CISCO SYSTEMS

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Channelized T1 Port Adapter Installation and Configuration

Product Number: PA-2CT1/PRI(=)

This configuration note describes how to install and configure the channelized T1 Integrated Services Digital Network (ISDN) Primary Rate Interface (PRI) port adapter (PA-2CT1/PRI), hereafter referred to as the 2CT1 port adapter, in the following platforms:

- Cisco 7200 series routers—which consist of the two-slot Cisco 7202, the four-slot Cisco 7204 and Cisco 7204VXR, and the six-slot Cisco 7206 and Cisco 7206VXR

- Second-generation Versatile Interface Processor (VIP2) in all Cisco 7000 series routers and Cisco 7500 series routers using the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI) installed

Document Contents

This configuration note is organized into three parts:

1 The following sections include general information and information about port adapter installation:

2 The following section includes information specific to the 2CT1 port adapter:

3 The following sections include information specific to the 2CT1 port adapter's use on the VIP2 in Cisco 7500 series routers and in Cisco 7000 series routers using the RSP7000 and RSP7000CI, and in Cisco 7200 series routers:

The "Cisco Connection Online" section on page 52 includes general reference information.

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Related Documentation

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

- For Cisco IOS software 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.

- For hardware installation and maintenance information on Cisco 7200 routers, refer to the *Cisco 7200 Series Installation and Configuration Guide* that shipped with your Cisco 7200 series router.

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

- For port adapter hardware and memory configuration guidelines for Cisco 7200 series routers, refer to the document *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.

- For international agency compliance, safety, and statutory information for interfaces for Cisco 7000 series routers, Cisco 7200 series routers, and Cisco 7500 series routers, refer to the following publications:

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

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

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

- For hardware installation and maintenance information on Cisco 7000 series and Cisco 7500 series routers, and the VIP2, refer to the following publications:

  — The installation and configuration guide that shipped with your Cisco 7000 series or Cisco 7500 series router

  — *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (for VIP2 users only)

To view Cisco documentation or obtain general information about the documentation, see the "Cisco Connection Online" section on page 52, the "Documentation CD-ROM" section on page 53, or call Customer Service at 800 553-6387 or 408 526-7208. Customer Service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding company holidays). You can also send e-mail to cs-rep@cisco.com, refer to the *Cisco Information Packet* that shipped with your router.

Port Adapter Installation Prerequisites

This section provides software and hardware requirements, a list of parts and tools you will need to perform the port adapter installation, and safety and electrostatic discharge prevention guidelines to help you avoid injury and damage to the equipment during installation. Also included is information on the systems in which port adapters can be installed and overview information on interface specifications.

The following sections discuss general information and information about port adapter installation requirements:

- Software and Hardware Requirements, page 3
- List of Parts and Tools, page 4
- Safety Guidelines, page 4

Software and Hardware Requirements

Table 1 lists the recommended minimum Cisco IOS software release required to use the 2CT1 port adapter in supported router platforms.

Table 1   PA-2CT1 Software Requirements

Router Platform	Recommended Minimum Cisco IOS Release
Cisco 7000 series and Cisco 7500 series	
• With VIP2-40(=)	Cisco IOS Release 11.1(10)CA or a later release of Cisco IOS Release 11.1 CA
• With VIP2-50(=)	Cisco IOS Release 11.1(14)CA or a later release of Cisco IOS Release 11.1 CA
Cisco 7200 series	
• Cisco 7204 and Cisco 7206	Cisco IOS Release 11.1(9)CA1 or a later release of Cisco IOS Release 11.1 CA
• Cisco 7202	Cisco IOS Release 11.1(19)CC1 or a later release of Cisco IOS Release 11.1 CC Cisco IOS Release 11.3(4)AA or a later release of Cisco IOS Release 11.3 AA

Note   The 2CT1 port adapter is not supported in Cisco 7200 VXR routers. The following error message is displayed if a 2CT1 port adapter is installed in a Cisco 7200 VXR router:

```
PA-3-NOTSUPPORTED: PA in slot1 (Channelized T1) is not supported on this chassis
```

2CT1 port adapters can be used in the second-generation Versatile Interface Processor (VIP2) in all Cisco 7500 series routers and Cisco 7000 series routers that use the RSP7000 and RSP7000CI, and in Cisco 7200 series routers.

2CT1 port adapters can be installed in port adapter slot 0 or slot 1 on the VIP2 motherboard, or in any available port adapter slot in Cisco 7200 series chassis.

Cisco 7000, Cisco 7500, and Cisco 7200 series routers support up to five installed 2CT1 port adapters that are running ISDN PRI (ten T1 ports total, including T1 ports on MultiChannel Interface Processors installed in Cisco 7000 series or Cisco 7500 series routers). There are no such limitations when installed 2CT1 port adapters are running channelized T1.

The specific VIP2 models recommended for the 2CT1 port adapters are VIP2-40(=), which has 2 MB of SRAM and 32 MB of DRAM, and VIP2-50(=), which has 4 to 8 MB of SRAM and 32 to 128 MB of SDRAM. The VIP2-40 and VIP2-50 support two installed 2CT1 port adapters that are running ISDN PRI with distributed services or channelized T1 with distributed switching or

distributed services. The VIP2-20(=), which has 1 MB of SRAM and 16 MB of DRAM, supports two installed 2CT1 port adapters that are running ISDN PRI or channelized T1 with distributed switching. The VIP2-15(=), which has 1 MB of SRAM and 8 MB of DRAM, supports one installed 2CT1 port adapter that is running ISDN PRI or channelized T1 without distributed switching.

Cisco 7200 series routers require a minimum of 32 MB of DRAM to support up to five installed 2CT1 port adapters that are running ISDN PRI or channelized T1.

For port adapter hardware and memory configuration guidelines for the Cisco 7200 series routers, refer to the document *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines.*

List of Parts and Tools

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

- PA-2CT1/PRI(=), 2CT1 port adapter.

- Your own external CSUs (channel service units).

- VIP2 (for installation in a Cisco 7000 or Cisco 7500 series chassis only). (For specific VIP2 models that support the 2CT1 port adapter, see the "Software and Hardware Requirements" section on page 3.)

- T1 interface cables (see the "2CT1 Port Adapter Cables and Pinouts" section on page 11.)

- Number 1 Phillips and a 3/16-inch, flat-blade screwdriver.

- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares.

Safety Guidelines

Following are safety guidelines that you should observe when working with any equipment that connects to electrical power or telephone wiring.

Safety Warnings

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

Warning   This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.

Waarschuwing 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 standaard maatregelen om ongelukken te voorkomen. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het document *Regulatory Compliance and Safety Information* (Informatie over naleving van veiligheids- en andere voorschriften) raadplegen dat bij dit toestel is ingesloten.

Varoitus Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä julkaisussa esiintyvien varoitusten käännökset löydät laitteen mukana olevasta *Regulatory Compliance and Safety Information* -kirjasesta (määräysten noudattaminen ja tietoa turvallisuudesta).

Attention Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez le document *Regulatory Compliance and Safety Information* (Conformité aux règlements et consignes de sécurité) qui accompagne cet appareil.

Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument *Regulatory Compliance and Safety Information* (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento *Regulatory Compliance and Safety Information* (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i dokumentet *Regulatory Compliance and Safety Information* (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. Para ver as traduções dos avisos que constam desta publicação, consulte o documento *Regulatory Compliance and Safety Information* (Informação de Segurança e Disposições Reguladoras) que acompanha este dispositivo.

¡Advertencia! Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. Para ver una traducción de las advertencias que aparecen en esta publicación, consultar el documento titulado *Regulatory Compliance and Safety Information* (Información sobre seguridad y conformidad con las disposiciones reglamentarias) que se acompaña con este dispositivo.

Varning! Denna varningssymbol 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 vanligt förfarande för att förebygga skador. Se förklaringar av de varningar som förkommer i denna publikation i dokumentet *Regulatory Compliance and Safety Information* (Efterrättelse av föreskrifter och säkerhetsinformation), vilket medföljer denna anordning.

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 and never assume that power has been disconnected from a circuit; always check.

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

Telephone Wiring Guidelines

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

- Never install telephone wiring during a lightning storm.

- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.

- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.

- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

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

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.

- Connect the equipment end of the strap to an unfinished chassis surface.

- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help to ensure that bus connectors are properly seated.

- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.

- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.

- Place a removed component board-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.

- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components from ESD voltages on the body; ESD voltages on clothing can still cause damage.

- Never attempt to remove the printed circuit board from the metal carrier.

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

What Is the 2CT1 Port Adapter?

The following sections discuss information specific to the 2CT1 port adapter locations, LEDs, and cables:

- Port Adapter Locations on the VIP2 and in Cisco 7200 Series Routers, page 8
- 2CT1 Port Adapter LEDs, page 10
- 2CT1 Port Adapter Cables and Pinouts, page 11

The 2CT1 port adapter, shown in Figure 1, provides up to two channelized T1 ISDN PRI interfaces for connecting Cisco 7000 series routers to channel service units (CSUs). Each 2CT1 interface can transmit and receive data bidirectionally at the T1 rate of 1.544 megabits-per-second (Mbps).

Both 2CT1 interfaces connect to external networks through a single port that has a 15-pin, D-shell receptacle. Two standard serial cables, null-modem and straight-through, for use with the 2CT1 port adapter are available from Cisco Systems and other vendors.

> **Note**   While the VIP2 supports online insertion and removal (OIR), individual port adapters do not. To replace port adapters, you must first remove the VIP2 from the chassis, then replace port adapters as required.
>
> Cisco 7200 series routers support the OIR of all port adapter types.

Figure 1   **2CT1 Port Adapter (Faceplate View)**
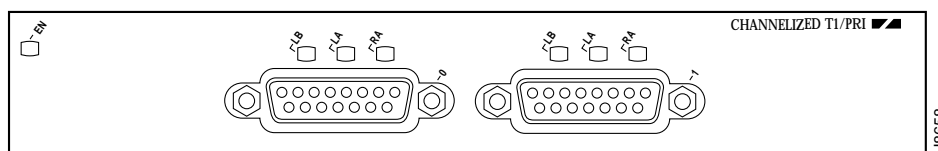
When running channelized T1, each 2CT1 interface can provide up to 24 T1 channel groups, which are numbered from 0 to 23. Each channel group provides up to 24, 64 kilobit-per-second (kbps) timeslots (DS0 channels), which are numbered 1 to 24. Multiple DS0 channels can be mapped to a single channel group. Each channel group is presented to the system as a serial interface that can be configured individually. Usable bandwidth for each channel group is calculated as n x 64 kbps, where n is a number of DS0 channels (1 to 24).

When running ISDN PRI, each 2CT1 interface provides 23 bearer (B) channels that can transmit and receive data at the rate of 64 kbps, full-duplex, and one data (D) channel that can transmit and receive data at the rate of 16 kbps, full-duplex. The B channels are used for transmitting user data. The D channel is used for call setup control and network connection teardown, and provides the communication from the router to the ISDN switch. The B and D channels are presented to the system as serial interfaces that support High-Level Data Link Control (HDLC) and Point-to-Point protocol (PPP) encapsulation. The 2CT1 port adapter supports dial-on-demand routing (DDR) when running ISDN PRI.

Port Adapter Locations on the VIP2 and in Cisco 7200 Series Routers

This section provides information about where you can install the 2CT1 port adapters on the VIP2 and in Cisco 7200 series routers.

Note   Port adapters have handles that allow for easy installation and removal; however, they are occasionally not shown in this publication to highlight port adapter faceplate detail.

Figure 2 shows a VIP2-15 or VIP2-50 with two installed port adapters. Figure 3 shows a VIP2-50 with two installed port adapters. With the VIP2 oriented as shown, the left port adapter is in port adapter slot 0, and the right port adapter is in port adapter slot 1.

Figure 2   **Two Port Adapters on the VIP2-15 or VIP2-40 (Horizontal Orientation Shown)**
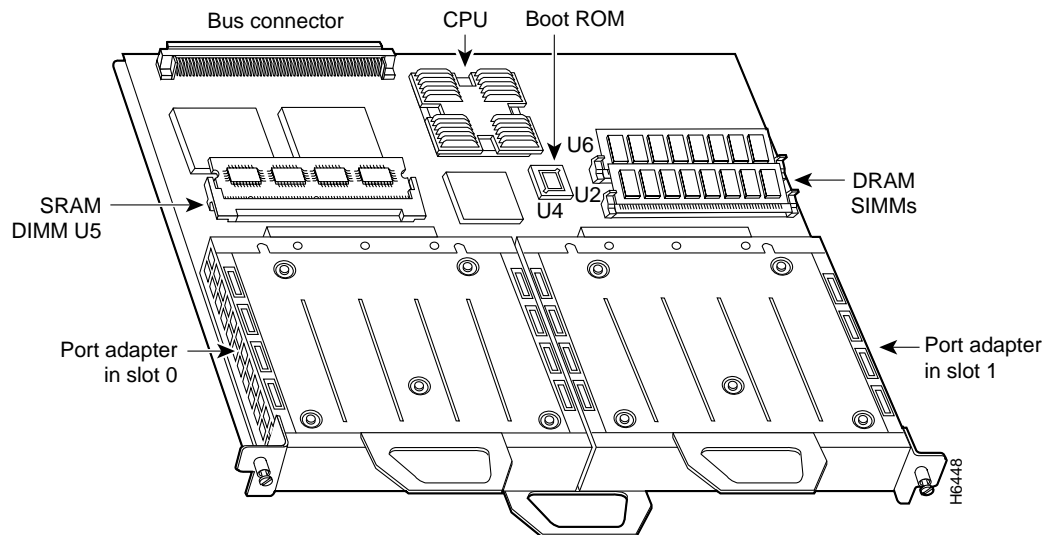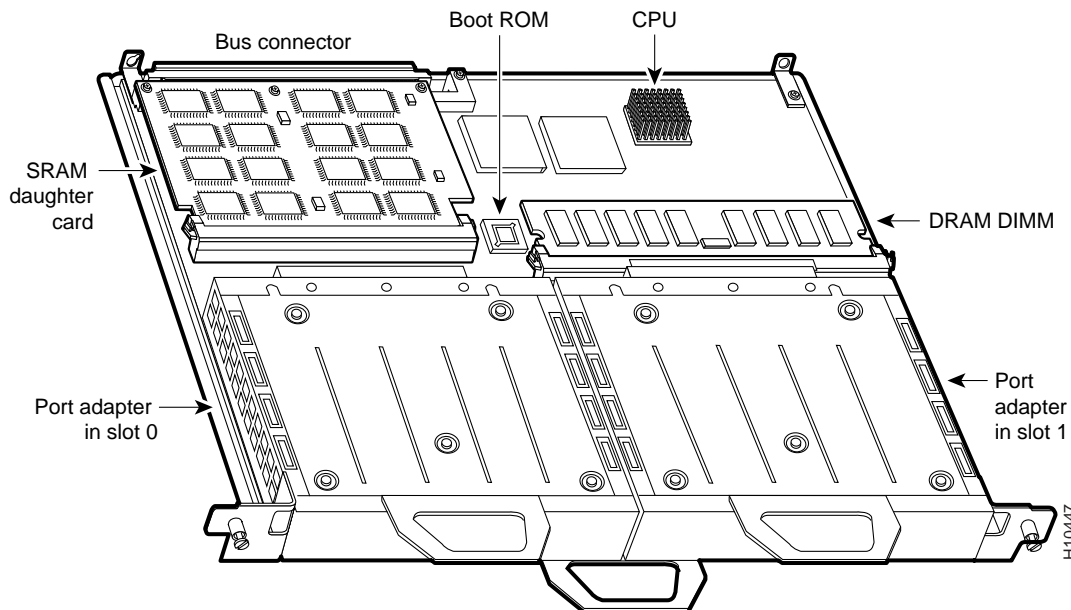
Figure 3   Two Port Adapters on a VIP2-50 (Horizontal Orientation Shown)


Note   In the Cisco 7000, Cisco 7507, and Cisco 7513 chassis, the VIP2 is installed vertically. In the Cisco 7010 and Cisco 7505 chassis, the VIP2 is installed horizontally.

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

Note   The I/O controller is available with or without a Fast Ethernet port. You can install both I/O controller types in all Cisco 7200 series routers; however, when you install an I/O controller with a Fast Ethernet port in a Cisco 7202, the system software automatically disables the port.

Figure 4 shows a Cisco 7206 with installed port adapters and an I/O controller with a Fast Ethernet port. Not shown are the Cisco 7202, which has two port adapter slots, the Cisco 7204 and Cisco 7204VXR, which have four port adapter slots, and the Cisco 7206VXR, which has six port adapter slots. The 2CT1 port adapter can be installed in any available port adapter slot in Cisco 7200 series routers.
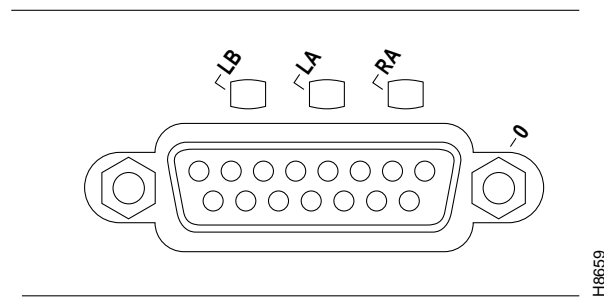
Figure 4   **Cisco 7200 Series Port Adapters (Cisco 7206 Shown)**
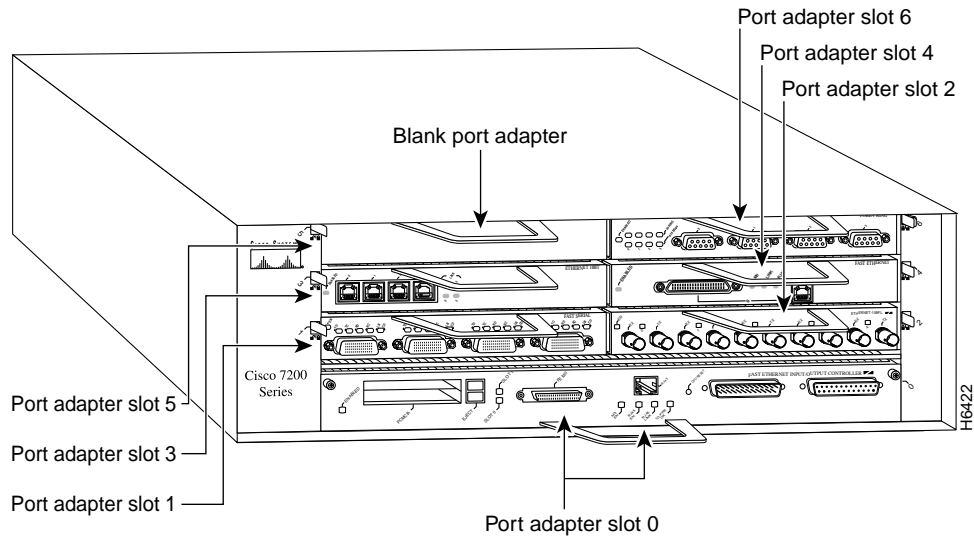
2CT1 Port Adapter LEDs

The 2CT1 port adapter has an enabled LED, standard on all port adapters, and three status LEDs for each port. (See Figure 5.)

Figure 5   **LEDs on the 2CT1 Port Adapter (Horizontal Orientation Shown)**

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

The following conditions must be met before the 2CT1 port adapter is enabled:

- The port adapter is correctly connected to the backplane or midplane and receiving power.
- A valid system software image for the port adapter has been downloaded successfully.
- The system software recognizes the port adapter or 2CT1-equipped VIP2.

If any of the above conditions are not met, or if the initialization fails for other reasons, the enabled LED will not go on. Table 2 lists port LED status indications.

Table 2   2CT1 Port LED Indications

Port LED	Status
LB (loopback)	This green LED comes on when the port is in loopback mode (line or local). The LED remains off during normal operation of the port adapter.
LA (local alarm)	This green LED comes on when the incoming signal from a remote source is out-of-frame (OOF), contains more than one errored second (ES) signal in a ten-second sampling period, or there is a loss of the incoming signal (LOS). The LED remains off during normal operation of the port adapter.
RA (remote alarm)	This green LED comes on when the remote source's incoming signal is OOF, contains more than one ES in a ten-second sampling period, or there is LOS. The LED remains off during normal operation of the port adapter.

2CT1 Port Adapter Cables and Pinouts

Two standard serial cables, null-modem and straight-through, for the 2CT1 port adapter are available from Cisco Systems and other vendors. Both cables have a 15-pin, D-shell (DB-15) connector at the router (VIP2 or Cisco 7200 series) end and at the network end. Figure 6 shows the 2CT1 interface cable, connectors, and pinouts.

Following are the product numbers for the 2CT1 interface cables:

- Null-modem cable—CAB-7KCT1NULL(=) or equivalent
- Straight-through cable—CAB-7KCT1DB15(=) or equivalent
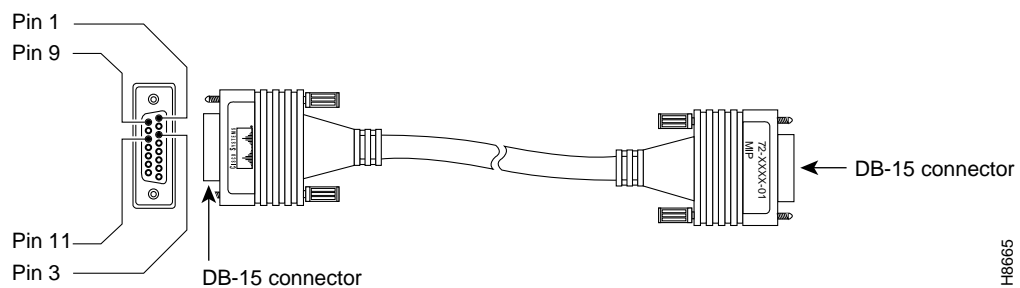
Figure 6   2CT1 Interface Cable

Table 3 lists connector pinouts for the 2CT1 null-modem cable, and Table 4 lists the connector pinouts for the 2CT1 straight-through cable.

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Table 3   2CT1 Null-Modem Interface Cable Pinouts

2CT1 End		Network End	
DB-15		DB-15	
Pin[1]	Signal	Pin	Signal
1	Transmit Tip	3	Receive Tip
3	Receive Tip	1	Transmit Tip
9	Transmit Ring	11	Receive Ring
11	Receive Ring	9	Transmit Ring

1   Any pins not described in the table are not connected.

Table 4   2CT1 Straight-Through Interface Cable Pinouts

2CT1 End		Network End	
DB-15		DB-15	
Pin[1]	Signal	Pin	Signal
1	Transmit Tip	1	Transmit Tip
3	Receive Tip	3	Receive Tip
9	Transmit Ring	9	Transmit Ring
11	Receive Ring	11	Receive Ring

1   Any pins not described in the table are not connected.

VIP2 and the 2CT1 Port Adapter

The following sections discuss information specific to the 2CT1 port adapter and its use on the VIP2 in Cisco 7000 series and Cisco 7500 series routers:

- Installing or Replacing a Port Adapter on a VIP2, page 14

- Attaching a 2CT1 Interface Cable, page 17

- Using the EXEC Command Interpreter, page 18

- Configuring 2CT1 Interfaces, page 18

  — Selecting Chassis Slot, Port Adapter, and Port Adapter Port Numbers, page 19

  — Shutting Down an Interface, page 20

  — Configuring Channelized T1 Interfaces, page 22

  — Configuring Channelized T1 ISDN PRI Interfaces, page 25

  — Checking the Configuration, page 28

The 2CT1 port adapter is used on the VIP2 and can be installed in port adapter slot 0 or port adapter slot 1. Figure 7 shows the 2CT1 port adapter installed on a VIP2-15 or VIP2-50 in port adapter slot 1.

Figure 7   **VIP2-15 or VIP2-40 with a 2CT1 Port Adapter in Port Adapter Slot 1**

Port adapter handles not shown
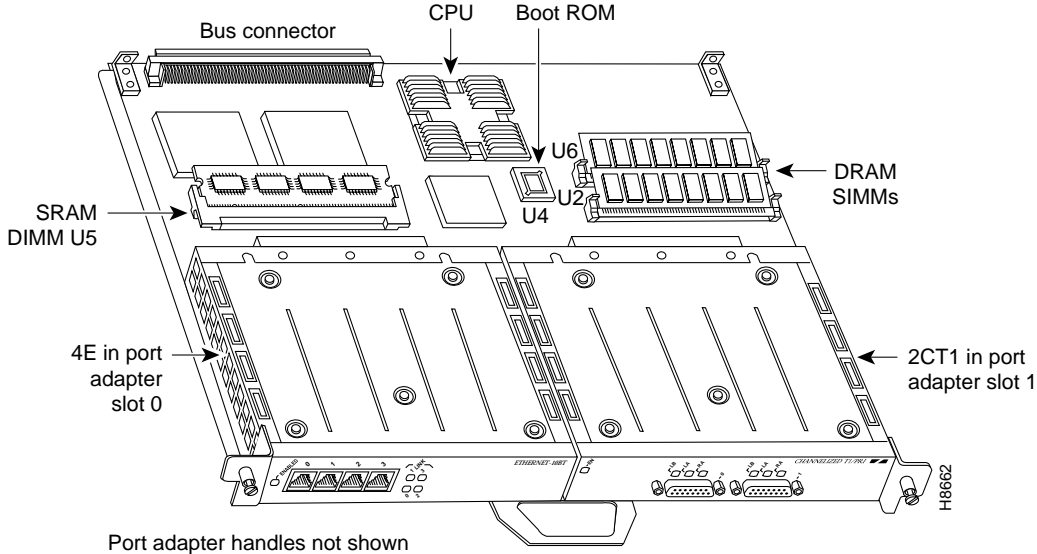
Note   Port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

Figure 8 shows two 2CT1 port adapters installed in port adapter slots 0 and 1, on a VIP2-50.

Figure 8   **VIP2-50 with Two 2CT1 Port Adapters in Port Adapter Slots 0 and 1**

Port adapter handles not shown

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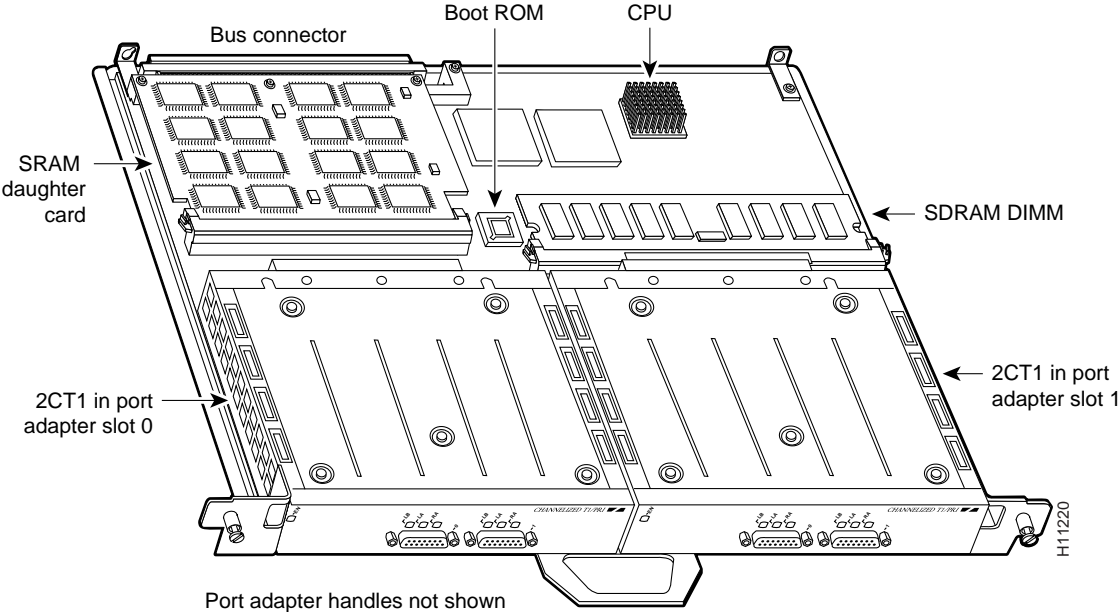
Installing or Replacing a Port Adapter on a VIP2

Depending on the circumstances, you might need to install a new port adapter on a VIP2 motherboard or replace a failed port adapter in the field. In either case, you need a number 1 Phillips screwdriver, an antistatic mat onto which you can place the removed interface processor, and an antistatic container into which you can place a failed port adapter for shipment back to the factory.

⚠️ **Caution** To prevent system problems, do not remove port adapters from the VIP2 motherboard, or attempt to install other port adapters on the VIP2 motherboard while the system is operating. To install or replace port adapters, first remove the VIP2 from its interface processor slot.


Note Each port adapter circuit board is mounted to a metal carrier and is sensitive to ESD damage. The following procedures should be performed by a Cisco-certified service provider only. While the VIP2 supports online insertion and removal (OIR), individual port adapters do not. To replace port adapters, you must first remove the VIP2 from the chassis, then install or replace port adapters as required. If a blank port adapter is installed on the VIP2 in which you want to install a new port adapter, you must first remove the VIP2 from the chassis, then remove the blank port adapter.

When only one port adapter is installed on a VIP2, a blank port adapter must fill the empty slot to allow the VIP2 and router chassis to conform to electromagnetic interference (EMI) emissions requirements, and to permit proper airflow through the chassis. If you plan to install a new port adapter, you must first remove the blank port adapter.

Use the following procedure to remove and replace any type of port adapter on the VIP2:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

Step 2 For a new port adapter installation or a port adapter replacement, disconnect any interface cables from the ports on the front of the port adapter. You can remove VIP2s with cables attached; however, we do not recommend it.

Step 3 To remove the VIP2 from the chassis, follow the steps in the section "Removing a VIP2" in the configuration note *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*, which shipped with your VIP2.

Step 4 Place the removed VIP2 on an antistatic mat.

Step 5 Locate the screw at the rear of the port adapter (or blank port adapter) to be replaced. (See Figure 9.) This screw secures the port adapter (or blank port adapter) to its slot.

Figure 9   Location of Port Adapter Screw (Partial Port Adapter View)
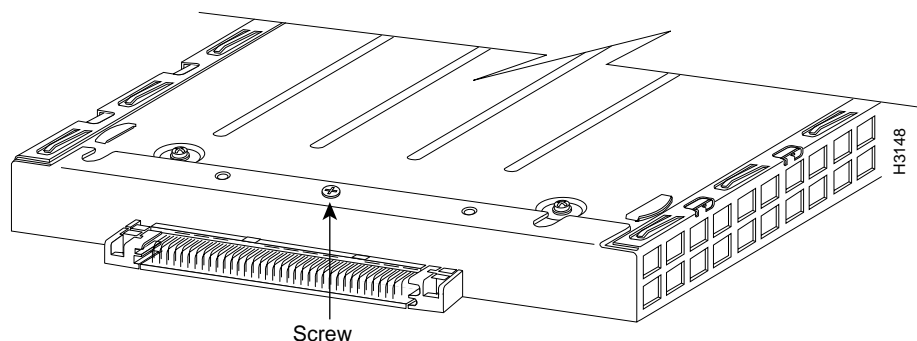
Screw

Step 6   Remove the screw that secures the port adapter (or blank port adapter).

Step 7   With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See Figure 10.)

**Figure 10**   **Pulling a Port Adapter Out of a Slot (Partial Port Adapter View)**
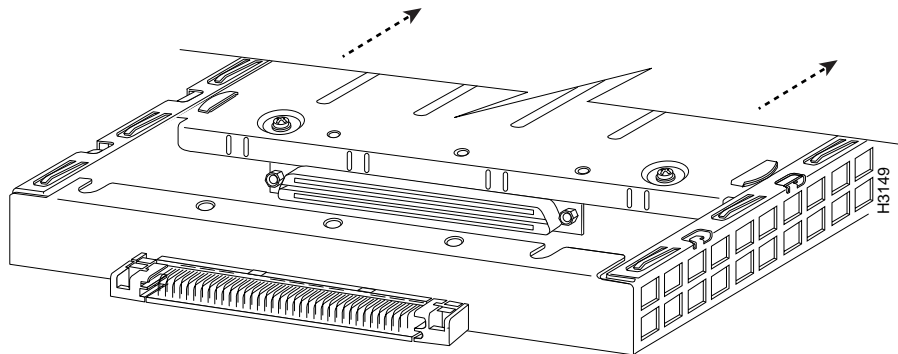
Step 8   If you removed a port adapter, place it in an antistatic container for safe storage or shipment back to the factory. If you removed a blank port adapter, no special handling is required; store the blank port adapter for potential future use.

Step 9   Remove the new port adapter from its antistatic container and position it at the opening of the slot. (See Figure 11.)

Caution   To prevent jamming the carrier between the upper and lower edges of the port adapter slot, and to ensure that the edge connector at the rear of the port adapter mates with the connector at the rear of the port adapter slot, make certain that the leading edges of the carrier are between the upper and lower slot edges, as shown in the cutaway in Figure 10.

Figure 11   **Installing a New Port Adapter**


Carrier

Upper edge

Lower edge
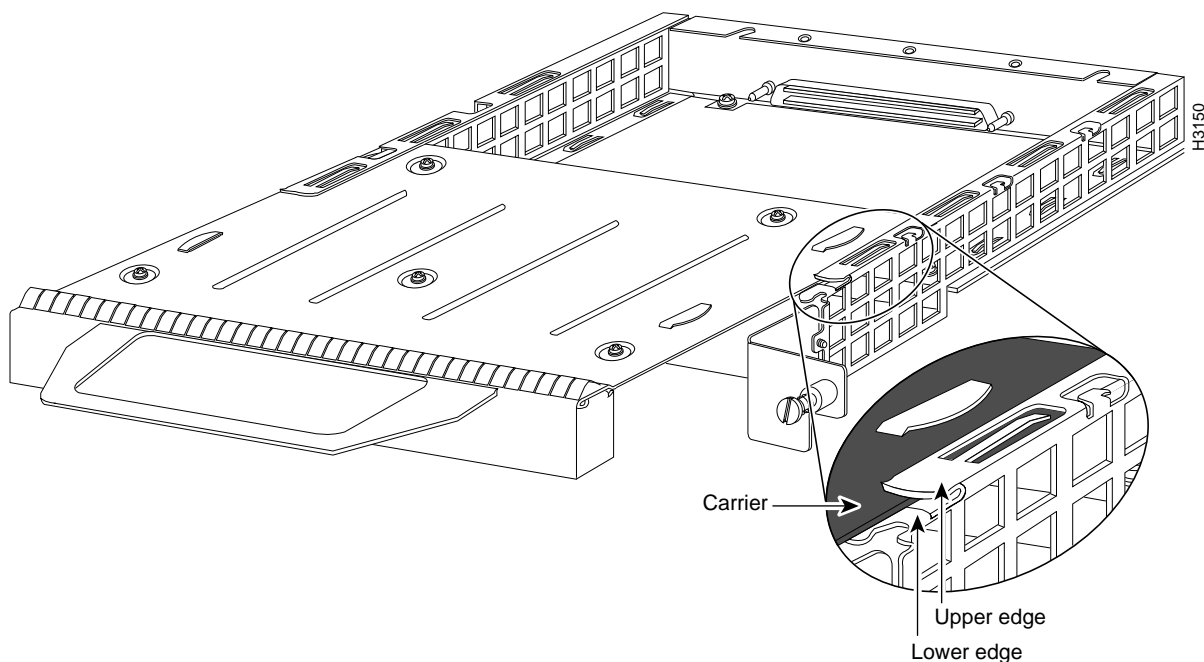
Step 10 Before you insert the new port adapter in its slot, verify that the port adapter carrier is between the upper and lower slot edges, as shown in Figure 10. Do not jam the carrier between the slot edges.

⚠ **Caution** To ensure a positive ground attachment between the port adapter carrier and the VIP2 motherboard and port adapter slot, and to ensure that the connectors at the rear of the port adapter and slot seat properly, make certain the carrier is between the upper and lower slot edges, as shown in Figure 11.

Step 11 Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely seated in the connector on the motherboard.

Figure 12   **Aligning the Carrier Edge with Upper and Lower Slot Edges (Partial View)**
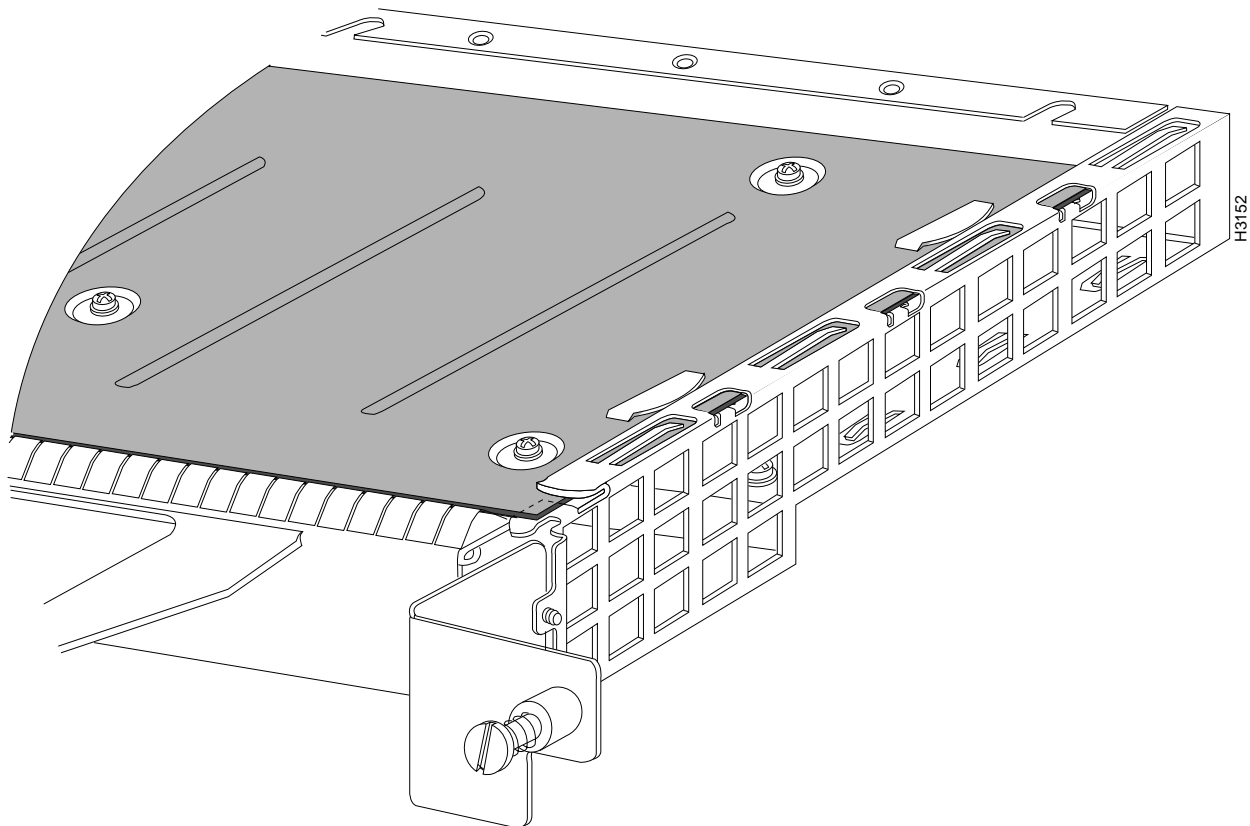
Step 12 Install the screw in the rear of the port adapter slot. (See Figure 9 for its location.) Do not overtighten this screw.

Step 13 To replace the VIP2 in the chassis, follow the steps in the section "Installing a VIP2" in the configuration note *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*, which shipped with your VIP2.

Step 14 Reconnect the interface cables to the interface processor.

This completes the procedure for installing a new port adapter or replacing a port adapter on a VIP2.
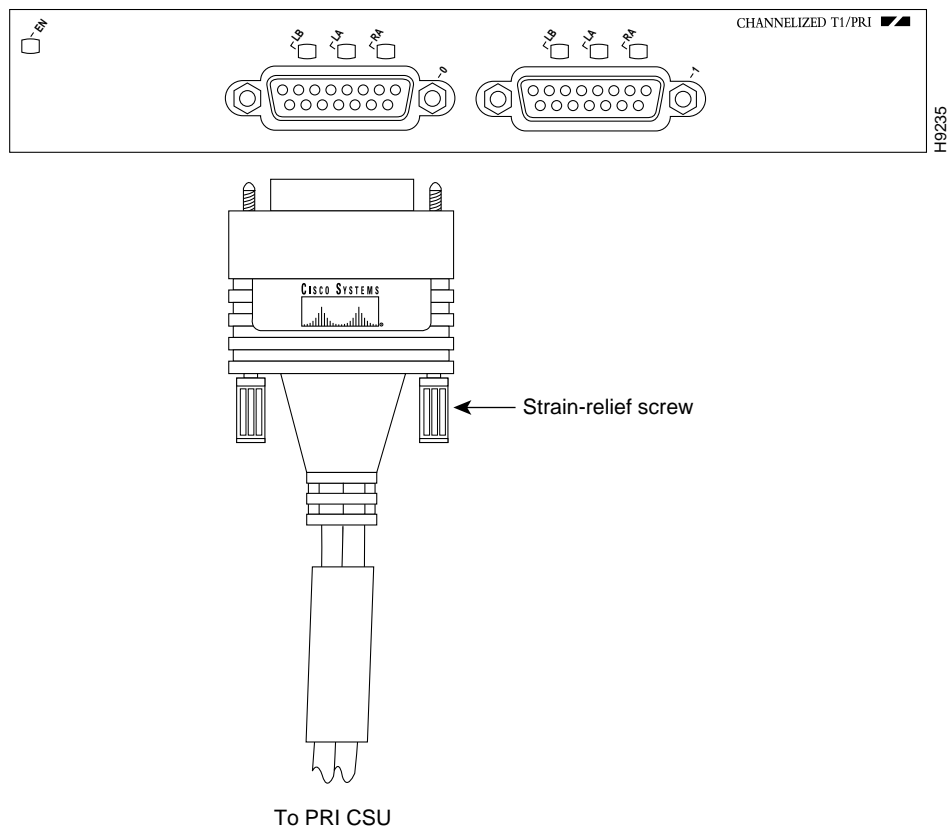
Attaching a 2CT1 Interface Cable

On a single 2CT1 port adapter, you can use up to two serial connections.

Use the following procedure to connect a 2CT1 interface cable:

Step 1   Attach the cable directly to the receptacle on the 2CT1 port adapter and tighten the strain-relief screws. (See Figure 13.)

Note   Port adapters have a handle attached, but this handle is not shown to allow a detailed view of each port adapter's faceplate.

Figure 13   **Connecting a 2CT1 Interface Cable (CT1 Port Adapter Front View—Shown without Handle)**

To PRI CSU

Step 2   Attach the network end of the cable to your Primary Rate Interface (PRI) channel service unit (CSU) and tighten the strain-relief screws.

This completes the procedure for attaching a 2CT1 interface cable.

Using the EXEC Command Interpreter

You modify the configuration of your router through the software command interpreter called the *EXEC*. 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 to 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 privileged-level passwords:

```
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#
```

Proceed to the following section to configure the new interfaces.

Configuring 2CT1 Interfaces

If you installed a new 2CT1-equipped VIP2 or if you want to change the configuration of an existing interface, you must use the privileged-level **configure** command. If you replaced a 2CT1 port adapter that was previously configured, the system will recognize the new 2CT1 port adapter interfaces and bring each of them up in their existing configuration.

After you verify that the new 2CT1 port adapter is installed correctly (the enabled LED goes on), use the **configure** command to configure the new interfaces. Be prepared with the information you will need, such as the following:

- ISDN switch type, when configuring ISDN PRI (Table 5 lists ISDN service provider switch types)

- T1 information, for example, clock source, line code, framing type, and so on

- Channel group and PRI group information and timeslot mapping

- Protocols and encapsulations you plan to use on the new interfaces

- Protocol specific information, such as IP addresses, if you plan to configure the interfaces for IP routing

- Whether the new interface will use bridging

Note   Configuration commands are executed from the privileged level of the EXEC command interpreter, which usually requires password access. See the previous section "Using the EXEC Command Interpreter" and contact your system administrator, if necessary, to obtain access.

Table 5   ISDN Service Provider Switch Types

Keywords by Area	Switch Type
Australia	
basic-ts013	Australian TS013 switches
Europe	
basic-1tr6	German 1TR6 ISDN switches
basic-nwnet3	Norwegian NET3 ISDN switches (phase 1)
basic-net3	NET3 ISDN switches (UK, Denmark, and other nations); covers the Euro-ISDN E-DSSI signaling system)
basic-net5	NET5 switches (UK and Europe)
primary-net5	European ISDN PRI switches (UK and Europe)
vn2	French VN2 ISDN switches
vn3	French VN3 ISDN switches
Japan	
ntt	Japanese NTT ISDN switches
primary-ntt	Japanese ISDN PRI switches
North America	
basic-5ess	AT&T basic rate switches
basic-dms100	NT DMS-100 basic rate switches
basic-ni1	National (North American) ISDN-1 switches
primary-4ess	AT&T 4ESS switch type for the U.S. (ISDN PRI only)
primary-5ess	AT&T 5ESS switch type for the U.S. (ISDN PRI only)
primary-dms100	NT DMS-100 switch type for the U.S. (ISDN PRI only)
New Zealand	
basic-nznet3	New Zealand NET3 switches

For complete descriptions of interface commands and the configuration options available for Cisco 7000 series and Cisco 7500 series-related interfaces, refer to the publications listed in the "Related Documentation" section on page 2.

Selecting Chassis Slot, Port Adapter, and Port Adapter Port Numbers

This section describes how to identify chassis slot, port adapter, and 2CT1 port adapter interface numbers.

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

In the router, physical port addresses specify the actual physical location of each interface port on the port adapter end. (See Figure 14.) This address is composed of a three-part number in the format *chassis slot number/port adapter number/interface port number.*

- The first number identifies the chassis slot in which the VIP2 is installed (as shown in the sample system in Figure 14).

- The second number identifies the physical port adapter number on the VIP2, and is either 0 or 1.

- The third number identifies the interface ports on each 2CT1 port adapter, which are always numbered in sequence as interface 0 through 1.

Interface ports on the 2CT1 port adapter maintain the same address regardless of whether other interface processors are installed or removed. However, when you move a VIP2 to a different slot, the first number in the address changes to reflect the new slot number.

Figure 14 shows some of the port adapter slots and interface ports of a sample Cisco 7505 system. For example, on the 2CT1-equipped VIP2 in chassis slot 3, the addresses for the interface ports are 3/1/0 through 3/1/1 (chassis slot 3, port adapter slot 1, and interface ports 0 through 1). If the port adapter was in port adapter slot 0, these same interface ports would be numbered 3/0/0 through 3/0/1.

The first port adapter slot number is always 0; the second port adapter slot number is always 1. The individual interface port numbers always begin with 0. The number of additional ports depends on the number of ports on a port adapter. Port adapters can occupy either port adapter slot; there are no restrictions.

Note If you remove the 2CT1-equipped VIP2 (shown in Figure 14) from chassis slot 3 and install it in chassis slot 2, the addresses of those same ports become 2/1/0 through 2/1/1.

Figure 14   Serial Interface Port Number Example (Cisco 7505 Shown)
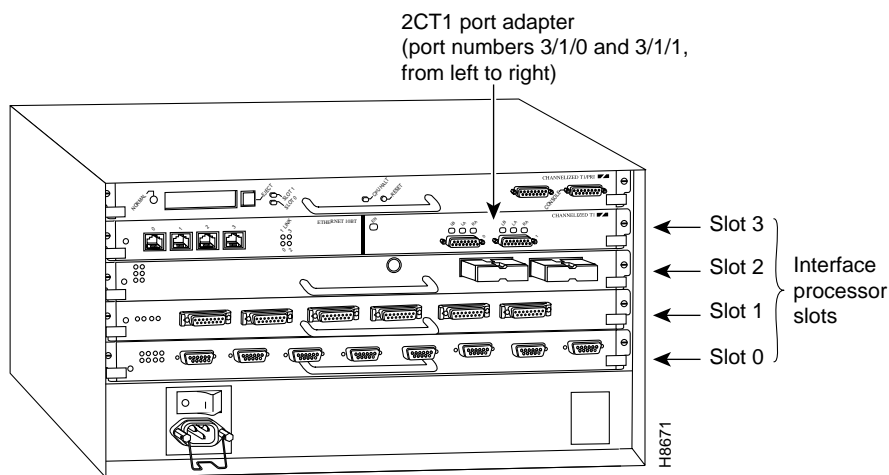
You can identify interface ports by physically checking the slot/port-adapter/interface port location on the back of the router or by using **show** commands to display information about a specific interface or all interfaces in the router.

Shutting Down an Interface

Before you replace an interface cable, replace port adapters, or remove an interface that you will not replace, use the **shutdown** command to shut down (disable) the interfaces. Doing so prevents anomalies from occurring when you reinstall the new or reconfigured VIP2. You can shut down all 24 interfaces of a controller by specifying the controller before issuing the **shutdown** command. You can shut down individual interfaces of a controller by specifying the channel group or PRI group assigned to each controller (channel groups and PRI groups are treated as serial interfaces by the system). 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. (See the ""Using the EXEC Command Interpreter" section on page 18" for instructions.)

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

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

Step 3   Specify the slot/port address of the controller that you want shut down by entering the command **controller**, followed by the *type* (**t1**) and *chassis slot number/port adapter number/interface port number*. The example that follows is for a 2CT1 in chassis slot 3:

```
Router(config)# controller t1 3/1/0
```

Step 4   Enter the **shutdown** command as follows:

```
Router(config-cont)# shutdown
```

Step 5   To shut down existing individual controller interfaces, enter the slot/port:channel-group or pri-group address of each interface followed by the **shutdown** command. When you have entered all the interfaces to be shut down, press **Ctrl-Z** (hold down the **Control** key while you press **Z**) to exit configuration mode and return to the EXEC command interpreter prompt as follows:

```
Router(config)# interface serial 3/1/0:0
Router(config-if)# shutdown
Ctrl-Z
Router#
```

Step 6   Write the new configuration to memory as follows:

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

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

Step 7   To verify that new interfaces are now in the correct state (shutdown), use the **show interfaces serial** *chassis slot number/port adapter number/interface port number:channel-group or pri-group* command to display the specific interface, or use the **show controller command**, followed by the *type* (**t1**) and *chassis slot number/port adapter number/interface port number,* to display the status of all interfaces of the controller.

```
Router# show interfaces serial 3/1/0:0

Serial3/1/0:0 is down, line protocol is down
  Hardware is cxBus T1
[display text omitted]
```

Step 8   To reenable the interfaces, repeat the above steps, but use the **no shutdown** command in Step 4; then write the new configuration to memory as follows:

```
Router(config)# interface serial 3/1/0:0
Router(config-if)# no shutdown
Ctrl-Z
Router#

Router# copy running-config startup-config
[OK]
Router# show interface serial 3/1/0:0

Serial3/1/0:0 is up, line protocol is up
  Hardware is cxBus T1
[display text omitted]
```

For complete descriptions of software configuration commands, refer to the publications listed in the "Related Documentation" section on page 2.

Configuring Channelized T1 Interfaces

Following are instructions for a basic channelized T1 configuration: enabling a controller and specifying IP routing. You might also need to enter other configuration commands depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration commands and the configuration options available, refer to the publications listed in the "Related Documentation" section on page 2.

The channel groups must be mapped before the 2CT1 controller can be configured. The following are controller commands used to map the channel group (the default variable is listed first):

- **controller t1** *chassis slot number/port adapter number/interface port number*

- **clock source** [*line | internal*]

- **linecode** [*ami | hdb3*]

- **framing** [*sf | esf*]

- **loopback** [*local | remote*]

- **shutdown**

- **channel-group** *number* **timeslots** *list* [*speed* {56 | 48 | 64}]

  number is the channel group 0 to 23.

  timeslots is a number between 1 to 24. You can enter timeslots individually and separate them by commas or enter them as a range separated by a hyphen (for example, 1-3, 8, 9-18). Timeslot 0 is an illegal configuration.

  speed specifies the DS0 speed of the channel group; 56 kbps is the default.

Note   Cisco 7000 series and Cisco 7500 series routers identify channel groups as serial interfaces by chassis slot number, port adapter (0 or 1), interface port number (0 or 1), and channel-group number (0 to 23). For example, the address of the 2CT1 installed in chassis slot 4, port adapter slot 1, interface port 1, and channel group 5, would be serial 4/1/1:5.

In the following procedure, press the **Return** key after each configuration step:

Step 1   At the privileged-level prompt, enter configuration mode and specify that the console terminal will be the source of the configuration commands as follows:

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

Step 2   At the prompt, specify the controller to configure by entering the command **controller**, followed by **t1**, and *chassis slot number/port adapter number/interface port number*. The example that follows is for the 2CT1 in chassis slot 3, port adapter slot 1, interface port 1:

```
Router(config)# controller t1 3/1/1
```

Step 3   Specify the clock source for the controller. The **clock source** command determines which end of the circuit provides the clocking signal.

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

Note   You can set the clock source to use internal clocking for testing purposes. One end of a T1 circuit must provide the clock source.

Step 4   Specify the controller's framing type by entering the **framing** command:

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

Step 5   Specify the controller's linecode format by entering the **linecode** command:

```
Router(config-controller)# linecode b8zs
```

Step 6   Specify a channel group and map timeslots to the channel group by entering the **channel-group** command. The following example specifies channel group 0 and maps timeslots 1, 3 through 5, and 7 to channel group 0:

```
Router(config-controller)# channel-group 0 timeslots 1,3-5,7
Router(config-controller)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/1/1:0,
changed state to down
%LINK-3-UPDOWN: Interface Serial3/1/1:0, changed state to up
```

Note   Each channel group is presented to the system as a serial interface that can be configured individually.

Step 7   If IP routing is enabled on the system, assign an IP address and subnet mask to the channel group with the **interface** and **ip address** commands as follows:

```
Router(config-controller)# interface serial 3/1/1:0
Router(config-if)# ip address 10.1.15.1 255.255.255.0
Router(config-if)#
```

Step 8   Add any additional configuration commands required to enable routing protocols and adjust the interface characteristics.

Step 9 Use the **no shutdown** and **exit** commands respectively to reenable the interface and return to configuration mode as follows:

```
Router(config-if)# no shutdown
Router(config-if)# exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/1/1:0,
changed state to up
%LINK-3-UPDOWN: Interface Serial3/1/1:0, changed state to up
```

Step 10 Repeat Step 6 through Step 9 for additional channel groups and timeslots.

Step 11 After configuring additional channel groups and timeslots, map all unused timeslots to an unused channel group and shut down the unused channel group by entering the **channel-group** and **shutdown** commands, respectively.

In the following example, unused timeslots 2, 6, and 8 through 24 are mapped to unused channel group 1, and channel group 1 is shut down:

```
Router(config)# controller t1 3/1/1
Router(config-controller)# channel-group 1 timeslots 2,6,8-24
Router(config-controller)#
Router(config-controller)# interface serial 3/1/1:1
Router(config-if)# shutdown
Router(config-if)# exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/1/1:1, changed state to
down
%LINEPROTO-5-UPDOWN: Interface Serial3/1/1:1, changed state to administratively
down
```

Step 12 After including all of the configuration commands, to complete the configuration, press **Ctrl-Z** (hold down the **Control** key while you press **Z**) or enter **end** to exit configuration mode and return to the EXEC command interpreter prompt as follows:

```
Router(config)#
Ctrl-Z
Router#
```

Step 13 Write the new configuration to memory as follows:

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

The system displays an OK message when the configuration is stored.

Step 14 Exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable

Router>
```

This completes the procedure for creating a basic channelized T1 configuration. Proceed to the "Checking the Configuration" section on page 28 to check the interface configuration using **show** commands. For additional information about configuring channelized T1 interfaces, refer to the publications *Wide-Area Networking Configuration Guide* and *Wide-Area Networking Command Reference*.

Configuring Channelized T1 ISDN PRI Interfaces

Following are instructions for a basic channelized T1 ISDN PRI configuration: enabling a controller and specifying IP routing. You might also need to enter other configuration commands depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration commands and the configuration options available, refer to the publications listed in the "Related Documentation" section on page 2.

The PRI group must be mapped before the 2CT1 controller can be configured (there is only one PRI group for each controller). The following are controller commands used to map the PRI group:

- **isdn switch-type** *switch-type*
- **controller t1** *chassis slot number/port adapter number/interface port number*
- **clock source** *line*
- **linecode** *b8zs*
- **framing** *esf*
- **loopback**
- **shutdown**
- **pri-group** [**timeslots** *list*]

  pri-group timeslots is a number between 1 to 24. (Timeslots 1 to 23 represent the B channels, and timeslot 24 represents the D channel. While the numbering scheme for entering timeslots is 1 to 24, the system recognizes the numbering of timeslots as 0 to 23. The PRI group is configured by using timeslot 24 [the D channel], which is recognized by the system as timeslot 23.) You can enter timeslots individually and separate them by commas or enter them as a range separated by a hyphen (for example, 1-3, 8, 9-18). The default DS0 speed of the PRI group is 56 kbps.

Note If you do not specify the timeslots, the controller is configured for 23 B channels (timeslots 1 to 23) and one D channel (timeslot 24).

Note Cisco 7000 series and Cisco 7500 series routers identify the PRI group as a serial interfaces by chassis slot number, port adapter slot (0 or 1), interface port number (0 or 1), and timeslot 23. For example, the address of the 2CT1 installed in chassis slot 4, port adapter slot 1, interface port 1, and timeslot 24, would be recognized by the system as serial 4/1/1:23.

In the following procedure, press the **Return** key after each configuration step:

Step 1   At the privileged-level prompt, enter configuration mode and specify that the console terminal will be the source of the configuration commands as follows:

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

Step 2   Identify the ISDN switch type. In the following example, the switch primary-5ess (a switch for the United States) is identified as the switch type:

```
Router(config)# isdn switch-type primary-5ess
```

Note The ISDN switch type that you identify is for all ISDN interface ports installed in the router.

Step 3   Specify the controller to configure by entering the command **controller**, followed by **t1**, *and chassis slot number/port adapter number/interface port number.* The example that follows is for the 2CT1 in chassis slot 3, port adapter slot 1, interface port 1:

```
Router(config)# cont t1 3/1/1
```

Step 4   Specify the controller's clock source by entering the **clock source** command as follows:

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

Note   You can set the clock source to use internal clocking for testing purposes. One end of a T1 circuit must provide the clock source.

Step 5   Specify the controller's framing type by entering the **framing** command as follows:

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

Step 6   Specify the controller's linecode format by entering the **linecode** command as follows:

```
Router(config-controller)# linecode b8zs
```

Step 7   Map timeslots to the controller's PRI group by entering the **pri-group** command. The following example shows PRI-group timeslots 1, 3 through 5, and 7 (the B channels) selected and mapped to timeslot 24 (the D channel), which is recognized by the system as timeslot 23:

```
Router(config-controller)# pri-group timeslots 1,3-5,7
Router(config-controller)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/1/1:23,
changed state to down
%LINK-3-UPDOWN: Interface Serial3/1/1:23, changed state to up
```

Note   In the above example, the line-protocol status for timeslot 24 (listed in the output as timeslot 23) represents the entire PRI group.

Step 8   If IP routing is enabled on the system, assign an IP address and subnet mask to the PRI group with the **interface** and **ip address** commands as follows.

Note   For channelized T1 ISDN PRI, the PRI group is configured by using timeslot 24, which is recognized by the system as timeslot 23.

```
Router(config-controller)# interface serial 3/1/1:23
Router(config-if)# ip address 10.1.15.1 255.255.255.0
Router(config-if)#
```

Step 9   Add any additional configuration commands required to enable routing protocols and adjust the interface characteristics.

Step 10   Use the **no shutdown** and **exit** commands respectively to reenable the interface and return to configuration mode as follows:

```
Router(config-if)# no shutdown
Router(config-if)# exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/1/1:23,
changed state to up
%LINK-3-UPDOWN: Interface Serial3/1/1:23, changed state to up
```

Step 11   After configuring the PRI group and timeslots, map all unused timeslots to an unused channel group and shut down the unused channel group by entering the **channel-group** and **shutdown** commands, respectively.

Note   Both 2CT1 port adapter interfaces support simultaneous operation in channelized T1 and ISDN PRI modes.

In the following example, unused timeslots 2, 6, and 8 through 23 are mapped to unused channel group 2, and channel group 2 is shut down:

```
Router(config)# controller t1 3/1/1
Router(config-controller)# channel-group 2 timeslots 2,6,8-23
Router(config-controller)#
Router(config-controller)# interface serial 3/1/1:2
Router(config-if)# shutdown
Router(config-if)# exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/1/1:2,
changed state to down
%LINEPROTO-5-UPDOWN: Interface Serial3/1/1:2, changed state to
administratively down
```

Step 12   After including all of the configuration commands, to complete the configuration, press **Ctrl-Z** (hold down the **Control** key while you press **Z**) or enter **end** to exit configuration mode and return to the EXEC command interpreter prompt as follows:

```
Router(config)#
Ctrl-Z
Router#
```

Step 13   Write the new configuration to memory as follows:

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

The system displays an OK message when the configuration is stored.

Step 14   Exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable

Router>
```

This completes the procedure for creating a basic channelized T1 ISDN PRI configuration. Proceed to the "Checking the Configuration" section on page 28 to check the interface configuration using **show** commands. For dialer interface configuration and additional channelized T1 ISDN PRI interface configuration information, refer to the publications *Wide-Area Networking Configuration Guide* and *Wide-Area Networking Command Reference*.

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.

Using show Commands to Verify the VIP2 Status

The following steps use **show** commands to verify that the new interfaces are configured and operating correctly:

Step 1 Display the system hardware configuration with the **show version** command. Ensure that the list includes the new serial interfaces.

Step 2 Display all the current interface processors and their interfaces with the **show controllers cbus** command. Verify that the new VIP2 appears in the correct slot.

Step 3 Specify one of the new T1 interfaces with the **show interfaces** *type slot/port adapter/interface:channel-group* or *pri-group* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

Step 4 Display the protocols configured for the entire system and specific interfaces with the **show protocols** command. If necessary, return to configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 5 Display the running configuration file with the **show running-config** command. Display the configuration stored in NVRAM using the **show startup-config** command. Verify that the configuration is accurate for the system and each interface.

If the interface is down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the network interface is properly connected and terminated. If you still have problems bringing up the interface, contact a customer service representative for assistance.

To display information about a specific interface, use the **show interfaces** command with the interface type, port adapter, interface, and channel group or PRI group address in the format **show interfaces** [*type slot/port adapter/interface:channel-group* or *pri-group*].

The following example of the **show interfaces serial** *slot/port adapter/port/channel-group* command shows all of the information specific to the second 2CT1 interface port (interface port 1) in chassis slot 3, port adapter slot 1, channel group 0:

```
Router# show interface serial 3/1/1:0
Serial3/1/1:0 is up, line protocol is up
  Hardware is cxBus T1
  Internet address is 10.1.15.1
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions alarm present
  Timeslot(s) Used:1-24, Transmitter delay is 0 flags, transmit queue length 0
```

The following example of the **show interfaces serial** *slot/port adapter/port/pri-group* command shows all of the information specific to the same interface port (interface port 1 in chassis slot 3, port adapter slot 1) when the port is configured for ISDN PRI:

```
Router# show interface serial 3/1/1:23
Serial3/1/1:23 is up, line protocol is up(spoofing)
  Hardware is cxBus T1
  Internet address is 10.1.15.1
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions alarm present
  Timeslot(s) Used:1-24, Transmitter delay is 0 flags, transmit queue length 0
```

Note In the preceding example, the term "spoofing" indicates that the interface is configured for ISDN PRI. The term "spoofing" is indicated only on timeslot 24 (the D channel), which is recognized by the system as timeslot 23.

The **show version** (or **show hardware**) command displays the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images. Following is an example of the **show version** command used with a Cisco 7500 series router:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-A), Version 11.1(10)CA
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Sat 10-Aug-96 17:56 by biff
Image text-base: 0x600108A0, data-base: 0x60952000

ROM: System Bootstrap, Version 11.1(5), RELEASE SOFTWARE
ROM: GS Software (RSP-BOOT-M), Version 11.1(10)CA, RELEASE SOFTWARE

Router uptime is 5 days, 4 minutes
System restarted by reload
System image file is "rsp-jv-mz", booted via slot0

cisco RSP2 (R4600) processor with 16384K bytes of memory.
R4600 processor, Implementation 32, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
Channelized E1, Version 1.0.
SuperLAT software copyright 1990 by Meridian Technology Corp).
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
Primary Rate ISDN software, Version 1.0.
Chassis Interface.
1 EIP controller (6 Ethernet).
```

```
1 TRIP controller (4 Token Ring).
2 MIP controllers (4 E1).
1 VIP2 controller (2 T1)(4 Token Ring).
6 Ethernet/IEEE 802.3 interfaces.
8 Token Ring/IEEE 802.5 interfaces.
3 Serial network interfaces.
6 Channelized E1/PRI ports.
2 Channelized T1/PRI ports.
125K bytes of non-volatile configuration memory.

8192K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
No slave installed in slot 7.
Configuration register is 0x0
```

To display all the ISDN interfaces installed in the router and the ISDN switch type for the interfaces, use the **show isdn status** command. The following example is for an 2CT1 port adapter in chassis slot 3, port adapter slot 1, with the ISDN switch type primary-5ess:

```
Router# show isdn status
The current ISDN Switchtype = primary-5ess
ISDN Serial3/1/0:23 interface
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
No Active Layer 3 Call(s)
    Activated dsl 0 CCBs = 0
ISDN Serial3/1/1:23 interface
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
No Active Layer 3 Call(s)
    Activated dsl 0 CCBs = 0
Total Allocated ISDN CCBs = 0
(Display text omitted.)
```

To determine which type of port adapter is installed on a VIP2 in your system, use the **show diag** *slot* command. Specific port adapter information is displayed, as shown in the following example of a 2CT1 port adapter in chassis slot 3:

```
Router# show diag 3
Slot 3:
        Physical slot 3, ~physical slot 0x7, logical slot 8, CBus 0
        Microcode Status 0xC
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status: Console I/O
        EEPROM format version 1
        VIP2 controller, HW rev 2.3, board revision UNKNOWN
        Serial number: 03513619  Part number: 73-1684-03
        Test history: 0x00        RMA number: 00-00-00
        Flags: cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20: 01 15 02 03 00 35 9D 13 49 06 94 03 00 00 00 00
          0x30: 06 3D 00 2A 1A 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags: 0x4      Insertion time: 0x12A0 (08:56:58 ago)
```

```
            Controller Memory Size: 8 MBytes

            PA Bay 0 Information:
                    Token Ring PA, 4 ports
                    EEPROM format version 1
                    HW rev 1.0, Board revision B0
                    Serial number: 02825610  Part number: 73-1390-04

            PA Bay 1 Information:
                   Multi-channel (T1) port adapter, 2 ports
                    EEPROM format version 255
                    HW rev FF.FF, Board revision UNKNOWN
                    Serial number: 4294967295  Part number: 255-65535-255
```

Use the **show controllers cbus** [*type slot/port adapter/interface*] command to display the internal status of each installed interface processor and VIP2, including slot locations, hardware versions, and the currently running microcode versions. The **show controllers cbus** command also lists each interface (port), including logical interface numbers, interface types, physical (slot/port) addresses, and hardware (station address) of each interface, and cable types attached to each interface.

The following example shows a 2CT1 port adapter installed in chassis slot 3:

```
Router# show controllers cbus

slot3: VIP2, hw 2.2, sw 21.40, ccb 5800FFA0, cmdq 480000C0, vps 8192
    software loaded from flash slot0:muck/amcrae/vip2_21-40.mxt
    FLASH ROM version 255.255
T1 3/1/1, applique is Channelized T1
gfreeq 48000138, lfreeq 48000180 (1536 bytes), throttled 0
rxlo 4, rxhi 99, rxcurr 0, maxrxcurr 0
[display text omitted]
```

Use the **show controllers t1** command to display the status of each installed T1 interface. The following example shows the status of a 2CT1 port adapter installed in chassis slot 3 port adapter slot 1 interface port 0:

```
Router# show controller t1
T1 3/1/0 is up.
  No alarms detected.
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.
  Data in current interval (700 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
  Data in Interval 1:
     10 Line Code Violations, 1 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
     1 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 1 Unavail Secs
  Total Data (last 1 15 minute intervals):
     10 Line Code Violations, 1 Path Code Violations,
     0 Slip Secs, 0 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
     1 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 1 Unavail Secs
T1 3/1/1 is up.
  No alarms detected.
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.
  Data in current interval (700 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
  Data in Interval 1:
     10 Line Code Violations, 1 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
     1 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 1 Unavail Secs
```

```
     Total Data (last 1 15 minute intervals):
         10 Line Code Violations, 1 Path Code Violations,
         0 Slip Secs, 0 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
         1 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 1 Unavail Secs
[display text omitted]
```

Using the ping and loopback Commands

The *packet internet groper* (**ping**) and **loopback** commands allow you to verify that an interface port is functioning properly and to check the path between a specific port and connected devices at various locations on the network after the system has booted successfully and is operational. This section provides brief descriptions of these commands. Refer to the publications listed in the "Related Documentation" section on page 2, 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 command 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 that the connection failed.

Following is an example of a successful **ping** command to a remote server with the address 10.1.1.10:

```
Router# ping 10.1.1.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.1.1.10, 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.

The loopback test allows you to detect and isolate equipment malfunctions by testing the connection between the 2CT1 port adapter interface and a remote device such as a modem or a CSU. 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 or interface cable. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or interface cable in the path of the loopback test.

Note The 2CT1 supports only the controller loopback test.


When no interface cable is attached to a 2CT1 port adapter interface, issuing the **loopback** controller command tests the path between the VIP2 and the interface port only (without leaving the VIP2 and port adapter).

For complete descriptions of interface commands and the configuration options available for Cisco 7000 series and Cisco 7500 series-related interfaces, refer to the publications listed in the section "Related Documentation" section on page 2.

Cisco 7200 Series and the 2CT1 Port Adapter

The 2CT1 port adapter is used in the Cisco 7200 series and can be installed in any of the available port adapter slots. Figure 15 shows a 2CT1 port adapter installed in port adapter slot 1 of a Cisco 7206.

Figure 15   Cisco 7206 with a 2CT1 Port Adapter in Port Adapter Slot 1
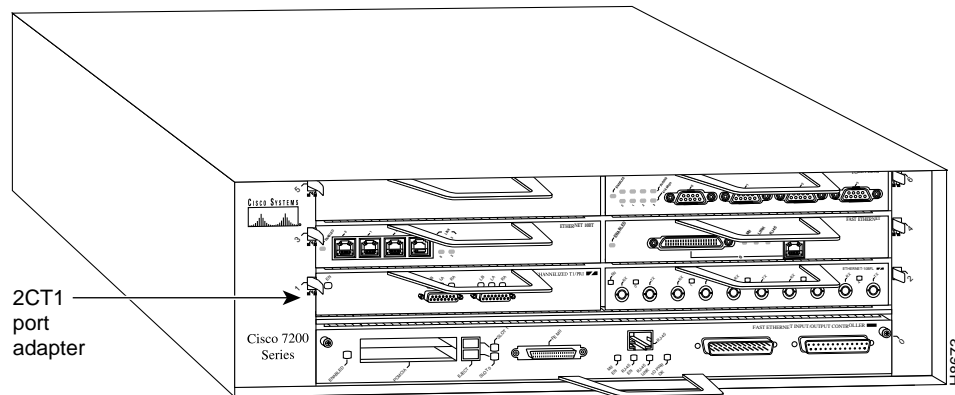
The following sections include information that is specific to the 2CT1 port adapter and its use in Cisco 7200 series routers:

- Installing or Replacing a Port Adapter in Cisco 7200 Series Routers, page 33
- Attaching a 2CT1 Interface Cable, page 36
- Using the EXEC Command Interpreter, page 37
- Configuring 2CT1 Interfaces, page 38
    — Selecting Port Adapter Slot and Serial Interface Port Numbers, page 39
    — Shutting Down an Interface, page 40
    — Configuring Channelized T1 Interfaces, page 41
    — Configuring Channelized T1 ISDN Interfaces, page 44
    — Checking the Configuration, page 47

Installing or Replacing a Port Adapter in Cisco 7200 Series Routers

Depending on your circumstances, you might need to install a new port adapter in a Cisco 7200 series router or replace a failed port adapter in the field. In either case, no tools are necessary; all port adapters available for the Cisco 7200 series connect directly to the router midplane and are locked into position by a port adapter lever. When removing and replacing a port adapter, you will need an antistatic mat onto which you can place a removed port adapter and an antistatic container into which you can place a failed port adapter for shipment back to the factory.

Note Cisco 7200 series routers support OIR; therefore, you do not have to power down Cisco 7200 series routers when removing and replacing a 2CT1 port adapter.

When a port adapter slot is not in use, a blank port adapter must fill the empty slot to allow the router to conform to EMI emissions requirements and to allow proper air flow 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 a blank port adapter.

Removing a Port Adapter

Use the following procedure to remove a port adapter from a Cisco 7200 series router:

Step 1   Attach an ESD-preventative wrist strap between you and an unfinished chassis surface.

Step 2   Place the port adapter lever for the desired port adapter slot in the unlocked position. The port adapter lever remains in the unlocked position. (See Figure 16.)

Figure 16   **Placing the Port Adapter Lever in the Unlocked Position (Cisco 7206 Shown)**

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

Port adapter handle

Port adapter lever (unlocked position)
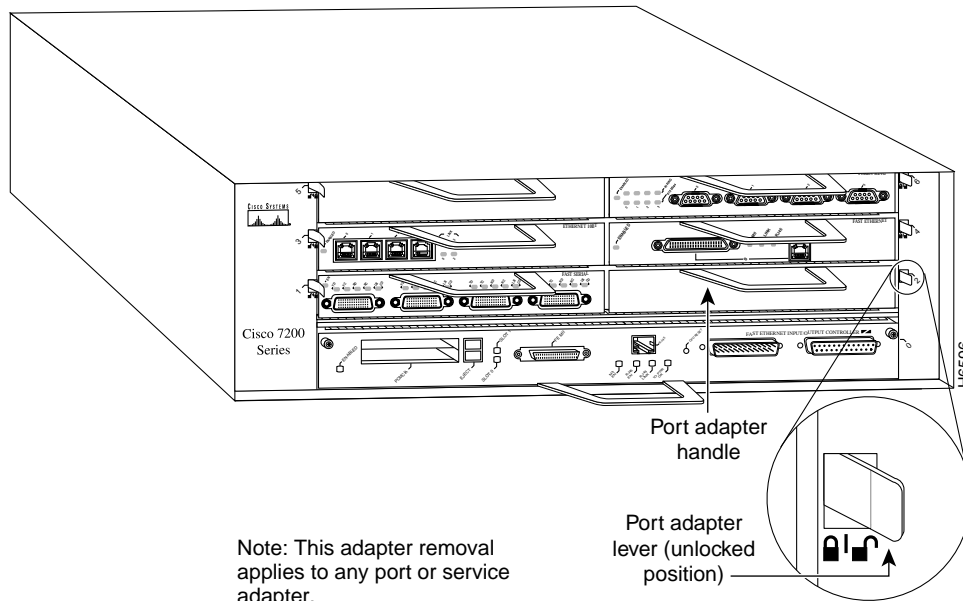
Step 3   Grasp the handle on the port adapter and pull the port adapter from the midplane, about halfway out of its slot. If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

Note   As you disengage the port adapter from the router midplane, OIR administratively shuts down all active interfaces on the port adapter.

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

Step 5   After disconnecting the cables, pull the port adapter from its chassis slot.

Caution   Always handle the port adapter by the carrier edges and handle; never touch the port adapter's components or connector pins. (See Figure 17.)

Figure 17   **Handling a Port Adapter**
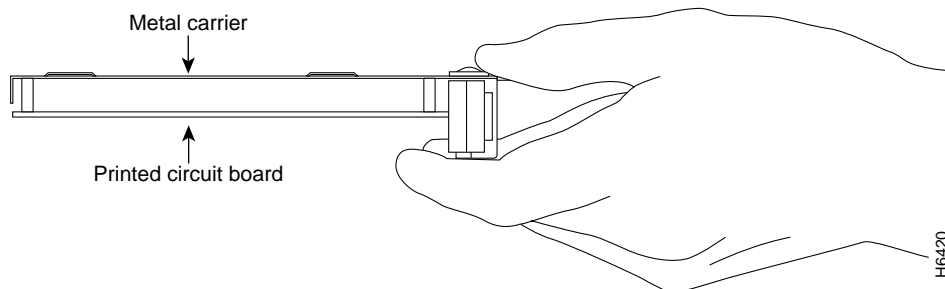
Step 6   Place the port adapter on an antistatic surface with its components facing upward, or in a static shielding bag. If the port adapter will be returned to the factory, immediately place it in a static shielding bag.

This completes the procedure for removing a port adapter from a Cisco 7200 series router.

Replacing a Port Adapter

Use the following procedure to install a new port adapter in a Cisco 7200 series router:

Step 1   Attach an ESD-preventative wrist strap between you and an unfinished chassis surface.

Step 2   Use both hands to grasp the port adapter by its metal carrier edges and position the port adapter so that its components are downward. (See Figure 17).

Step 3   Align the left and right edge of the port adapter metal carrier between the guides in the port adapter slot. (See Figure 18.)

Figure 18   **Aligning the Port Adapter Metal Carrier Between the Slot Guides (Cisco 7206 Shown)**
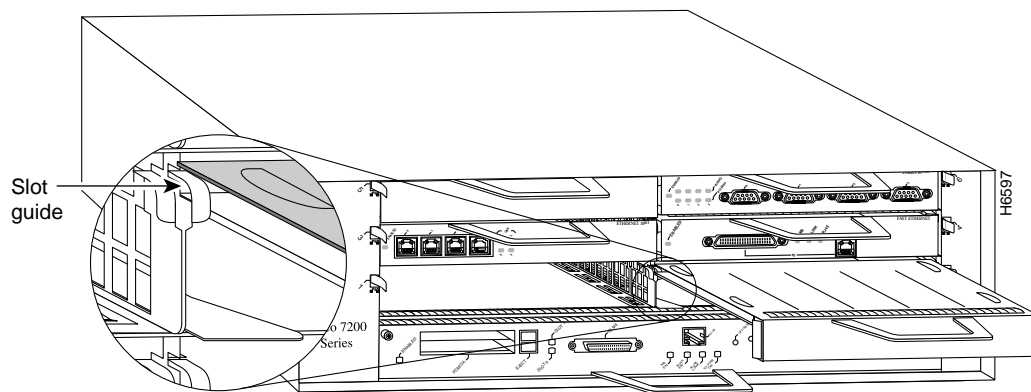
Note: This adapter alignment applies to any port or service adapter.

Step 4   With the metal carrier aligned in the slot guides, gently slide the port adapter halfway into the slot.
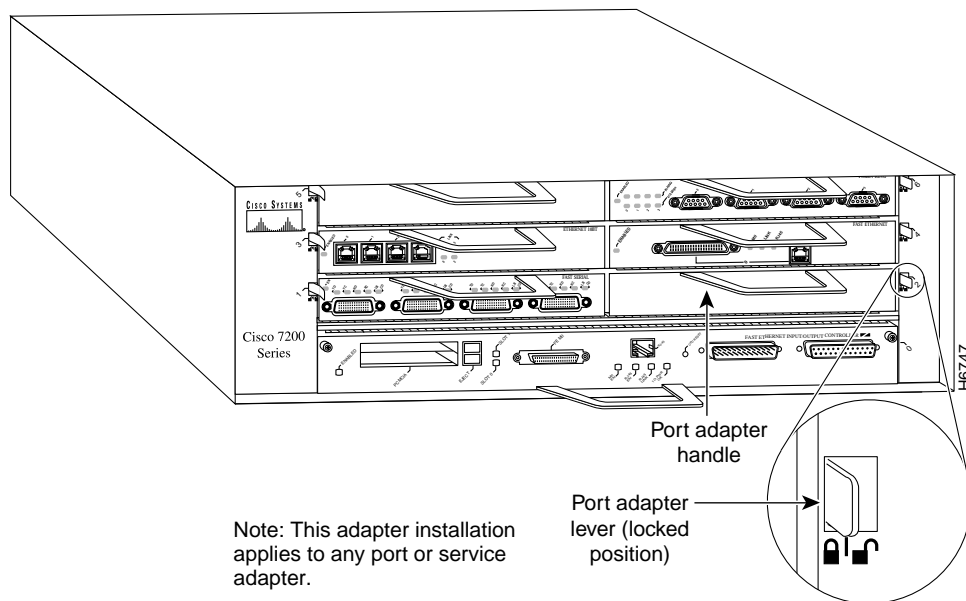
⚠ **Caution**   Do not slide the port adapter all the way into the slot until you have connected all required cables. Trying to do so will disrupt normal operation of the router.

Step 5 With the port adapter halfway in the slot, connect all required cables to the port adapter.

Step 6 After connecting all required cables, carefully slide the port adapter all the way into the slot until you feel the port adapter's connectors make contact with the midplane.

Step 7 After feeling the connectors make contact, move the port adapter lever to the locked position. Figure 19 shows the port adapter lever in the locked position.

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

Figure 19 Placing the Port Adapter Lever in the Locked Position (Cisco 7206 Shown)

Port adapter handle

Port adapter lever (locked position)

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

This completes the procedure for installing a new port adapter in a Cisco 7200 series router.

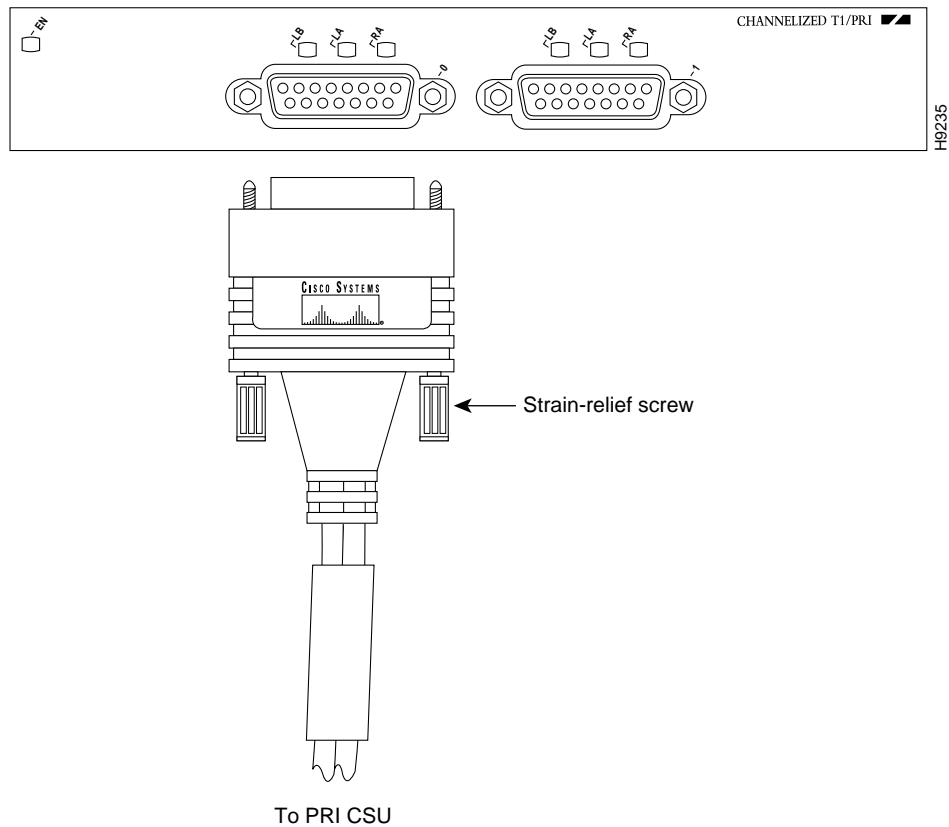## Attaching a 2CT1 Interface Cable

On a single 2CT1 port adapter, you can use up to two serial connections.

Use the following procedure to connect a 2CT1 interface cable:

Step 1 Attach the cable directly to the receptacle on the 2CT1 port adapter and tighten the strain-relief screws. (See Figure 20.)

Note Port adapters have a handle attached, but this handle is not shown to allow a detailed view of each port adapter's faceplate.

Figure 20 **Connecting a 2CT1 Interface Cable (2CT1 Port Adapter Front View—Shown Without Handle)**

Strain-relief screw

To PRI CSU

Step 2 Attach the network end of the cable to your Primary Rate Interface (PRI) channel service unit (CSU) and tighten the strain-relief screws.

This completes the procedure for attaching a 2CT1 interface cable.

Using the EXEC Command Interpreter

You modify the configuration of your router through the software command interpreter called the *EXEC*. 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 to 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:

```
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#
```

Proceed to the following section to configure the new interfaces.

Configuring 2CT1 Interfaces

If you installed a new 2CT1 or if you want to change the configuration of an existing interface, you must use the privileged-level **configure** command. If you replaced a 2CT1 port adapter that was previously configured, the system will recognize the new 2CT1 port adapter interfaces and bring each of them up in their existing configuration.

After you verify that the new 2CT1 port adapter is installed correctly (the enabled LED goes on), use the **configure** command to configure the new interfaces. Be prepared with the information you will need, such as the following:

- ISDN switch type, when configuring ISDN PRI (lists ISDN service provider switch types)

- T1 information, for example, clock source, line code, framing type, and so on

- Channel group and PRI group information and timeslot mapping

- Protocols and encapsulations you plan to use on the new interfaces

- Protocol specific information, such as IP addresses, if you plan to configure the interfaces for IP routing

- Whether the new interface will use bridging

Note Configuration commands are executed from the privileged level of the EXEC command interpreter, which usually requires password access. See the previous section "Using the EXEC Command Interpreter" and contact your system administrator, if necessary, to obtain access.

Table 6   ISDN Service Provider Switch Types

Keywords by Area	Switch Type
Australia	
basic-ts013	Australian TS013 switches
Europe	
basic-1tr6	German 1TR6 ISDN switches
basic-nwnet3	Norwegian NET3 ISDN switches (phase 1)
basic-net3	NET3 ISDN switches (UK, Denmark, and other nations); covers the Euro-ISDN E-DSSI signaling system)
basic-net5	NET5 switches (UK and Europe)
primary-net5	European ISDN PRI switches (UK and Europe)
vn2	French VN2 ISDN switches
vn3	French VN3 ISDN switches
Japan	
ntt	Japanese NTT ISDN switches
primary-ntt	Japanese ISDN PRI switches

Table 6   ISDN Service Provider Switch Types (continued)

Keywords by Area	Switch Type
North America	
basic-5ess	AT&T basic rate switches
basic-dms100	NT DMS-100 basic rate switches
basic-ni1	National (North American) ISDN-1 switches
primary-4ess	AT&T 4ESS switch type for the U.S. (ISDN PRI only)
primary-5ess	AT&T 5ESS switch type for the U.S. (ISDN PRI only)
primary-dms100	NT DMS-100 switch type for the U.S. (ISDN PRI only)
New Zealand	
basic-nznet3	New Zealand NET3 switches

For complete descriptions of interface commands and the configuration options available for Cisco 7200 series-related interfaces, refer to the publications listed in the section "Related Documentation" section on page 2.

Selecting Port Adapter Slot and Serial Interface Port Numbers

This section describes how to identify port adapter slot and 2CT1 port adapter interface numbers.

Physical port addresses specify the actual physical location of each interface port on the router. (See Figure 21.) This address is composed of a two-part number in the format *port adapter slot number/interface port number*, as follows:

- The first number identifies the chassis slot in which the 2CT1 port adapter is installed.

- The second number identifies the interface ports on each 2CT1 port adapter, which are always numbered in sequence as interface 0 and 1.

Interface ports on the 2CT1 port adapter 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 address changes to reflect the new slot number.

Figure 21 shows the interface ports of a 2CT1 port adapter in slot 1 of a Cisco 7206 router. The individual interface port numbers always begin with 0. The number of additional ports depends on the number of ports on a port adapter. Port adapters can occupy any port adapter slot. There are no restrictions.

For example, the addresses of the interface ports on the 2CT1 port adapter in chassis slot 1 are 1/0 and 1/1 (chassis slot 1 and interface ports 0 and 1). If the 2CT1 port adapter was in port adapter slot 4, these same interface ports would be numbered 4/0 and 4/1.

Figure 21   2CT1 Interface Port Number Example
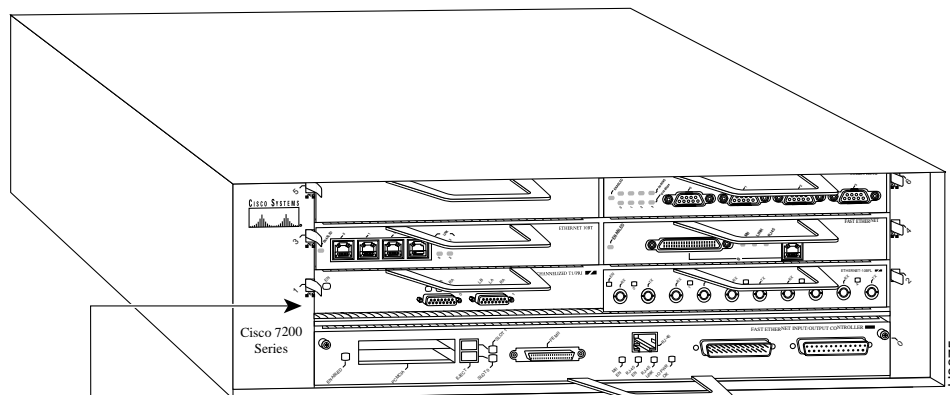
2CT1 port adapter
(port numbers 1/0 and 1/1
from left to right)

You can identify interface ports by physically checking the port adapter slot/interface port location on the front of the router or by using software commands to display information about a specific interface or all interfaces in the router.

Shutting Down an Interface

Before you replace an interface cable, replace port adapters, or remove an interface that you will not replace, use the **shutdown** command to shut down (disable) the interfaces. Doing so prevents anomalies from occurring when you reinstall the new or reconfigured port adapters. You can shut down all 24 interfaces of a controller by specifying the controller before issuing the **shutdown** command. You can shut down individual interfaces of a controller by specifying the channel group or PRI group assigned to each controller (channel groups and PRI groups are treated as serial interfaces by the system). 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. (See the "Using the EXEC Command Interpreter" section on page 37 for instructions.)

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

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

Step 3   Specify the slot/port address of the controller that you want shut down by entering the command **controller**, followed by the *type* (**t1**) and *port adapter slot number/interface port number*. The example that follows is for a 2CT1 in chassis slot 1:

```
Router(config)# controller t1 1/0
```

Step 4   Enter the **shutdown** command as follows:

```
Router(config-cont)# shutdown
```

Step 5 To shut down existing individual controller interfaces, enter the slot/port:channel-group or pri-group address of each interface followed by the **shutdown** command. When you have entered all the interfaces to be shut down, press **Ctrl-Z** (hold down the **Control** key while you press **Z**) to exit configuration mode and return to the EXEC command interpreter prompt as follows:

```
Router(config)# interface serial 1/0:0
Router(config-if)# shutdown
Ctrl-Z
Router#
```

Step 6 Write the new configuration to memory as follows:

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

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

Step 7 To verify that new interfaces are now in the correct state (shutdown), use the **show interface serial** *port adapter slot number/interface port number:channel-group or pri-group* command to display the specific interface, or use the **show controller command**, followed by the *type* (**t1**) and *port adapter slot number/interface port number,* to display the status of all interfaces of the controller.

```
Router# show interface serial 1/0:0

Serial1/0:0 is down, line protocol is down
  Hardware is MPA-T1
[display text omitted]
```

Step 8 To reenable the interfaces, repeat the above steps, but use the **no shutdown** command in Step 4; then write the new configuration to memory as follows:

```
Router(config)# int serial 1/0:0
Router(config-if)# no shutdown
Ctrl-Z
Router#

Router# copy running-config startup-config
[OK]
Router# show interface serial 1/0:0

Serial1/0:0 is up, line protocol is up
  Hardware is MPA-T1
[display text omitted]
```

For complete descriptions of software configuration commands, refer to the publications listed in the "Related Documentation" section on page 2.

Configuring Channelized T1 Interfaces

Following are instructions for a basic channelized T1 configuration: enabling a controller and specifying IP routing. You might also need to enter other configuration commands depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration commands and the configuration options available, refer to the publications listed in the "Related Documentation" section on page 2.

The channel groups must be mapped before the 2CT1 controller can be configured. The following are controller commands used to map the channel group (the default variable is listed first):

- **controller t1** *port adapter slot number/interface port number*

- **clock source** [*line* | *internal*]

- **linecode** [*ami* | *hdb3*]

- **framing** [*sf* | *esf*]

- **loopback** [*local* | *remote*]

- **shutdown**

- **channel-group** *number* **timeslots** *list* [*speed* {56 | 48 | 64}]

  number is the channel-group 0 to 23.

  timeslots is a number between 1 to 24. You can enter timeslots individually and separate them by commas or enter them as a range separated by a hyphen (for example, 1-3, 8, 9-18). Timeslot 0 is an illegal configuration.

  speed specifies the DS0 speed of the channel group; 56 kbps is the default.

Note Cisco 7200 series routers identify channel groups as serial interfaces by port adapter slot number, interface port number (0 or 1), and channel-group number (0 to 23). For example, the address of the 2CT1 installed in port adapter slot 1, interface port 1, and channel group 5 would be serial 1/1:5.

In the following procedure, press the **Return** key after each configuration step:

Step 1 At the privileged-mode prompt, enter configuration mode and specify that the console terminal will be the source of the configuration commands as follows:

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

Step 2 At the prompt, specify the controller to configure by entering the command **controller**, followed by **t1**, and *port adapter slot number/interface port number.* The example that follows is for the 2CT1 in port adapter slot 1, interface port 1:

```
Router(config)# controller t1 1/1
```

Step 3 Specify the controller's clock source by entering the **clock source** command as follows:

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

Note You can set the clock source to use internal clocking for testing purposes. One end of a T1 circuit must provide the clock source.

Step 4 Specify the controller's framing type by entering the **framing** command:

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

Step 5   Specify the controller's linecode format by entering the **linecode** command:

```
Router(config-controller)# linecode b8zs
```

Step 6   Specify a channel group and map timeslots to the channel group by entering the **channel-group** command. The following example specifies channel group 0 and maps timeslots 1, 3 through 5, and 7 to channel group 0:

```
Router(config-controller)# channel-group 0 timeslots 1,3-5,7
Router(config-controller)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1:0,
changed state to down
%LINK-3-UPDOWN: Interface Serial1/1:0, changed state to up
```

Note   Each channel group is presented to the system as a serial interface that can be configured individually.

Step 7   If IP routing is enabled on the system, assign an IP address and subnet mask to the channel group with the **interface** and **ip address** commands as follows:

```
Router(config-controller)# interface serial 1/1:0
Router(config-if)# ip address 10.1.15.1 255.255.255.0
Router(config-if)#
```

Step 8   Add any additional configuration commands required to enable routing protocols and adjust the interface characteristics.

Step 9   Use the **no shutdown** and **exit** commands respectively to reenable the interface and return to configuration mode as follows:

```
Router(config-if)# no shutdown
Router(config-if)# exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1:0,
changed state to up
%LINK-3-UPDOWN: Interface Serial1/1:0, changed state to up
```

Step 10   Repeat Step 6 through Step 9 for additional channel groups and timeslots.

Step 11   After configuring additional channel groups and timeslots, map all unused timeslots to an unused channel group and shut down the unused channel group by entering the **channel-group** and **shutdown** commands, respectively.

In the following example, unused timeslots 2, 6, and 8 through 24 are mapped to unused channel group 1, and channel group 1 is shut down:

```
Router(config)# controller t1 1/1
Router(config-controller)# channel-group 1 timeslots 2,6,8-24
Router(config-controller)#
Router(config-controller)# interface serial 1/1:1
Router(config-if)# shutdown
Router(config-if)# exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1:1, changed
state to down
%LINEPROTO-5-UPDOWN: Interface Serial1/1:1, changed state to
administratively down
```

Step 12   After including all of the configuration commands, to complete the configuration, press
Ctrl-Z (hold down the **Control** key while you press **Z**) or enter **end** to exit configuration
mode and return to the EXEC command interpreter prompt as follows:

```
Router(config)#
Ctrl-Z
Router#
```

Step 13   Write the new configuration to memory as follows:

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

The system displays an OK message when the configuration is stored.

Step 14   Exit the privileged level and return to the user level by entering **disable** at the prompt as
follows:

```
Router# disable

Router>
```

This completes the procedure for creating a basic channelized T1 configuration. Proceed to the
"Checking the Configuration" section on page 47 to check the interface configuration using **show**
commands. For additional information about configuring channelized T1 interfaces, refer to the
publications *Wide-Area Networking Configuration Guide* and *Wide-Area Networking Command
Reference*.

Configuring Channelized T1 ISDN Interfaces

Following are instructions for a basic channelized T1 ISDN PRI configuration: enabling a controller
and specifying IP routing. You might also need to enter other configuration commands depending
on the requirements for your system configuration and the protocols you plan to route on the
interface. For complete descriptions of configuration commands and the configuration options
available, refer to the publications listed in the "Related Documentation" section on page 2.

The PRI group must be mapped before the 2CT1 controller can be configured. (There is only one
PRI group for each controller). The following are controller commands used to map the PRI group:

- **isdn switch-type** *switch-type*
- **controller t1** *port adapter slot number/interface port number*
- **clock source** *line*
- **linecode** *b8zs*
- **framing** *esf*
- **loopback**
- **shutdown**
- **pri-group** [**timeslots** *list*]

   pri-group timeslots is a number between 1 and 24. (Timeslots 1 to 23 represent the B channels,
   and timeslot 24 represents the D channel. While the numbering scheme for entering timeslots is
   1 to 24, the system recognizes the numbering of timeslots as 0 to 23. The PRI group is configured
   by using timeslot 24 [the D channel], which is recognized by the system as timeslot 23.) You can
   enter timeslots individually and separate them by commas or enter them as a range separated by
   a hyphen (for example, 1-3, 8, 9-18). The default DS0 speed of the PRI group is 56 kbps.

Note If you do not specify the timeslots, the controller is configured for 23 B channels (timeslots 1 to 23) and one D channel (timeslot 24).

Note Cisco 7200 series routers identify the PRI group as a serial interface by port adapter slot number, interface port number (0 or 1), and timeslot 23. For example, the address of the 2CT1 installed in port adapter slot 1, interface port 1, and timeslot 24, would be recognized by the system as serial 1/1:23.

In the following procedure, press the **Return** key after each configuration step:

Step 1 At the privileged-mode prompt, enter configuration mode and specify that the console terminal will be the source of the configuration commands as follows:

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

Step 2 Identify the ISDN switch type. In the following example, the switch primary-5ess (a switch for the United States) is identified as the switch type:

```
Router(config)# isdn switch-type primary-5ess
```

Note The ISDN switch type that you identify is for all ISDN interface ports installed in the router.

Step 3 At the prompt, specify the controller to configure by entering the command **controller**, followed by **t1**, and *port adapter slot number/interface port number*. The example that follows is for the 2CT1 in port adapter slot 1, interface port 1:

```
Router(config)# controller t1 1/1
```

Step 4 Specify the controller's clock source by entering the **clock source** command as follows:

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

Note You can set the clock source to use internal clocking for testing purposes. One end of a T1 circuit must provide the clock source.

Step 5 Specify the controller's framing type by entering the **framing** command as follows:

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

Step 6 Specify the controller's linecode format by entering the **linecode** command as follows:

```
Router(config-controller)# linecode b8zs
```

Step 7 Map timeslots to the controller's PRI group by entering the **pri-group** command. The following example shows PRI-group timeslots 1, 3 through 5, and 7 (the B channels) selected and mapped to timeslot 24 (the D channel), which is recognized by the system as timeslot 23:

```
Router(config-controller)# pri-group timeslots 1,3-5,7
Router(config-controller)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1:23,
changed state to down
%LINK-3-UPDOWN: Interface Serial1/1:23, changed state to up
```

Note In the above example, the line-protocol status for timeslot 24 (listed in the output as timeslot 23) represents the entire PRI group.

Step 8 If IP routing is enabled on the system, assign an IP address and subnet mask to the PRI group with the **interface** and **ip address** commands as follows.

Note For channelized T1 ISDN PRI, the PRI group is configured by using timeslot 24, which is recognized by the system as timeslot 23.

```
Router(config-controller)# interface serial 1/1:23
Router(config-if)# ip address 10.1.15.1 255.255.255.0
Router(config-if)#
```

Step 9 Add any additional configuration commands required to enable routing protocols and adjust the interface characteristics.

Step 10 Use the **no shutdown** and **exit** commands respectively to reenable the interface and return to configuration mode as follows:

```
Router(config-if)# no shutdown
Router(config-if)# exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1:23,
changed state to up
%LINK-3-UPDOWN: Interface Serial1/1:23, changed state to up
```

Step 11 After configuring the PRI group and timeslots, map all unused timeslots to an unused channel group and shut down the unused channel group by entering the **channel-group** and **shutdown** commands, respectively.

Note Both 2CT1 port adapter interfaces support simultaneous operation in channelized T1 and ISDN PRI modes.

In the following example, unused timeslots 2, 6, and 8 through 23 are mapped to unused channel group 2, and channel group 2 is shut down:

```
Router(config)# controller t1 1/1
Router(config-controller)# channel-group 2 timeslots 2,6,8-23
Router(config-controller)#
Router(config-controller)# interface serial 1/1:2
Router(config-if)# shutdown
Router(config-if)# exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1:2,
changed state to down
%LINEPROTO-5-UPDOWN: Interface Serial1/1:2, changed state to
administratively down
```

Step 12 After including all of the configuration commands, to complete the configuration, press **Ctrl-Z** (hold down the **Control** key while you press **Z**) or enter **end** to exit configuration mode and return to the EXEC command interpreter prompt as follows:

```
Router(config)#
Ctrl-Z
Router#
```

Step 13 Write the new configuration to memory as follows:

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

The system displays an OK message when the configuration is stored.

Step 14 Exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable

Router>
```

This completes the procedure for creating a basic channelized T1 ISDN PRI configuration. Proceed to the section "Checking the Configuration" to check the interface configuration using **show** commands. For dialer interface configuration and additional channelized T1 ISDN PRI interface configuration information, refer to the publications *Wide-Area Networking Configuration Guide* and *Wide-Area Networking Command Reference*.

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.

Using show Commands to Verify the New Interface Status

The following steps use **show** commands to verify that the new interfaces are configured and operating correctly:

Step 1 Display the system hardware configuration with the **show version** command. Ensure that the list includes the new serial interfaces.

Step 2 Display all the current interfaces with the **show controllers** command.

Step 3 Specify one of the new T1 interfaces with the **show interfaces** *type port adapter slot/interface port number:channel-group* or *pri-group* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

Step 4 Display the protocols configured for the entire system and specific interfaces with the **show protocols** command. If necessary, return to configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 5 Display the running configuration file with the **show running-config** command. Display the configuration stored in NVRAM using the **show startup-config** command. Verify that the configuration is accurate for the system and each interface.

If the interface is down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the network interface is properly connected and terminated. If you still have problems bringing up the interface, contact a customer service representative for assistance.

To display information about a specific interface, use the **show interfaces** command with the interface type, port adapter slot, interface port, and channel-group or PRI group address in the format **show interfaces** [*type port adapter slot/interface port:channel-group* or *pri-group*].

The following example of the **show interfaces serial** *port adapter slot number/interface port number:channel-group* command shows all of the information specific to the second 2CT1 interface port (interface port 1) in port adapter slot 1, channel group 2:

```
Router# show interface serial 1/0:2
Serial1/1:2 is up, line protocol is up
  Hardware is MPA-T1
  Internet address is 10.1.15.1
  MTU 1500 bytes, BW 1984 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set
  Last input 00:00:42, output 00:00:56, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/64/0 (size/threshold/drops)
     Conversations  0/1 (active/max active)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     149 packets input, 40207 bytes, 0 no buffer
     Received 298 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     128 packets output, 44416 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     20 carrier transitions no alarm present
  Timeslot(s) Used:1-24, subrate: 64Kb/s, transmit delay is 0 flags
```

The following example of the **show interfaces serial** *port adapter slot number/interface port number:pri-group* command shows all of the information specific to the same interface (interface port 1 in port adapter slot 1) when the interface is configured for ISDN PRI:

```
Router# show interface serial 1/1:23
Serial1/1:23 is up, line protocol is up (spoofing)
  Hardware is MPA-T1
  Internet address is 10.1.15.1
  MTU 1500 bytes, BW 1984 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set
  Last input 00:00:42, output 00:00:56, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/64/0 (size/threshold/drops)
     Conversations  0/1 (active/max active)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     149 packets input, 40207 bytes, 0 no buffer
     Received 298 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     128 packets output, 44416 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     20 carrier transitions no alarm present
  Timeslot(s) Used:1-24, subrate: 64Kb/s, transmit delay is 0 flags
```

Note   In the above example, the term "spoofing" indicates that the interface is configured for ISDN PRI. The term "spoofing" is indicated only on timeslot 24 (the D channel), which is recognized by the system as timeslot 23.

Use the **show controllers t1** [port adapter slot number/interface port number] command to display the status of each installed T1 interface. The following example of the **show controllers t1** command shows the status of a 2CT1 port adapter installed in port adapter slot 1, interface port 0:

```
Router# show controllers t1 1/0
T1 1/0 is up.
  No alarms detected.
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.
  Data in current interval (710 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
  Data in Interval 1:
     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
[display text omitted]
```

To display all the ISDN interfaces installed in the router and the ISDN switch type for the interfaces, use the **show isdn status** command. The following example is for an 2CT1 port adapter in port adapter slot 1, with the ISDN switch type primary-5ess:

```
Router# show isdn status
The current ISDN Switchtype = primary-5ess
ISDN Serial1/0:23 interface
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
        No Active Layer 3 Call(s)
    Activated dsl 0 CCBs = 0
ISDN Serial1/1:23 interface
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
        No Active Layer 3 Call(s)
    Activated dsl 1 CCBs = 0
    Total Allocated ISDN CCBs = 0
```

The **show version** (or **show hardware**) command displays the configuration of the system hardware (the number of each interface type installed), the software version, the names and sources of configuration files, and the boot images. Following is an example of the **show version** command:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Version 11.1(9)CA1
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Sun 04-Aug-96 06:00 by biff
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 11.1(5) RELEASE SOFTWARE
ROM: 7200 Software (C7200-BOOT-M), RELEASE SOFTWARE 11.1(9)CA1

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

cisco 7206 (NPE150) processor with 12288K/4096K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (Level 2 Cache)
Last reset from power-on
Bridging software.
Channelized E1, Version 1.0.
SuperLAT software copyright 1990 by Meridian Technology Corp.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV INC).
Primary Rate ISDN software, Version 1.0.
Chassis Interface.
4 Ethernet/IEEE 802.3 interfaces.
1 FastEthernet/IEEE 802.3 interface.
4 Token Ring /IEEE802.5 interfaces.
12 Serial network interfaces.
2 Channelized T1/PRI ports.
125K bytes of non-volatile configuration memory.
1024K bytes of packet SRAM memory.

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

To determine which type of port adapter is installed in your system, use the **show diag** *slot* command. Specific port adapter information is displayed, as shown in the following example of a 2CT1 port adapter in chassis slot 1:

```
Router# show diag 1

Slot 1:
        Channelized T1 port adapter, 2 ports
        Port adapter is analyzed
        Port adapter insertion time 02:18:20 ago
        Hardware revision 255.255                   Board revision UNKNOWN
        Serial number      4294967295    Part number     255-65535-255
        Test history       0xFF          RMA number      255-255-255
        EEPROM format version 255
        EEPROM contents (hex):
          0x20: FF 07 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x30: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

For command descriptions and examples for Cisco 7200 series routers, refer to the publications listed in the "Related Documentation" section on page 2.

Using the ping and loopback Commands

The *packet internet groper* (**ping**) and **loopback** commands allow you to verify that an interface port is functioning properly and to check the path between a specific port and connected devices at various locations on the network after the system has booted successfully and is operational. This section provides brief descriptions of these commands. Refer to the publications listed in the "Related Documentation" section on page 2, 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 command 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 that the connection failed.

Following is an example of a successful **ping** command to a remote server with the address 10.1.1.10:

```
Router# ping 10.1.1.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.1.1.10, 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.

The loopback test allows you to detect and isolate equipment malfunctions by testing the connection between the 2CT1 port adapter interface and a remote device such as a modem or a CSU. The **loopback** command places an interface in loopback mode, which enables test packets generated from the **ping** command to loop through a remote device or interface cable. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or interface cable in the path of the loopback test.

Note The 2CT1 supports only the controller loopback test.

When no interface cable is attached to a 2CT1 port adapter interface, issuing the **loopback** controller command tests the path between the network processing engine and the interface port only (without leaving the network processing engine and port adapter).

For complete descriptions of interface commands and the configuration options available for Cisco 7200 series-related interfaces, refer to the publications listed in the "Related Documentation" section on page 2.

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- WWW: http://www-europe.cisco.com

- WWW: http://www-china.cisco.com

- Telnet: cco.cisco.com

- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and connection rates up to 28.8 kbps.

For a copy of CCO's Frequently Asked Questions (FAQ), contact cco-help@cisco.com. For additional information, contact cco-team@cisco.com.

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