Multichannel T1/E1 Port Adapter Support

Feature Summary

The multichannel E1 and T1 Integrated Services Digital Network (ISDN) Primary Rate Interface (PRI) port adapters (PA-MC-8E1/120, PA-MC-4T1, PA-MC-8T1, and PA-MC-8DSX1) are available on Cisco 7200 series routers, Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

The PA-MC-8E1/120, PA-MC-4T1, and PA-MC-8T1 are single-wide modules that integrate channel service unit (CSU) functionality, data service unit (DSU) functionality, and E1 or T1 channel support into the Cisco router. The PA-MC-8DSX1 is a single-wide module that integrates DS1 DSU functionality and DS0 channel support into the Cisco router.

The PA-MC-8E1/120, PA-MC-4T1, PA-MC-8T1, and PA-MC-8DSX1 provide four or eight independent T1 (100-ohm) or E1 (120-ohm) connections via RJ-48C connectors. Each T1 or E1 port adapter can provide up to 128 separate full-duplex HDLC fractional or full T1 or E1 channels. Individual T1 connections of the DSX-1 version of the port adapters can connect to external CSUs, to digital cross connects (DACS), or to any other equipment that uses a DSX-1 interface.

For more information on these port adapters, refer to the following publications that accompany the hardware:

- *Multichannel DS1/PRI Port Adapter Installation and Configuration*
- *Multitchannel E1/PRI Port Adapter Installation and Configuration*

Benefits

These port adapters provide the following features and physical characteristics:

- Transmit and receives data bidirectionally at the rate of 2.048 Mbps for each E1 port or 1.536 Mbps for each T1 port.
- Supports RFC 1406 (except for the Frac table).
- Confirms with ITU G.703 and G.704.
- For wide-area networking, the port adapters can function as a concentrator for a remote site.
- E1 port adapter supports user-configurable international and national bits, set to predetermined pattern.
- T1 port adapter supports facilities data link (FDL) in extended super frame (ESF) framing

- Supports network and payload loopbacks and bit error rate testing (BERT).
- Supports ATM-DXI, Frame Relay, HDLC, LAPB, PPP, SMDS, and X.25 encapsulation.

Document Conventions

Command descriptions use these conventions:

- **Boldface** indicates commands and keywords that are entered literally as shown.
- *Italics* indicate arguments for which you supply values; in contexts that do not allow italics, arguments are enclosed in angle brackets (>).
- Square brackets ([ ]) indicate optional elements.
- Braces ({ }) group required choices, and vertical bars (|) separate alternative elements.
- Braces and vertical bars within square brackets ([{ | }]) indicate a required choice within an optional element.

Platform

This feature is supported on these platforms:

- Cisco 7200 series
- Cisco 7500 series
- Cisco 7000 series with the RSP7000 and RSP7000CI

Supported MIBs and RFCs

This feature supports RFC 1406 (except for the Frac table).

Configuration Tasks

Perform the tasks in the following sections to configure the PA-MC-8E1/120, PA-MC-4T1, PA-MC-8T1, and PA-MC-8DSX1 port adapters:

- Configure E1 Controllers (required)
- Configure T1 Controllers (required)
- Configure the Serial Interfaces (required)
- Troubleshoot E1 and T1 Controllers (optional)
- Monitor and Maintain the Port Adapter (optional)

After you configure the T1 and E1 controllers, you can continue configuring the interface as you would a normal serial interface. All serial interface commands might not be applicable to the T1 or E1 channel. For information on serial interfaces, refer to the “Configure a Synchronous Serial Interface” section in the “Configuring Interfaces” chapter of the *Configuration Fundamentals Configuration Guide* (Cisco IOS Release 11.2).

For additional information, refer to the following publications that accompany the hardware:

- *Multichannel DS1/PRI Port Adapter Installation and Configuration*
- *Multitchannel E1/PRI Port Adapter Installation and Configuration*

For information on other commands that can be used by these interfaces, refer to the Cisco IOS Release 11.2 or 11.3 configuration guides.

Configure E1 Controllers

To configure the E1 controller, you specify the timeslots used by the channel group or PRI group. All other configuration commands are optional. Table 1 lists the E1 controller configuration defaults.

Table 1 E1 Controller Defaults

Command	Default Value
clock source	line
framing	crc4
linecode	hdb3
national reserve	1 1 1 1 1 1

Configure Channel Groups

To configure the E1 controller and change any of the default configuration attributes, complete the first task in global configuration mode followed by any of the other tasks in controller configuration mode (you must at least configure a channel group or PRI group):

Task		Command
Step 1	Select the E1 controller and enter controller configuration mode.	**controller e1** *slot/port-adapter/port* (Cisco 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI) **controller e1** *slot/port* (Cisco 7200 series)
Step 2	Configure the timeslots used by this E1 channel group and optionally specify the speed. Channel groups range from 0-30, and timeslot range from 1-31.	**channel group** *number* **timeslots** *range* [**speed** {**56** | **64**}
or		
Step 3	Configure the E1 channel group as unframed. Channel groups range from 0-30.	**channel group** *number* **unframed**
Step 4	Change the clock source	**clock source** {**internal** | **line**}
Step 5	Enter up to 80 characters to describe this controller.	**description** *text*
Step 6	Change the framing used by the controller.	**framing** {**crc4** [**australia**] | **no-crc4**}
Step 7	Change the line coding format used by the controller.	**linecode** {**ami** | **hdb3**}
Step 8	Change the national reserved bit used by the controller. Select **0** or **1** for each bit.	**national reserve** {*international-bit*} {*sa4-bit*} {*sa5-bit*} {*sa6-bit*} {*sa7-bit*} {*sa8-bit*}

Task		Command
Step 9	Optionally exit configuration mode when you have finished configuring the E1 controller.	**end**

Configure Pri-Groups

Task		Command
Step 1	Select the E1 controller and enter controller configuration mode.	**controller e1** *slot*/*port-adapter*/*port* (Cisco 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI) **controller e1** *slot*/*port* (Cisco 7200 series)
Step 2	Configure the timeslots used by this E1 controller as a PRI group. The timeslot range is 1-31. When configuring a PRI group, you must use the **isdn switch-type** global configuration command to configure the switch type.	**pri-group timeslots** *range*
Step 3	Change the clock source	**clock source** {**internal** | **line**}
Step 4	Enter up to 80 characters to describe this controller.	**description** *text*
Step 5	Change the framing used by the controller.	**framing** {**crc4** [**australia**] | **no-crc4**}
Step 6	Change the line coding format used by the controller.	**linecode** {**ami** | **hdb3**}
Step 7	Change the national reserved bit used by the controller. Select **0** or **1** for each bit.	**national reserve** {*international-bit*} {*sa4-bit*} {*sa5-bit*} {*sa6-bit*} {*sa7-bit*} {*sa8-bit*}
Step 8	Optionally exit configuration mode when you have finished configuring the E1 controller.	**end**

When you are running channelized E1, each E1 interface can provide up to 31 E1 channel groups, which are numbered from 0 to 30. Each channel group provides up to thirty-one 64-kbps timeslots (E1 channels), which are numbered 1 to 31. Multiple timeslots 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 56 kbps or *n* x 64 kbps, where *n* is a number of E1 channels (1 to 31).

When you are running ISDN PRI, each E1 interface provides 30 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 multichannel E1/PRI port adapter supports dial-on-demand routing (DDR) when you are running ISDN PRI.

Each of the E1 channels on the multichannel E1/PRI port adapter uses a portion of the E1 bandwidth (fractional E1) or the entire E1 bandwidth for data transmission. Usable bandwidth for each E1 is *n* x 64 or *n* x 56 kbps, where *n* is a number from 1 to 31. The unused portion of the E1 bandwidth, when you are not running at full E1 speeds, cannot be used and is filled with idle channel data.

Note Note E1 timeslots on the multichannel E1/PRI port adapter are numbered 1 to 31, rather than the more traditional zero-based scheme (0 to 30) used with other Cisco products. This is to ensure consistency with Telco numbering schemes for E1 channels within channelized equipment.

The multichannel E1/PRI port adapter does not contain hardware support for the aggregation of multiple E1s (called inverse muxing or bonding) for higher bandwidth data rates.

Configure T1 Controllers

To configure the T1 controller, you specify the timeslots used by the channel group or PRI group. All other configuration commands are optional. Table 2 lists the T1 controller configuration defaults.

Table 2 T1 Controller Defaults

Command	Default Value
cablelength	long gain 36 (T1)
	short 133 (DXS1)
clock source	line
framing	esf
linecode	b8zs

To configure the T1 controller and change any of the default configuration attributes, complete the first task in global configuration mode followed by any of the other tasks in controller configuration mode (you must at least configure a channel group or PRI group):

Task		Command
Step 1	Select the T1 controller and enter controller configuration mode.	**controller t1** *slot/port-adapter/port* (Cisco 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI)
		controller t1 *slot/port* (Cisco 7200 series)
Step 2	Configure the timeslots used by this T1 channel group. Channel groups range from 0-23. The timeslot range is 1-24.	**channel group** *number* **timeslots** *range* [**speed** {**56** | **64**}
or		
Step 3	Configure the timeslots used by this T1 PRI group. The timeslot range is 1-24. When configuring a PRI group, you must use the **isdn switch-type** global configuration command to configure the switch type.	**pri-group timeslots** *range*
Step 4	Change the cable length.	**cablelength** {**long** {**gain26** | **gain36**} {**-15db** | **-22.5db** | **-7.5db** | **0db**} | **short** {**133** | **266** | **399** | **533** | **655**}}
Step 5	Change the clock source	**clock source** {**internal** | **line**}
Step 6	Enter up to 80 characters to describe this controller.	**description** *text*

Task		Command
Step 7	Enable performance monitoring via Facility Data Link (FDL) per ANSI T1.403 or AT&T TR54016.	**fdl** {**ansi** | **att**}
Step 8	Change the framing used by the controller.	**framing** {**esf** | **sf**}
Step 9	Change the line coding format used by the controller.	**linecode** {**ami** | **b8zs**}
Step 10	Optionally exit configuration mode when you have finished configuring the T1 controller.	**end**

When you are running channelized T1, each DS1 interface can provide up to 24 T1 channel groups, which are numbered from 0 to 23. Each channel group provides up to twenty-four 64-kbps timeslots (DS0 channels), which are numbered 1 to 24.

Multiple timeslots 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 56 kbps or *n* x 64 kbps, where *n* is a number of DS0 channels (1 to 24).

When you are running ISDN PRI, each DS1 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 multichannel DS1/PRI port adapter supports dial-on-demand routing (DDR) when you are running ISDN PRI.

Each of the T1 channels on the multichannel DS1/PRI port adapter uses a portion of the T1 bandwidth (fractional T1) or the entire T1 bandwidth for data transmission. Usable bandwidth for each T1 is *n* x 64 or *n* x 56 kbps, where *n* is a number from 1 to 24. The unused portion of the T1 bandwidth, when you are not running at full T1 speeds, cannot be used and is filled with idle channel data.

Note Note T1 timeslots on the multichannel DS1/PRI port adapter are numbered 1 to 24, rather than the more traditional zero-based scheme (0 to 23) used with other Cisco products. This is to ensure consistency with Telco numbering schemes for T1 channels within channelized equipment.

The multichannel DS1/PRI port adapter supports facilities data link (FDL) in extended super frame (ESF) framing.

The multichannel DS1/PRI port adapter does not contain hardware support for the aggregation of multiple E1s (called inverse muxing or bonding) for higher bandwidth data rates.

Configure the Serial Interfaces

A channelized E1 controller can have up to 31 serial interfaces (numbered 0 to 30), and a channelized T1 controller can have up to 24 serial interfaces (numbered 0 to 23). After you define the channel groups or PRI groups, you can configure each group as a serial interface.

These port adapters support Cisco HDLC, Frame Relay, PPP, and SMDS Data Exchange Interface (DXI) encapsulations over each E1 or T1 link. For SMDS only, DXI is sent on the E1 or T1 line, so it needs to connect to an SMDS switch that has direct DXI input.

To enter interface configuration mode and configure the serial interface that corresponds to an E1 or T1 channel group, perform the following task in global configuration mode:

Task		Command
Step 1	Select the E1 or T1 channel group and enter interface configuration mode. Channel group for the E1 is 0-30 and for the T1 is 0-23. For a PRI group, the channel group is 30 for E1 and 23 for T1.	**interface serial** *slot*/*port-adapter*/*port*:*channel groupings* 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI) **interface serial** *slot*/*port*:*channel-group (*Cisco 7200 series)
Step 2	Configure any interface commands, optionally exit configuration mode.	**end**

Some interface configuration commands you might want to configure are the IP address and the encapsulation type. For more information on how to configure a serial interface, refer to the *Configuration Fundamentals Configuration Guide* (Cisco IOS Release 11.2 or 11.3).

The default settings for the serial interfaces are:

Table 3 Serial Interface Default Settings

Default Setting	Default Value
encapsulation hdlc	HDLC
crc 16	16
no invert data	non-inverted

Troubleshoot E1 and T1 Controllers

You can use the following methods to troubleshoot the E1 and T1 controllers using Cisco IOS software:

- Set Loopbacks
- Run Bit Error Rate Test

Set Loopbacks

To set a loopback on the E1 controller, perform the first task followed by any of the following tasks beginning in global configuration mode:

Task	Command
Select the E1 controller and enter controller configuration mode.	**controller e1** *slot*/*port-adapter*/*port* (Cisco 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI) **controller e1** *slot*/*port* (Cisco 7200 series)
Set a diagnostic loopback on the E1 line.	**loopback diag**
Set a local loopback on the E1 line.	**loopback local** {**line** | **payload**}

Task	Command
Exit configuration mode when you have finished configuring the controller.	**end**

To set a loopback on the T1 controller, perform the first task followed by any of the following tasks beginning in global configuration mode:

Task	Command
Select the T1 controller and enter controller configuration mode.	**controller t1** *slot*/*port-adapter*/*port* (Cisco 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI) **controller t1** *slot*/*port* (Cisco 7200 series)
Set a diagnostic loopback on the T1 line.	**loopback diag**
Set a local loopback on the T1 line. You can select to loopback the line or the payload.	**loopback local** {**line** | **payload**}
Set a remote loopback on the T1 line. This loopback setting will loopback the far end at line or payload, using IBOC (in band bit-orientated code) or the ESF loopback codes to communicate the request to the far end..	**loopback remote** {**esf** {**line** | **payload**} | **iboc**}
Exit configuration mode when you have finished configuring the controller.	**end**

Note To remove a loopback, use the **no loopback** command.

Table 4 Loopback Descriptions

Loopback	Description
loopback diag	Loops the outgoing transmit signal back to the receive signal. This is done using the diagnostic loopback feature in the port adapter's PMC framer. The port adapter transmits AIS in this mode. Set the **clock source** command to **internal** for this loopback mode.
loopback local	Loops the incoming receive signal back out the transmitter. You can specify whether to use the **line** or **payload**.
local line	The incoming signal is looped back in the port adapter using the framer's line loopback mode. The framer does not reclock or reframe the incoming data. All incoming data is receive by the port adapter's driver.
local payload	The incoming signal is looped back in the port adapter using the framer's payload loopback mode. The framer reclocks and reframes the incoming data before sending it back out to the network. When in payload loopback, an all 1s data pattern is received by the local HDLC receiver, and the clock source is automatically set to line (overriding the **clock source** command). When the payload loopback is ended, the clock source returns to the last setting selected by the **clock source** command.

Table 4 Loopback Descriptions

Loopback	Description
loopback remote esf	Attempts to set the far-end T1 interface into either payload or line loopback. This command sends an out-of-band bit-oriented code through the FDL signalling channel. Execution of the loopback depends on the far-end device recognizing and responding to these codes. This command is only available when using ESF framing mode. You can specify whether to use **line** or **payload**.
loopback remote iboc	Attempts to set the far-end T1 interface into line loopback. This command sends an in-band bit-oriented code to the far-end to cause it to go into line loopback. This command is available when using ESF or SF framing mode.

Run Bit Error Rate Test

Bit error rate testing (BERT) is supported on each of the E1 or T1 links. The BERT testing is done only over a framed E1 or T1 signal and can be run only on one port at a time.

The port adapter contains onboard BERT circuitry. With this, the port adapter software can send and detect a programmable pattern that is compliant with CCITT/ITU O.151, O.152, and O.153 pseudo-random and repetitive test patterns. BERTs allow you to test cables and signal problems in the field.

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

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

To run a BERT on an E1 or T1 controller, perform the following optional tasks beginning in global configuration mode:

Task		Command
Step 1	Select the E1 or T1 controller and enter controller configuration mode.	**controller** {**e1** | **t1**} *slot*/*port-adapter*/*port* (Cisco 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI) **controller** {**e1** | **t1**} *slot*/*port* (Cisco 7200 series)
Step 2	Specify the BERT pattern for the E1 or T1 line and the duration of the test in minutes (1 to 1440 minutes).	**bert pattern** {**0s** | **1s** | **2^11** | **2^15** | **2^20-O153** | **2^20-QRSS** | **2^23** | **alt-0-1**} **interval** *minutes*
Step 3	Exit configuration mode when you have finished configuring the controller.	**end**
Step 4	View the BERT results.	**show controllers** {**e1** | **t1**} *slot*/*port-adapter*/*port* (Cisco 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI) **show controllers** {**e1** | **t1**} *slot*/*port* (Cisco 7200 series)

The following keywords list different BERT keywords and their descriptions.

Table 5 BERT Pattern Descriptions

Keyword	Description
0s	Repeating pattern of zeros (...000...).
1s	Repeating pattern of ones (...111...).

Table 5 BERT Pattern Descriptions

Keyword	Description
2^11	Pseudo-random test pattern that is 2,048 bits in length.
2^15	Pseudo-random O.151 test pattern that is 32,768 bits in length.
2^20-O153	Pseudo-random O.153 test pattern that is 1,048,575 bits in length.
2^20-QRSS	Pseudo-random QRSS O.151 test pattern that is 1,048,575 bits in length.
2^23	Pseudo-random 0.151 test pattern that is 8,388,607 bits in length.
alt-0-1	Repeating alternating pattern of zeros and ones (...01010...).

Both the total number of error bits received and the total number of bits received are available for analysis. You can select the testing period from 1 minute to 24 hours, and you can also retrieve the error statistics anytime during the BER test.

Note To terminate a BER test during the specified test period, use the **no bert** command.

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

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

Monitor and Maintain the Port Adapter

After configuring the new interface, you can monitor the status and maintain the port adapter by using **show** commands. To display the status of any interface, complete any of the following tasks in EXEC mode:

Task	Command
Display the status of the E1 or T1 controller.	**show controllers** {**e1** | **t1**} [*slot/port-adapter/port/e1-line*] [**brief**] (Cisco 7500 series and Cisco 7000 series routers with RSP7000 and RSP7000CI) **show controllers** {**e1** | **t1**} [*slot/port/e1-line*] [**brief**] (Cisco 7200 series)
Display statistics about the serial information for a specific E1 or T1 channel group (values are 0 to 30 for E1 and 0 to 23 for T1).	**show interface serial** *slot/port-adapter/port/e1-line:channel-group* (Cisco 7500 series and Cisco 7000 series routers with the RSP7000 and RSP7000CI) **show interface serial** *slot/port/e1-line:channel-group* (Cisco 7200 series)
To clear the interface counters, use the **clear counters** EXEC command.	**clear counters serial** *slot/port/e1-line:channel-group* (7200) **clear interface** *slot/port-adapter/port/e1-line:channel group* (7500)

Configuration Examples

The following example shows how to configure a basic channelized E1 PRI ISDN port adapter. In this example, the controller is enabled, timeslots are assigned to the PRI group, and the ISDN switch type used on all ISDN interfaces on the router is a switch for the European community (primary-net5). The PRI group timeslots of 1, 3, 4, 5, and 7 (the B channels) are selected to map to timeslot 16 (the D channel), which is recognized by the system as timeslot 15.

```
Router# configure terminal
Router (config)# isdn switch-type primary-net5
Router (config)# controller e1 3/1/1
Router (config-controller)# framing crc4
Router (config-controller)# linecode hdb3
Router (config-controller)# pri-group timeslots 1,3-5,7
Router (config-controller)# exit
Router (config)# interface serial 3/1/1:30
Router (config-if)# ip address 1.1.15.1 255.255.255.0
Router (config-if)# end
Router#
```

The following example shows how to configure a basic channelized T1 PRI ISDN port adapter. In this example, the controller is enabled, timeslots are assigned to the PRI group, and the ISDN switch type used on all ISDN interfaces on the router is for the United States switch (primary-5ess). The PRI group timeslots of 1, 3, 4, 5, and 7 (the B channels) are selected to map to timeslot 24 (the D channel), which is recognized by the system as timeslot 23.

```
Router# configure terminal
Router (config)# isdn switch-type- primary-5ess
Router (config)# controller t1 3/1/1
Router (config-controller)# framing esf
Router (config-controller)# linecode b8zs
Router (config-controller)# pri-group timeslots 1,3-5,7
Router (config-controller)# exit
Router (config)# interface serial 3/1/1:23
Router (config-if)# ip address 1.1.15.1 255.255.255.0
Router (config-if)# end
Router#
```

The following example shows channel group 0 and timeslots 1, 3 through 5, and 7 selected for mapping. The example shows how to configure a basic channelized E1 port adapter on a Cisco 7200 series router:

```
Router# configure terminal
Router (config)# controller e1 1/1
Router (config-controller)# clock source line
Router (config-controller)# framing crc4
Router (config-controller)# linecode hdb3
Router (config-controller)# channel-group 0 timeslots 1,3-5,7
Router (config)# interface serial 1/1:0
Router (config-if)# ip address 1.1.15.1 255.255.255.0
Router (config-if)# end
Router#
```

Note 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 more information, refer to the Cisco IOS Release 11.2 or 11.3 configuration guides.

Note For additional examples, refer to the "Configuring Interfaces" chapter of the *Configuration Fundamentals Configuration Guide* (Cisco IOS Release 11.2 or 11.3).

Command Reference

This section documents modified commands. All other commands used with this feature are documented in the Cisco IOS Release 11.2 and 11.3 command references.

- **bert pattern**
- **channel-group**
- **cablelength**
- **loopback**
- **national reserve**
- **show controllers**
- **show interface serial**

bert pattern

To enable a BERT test pattern on an E1 or T1 line, use the **bert pattern** controller configuration command. To disable a BERT test pattern, use the **no** form of this command.

bert pattern {**0s** | **1s** | **2^11** | **2^15** | **2^20-O153** | **2^20-QRSS** | **2^23 | alt-0-1**} **interval** *minutes*
no bert pattern {**0s** | **1s** | **2^11** | **2^20-O153** | **2^20-QRSS** | **2^23 | alt-0-1**} **interval** *minutes*

Syntax Description

pattern {**0s** | **1s** | **2^15** | **2^11** | **2^20-O153** | **2^20-QRSS** | **2^23** | **alt-0-1**}	Specifies the length of the repeating BERT test pattern. Values are: • 0s—Repeating pattern of zeros (...000...). • 1s—Repeating pattern of ones (...111...). • 2^11—Pseudo-random test pattern that is 2,048 bits in length. • 2^15—Pseudo-random O.151 test pattern that is 32,768 bits in length. • 2^20-O153—Pseudo-random O.153 test pattern that is 1,048,575 bits in length. • 2^20-QRSS—Pseudo-random QRSS 0.151 test pattern that is 1,048,575 bits in length. • 2^23—Pseudo-random 0.151 test pattern that is 8,388,607 bits in length. • alt-0-1—Repeating alternating pattern of zeros and ones (...01010...).
interval *minutes*	Specifies the duration of the BERT test. The interval can be a value from 1 to 14400 minutes.

Default

No BERT test is performed.

Command Mode

Controller configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.1 CC.

Bit error rate testing (BERT) is supported on each of the E1 or T1 links. The BER testing is done only over a framed E1 or T1 signal and can be run only on one port at a time.

To view the BERT results, use the **show controller e1** or **show controller t1** EXEC command. The BERT results include the following information:

- Type of test pattern selected
- Status of the test

- Interval selected
- Time remaining on the BER test
- Total bit errors
- Total bits received

When the E1 or T1 line has a BER test running, the line state is DOWN. Also, when the BER test is running and the Status field is Not Sync, the information in the Bit Errors field is not valid. When the BER test is done, the Status field is not relevant.

The **bert pattern** command is not written to NVRAM because it is only used for testing the E1 or T1 line for a short predefined interval and to avoid accidentally saving the command, which could cause the interface not to come up the next time the router reboots.

Example

In the following example, a BER test pattern of all zeros is run for 30 minutes on E1 line 0 on the port adapter in slot 9:

```
Router# controller e1 9/0
Router(config-controll)# bert pattern 0s interval 30
```

Related Commands

show controllers e1
show controllers t1

channel-group

To create a channel group on an E1 or T1 line, use the **channel-group** controller configuration command. To remove a channel group, use the **no** form of this command.

channel-group *group-number* {**timeslots** *range* [**speed** {**56** | **64**}] | **unframed**}
no channel-group *group-number* {**timeslots** *range* [**speed** {**56** | **64**}] | **unframed**}

Syntax Description

channel-group *group-number*	Channel group number. When configuring a T1 data line, channel group numbers can be values from 0 to 23. When configuring an E1 data line, channel group numbers can be values from 0 to 30.
timeslot *range*	Timeslot or range of timeslots belonging to the channel group. The first timeslot is numbered 1. For a T1 controller, the timeslot range is from 1 to 24. For an E1 controller, the timeslot range is from 1 to 31. A dash represents a range of timeslots, and a comma separates timeslots. For example, 1-10,15-18 assigns timeslots 1 through 10 and 15 through 18.
speed {**56** | **64**}	(Optional) Line speed (in kilobits per second) of the T1 or E1 line.
unframed	Specifies that the channel group is not framed. Supported on E1 lines only.

Default

The default line speed when configuring a T1 controller is 56 kbps.

The default line speed when configuring an E1 controller is 64 kbps.

Command Mode

Controller configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0. This command was modified in Cisco IOS Release 11.1 CC to add the **unframed** keyword.

You must specify the timeslots used by each channel group of the E1 or T1 line. The unconfigured timeslots are not used and are filled with an idle pattern.

After you configure the E1 or T1 lines, they are recognized by the software as a serial interface, and all configuration commands for a serial interface are available.

Examples

In the following example, timeslots 1, 2, 3, 4, 5, 20, 21, 22, and 23 are assigned to channel group 20, and timeslots 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19 are assigned to channel group 21 on the E1 line:

```
Router# configure terminal
Router(config)# controller e1 1/1/0
Router(config-controll)# channel-group 20 timeslot 1-5, 20-23
Router(config-controll)# channel-group 21 timeslot 6-19
Router(config-controll)# interface serial 1/1/0:20
Router(config-if)# ip address 10.20.30.1 255.255.255.0
Router(config-if)# interface serial 1/0/0:21
Router(config-if)# ip address 10.20.40.1 255.255.255.0
```

Related Commands

show controllers e1
show controllers t1

cablelength

To increase the pulse of a signal at the receiver and decrease the pulse from the transmitter using pulse equalization and line build-out or to specify the distance of the cable from the router to the network equipment for an E1 or T1 cable, use the **cablelength** interface configuration command. To return the default settings, use the **no** form of this command.

cablelength {**long** {**gain26** | **gain36**} {**-15db** | **-22.5db** | **-7.5db** | **0db**} |
short {**133** | **266** | **399** | **533** | **655**}}
no cablelength {**long** {**gain26** | **gain36**} {**-15db** | **-22.5db** | **-7.5db** | **0db**} |
short {**133** | **266** | **399** | **533** | **655**}}

Syntax Description

long {**gain26** | **gain36**} {**-15db** | **-22.5db** | **-7.5db** | **0db**}	Number of decibels by which the signal is increased. The default is **gain36 0db**.
short {**133** | **266** | **399** | **533** | **655**}	Cable length in feet. Below are the ranges for each length: • 133—0 to 133 feet • 266—133 to266 feet • 399—266 to 399 feet • 533—399 to 533 feet • 655—533 to 655 feet

Default

For long **gain36 0db**.

For short **133**.

Command Mode

Controller configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.1 CC.

A pulse equalizer regenerates a signal that has been attenuated and filtered by a cable loss. Pulse equalization does not produce a simple gain, but it filters the signal to compensate for complex cable loss. A gain26 receiver gain compensates for a long cable length equivalent to 26 dB of loss, while a gain36 compensates for 36 dB of loss.

The lengthening or building out of a line is used to control far-end crosstalk. Line build-out attenuates the stronger signal from the customer installation transmitter so that the transmitting and receiving signals have similar amplitudes. A signal difference of less than 7.5 dB is ideal. Line build-out does not produce simple flat loss (also known as resistive flat loss). Instead, it simulates a cable loss of 7.5 dB, 15 dB, or 22.5 dB so that the resulting signal is handled properly by the receiving equalizer at the other end.

Example

The following example increases the receiver gain by 26 decibels and decreases the transmitting pulse by 7.5 decibels for a long cable:

```
Router(config)# controller t1 0/0/0
Router(config-controller)# cablelength long gain26 -7.5db
```

loopback

To set a loopback on the E1 or T1 controller, use the **loopback** controller configuration command. To remove the loopback, use the **no** form of this command.

loopback {**diag** | **local** {**line** | **payload**}} (for E1 lines)
no loopback {**diag** | **local** {**line** | **payload**}} (for E1 lines)

loopback {**diag** | **local** {**line** | **payload**} | **remote** {**esf** {**line** | **payload**} | **iboc**}} (for T1 lines)
no loopback {**diag** | **local** {**line** | **payload**} | **remote** {**esf** {**line** | **payload**} | **iboc**}} (for T1 lines)

Syntax Description

diag	Loops the outgoing transmit signal back to the receive signal. This is done using the diagnostic loopback feature in the port adapter's PMC framer. The port adapter transmits AIS in this mode. Set the **clock source** command to **internal** for this loopback mode.
local {**line** | **payload**}	Loops the incoming receive signal back out the transmitter. You can specify whether to use the **line** or **payload**. In **local line** loopback, the incoming signal is looped back in the port adapter using the framer's line loopback mode. The framer does not reclock or reframe the incoming data. All incoming data is received by the port adapter's driver. In **local payload** loopback, the incoming signal is looped back in the port adapter using the framer's payload loopback mode. The framer reclocks and reframes the incoming data before sending it back out to the network. When in payload loopback, an all 1s data pattern is received by the local HDLC receiver, and the clock source is automatically set to line (overriding the **clock source** command). When the payload loopback is ended, the clock source returns to the last setting selected by the **clock source** command.
remote esf {**line** | **payload**}	Attempts to set the far-end T1 interface into either payload or line loopback. The **esf** loopback sends an out-of-band bit-oriented code through the FDL signaling channel. Execution of the loopback depends on the far-end device recognizing and responding to these codes. This command is only available when using ESF framing mode. You can specify whether to use **line** or **payload**.
remote iboc	Attempts to set the far-end T1 interface into line loopback. The **iboc** loopback sends an in-band bit-oriented code to the far-end to cause it to go into line loopback. This command is available when using ESF or SF framing mode.

Default

No loopbacks are set.

Usage Guidelines

Use the local loopback to diagnose problems with cables between the port adapter and the central switching office. You can also use this loopback mode with bit error rate (BER) tests.

Examples

The following examples show how to set a local line loopback on a T1 controller in slot 4:

```
Router(config)# controller t1 4/1/0
Router(config-controll)# loopback local line
Router(config-controll)# end
```

The following examples show how to set a local payload loopback on a T1 controller in slot 4:

```
Router(config)# controller t1 4/1/0
Router(config-controll)# loopback local payload
Router(config-controll)# end
```

The following examples show how to set a remote IBOC loopback on a T1 controller in slot 4:

```
Router(config)# controller t1 4/1/0
Router(config-controll)# loopback remote iboc
Router(config-controll)# end
```

The following examples show how to set a remote ESF payload loopback on a T1 controller in slot 4:

```
Router(config)# controller t1 4/1/0
Router(config-controll)# loopback remote esf payload
Router(config-controll)# end
```

national reserve

To set the E1 national reserve bits, use the **national reserve** controller configuration command.

national bit {*international-bit*} {*sa4-bit*} {*sa5-bit*} {*sa6-bit*} {*sa7-bit*} {*sa8-bit*}

Syntax Description

international-bit	Set the international bit to **0** or **1**. The default is **1**.
sa4-bit	Set the SA4 bit to **0** or **1**. The default is **1**.
sa5-bit	Set the SA5 bit to **0** or **1**. The default is **1**.
sa6-bit	Set the SA6 bit to **0** or **1**. The default is **1**.
sa7-bit	Set the SA7 bit to **0** or **1**. The default is **1**.
sa8-bit	Set the SA8 bit to **0** or **1**. The default is **1**.

Default

0 0 0 0 0 0

Command Mode

Controller configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.1 CC.

Example

In the following example, the national reserved bits are set to 1:

```
Router(config)# controller e1 1/1/0
Router(config-controll)# national reserve 1 1 1 1 1 1
```

show controllers

To display information about the E1 or T1 contollers, use the **show controllers** EXEC command.

show controllers t1 [*slot*/*port-adapter*/*port*] [**brief** | **remote**] (Cisco 7500 series and Cisco 7000 series routers with RSP7000 and RSP7000CI)
show controllers t1 [*slot*/*port*] [**brief** | **remote**] (Cisco 7200 series)

show controllers e1 [*slot*/*port-adapter*/*port*] [**brief**] (Cisco 7500 series and Cisco 7000 series routers with RSP7000 and RSP7000CI)
show controllers e1 [*slot*/*port*] [**brief**] (Cisco 7200 series)

Syntax Description

slot	(Optional) Slot location of the of the port adapter.
port-adapter	(Optional) On the Cisco 7500 series and Cisco 7000 series with RSP7000 and RSP7000CI, specifies the ports on a VIP. The value can be 0 or 1.
port	(Optional) Port number on the port adapter.
brief	(Optional) Displays a list of configurations only.
remote	(Optional) Displays T1 controller information for the remote end.

Command Mode

EXEC

Usage Guidelines

This command was modified in Cisco IOS Release 11.1 CC to add the **remote** keyword to the **show controllers t1** command, add the **show controllers e1** command, and to include sample output from the PA-MC-8E1/120, PA-MC-4T1, PA-MC-8T1, and PA-MC-8DSX1 port adapters.

Sample Displays

The following is partial sample output from the **show controller e1** command for a port adapter in port adapter slot 3 port 0:

```
Router# show controllers e1 3/0
E1 3/0 is up. (Diagnostic Loopback)
   DSX1 BERT pattern     : zeros
   DSX1 BERT sync        : done
   DSX1 BERT sync count  : 1
   DSX1 BERT interval    : 2
   DSX1 BERT time remain : 0
   DSX1 BERT total errs  : 0
   DSX1 BERT total k bits: 230930
   DSX1 BERT errors (last): 0
   DSX1 BERT k bits (last): 230930
  Applique type is Channelized E1 - balanced
  Receiver has no alarms.
  Framing is CRC4, Line Code is HDB3, Clock Source is Line.
  International Bit: 1, National Bits: 01010
  Data in current interval (735 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
    Total Data (last 1 15 minute intervals):
      0 Line Code Violations, 0 Path Code Violations,
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

The following is partial sample output from the **show controller t1** command for a port adapter in port adapter slot 6, port 1:

```
Router# show controllers t1 6/1
T1 6/1 is up.
  Applique type is Channelized T1
  No alarms detected.
  Cablelength is long gain36 0db
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.
  Data in current interval (761 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
  Total Data (last 1 15 minute intervals):
     0 Line Code Violations, 0 Path Code Violations,
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

Table 6 describes the **show controller e1** and **show controller t1** display fields.

Table 6 Show Controller E1 Field Descriptions

Field	Description
E1 1/0/0 is up T1 6/1 is up	The controller's state can be up, down, administratively down. Loopback conditions are shown by (Locally looped), (Remotely Looped), or (Diagnostic Loopback).
DSX1 BERT pattern	Pattern selected by most recent bert command
DSX1 BERT sync	Indicates whether BERT hardware is receiving a pattern that can be matched when sent.
DSX1 BERT sync count	Number of times the BERT hardware has gotten up sync since last BERT command.
DSX1 BERT interval	Number of minutes the most recent BERT command requested the BERT process to run.
DSX1 BERT time remain	The number of minutes the most recent BERT command has left to run until completion (rounded up).
DSX1 BERT total errs	Total number of bits in error since the most recent BERT command was issued.
DSX1 BERT total k bits	Total number of K bits received since the most recent BERT command was issued.
DSX1 BERT errors (last)	The BERT hardware is monitored on a periodic interval of about 9 seconds. This is the number of errors in the last 9 second interval.

Table 6 Show Controller E1 Field Descriptions (Continued)

Field	Description
DSX1 BERT k bits (last)	The BERT hardware is monitored on a periodic interval of about 9 seconds. this is the number of K bits received in the last 9 second interval.
Applique type	Controller type.
Receiver has no alarms No alarms detected	Any alarms detected by the controller are displayed here. Possible alarms are as follows: • Transmitter is sending remote alarm. • Transmitter is sending AIS. • Receiver has loss of signal. • Receiver is getting AIS. • Receiver has loss of frame. • Receiver has remote alarm. • Receiver has no alarms.
Cablelength is	User-specified cable length.
Framing is	User-specified framing format.
Line Code is	User-specified line coding format on the line.
Clock Source is	User-specified clock source (line or internal).
International Bit	User-specified international bit.
National Bits	User-specified national bits.
Data in current interval (seconds elapsed)	Shows the current accumulation period, which rolls into the 24-hour accumulation every 15 minutes. Accumulation period is from 1 to 900 seconds. The oldest 15-minute period falls off the back of the 24-hour accumulation buffer.
Line Code Violations	Line Code Violations (LCV) is a count of both Bipolar Violations (BPVs) and Excessive Zeros (EXZs) occurring over the accumulation period. An EXZ increments the LCV by one regardless of the length of the zero string.
Path Code Violations	Path coding violation (PCV) error event is a frame synchronization bit error in the E1-noCRC formats or a CRC error in the E1-CRC formats.
Slip Secs	Severely errored framing seconds (SEFS) is a second with one or more out of frame defects or a detected incoming AIS.
Frame Loss Secs	Frame loss seconds (SELS) is the number of seconds an Out Of Frame (OOF) error is detected.
Line Err Secs	Line errored seconds (LES) is a second in which one or more code violations occurred or one or more LOS defects.
Degraded Mins	Degraded minute (DM) is one in which the estimated error rate exceeds 1E-6 but does not exceed 1E-3. For more information, refer to RFC 1406.
Errored Secs	Errored seconds (ES) is a second with one or more path coding violations, one or more Out of Frame defects, or one or more controlled slip events or a detected AIS defect.
Bursty Err Secs	Bursty errored seconds (BES) is a second with fewer than 320 and more than one path coding violation error events, no Severely Errored Frame defects, and no detected incoming AIS defects. Controlled slips are not included in this parameter.

Table 6 Show Controller E1 Field Descriptions (Continued)

Field	Description
Severely Err Secs	Severely errored seconds (SES) is a second with 320 or more path code violation errors events, one or more Out of Frame defects, or a detected AIS defect.
Unavail Secs	Unavailable seconds (UAS) are calculated by counting the number of seconds that the interface is unavailable. For more information, refer to RFC 1407.
Data in Interval 1	Shows the last 15-minute accumulation period.
Total Data (last 1 15 minute intervals)	Displays total accumulated data for all intervals.

show interface serial

To display information about a serial interface for the T1 or E1 channel group on an PA-MC-8E1/120, PA-MC-4T1, PA-MC-8T1, and PA-MC-8DSX1 port adapters, use the **show interfaces serial** privileged EXEC command.

show interfaces serial [*slot*/*port-adapter*/*port***:***channel-group*] (Cisco 7500 series and Cisco 7000 series routers with RSP7000)
show interfaces serial [*slot*/*port***:***channel-group*] (Cisco 7200 series)

Syntax Description

slot	(Optional) Slot location of the port adapter.
port-adapter	(Optional) On the Cisco 7500 series and Cisco 7000 series with RSP7000 and RSP7000CI, specifies the ports on a VIP card. The value can be 0 or 1.
port	(Optional) Port number on the port adapter.
:*channel-group*	(Optional) Specifies the E1 or T1 channel-group number in the range of 0 to 30 for E1 and 0 to 23 for T1. For a PRI group, the channel group is 30 for E1 and 23 for T1.

Command Mode

Privileged EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.0 for the Cisco 7000 series. This command was modified in Cisco IOS Release 11.1 CC to include sample output from the PA-MC-8E1/120, PA-MC-4T1, PA-MC-8T1, and PA-MC-8DSX1 port adapters.

Sample Displays

The following is sample output from the **show interface serial** command for E1 channel group 30 for the port adapter in slot 3, port 0:

```
Router# show interface serial 3/0:30
Serial3/0:30 is up, line protocol is up (looped)
  Hardware is Multichannel E1
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, CRC 16, Data non-inverted, keepalive set (10 sec)
  Last input 00:00:08, output 00:00:08, output hang never
  Last clearing of "show interface" counters 00:00:27
  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
     2 packets input, 48 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     2 packets output, 48 bytes, 0 underruns
```

```
     0 output errors, 0 collisions, 0 interface resets
     0 output buffers copied, 0 interrupts, 0 failures
     0 carrier transitions
  no alarm present
  Timeslot(s) Used:31, subrate: 64Kb/s, transmit delay is 0 flags
```

The following is sample output from the **show interface serial** command for T1 channel group 1 for the port adapter in slot 6, port 1:

```
Router# show interface serial 6/1:1
Serial6/1:1 is up, line protocol is up
  Hardware is Multichannel T1
  Internet address is 10.10.1.2/24
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, CRC 16, Data non-inverted, keepalive set (10 sec)
  Last input 00:00:09, output 00:00:05, output hang never
  Last clearing of "show interface" counters 00:00:29
  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
     3 packets input, 408 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     4 packets output, 433 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffers copied, 0 interrupts, 0 failures
     0 carrier transitions
  no alarm present
  Timeslot(s) Used:1-24, subrate: 64Kb/s, transmit delay is 0 flags
```

Table 7 describes significant fields shown in the display.

Table 7 Show Interfaces Serial Field Descriptions

Field	Description
Serial... is {up | down} ...is administratively down	Indicates whether the interface hardware is currently active (whether carrier detect is present) or if it has been taken down by an administrator.
line protocol is {up | down}	Indicates whether the software processes that handle the line protocol consider the line usable (that is, whether keepalives are successful) or if it has been taken down by an administrator.
(looped)	Indicates whether loopback is set or not.
Hardware is	Specifies the hardware type.
Internet address is	Specifies the Internet address and subnet mask.
MTU	Maximum transmission unit of the interface.
BW	Indicates the value of the bandwidth parameter that has been configured for the interface (in kilobits per second). The bandwidth parameter is used to compute IGRP metrics only.
DLY	Delay of the interface in microseconds.
rely	Reliability of the interface as a fraction of 255 (255/255 is 100% reliability), calculated as an exponential average over 5 minutes.

Table 7 Show Interfaces Serial Field Descriptions (Continued)

Field	Description
load	Load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes.
Encapsulation	Encapsulation method assigned to interface.
CRC	Whether CRC-16 or CRC-32 is used.
Data non-inverted	
keepalive set	Indicates whether keepalives are set or not.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface. Useful for knowing when a dead interface failed.
Last output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface.
output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the “last” fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed.
Last clearing of show interface counters	Time since the counters were cleared.
Input queue: (size/max/drops)	size—Number of packets in the input queue.
Total output drops:	max—maximum size of the queue.
	drops—number of packets dropped due to a full queue.
Output queue: (size/threshold/drops)	size—Current size of the output queue. threshold—congestive-discard threshold. Number of messages in the queue after which new messages for high-bandwidth conversations are dropped.
	drops—Number of dropped messages.
Conversations (active/max active)	active—Number of currently active conversations.
	max active—Maximum number of concurrent conversations allowed.
Reserved Conversations (allocated/max allocated)	Weighted fair queue subqueues that are available and the maximum that are available to be reserved by the Resource Reservation Protocol (RSVP).
5 minute input rate 5 minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes. The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
packets input	Total number of error-free packets received by the system.
bytes	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system.
no buffers	Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernets and bursts of noise on serial lines are often responsible for no input buffer events.

Table 7 Show Interfaces Serial Field Descriptions (Continued)

Field	Description
Received... broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	Number of packets that are discarded because they are smaller than the medium's minimum packet size.
giants	Number of packets that are discarded because they exceed the medium's maximum packet size.
input errors	Total number of no buffer, runts, giants, CRCs, frame, overrun, ignored, and abort counts. Other input-related errors can also increment the count, so that this sum might not balance with the other counts.
CRC	Cyclic redundancy checksum generated by the originating station or far-end device does not match the checksum calculated from the data received. On a serial link, CRCs usually indicate noise, gain hits, or other transmission problems on the data link.
frame	Not applicable
overrun	Number of times the serial receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. Broadcast storms and bursts of noise can cause the ignored count to be increased.
abort	Illegal sequence of one bits on a serial interface. This usually indicates a clocking problem between the serial interface and the data link equipment.
packets output	Total number of messages transmitted by the system.
bytes output	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of times that the transmitter has been running faster than the router can handle. This might never be reported on some interfaces.
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this might not balance with the sum of the enumerated output errors, as some datagrams can have more than one error, and others can have errors that do not fall into any of the specifically tabulated categories.
collisions	Not applicable.
interface resets	Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within several seconds' time. On a serial line, this can be caused by a malfunctioning modem that is not supplying the transmit clock signal, or by a cable problem. If the system notices that the carrier detect line of a serial interface is up, but the line protocol is down, it periodically resets the interface in an effort to restart it. Interface resets can also occur when an interface is looped back or shut down.
output buffers copied	Number of packets copied to system memory.
interrupts	Should always be zero.
failures	Number of no resource errors received on the output.

Table 7 Show Interfaces Serial Field Descriptions (Continued)

Field	Description
carrier transitions	Number of times the carrier detect signal of a serial interface has changed state. For example, if data carrier detect (DCD) goes down and comes up, the carrier transition counter will increment two times. Indicates modem or line problems if the carrier detect line is changing state often.
no alarms present	This line shows current interface status. Possible values are: "Reset" - interface being reset "alarm present" - interface is down. "no alarm present" - interface is up. "administratively down" - interface is shut
Timeslot(s) Used	Number of timeslots allocated for this interface.
subrate	Line rate of 64 kbps or 56 kbps.
transmitter delay	Number of idle flags inserted between each HDLC frame.