The instructions that follow apply to all supported platforms.

This chapter contains the following sections:

Upgrading the Field-Programmable Device Before Configuring the T3 Mode

Before you can configure the T3 mode, you must upgrade the field-programmable device (FPD), if an upgrade is required. An FPD upgrade requirement message appears when the hardware is installed and it is recognized. The FPD upgrade is first available in Cisco IOS Release 12.4(15)T and is available in future releases of Cisco IOS Release 12.4T.

You can perform the upgrade automatically or manually. The automatic upgrade method is preferred.

See the *Field-Programmable Device Upgrades* document for complete information at http://www.cisco.com/en/US/docs/routers/7200/configuration/feature_guides/fpd.html

Use the following FPD packages for your product:

- c7200p-fpd-pkg for NPE-G2
- c7301-fpd-pkg for Cisco 7301
- c7200-fpd-pkg for NPE-G1 and NPE-400

To upgrade the FPD automatically, follow these instructions:

Step 1 At the command prompt, enter the following command:

```
Router(config)# upgrade fpd auto
```

The following is example text of what is displayed:

```
Router(config)# upgrade fpd path ?
bootflash: Locate FPD image package from bootflash:
disk2: Locate FPD image package from disk2:
ftp: Locate FPD image package from ftp:
http: Locate FPD image package from http:
https: Locate FPD image package from https:
pram: Locate FPD image package from pram:
rcp: Locate FPD image package from rcp:
scp: Locate FPD image package from scp:
tftp: Locate FPD image package from tftp:
Router(config)# upgrade fpd path tftp://0.0.0.0/biff
```

Step 2 Reload the router or do a OIR of the port adapter with the FPD upgrade image at the /tftpboot/xxxxx location, or place it in some other location such as mentioned in the example.

To manually upgrade the FPD, use the following CLI:

```
Router# upgrade hw-module slot slotno fpd file tftp://0.0.0.0/biff/[c7200p-fpd-pkg |
c7301-fpd-pkg |  c7200-fpd-pkg]
```

See the *Field-Programmable Device Upgrades* document for complete information at http://www.cisco.com/en/US/docs/routers/7200/configuration/feature_guides/fpd.html

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 5-3.

Configuring the Card Type

Use the **card type** command to configure or change the card type to T3 or E3 when the card is first inserted into the router. You must use this command before you can proceed with any other configuration tasks.

To enable the card type, issue the command. **card type** {**t3** | **e3**}

Note If you change the card type, you must reboot the router for the configuration to take effect.

Configuring the Interfaces

After you verify that the new PA-T3/E3-EC 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-T3/E3-EC or if you want to change the configuration of an existing interface, you must enter configuration mode to configure the new interfaces. If you replace a PA-T3/E3-EC that was previously configured, the system recognizes the new interfaces and brings each of them up in their existing configurations.

For a summary of the configuration options available and instructions for configuring interfaces on a PA-T3/E3-EC, refer to the appropriate configuration publications listed in the "Related Documentation" section on page iv.

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 5-2 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 compact coaxial 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 interface processor. 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 5-2 for instructions.)

Step 2 At the privileged-level prompt, enter configuration mode and specify that the console terminal is the source of the configuration commands, 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** command (followed by the interface address of the interface), and then enter the **shutdown** command. Table 5-1 shows the command syntax.

Step 4 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 5-1 Syntax of the shutdown Command

Platform	Command	Example

Cisco 7200 VXR routers	**interface**, *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#`

Cisco 7201 router	**interface**, followed by the *type* (**serial**) and *slot/port* (port-adapter-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 and interface 1 on a port adapter in slot 1.
		`Router(config)# interface serial 1/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface serial 1/1`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Cisco 7301 router	**interface**, *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 slot 1.
		`Router(config)# interface serial 1/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface serial 1/1`
		`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 5 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 6 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 5-2 provides examples.

Table 5-2 Examples of the show interfaces Command

Platform	Command	Example

Cisco 7200 VXR routers	**show interfaces serial**, *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]`

Cisco 7201 router	**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 1.
		`Router# show interfaces serial 1/0`
		`Serial 1/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

Cisco 7301 router	**show interfaces serial**, *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1.
		`Router# show interfaces serial 1/0`
		`Serial 1/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

Step 7 Re-enable interfaces by doing the following:

a. Repeat Step 3 to re-enable an interface, but 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 iv.

Performing a Basic Configuration

Following are instructions for a basic configuration: enabling an interface, specifying IP routing, and setting up external timing on a DCE interface. You might also need to enter other configuration commands, depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration commands 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 commands, 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** command, 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 5-3 provides examples.

Table 5-3 Examples of the interface serial Command

Platform	Command	Example

Cisco 7200 VXR routers	**interface serial**, *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)#`

Cisco 7201 router	**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 1.
		`Router(config)# interface serial 1/0`
		`Router(config-if)#`

Cisco 7301 router	**interface serial**,*slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 1.
		`Router(config)# interface serial 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** command, as in the following example:

```
Router(config-if)# ip address 10.0.0.0 10.255.255.255
```

Step 4 Add any additional configuration commands required to enable routing protocols and set the interface characteristics.

Step 5 Re-enable the interfaces using the **no shutdown** command. (See the "Shutting Down an Interface" section on page 5-4.)

Step 6 Configure all additional port adapter interfaces as required.

Step 7 After including all of the configuration commands 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 8 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 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.

Table 5-4 summarizes cyclic redundancy check (CRC) commands.

Table 5-4 CRC Commands

Purpose	Command	Example

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

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

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, 32-bit CRC is specified:

```
Router(config-if)# crc 32
```

The preceding command example applies to all systems in which the PA-T3/E3-EC is supported. Use the **no crc 32** command to disable 3-bit CRC 2 and return the interface to the default 16-bit CRC (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 "Related Documentation" section on page iv.

Customizing the PA-T3/E3-EC

You can customize the PA-T3/E3-EC. The features you can customize have default values that will probably suit your environment and need not be changed. However, you might need to enter configuration commands, depending on the requirements for your system configuration and the protocols you plan to route on the interface.

Perform the tasks in the following sections if you need to customize the PA-T3/E3-EC.

Setting the Bandwidth

In interface configuration mode, reduce effective bandwidth (range of 22 to 34010 kilobits per second) by entering the **dsu bandwidth** configuration command, as in the following example:

```
Router(config-if)# dsu bandwidth 16000
```

Use the **no** form of this command to return to the default, 34010.

Note The local port configuration must match the remote port configuration. For example, if you reduce the effective bandwidth to 16000 on the local port, you must do the same on the remote port.

Defining the DSU Mode

In interface configuration mode, define the DSU interoperability mode by entering the **dsu mode** [**0** | **1**] configuration command, as in the following example:

```
Router(config-if)# dsu mode 1
```

Use the **no** form of this command to return to the default, 0.

The local port configuration must match the remote port configuration. For example, if you define the DSU interoperability mode as 1 on the local port, you must do the same on the remote port. You need to know what type of DSU is at the remote port to find out if it interoperates with the PA-T3/E3-EC. For E3 serial interfaces, specify mode 0 for connection from a PA-T3/E3-EC to another PA-T3/E3-EC or a Digital Link DSU (DL3100). Specify mode 1 for connection from a PA-T3/E3-EC to a Kentrox DSU.

Also refer to the Table 1-3 on page 1-4 section on for information regarding DSU feature compatibilities.

Defining Set Bit (National)

In interface configuration mode, define the set bit in G.751 frame (national bit) by entering the **national bit** [**0** | **1**] configuration command, as in the following example:

```
Router(config-if)# national bit 1
```

Use the **no** form of this command to return to the default, 0.

Enabling E3 Scrambling

In interface configuration mode, enable E3 scrambling by entering the **scramble** configuration command, as in the following example:

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

Use the **no** form of this command to restore the default value, disabled.

The local port configuration must match the remote port configuration. For example, if you enable scrambling on the local port, you must do the same on the remote port.

Specifying E3 Framing

In interface configuration mode, specify E3 framing by entering the **framing** {**g751** | **bypass**} configuration command, as in the following example:

```
Router(config-if)# framing g751
```

Use the **no** form of this command to return to the default, G.751 framing.

Note If you use the **bypass** option, scrambling must be set to the default, disabled; the DSU mode must be set to the default, 0; and the DSU bandwidth must be set to the default, 34010.

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, page 5-10
- Using the ping Command to Verify Network Connectivity, page 5-15
- Using loopback Commands, page 5-16

Using show Commands to Verify the New Interface Status

Table 5-5 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the PA-T3/E3-EC 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 iv.

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 5-5 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 VXR router and Cisco 7301 router	`Router# show interfaces serial 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`
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 display indicates that the hardware is not functioning properly, ensure that the interface is properly connected and terminated. If you still have problems bringing up the interface, contact a service representative for assistance. This section includes the following subsections:

- Using the show version or show hardware Commands, page 5-11
- Using the show diag Command, page 5-13
- Using the show interfaces Command, page 5-14

These subsections offer some platform-specific output examples using the **show** commands. Choose the subsection appropriate for your system. Proceed to the "Using the ping Command to Verify Network Connectivity" section on page 5-15 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 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.

Cisco 7200 VXR Routers

Following is an example of the **show version** command from a Cisco 7200 VXR router with the PA-T3/E3-EC:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Version 11.1(7)CA [biff 105]
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Sun 04-Aug-96 06:00 by biff
Image text-base: 0x600088A0, data-base: 0x605A4000

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

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

cisco 7206 (NPE150) processor with 12288K/4096K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV INC).
Chassis Interface.
4 Ethernet/IEEE 802.3 interfaces.
2 FastEthernet/IEEE 802.3 interfaces.
4 Token Ring /IEEE802.5 interfaces.
12 Serial network interfaces.
1 Compression port adapter.
125K bytes of non-volatile configuration memory.
1024K bytes of packet SRAM memory.

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

Cisco 7201 Router

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

```
Router# show version
```

```
Cisco IOS Software, 7200 Software (C7200P-ADVENTERPRISEK9-M), Version
12.4(biffDEV.061001), INTERIM SOFTWARE Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Sun 01-Oct-06 23:42 by biff
ROM: System Bootstrap, Version 12.4(4r)XD5, RELEASE SOFTWARE (fc1)
BOOTLDR: Cisco IOS Software, 7200 Software (C7200P-KBOOT-M), Version 12.4(TAZ3DEV.060927),
INTERIM SOFTWARE
c7201alpha1 uptime is 5 days, 18 hours, 32 minutes System returned to ROM by power-on
System image file is "disk0:c7200p-adventerprisek9-mz.2006-10-01.biffdev"
This product contains cryptographic features and is subject to United States and local
country laws governing import, export, transfer and use. Delivery of Cisco cryptographic
products does not imply third-party authority to import, export, distribute or use
encryption.
Importers, exporters, distributors and users are responsible for compliance with U.S. and
local country laws. By using this product you agree to comply with applicable laws and
regulations. If you are unable to comply with U.S. and local laws, return this product
immediately.
A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
If you require further assistance please contact us by sending email to export@cisco.com.
Cisco 7201 (c7201) processor (revision A) with 917504K/65536K bytes of memory.
Processor board ID 2222222222222
MPC7448 CPU at 1666Mhz, Implementation 0, Rev 2.2
1 slot midplane, Version 2.255
Last reset from power-on
1 FastEthernet interface
4 Gigabit Ethernet interfaces
2045K bytes of NVRAM.
62443K bytes of USB Flash usbflash0 (Read/Write)
250880K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
65536K bytes of Flash internal SIMM (Sector size 512K).
Configuration register is 0x2
```

Cisco 7301 Router

Following is an example of the **show version** command from a Cisco 7301 router with the PA-T3/E3-EC:

```
Router# show version

Cisco IOS Software, 7301 Software (C7301-JS-M), Experimental Version 12.4(xxx)
[biff-7301_testing 101]
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Sat 19-Aug-06 14:36 by biff
ROM: System Bootstrap, Version 12.3(4r)T2, RELEASE SOFTWARE (fc1)
BOOTLDR: 7301 Software (C7301-BOOT-M), Version 12.2(15)B, EARLY DEPLOYMENT RELEASE
SOFTWARE (fc1)
ws2_7301 uptime is 2 hours, 51 minutes
System returned to ROM by reload at 11:42:47 UTC Wed Aug 23 2006
System restarted at 11:58:28 UTC Wed Aug 23 2006
System image file is "tftp://10.77.11.10/biff/c7301-js-mz.c7301_testing"
Last reload reason: Reload Command

Cisco 7301 (NPE) processor (revision C) with 491520K/32768K bytes of memory.
Processor board ID 74806832
SB-1 CPU at 700MHz, Implementation 1025, Rev 0.2, 512KB L2 Cache
1 slot midplane, Version 3.0
Last reset from watchdog nmi
3 Gigabit Ethernet interfaces
1 Serial interface
1 Subrate T3/E3 port
509K bytes of NVRAM.
```

```
250880K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

Using the show diag Command

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

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.

Following is an example of the **show diag** *slot* command that shows a PA-T3/E3-EC in port adapter slot 2 of a Cisco 7200 VXR router:

```
Router# show diag 2

Slot 2:
Enhanced 2 port T3 multichannel Port adapter, 2 ports
Port adapter is analyzed
Port adapter insertion time 00:00:50 agoh
EEPROM contents at hardware discovery:
PCB Serial Number : JAE103394R8
Hardware Revision : 1.1
Part Number : 73-10698-02
Board Revision : 06
RMA Test History : 00
RMA Number : 0-0-0-0
RMA History : 00
Deviation Number : 85586
Product (FRU) Number : PA-MC-2T3-EC
Version Identifier : V01
Top Assy. Part Number : 68-2713-02
CLEI Code :
EEPROM format version 4
EEPROM contents (hex):
0x00: 04 FF C1 8B 4A 41 45 31 30 33 33 39 34 52 38 40
0x10: 05 44 41 01 01 82 49 29 CA 02 42 30 36 03 00 81
0x20: 00 00 00 00 04 00 88 00 01 4E 52 CB 94 50 41 2D
0x30: 4D 43 2D 32 54 33 2D 45 43 20 20 20 20 20 20 20
0x40: 20 89 56 30 31 20 D9 03 C1 40 CB 87 44 0A 99 02
0x50: C6 8A 20 20 20 20 20 20 20 20 20 20 FF FF FF FF
0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

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

```
Router# show diag 1
Slot 1:
    Dual OC3 POS Port adapter, 2 ports
    Port adapter is analyzed
    Port adapter insertion time 00:02:19 ago
    EEPROM contents at hardware discovery:
    Hardware Revision : 1.0
    PCB Serial Number : JAE07520DYL
    Part Number : 73-8220-02
    Board Revision : A0
    RMA Test History : 00
```

```
RMA Number : 0-0-0-0
RMA History : 00
Deviation Number : 0
Product (FRU) Number : PA-POS-2OC3
Top Assy. Part Number : 800-21857-02
EEPROM format version 4
EEPROM contents (hex):
    0x00: 04 FF 40 03 E3 41 01 00 C1 8B 4A 41 45 30 37 35
    0x10: 32 30 44 59 4C 82 49 20 1C 02 42 41 30 03 00 81
    0x20: 00 00 00 00 04 00 88 00 00 00 00 CB 94 50 41 2D
    0x30: 50 4F 53 2D 32 4F 43 33 20 20 20 20 20 20 20 20
    0x40: 20 C0 46 03 20 00 55 61 02 FF FF FF FF FF FF FF
    0x50: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

Using the show interfaces Command

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

For complete descriptions of interface commands and the configuration options available for interfaces, refer to the publications listed in the "Related Documentation" section on page iv.

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.

Following is an example of the **show interfaces serial** command for a Cisco 7200 VXR router. In this example, the two serial interfaces (0 and 1) 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# show interfaces serial 1/0

Serial 1/0 is up, line protocol is up
Hardware is PA-2T3/E3-EC
Internet address is 209.165.200.224
MTU 4470 bytes, BW 34010 Kbit, DLY 200 usec,
reliability 255/255, txload 133/255, rxload 133/255
Encapsulation PPP, LCP Open
Open: IPCP, CDPCP, crc 16, loopback not set
Keepalive set (10 sec)
Restart-Delay is 0 secs
Last input 00:00:58, output 00:00:00, output hang never
Last clearing of "show interface" counters 18:20:02
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 17858000 bits/sec, 44603 packets/sec
5 minute output rate 17858000 bits/sec, 44644 packets/sec
2945861066 packets input, 1264008542 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 parity
3 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 3 abort
2946010876 packets output, 1271709372 bytes, 0 underruns
0 output errors, 0 applique, 0 interface resets
0 output buffer failures, 0 output buffers swapped out
0 carrier transitions
R1_npe400#
```

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

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

Proceed to the next section, "Using the ping Command to Verify Network Connectivity," to check network connectivity of the PA-T3/E3-EC 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 iv 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

Use the **loopback** {**dte** | **local** | **network** [**line** | **payload**]} command to troubleshoot the E3 serial port adapter at the physical interface level. The command loops all packets from the E3 interface either back to the interface or from the network back out toward the network. Use the **no** form of the command to remove the loop.

The following examples of the **loopback** {**dte** | **local** | **network line** | **payload**} command configure loopback modes on the single interface (interface 0) of a one-port E3 serial port adapter in port adapter slot 1 to 7 of a Cisco 7200 VXR router:

- Set the interface into loopback data terminal equipment (DTE) mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface serial 1/0
Router(config-if)# loopback dte
```

DTE loopback loops the router output data back toward the router (after the line interface unit).

- Set the interface into local loopback mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface serial 1/0
Router(config-if)# loopback local
```

Local loopback loops the router output data back toward the router at the framer.

- Set the interface into network line loopback mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface serial 1/0
Router(config-if)# loopback network line
```

Network line loopback loops the data back toward the network (before the framer).

- Set the interface into network payload loopback mode as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface serial 1/0
Router(config-if)# loopback network payload
```

Network payload loopback loops just the payload data back toward the network at the E3 framer.