Configuring the PA-T3+

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

This chapter contains the following sections:

- Using the EXEC Command Interpreter, page 4-1
- Configuring the Interfaces, page 4-2
- Checking the Configuration, page 4-17

Using the EXEC Command Interpreter

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

At the console terminal, use the following procedure to enter the privileged level:

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

```
Router> enable

Password:
```

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

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

```
Router#
```

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

Configuring the Interfaces

After you verify that the new PA-T3+ is installed correctly (the enabled LED goes on), use the privileged-level **configure** command to configure the new interfaces. Have the following information available:

- T3+ information such as clock source and framing type
- Protocols you plan to route on each new interface
- IP addresses, if you plan to configure the interfaces for IP routing
- Bridging protocols you plan to use
- Timing source for each new interface and clock speeds for external timing

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

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

You execute configuration commands from the privileged level of the EXEC command interpreter, which usually requires password access. Contact your system administrator, if necessary, to obtain password access. (See the "Using the EXEC Command Interpreter" section on page 4-1 for an explanation of the privileged level of the EXEC.)

This section contains the following subsections:

Shutting Down an Interface

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

Follow these steps to shut down an interface:

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

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

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

Step 3   Shut down interfaces by entering the **interface serial** subcommand (followed by the interface address of the interface), and then enter the **shutdown** command.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter.

Table 4-1 shows the **shutdown** command syntax for the supported platforms.

Table 4-1   Syntax of the shutdown Command for the Supported Platforms

Platform	Command	Example

Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches	**interface**, followed by the type (**serial**) and *mod_num*/*bay*/*port* (module-slot-number/ port-adapter-bay-number/ interface-port- number)
	
	 shutdown
		The example is for interface 0 and interface 1 on a port adapter in bay 0 of a FlexWAN module installed in module slot 3.
		
		 `Router(config-if)# interface serial 3/0/0`
		 `Router(config-if)# shutdown`
		 `Router(config-if)# interface serial 3/0/1`
		 `Router(config-if)# shutdown`
		 `Ctrl-Z`
		 `Router#`

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

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

Cisco 7301 router	**interface**, followed by the *type* (**serial**) and *slot/port* (port-adapter-slot-number/ interface-port-number)
	
	 shutdown
		The example is for interface 0 and interface 1 on a port adapter in port adapter slot 1.
		
		 `Router(config-if)# interface serial 1/0`
		 `Router(config-if)# shutdown`
		 `Router(config-if)# interface serial 1/1`
		 `Router(config-if)# shutdown`
		 `Ctrl-Z`
		 `Router#`

Table 4-1   Syntax of the shutdown Command for the Supported Platforms (continued)

Platform	Command	Example
Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	**interface**, followed by the *type* (**serial**) and *slot/port* (module-slot-number/ interface-port-number) **shutdown**	The example is for interface 0 and interface 1 on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router. `Router(config-if)# `**`interface serial 3/0`** `Router(config-if)# `**`shutdown`** `Router(config-if)# `**`interface serial 3/1`** `Router(config-if)# `**`shutdown`** **Ctrl-Z** `Router#`
Cisco 7401ASR router	**interface**, followed by the *type* (**serial**) and *slot/port* (port-adapter-slot-number/ interface-port-number) **shutdown**	The example is for the 0 interface and interface 1 on a port adapter in slot 1. `Router(config)# `**`interface serial 1/0`** `Router(config-if)# `**`shutdown`** `Router(config-if)# `**`interface serial 1/1`** `Router(config-if)# `**`shutdown`** **Ctrl-Z** `Router#`
VIP in Cisco 7000 series routers or Cisco 7500 series routers	**interface**, followed by the *type* (**serial**) and *slot/port adapter/port* (interface-processor-slot-number port-adapter-slot-number/ interface-port-number) **shutdown**	The example is for interface 1 and interface 0 on a port adapter in port adapter slot 1 of a VIP installed in interface processor slot 1. `Router(config-if)# `**`interface serial 1/1/1`** `Router(config-if)# `**`shutdown`** `Router(config-if)# `**`interface serial 1/1/0`** `Router(config-if)# `**`shutdown`** **Ctrl-Z** `Router#`

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

Step 4   Write the new configuration to NVRAM as follows:

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

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

Step 5   Verify that new interfaces are now in the correct state (shut down) using the **show interfaces** command (followed by the interface type and interface address of the interface) to display the specific interface.

Table 4-2 provides examples of the **show interfaces serial** command for the supported platforms.

Table 4-2   Examples of the show interfaces serial Command for the Supported Platforms

Platform	Command	Example
Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches	**show interfaces serial**, followed by *mod_num*/*bay*/*port* (module-slot-number/ port-adapter-bay-number/ interface-port-number)	The example is for interface 0 on a port adapter in bay 0 of a FlexWAN module in module slot 3. Router# **show interfaces serial 3/0/0** Serial 3/0/0 is administratively down, line protocol is down [Additional display text omitted from this example]
Cisco 7200 series routers and Cisco VXR routers	**show interfaces serial**, followed by *slot*/*port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 6. Router# **show interfaces serial 6/0** Serial 6/0 is administratively down, line protocol is down [Additional display text omitted from this example]
Cisco 7201 router	**show interfaces serial**, followed by *slot*/*port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1. Router# **show interfaces serial 1/0** Serial 1/0 is administratively down, line protocol is down [Additional display text omitted from this example]
Cisco 7301 router	**show interfaces serial**, followed by *slot*/*port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1. Router# **show interfaces serial 1/0** Serial 1/0 is administratively down, line protocol is down [Additional display text omitted from this example]
Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	**show interfaces serial**, followed by *slot*/*port* (module-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router. Router# **show interfaces serial 3/0** Serial 3/0 is administratively down, line protocol is down [Additional display text omitted from this example]

Table 4-2   Examples of the show interfaces serial Command for the Supported Platforms (continued)

Platform	Command	Example

Cisco 7401ASR router	**show interfaces serial**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1.
		
		`Router# `**`show interfaces serial 1/0`**
		
		`Serial 1/0 is administratively down, line protocol is down`
		
		`[Additional display text omitted from this example]`

VIP in Cisco 7000 series routers or Cisco 7500 series routers	**show interfaces serial**, followed by *slot/port adapter/port* (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1 of a VIP in interface processor slot 1.
		
		`Router# `**`show interfaces serial 1/1/0`**
		
		`Serial 1/1/0 is administratively down, line protocol is down`
		
		`[Additional display text omitted from this example]`

Step 6   Re-enable interfaces by doing the following:

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

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

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

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

Performing a Basic Interface Configuration

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

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

```
Router# disable

Router>
```

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

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

Step 2   Specify the first interface to configure by entering the **interface serial** subcommand, followed by the interface address of the interface you plan to configure.

Table 4-3 provides examples of the **interface serial** subcommand for the supported platforms.

Table 4-3   Examples of the interface serial Subcommand for the Supported Platforms

Platform	Command	Example

Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches	**interface serial**, followed by *mod_num*/*bay*/*port* (module-slot-number/ port-adapter-bay-number/ interface-port-number)	The example is for interface 0 on a port adapter in bay 0 of a FlexWAN module installed in module slot 3.
		
		`Router(config)# interface serial 3/0/0`
		`Router(config-if)#`

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

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

Cisco 7301 router	**interface serial**, followed by *slot*/*port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 1.
		
		`Router(config)# interface serial 1/0`
		`Router(config-if)#`

Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	**interface serial**, followed by *slot*/*port* (module-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router.
		
		`Router(config)# interface serial 3/0`
		`Router(config-if)#`

Cisco 7401ASR router	**interface serial**, followed by *slot*/*port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 of a port adapter in port adapter slot 1.
		
		`Router(config)# interface serial 1/0`
		`Router(config-if)#`

VIP in Cisco 7000 series router or Cisco 7500 series router	**interface serial**, followed by *slot*/*port adapter*/*port* (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)	The example is for interface 0 of a port adapter in port adapter slot 1 of a VIP in interface processor slot 1.
		
		`Router(config)# interface serial 1/1/0`
		`Router(config-if)#`

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

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

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

Step 5 Re-enable the interfaces using the **no shutdown** command. (See the "Shutting Down an Interface" section on page 4-2.)

Step 6 Configure all additional port adapter interfaces as required.

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

Step 8 Write the new configuration to NVRAM as follows:

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

This completes the procedure for creating a basic configuration.

Configuring Timing (Clock) Signals

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

Table 4-4   *Clock Rate Configuration Commands*

Purpose	Command	Example	Additional Information

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

Set nonstandard clock rate.	**clock rate**	The example is for a serial interface with a nonstandard clock rate of 1234567 kbps.
		
		`Router(config)# interface serial 3/0`
		`Router(config-if)# clock rate 1234567`
			"Configuring Cyclic Redundancy Checks"

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

Table 4-4   *Clock Rate Configuration Commands (continued)*

Purpose	Command	Example	Additional Information
Invert the transmit clock signal.	**invert-txc**	The example inverts the transmit clock signal for a serial interface. `Router(config)# ` **`interface serial 3/0`** `Router(config-if)# ` **`invert-txc`**	"Inverting the Clock Signal"
Change the clock signal back to its original phase.	**no invert-txc**	The example sets the transmit clock signal for a serial interface back to its original phase. `Router(config)# ` **`interface serial 3/0`** `Router(config-if)# ` **`no invert-txc`**	"Inverting the Clock Signal"
Invert the data signal.	**invert data**	The example inverts the data stream for both transmit and receive for a serial interface: `Router(config)# ` **`interface serial 3/0`** `Router(config-if)# ` **`invert data`**	"Inverting the Data Signal"

Setting the Clock Rate

The default operation on a PA-T3+ DCE interface is for the DCE device to generate its own clock signal (TxC) and send it to the remote DTE. The remote DTE device returns the clock signal to the DCE (the PA-T3+). Set the clock rate of an interface using the **clock rate** subcommand, which specifies the clock rate as a bits-per-second value. This subcommand functions in the same way on all supported platforms.

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

In the following example, the clock rate is specified as 72 kbps. This example applies to all systems in which the PA-T3+ is supported.

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

Use the **no clock rate** command to remove the clock rate.

Following are the standard clock rates:

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

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.

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

Note Cisco IOS Release 11.2(7a)P or a later release of 11.2 P, or Release 11.1(10)CA or a later release of 11.1 CA loaded on your Cisco 7200 router or on your Cisco 7000 series router or Cisco 7500 series router with a VIP2-40(=) supports nonstandard clock rates (any value from 1200 to 8000000) on PA-T3+ interfaces.

Cisco IOS Release 12.0(3)T or a later release of 12.0T, or Release 12.0(1)XE or a later release of 12.0XE supports nonstandard clock rates on PA-T3+ interfaces installed in Cisco 7204VXR and Cisco 7206VXR routers.

Cisco IOS Release 11.3(7)NA or a later release of 11.3 NA, or Release 12.0(3)T or a later release of 12.0T loaded on your Cisco uBR7200 series router supports nonstandard clock rates (any value from 1200 to 8000000) on PA-T3+ interfaces.

Nonstandard clock rates are rounded (if necessary) to the nearest clock rate that the hardware can support.

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

In the following example, a nonstandard clock rate of 1234567 bps is specified. This example applies to all systems in which the PA-T3+ is supported.

```
Router(config-if)# clock rate 1234567
```

Use the **no clock rate** command to remove the clock rate.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.

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

The following example shows how to use the **show running-config** command to determine the exact clock rate to which the nonstandard clock rate was rounded. In this example, only the relevant output from the **show running-config** command is shown; other information is omitted

```
Router# show running-config
Building configuration...
...
!
interface Serial1/0 (interface Serial3/1/0 on a VIP2)

 no ip address
 clockrate 1151526
!
...
```

Inverting the Clock Signal

Systems that use long cables or cables that are not transmitting the TxC (clock) signal might experience high error rates when operating at higher transmission speeds. If a PA-T3+ DCE port is reporting a high number of error packets, a phase shift might be the problem: inverting the clock might correct this phase shift.

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

Inverting the Data Signal

If you use an EIA/TIA-232 interface on the PA-T3+ port adapter to drive a dedicated T1 line that does not have B8ZS encoding—a method to avoid 15 zeros—you must invert the data stream (both TXD and RXD) either in the connecting CSU/DSU or on the interface. To invert the data stream coming out of the PA-T3+, use the **invert data** command. By inverting the HDLC data stream, the HDLC zero insertion algorithm becomes a ones insertion algorithm that satisfies the T1 requirements.

Note   Invert data *only* on the PA-T3+ interface *or* on the CSU/DSU; inverting both cancels out both data inversions.

Configuring NRZI Format

All EIA/TIA-232 interfaces on the PA-T3+ support nonreturn-to-zero (NRZ) and nonreturn-to-zero inverted (NRZI) formats. Both formats use two different voltage levels for transmission. NRZ signals maintain constant voltage levels with no signal transitions—no return to a zero voltage level—during a bit interval and are decoded using absolute values: 0 and 1. NRZI uses the same constant signal levels but interprets the absence of data—a space—at the beginning of a bit interval as a signal transition and the presence of data—a mark—as no signal transition. NRZI uses relational encoding to interpret signals rather than determining absolute values.

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

Table 4-5 summarizes NRZI format commands.

Table 4-5   NRZI Format Commands

Purpose	Command	Example
Enable NRZI encoding.	**nrzi-encoding** [**mark**][1]	The example is for a serial interface with NRZI mark encoding specified: `Router(config)# `**`interface serial 3/0`** `Router(config-if)# `**`nrzi-encoding mark`** The example is for a serial interface with NRZI space encoding specified: `Router(config)# `**`interface serial 3/0`** `Router(config-if)# `**`nrzi-encoding`**
Disable NRZI encoding.	**no nrzi-encoding**	The example disables NRZI encoding on a serial interface: `Router(config)# `**`interface serial 3/0`** `Router(config-if)# `**`no nrzi-encoding`**

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

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

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

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

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

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

Use the **no nrzi-encoding** command to disable NRZI encoding.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.

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

For complete command descriptions and instructions, refer to the *Configuration Fundamentals Configuration Guide* on Cisco.com.

Configuring Cyclic Redundancy Checks

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

Table 4-6 summarizes CRC commands.

Table 4-6   CRC Commands

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

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

In the example that follows, 32-bit CRC is specified:

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

Use the **no crc 32** command to disable CRC-32 and return the interface to the default CRC-16 (CRC-CITT) setting.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.

For command descriptions, refer to the *Configuration Fundamentals Configuration Guide* on Cisco.com.

Note   If you are configuring a PA-T3+ in a Cisco 7200 series router and you want to configure the interface for half-duplex or Bisync operation, proceed to the next section, "Configuring Half-Duplex and Binary Synchronous Communications in Cisco 7200 Series Routers" section on page 4-14; otherwise, proceed to the "Setting the Bandwidth" section on page 4-16.

Configuring Half-Duplex and Binary Synchronous Communications in Cisco 7200 Series Routers

This section explains how to configure EIA/TIA-232 interfaces for half-duplex and Bisync operation on Cisco 7200 series routers.

Note Cisco IOS Release 11.2(7a)P or a later release of 11.2P supports half-duplex and Bisync operation on the PA-T3+ in Cisco 7200 series routers.

Cisco IOS Release 11.1(19)CC1 or a later release of 11.1 CC, or Release 11.3(4)AA or a later release of 11.3AA supports half-duplex and Bisync operation on the PA-T3+ installed in Cisco 7202 routers.

Cisco IOS Release 12.0(3)T or a later release of 12.0T, or Release 12.0(2)XE or a later release of 12.0XE supports half-duplex and Bisync operation on the PA-T3+ in Cisco 7204VXR router and Cisco 7206VXR router.

The Catalyst RSM/VIP2, Cisco 7100 series routers, Cisco uBR7200 series routers, and the VIP do not support half-duplex and Bisync operation on the PA-T3+.

Use the **half-duplex** command to configure EIA/TIA-232 interfaces for half-duplex mode; full-duplex mode is the default for low-speed serial interfaces. Serial DCE interfaces in half-duplex mode can be configured for controlled-carrier mode or constant-carrier mode; constant-carrier mode is the default. Controlled-carrier mode sets the EIA/TIA-232 interface to deactivate Data Carrier Detect (DCD) until a transmission is sent to the interface. After a transmission is received, DCD is activated and the interface waits a user-configured amount of time and then transmits the data. After the transmission, the interface waits a user-configured amount of time and then deactivates DCD. Constant-carrier mode activates DCD at all times.

Use the **half-duplex controlled-carrier** command to configure an EIA/TIA-232 interface for controlled-carrier mode. Use the **no half-duplex controlled-carrier** command to return the interface to constant-carrier mode.

Follow these steps to configure controlled-carrier mode on an EIA/TIA-232 interface:

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

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

Step 2 Specify the interface to configure for controlled-carrier mode using the **interface serial** subcommand (followed by the interface address of the interface) and then enter the **half-duplex controlled-carrier** subcommand:

The following example is for the first interface of the port adapter in port adapter slot 1:

```
Router(config)# interface serial 1/0
Router(config-if)# half-duplex controlled-carrier
```

Step 3   Specify the length of the timer delay the interface uses when it is configured for controlled-carrier mode by using the following command:

```
Router(config-if)# half-duplex timer {cts-delay value | cts-drop-timeout value |
dcd-drop-delay value | dcd-txstart-delay value | rts-drop-delay value | rts-timeout value
| transmit-delay value}
```
where *value* is the length of the timer delay in milliseconds.

The following example specifies a Data Carrier Detect (DCD) drop delay of 100 milliseconds on the first interface of a port adapter in port adapter slot 1:

```
Router(config)# interface serial 1/0
Router(config-if)# half-duplex timer dcd-drop-delay 100 ms
```

Table 4-7 lists the default delay settings and the *value* argument for each timer you can use with the **half-duplex timer** command.

Table 4-7   Half-Duplex Timer Default Delay Settings

Timer	Command Syntax	Default Settings[1]
CTS delay[2]	**half-duplex timer cts-delay**	0
CTS drop timeout	**half-duplex timer cts-drop-timeout**	250
DCD drop delay[3]	**half-duplex timer dcd-drop-delay**	100
DCD transmission start delay	**half-duplex timer dcd-txstart-delay**	100
RTS drop delay[4]	**half-duplex timer rts-drop-delay**	3
RTS timeout	**half-duplex timer rts-timeout**	3
Transmit delay	**half-duplex transmit-delay**	0

1. In milliseconds (ms).

2. Clear To Send (CTS).

3. Data Carrier Detect (DCD).

4. Request To Send (RTS).

Step 4   Complete the configuration by pressing **Ctrl-Z**—hold down the **Control** key while you press **Z**—or entering **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.

Step 5   Write the new configuration to NVRAM as follows:

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

This completes the procedure for configuring controlled-carrier mode on an EIA/TIA-232 interface. For additional information on configuring half-duplex operation on low-speed serial interfaces, refer to the chapter "Configuring Interfaces" of the *Configuration Fundamentals Configuration Guide* on Cisco.com.

To configure EIA/TIA-232 interfaces for Binary Synchronous (Bisync) operation in series routers, refer to the "Block Serial Tunneling (BSTUN)" section of the "Configuring Serial Tunnel (STUN) and Block Serial Tunnel (BSTUN)" chapter of the *Bridging and IBM Networking Configuration Guide* on Cisco.com.

Setting the Bandwidth

In interface configuration mode, reduce effective bandwidth (range of 22 to 44210 kbps) by entering the **dsu bandwidth** configuration subcommand, as in the following example:

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

Use the **no** form of this command to return to the default, 44210.

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

Defining the DSU Mode

In interface configuration mode, define the DSU interoperability mode by entering the **dsu mode** [**0** | **1** | **2**] configuration subcommand, as in the following example:

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

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

Note The local port configuration must match the remote port configuration. For example, if you define the DSU interoperability mode as 1 on the local port, you must do the same on the remote port. You need to know what type of DSU is at the remote port to find out if it interoperates with the PA-T3+. For T3+ serial interfaces, specify mode 0 for connection from a PA-T3+ to another PA-T3+ or a Digital Link DSU (DL3100). Specify mode 1 for connection from a PA-T3+ to a Kentrox DSU. Specify mode 2 for connection from a PA-T3+ to a Larscom DSU.

See the "Interoperability Guidelines for PA-T3+ DSUs" section on page 1-3 for additional information regarding DSU feature compatibilities.

Enabling T3+ Scrambling

In interface configuration mode, enable T3+ scrambling by entering the **scramble** configuration subcommand, as in the following example:

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

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

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

See the "Interoperability Guidelines for PA-T3+ DSUs" section on page 1-3 for additional information regarding DSU feature compatibilities.

Specifying T3+ Framing

In interface configuration mode, specify T3+ framing by entering the **framing** {**c-bit** | **m13** | **bypass**} configuration subcommand, as in the following example:

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

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

Note If you use the **bypass** option, scrambling must be set to the default, disabled; the DSU mode must be set to the default, 0; and the DSU bandwidth must be set to the default, 44210.

Setting the Cable Length

In interface configuration mode, set the cable length (0 to 450 feet), as in the following example:

```
Router(config-if)# cablelength 250
```

Use the **no** form of this command to return to the default, which is 10 feet.

Checking the Configuration

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

- Using show Commands to Verify the New Interface Status, page 4-17
- Using the ping Command to Verify Network Connectivity, page 4-29
- Using loopback Commands, page 4-29

Using show Commands to Verify the New Interface Status

Table 4-8 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the PA-T3+ appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow. For complete command descriptions and examples, refer to the publications listed in the "Related Documentation" section on page viii.

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

Table 4-8   Using show Commands

Command	Function	Example
show version or **show hardware**	Displays system hardware configuration, the number of each interface type installed, Cisco IOS software version, names and sources of configuration files, and boot images	Router# **show version**
show controllers	Displays all the current interface processors and their interfaces	Router# **show controllers**
show diag *slot*	Displays types of port adapters installed in your system and information about a specific port adapter slot, interface processor slot, or chassis slot	Router# **show diag 2**
show interfaces *type module-slot- number/ port-adapter-bay-number/ interface-port-number*	Displays status information about a specific type of interface (for example, serial) on a Catalyst 6000 family FlexWAN module	Router# **show interfaces serial 3/0/0**
show interfaces *type port-adapter-slot-number/ interface-port-number*	Displays status information about a specific type of interface (for example, serial) in a Cisco 7200 series router, Cisco 7200 VXR router, Cisco 7201 router, Cisco 7301 router, and Cisco 7401ASR router	Router# **show interfaces serial 1/0**
show interfaces *type* **2** or **3** or **4** or **5**/ *interface-port-number*	Displays status information about a specific type of interface (for example, serial) on a Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	Router# **show interfaces serial 3/0**
show interfaces *type interface-processor-slot-number/port-adapter-slot-number/ interface-port-number*	Displays status information about a specific type of interface (for example, serial) on a VIP in a Cisco 7000 series router or Cisco 7500 series router	Router# **show interfaces serial 3/1/0**
show protocols	Displays protocols configured for the entire system and for specific interfaces	Router# **show protocols**
show running-config	Displays the running configuration file	Router# **show running-config**
show startup-config	Displays the configuration stored in NVRAM	Router# **show startup-config**

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

Choose the subsection appropriate for your system. Proceed to the "Using the ping Command to Verify Network Connectivity" section on page 4-29 when you have finished using the **show** commands.

Using the show version or show hardware Commands

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

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

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

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

Following is an example of the **show version** command from a Catalyst 6000 family switch with a PA-T3+ installed:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) MSFC Software (C6MSFC-JSV-M), Experimental Version 12.1(20000209:134547)
[amcrae-cosmos_e_nightly 163]
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Wed 09-Feb-00 07:10 by
Image text-base: 0x60008900, data-base: 0x6140E000

ROM: System Bootstrap, Version 12.0(3)XE, RELEASE SOFTWARE

const-uut uptime is 5 minutes
System returned to ROM by reload
System image file is "bootflash:c6msfc-jsv-mz.Feb9"

cisco Cat6k-MSFC (R5000) processor with 122880K/8192K bytes of memory.
```

```
Processor board ID SAD03457061
R5000 CPU at 200Mhz, Implementation 35, Rev 2.1, 512KB L2 Cache
Last reset from power-on
Channelized E1, Version 1.0.
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
Primary Rate ISDN software, Version 1.1.
6 FlexWAN controllers (13 Serial)(8 E1)(8 T1)(2 HSSI)(2 ATM)(1 Channelized T3)(1
Channelized E3)(2 POS).
1 Virtual Ethernet/IEEE 802.3  interface(s)
17 Serial network interface(s)
2 HSSI network interface(s)
2 ATM network interface(s)
2 Packet over SONET network interface(s)
1 Channelized T3 port(s)
1 Channelized E3 port(s)
123K bytes of non-volatile configuration memory.
4096K bytes of packet SRAM memory.

16384K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x1
```

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

Following is an example of the **show version** command from a Cisco 7200 series router with a PA-T3+ installed:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Released Version 11.1(24)CC
FIB_branch Synced to mainline version:11.1(21.2)CA
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 03-Nov-98 16:44 by
Image text-base:0x600088E0, data-base:0x60882000

ROM:System Bootstrap, Version 11.1(13)CA, RELEASE SOFTWARE

router uptime is 2 days, 14 hours, 48 minutes
System restarted by reload
System image file is "slot0:c7200-j-mz.111CC", booted via console

cisco 7206 (NPE200) processor with 122880K/8192K bytes of memory.
R5000 processor, Implementation 35, Revision 2.1 (512KB Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
4 Ethernet/IEEE 802.3 interfaces.
3 FastEthernet/IEEE 802.3 interfaces.
3 Serial network interfaces.
125K bytes of non-volatile configuration memory.
4096K bytes of packet SRAM memory.

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

Cisco 7201 Router—Example Output of the show version Command

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

```
Router# show version

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

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

Following is an example of the **show version** command from a Cisco 7401ASR router with a PA-T3+
installed:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7401ASR Software (C7401ASR-J-M), Released Version 11.1(24)CC
FIB_branch Synced to mainline version:11.1(21.2)CA
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 03-Nov-98 16:44 by
Image text-base:0x600088E0, data-base:0x60882000

ROM:System Bootstrap, Version 11.1(13)CA, RELEASE SOFTWARE

router uptime is 2 days, 14 hours, 48 minutes
System restarted by reload
System image file is "slot0:c7200-j-mz.111CC", booted via console

cisco 7401ASR processor with 122880K/8192K bytes of memory.
R5000 processor, Implementation 35, Revision 2.1 (512KB Level 2 Cache)
Last reset from power-on
Bridging software.
```

```
SuperLAT software (copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
4 Ethernet/IEEE 802.3 interfaces.
3 FastEthernet/IEEE 802.3 interfaces.
3 Serial network interfaces.
125K bytes of non-volatile configuration memory.
4096K bytes of packet SRAM memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
4096K bytes of Flash internal SIMM (Sector size 256K).
```

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

Following is an example of the **show version** command from a Cisco 7500 series router with a PA-T3+ intalled:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-PV-M), Released Version 11.1(24)CC
FIB_branch Synced to mainline version:11.1(21.2)CA
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 03-Nov-98 17:20 by
Image text-base:0x60010910, data-base:0x6081E000

ROM:System Bootstrap, Version 11.1(8)CA1, RELEASE SOFTWARE

router uptime is 2 days, 14 hours, 52 minutes
System restarted by reload
System image file is "rsp-pv-mz.111CC", booted via console

cisco RSP4 (R5000) processor with 65536K/2072K bytes of memory.
R5000 processor, Implementation 35, Revision 2.1 (512KB Level 2 Cache)
Last reset from power-on
G.703/E1 software, Version 1.0.
G.703/JT2 software, Version 1.0.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Chassis Interface.
1 EIP controller (6 Ethernet).
1 VIP2 controller (4 Serial).
2 VIP2 R5K controllers (2 Serial)(2 HSSI).
6 Ethernet/IEEE 802.3 interfaces.
6 Serial network interfaces.
2 HSSI network interfaces.
123K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
20480K bytes of Flash PCMCIA card at slot 1 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x100
```

Using the show diag Command

Display the types of port adapters installed in your system (and specific information about each) using the **show diag** *slot* command, where *slot* is the *port adapter slot* in a Cisco 7200 series router, Cisco 7200 VXR router, Cisco 7201 router, Cisco 7301 router, or Cisco 7401ASR router, the *module slot* in a Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router, and the *interface processor slot* in a Cisco 7000 series router or Cisco 7500 series router with a VIP. In the FlexWAN module, the **show diag** command is used without the *slot* designation.

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

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

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

Following is an example of the **show diag** command that shows a PA-T3+ installed in chassis slot 9 on a Catalyst 6000 family FlexWAN module:

```
Router# show diag

[Additional display text omitted from this example]
Slot 9: Logical_index 18
    Board is analyzed ipc ready FlexWAN controller

    Slot database information:
    Flags: 0x2004Insertion time: unknown

    CWAN Controller Memory Size: Unknown

PA Bay 0 Information:
        T3+ Serial PA, 1 ports
        EEPROM format version 0
        HW rev 0.00, Board revision UNKNOWN
        Serial number: 00000000  Part number: 00-0000-00
[Additional display text omitted from this example]
```

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

Following is an example of the **show diag** command that shows a PA-T3+ installed in port adapter slot 6 of a Cisco 7200 series router:

```
Router# show diag 6
Slot 6:
        T3+ PA port adapter, 1 port
        Port adapter is analyzed
        Port adapter insertion time 2d14h 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 1
        EEPROM contents (hex):
          0x20:01 CB 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 FF
```

Cisco 7201 Router—Example Output of the show diag Command

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

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

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

Following is an example of the **show diag** command that shows a PA-T3+ installed in port adapter slot 1 of a Cisco 7401ASR router:

```
Router# show diag 1
Slot 1:
        T3+ PA port adapter, 1 port
        Port adapter is analyzed
        Port adapter insertion time 2d14h 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 1
        EEPROM contents (hex):
          0x20:01 CB 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 FF
```

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

Following is an example of the **show diag** command that shows a PA-T3+ installed in port adapter slot 1 on a VIP in interface processor slot 10:

```
Router# show diag 10
slot 10:
        Physical slot 1, ~physical slot 0xE, logical slot 1, CBus 0
        Microcode Status 0x4
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status:None
        EEPROM format version 1
        VIP2 R5K controller, HW rev 2.02, board revision A0
        Serial number:08217772  Part number:73-2167-04
        Test history:0x00        RMA number:00-00-00
        Flags:cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20:01 1E 02 02 00 7D 64 AC 49 08 77 04 00 00 00 00
          0x30:50 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00
Slot database information:
        Flags:0x4      Insertion time:0x1B28 (2d14h ago)

        Controller Memory Size:64 MBytes DRAM, 8192 KBytes SRAM

        PA Bay 0 Information:
                T3+ Serial PA, 1 ports
                EEPROM format version 1
                HW rev 255.255, Board revision UNKNOWN
                Serial number:4294967295  Part number:255-65535-255

        PA Bay 1 Information:
                T3+ Serial PA, 1 ports
                EEPROM format version 1
                HW rev 255.255, Board revision UNKNOWN
                Serial number:4294967295  Part number:255-65535-255
```

Using the show interfaces Command

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

For complete descriptions of interface subcommands and the configuration options available for the individual platforms, refer to the publications listed in the "Related Documentation" section on page viii.

✎

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

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

- Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches—Example Output of the show interfaces Command, page 4-26
- Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show interfaces Command, page 4-27
- Cisco 7201 Router—Example Output of the show interfaces Command, page 4-27
- Cisco 7401ASR Router—Example Output of the show interfaces Command, page 4-28
- VIP in Cisco 7000 Series Routers or Cisco 7500 Series Routers—Example Output of the show interfaces Command, page 4-28

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

Followingare examples of the **show interfaces serial** command from a FlexWAN module. In these examples, the two serial interfaces (0 to 1) are on a port adapter in bay 0 of a FlexWAN module in module slot 9; also, most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
Router# show interfaces serial 9/0/0
Serial9/0/0 is administratively down, line protocol is down
  Hardware is PODS3+ Serial
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
[Additional display text omitted from this example]

Router# show interfaces serial 9/0/1
Serial9/0/1 is administratively down, line protocol is down
  Hardware is PODS3+ Serial
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
[Additional display text omitted from this example]
```

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

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

```
Router# show interfaces serial 1/0
Serial1/0 is up, line protocol is up
   Hardware is M8T-RS232
   Internet address is 10.0.0.0
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation HDLC, loopback not set, keepalive set (10 sec)
[Additional display text omitted from this example]


Router# show interfaces serial 1/1
Serial1/1 is up, line protocol is up
   Hardware is M8T-RS232
   Internet address is 10.0.0.1
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation HDLC, loopback not set, keepalive set (10 sec)
[Additional display text omitted from this example]
```

Cisco 7201 Router—Example Output of the show interfaces Command

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

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

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

Following are examples of the **show interfaces** command from a Cisco 7401ASR router. In these examples, the serial two interfaces (0 to 1) are on a port adapter in port adapter slot 1; also, most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
Router# show interfaces serial 1/0
Serial1/0 is up, line protocol is up
    Hardware is M8T-RS232
    Internet address is 10.0.0.0
    MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
    Encapsulation HDLC, loopback not set, keepalive set (10 sec)
[Additional display text omitted from this example]

Router# show interfaces serial 1/1
Serial1/1 is up, line protocol is up
    Hardware is M8T-RS232
    Internet address is 10.0.0.1
    MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
    Encapsulation HDLC, loopback not set, keepalive set (10 sec)
[Additional display text omitted from this example]
```

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

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

```
Router# show interfaces serial 3/1/0
Serial3/1/0 is up, line protocol is up
    Hardware is cyBus Serial
  Internet address is 10.0.0.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
[Additional display text omitted from this example]

Router# show interfaces serial 3/1/1
Serial3/1/1 is up, line protocol is up
    Hardware is cyBus Serial
  Internet address is 10.0.0.1
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
[Additional display text omitted from this example]
```

Proceed to the next section, "Using the ping Command to Verify Network Connectivity," to check network connectivity of the *PA-T3+* and switch or router.

Using the ping Command to Verify Network Connectivity

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

The **ping** command sends echo request packets out to a remote device at an IP address that you specify. After sending an echo request, the system waits a specified time for the remote device to reply. Each echo reply is displayed as an exclamation point (!) on the console terminal; each request that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate a bad connection.

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

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

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

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

Using loopback Commands

With the loopback test, you can detect and isolate equipment malfunctions by testing the connection between the PA-T3+ interface and a remote device such as a modem or a CSU/DSU. 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 compact serial cable. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or compact serial cable in the path of the loopback test.

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

- When no compact serial cable is attached to the PA-T3+ interface port, or if a DCE cable is attached to a port that is configured as line protocol up, the **loopback** command tests the path between the network processing engine and the interface port only (without leaving the network processing engine and port adapter).

- When a DTE cable is attached to the port, the **loopback** command tests the path between the network processing engine and the near (network processing engine) side of the DSU or modem to test the PA-T3+ interface and compact serial cable.

Table 4-9 provides examples of the **loopback** {**dte** | **local** | **network** {**line** | **payload**} | **remote**} command. The examples given are for interface 0 of a one-port PA-T3+ in port adapter slot 0 of a VIP in chassis slot 10 of a Cisco 7500 series router:

Table 4-9   Using loopback Commands

Command	Function	Example
loopback dte	Sets the interface into loopback data terminal equipment (DTE). Loopback DTE loops the router output data back toward the router (after the LIU).	`Router(config)#` **`interface serial 1/0`** `router(config-if)#` **`loopback dte`**
loopback local	Sets the interface into local loopback mode. Local loopback loops the router output data back toward the router at the framer.	`Router(config)#` **`interface serial 10/0/0`** `router(config-if)#` **`loopback local`**
loopback network line	Sets the interface into network line loopback mode. Network line loopback loops the data back toward the network (before the framer).	`Router(config)#` **`interface serial 10/0/0`** `router(config-if)#` **`loopback network line`**
loopback network payload	Sets the interface into network payload loopback mode. Network payload loopback loops just the payload data back toward the network at the T3+ framer.	`Router(config)#` **`interface serial 10/0/0`** `router(config-if)#` **`loopback network payload`**
loopback remote[1]	Sets the interface into remote loopback mode. Remote loopback loops the data back toward the network (before the framer at the remote T3 device).	`Router(config)#` **`interface serial 10/0/0`** `router(config-if)#` **`loopback remote`**

1. Remote loopback mode works with C-bit framing only. The other loopback modes listed above work with C-bit, M13, and bypass framing. Refer to the "Specifying T3+ Framing" section on page 4-17 for information on configuring C-bit framing.