PA-MC-T3-EC Port Adapter Installation and Configuration

PA-MC-T3-EC=, PA-MC-2T3-EC=

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Preface

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

- Document Revision History, page iii
- Objectives, page iii
- Organization, page iv
- Related Documentation, page iv
- Obtaining Documentation and Submitting a Service Request, page v

Document Revision History

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

Document Version	Date	Change Summary
OL-10589-02	July, 2007	This document adds information about accelerated features and restrictions for the channelized mode; see Chapter 5.
	July, 2009	Added recommendations for configuring MLPPP/MLFR bundles on 7200 router, "MLPPP/MLFR Scale Recommendations" section on page 5-4.
OL-10589-01	November, 2006	This is the first version of this document.

Objectives

This document describes how to install and configure 1-port PA-MC-T3-EC port adapter and the 2-port PA-MC-2T3-EC port adapter, hereafter referred to as the PA-MC-T3-EC port adapter, which is used in the Cisco 7204VXR router and 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-MC-T3-EC port adapter and its LEDs and cables. Provides supporting information about addressing and networks.
Chapter 2	Preparing for Installation	Describes safety considerations and tools required for the installation.
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 Unchannelized Mode	Provides instructions for configuring your port adapter in the unchannelized mode.
Chapter 5	Configuring the Channelized Mode	Provides instructions for configuring your port adapter in the channelized 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:
  - Cisco 7200 Series Routers Documentation Roadmap for a list of all Cisco 7200 series routers documentation and troubleshooting tools and information. See http://www.cisco.com/en/US/docs/routers/7200/roadmaps/7200_series_doc_roadmap/3512.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/docs/routers/7200/configuration/7200_port_adapter_config_guidelines/config.html

  - *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

  - Cisco 7200 Series Routers Troubleshooting Documentation Roadmap for links to troubleshooting tools, utilities, and Tech Notes. See https://www.cisco.com/en/US/docs/routers/7200/roadmaps/7200_series_trblshoot_doc_roadmap/3518.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 7301 Router contains extensive features and functionality, which are documented in the following resources:
  - *Cisco 7301 Router Documentation Roadmap* contains a linked list of all documents pertaining to the Cisco 7301 router.
  - *Cisco 7301 Router Port Adapter Documentation Roadmap* contains a linked list of all port adapter documents pertaining to the Cisco 7301 router.
  - *Cisco 7301 Router Troubleshooting Documentation Roadmap* contains a linked list of all troubleshooting documents pertaining to the Cisco 7301 router.
- 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 AS5850 Universal Gateway Operations, Administration, Maintenance, and Provisioning 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-MC-T3-EC port adapter and contains the following sections:

- Port Adapter Overview, page 1-1
- Channelized T3 Overview, page 1-2
- Unchannelized T3 Overview, page 1-3
- T3 Specifications, page 1-3
- LEDs, page 1-4
- Port Adapter Slot Locations, page 1-4
- Identifying Interface Addresses, page 1-6

Port Adapter Overview

The PA-MC-2T3-EC is a single-width port adapter that provides two T3 interface connections using BNC connectors. (See Figure 1-2.) The PA-MC-T3-EC provides one T3 interface connection using BNC connectors. (See Figure 1-1.) Hereafter, both versions of this port adapter will be referred to as the PA-MC-TE-EC. A channelized T3 provides 28 T1 lines multiplexed into the T3.

The PA-MC-T3-EC supports the following hardware accelerated features.

- Multilink PPP (MLPPP)
- Multilink Frame Relay (FRF.16)
- Frame Relay Fragmentation (FRF.12)

For more information on the features, and restrictions, see Chapter 5, "Configuring the Channelized Mode."

Figure 1-1 PA-MC-T3-EC—Front Panel

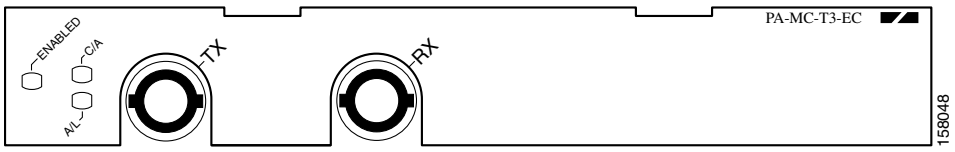
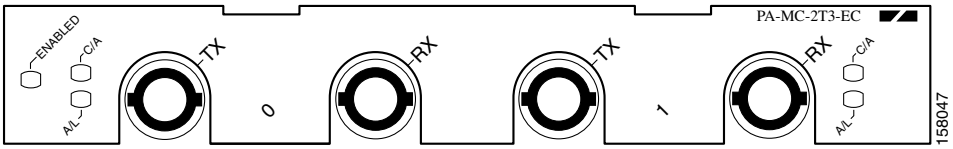


Figure 1-2 PA-MC-2T3-EC—Front Panel



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

- The PA-MC-T3-EC supports channelized operations.
- The PA-MC-T3-EC transmits and receives data bidirectionally at the T3 rate of 44.736 Mbps.
- The PA-MC-T3-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-MC-T3-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-MC-T3-EC microcode is loaded at initialization and is bundled into Cisco IOS software.

Note The PA-MC-T3-EC does not support E1 into channelized T3.

Channelized T3 Overview

In the channelized mode of operation, a PA-MC-T3-EC T3 link is channelized into 28 DS1 data lines in an industry standard multiplexing format.

Each of the T1 lines contains 24 time slots of 64 or 56 kbps each. The T1 lines can support one or more user data channels which appear to the system as serial interfaces. Each serial interface is assigned one or more of the time slots giving the serial interface a bandwidth of *n* x 56 kbps or *n* x 64 kbps, where *n* is the number of time slots assigned. Any unused time slots of the T1 are filled with an idle channel pattern.

The following restrictions apply: A time slot can only be used by one serial interface. A serial interface cannot use time slots from more than one T1 line. Each T3 line can have a maximum of 128 serial interfaces. Unused serial interfaces on one T3 cannot be used by the other T3 line.

The PA-MC-T3-EC supports Cisco High-Level Data Link Control (HDLC), Frame Relay, PPP, and Switched Multimegabit Data Service (SMDS) Data Exchange Interface (DXI) encapsulations over each serial interface.

Note T1 lines on the PA-MC-T3-EC are numbered 1–28, rather than the more traditional zero-based scheme (0–27) used with other Cisco products. This is to ensure consistency with telco numbering schemes for T1 lines within channelized T3 equipment.

Note The PA-MC-T3-EC does not support the aggregation of multiple T1 lines (called inverse multiplexing or bonding) in hardware for higher bandwidth data rates. MLPPP may be used for this purpose in software.

The T3 section of the PA-MC-T3-EC supports the maintenance data link (MDL) channel when using c-bit parity framing as well as local and network loopbacks. The T1 section of the PA-MC-T3-EC supports facilities data link (FDL) in Extended Superframe (ESF) framing, as well as various loopbacks. Bit error rate (BER) testing is supported on each of the T1 lines, although a test may not be active on more than one T1 line at a time. BER testing may be done over a framed or unframed T1 signal.

Unchannelized T3 Overview

In the unchannelized mode of operation, a T3 link provides a single high speed user data channel, rather than being multiplexed into 28 T1 lines. The data channel 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 standard exists for subdividing the T3 bandwidth, but the PA-MC-T3-EC is compatible with the proprietary formats of five vendors of data service units (DSUs), when used at the far end of the T3 link.

In unchannelized T3 mode, the T3 section sports the maintenance data link (MDL) channel when using c-bit parity framing as well as local and network loopbacks. Bit error rate (BER) testing is supported on the T3 link. The PA-MC-T3-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.

T3 Specifications

The PA-MC-T3-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

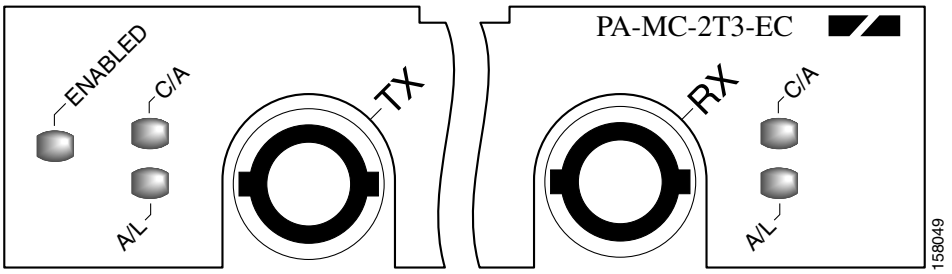
Parameter	Specification
Line rate	44.736 Mbps (±20 ppm)
Line code	B3ZS (bipolar with three-zero substitution)
Impedance	75 ohms
Output pulse shape	ANSI T1.102, pulse amplitude is between 0.36 and 0.85 volts peak
Input signal	0.035-1.1 volts peak
Output signal	Able to drive 450 feet (135 meters) of 75-ohm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

LEDs

The PA-MC-T3-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-MC-2T3-EC Status LEDs—Partial Horizontal View



LED Label	Color	State	Meaning
ENABLED	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.
	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).

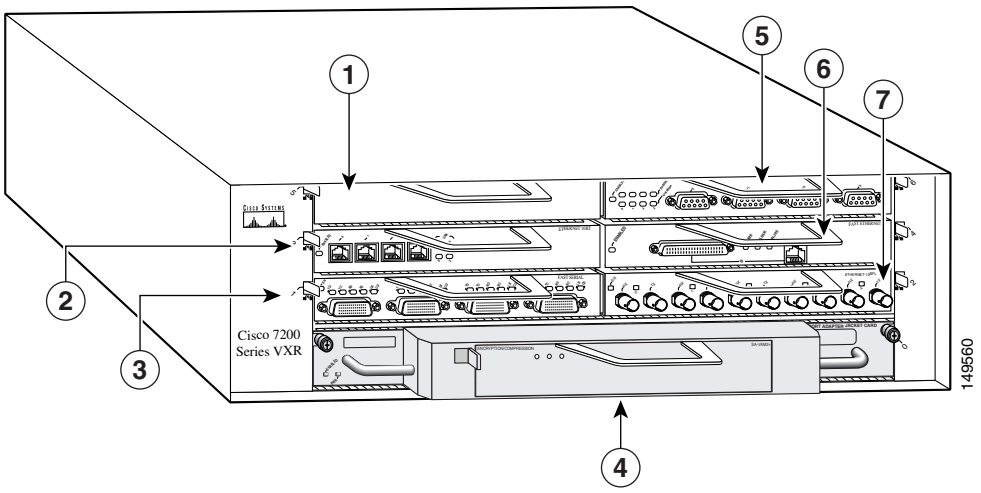
Port Adapter Slot Locations

This section discusses port adapter slot locations on the Cisco 7200 VXR routers.

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-MC-T3-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 Cisco 7206VXR Router with the Port Adapter Jacket Card



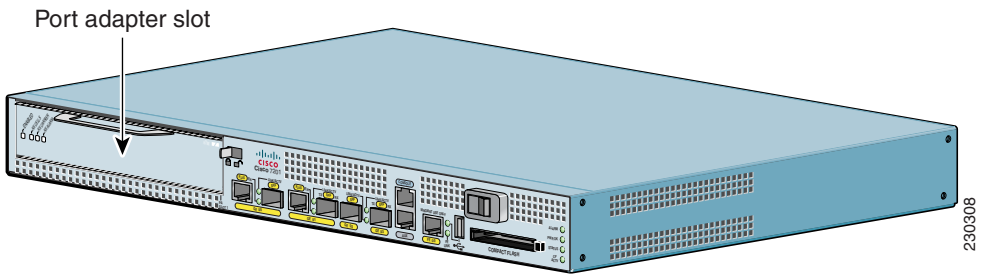
1	Slot 5	**5**	Slot 6
2	Slot 3	**6**	Slot 4
3	Slot 1	**7**	Slot 2
4	Slot 7 for the port adapter slot 0 for the Jacket Card		

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 slot 0. The port adapter in the Port Adapter Jacket Card resides in port adapter slot 5 on the Cisco 7204VXR 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.

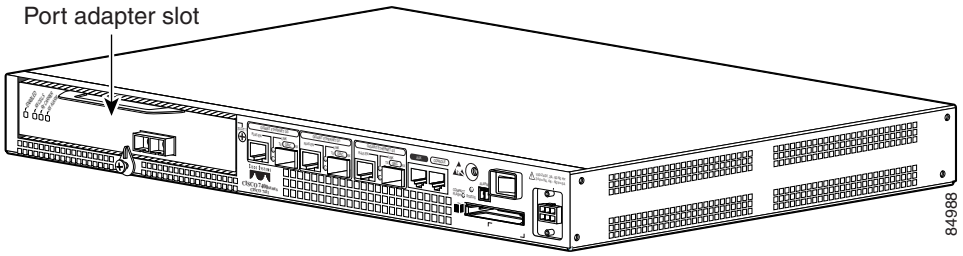
Figure 1-5 Port Adapter Slot in the Cisco 7201 Router



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-MC-T3-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-MC-T3-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 1-2 explains how to identify interface addresses

Table 1-2 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 routers[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`
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 2 for the Cisco 7202, slot 4 for the Cisco 7204 and Cisco 7204VXR, and slot 6 for the Cisco 7206 and Cisco 7206VXR. (Port adapter slot 0 is reserved for the optional Fast Ethernet port on the I/O controller—if present.)

The interface addresses of the interfaces on the PA-MC-T3-EC in port adapter slot 1 are 1/0 and 1/1 (port adapter slot 1 and interfaces 0 and 1). If the PA-MC-T3-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-MC-T3-EC port adapter. This chapter contains the following sections:

- Required Tools and Equipment, page 2-1
- Software and Hardware Requirements, page 2-2
- Checking Hardware and Software Compatibility, page 2-2
- 75-Ohm In-Line Coaxial Attenuator, page 2-2
- Safety Guidelines, page 2-2
- FCC Class A Compliance, page 2-9

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-MC-T3-EC(=) or the Cisco PA-MC-2T3-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)

Software and Hardware Requirements

The PA-MC-T3-EC and PA-MC-2T3-EC require Cisco IOS Release 12.4(11)T, Cisco IOS 12.4(15)T1, or a later release of Cisco IOS Release 12.4T.

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

Additionally, the PA-MC-T3-EC and PA-MC-2T3-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-MC-T3-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-MC-T3-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/univercd/cc/td/doc/product/core/7206/fru/12884att.htm

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。

주의 중요 안전 지침

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

이 지시 사항을 보관하십시오.

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

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

GUARDE ESTAS INSTRUÇÕES

Advarsel **VIGTIGE SIKKERHEDSANVISNINGER**

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

GEM DISSE ANVISNINGER

تحذير **إرشادات الأمان الهامة**

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

Upozorenje **VAŽNE SIGURNOSNE NAPOMENE**

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

SAČUVAJTE OVE UPUTE

Upozornění

DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY

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

USCHOVEJTE TYTO POKYNY

Προειδοποίηση

ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

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

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

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

שמור הוראות אלה

Opomena

ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА

Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.

ЧУВАЈТЕ ГИ ОВИЕ НАПАТСТВИЈА

Ostrzeżenie **WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA**

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

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie **DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY**

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

USCHOVAJTE SI TENTO NÁVOD

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

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

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-MC-T3-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-MC-T3-EC port adapter from the supported platform and also how to install a new or replacement port adapter. This chapter contains the following sections:

- Handling Port Adapters, page 3-2
- Online Insertion and Removal, page 3-2
- Warnings and Cautions, page 3-3
- Port Adapter Removal and Installation, page 3-4
- Cisco 7201 Router—Removing and Installing a Port Adapter, page 3-6

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

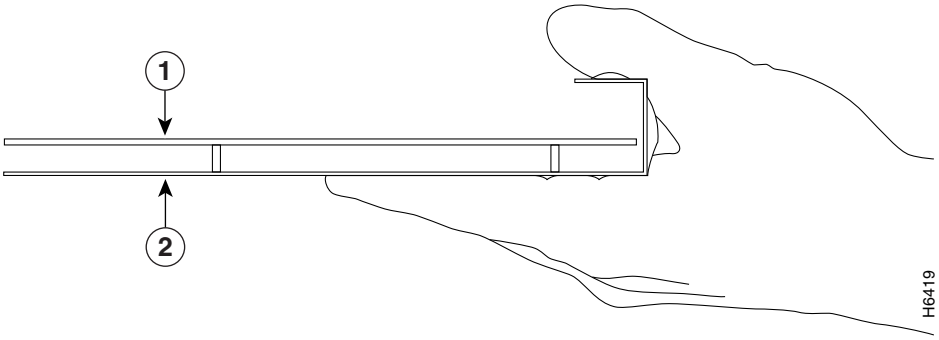
Caution When powering off the router, wait a minimum of 30 seconds before powering it on again.

Handling Port Adapters

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

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

Figure 3-1 Handling a Port Adapter



1	Printed circuit board	2	Metal carrier

Online Insertion and Removal

The Cisco 7200 VXR platform supports online insertion and removal (OIR) of port adapters; therefore, you do not have to power down routers when removing and replacing a PA-MC-T3-EC in Cisco 7200 VXR routers.

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-MC-T3-EC, wait 3 minutes before reinstalling or reinserting a PA-MC-T3-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.

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

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 illustration.

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:

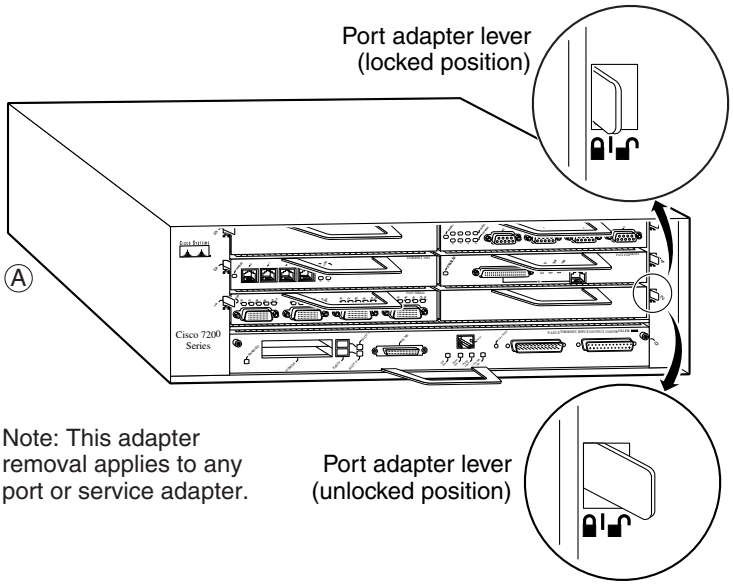
- Cisco 7200 VXR Routers—Removing and Installing a Port Adapter, page 3-5
- Cisco 7201 Router—Removing and Installing a Port Adapter, page 3-6
- Cisco 7301 Router—Removing and Installing a Port Adapter, page 3-7

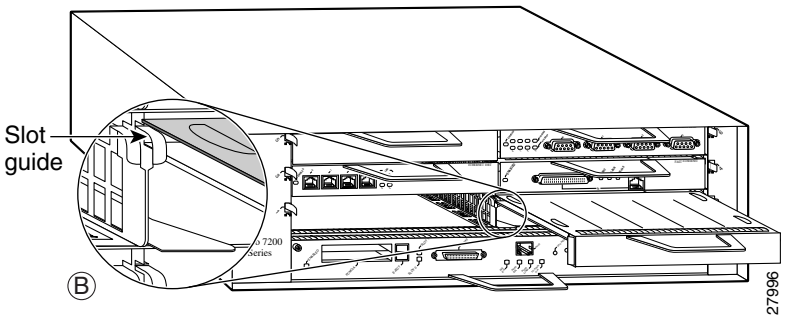
Warning **Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034

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

Cisco 7200 VXR Routers—Removing and Installing a Port Adapter

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





Step 1

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

Step 2

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

Step 3

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

Step 4

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

Step 5

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

Step 6

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

Step 7

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

Cisco 7201 Router—Removing and Installing a Port Adapter

Figure 3-3 Installing a Port Adapter in a Cisco 7201 Router

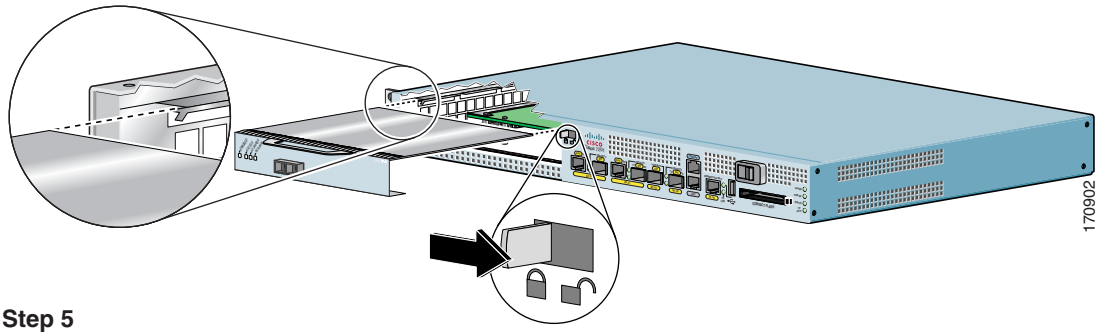
Step 1
Use an ESD wrist strap to ground yourself to the router.

Step 2
To remove the port adapter, place the port adapter lever in the unlocked position. The port adapter lever remains in the unlocked position.

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

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

Caution
The port adapter must slide into the slot guides close to the chassis lid. Do not allow the port adapter components to come in contact with the system board or the port adapter could be damaged.



Step 5
To insert the port adapter, carefully align the port adapter carrier in the slot guides. Slide the new port adapter halfway into the chassis.

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

Step 7
After the port adapter is properly seated, lock the port adapter lever.

Cisco 7301 Router—Removing and Installing a Port Adapter

Figure 3-4 Installing a Port Adapter in a Cisco 7301 Router

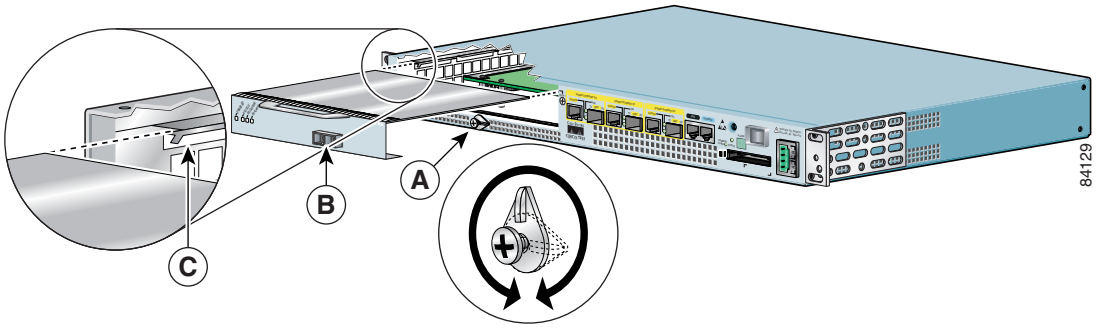
Step 1
Use an ESD wrist strap to ground yourself to the router.

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

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

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

Caution
The port adapter must slide into the slot guides close to the chassis lid. (See C.) Do not allow the port adapter components to come in contact with the system board or the port adapter could be damaged.



Step 5
To insert the port adapter, carefully align the port adapter carrier in the slot guides. (See C.) Slide the new port adapter halfway into the chassis.

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

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

Cables and Connectors

The interface connectors on the PA-MC-T3-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-MC-T3-EC line interface unit (LIU), which is the analog physical interface on the PA-MC-T3-EC.

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

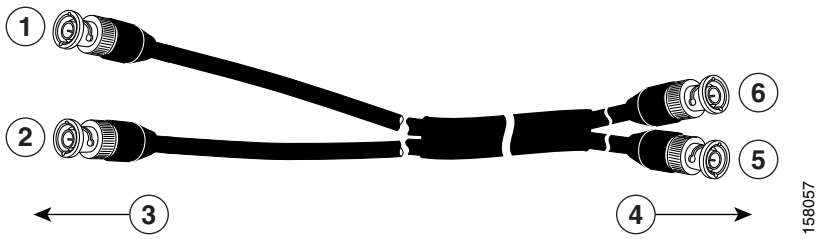
- Transmit (TX)—Transmitted signals appear on the center contact, and the outer shield is grounded for the 75-ohm 734A coaxial cable you attach to the TX BNC connector.
- Receive (RX)—Received signals appear on the center contact, and the outer shield is grounded for the 75-ohm 734A coaxial cable you 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. See "T3 Specifications" section on page 1-3 for supported cable lengths.

Figure 3-5 shows the typical 75-ohm 734A coaxial cable pair recommended for use with the PA-MC-T3-EC. Use one 75-ohm coaxial cable for each PA-MC-T3-EC connection: RX and TX.

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

Figure 3-5 75-Ohm 734A Coaxial Cable Pair



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

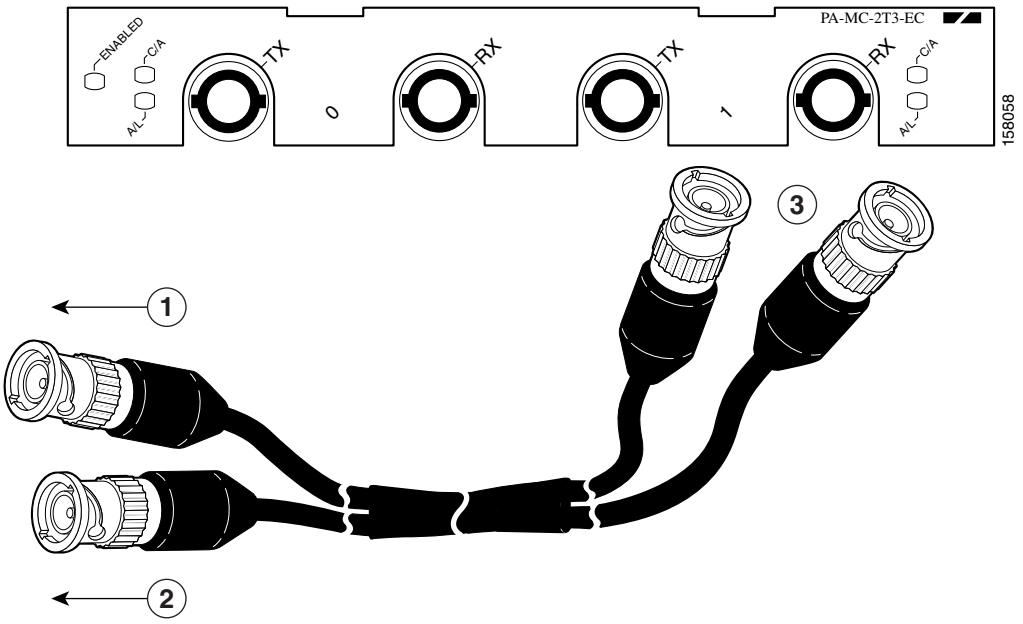
Connecting the Cables

This section describes the procedure for attaching 75-ohm 734A coaxial cables between the PA-MC-T3-EC port adapter and your external DS3 equipment. To continue your PA-MC-T3-EC port adapter installation, you must install the port adapter cables. The instructions that follow apply to all supported platforms.

Connect the 75-ohm coaxial cables to the PA-MC-T3-EC as follows:

Step 1 Attach the 75-ohm coaxial cables directly to the BNC ports on the PA-MC-T3-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 3-6 on page 3-9.)

Figure 3-6 Attaching 75-Ohm, 734A Coaxial Cables to a PA-MC-2T3-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-MC-T3-EC TX port to the RX port on your external T3 equipment.
- Attach the coaxial cable from the PA-MC-T3-EC RX port to the TX port on your external T3 equipment.

This completes the procedure for attaching 75-ohm coaxial cables on the PA-MC-T3-EC.

CHAPTER 4

Configuring the Unchannelized Mode

To continue your Cisco PA-MC-T3-EC port adapter installation, you must configure the PA-MC-T3-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, page 4-1
- Using the EXEC Command Interpreter, page 4-2
- Replacing an Existing Port Adapter, page 4-3
- Configuring an Unchannelized T3 Link, page 4-4
- Performing a Basic Serial Interface Configuration, page 4-14
- Checking the Configuration, page 4-15

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 subcommands, 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-MC-T3-EC with the controller **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 7200VXR router:

```
Router(config)# controller T3 1/0
Router(config-controller)# shutdown

Router(config)# controller T3 1/1
Router(config-controller)# shutdown
```

Note Both T3 ports of the PA-MC-T3-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-MC-T3-EC in port adapter slot 6 of a Cisco 7200 VXR router:

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

Router# show controller T3 6/1
T3 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 "Port Adapter Removal and Installation" section on page 3-4 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 an Unchannelized T3 Link

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

After you verify that the new PA-MC-T3-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.

Configuring the T3 Controller

This section provides procedures and examples for configuring the T3 controller on the PA-MC-T3-EC, and includes information on the following topics:

- Selecting a T3 Controller, page 4-5
- Setting Unchannelized Mode for the T3 Controller, page 4-5
- Setting the Framing Type for the Serial Interface, page 4-5
- Specifying the Cable Length for the Serial Interface, page 4-6
- Setting the Clock Source for the Serial Interface, page 4-6
- Configuring MDL Messages for the Serial Interface, page 4-7
- Examples of MDL Message Configuration, page 4-7
- Setting the DSU Mode for the Serial Interface, page 4-8
- Setting the Bandwidth for the Serial Interface, page 4-9
- Setting Scrambling for the Serial Interface, page 4-9
- Configuring Loopback Mode for the Serial Interface, page 4-9
- Configuring the T3 Controller to Enable Loopbacks, page 4-10
- Shutting Down the T3 Controller, page 4-11
- Configuring a BER Test on the T3 Controller, page 4-11
- Sending a BER Test Pattern on the T3 Line, page 4-12

- Viewing the Results of a BER Test, page 4-12
- Terminating a BER Test, page 4-14

Selecting a T3 Controller

You must enter the following controller command, before any other configuration commands, to select the T3 controller you want to configure:

controller T3 *chassis-slot/T3-port*

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

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller t3 1/0
Router(config-controller)#
```

Setting Unchannelized Mode for the T3 Controller

To configure the T3 for unchannelized mode, use the **no channelized command.** After the full-rate T3 interface is configured, use the **dsu bandwidth** command to create a subrate T3 interface. The following example configures a subrate T3 interface on a PA-MC-T3-EC in port adapter slot 1 of a Cisco 7200 VXR router:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller t3 1/0
Router(config-controller)# no channelized
Router(config-controller)# exit
Router(config)# interface serial 1/0
Router(config-if)# dsu bandwidth 16000
Router(config-if)# encapsulation frame-relay
Router(config-if)# ip address 10.10.10.10 255.255.255.255
Router(config-if)# no shutdown
```

When the PA-MC-T3-EC is configured for unchannelized T3 mode, its default MTU size is set to 4470 for compatibility with other T3 equipment and port adapters.

Setting the T3 port to unchannelized mode creates a serial interface that the following commands may be used to configure. Use the **interface serial** command to select the serial interface.

```
Router# configure terminal
Router# interface serial 1/0/1
Router(config-if)#
```

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 as follows: 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-MC-T3-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-MC-T3-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-MC-T3-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-MC-T3-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 4-5.)

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 of a 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 data 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-MC-T3-EC. Specify mode 0 for connection from a PA-MC-T3-EC to another PA-MC-T3-EC or a Digital Link DSU (DL3100). Specify mode 1 for connection from a PA-MC-T3-EC to a Kentrox DSU. Specify mode 2 for connection from a PA-MC-T3-EC to a Larscom DSU. See Table 4-1 for a list of DSUs and their corresponding bandwidth ranges.

Table 4-1 DSU Mode Bandwidth Ranges

Mode	DSU	Bandwidth Range
0	PA-MC-T3-EC, PA-MC-2T3-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-MC-T3-EC.

Caution The PA-MC-T3-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-MC-T3-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-MC-T3-EC T3 port back to the network, allowing the remote end to test the connection to the PA-MC-T3-EC.

Local loopback loops the PA-MC-T3-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. If not, you can isolate a fault to the remote device or cables in the path of the loopback test.

You can configure the serial interface for loopback modes using the **loopback** [**local | network | remote**] interface command.

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.

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 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 4-5 for information on configuring c-bit framing.
2. These loopback commands are only available when the DSU mode is set to 1, Kentrox mode.

Configuring the T3 Controller to Enable Loopbacks

The PA-MC-T3-EC can be configured to respond to or to ignore remote T3 loopback requests sent to it from the far-end T3 equipment. The **equipment customer loopback** command enables the port adapter to respond to remote T3 loopback commands from the remote T3 equipment while the **equipment network loopback** command causes the port adapter to ignore remote T3 loopback commands.

```
Router(config)# controller T3 1/0
Router(config-controller)# equipment customer loopback
```

Note Remote loopbacks are only available when you use c-bit parity framing.

Shutting Down the T3 Controller

You can shut down the T3 controller on the PA-MC-T3-EC with the **shutdown** controller comman.:

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)# controller T3 1/0
Router(config-controller)# shutdown
```

Configuring a BER Test on the T3 Controller

Bit error rate test (BERT) circuitry is built into the PA-MC-T3-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)# controller T3 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)# controller T3 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 T3 5/0

T3 5/0 is up.  Hardware is 2CT3+ single wide port adapter
  CT3 H/W Version : 0.1.1, CT3 ROM Version : 0.95, CT3 F/W Version : 1.4.4
  FREEDM version: 1, reset 0
  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 Internal
  Rx throttle total 0, equipment customer loopback
  Data in current interval (63 seconds elapsed):
```

```
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  Data in Interval 1:
     4905 Line Code Violations, 4562 P-bit Coding Violation
     5167 C-bit Coding Violation, 2 P-bit Err Secs
     1 P-bit Severely Err Secs, 3 Severely Err Framing Secs
     58 Unavailable Secs, 1 Line Errored Secs
     3 C-bit Errored Secs, 3 C-bit Severely Errored Secs
  Data in Interval 2:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
(additional display text ommitted)
BERT test result (running)
     Test Pattern : All 1's, Status : Sync, Sync Detected : 1
     Interval : 14400 minute(s), Time Remain : 14400 minute(s)
     Bit Errors (since BERT started): 0 bits,
     Bits Received (since BERT started): 92 Mbits
     Bit Errors (since last sync): 0 bits
     Bits Received (since last sync): 92 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 start): 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 controller **no bert** 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)# controller T3 1/0
Router(config-controller)# no bert
```

To check your configurations using **show** commands, proceed to the "Checking the Configuration" section on page 4-15; otherwise, proceed to the "Performing a Basic Serial Interface Configuration" section on page 4-14..

Performing a Basic Serial Interface Configuration

Note The Cisco 7200 VXR Port Adapter Jacket Card requires no configuration. Configure a port adapter in it as you would any other port adapter.

Following are instructions for a basic configuration: enabling an interface and specifying IP routing. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration subcommands and the configuration options available for *serial* interfaces, refer to the appropriate software documentation.

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

```
Router# disable

Router>
```

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

```
Router# 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** subcommand, followed by the interface address of the interface you plan to configure. See "Port Adapter Slot Locations" section on page 1-4 and "Identifying Interface Addresses" section on page 1-6.

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** subcommand, as in the following example:

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

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

Step 5 Re enable the interfaces using the **no shutdown** command. (See the "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 subcommands to complete your configuration, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.

Step 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, page 4-15
- Using the ping Command to Verify Network Connectivity, page 4-20
- Using loopback Commands to Troubleshoot Network Problems, page 4-20

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-MC-T3-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 7301 routers: **show interfaces serial** *port-adapter/t3-port*	Displays status information about a specific type of interface	`Router# show interfaces serial 3/1`
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 4-17
- Using the show diag Command, page 4-18
- Using the show interfaces Command, page 4-19
- 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. Following is an examples of the **show version** 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-MC-T3-EC:

```
Router# show version

Cisco IOS Software, 7200 Software (C7200-JS-M), Experimental Version 12.4(20060505:140248)
[sprafull-CJ-G2 102]
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Fri 05-May-06 20:21 by

ROM: System Bootstrap, Version 12.4(4r)XD3, RELEASE SOFTWARE (fc1)

reg2 uptime is 14 hours, 35 minutes
System returned to ROM by reload at 07:19:23 UTC Sun Jan 16 2000
System image file is "disk2:c7200p-js-mz.CJ_DTHO_20060505"
Last reload reason: Reload Command


Cisco 7206VXR (NPE-G2) processor (revision B) with 917504K/65536K bytes of memory.
Processor board ID 34149641
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 660 bandwidth points.
The set of PA-2FE, PA-POS-2OC3, and I/O-2FE qualify for "half
bandwidth points" consideration, when full bandwidth point counting
results in oversubscription, under the condition that only one of the
two ports is used. With this adjustment, current configuration on bus
mb1 has a total of 660 bandwidth points.
This configuration has oversubscripted the PCI bus and is not a
supported configuration.

PCI bus mb2 (Slots 2, 4 and 6) has a capacity of 600 bandwidth points.
Current configuration on bus mb2 has a total of 960 bandwidth points.
The set of PA-2FE, PA-POS-2OC3, and I/O-2FE qualify for "half
bandwidth points" consideration, when full bandwidth point counting
results in oversubscription, under the condition that only one of the
two ports is used. With this adjustment, current configuration on bus
mb2 has a total of 660 bandwidth points.
This configuration has oversubscripted the PCI bus and is not a
supported configuration.

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.

WARNING: PCI bus mb1 Exceeds 600 bandwidth points
WARNING: PCI bus mb2 Exceeds 600 bandwidth points
```

```
3 FastEthernet interfaces
3 Gigabit Ethernet interfaces
56 Serial interfaces
2 Packet over SONET interfaces
8 Channelized T3 ports
2045K bytes of NVRAM.

250880K bytes of ATA PCMCIA card at slot 2 (Sector size 512 bytes).
65536K bytes of Flash internal SIMM (Sector size 512K).
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 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-MC-T3-EC in port adapter slot 2of 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
```

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 subcommands and the configuration options available for Cisco 7200 VXR router interfaces, 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 for Cisco 7200 VXR routers. In this example, the port adapter is in slot 5 of a Cisco 7200 VXR router:

```
Router# show interfaces serial 1/0/1:0
Serial 1/0/1:0 is up, line protocol is up
  Hardware is PA-MC-2T3E
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Last input 00:00:08, output 03:29:07, output hang never
  Last clearing of "show interface" counters 01:08:09
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/1/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1152 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     73 packets input, 22338 bytes, 0 no buffer
     Received 71 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     70 packets output, 19838 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions

(additional displayed text not shown)
```

Using the show controllers Command

You can display information for the T3 controller within a PA-MC-T3-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/t3-port* 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 (*slot/port-adapter/port*), all information is displayed for all T3 port adapters in the router; therefore, the resulting display output can be extensive.

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-MC-T3-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 4-9 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-MC-T3-EC in local loopback using the **loop 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-MC-T3-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-MC-T3-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 a problem exists for: the T3 link to the remote site, the remote server , the DSU configuration, or the hardware.

CHAPTER 5

Configuring the Channelized Mode

To continue your Cisco PA-MC-T3-EC port adapter installation, you must configure the PA-MC-T3-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, page 5-1
- PA-MC-T3-EC Hardware Accelerated Features and Restrictions, page 5-2
- Using the EXEC Command Interpreter, page 5-7
- Replacing an Existing Port Adapter, page 5-7
- Configuring a Channelized T3 Link, page 5-8
- Performing a Basic Serial Interface Configuration, page 5-24
- Checking the Configuration, page 5-25

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.

PA-MC-T3-EC Hardware Accelerated Features and Restrictions

The Multilink PPP (MLPPP), Multilink Frame Relay (FRF.16), and Frame Relay Fragmentation (FRF.12) features are accelerated in hardware by default. The following information is in this section:

- Using the show ppp multilink Command to Determine if MLPPP Is Hardware Accelerated, page 5-2
- Restrictions for MLP to Be in the Hardware Accelerated Mode, page 5-3
- Using the show frame-relay multilink Command to Determine if MLFR Is Hardware Accelerated, page 5-4
- Restrictions for MLFR to Be in the Hardware Accelerated Mode, page 5-5
- Using the show frame-relay fragment Command to Determine if Frame Relay Fragmentation Is Hardware Accelerated, page 5-6
- Restrictions for Frame Relay Fragmentation to Be in the Hardware Accelerated Mode, page 5-6

Using the show ppp multilink Command to Determine if MLPPP Is Hardware Accelerated

The **show ppp multilink** command provides information that the MLPPP is accelerated in hardware.

```
Router # show ppp multilink
Multilink27
  Bundle name: mu27
  Remote Endpoint Discriminator: [1] mu27
  Local Endpoint Discriminator: [1] mu27
  Bundle up for 18:26:12, total bandwidth 128, load 1/255
  Receive buffer limit 24000 bytes, frag timeout 1500 ms
  0 lost fragments, 0 reordered, 0 unassigned
  0 discarded, 0 lost received
  received sequence unavailable, 0x0 sent sequence
  Multilink is hardware enabled
  Member links: 2 active, 0 inactive (max not set, min not set)
    Se1/0/27:0, since 18:26:12
    Se1/0/27:1, since 18:26:12
```

Restrictions for MLP to Be in the Hardware Accelerated Mode

If the restrictions in this section are met, the Multilink PPP (MLP) bundle operates in hardware mode by default.

- The maximum supported member link bandwidth is T1. If a clear channel interface is made part of a Multilink bundle, the bundle will operate in software mode.
- All links in the bundle must be of equal bandwidth. Adding a link of unequal bandwidth causes the Multilink bundle to go into software mode.
- All links must be from the same port adapter. Adding any additional link from another port adapter causes the bundle to switch to software mode.
- A maximum of 12 links per bundle is supported. Adding any additional links to the bundle causes the Multilink bundle to go into software mode.
- Configuring **ppp multilink multiclass** MLP causes the Multilink bundle to go into software mode.
- Fragment sizes supported in the hardware mode are 128, 256, and 512 bytes. If different fragmentation sizes are configured, and if the bundle is in hardware mode, fragment size is adjusted to the nearest of the supported fragment sizes, and the hardware is programmed accordingly.
- The bundle will operate in software mode if MLPPP is configured using Virtual-Templates as described in the following link.
  http://cco/en/US/tech/tk713/tk507/technologies_configuration_example09186a00800a3e98.shtml

Use the **show ppp multilink** command to display fragmentation size if the fragment size has been configured.

```
Router # show ppp multilink

(display text omitted)

  Fragment size in hardware 256
  Member links: 2 active, 0 inactive (max not set, min not set)
    Se1/0/27:0, since 18:26:12
    Se1/0/27:1, since 18:26:12
```

- If interleaving is enabled, and no fragmentation has been configured, the fragment size is selected based on the link size displayed in **show ppp fragment**.

```
Router# show ppp fragment
(display text omitted)

Fragment size in hardware 256.
    Member links: 1 active, 0 inactive (max not set, min not set)
```

```
Se3/0/11:0, since 1d20h, 480 weight, 472 frag size
```

- If interleaving is enabled, the bundle is in hardware mode only if there is only one link in the bundle and the fragment size configured (or selected) is 128 bytes and above. The bundle switches to software mode if any additional link is added or the fragment size that is configured or selected is less than 128 bytes.
- A maximum of 168 bundles per port adapter are supported in hardware mode. For calculating the maximum number of bundles in hardware mode, MLP a nd Multilink Frame Relay bundles in hardware mode are included, and the MLP bundles that have interleaving enabled and are in hardware mode are excluded. Configuring any additional bundle makes the bundle operating in software mode.
- Fragmentation counters on the transmit (TX) side are not available because the hardware does not support these counters.

MLPPP/MLFR Scale Recommendations

Table 5-1 list s the recommendations to consider when you use PA-MC-T3-EC/PA-MC-2T3-EC to configure MLPPP/MLFR bundles on 7200 router:

Table 5-1 MLPPP/MLFR Bundles Recommendations

Maximum MLPPP/MFR Bundles	Number of Links in the Bundle
56	2
28	4
14	8

Note The MLPPP/MFR bundles with links across different port adapters on the Cisco 7200 router are supported for backward compatibility. Cisco recommends that the MLPPP/MLFR bundles using PA-MC-T3-EC/ PA-MC-2T3-EC are from the same port adapter.

Using the show frame-relay multilink Command to Determine if MLFR Is Hardware Accelerated

The **show frame-relay multilink** command provides information on whether or not the Multilink Frame Relay (FRF.16) bundle is in hardware mode.

```
Router#  show frame-relay multilink
Bundle: MFR1, State = up, class = A, fragmentation disabled
 BID = MFR1
 MFR is hardware enabled
 Bundle links:
  Serial1/0/23:0, HW state = up, link state = Up, LID = Serial1/0/23:0
  Serial1/0/22:0, HW state = up, link state = Up, LID = Serial1/0/22:0
```

Restrictions for MLFR to Be in the Hardware Accelerated Mode

If the restrictions in this section are met, the Multilink Frame Relay (MLFR FRF.16) bundle operates in hardware mode by default.

- The maximum supported member link bandwidth is T1. If a clear channel interface is made part of a MLFR bundle, the bundle will operate in software mode.
- All links in the bundle must be of equal bandwidth. Adding a link of unequal bandwidth causes the MLFR bundle to go into software mode.
- All links must be from the same port adapter. Adding any additional links from a different port adapter causes the MLFR bundle to switch to software mode.
- A maximum of 12 links per bundle is supported. Adding any additional links to the bundle will causes the MLFR bundle to go into software mode.

- Transmit (TX) fragmentation with hardware-enabled MLFR is not supported.
- A maximum of 168 bundles per port adapter is supported in hardware mode. For calculating the maximum number of bundles in hardware mode, MLP and MLFR bundles in hardware mode are included, and the MLP bundles that have interleaving enabled and are in hardware mode are excluded. Configuring any additional bundle makes the bundle operate in software mode.

Using the show frame-relay fragment Command to Determine if Frame Relay Fragmentation Is Hardware Accelerated

The **show frame-relay fragment** command provides information on whether Frame Relay Fragmentation (FRF.12) on a data-link connection identifier (DLCI) is enabled in hardware.

```
Router# show frame-relay fragment
interface            dlci   frag-type     size   in-frag    out-frag   dropped-frag
Se1/0/28:0.1          200   end-to-end    256   Hardware   FRF12:     No Counter Support
Se1/0/28:0.2          201   VoFR-cisco       300   129         2662            0
MF1                  214   VoFR-cisco       300   112         112             0
```

Restrictions for Frame Relay Fragmentation to Be in the Hardware Accelerated Mode

If the restrictions in this section are met, the Frame Relay Fragmentation (FRF.12) bundle operates in hardware mode by default.

- The hardware mode supports only three fragment sizes: 128, 256, and 512 bytes. If the user configures a different fragment size, the fragment size is adjusted to the supported fragment size.
- If the **vofr** command is configured on a data-link connection identifier (DLCI), FRF.12 goes into software mode, and is configured in software. Removing the **vofr** command again reconfigures the FRF.12 bundle to be in hardware mode.
- If the **frame-relay fragmentation voice-adaptive** command is configured on an interface, the FRF.12 bundles on all DLCIs on that interface switch to software mode. Removing the command again reconfigures the FRF.12 bundle to be in hardware mode.
- FRF.12 for MFR interfaces are always in software mode.
- The **frame-relay fragment** <*size*> **end-to-end** command is not supported on a MFR interface which is hardware enabled. An error message like below is generated by the router.

  ```
  %MFR1 : is Hardware enabled.
  % Use map-class for configuring frf.12 on this interface.
  ```

- If PPP over Frame Relay (PPPoFR) or Multilink PPP over Frame Relay (MLPoFR) is configured on any DLCI, all the DLCIs configured with the hardware FRF.12 on that interface switch to software mode.
- Removing the PPPoFR or MLPoFR configuration on the DLCI does not switch back the DLCIs to operate in hardware mode. Moving to hardware mode can be done only after removing all PPPoFR or MLPoFR configuration on all DLCIs on the interface and reloading the router.

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 5-7 for instructions.)

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

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

Step 3 Shut down the T3 controller on the PA-MC-T3-EC with the **shutdown** controller 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)# controller T3 1/0
Router(config-controller)# shutdown

Router(config)# controller T3 1/1
Router(config-controller)# shutdown
```

Note Both T3 ports of the PA-MC-T3-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-MC-T3-EC in port adapter slot 6 of a Cisco 7200 VXR router:

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

Router# show controller T3 6/1
T3 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 "Replacing an Existing Port Adapter" section on page 5-7 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 a Channelized T3 Link

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

After you verify that the new PA-MC-T3-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.

Configuring the T3 Controller

This section provides procedures and examples for configuring the T3 controller on the PA-MC-T3-EC, and includes information on the following topics:

- Selecting a T3 Controller, page 5-9
- Setting Channelized Mode for the T3 Controller, page 5-9
- Setting the Framing Type for the T3 Controller, page 5-10
- Specifying the Cable Length for the T3 Controller, page 5-10
- Setting the Clock Source for the T3 Controller, page 5-10
- Configuring MDL Messages for the T3 Controller, page 5-11
- Examples of MDL Message Configuration, page 5-11
- Configuring Loopback Mode for the T3 Controller, page 5-12
- Configuring the T3 Controller to Enable Remote Loopback, page 5-13
- Shutting Down the T3 Controller, page 5-13

Selecting a T3 Controller

You must enter the following controller command, before any other configuration commands, to select the T3 controller you want to configure:

controller T3 *chassis-slot/T3-port for Cisco 7200 series router*

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

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller t3 1/0
Router(config-controller)#
```

Setting Channelized Mode for the T3 Controller

Note Channelized mode is the default, so you only need to configure the T3 controller for channelized mode if it had previously been set to "no channelized" mode.

To configure the T3 for channelized mode, use the **channelized** command. The following example is for a PA-MC-T3-EC in port adapter slot 1 of a Cisco 7200 VXR router:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 1/0
Router (config)# channelized

Change to channelized mode will cause cbus complex reset. Proceed? [yes/no]:
```

When the PA-MC-T3-EC is configured for channelized T3 mode, its default MTU size is set to 1500 for compatibility with other T3 equipment and port adapters.

When the T3 controller is configured to be channelized, 28 T1 lines are created. To configure the T1 lines, refer to the "Configuring T1 Lines" section on page 5-13.

Setting the Framing Type for the T3 Controller

At the prompt, specify the framing type using the **framing** [**c-bit | m23 | auto-detect**] controller command.

You can set c-bit framing format as follows:

```
Router(config-controller)# framing c-bit
```

You can set M23 framing format as follows:

```
Router(config-controller)# framing m23
```

You can request the PA-MC-T3-EC to detect the framing type it is receiving from the far end and transmit that same framing type as follows:

```
Router(config-controller)# framing auto-detect
```

Specifying the Cable Length for the T3 Controller

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

- *feet* is a numeral from 0 to 450.
- The default value is 49 feet.

An example follows:

```
Router(config-controller)# 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-MC-T3-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 T3 Controller

At the prompt, set the internal or line clock source for the selected T3 controller with the **clock source** {**internal | line**} controller 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-MC-T3-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)# controller T3 1/0
  ```

```
Router(config-controller)# clock source line
```

- Instruct the PA-MC-T3-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)# controller T3 1/0
Router(config-controller)# clock source internal
```

Configuring MDL Messages for the T3 Controller

You can configure maintenance data link (MDL) messages (which are defined in the ANSI T1.107a-1990 specification) on the PA-MC-T3-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 T3 Controller" section on page 5-10.)

To configure MDL messages, use the **mdl {transmit {path | idle-signal | test-signal} | string {eic | lic | fic | unit | pfi | port | generator}** ***string*****}** controller 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 controller configuration mode first.

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

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 1/0
Router(config-controller)#
```

- 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-controller)# mdl transmit idle-signal
```

- Enable the MDL test signal message transmission as follows:

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

- Enter the equipment identification code as follows:

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

- Enter the location identification code as follows:

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

- Enter the frame identification code as follows:

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

- Enter the unit identification code as follows:

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

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

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

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

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

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

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

Configuring Loopback Mode for the T3 Controller

With loopbacks, you can detect and isolate equipment malfunctions by testing the connection between thePA-MC-T3-EC interface and a remote T3 device such as a DS3 MUX. Remote loopback sends a command to loop the T3 line at the far end (central office). It can be used to diagnose problems with cables from the port adapter to the switching office. Network loopback loops the PA-MC-T3-EC port back to the network, allowing the remote end to test the connection to the PA-MC-T3-EC.

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

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

You can configure the T3 controller for loopback modes using the **loopback {local | network line| remote**} controller command.

The default is no loopback.

To return the T3 controller to its default unlooped condition, use the **no** form of the command.

Table 5-2 provides examples of the **loopback** {**local | network line| remote**} command.

Table 5-2 Using loopback Commands

loopback local	Sets the T3 port into local loopback mode. Local loopback loops the router output data back toward the router at the framer.	`Router(config)# controller T3 10/0/0` `Router(config-controller)# loopback local`

Table 5-2 Using loopback Commands (continued)

loopback network line	Sets the T3 port into network line loopback mode. Network line loopback loops the data back toward the network (before the framer).	`Router(config)# controller T3 10/0/0` `Router(config-controller)# loopback network line`
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)# controller T3 10/0/0` `Router(config-controller)# loopback remote`

1. Remote loopback mode works with C-bit framing only. The other loopback modes listed above work with c-bit and M23 framing. Refer to the "Setting the Framing Type for the T3 Controller" section on page 5-10 for information on configuring c-bit framing.

Configuring the T3 Controller to Enable Remote Loopback

The **equipment customer loopback** command enables the PA-MC-T3-EC port adapter to respond to remote T3 loopback and T1 loopback requests it receives from the remote site, while the **equipment network loopback** command causes the port adapter to ignore remote T3 and T1 loopback commands.

equipment [**customer** | **network**] **loopback**

```
Router(config)# controller T3 3/0
Router(config-controller)# equipment customer loopback

Router(config)# controller T3 3/0
Router(config-controller)# equipment network loopback
```

Note T3 remote loopbacks are only available when you use c-bit parity framing.

Shutting Down the T3 Controller

You can shut down the T3 controller on the PA-MC-T3-EC with the **shutdown** controller 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 (with an NPE-G1 or NPE-G2):

```
Router(config)# controller t3 1/0
Router(config-controller)# shutdown
```

Configuring T1 Lines

This section provides procedures and examples for configuring T1 lines on the T3 link of the PA-MC-T3-EC, and includes information on the following topics:

- Creating a Logical Channel Group on a T1 Line, page 5-14
- Removing a Logical Channel Group from a T1 Line, page 5-15
- Setting the Framing Format on a T1 Line, page 5-15
- Setting the Yellow Alarm Configuration for a T1 Line, page 5-16
- Setting the Clock Source on a T1 Line, page 5-16
- Setting the FDL Configuration for a T1 Line, page 5-16

- Setting Loopbacks on a T1 Line, page 5-16
- Configuring a BER Test on a T1 Line, page 5-19
- Sending a BER Test Pattern on a T1 Line, page 5-19
- Viewing the Results of a BER Test, page 5-20
- Terminating a BER Test, page 5-23

Note For consistency throughout the following configuration examples and whenever possible, the port addresses 1/0 and 1/0/1:1 are used for Cisco 7200 VXR routers.

Your PA-MC-T3-EC port addressing might be different depending on the Cisco 7200 VXR router chassis slot in which your PA-MC-T3-EC is installed.

Creating a Logical Channel Group on a T1 Line

You can create a logical channel group on a T1 line using the **t1** *t1-line-number* **channel-group** *channel-group-number* **timeslots** *list-of-timeslots* [**speed** {56 | 64}] controller command where:

- *t1-line-number* is 1 to 28.
- **channel-group** defines a logical channel group.
- *channel-group-number* is 0 to 23.
- **timeslots** *list-of-timeslots* can be 1 to 24 or a combination of subranges within 1 to 24 (each subrange is a list of time slots of the T1 line).
- **speed**{**56** | **64**} is an optional argument that specifies the speed of a time slot to be either 56 kbps or 64 kbps.

The following example configures logical channel group 20 on T1 line 1 and assigns channelized time slots 1 to 5 and 20 to 23.

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

```
Router(config)# controller T3 1/0
Router(config-controller)# t1 1 channel-group 20 timeslots 1-5, 20-23
```

Note Each T1 link may have up to 24 channel groups with an overall limit of 128 for the 28 T1 links on each T3 port. Unused channel groups in one T3 port may not be used by the other T3 port.

Note Each channel group defined with this command causes a serial interface to be created. Refer to the "Performing a Basic Serial Interface Configuration" section on page 5-24 for instructions on configuring these interfaces.

Note All the encapsulation formats, such as PPP, HDLC, SMDS, Frame Relay, and switching types are applicable to the serial interface and can be set using the serial interface configuration commands.

Removing a Logical Channel Group from a T1 Line

You can remove a logical channel group from a T1 line with the **no t1** *t1-line-number* **channel-group** *channel-group-number* controller command where:

- *t1-line-number* is 1 to 28.
- *channel-group-number* is 0 to 23.

The following example removes logical channel group 10 from channelized T1 line 1.

The example is for a port adapter in slot 1 of a Cisco 7200 VXR router.

```
Router(config)# controller T3 1/0
Router(config-controller)# no t1 1 channel-group 10
```

Note If logical channel groups have previously been configured on a port, and you switch to no channelized mode, first remove all channel groups before invoking the **no channelized** command.

Setting the Framing Format on a T1 Line

You can specify the T1 framing format using the **t1** *t1-line-number* **framing** {**esf** | **sf**} controller command where:

- *t1-line-number* is 1 to 28.
- The default framing format is Extended Supe frame (ESF).

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

  ```
  Router(config)# controller T3 1/0
  Router(config-controller)# t1 6 framing sf
  ```

Other options for setting Super Frame (SF) include:

```
Router(config-controller)# t1 6 framing ?
    esf  Extended Superframe Framing format
    sf   Superframe Framing Format

Router(config-controller)# t1 6 framing sf ?
    hdlc-idle  Specify the HDLC idle pattern on a T1
    <cr>

Router(config-controller)# t1 6 framing sf hdlc-idle ?
    0x7E  Use 0x7E as HDLC idle pattern
    0xFF  Use 0xFF as HDLC idle pattern

Router(config-controller)# t1 6 framing sf hdlc-idle 0x7e ?
```

The following example sets ESF framing format for T1 line 16.

```
Router(config)# controller T3 1/0
Router(config-controller)# t1 16 framing esf
```

Note Use of the 0xFF HDLC idle pattern may help prevent false yellow alarms in the remote T1 device when SF framing is used.

Setting the Yellow Alarm Configuration for a T1 Line

You can use the [**no**] **t1** *t1-line-number* **yellow** {**detection** | **generation**} command (where *t1-line-number* is 1 to 28) to turn the detection or generation of a yellow alarm on and off. When you select SF framing, you should consider using the **no** *t1-line-number* **yellow detection** command to turn off yellow alarm detection, because the yellow alarm can be incorrectly detected with SF framing.

Setting the Clock Source on a T1 Line

You can set the internal or line (network) clock source for a T1 line with the **t1** *t1-line-number* **clock source** {**internal** | **line**} controller command where:

- *t1-line-number* is 1 to 28.
- **internal** selects an internal clock source.
- **line** selects a network clock source.

The default clock source is internal.

Examples follow:

- Instruct T1 line 1 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)# controller T3 1/0
Router(config-controller)# t1 1 clock source internal
```

- Instruct T1 line 16 to use a line clock source received from the network.

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

```
Router(config)# controller T3 1/0
Router(config-controller)# t1 16 clock source line
```

Note Normally the T1 link should be configured to use the line clock recovered from the network. In cases where the network does not provide the clock, such as two PA-MC-T3-EC port adapters connected back-to-back, one end of the T1 link must be set to internal clock and the other end to line clock.

Setting the FDL Configuration for a T1 Line

To enable and disable one-second transmissions of performance reports through the facility data link (FDL) (per ANSI T1.403 specification), you must use the **t1** *t1-line-number* **fdl ansi** command where: *t1-line-number* is 1 to 28 on both ends of the connection.

Note You can use this command *only* when the T1 framing is ESF.

Use the **no** form of the command to disable remote performance reports.

Setting Loopbacks on a T1 Line

If you have difficulty with the PA-MC-T3-EC configuration or installation, you can troubleshoot the port adapter using the **loopback** command. Specify loopback for a T1 line using the following **t1** *t1-line-number* **loopback** [**local** | **network** | **remote**]command where: *t1-line-number* is 1 to 28.

Note This command requires that you are in T3 controller mode.

Note The **fdl loopback** commands are available only for T1 lines configured for ESF framing.

Explanations of specific loopback modes follow:

local	Loops the router output data back toward the router at the T1 framer and sends an AIS out toward the network.
network {**line** | **payload**}	Loops the data back toward the network before the T1 framer and automatically sets a local loopback at the HDLC controllers (line), or loops the payload data back toward the network at the T1 framer and automatically sets a local loopback at the HDLC controllers (payload).
remote line fdl {**ansi** | **bellcore**}	Sends a repeating, 16-bit ESF data link code word (00001110 11111111 for ANSI; 00010010 11111111 for Bellcore) to the remote end, requesting that it enter into a network line loopback. Specify the **ansi** keyword to enable the remote line facility data link (FDL) ANSI loopback on the T1 channel, per the ANSI T1.403 specification. Specify the **bellcore** keyword to enable the remote SmartJack loopback on the T1 channel, per the TR-TSY-000312 specification.
remote line inband	Sends a repeating, 5-bit inband pattern (00001) to the remote end, requesting that it enter into a network line loopback.
remote payload [**fdl**] [**ansi**]	Sends a repeating, 16-bit ESF data link code word (00010100 11111111) to the remote end, requesting that it enter into a network payload loopback. Enables the remote payload facility data link (FDL) ANSI loopback on the T1 channel. You can optionally specify **fdl** or **ansi**, but it is not necessary.

Examples of the **loopback** commands follow. Examplex are for a port adapter in slot 1 of a Cisco 7200 VXR router.

- Set the first T1 line into local loopback.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 1/0
Router(config-controller)# t1 1 loopback local
```

In the preceding examples, local loopback loops the router output data back toward the router at the T1 framer and sends an AIS out toward the network.

- Set the first T1 line into network line loopback.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 1/0
Router(config-controller)# t1 1 loopback network line
```

  In the preceding example, network line loopback loops the data back toward the network (before the T1 framer).

- Set the first T1 line into network payload loopback.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller T3 1/0
Router(config-controller)# t1 1 loopback network payload
```

  In the preceding examples, network payload loopback loops just the payload data back toward the network at the T1 framer.

- Set the first T1 line into remote line inband loopback.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# controller T3 1/0
Router(config-controller)# t1 1 loop remote line inband
```

  In the preceding example, remote line inband loopback sends a repeating five-bit in-band pattern (of 00001) to the remote end, requesting that it enter into a network line loopback.

- Set the first T1 line into remote line FDL ANSI loopback.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# controller T3 1/0
Router(config-controller)# t1 1 loop remote line fdl ansi
```

  In the preceding examples, remote line FDL ANSI loopback sends a repeating 16-bit ESF data link code word (of 00001110 11111111) to the remote end, requesting that it enter into a network line loopback.

- Set the first T1 line into remote line FDL bellcore loopback

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router (config)# controller t3 1/0
Router (config-controller)# t1 1 loop remote line fdl bellcore
```

  In the preceding example, remote line FDL Bellcore loopback sends a repeating 16-bit ESF data link code word (of 00010010 11111111) to the remote end, requesting that it enter into a network line loopback.

- Set the first T1 line into remote payload FDL ANSI loopback.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# controller T3 1/0
Router(config-controller)# t1 1 loop remote payload fdl ansi
```

  In the preceding example, remote payload ANSI loopback sends a repeating 16-bit ESF data link code word (of 00010100 11111111) to the remote end, requesting that it enter into a network payload loopback.

Configuring a BER Test on a T1 Line

Bit error rate test (BERT) circuitry is built into the PA-MC-T3-EC. With BER tests, you can test cables and signal problems in the field. You can configure BER tests on each of the 28 T1 lines, but only one BER test can be active at a time.

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:
  - 2^11 (per CCITT/ITU O.151)
  - 2^15 (per CCITT/ITU O.151)
  - 2^20 (per CCITT/ITU O.153)
  - 2^20 QRSS (per CCITT/ITU O.151)
  - 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.

Note BER testing for the T3 link is not supported in channelized T3 mode. It is only supported for unchannelized T3 ports.

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 a T1 Line

You can send a BERT pattern on a T1 line with the **t1** *t1-line-number* **bert pattern** *pattern* **interval** *time* [**unframed**]controller command. where:

- *t1-line-number* is 1 to 28.
- *time* is 1 to 14400 minutes.
- *pattern* is one of the following:
  - 0s, repetitive test pattern of all zeros (as 00000...)
  - 1s, repetitive test pattern of all ones (as 11111...)
  - 2^11, pseudorandom test pattern (2,048 bits long)

- 2^15, pseudorandom O.151 test pattern (32,768 bits long)
- 2^20-O153, pseudorandom O.153 test pattern (1,048,575 bits long)
- 2^20-QRSS, pseudorandom O.151 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)

The unframed option causes the BERT pattern to use the entire T1 bandwidth including the T1 framing as well as payload bits. If **unframed** is omitted, then the T1 linewill be either SF or ESF framed as configured by the T1 **framing** command and the BERT pattern will occupy only the T1 payload bits.

Examples follow:

- Send a BERT pseudorandom pattern of 2^23 through T1 line 10 for 5 minutes.

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

```
Router(config)# controller T3 1/0
Router(config-controller)# t1 10 bert pattern 2^23 interval 5 unframed
```

- Send a repetitive pattern of all ones through T1 line 10 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)# controller T3 1/0
Router(config-controller)# t1 10 bert pattern 1s interval 14400 unframed
```

Note You can terminate a BER test during the specified test period with the **no t1 bert** command.

Viewing the Results of a BER Test

You can view the results of a BER test using the **show controllers T3** *chassis-slot/t3-port/t1-line-number* controller command where: *t1-line-number* is 1 to 28.

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

- After you terminate the test using the **no t1 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 T3 5/0

T3 5/0 is up.  Hardware is 2CT3-EC single wide port adapter
  CT3 H/W Version: 0.1.1, CT3 ROM Version: 0.95, CT3 F/W Version: 1.4.4
  FREEDM version: 1, reset 0
  Applique type is Channelized 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 Internal
  Rx throttle total 0, equipment customer loopback
  Data in current interval (63 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
```

```
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  Data in Interval 1:
     4905 Line Code Violations, 4562 P-bit Coding Violation
     5167 C-bit Coding Violation, 2 P-bit Err Secs
     1 P-bit Severely Err Secs, 3 Severely Err Framing Secs
     58 Unavailable Secs, 1 Line Errored Secs
     3 C-bit Errored Secs, 3 C-bit Severely Errored Secs
  Data in Interval 2:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs

(additional display text ommitted)

  T1 1
    Not configured.

  T1 2
    Not configured.

  T1 3
    Not configured.

  T1 4
    Not configured.

  T1 5
    Not configured.

  T1 6
    Not configured.

  T1 7
    Not configured.

  T1 8
    Not configured.

  T1 9
    Not configured.

  T1 10
    Not configured.
  BERT test result (running)
     Test Pattern : All 1's, Status : Sync, Sync Detected : 1
     Interval : 14400 minute(s), Time Remain : 14400 minute(s)
     Bit Errors (since BERT started): 0 bits,
     Bits Received (since BERT started): 92 Mbits
     Bit Errors (since last sync): 0 bits
     Bits Received (since last sync): 92 Mbits

  T1 11
    Not configured.

  T1 12
    Not configured.

  T1 13
    Not configured.

  T1 14
    Not configured.
```

```
T1 15
  Not configured.

T1 16
  Not configured.

T1 17
  Not configured.

T1 18
  Not configured.

T1 19
  Not configured.

T1 20
  Not configured.

T1 21
  Not configured.

T1 22
  Not configured.

T1 23
  Not configured.

T1 24
  Not configured.

T1 25
  Not configured.

T1 26
  Not configured.

T1 27
  Not configured.

T1 28
  Not configured.
```

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 : 2^11, Status : Sync, Sync Detected : 1`	This line indicates the test pattern you selected for the test (2^11), 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".

Note Unless unframed is selected, the BER test runs over the currently configured framing option for the specified T1 line (SF or ESF). Before running a BER test, you should configure the framing option that is appropriate to your application. (Refer to the "Setting the Framing Format on a T1 Line" section on page 5-15.)

Terminating a BER Test

You can terminate a BER test with the **no t1** *t1-line-number* **bert** controller command, where: *t1-line-number* is 1 to 28.

Examples follow:

The following example terminates the BER test running on T1 line 10.

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

```
Router(config)# controller T3 1/0
Router(config-controller)# no t1 10 bert
```

To check your configurations using **show** commands, proceed to the "Checking the Configuration" section on page 5-25; otherwise, proceed to the "Performing a Basic Serial Interface Configuration" section on page 5-24.

Performing a Basic Serial Interface Configuration

Note The Cisco 7200 VXR Port Adapter Jacket Card requires no configuration. Configure a port adapter in it as you would any other port adapter.

Following are instructions for a basic configuration: enabling an interface and specifying IP routing. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration subcommands and the configuration options available for serial interfaces, refer to the appropriate software documentation.

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

```
Router# disable

Router>
```

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

```
Router# 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** subcommand, followed by the interface address of the interface you plan to configure. Table 5-3 provides an example.

Table 5-3 Examples of the interface serial Subcommand

Platform	Command	Example

Cisco 7200 VXR routers	**interface serial**, *port-adapter-slot/T3-port/T1-line-number*:*channel-group-number*	The example is for T3 port 0, T1 1, channel group 0 of a port adapter in port adapter slot 6.
		`Router(config)# interface serial 6/0/1:0`
		`Router(config-if)#`

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

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

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

Step 5 Re-enable the interfaces using the **no shutdown** command. (See the "Replacing an Existing Port Adapter" section on page 5-7.)

Step 6 Configure all additional port adapter interfaces as required.

Step 7 After including all of the configuration subcommands to complete your configuration, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.

Step 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, page 5-25
- Using the ping Command to Verify Network Connectivity, page 5-34
- Using loopback Commands to Troubleshoot Network Problems, page 5-34

Using show Commands to Verify the New Interface Status

Table 5-4 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the PA-MC-T3-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 5-4 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`

Table 5-4 Using show Commands (continued)

Command	Function	Example
show interfaces *type port-adapter-slot-number/ T3-port-/T1-line-number*: *channel-group number*	Displays status information about a specific type of interface (for example, serial) in a Cisco 7200 VXR router	`Router# show interfaces serial 1/0/2:0`
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 5-26
- Using the show diag Command, page 5-28
- Using the show interfaces Command, page 5-28
- Using the show controllers Command, page 5-29

Choose the subsection appropriate for your system. Proceed to the "Using the ping Command to Verify Network Connectivity" section on page 5-34 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. Following are examples for some of the supported platforms.

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

Following is an example of the **show version** command from a Cisco 7200 VXR router (with an NPE-G2) with the PA-MC-T3-EC:

```
Router# show version

Cisco IOS Software, 7200 Software (C7200-JS-M), Experimental Version 12.4(20060505:140248)
[sprafull-CJ-G2 102]
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Fri 05-May-06 20:21 by

ROM: System Bootstrap, Version 12.4(4r)XD3, RELEASE SOFTWARE (fc1)

reg2 uptime is 14 hours, 35 minutes
System returned to ROM by reload at 07:19:23 UTC Sun Jan 16 2000
System image file is "disk2:c7200p-js-mz.CJ_DTHO_20060505"
```

```
Last reload reason: Reload Command


Cisco 7206VXR (NPE-G2) processor (revision B) with 917504K/65536K bytes of memory.
Processor board ID 34149641
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 660 bandwidth points.
The set of PA-2FE, PA-POS-2OC3, and I/O-2FE qualify for "half
bandwidth points" consideration, when full bandwidth point counting
results in oversubscription, under the condition that only one of the
two ports is used. With this adjustment, current configuration on bus
mb1 has a total of 660 bandwidth points.
This configuration has oversubscripted the PCI bus and is not a
supported configuration.

PCI bus mb2 (Slots 2, 4 and 6) has a capacity of 600 bandwidth points.
Current configuration on bus mb2 has a total of 960 bandwidth points.
The set of PA-2FE, PA-POS-2OC3, and I/O-2FE qualify for "half
bandwidth points" consideration, when full bandwidth point counting
results in oversubscription, under the condition that only one of the
two ports is used. With this adjustment, current configuration on bus
mb2 has a total of 660 bandwidth points.
This configuration has oversubscripted the PCI bus and is not a
supported configuration.

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.

WARNING: PCI bus mb1 Exceeds 600 bandwidth points
WARNING: PCI bus mb2 Exceeds 600 bandwidth points

3 FastEthernet interfaces
3 Gigabit Ethernet interfaces
56 Serial interfaces
2 Packet over SONET interfaces
8 Channelized T3 ports
2045K bytes of NVRAM.

250880K bytes of ATA PCMCIA card at slot 2 (Sector size 512 bytes).
65536K bytes of Flash internal SIMM (Sector size 512K).
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 (with an NPE-G1 or NPE-G2).

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-MC-T3-EC in port adapter slot 2 of a Cisco 7200 VXR router with an NPE-G1 or NPE-G2.

```
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
```

Using the show interfaces Command

The **show interfaces** command displays status information (including the physical slot and interface address) for the interfaces you specify. Following is an example that specifies serial interfaces.

For complete descriptions of interface subcommands 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 for a Cisco 7200 VXR router. In this example, the port adapter is in slot 1 of a Cisco 7200 VXR router with an NPE-G1 or NPE-G2.

```
Router# show interfaces serial 1/0/1:0
Serial 1/0/1:0 is up, line protocol is up
  Hardware is PA-MC-2T3E
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Last input 00:00:08, output 03:29:07, output hang never
  Last clearing of "show interface" counters 01:08:09
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/1/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1152 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     73 packets input, 22338 bytes, 0 no buffer
     Received 71 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     70 packets output, 19838 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions

(additional displayed text not shown)
```

Using the show controllers Command

You can display information for all T1 lines within a PA-MC-T3-EC with the **show controllers T3** *slot/port-adapter/port* [**brief | tabular | remote performance**] command where:

- **brief** displays a list of configurations only.
- **tabular** displays a list of configurations and MIB data in a tabular format.
- **remote performance** displays a list of performance data from the remote end of a T1 connection.

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

You can also display brief configuration information or tabular configuration and MIB information about a specific T1 line within a PA-MC-T3-EC with the**show controllers T3** *slot/port-adapter/t3-port/t1-line-number* [**brief | tabular | remote performance**] command where:

- *t1-line-number* is 1 to 28.
- **brief** displays a list of configurations only.
- **tabular** displays a list of configurations and MIB data in a tabular format.
- **remote performance** displays performance data from the remote T1 equipment.

The syntax is as follows:

- **show controllers T3** *chassis-slot/t3-port* **brief**

- **show controllers T3** *chassis-slot/t3-port* **tabular**
- **show controllers T3** *chassis-slot/t3-port* **remote performance**

Examples of these **show controllers T3** commands for Cisco 7200 VXR routers are shown below.

The **show controllers** command with no arguments displays information about every controller and interface in the router. Use the **show controllers T3** command to display information about the PA-MC-T3-EC port adapter:

```
Router# show controllers T3
T3 1/0 is up.
  Applique type is Channelized T3
  No alarms detected.
  Framing is M23, Line Code is B3ZS, Clock Source is Internal
  Equipment customer loopback
  Data in current interval (77 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  Total Data (last 50 15 minute intervals):
     0 Line Code Violations, 0 P-bit Coding Violation,
     0 C-bit Coding Violation, 0 P-bit Err Secs,
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
     0 Unavailable Secs, 0 Line Errored Secs,
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs

  T1 1 is up
  timeslots: 1-24
  FDL per AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Internal
  Data in current interval (77 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
     0 Unavail Secs, 0 Stuffed Secs
  Total Data (last 50 15 minute intervals):
     0 Line Code Violations,0 Path Code Violations,
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
     0 Unavail Secs, 0 Stuffed Secs

(additional displayed text not shown)
```

Using the show controllers T3 brief Command

The following example of the **show controllers T3** *chassis-slot/t3-port* **brief** command output displays a list of configurations only.

```
Router# show controllers T3 2/0 brief
T3 2/0 is up.
  Applique type is Channelized T3
  No alarms detected.
  Framing is M23, Line Code is B3ZS, Clock Source is Internal
  Equipment customer loopback

  T1 1 is up
  timeslots: 1-24
  FDL per ANSI T1.403 and AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Internal
```

```
T1 2 is up
  timeslots: 1-24
  FDL per ANSI T1.403 and AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Internal

  T1 3 is up
  timeslots: 1-24
  FDL per ANSI T1.403 and AT&T 54016 spec.
  No alarms detected.
  Framing is ESF, Clock Source is Internal
(additional displayed text not shown)
```

Using the show controllers T3 tabular Command

The following example of the **show controllers T3** *chassis-slot/t3-port* **tabular** command output displays a list of configurations and MIB data in a tabular format.

```
Router# show controllers T3 2/0 tabular
T3 2/0 is up.
  Applique type is Channelized T3
  No alarms detected.
  Framing is M23, Line Code is B3ZS, Clock Source is Internal
  Equipment customer loopback
  INTERVAL      LCV   PCV   CCV   PES  PSES  SEFS   UAS   LES   CES  CSES
  22:30-22:34     0     0     0     0     0     0     0     0     0     0
  22:15-22:30     0     0     0     0     0     0     0     0     0     0
  22:00-22:15     0     0     0     0     0     0     0     0     0     0
  21:45-22:00     0     0     0     0     0     0     0     0     0     0
  21:30-21:45     0     0     0     0     0     0     0     0     0     0
  21:15-21:30     0     0     0     0     0     0     0     0     0     0
  21:00-21:15     0     0     0     0     0     0     0     0     0     0
  20:45-21:00     0     0     0     0     0     0     0     0     0     0
  20:30-20:45     0     0     0     0     0     0     0     0     0     0
  20:15-20:30     0     0     0     0     0     0     0     0     0     0
  20:00-20:15     0     0     0     0     0     0     0     0     0     0
  19:45-20:00     0     0     0     0     0     0     0     0     0     0
  19:30-19:45     0     0     0     0     0     0     0     0     0     0
  19:15-19:30     0     0     0     0     0     0     0     0     0     0
  19:00-19:15     0     0     0     0     0     0     0     0     0     0
  18:45-19:00     0     0     0     0     0     0     0     0     0     0
  18:30-18:45     0     0     0     0     0     0     0     0     0     0
  18:15-18:30     0     0     0     0     0     0     0     0     0     0
  18:00-18:15     0     0     0     0     0     0     0     0     0     0
  17:45-18:00     0     0     0     0     0     0     0     0     0     0
  17:30-17:45     0     0     0     0     0     0     0     0     0     0
  17:15-17:30     0     0     0     0     0     0     0     0     0     0
  17:00-17:15     0     0     0     0     0     0     0     0     0     0
  16:45-17:00     0     0     0     0     0     0     0     0     0     0
  16:30-16:45     0     0     0     0     0     0     0     0     0     0
  16:15-16:30     0     0     0     0     0     0     0     0     0     0
  16:00-16:15     0     0     0     0     0     0     0     0     0     0
  15:45-16:00     0     0     0     0     0     0     0     0     0     0
  15:30-15:45     0     0     0     0     0     0     0     0     0     0
  15:15-15:30     0     0     0     0     0     0     0     0     0     0
  15:00-15:15     0     0     0     0     0     0     0     0     0     0
  14:45-15:00     0     0     0     0     0     0     0     0     0     0
  14:30-14:45     0     0     0     0     0     0     0     0     0     0
  14:15-14:30     0     0     0     0     0     0     0     0     0     0
  14:00-14:15     0     0     0     0     0     0     0     0     0     0
  13:45-14:00     0     0     0     0     0     0     0     0     0     0
  13:30-13:45     0     0     0     0     0     0     0     0     0     0
```

```
13:15-13:30     0     0     0     0     0     0     0     0     0     0
13:00-13:15     0     0     0     0     0     0     0     0     0     0
12:45-13:00     0     0     0     0     0     0     0     0     0     0
12:30-12:45     0     0     0     0     0     0     0     0     0     0
12:15-12:30     0     0     0     0     0     0     0     0     0     0
12:00-12:15     0     0     0     0     0     0     0     0     0     0
11:45-12:00     0     0     0     0     0     0     0     0     0     0
11:30-11:45     0     0     0     0     0     0     0     0     0     0
11:15-11:30     0     0     0     0     0     0     0     0     0     0
11:00-11:15     0     0     0     0     0     0     0     0     0     0
10:45-11:00     0     0     0     0     0     0     0     0     0     0
10:30-10:45     0     0     0     0     0     0     0     0     0     0
10:15-10:30     0     0     0     0     0     0     0     0     0     0
10:00-10:15     0     0     0     0     0     0     0     0     0     0
09:45-10:00     0     0     0     0     0     0     0     0     0     0
09:30-09:45     0     0     0     0     0     0     0     0     0     0
Total           0     0     0     0     0     0     0     0     0     0

T1 1 is up
timeslots: 1-24
FDL per ANSI T1.403 and AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
INTERVAL      LCV    PCV    CSS   SELS    LES     DM     ES    BES    SES    UAS     SS
22:30-22:34     0      0      0      0      0      0      0      0      0      0      0
22:15-22:30     0      0      0      0      0      0      0      0      0      0      0
22:00-22:15     0      0      0      0      0      0      0      0      0      0      0
21:45-22:00     0      0      0      0      0      0      0      0      0      0      0
21:30-21:45     0      0      0      0      0      0      0      0      0      0      0
21:15-21:30     0      0      0      0      0      0      0      0      0      0      0
21:00-21:15     0      0      0      0      0      0      0      0      0      0      0
20:45-21:00     0      0      0      0      0      0      0      0      0      0      0
20:30-20:45     0      0      0      0      0      0      0      0      0      0      0
20:15-20:30     0      0      0      0      0      0      0      0      0      0      0
20:00-20:15     0      0      0      0      0      0      0      0      0      0      0
19:45-20:00     0      0      0      0      0      0      0      0      0      0      0
19:30-19:45     0      0      0      0      0      0      0      0      0      0      0
19:15-19:30     0      0      0      0      0      0      0      0      0      0      0
19:00-19:15     0      0      0      0      0      0      0      0      0      0      0
18:45-19:00     0      0      0      0      0      0      0      0      0      0      0
18:30-18:45     0      0      0      0      0      0      0      0      0      0      0
18:15-18:30     0      0      0      0      0      0      0      0      0      0      0
18:00-18:15     0      0      0      0      0      0      0      0      0      0      0
17:45-18:00     0      0      0      0      0      0      0      0      0      0      0
17:30-17:45     0      0      0      0      0      0      0      0      0      0      0
17:15-17:30     0      0      0      0      0      0      0      0      0      0      0
17:00-17:15     0      0      0      0      0      0      0      0      0      0      0
16:45-17:00     0      0      0      0      0      0      0      0      0      0      0
16:30-16:45     0      0      0      0      0      0      0      0      0      0      0
16:15-16:30     0      0      0      0      0      0      0      0      0      0      0
16:00-16:15     0      0      0      0      0      0      0      0      0      0      0
15:45-16:00     0      0      0      0      0      0      0      0      0      0      0
15:30-15:45     0      0      0      0      0      0      0      0      0      0      0
15:15-15:30     0      0      0      0      0      0      0      0      0      0      0
15:00-15:15     0      0      0      0      0      0      0      0      0      0      0
14:45-15:00     0      0      0      0      0      0      0      0      0      0      0
14:30-14:45     0      0      0      0      0      0      0      0      0      0      0
14:15-14:30     0      0      0      0      0      0      0      0      0      0      0
14:00-14:15     0      0      0      0      0      0      0      0      0      0      0
13:45-14:00     0      0      0      0      0      0      0      0      0      0      0
13:30-13:45     0      0      0      0      0      0      0      0      0      0      0
13:15-13:30     0      0      0      0      0      0      0      0      0      0      0
13:00-13:15     0      0      0      0      0      0      0      0      0      0      0
12:45-13:00     0      0      0      0      0      0      0      0      0      0      0
```

```
  12:30-12:45     0     0     0     0     0     0     0     0     0     0     0
  12:15-12:30     0     0     0     0     0     0     0     0     0     0     0
  12:00-12:15     0     0     0     0     0     0     0     0     0     0     0
  11:45-12:00     0     0     0     0     0     0     0     0     0     0     0
  11:30-11:45     0     0     0     0     0     0     0     0     0     0     0
  11:15-11:30     0     0     0     0     0     0     0     0     0     0     0
  11:00-11:15     0     0     0     0     0     0     0     0     0     0     0
  10:45-11:00     0     0     0     0     0     0     0     0     0     0     0
  10:30-10:45     0     0     0     0     0     0     0     0     0     0     0
  10:15-10:30     0     0     0     0     0     0     0     0     0     0     0
  10:00-10:15     0     0     0     0     0     0     0     0     0     0     0
  09:45-10:00     0     0     0     0     0     0     0     0     0     0     0
  09:30-09:45     0     0     0     0     0     0     0     0     0     0     0
  Total           0     0     0     0     0     0     0     0     0     0     0

(additional displayed text not shown)
```

Note The PA-MC-T3-EC does not support slip buffers and always reports local controlled slip seconds (CSS) as 0.

Note To enable and display remote performance reports, see the "Setting the FDL Configuration for a T1 Line" section on page 5-16, and the "Using the show controllers T3 remote performance Command" section on page 5-33.

Using the show controllers T3 remote performance Command

Use the **show controllers T3** *chassis-slot/t3-port* **remote performance** command to display performance data from the remote T1 equipment.

```
Router# show controllers T3 2/0 remote performance

T3 2/0 is up.
T1 1 - Remote Performance Data
Data in current interval (273 seconds elapsed):
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
0 Unavail Secs

T1 2 - Remote Performance Data
Data in current interval (5 seconds elapsed):
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
5 Unavail Secs

T1 3 - Remote Performance Data
Data in current interval (4 seconds elapsed):
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
4 Unavail Secs

(additional displayed text not shown)
```

Note If you do not first enable remote performance data with the **t1** *t1-line-number* **fdl ansi** command, the following message is displayed:

```
T1 1 - Remote Performance Data (Not available)
```

Note Although the PA-MC-T3-EC does not support local controlled slip seconds (CSS), remote T1 equipment may report CSS values in the remote performance reports.

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.

Using loopback Commands to Troubleshoot Network Problems

If you have difficulty with the PA-MC-T3-EC configuration or installation, you can troubleshoot the port adapter using the **loopback** command. Refer to the "Configuring Loopback Mode for the T3 Controller" section on page 5-12 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-MC-T3-EC in local loopback using the **loop 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-MC-T3-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-MC-T3-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 a problem exists for: the T3 link to the remote site, the remote server , the DSU configuration, or the hardware.