



Configuring T1/E1 Interfaces

Effective Cisco IOS-XE Release 3.14.0S, the Cisco ASR-920-24SZ-IM, ASR-920-24SZ-M, ASR-920-24TZ-M Aggregation Services Router supports the following types of interface modules (IMs):

- 8x1G Cu IM (A900-IMA8T)
- 8xT1/E1 IM (A900-IMA8D)
- 1x10G IM (A900-IMA1Z)
- 2x10G IM (A900-IMA2Z)

Effective Cisco IOS-XE Release 3.16S, the Cisco ASR-920-12SZ-IM Aggregation Services Router supports the following types of interface modules (IMs):

- A900-IMA8T
- A900-IMA8S
- A900-IMA8D
- A900-IMA16D
- A900-IMA1X

This chapter provides information about configuring the T1/E1 interface module on the Cisco ASR 920 Series Router. For information about managing your system images and configuration files, refer to the [Cisco IOS Configuration Fundamentals Configuration Guide](#) and [Cisco IOS Configuration Fundamentals Command Reference](#) publications.

For more information about the commands used in this chapter, refer to the [Cisco IOS Command Reference](#) publication for your Cisco IOS software release.

The router does not support swapping of the TDM interface modules to Gigabit Ethernet modules. If the TDM interface module is swapped with the Gigabit Ethernet module in the same slot or vice-versa, the router must be reloaded.

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Configuration Tasks

This section describes how to configure the T1/E1 interface module for the Cisco ASR 920 Series Router.

Limitations

This section describes the software limitations that apply when configuring the T1/E1 interface module on the Cisco ASR 920 Series Router.

- The Cisco ASR 920 Series Router does not support ATM and IMA on T1/E1 interface modules.
- The Cisco ASR 920 Series Router only supports the following BERT patterns: 2¹¹, 2¹⁵, 2²⁰-O153, and 2²⁰-QRSS.
- When TDM is inserted in the Cisco ASR 920 Series Router, it should be activated by running the **hw-module subslot slot-number/subslot-number activate** command in EXEC mode.

This command removes the following ports from front panel and brings up the respective IMs:

- Slots 20–23 for T1E1 IMs
- Slot 16–23 for copper IMs

Once the TDM is activated, you must reload the router to bring up the T1/E1 interface module.



Note The above command is not required to bring up the 8X1G Cu, 1x10G and 2x10G IMs.

- To recover the front panel ports from the IMs, run the **hw-module subslot slot-number/subslot-number deactivate** command in EXEC mode.
- The above activation and deactivation commands assume that the correct IM is inserted in its corresponding slot. If an IM inserted in a different slot than what is activated, the IM does not come up and the corresponding front panel interfaces are removed.
- front panel interfaces will be removed)
- L2TPv3 encapsulation is not supported on the Cisco ASR 920 Series Router.
- CEM on access BDI in core is not supported.
- Any change in the card type requires a router reload. To change the card type, the current card type must be unconfigured, then the router must be reloaded, and then the new card type must be changed.
- The Payload calculation per unit for T1/E1 interface module is:
 - Framed E1 / T1 with no. of time slots less than 4 → Payload = 4 x no. of time slots
 - Framed E1 / T1 with no. of timeslots greater than or equal 4 → Payload = 2 x no. of time slots
 - Unframed T1, C11 → Payload = 48 (2 x 24 (all slots))
 - Unframed E1, C12 → Payload = 64 (2 x 32 (all slots))
- Channelization is not supported for serial interfaces. However, channelization is supported for CEM at the DS0 level.



Note A card type change cannot be applied when the interface module is booting up. You must wait until after the interface module is administratively up.

Required Configuration Tasks

This section lists the required configuration steps to configure the T1/E1 interface module. Some of the required configuration commands implement default values that might be appropriate for your network. If the default value is correct for your network, then you do not need to configure the command.

Activating the IMs

Procedure

- Step 1** Verify that the correct IM is inserted properly in IM slot
- Step 2** Shut down all interfaces that are active in system and which will be removed during the IM activation process.
- Slots 20–23 for T1E1 IMs
 - Slot 16–23 for copper IMs
- Step 3** Wait for a minute.
- Step 4** Default all interfaces that will be removed from the system.
- Step 5** Activate the correct IM type that is preset in the IM slot.
-

Deactivating the IMs

Procedure

- Step 1** Verify that IM is in 'OK' state.
- Step 2** Using the **no interface** *interface-name* command, remove all the Virtual Interfaces associated with the IM. These include MPLS TP tunnels, TE tunnels, BDI interface, Port-Channel interface and so on.
- Step 3** Shut down all pluggable IM interfaces in system.
- Step 4** Wait for a minute.
- Step 5** Default all pluggable IM interfaces in the system.
- Step 6** Deactivate the pluggable IMs.
-

Setting the Card Type

The interface module is not functional until the card type is set. Information about the interface module is not indicated in the output of any show commands until the card type has been set. There is no default card type.



Note Mixing of T1 and E1 interface types is not supported. All ports on the interface module must be of the same type.

To set the card type for the T1/E1 interface module, complete these steps:

Procedure

	Command or Action	Purpose
Step 1	Router# configure terminal	Enters global configuration mode.
Step 2	Router(config)# card type {e1 t1} slot subslot	Sets the serial mode for the interface module: <ul style="list-style-type: none"> • t1—Specifies T1 connectivity of 1.536 Mbps. B8ZS is the default linecode for T1. • e1—Specifies a wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 1.984 Mbps in framed mode and 2.048 Mbps in unframed E1 mode. • <i>slot subslot</i>—Specifies the location of the interface module.
Step 3	Router(config)# exit	Exits configuration mode and returns to the EXEC command interpreter prompt.

Configuring the Controller

To create the interfaces for the T1/E1 interface module, complete these steps:

Procedure

	Command or Action	Purpose
Step 1	Router# configure terminal	Enters global configuration mode.
Step 2	Router(config)# controller {t1 e1} slot/port	Selects the controller to configure and enters controller configuration mode. <ul style="list-style-type: none"> • t1—Specifies the T1 controller. • e1—Specifies the E1 controller. • <i>slot/port</i>—Specifies the location of the interface. <p>Note The slot number is always 0 and subslot number is always 1.</p>
Step 3	Router(config-controller)# clock source {internal line}	Sets the clock source. <p>Note The clock source is set to internal if the opposite end of the connection is set to line and the clock source is set to line if the opposite end of the connection is set to internal.</p> <ul style="list-style-type: none"> • internal—Specifies that the internal clock source is used.

	Command or Action	Purpose
		<ul style="list-style-type: none"> line—Specifies that the network clock source is used. This is the default for T1 and E1.
Step 4	<pre>Router(config-controller)# linecode {ami b8zs hdb3}</pre>	<p>Selects the linecode type.</p> <ul style="list-style-type: none"> ami—Specifies Alternate Mark Inversion (AMI) as the linecode type. Valid for T1 and E1 controllers. b8zs—Specifies binary 8-zero substitution (B8ZS) as the linecode type. Valid for T1 controller only. This is the default for T1 lines. hdb3—Specifies high-density binary 3 (HDB3) as the linecode type. Valid for E1 controller only. This is the default for E1 lines.
Step 5	<p>For T1 Controllers:</p> <p>Example:</p> <pre>Router(config-controller)# framing {sf esf}</pre> <p>Example:</p> <pre>Router(config-controller)# framing {crc4 no-crc4}</pre>	<p>For E1 Controllers:</p> <p>Selects the framing type.</p> <ul style="list-style-type: none"> sf—Specifies Super Frame as the T1 frame type. esf—Specifies Extended Super Frame as the T1 frame type. This is the default for E1. crc4—Specifies CRC4 as the E1 frame type. This is the default for E1. no-crc4—Specifies no CRC4 as the E1 frame type.
Step 6	<p>cablelength {long short}</p> <p>Example:</p> <pre>Router(config-controller)# cablelength long</pre>	<p>To fine-tune the pulse of a signal at the receiver for an E1 cable, use the cablelength command in controller configuration mode.</p>
Step 7	<p>exit</p> <p>Example:</p> <pre>Router(config)# exit</pre>	<p>Exits configuration mode and returns to the EXEC command interpreter prompt.</p>

Verifying Controller Configuration

To verify the controller configuration, use the show controllers command :

```
Router# show controllers t1 0/1 brief
T1 0/1 is up.
  Applique type is A900-IMA16D
  Cablelength is long gain36 0db
```

```

No alarms detected.
alarm-trigger is not set
Soaking time: 3, Clearance time: 10
AIS State:Clear LOS State:Clear LOF State:Clear
Framing is ESF, Line Code is B8ZS, Clock Source is Internal.
Data in current interval (230 seconds elapsed):
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
Total Data (last 24 hours)
  136 Line Code Violations, 63 Path Code Violations,
  0 Slip Secs, 6 Fr Loss Secs, 4 Line Err Secs, 0 Degraded Mins,
  7 Errored Secs, 1 Bursty Err Secs, 6 Severely Err Secs, 458 Unavail Secs
  2 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs

```

Optional Configurations

There are several standard, but optional, configurations that might be necessary to complete the configuration of your T1/E1 interface module.

Configuring Framing

Framing is used to synchronize data transmission on the line. Framing allows the hardware to determine when each packet starts and ends. To configure framing, use the following commands.

Procedure

	Command or Action	Purpose
Step 1	Router# configure terminal	Enters global configuration mode.
Step 2	Router(config)# controller {t1 e1} slot/port	<p>Selects the controller to configure.</p> <ul style="list-style-type: none"> • t1—Specifies the T1 controller. • e1—Specifies the E1 controller. • slot/port—Specifies the location of the controller. <p>Note The slot number is always 0 and subslot number is always 1.</p>
Step 3	<p>For T1 controllers</p> <p>Example:</p> <pre>Router(config-controller)# framing {sf esf}</pre> <p>Example:</p> <pre>Router(config-controller)# framing {crc4 no-crc4}</pre>	<p>For E1 controllers</p> <p>Sets the framing on the interface.</p> <ul style="list-style-type: none"> • sf—Specifies Super Frame as the T1 frame type. • esf—Specifies Extended Super Frame as the T1 frame type. This is the default for T1. • crc4—Specifies CRC4 frame as the E1 frame type. This is the default for E1. • no-crc4—Specifies no CRC4 as the E1 frame type.

	Command or Action	Purpose
Step 4	exit Example: Router(config)# exit	Exits configuration mode and returns to the EXEC command interpreter prompt.

Verifying Framing Configuration

Use the show controllers command to verify the framing configuration:

```
Router# show controllers t1 0/1 brief
T1 0/1 is up.
  Applique type is A900-IMA16D
  Cablelength is long gain36 0db
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  AIS State:Clear LOS State:Clear LOF State:Clear
  Framing is ESF, Line Code is B8ZS
, Clock Source is Line.
Data in current interval (740 seconds elapsed):
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
Total Data (last 24 hours)
  0 Line Code Violations, 0 Path Code Violations,
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
```

Setting an IP Address

To set an IP address for the serial interface, complete these steps:



Note You can also set an IP address using an IMA or CEM configuration.

Procedure

	Command or Action	Purpose
Step 1	Router(config)# interface serial <i>slot/port</i>	Selects the interface to configure from global configuration mode. <ul style="list-style-type: none"> • <i>slot</i>—Specifies the slot in which the T1/E1 interface module is installed. • <i>port</i> —Specifies the location of the controller. The port range for T1 and E1 is 0 to 1.
Step 2	Router(config-if)# ip address <i>address mask</i>	Sets the IP address and subnet mask. <ul style="list-style-type: none"> • <i>address</i> —Specify the IP address.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • <i>mask</i> —Specify the subnet mask.
Step 3	Router(config)# exit	Exits configuration mode and returns to the EXEC command interpreter prompt.

What to do next



Note IPv4 routing protocols, such as *ospf*, *ospf*, *bgp*, and *rip*, are supported on serial interfaces.

Configuring Encapsulation

When traffic crosses a WAN link, the connection needs a Layer 2 protocol to encapsulate traffic.



Note L2TPv3 encapsulation is not supported on the Cisco ASR 920 Series Routers.

To set the encapsulation method, use the following commands:

Procedure

	Command or Action	Purpose
Step 1	Router# configure terminal	Enters global configuration mode.
Step 2	Router(config)# interface serial slot/port	Selects the interface to configure from global configuration mode. <ul style="list-style-type: none"> • <i>slot</i>—Specifies the slot in which the T1/E1 interface module is installed. • <i>port</i> —Specifies the location of the controller. The port range for T1 and E1 is 0 to 1.
Step 3	Router(config-if)# encapsulation encapsulation-type {hdlc ppp}	Set the encapsulation method on the interface. <ul style="list-style-type: none"> • <i>hdlc</i>—High-Level Data Link Control (HDLC) protocol for a serial interface. This encapsulation method provides the synchronous framing and error detection functions of HDLC without windowing or retransmission. This is the default for synchronous serial interfaces. • <i>ppp</i>—Described in RFC 1661, PPP encapsulates network layer protocol information over point-to-point links.
Step 4	Router(config)# exit	Exits configuration mode and returns to the EXEC command interpreter prompt.

Verifying Encapsulation

Use the **show interfaces serial** command to verify encapsulation on the interface:

```
Router# show interfaces serial
0/1
Serial0/1 is up, line protocol is up
  Hardware is Multichannel T1
  MTU 1500 bytes, BW 1536 Kbit/sec, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC
, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:01, output 00:00:02, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    60 packets input, 8197 bytes, 0 no buffer
  Received 39 broadcasts (0 IP multicasts)
  0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  64 packets output, 8357 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets
  0 unknown protocol drops
  0 output buffer failures, 0 output buffers swapped out
  1 carrier transitions
```

Configuring the CRC Size for T1 Interfaces

All T1/E1 serial interfaces use a 16-bit cyclic redundancy check (CRC) by default, but also support a 32-bit CRC. CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. The designators 16 and 32 indicate the length (in bits) of the frame check sequence (FCS). A CRC of 32 bits provides more powerful error detection, but adds overhead. Both the sender and receiver must use the same setting.

CRC-16, the most widely used CRC throughout the United States and Europe, is used extensively with WANs. CRC-32 is specified by IEEE 802 and as an option by some point-to-point transmission standards.

To set the length of the cyclic redundancy check (CRC) on a T1 interface, use these commands:

Procedure

	Command or Action	Purpose
Step 1	Router# configure terminal	Enters global configuration mode.
Step 2	Router(config)# interface serial slot/port	Selects the interface to configure from global configuration mode. <ul style="list-style-type: none"> • <i>slot</i>—Specifies the slot in which the T1/E1 interface module is installed. • <i>port</i>—Specifies the location of the controller. The port range for T1 and E1 is 0 to 1.
Step 3	Router(config-if)# crc {16 32}	Selects the CRC size in bits.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • 16—16-bit CRC. This is the default. • 32—32-bit CRC. <p>Note Moving from CRC 16 to 32 bit (and vice-versa) is not supported.</p>
Step 4	Router(config)# exit	Exits configuration mode and returns to the EXEC command interpreter prompt.

Verifying the CRC Size

Use the **show interfaces serial** command to verify the CRC size set on the interface:

```
Router# show interfaces serial 0/1
Serial0/1 is up, line protocol is up
  Hardware is Multichannel T1
  MTU 1500 bytes, BW 1536 Kbit/sec, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16
, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:01, output 00:00:02, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    60 packets input, 8197 bytes, 0 no buffer
    Received 39 broadcasts (0 IP multicasts)
    0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    64 packets output, 8357 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 unknown protocol drops
    0 output buffer failures, 0 output buffers swapped out
    1 carrier transitions
```

Saving the Configuration

To save your running configuration to nonvolatile random-access memory (NVRAM), use the following command in privileged EXEC configuration mode:

Command	Purpose
Router# copy running-config startup-config	Writes the new configuration to NVRAM.

For information about managing your system images and configuration files, refer to the [Cisco IOS Configuration Fundamentals Configuration Guide](#) and [Cisco IOS Configuration Fundamentals Command Reference](#) publications.

Troubleshooting E1 and T1 Controllers

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

Setting a Loopback on the E1 Controller

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

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Select the E1 controller and enter controller configuration mode.	controller e1 slot/port Note The slot number is always 0.
Set a diagnostic loopback on the E1 line.	loopback diag
Set a network payload loopback on the E1 line.	loopback network {line payload}
Exit configuration mode when you have finished configuring the controller.	end

Setting a Loopback on the T1 Controller

You can use the following loopback commands on the T1 controller in global configuration mode:

Task	Command
Selects the T1 controller and enter controller configuration mode.	controller t1 slot/port Note The slot number is always 0.
Sets a local loopback on the T1 line. You can select to loopback the line or the payload.	loopback local {line payload}
Sets 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 Extended Super Frame (ESF) loopback codes to communicate the request to the far end.	loopback remote iboc
Exits configuration mode when you have finished configuring the controller.	end



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

Table 1: Loopback Descriptions

Loopback	Description
loopback local	Loops the incoming receive signal back out to the transmitter. You can specify whether to use the line or payload .

Loopback	Description
loopback network	Loops the inbound traffic back to the network. 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.
network line	Loops the incoming signal back in the interface module using the line loopback mode of the framer. The framer does not reclock or reframe the incoming data. All incoming data is received by the interface module driver.
network payload	Loops the incoming signal back using the payload loopback mode of the framer. The framer reclocks and reframes the incoming data before sending it back out to the network. When in payload loopback mode, 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.

Running Bit Error Rate Testing

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 interface modules contain onboard BERT circuitry. With this, the interface module 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 allows 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 BERT 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
Selects the E1 or T1 controller and enters controller configuration mode.	Router(config)# controller {e1 t1} slot/port Note The slot number is always 0.
Specifies the BERT pattern for the E1 or T1 line and the duration of the test in minutes. The valid range is 1 to 1440 minutes. Note Only the 2 ¹¹ , 2 ¹⁵ , 2 ²⁰ -O153, and 2 ²⁰ -QRSS patterns are supported.	Router(config-controller)# bert pattern {2¹⁵ 2²³ All 1s} interval minutes
Exit configuration mode when you have finished configuring the controller.	Router(config-controller)# end
Displays the BERT results.	show controllers {e1 t1} slot/port

The following keywords list different BERT keywords and their descriptions.

Table 2: BERT Pattern Descriptions

Keyword	Description
1s	Repeating pattern of ones (...111...).
2^15	Pseudo-random 0.151 test pattern that is 32,768 bits in length.
2^23	Pseudo-random 0.151 test pattern that is 8,388,607 bits in length.

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 BERT test during the specified test period, use the **no bert** command.



Note BERT is supported only on controllers with channel-group configured. If CEM, IMA, or ATM are configured on controller, the BERT option is disabled.



Note When BERT is running, the serial interface of that controller will be made down till BERT is complete.

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

- After you terminate the test using the **no bert** command
- After the test runs completely

Monitoring and Maintaining the T1/E1 Interface Module

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

Task	Command
Displays the status of the E1 or T1 controller.	show controllers {e1 t1} [slot/port-adapter/port/e1-line] [brief]
Displays statistics about the serial information for a specific E1 or T1 channel group. Valid values are 0 to 30 for E1 and 0 to 23 for T1.	show interface serial slot/port
Clears the interface counters.	clear counters serial slot/port



Note To change the T1/E1 card type configuration, use the **no card type** command and reload the router.

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display your Cisco ASR 920 Series Router configuration settings, you can use the **show interfaces serial** and the **show controllers serial** commands to get detailed information on a per-port basis for your T1/E1 interface module.

Verifying Per-Port Interface Status

To view detailed interface information on a per-port basis for the T1/E1 interface module, use the **show interfaces serial** command.

```
Router# show interfaces serial 0/1/x
Serial0/1/x is up, line protocol is up
  Hardware is ASR900-IMA8D
  Internet address is 79.1.1.2/16
  MTU 1500 bytes, BW 1984 Kbit, DLY 20000 usec,
    reliability 255/255, txload 240/255, rxload 224/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Last input 3d21h, output 3d21h, output hang never
  Last clearing of 'show interface' counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 2998712
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 1744000 bits/sec, 644 packets/sec
  5 minute output rate 1874000 bits/sec, 690 packets/sec
    180817311 packets input, 61438815508 bytes, 0 no buffer
    Received 0 broadcasts (0 IP multicasts)
    0 runts, 0 giants, 0 throttles
    2 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 2 abort
    180845200 packets output, 61438125092 bytes, 0 underruns
    0 output errors, 0 collisions, 2 interface resets
    0 output buffer failures, 0 output buffers swapped out
    1 carrier transitions no alarm present
  Timeslot(s) Used:1-31, subrate: 64Kb/s, transmit delay is 0 flags 2
```

Configuration Examples

This section includes the following configuration examples:

Example: Framing and Encapsulation Configuration

The following example sets the framing and encapsulation for the controller and interface:

```
! Specify the controller and enter controller configuration mode
!
Router(config)# controller t1 2/0/0
```

```
!  
! Specify the framing method  
!  
Router(config-controller)# framing esf  
!  
! Exit controller configuration mode and return to global configuration mode  
!  
Router(config-controller)# exit  
!  
! Specify the interface and enter interface configuration mode  
!  
Router(config)# interface serial 0/1/x  
!  
! Specify the encapsulation protocol  
!  
Router(config-if)# encapsulation ppp  
!  
! Exit interface configuration mode  
!  
Router(config-if)# exit  
!  
! Exit global configuration mode  
!  
Router(config)# exit
```

Example: CRC Configuration

The following example sets the CRC size for the interface:

```
! Specify the interface and enter interface configuration mode  
!  
Router(config)# interface serial 0/1/x  
!  
! Specify the CRC size  
!  
Router(config-if)# crc 32  
!  
! Exit interface configuration mode and return to global configuration mode  
!  
Router(config-if)# exit  
!  
! Exit global configuration mode  
!  
Router(config)# exit
```

Example: Facility Data Link Configuration

The following example configures Facility Data Link:

```
! Specify the controller and enter controller configuration mode  
!  
Router(config)# controller t1 0/1/x  
!  
! Specify the FDL specification  
!  
Router(config-controller)#  
fdl ansi  
!  
! Exit controller configuration mode and return to global configuration mode
```

```
!  
Router(config-controller)# exit  
!  
! Exit global configuration mode  
!  
Router(config)# exit
```

Example: Invert Data on the T1/E1 Interface

The following example inverts the data on the serial interface:

```
! Enter global configuration mode  
!  
Router# configure terminal  
!  
! Specify the serial interface and enter interface configuration mode  
!  
Router(config)# interface serial 0/1/x  
!  
! Configure invert data  
!  
Router(config-if)# invert data  
!  
! Exit interface configuration mode and return to global configuration mode  
!  
Router(config-if)# exit  
!  
! Exit global configuration mode  
!  
Router(config)# exit
```