Configuring T1/E1 Interfaces

This chapter provides information about configuring the T1/E1 interface module on the chassis. It includes the following sections:

For information about managing your system images and configuration files, refer to the Cisco IOS Configuration Fundamentals Configuration Guide and 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.

Configuration Tasks

This section describes how to configure the following T1/E1 interface modules for the chassis.

Table 1: Supported T1/E1 Interface Module

T1/E1 Interface Module	Part Number
16-port T1/E1 Interface Module	A900-IMA16D
8-portT1/E1 Interface Module	A900-IMA8D
32-Port T1/E1 Interface Module	A900-IMA32D

This section includes the following topics:

Limitations

This section describes the software limitations that apply when configuring the T1/E1 interface module.

- The following interface modules are not supported on the RSP3 module:
  - 16-port T1/E1 interface module
  - 8-portT1/E1 interface module

  - 32-portT1/E1 interface module

- The **configure replace** command is not supported on the T1/E1 interface modules.
- The chassis does *not* support more than 16 IMA groups on each T1/E1 interface module.
- The chassis only supports the following BERT patterns: 2^11, 2^15, 2^20-O153, and 2^20-QRSS.
- L2TPv3 encapsulation is not supported.
- Replacing a configured interface module with a different interface module in the same slot is not supported.
- Mixed configurations of features are not supported on the same port.
- 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 Time Slots 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 x32(all slots))
- Channelization is not supported for serial interfaces. However, channelization is supported for CEM at the DS0 level.

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.

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

Step 1 **configure terminal**

Example:

```
Router# configure terminal
```

Enters global configuration mode.

Step 2 **card type** {**e1** | **t1**} *slot/subslot*

Example:

```
Router(config)# card type e1 0/3
```

Sets the serial mode for the interface module:

- 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.
- *slot subslot* —Specifies the location of the interface module.

Step 3 **exit**

Example:

```
Router(config)# exit
```

Exits configuration mode and returns to the EXEC command interpreter prompt.

Enabling T1 Controller

Note T1/T3 or E1/E3 does not require any license.

To enable T1 controller:

```
enable
configure terminal
controller mediatype 0/4/0
mode t1
end
```

Configuring the Controller

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

Procedure

Step 1 **configure terminal**

Example:

```
Router# configure terminal
```

Enters global configuration mode.

Step 2 **controller** {**t1** | **e1**} *slot/subslot/port*

Example:

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

Selects the controller to configure and enters controller configuration mode.

- t1—Specifies the T1 controller.
- e1—Specifies the E1 controller.
- *slot/subslot/port*—Specifies the location of the interface.

Note The slot number is always 0.

Step 3 **clock source** {**internal** | **line**}

Example:

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

Sets the clock source.

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.

- internal—Specifies that the internal clock source is used.
- line—Specifies that the network clock source is used. This is the default for T1 and E1.

Step 4 **linecode** {**ami** | **b8zs** | **hdb3**}

Example:

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

Selects the linecode type.

- 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 For T1 Controllers:

Example:

`framing {sf | esf}`

Example:

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

Example:

```
For E1 Controllers:
```

Example:

`framing {crc4 | no-crc4}`

Example:

```
Router(config-controller)# framing crc4
```

Selects the framing type.

- 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 **cablelength** {**long** | **short**}

Example:

```
Router(config-controller)# cablelength long
```

To fine-tune the pulse of a signal at the receiver for an E1 cable, use the **cablelength** command in controller configuration mode.

Step 7 **exit**

Example:

```
Router(config)# exit
```

Exits configuration mode and returns to the EXEC command interpreter prompt.

Verifying Controller Configuration

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

```
Router# show controllers t1 0/3/0 brief
T1 0/3/0 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

Step 1 **configure terminal**

Example:

```
Router# configure terminal
```

Enters global configuration mode.

Step 2 **controller** {**t1** | **e1**} *slot/subslot/port*

Example:

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

Selects the controller to configure.

- t1—Specifies the T1 controller.
- e1—Specifies the E1 controller.
- slot/subslot/port—Specifies the location of the controller.

Note The slot number is always 0.

Step 3 For T1 controllers

Example:

framing {**sf** | **esf**}

Example:

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

Example:

Example:

```
For E1 controllers
```

Example:

framing {**crc4** | **no-crc4**}

Example:

```
Router(config-controller)# framing crc4
```

Sets the framing on the interface.

- 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.

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 0/3/0 brief
T1 0/3/0 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:

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

Procedure

Step 1 **interface serial** *0/subslot/port:channel-group*

Example:

```
Router(config)# interface serial 0/0/1:0
```

Selects the interface to configure from global configuration mode.

- *subslot*—**Specifies the subslot in which the T1/E1 interface module is installed.**
- *port* —Specifies the location of the controller. The port range for T1 and E1 is 1 to 16.
- *channel-group* —Specifies the channel group number configured on the controller. For example: interface serial 0/0/1:1.

Step 2 **ip address** *address mask*

Example:

```
Router(config-if)# ip address 192.0.2.1 255.255.255.0
```

Sets the IP address and subnet mask.

- *address* —Specify the IP address.
- *mask* —Specify the subnet mask.

Step 3 **exit**

Example:

```
Router(config)# exit
```

Exits configuration mode and returns to the EXEC command interpreter prompt.

What to do next

Note IPV4 routing protocols, such as *eigrp* , *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.

To set the encapsulation method, use the following commands:

Procedure

Step 1 **configure terminal**

Example:

```
Router# configure terminal
```

Example:

Enters global configuration mode.

Step 2 **interface serial** *0/subslot/port:channel-group*

Example:

```
Router(config)# interface serial 0/0/1:0
```

Example:

Selects the interface to configure from global configuration mode.

- *subslot***—Specifies the subslot in which the T1/E1 interface module is installed.**
- *port* —Specifies the location of the controller. The port range for T1 and E1 is 1 to 16.
- *channel-group* —Specifies the channel group number configured on the controller. For example: interface serial 0/0/1:1.

Step 3 **encapsulation** {**hdlc** | **ppp**}

Example:

```
Router(config-if)# encapsulation hdlc
```

Set the encapsulation method on the interface.

- **hdlc**—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.
- **ppp**—Described in RFC 1661, PPP encapsulates network layer protocol information over point-to-point links.

Step 4 **exit**

Example:

```
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
  0/0/1:0
Serial0/0/1:0 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

Step 1 **configure terminal**

Example:

```
Router# configure terminal
```

Example:

Enters global configuration mode.

Step 2 **interface serial** *0/subslot/port:channel-group*

Example:

```
Router(config)# interface serial 0/0/1:0
```

Example:

Selects the interface to configure from global configuration mode.

- *number* —Specifies the location of the controller. The number range for T1 and E1 is 1 to 16.
- *channel-group* —Specifies the channel group number configured on the controller. For example: interface serial 0/1:1.

Step 3 **crc** {**16** | **32**}

Example:

```
Router(config-if)# crc 16
```

Selects the CRC size in bits.

- 16—16-bit CRC. This is the default.

- 32—32-bit CRC.

Note Moving from CRC 16 to 32 bit (and vice-versa) is not supported.

Step 4 **exit**

Example:

```
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  0/0/1:0
Serial0/0/1:0 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 a Channel Group

Follow these steps to configure a channel group:

Procedure

Step 1 **configure terminal**

Example:

```
Router# configure terminal
```

Enters global configuration mode.

Step 2 **controller** {**t1** | **e1**} *slot/subslot/port*

Example:

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

Select the controller to configure and enter global configuration mode.

Step 3 **channel-group** [**t1** | **e1**] *number* {**timeslots** *range* | **unframed**} [**speed** {**56** | **64**}]

Example:

```
Router(config-controller)# channel-group t1 1timeslots 1 | unframed speed 56
```

Defines the time slots that belong to each T1 or E1 circuit.

- *number*— Channel-group number. When configuring a T1 data line, channel-group numbers can be values from 1 to 28. When configuring an E1 data line, channel-group numbers can be values from 0 to 30.
- **timeslots** *range*— One or more time slots or ranges of time slots belonging to the channel group. The first time slot is numbered 1. For a T1 controller, the time slot range is from 1 to 24. For an E1 controller, the time slot range is from 1 to 31.
- **unframed**—Unframed mode (G.703) uses all 32 time slots for data. None of the 32 time slots are used for framing signals.
- **speed**—(Optional) Specifies the speed of the underlying DS0s in kilobits per second. Valid values are 56 and 64.

Note The default is 64. Speed is not mentioned in the configuration.

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

Note Once a channel group has been created with the channel-group command, the channel group cannot be changed without removing the channel group. To remove a channel group, use the **no** form of the **channel-group** command.

Note The unframed option is not currently supported.

Note DS0-level channelization is not currently supported.

Step 4 **exit**

Example:

```
Router(config)# exit
```

Exits configuration mode and returns to the EXEC command interpreter prompt.

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
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 Loopbacks, on page 13
- Runing Bit Error Rate Testing, on page 14

Setting Loopbacks

The following sections describe how to set loopbacks:

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

Setting a Loopback on the T1 Controller

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

Task	Command
controller t1 *slot/subslot/port*	Selects the T1 controller and enter controller configuration mode The slot number is always 0.
loopback diag	Sets a diagnostic loopback on the T1 line.
loopback local {**line** | **payload**}	Sets a local loopback on the T1 line. You can select to loopback the line or the payload.
loopback remote iboc	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.
end	Exits configuration mode when you have finished configuring the controller.

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

Table 2: 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 interface module's PMC framer. The interface module 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 to the transmitter. You can specify whether to use the **line** or **payload**.
local line	The incoming signal is looped back in the interface module using the framer's line loopback mode. The framer does not reclock or reframe the incoming data. All incoming data is received by the interface module driver.
local payload	Loops the incoming signal back in the interface module 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.
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.

Runing 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
controller {**e1** | **t1**} *slot/subslot/port*	Selects the E1 or T1 controller and enters controller configuration mode. The slot number is always 0.
bert pattern 0s | **1s** | **2^11** | **2^15** | **2^20-O153** | **2^20-QRSS** | **2^23** | **alt-0-1**} **interval** *minutes*	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.
end	Exit configuration mode when you have finished configuring the controller.
show controllers {**e1** | **t1**} *slot/subslot/port*	Displays the BERT results.

The following keywords list different BERT keywords and their descriptions.

Caution Currently only the 2^11, 2^15, 2^20-O153, and 2^20-QRSS patterns are supported.

Table 3: BERT Pattern Descriptions

Keyword	Description
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 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.

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

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
- Anytime during the test (in real time)

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
show controllers {**e1** | **t1**} [*slot/port-adapter/port/e1-line*] [**brief**	Displays the status of the E1 or T1 controller.
show interface serial*slot/subslot/port*	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.
clear counters serial *slot/subslot/port*	Clears the interface counters

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

AIS on Core Failure

AIS stands for Alarm Indication Signal. Prior to Cisco IOS XE Fuji Release 16.7.1, the PDH AIS alarms were generated only when the CE would go down and an event was set in the CEM control-word by the remote provider edge (PE). AIS alarms were not generated when the pesudowire went down. Now, AIS alarm are generated when the pesudowire goes down.

This feature is only supported on the Cisco ASR 900 RSP2 module, for 8-port T1/E1 and 16-port T1/E1 interface modules and only for unframed E1 mode (SAToP) type.

Limitations of AIS

- AIS is not supported on CESoP and CEM over UDP.
- AIS is not supported on T1 mode. It is only supported on E1 mode.
- AIS is not supported on the 4-port OC3/STM-1 (OC-3) interface module (IM) and 32-port T1/E1 IM.
- AIS is supported only for MPLS core.
- AIS is not supported in pseudowire HSPW mode, when **graceful-restart** command is enabled.
- Removing the MPLS IP address from the core interfaces results in a delay of 10-12 minutes to notify the peer end. This depends on the negotiated forwarding hold timer between the routers, which is the least value of the configured LDP GR forwarding hold timer of the two routers.
- Supported CEM class range of de-jitter buffer size is between 1 to 32 ms.
- If the **shutdown unpowered** command is used to shut down the IM, an OIR must be performed to trigger the AIS alarms..

Core Failure Event Detection

AIS configuration is used to detect core defects. The core failure is detected in the following events:

- Shutdown of the PE controller or tug level.
- Removing the cross-connect feature.
- Removal of Gigabit Ethernet configuration, CEM configuration, controller configuration, or OSPF configuration.
- Shut on OSPF, CEM group, cross-connect, or Gigabit Ethernet interface.
- CE1 controller shut—AIS alarm is seen on the remote CE.
- PE1 controller shut—AIS alarm is seen on the remote CE.
- PE1 core shut—AIS alarm is seen on both the CEs.
- PE2 core shut—AIS alarm is seen on both the CEs.
- Pesudowire down—AIS alarm is seen on both the CEs.
- Core IGP down—AIS alarm is seen on both the CEs.
- Core LDP down—AIS alarm is seen on both the CEs.

Configuring AIS for Core Failure

When you enable the AIS, Plesiochronous Digital Hierarchy (PDH) AIS alarm is supported for core failure events on the 8-port T1/E1 and 16-port T1/E1 interface modules. When a core failure is detected due to any event, core flap flag is updated and the core flap event sends an event, which asserts an AIS. When the AIS is not enabled, core failure events are ignored.

Use the following procedure to enable AIS:

```
Router> enable
Router#configure terminal
```

```
Router(config)#controller t1 0/1/2
Router(config-controller)#ais-core-failure
```

Verifying AIS Configuration

Use the **show run | sec** command to verify the configuration of AIS:

```
Router(config-controller)#show run | sec 0/3/0
controller E1 0/3/0
 ais-core-failure
 framing unframed
  cem-group 30 unframed
interface CEM0/3/0
```

Example: AIS Trigger

The following example shows a sample configuration of a controller O/P when an AIS is triggered:

```
Router#show controller e1 0/2/1
E1 0/2/1 is down.
Applique type is A900-IMA16D
Cablelength is Unknown
Transmitter is sending remote alarm.
Receiver is getting AIS. <<<<<<<<<<<<< This is AIS alarm received
ais-shut is not set
alarm-trigger is not set
Framing is crc4, Line Code is HDB3, Clock Source is Line.
BER thresholds: SF = 10e-5 SD = 10e-5
International Bit: 1, National Bits: 11111
Data in current interval (0 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
1 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
```

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display the configuration settings, 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 0/0/1:0
Serial0/0/1:0 is up, line protocol is up
  Hardware is SPA-8XCHT1/E1
  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 2/0/0:0
!
! 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 2/0/0:0
```

```
!
! 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 2/0/0
!
! 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 2/1/3:0
!
! 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
```