



# Configuring T1 Interfaces

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## Information About T1 Interfaces

The following sections provide information about T1 interfaces.

### Overview of T1 Interfaces

The 12-port T1 interface module on CEM line card supports generic single or dual-port T1 trunk interfaces for voice, data, and integrated voice or data applications.

### Configuring the Controller

To configure T1 interface, use the following commands:

```
enable
configure terminal
controller mediatype 0/4/0
mode t1
exit
controller t1 0/4/0
clock source internal
framing esf
cablelength short 110
linecode b8zs
no shutdown
exit
```

### Verifying Controller Configuration

Use `show controllers` command to verify the controller configuration:

```

#show controller t1 0/4/0
T1 0/4/0 is up
  Applique type is
  Cablelength is short 110
  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, FDL is ansi, Line Code is B8ZS, Clock Source is Line.
  BER thresholds:  SF = 10e-3  SD = 10e-6
  Data in current interval (230 seconds elapsed):
    Near End
      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 Unavailable Secs
      0 Path Failures, 0 SEF/AIS Secs
    Far End
      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 Unavailable Secs
      0 Path Failures
  Data in Interval 1:
    Near End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
      1 Path Failures, 0 SEF/AIS Secs
    Far End Data
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
      4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
      0 Path Failures
  Total Data (last 1 15 minute intervals):
    Near End
      0 Line Code Violations, 0 Path Code Violations,
      0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins,
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
      1 Path Failures, 0 SEF/AIS Secs
    Far End
      0 Line Code Violations, 0 Path Code Violations,
      0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
      4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
      0 Path Failures

```

## Performance Monitoring

The performance monitoring result displays the statistics or error count generated on the TDM lines for DS1.

To view the performance monitoring error details, use the **show controller t1** command:

```

PE2#show controller t1 0/4/0
T1 0/4/0 is up
  Applique type is
  Cablelength is short 110
  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, FDL is ansi, Line Code is B8ZS, Clock Source is Line.
  BER thresholds:  SF = 10e-3  SD = 10e-6
  Data in current interval (230 seconds elapsed):
    Near End

```

```

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 Unavailable Secs
0 Path Failures, 0 SEF/AIS Secs
Far End
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 Unavailable Secs
0 Path Failures
Data in Interval 1:
Near End
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
1 Path Failures, 0 SEF/AIS Secs
Far End Data
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
0 Path Failures
Total Data (last 1 15 minute intervals):
Near End
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins,
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
1 Path Failures, 0 SEF/AIS Secs
Far End
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
0 Path Failures

```

## Configuring Structure-Agnostic TDM over Packet - T1 Interfaces

To configure Structure-Agnostic TDM over Packet (SAToP):

```

enable
configure terminal
controller t1 0/4/0
cem-group 0 unframed
exit
interface cem 0/4/0
cem 0
xconnect 2.2.2.2 10000 encapsulation mpls
exit

```

## Verifying CEM Configuration for SAToP

Use the following command to verify the CEM configuration for T1 interfaces:

```

#show cem ci interface cem 0/4/0

CEM 0/4/0, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :T1, CEM Mode: T1-SAToP
Controller state: up, T1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 6 (In use: 0)
Payload Size: 192
Framing: Unframed
CEM Defects Set

```

None

Signalling: No CAS  
 RTP: No RTP

Ingress Pkts:	6463477	Dropped:	0
Egress Pkts:	5132190	Dropped:	0

## CEM Counter Details

Input Errors:	0	Output Errors:	0
Pkts Missing:	0	Pkts Reordered:	0
Misorder Drops:	0	JitterBuf Underrun:	0
Error Sec:	0	Severly Errored Sec:	0
Unavailable Sec:	0	Failure Counts:	0
Pkts Malformed:	0	JitterBuf Overrun:	0
Generated Lbits:	0	Received Lbits:	0
Generated Rbits:	0	Received Rbits:	0

## Overview of Framed Structure-Agnostic TDM over Packet (SAToP)

Framed Structure-Agnostic TDM over Packet (SAToP) is required to detect an incoming AIS alarm in the DS1 SAToP mode. An AIS alarm indicates a problem with the line that is upstream from the DS1 network element connected to the interface. Framed SAToP further helps in the detection of a packet drop.

In case of unframed mode of SAToP, data received from the Customer Edge (CE) device is transported over the pseudowire. If the Provider Edge (PE) device receives a Loss of Frame (LOF) signal or Remote Alarm Indication (RAI) signal from a CE, the PE can only transmit the signal that is detected by the CE device. With the introduction of Framed SAToP, when the PE device receives the LOF or RAI signal, the PE device can detect the alarm for SAToP. Thus, the alarm can be detected earlier in the network. This helps in enhanced performance.




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**Note** BERT is *not* supported in system direction for framed SAToP.

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**Note** Framing type should be maintained same in all routers end to end.

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### Difference between Framed and Unframed SAToP:

1. For unframed SAToP, the incoming signal is transmitted to the far end. This signal is not analyzed by the PE device. Hence, no alarm is reported.
2. For framed SAToP, the incoming signal is analyzed but is not terminated. If a LOF or RAI signal is detected, the remote PE detects the signals and transmits towards the remote CE.

### Difference between Framed SAToP and CESoP:

**Table 1: Behaviour Difference between Unframed SAToP, Framed SAToP, and CESoP on LOF Alarm**

Modes	Alarm Detected at PE	Controller Status at PE	Alarm Detected at CE (Remote)	Framing Bits Generation at PE (Remote)	Framing Bits Terminated at PE (Remote)
Unframed SAToP	None	Up	LOF	No	No
Framed SAToP	LOF	Down (Data path remains up)	LOF <sup>12</sup>	Yes	No
CESOP	LOF	Down (Data path remains up)	AIS	Yes	Yes

<sup>1</sup> AIS—Support until Cisco IOS XE 16.9.3 Fuji release

<sup>2</sup> LOF—Starting from Cisco IOS XE Fuji 16.9.4 or later releases

**Table 2: Behaviour Difference between Unframed SAToP, Framed SAToP, and CESoP on RDI Alarm**

Modes	Alarm Detected at PE	Controller Status at PE	Alarm Detected at CE (Remote)	Framing Bits Generation at PE (Remote)	Framing Bits Terminated at PE (Remote)
Unframed SAToP	None	Up	RDI	No	No
Framed SAToP	RDI	Down (data path remains up)	RDI	No	No
CESOP	RDI	Down (data path remains up)	RDI	M-bit is set into control word	Yes

**Table 3: Behaviour Difference between Unframed SAToP, Framed SAToP, and CESoP on AIS alarm**

Modes	Alarm Detected at PE	Controller Status at PE	Alarm Detected at CE (Remote)	Framing Bits Generation at PE (Remote)	Framing Bits Terminated at PE (Remote)
Unframed SAToP	AIS	Down (data path remains up)	AIS	No	No
Framed SAToP	AIS	Down (data path remains up)	AIS	No	No
CESOP	AIS	Down (data path remains up)	AIS	L-bit is set into control word	Yes

**Remote Loopback from CE to PE Detection:**

Framed SAToP does not detect any loopback.

	Loopback Detected at PE	Controller Status at PE (Remote)	Controller Status at CE (Remote)
Unframed SAToP	No	Not in Loopback	Loopback
Framed SAToP	No	Not in Loopback	Loopback
CESOP	Yes	Loopback	Not in loopback

## Configuring Framed SAToP



**Note** Framing type should be maintained same in all routers end to end.

To configure Framed Structure-Agnostic TDM over Packet (SAToP):

```
enable
configure terminal
controller t1 0/4/0
framing esf
cem-group 0 framed
exit
interface cem 0/4/0
cem 0
xconnect 2.2.2.2 10000 encapsulation mpls
exit
```

## Verifying CEM Configuration for Framed SAToP

Use **show cem ci interface** to verify CEM configuration for Framed SAToP:

```
#show cem ci interface cem 0/4/0

CEM 0/4/0, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :T1, CEM Mode: T1-SAToP
Controller state: up, T1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 6 (In use: 0)
Payload Size: 192
Framing: Framed SAToP
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    6463477          Dropped:          0
Egress Pkts:    6463477          Dropped:          0

CEM Counter Details
Input Errors:    0                Output Errors:    0
Pkts Missing:   0                Pkts Reordered:  0
Misorder Drops: 0                JitterBuf Underrun: 0
Error Sec:      0                Severly Errored Sec: 0
Unavailable Sec: 0                Failure Counts:   0
Pkts Malformed: 0                JitterBuf Overrun: 0
```

```
Generated Lbits: 0      Received Lbits: 0
Generated Rbits: 0      Received Rbits: 0
```

## Troubleshooting T1 Controllers

You can use the following methods to troubleshoot the T1 controllers:

### Running Bit Error Rate Testing

Bit error rate testing (BERT) is supported on T1 interfaces.

The interface module contains 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, O.153 pseudo-random and repetitive test patterns. BERT allows you to test cables and signal problems in the field.

When running a BERT 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

The following keywords list different BERT keywords and their descriptions.

**Table 4: BERT Pattern Descriptions**

Keyword	Description
<b>2^11</b>	Pseudo-random test pattern that is 2,048 bits in length.
<b>2^15</b>	Pseudo-random O.151 test pattern that is 32,768 bits in length.
<b>2^20-O153</b>	Pseudo-random O.153 test pattern that is 1,048,575 bits in length.
<b>2^20-QRSS</b>	Pseudo-random QRSS O.151 test pattern that is 1,048,575 bits in length.
<b>2^23</b>	Pseudo-random 0.151 test pattern that is 8,388,607 bits in length.

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 BERT test.

BERT is supported in two directions:

- Line - supports BERT in TDM direction
- System - supports BERT in PSN direction



**Note** Before starting system side BERT, you must configure CEM. When the BERT is configured towards system direction, it internally loopbacks the TDM side. BERT in system direction is *not* supported for framed SAToP.

## Configuring BERT

Before you run BERT test, you must configure card type and controller.

To run a BERT on T1 interface, perform the following tasks in global configuration mode.

```
enable
configure terminal
controller t1 0/4/0
bert pattern 2^11 interval 5 direction [line | system]
exit
```

### Verifying BERT Configuration for SAToP

Use the following command to verify the BERT configuration for T1 interfaces:

```
Router# show controllers t1 0/4/0
T1 0/4/0 is up.
Applique type is
Cablelength is short 110
DSX1 BERT pattern : 2^11
DSX1 BERT direction : Line
DSX1 BERT sync : no sync
DSX1 BERT sync count : 0
DSX1 BERT interval : 5
DSX1 BERT time remain : 2
DSX1 BERT total errs : 0
DSX1 BERT total k bits: 0
DSX1 BERT errors (last): 0
DSX1 BERT k bits (last): 0
Last clearing of BERT counters never
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 unframed, Line Code is B8ZS, Clock Source is Internal.
Data in current interval (230 seconds elapsed):
  Near End
    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 Unavailable Secs
    0 Path Failures, 0 SEF/AIS Secs
  Far End
    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 Unavailable Secs
    0 Path Failures
  Data in Interval 1:
    Near End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
      1 Path Failures, 0 SEF/AIS Secs
    Far End Data
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
      4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
```



```

0 Path Failures
Total Data (last 1 15 minute intervals):
Near End
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins,
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
1 Path Failures, 0 SEF/AIS Secs
Far End
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
0 Path Failures

```

## Loopback on T1 Interfaces

Loopback is supported on both unframed and framed modes. You can use the following loopback on the T1 interfaces.

Loopback	Description
<b>loopback diag</b>	Loops the outgoing transmit signal back to the receive signal. This is done using the diagnostic loopback feature in the interface module's framer. The interface transmits AIS in this mode. Set the <b>clock source</b> command to internal for this loopback mode.
<b>loopback local</b>	Loops the incoming receive signal back out to the transmitter. You can specify whether to use the line or payload.
<b>loopback local line</b>	The incoming signal is looped back in the interface 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 driver.
<b>loopback local payload</b>	Loops the incoming signal back in the interface using the payload loopback mode of the framer. The framer reclocks and reframes the incoming data before sending it back out to the network.  <b>Note</b> Loopback Local Payload support is available only when framing is ESF.
<b>loopback network line</b>	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.

### Configuring Loopback

Before you configure loopback, you must configure the controller and the CEM.

To set a loopback local on the T1 interface, perform the following tasks in global configuration mode:

```
enable
```

```
configure terminal
controller t1 0/4/0
loopback local line
exit
```

To set a loopback diag on the T1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t1 0/4/0
loopback diag
exit
```



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



**Note** Network payload configuration is not supported on SAToP. To configure loopback network payload when SAToP is configured, you need to remove the CEM configuration and then configure the loopback.

## Associated Commands

The commands used to configure the Interfaces.

Commands	URL
<b>cem-group</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2440628600">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2440628600</a>
<b>payload-size dejitter-buffer</b>	<a href="https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-o1.html#wp3946673156">https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-o1.html#wp3946673156</a>
<b>class cem</b>	<a href="https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2169323859">https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2169323859</a>
<b>controller t1/e1</b>	<a href="https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp1472647421">https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp1472647421</a>
<b>xconnect</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-t2.html#wp8578094790">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-t2.html#wp8578094790</a>
<b>linecode</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-l1.html#wp2312535965">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-l1.html#wp2312535965</a>

Commands	URL
<b>framing</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-f1.html#wp2853515177">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-f1.html#wp2853515177</a>
<b>clock source</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp6081785140">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp6081785140</a>
<b>cable length</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2492964151">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2492964151</a>
<b>bert pattern</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-a1.html#wp3620978929">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-a1.html#wp3620978929</a>
<b>channelized</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp7026926390">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp7026926390</a>
<b>loopback</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-l1.html#wp1033903426">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-l1.html#wp1033903426</a>
<b>show controller t1</b>	<a href="http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-s3.html#wp2149471094">http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-s3.html#wp2149471094</a>

