



# Configuring Clear Channel T3/E3 Controllers and Channelized T3 and T1/E1 Controllers

This module describes the configuration of clear channel T3/E3 controllers and channelized T3 and T1/E1 controllers.

You must configure the T3/E3 controller before you can configure an associated serial interface.

## Feature History for Configuring T3/E3 Controller Interfaces

Release	Modification
Release 3.9.0	This feature was introduced on the Cisco ASR 9000 Series Router for the Cisco 2-Port Channelized OC-12c/DS0 SPA.
Release 4.0.0	Support for the following features was added on the Cisco 2-Port Channelized OC-12c/DS0 SPA: <ul style="list-style-type: none"> <li>• NxDS0 channelization</li> <li>• Link Noise Monitoring</li> </ul> Support for clear channel T3 controllers on the 1-Port Channelized OC-48/STM-16 SPA was introduced.
Release 4.0.1	Support for the following SPAs was added: <ul style="list-style-type: none"> <li>• Cisco 1-Port Channelized OC-3/STM-1 SPA</li> <li>• Cisco 2-Port and 4-Port Clear Channel T3/E3 SPA</li> </ul>
Release 4.1.0	<ul style="list-style-type: none"> <li>• Support for the following SPAs was added: <ul style="list-style-type: none"> <li>• Cisco 4-Port Channelized T3/DS0 SPA</li> <li>• Cisco 8-Port Channelized T1/E1 SPA</li> </ul> </li> <li>• Support for a Link Noise Monitoring enhancement was added on the Cisco 2-Port Channelized OC-12c/DS0 SPA to set thresholds for noise errors on T1/E1 links that are used to signal the Noise Attribute to PPP for removal of an MLPPP bundle link.</li> </ul>

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- [Information About T3/E3 Controllers and Serial Interfaces, on page 2](#)
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## Prerequisites for Configuring T3/E3 Controllers

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Before configuring T3/E3 controllers, be sure that you have one of the following supported SPAs installed in the router:

- Cisco 2-Port and 4-Port Clear Channel T3/E3 SPA
- Cisco 4-Port Channelized T3/DS0 SPA




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**Note** The 4-Port Channelized T3/DS0 SPA can run in clear channel mode, or it can be channelized into 28 T1 or 21 E1 controllers.

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- Cisco 1-Port Channelized OC-3/STM-1 SPA
- Cisco 2-Port Channelized OC-12c/DS0 SPA
- Cisco 1-Port Channelized OC-48/STM-16 SPA
- Cisco 8-Port Channelized T1/E1 SPA
- Before you can configure a clear channel T3 controller on the channelized SONET SPAs, you must configure the SPA for an STS stream channelized for T3. For more information, see the [Configuring Channelized SONET/SDH](#) module.

## Information About T3/E3 Controllers and Serial Interfaces

The 2-Port and 4-Port Clear Channel T3/E3 SPAs support clear channel services over serial lines only. The 4-Port Channelized T3/DS0 SPA supports clear channel services and channelized serial lines.

If a controller is not channelized, then it is a clear channel controller, and the full bandwidth of its associated serial line is dedicated to a single channel that carries serial services.

When a T3 controller is channelized, it is logically divided into smaller bandwidth T1 or E1 controllers, depending on which mode of channelization you select. The sum of the bandwidth of the serial interfaces on the T1 or E1 controllers cannot exceed the bandwidth of the T3 controller that contains those channelized T1 or E1 controllers.

When you channelize a T3 controller, each individual T1 or E1 controller is automatically further channelized into DS0 time slots. A single T1 controller carries 24 DS0 time slots, and a single E1 controller carries 31 DS0 time slots. Users can divide these DS0 time slots up into individual channel groups. Each channel group can support a single serial interface.

When a controller is channelized, and channel groups have been created, services are provisioned on the associated serial interfaces.

The channelization feature in this release allows the following types of channelization:

- A single T3 controller into 28 T1 controllers, for a total controller size of 44210 kbps.
- A single T3 controller into 21 E1 controllers, for a total controller size of 43008 kbps.
- A single T1 controller supports up to 1.536 MB.
- A single E1 controller supports up to 2.048 MB.



**Note** A single shared port adapter (SPA) can support up to 448 channel groups.

This section includes the following additional topics:

**Supported Features**

This table shows a summary of some of the supported features by SPA type.

**Table 1: Supported Features on Channelized T3/E3, T1/E1, and Clear Channel SPAs**

	<b>1-Port Channelized OC-3/STM-1 SPA</b>	<b>2-Port Channelized OC-12c/DS0 SPA</b>	<b>1-Port Channelized OC-48/STM-16 SPA</b>	<b>4-Port Channelized T3/DS0 SPA</b>	<b>8-Port Channelized T1/E1 SPA</b>	<b>2-Port Channelized T3/E1 SPA</b>
Bit Error Ratio Test (BERT)	T3, T1, E3, E1, and DS0 channels  Maximum of 12 sessions <sup>1</sup>  Maximum 1 session for T1	T3 channels	T3 and E3  Maximum of 2 simultaneous BERT tests are possible per STS-12.	T3, T1, E1 and DS0 channels	T1, E1, and DS0 channels	T3 and E1 channels
Channelization and Clear Channel Modes	Channelized SONET/SDH  Channelized T1/E1 to DS0s  Clear channel SONET  Clear channel T3 and E3 in SDH mode for serial interfaces	Channelized SONET/SDH  Channelized T3/E3  Channelized T1/E1 to DS0s  Clear channel SONET	Channelized SONET/SDH  Channelized T3/E3  Clear channel SONET	Channelized T3  Channelized T1/E1  T3 clear channel	Channelized T1/E1 to DS0s.  Clear channel T1 and E1	Channelized T3 and E1

	<b>1-Port Channelized OC-3/STM-1 SPA</b>	<b>2-Port Channelized OC-12c/DS0 SPA</b>	<b>1-Port Channelized OC-48/STM-16 SPA</b>	<b>4-Port Channelized T3/DS0 SPA</b>	<b>8-Port Channelized T1/E1 SPA</b>	<b>2-Port 4-Port Channelized SPA</b>
DSU Modes	Adtran Digital-link Cisco Kentrox Larscom Verilink  For E3  Cisco (Default) Digital Link Kentrox	Adtran Digital-link Cisco Kentrox Larscom Verilink	Adtran Digital-link Cisco Kentrox Larscom Verilink  <b>Note</b> Subrate for E3 is not supported.	Adtran Digital-link Cisco Kentrox Larscom Verilink	Adtran Digital-link Cisco Kentrox Larscom Verilink	Adtran Digital-link Cisco Kentrox Larscom Verilink
Encapsulations	Frame Relay HDLC PPP	HDLC PPP	Frame Relay HDLC PPP	Frame Relay HDLC PPP	Frame Relay HDLC PPP	Frame Relay HDLC PPP
Equal Cost Multipath (ECMP)	Yes	ECMP support for egress paths over T3 or T1 speed channels with either PPP or HDLC encapsulation  ECMP support for paths on multiple controllers, SPAs, and SIPs	Yes	Yes	Yes	Yes
Facility Data Link (FDL)	Yes	Yes	Yes	Yes	Yes	No
Far End Alarm Control (FEAC)	For T3 C-bit framing	For T3 C-bit framing	For T3 C-bit framing	For T3 C-bit framing		For T3 framing
Inter-Chassis Stateful Switchover (ICSSO) <sup>2</sup>	For PPP on T3, T1, and E1 channels only (not DS0)  For MLPPP on T1 and E1 sessions	For PPP on T3 channels  For T1 when T3 channels are configured on the same system, SIP, SPA or port	No	T3, T1, and E1 channels only (not DS0)	T1 and E1 channels only (not DS0)	No
IP Fast Reroute (IP-FRR)	No	For PPP only	No	T3, T1, and E1 channels	T1 and E1 channels	No
Link Noise Monitoring	No	Yes	No	No	No	No

	<b>1-Port Channelized OC-3/STM-1 SPA</b>	<b>2-Port Channelized OC-12c/DS0 SPA</b>	<b>1-Port Channelized OC-48/STM-16 SPA</b>	<b>4-Port Channelized T3/DS0 SPA</b>	<b>8-Port Channelized T1/E1 SPA</b>	<b>2-Port Channelized T3 SPA</b>
Loopback <sup>3</sup>	Yes	Yes	Yes	Yes—Not DS0	Yes—Not DS0	Yes
Maintenance Data Link (MDL) Message Support	Yes	Yes	Yes	Yes	N/A	Yes
Circuit Emulation Service Over Packet Switched Network Support	Yes	Yes	No	No	No	No
Mixed Channel Support	No—T3 and E3 cannot be mixed. T1 and E1 cannot coexist on single STS-1.	Yes—T3 and T1 channels supported on the same SIP, SPA, or port	Yes	Yes	No—All channels must be either in T1 or E1 mode.	No
Scalability	1000 channels per SPA	48 T3 channels per SIP 24 T3 channels per SPA 12 T3 channels per interface	48 T3/E3 channels	1000 channels per SPA	8 T1 or E1 ports Up to 256 full-duplex HDLC channels Nx64 K channel speed for E1 where N is less than or equal to 32 AND Nx64 K or Nx56K channel speeds for T1, where N is less than or equal to 24.	2 channels per port

- <sup>1</sup> (1)
- <sup>2</sup> (2)
- <sup>3</sup> (3)

6 simultaneous BERT sessions among first three physical ports and 6 simultaneous BERT sessions on 4th port.

All interfaces configured on a SONET/SDH controller for the 1-Port Channelized OC-3/STM-1 SPA should be IC-SSO protected or none of them should be IC-SSO protected.

For detailed information about loopback support, see the “Loopback Support” section.

## Loopback Support

This section describes the types of loopback support on the 1-Port Channelized OC-3/STM-1 SPA.

### Cisco 1-Port Channelized OC-3/STM-1 SPA

This section describes the types of loopback supported on the 1-Port Channelized OC-3/STM-1 SPA:

- For SONET controller:
  - Local loopback
  - Network line loopback
- For T3:
  - Local loopback
  - Network loopback
  - Remote loopback line (Use FEAC in C-Bit mode for T3)
  - Remote loopback payload (Use FEAC in C-Bit mode for T3)
- For E3:
  - Local loopback
  - Network loopback
- For T1:
  - Local loopback
  - Network line loopback
  - Remote line FDL ANSI loopback (also known as Remote CSU loopback - ESF mode)
  - Remote line FDL Bellcore loopback (also known as Remote SmartJack loopback - ESF mode)
  - Remote line inband loopback (SF inband loopback)
  - Remote payload FDL ANSI loopback (ESF remote payload loopback)
- For E1:
  - Local loopback
  - Network line loopback

### Cisco 2-Port Channelized OC-12c/DS0 SPA

This section describes the types of loopback supported on the 2-Port Channelized OC-12c/DS0 SPA:

- For T3
  - Local loopback
  - Network line loopback

- For ports
  - Local line loopback
  - Network line loopback

#### **Cisco 1-Port Channelized OC-48/STM-16 SPA**

This section describes the types of loopback supported on the 1-Port Channelized OC-48/STM-16 SPA:

- For SONET:
  - Local line loopback
  - Network line loopback
- For T3:
  - Local loopback
  - Network line loopback
  - Network payload loopback
- For E3:
  - Local loopback
  - Network loopback

#### **Cisco 4-Port Channelized T3/DS0 SPA**

This section describes the types of loopback supported on the 4-Port Channelized T3/DS0 SPA:

- For T3:
  - Local loopback
  - Network loopback
  - Remote loopback line
- For T1:
  - Local loopback
  - Network line loopback
  - Remote line FDL ANSI loopback (also known as Remote CSU loopback - ESF mode)
  - Remote line FDL Bellcore loopback (also known as Remote SmartJack loopback - ESF mode)
- For E1:
  - Local loopback
  - Network line loopback

### Cisco 8-Port Channelized T1/E1 SPA

This section describes the types of loopback supported on the 8-Port Channelized T1/E1 SPA:

- For T1:
  - Local loopback
  - Network line loopback
  - Remote line FDL ANSI loopback (also known as Remote CSU loopback - ESF mode)
  - Remote line FDL Bellcore loopback (also known as Remote SmartJack loopback - ESF mode)
- For E1:
  - Local loopback

### Cisco 2-Port and 4-Port Clear Channel T3/E3 SPA

This section describes the types of loopback supported on the 2-Port and 4-Port Clear Channel T3/E3 SPA:

- Local loopback
- Network payload loopback (Configure the local framer to send all data received from the remote side back to the remote side.)
- Network line loopback (Configure the local LIU to send all data received from the remote side back to the remote side.)
- Remote line loopback (Use FEAC to request the remote interface to loop back to SPA—T3 only)

## Configuration Overview

Configuring a channelized T3 controller and its associated serial interfaces is a 4-step process:

1. Configure the T3 controller, and set the mode for that controller to T1 or E1.
2. Configure the T1 or E1 controller.
3. Create channel groups and assign DS0 time slots to these channel groups as desired.
4. Configure the serial interfaces that are associated with the individual channel groups, as described in the [Configuring Serial Interfaces](#) module later in this document.

## Default Configuration Values for T3 and E3 Controllers

This table describes the default configuration parameters that are present on the T3 and E3 controllers.

**Note**

- Auto-detect framing is not supported on the 2-Port Channelized OC-12c/DS0 SPA.
- E3 is not supported on the 4-Port Channelized T3/DS0 SPA.



Table 2: T3 and E3 Controller Default Configuration Values

Parameter	Default Value	Configuration File Entry
Frame type for the data line	For T3: C-bit framing For E3: G.751	<b>framing</b> { <b>auto-detect</b>
Clocking for individual T3/E3 links	<b>internal</b>	<b>clock source</b> { <b>internal</b>   <b>line</b> }
Cable length	224 feet	<b>cablelength</b> <i>feet</i>
Maintenance data link (MDL) messages (T3 only)	<b>disable</b>	<b>mdl transmit</b> { <b>idle-signal</b>   <b>path</b>   <b>test-signal</b> } { <b>disable</b>   <b>enable</b> }
National reserved bits for an E3 port (E3 only)	<b>enable</b> , and the bit pattern value is 1.	<b>national bits</b> { <b>disable</b>   <b>enable</b> }



**Note** When configuring clocking on a serial link, you must configure one end to be **internal**, and the other end to be **line**. If you configure **internal** clocking on both ends of a connection, framing slips occur. If you configure **line** clocking on both ends of a connection, the line does not come up.

## Default Configuration Values for T1 and E1 Controllers

This table describes the default configuration parameters that are present on the T1 and E1 controllers.

Table 3: T1 and E1 Controller Default Configuration Values

Parameter	Default Value	Configuration File Entry
Frame type for the data line	For T1: extended superframe ( <b>esf</b> )  For E1: framing with CRC-4 error monitoring capabilities ( <b>erc4</b> ).	For T1: <b>framing</b> { <b>sf</b>   <b>esf</b> }  For E1: <b>framing</b> { <b>erc4</b>   <b>no-erc4</b>   <b>unframed</b> }
Detection and generation of T1 yellow alarms. (T1 only)	Yellow alarms are detected and generated on the T1 channel.	<b>yellow</b> { <b>detection</b>   <b>generation</b> } { <b>disable</b>   <b>enable</b> }
Clocking for individual T1 and E1 links	<b>internal</b>	<b>clock source</b> { <b>internal</b>   <b>line</b> }
Cable length (T1 only)	For <b>cablelength long</b> command: <i>db-gain-value</i> : <i>gain26</i> ; <i>db-loss-value</i> : 0db.  For <b>cablelength short</b> command: 533 feet.	To set a cable length of longer than 655 feet: <b>cablelength long</b> <i>db-gain-value db-loss-value</i>  To set a cable length of 655 feet or shorter: <b>cablelength</b> <b>short</b> <i>length</i>

Parameter	Default Value	Configuration File Entry
Transmission of ANSI T1.403 or AT&T TR54016 once-per-second performance reports through Facility Data Link (FDL) for a T1 channel (T1 only)	<b>disable</b>	<b>fdl {ansi   att} {enable   disable}</b>
National reserved bits for an E1 port (E1 only)	0 (which corresponds to <i>0x1f</i> in hexadecimal format)	<b>national bits bits</b>



**Note** When configuring clocking on a serial link, you must configure one end to be **internal**, and the other end to be **line**. If you configure **internal** clocking on both ends of a connection, framing slips occur. If you configure **line** clocking on both ends of a connection, the line does not come up.

## Link Noise Monitoring on T1 or E1 Links

Link Noise Monitoring (LNM) provides the ability to monitor Path Code Violation (PCV) errors on T1 and E1 links on the 2-Port Channelized OC-12c/DS0 SPA on the Cisco ASR 9000 Series Router, and to signal events and alarms on these links when noise continuously meets or exceeds configured thresholds (the **set** threshold values) for those errors. Events are also signaled when noise falls below configured improved thresholds (the **clear** threshold values).

Beginning in Cisco IOS XR Release 4.1, the LNM feature supports the **lnm remove** command to signal the Noise Attribute to PPP to remove an MLPPP bundle member link when specified thresholds are crossed.



**Note** An LCV is an occurrence of either a Bi-Polar Violation (BPV) or Excessive Zeroes (EXZ) error, and a PCV is an occurrence of a CRC error in a timeslot. However, the LNM feature currently only monitors PCV errors. The LCV values are only used to calculate an expected PCV if the PCV values are not specified. If the PCV values are specified, then the LCV values are ignored.

## LNM Events

There are two basic types of monitoring events produced by LNM:

- Crossed events—A *crossed* event signals when PCV threshold values continuously meet or exceed the specified **set** values for major and minor warnings for a specified period of time (**duration**). When a crossed event occurs, the major or minor monitoring type for the controller is reported as the *alarm* state. When the crossed event is no longer present, the monitoring type returns to the *stable* state.

The following are examples of crossed events:

```
RP/0/RSP0/CPU0:Router#0/1/CPU0:May 13 9:54:10.980 : g_spa_1[181]:
%L2-T1E1_LNM-3-MINWARNOISE :
Interface T10/1/1/0/1/1/1, noise crossed minor warning threshold

RP/0/RSP0/CPU0:Router#0/1/CPU0:May 13 9:54:11.980 : g_spa_1[181]:
```

```
%L2-T1E1_LNM-3-MAJWARNNOISE :
Interface T10/1/1/0/1/1/1, noise crossed major warning threshold
```

- Cleared events—A *cleared* event signals when threshold values that were crossed have fallen below the specified **clear** values for major and minor warnings.

The following are examples of cleared events:

```
RP/0/RSP0/CPU0:Router#LC/0/1/CPU0:May 13 10:27:25.809 : g_spa_1[181]:
%L2-T1E1_LNM-3-MAJWARNNOISE :
Interface T10/1/1/0/1/1/1, noise cleared major warning threshold

RP/0/RSP0/CPU0:Router#LC/0/1/CPU0:May 13 10:28:14.810 : g_spa_1[181]:
%L2-T1E1_LNM-3-MINWARNNOISE :
Interface T10/1/1/0/1/1/1, noise cleared minor warning threshold
```

## LNM Logging

When you enable syslog messages for LNM events using the **lnm syslog** command, LNM messages will appear in both the system log and in the log events buffer. You can display LNM events in the log events buffer using the **show logging events buffer bistate-alarms-set** command, and also using the **show logging** command, which are described in the *Cisco ASR 9000 Series Aggregation Services Router System Monitoring Command Reference*.

LNM supports hierarchical level alarm reporting as defined in the Telcordia (Bellcore) GR-253 standard. Hierarchical alarm reporting means that whenever a higher alarm is asserted, the lower alarm state is suppressed. When the high alarm is cleared, the lower alarm will re-assert if the condition still exists.

For LNM, this means that if a major warning threshold is continuously met or exceeded resulting in a crossed event and alarm state, then a minor warning alarm state is suppressed and returned to stable state. The minor crossed event also is removed from the bistate log. When the major warning is cleared, the minor warning alarm is asserted if the condition still exists.

Only a single crossed event for major warnings will appear in the bistate log for the controller. Therefore, you will see only a single log message for a controller if noise exists above configured threshold values.

# How to Configure Clear Channel T3/E3 Controllers and Channelized T1/E1 Controllers

The T3/E3 controllers are configured in the physical layer control element of the Cisco IOS XR software configuration space. This configuration is described in the following tasks:

## Configuring a Clear Channel E3 Controller

### Before you begin

#### Restrictions

- If you configure an option that is not valid for your controller type, you receive an error when you commit the configuration.
- A single SPA cannot support a mixture of T3 and E3 interfaces.

- E3 is not supported on the 4-Port Channelized T3/DS0 SPA.

## SUMMARY STEPS

1. **configure**
2. **controller e3** *interface-path-id*
3. **mode serial**
4. **no shutdown**
5. **end** or **commit**
6. **show controllers e3** *interface-path-id*

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
<b>Step 2</b>	<b>controller e3</b> <i>interface-path-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# controller t3 0/1/0/0	Specifies the E3 controller name in the notation <i>rack/slot/module/port</i> and enters E3 configuration mode.
<b>Step 3</b>	<b>mode serial</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-e3)# mode serial	Configures the mode of the port to be clear channel serial. <b>Note</b> <ul style="list-style-type: none"> <li>• This step is required for the 2-Port and 4-Port Channelized T3 SPA only. The 2-Port and 4-Port Clear Channel T3/E3 SPA run in serial mode by default.</li> </ul>
<b>Step 4</b>	<b>no shutdown</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-e3)# no shutdown	Removes the shutdown configuration. <ul style="list-style-type: none"> <li>• The removal of the shutdown configuration removes the forced administrative down on the controller, enabling the controller to move to an up or a down state.</li> </ul>
<b>Step 5</b>	<b>end</b> or <b>commit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-e3)# end or RP/0/RSP0/CPU0:router(config-e3)# commit	Saves configuration changes. <ul style="list-style-type: none"> <li>• When you issue the <b>end</b> command, the system prompts you to commit changes:   Uncommitted changes found, commit them before exiting(yes/no/cancel)?  [cancel]:  - Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>- Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>- Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> <li>• Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>
<b>Step 6</b>	<p><b>show controllers e3</b> <i>interface-path-id</i></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# show controllers e3 0/1/0/0</pre>	(Optional) Displays information about the E3 controllers.

**What to do next**

- Modify the default configuration that is running on the E3 controller you just configured, as described in the “Modifying the Default E3 Controller Configuration” section later in this module.
- Configure a bit error rate test (BERT) on the controller to test its integrity, as described in the “Configuring BERT” section later in this module.
- Configure the associated serial interface, as described in the Configuring Serial Interfaces on the Cisco ASR 9000 Series Router module later in this document.

## Modifying the Default E3 Controller Configuration

**Restrictions**

- E3 is not supported on the 4-Port Channelized T3/DS0 SPA.

This task explains how to modify the default E3 controller configuration, which is described in the "Default Configuration Values for T3 and E3 Controllers" section earlier in this module.

**SUMMARY STEPS**

1. **configure**
2. **controller e3** *interface-path-id*
3. **clock source** {**internal** | **line**}
4. **cablelength** *feet*
5. **framing** {**g751** | **g832**}
6. **national bits** {**disable** | **enable**}
7. **no shutdown**
8. **end** or **commit**
9. **show controllers e3** *interface-path-id*

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b>  RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
<b>Step 2</b>	<b>controller e3 interface-path-id</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config)# controller t3 0/1/0/0	Specifies the E3 controller name in the notation <i>rack/slot/module/port</i> and enters E3 configuration mode.
<b>Step 3</b>	<b>clock source {internal   line}</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config-e3)# clock source internal	(Optional) Sets the clocking for individual E3 links.  <b>Note</b> <ul style="list-style-type: none"> <li>• The default clock source is <b>internal</b>.</li> <li>• When configuring clocking on a serial link, you must configure one end to be <b>internal</b>, and the other end to be <b>line</b>. If you configure <b>internal</b> clocking on both ends of a connection, framing slips occur. If you configure <b>line</b> clocking on both ends of a connection, the line does not come up.</li> </ul>
<b>Step 4</b>	<b>cablelength feet</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config-e3)# cablelength 250	(Optional) Specifies the distance of the cable from the router to the network equipment.  <b>Note</b> <ul style="list-style-type: none"> <li>• The default cable length is 224 feet.</li> </ul>
<b>Step 5</b>	<b>framing {g751   g832}</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config-e3)# framing g832	(Optional) Selects the frame type for the E3 port. Possible E3 frame types are G.751 and G.832.  <b>Note</b> <ul style="list-style-type: none"> <li>• The default framing for E3 is G.751.</li> </ul>
<b>Step 6</b>	<b>national bits {disable   enable}</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config-e3)# national bits enable	(Optional) Enables or disables the 0x1F national reserved bit pattern on the E3 port.  <b>Note</b> <ul style="list-style-type: none"> <li>• The E3 national bit is enabled by default, and the bit pattern value is 1.</li> </ul>
<b>Step 7</b>	<b>no shutdown</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config-e3)# no shutdown	Removes the shutdown configuration.  <ul style="list-style-type: none"> <li>• The removal of the shutdown configuration removes the forced administrative down on the controller, enabling the controller to move to an up or a down state.</li> </ul>

	Command or Action	Purpose
Step 8	<p><b>end</b> or <b>commit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e3)# end</pre> <p>or</p> <pre>RP/0/RSP0/CPU0:router(config-e3)# commit</pre>	<p>Saves configuration changes.</p> <ul style="list-style-type: none"> <li>When you issue the <b>end</b> command, the system prompts you to commit changes: <pre>Uncommitted changes found, commit them before   exiting(yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> <li>Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> </ul> </li> <li>Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>
Step 9	<p><b>show controllers e3</b> <i>interface-path-id</i></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# show controllers e3 0/1/0/0</pre>	(Optional) Displays information about the E3 controllers.

#### What to do next

- Modify the default configuration that is running on the T3 controller you just configured, as described in the “Modifying the Default T3 Controller Configuration” section later in this module.
- Configure BERT on the controller to test its integrity, as described in the “Configuring BERT” section later in this module.
- Configure the associated serial interface, as described in the *Configuring Serial Interfaces on the Cisco ASR 9000 Series Router* module later in this document.

## Configuring a Clear Channel T3 Controller

#### Before you begin

Before you can configure a clear channel T3 controller on a channelized SPA, you must configure the SPA for an STS stream channelized for T3. For more information, see the *Configuring Channelized SONET/SDH on Cisco XR Software Cisco ASR 9000 Series Router* module.

#### Restrictions

- If you configure an option that is not valid for your controller type, you receive an error when you commit the configuration.
- A single SPA cannot support a mixture of T3 and E3 interfaces.

## SUMMARY STEPS

1. **configure**
2. **controller t3** *interface-path-id*
3. **mode serial**
4. **no shutdown**
5. **end** or **commit**
6. **show controllers t3** *interface-path-id*

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
<b>Step 2</b>	<b>controller t3</b> <i>interface-path-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# controller t3 0/1/0/0	Specifies the T3 controller name in the <i>rack/slot/module/port</i> notation and enters T3 configuration mode.
<b>Step 3</b>	<b>mode serial</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t3)# mode serial	Configures the mode of the port to be clear channel serial.
<b>Step 4</b>	<b>no shutdown</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t3)# no shutdown	Removes the shutdown configuration. <ul style="list-style-type: none"> <li>• The removal of the shutdown configuration removes the forced administrative down on the controller, enabling the controller to move to an up or a down state.</li> </ul>
<b>Step 5</b>	<b>end</b> or <b>commit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t3)# end or RP/0/RSP0/CPU0:router(config-t3)# commit	Saves configuration changes. <ul style="list-style-type: none"> <li>• When you issue the <b>end</b> command, the system prompts you to commit changes:                 Uncommitted changes found, commit them before                exiting(yes/no/cancel)?                [cancel]:             </li> </ul>



	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>- Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>- Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>- Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> <li>• Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>
<b>Step 6</b>	<b>show controllers t3</b> <i>interface-path-id</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router# show controllers t3 0/1/0/0</pre>	(Optional) Displays information about the T3 controllers.

#### What to do next

- Modify the default configuration that is running on the T3 controller you just configured, as described in the “Modifying the Default T3 Controller Configuration” section later in this module.
- Configure BERT on the controller to test its integrity, as described in the “Configuring BERT” section later in this module.
- Configure the associated serial interface, as described in the Configuring Serial Interfaces on the Cisco ASR 9000 Series Router module.
- When a T3 controller is in clear channel mode, it carries a single serial interface.
- The T3 controllers are configured in the T3 configuration mode.

## Configuring a Channelized T3 Controller

The SPAs that support channelized T3 support channelization to T1, E1, and DS0. The steps in this section describe how to channelize a single T3 controller into 28 T1 controllers or 21 E1 controllers. Once you have created T1 or E1 controllers, you can further channelize those controllers into DS0 time slots, as described in the following sections:

- [Configuring a T1 Controller](#)
- [Configuring an E1 Controller](#)

Each individual T1 controller supports a total of 24 DS0 time slots, and each individual E1 controller supports a total of 31 DS0 time slots.

**Before you begin**

Before you configure a channelized T3 controller, be sure that the following requirements are met:

- You have one of the following SPAs installed:
  - 1-Port Channelized OC-3/STM-1 SPA
  - 2-Port Channelized OC-12/DS0 SPA
  - 4-Port Channelized T3/DS0 SPA
- For the channelized SONET SPAs, you have configured the SPA for an STS stream channelized for T3. For more information, see the [Configuring Channelized SONET/SDH](#) module.




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**Note** If you configure an option that is not valid for your controller type, you receive an error when you commit the configuration.

---

**SUMMARY STEPS**

1. **configure**
2. **controller T3** *interface-path-id*
3. **mode t1**
4. **no shutdown**
5. **end** or **commit**
6. **show controllers t3** *interface-path-id*

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b>  RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
<b>Step 2</b>	<b>controller T3</b> <i>interface-path-id</i> <b>Example:</b>  RP/0/RSP0/CPU0:router(config)# controller t3 0/1/0/0	Specifies the T3 controller name in the notation <i>rack/slot/module/port</i> and enters T3 configuration mode.
<b>Step 3</b>	<b>mode t1</b> <b>Example:</b>  RP/0/RSP0/CPU0:router(config-t3)# mode t1	Sets the mode of the channelized controllers to be T1, and creates 28 T1 controllers.
<b>Step 4</b>	<b>no shutdown</b> <b>Example:</b>	Removes the shutdown configuration.

	Command or Action	Purpose
	RP/0/RSP0/CPU0:router(config-t3)# no shutdown	<ul style="list-style-type: none"> <li>The removal of the shutdown configuration removes the forced administrative down on the controller, enabling the controller to move to an up or a down state.</li> </ul>
<b>Step 5</b>	<p><b>end</b> or <b>commit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t3)# end</pre> <p>OR</p> <pre>RP/0/RSP0/CPU0:router(config-t3)# commit</pre>	<p>Saves configuration changes.</p> <ul style="list-style-type: none"> <li>When you issue the <b>end</b> command, the system prompts you to commit changes:                     <pre>Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> <li>Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> </ul> </li> <li>Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>
<b>Step 6</b>	<p><b>show controllers t3 interface-path-id</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# show controllers t3 0/1/0/0</pre>	(Optional) Displays information about the T3 controllers.

**What to do next**

- Modify the default configuration that is running on the T3 controller you just configured, as described in the “Modifying the Default T3 Controller Configuration” section on page 464.
- If you channelized your T3 controller into 28 T1 controllers, configure the T1 controllers and assign DS0 time slots to them, as described in the “Configuring a T1 Controller” section on page 466.
- If you channelized your T3 controller into 21 E1 controllers, configure the E1 controllers and assign DS0 time slots to them, as described in the “Configuring an E1 Controller” section on page 470.

## Modifying the Default T3 Controller Configuration

This task explains how to modify the default T3 controller configuration, which is described in the Default Configuration Values for T3 and E3 Controllers section.

**Before you begin**

You must configure a clear channel or channelized T3 controller, as described in one of the following sections:

- [Configuring a Clear Channel T3 Controller](#)
- [Configuring a Channelized T3 Controller](#)

**SUMMARY STEPS**

1. **configure**
2. **controller T3** *interface-path-id*
3. **clock source** {**internal** | **line**}
4. **cablelength** *feet*
5. **framing** {**auto-detect** | **c-bit** | **m23**}
6. **mdl transmit** {**idle-signal** | **path** | **test-signal**} {**disable** | **enable**}
7. **mdl string** {**eic** | **fi** | **fic** | **gen-number** | **lic** | **port-number** | **unit**} *string*
8. **no shutdown**
9. **end** or **commit**
10. **show controllers t3** *interface-path-id*

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
<b>Step 2</b>	<b>controller T3</b> <i>interface-path-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# controller t3 0/1/0/0	Specifies the T3 controller name in the notation <i>rack/slot/module/port</i> and enters T3 configuration mode.
<b>Step 3</b>	<b>clock source</b> { <b>internal</b>   <b>line</b> } <b>Example:</b> RP/0/RSP0/CPU0:router(config-t3)# clock source internal	(Optional) Sets the clocking for the T3 port. <b>Note</b> <ul style="list-style-type: none"> <li>• The default clock source is <b>internal</b>.</li> <li>• When configuring clocking on a serial link, you must configure one end to be <b>internal</b>, and the other end to be <b>line</b>. If you configure <b>internal</b> clocking on both ends of a connection, framing slips occur. If you configure <b>line</b> clocking on both ends of a connection, the line does not come up.</li> </ul>
<b>Step 4</b>	<b>cablelength</b> <i>feet</i> <b>Example:</b>	(Optional) Specifies the distance of the cable from the router to the network equipment.

	Command or Action	Purpose
	<pre>RP/0/RSP0/CPU0:router(config-t3)# cablelength 250</pre>	<p><b>Note</b></p> <ul style="list-style-type: none"> <li>The default cable length is 224 feet.</li> </ul>
<b>Step 5</b>	<p><b>framing {auto-detect   c-bit   m23}</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t3)# framing c-bit</pre>	<p>(Optional) Selects the frame type for the T3 port.</p> <p><b>Note</b></p> <ul style="list-style-type: none"> <li>The default frame type for T3 is C-bit. Auto-detect is not supported on the 2-Port Channelized OC-12c/DS0 SPA.</li> </ul>
<b>Step 6</b>	<p><b>mdl transmit {idle-signal   path   test-signal} {disable   enable}</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t3)# mdl transmit path enable</pre>	<p>(Optional) Enables Maintenance Data Link (MDL) messages on the T3 port.</p> <p><b>Note</b></p> <ul style="list-style-type: none"> <li>MDL messages are supported only when the T3 framing is C-bit parity.</li> <li>MDL message are disabled by default.</li> </ul>
<b>Step 7</b>	<p><b>mdl string {eic   fi   fic   gen-number   lic   port-number   unit} string</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t3)# mdl fi facility identification code</pre>	<p>(Optional) Specifies the values of the strings sent in the MDL messages.</p>
<b>Step 8</b>	<p><b>no shutdown</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t3)# no shutdown</pre>	<p>Removes the shutdown configuration.</p> <ul style="list-style-type: none"> <li>The removal of the shutdown configuration removes the forced administrative down on the controller, enabling the controller to move to an up or a down state.</li> </ul>
<b>Step 9</b>	<p><b>end or commit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t3)# end</pre> <p>OR</p> <pre>RP/0/RSP0/CPU0:router(config-t3)# commit</pre>	<p>Saves configuration changes.</p> <ul style="list-style-type: none"> <li>When you issue the <b>end</b> command, the system prompts you to commit changes:</li> </ul> <pre>Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> <li>- Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>- Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>- Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>
<b>Step 10</b>	<b>show controllers t3 interface-path-id</b>  <b>Example:</b>  RP/0/RSP0/CPU0:router# show controllers t3 0/1/0/0	(Optional) Displays information about the T3 controllers.

### What to do next

- If you configured a clear channel T3 controller, perform the following tasks:
  - Configure BERT on the controller to test its integrity, as described in the “Configuring BERT” section on page 474 later in this module.
  - Configure the associated serial interface, as described in the *Configuring Serial Interfaces on the Cisco ASR 9000 Series Router* module.
- If you channelized your T3 controller into 28 T1 controllers, configure the T1 controllers and assign DS0 time slots to them, as described in the “Configuring a T1 Controller” section on page 466.
- If you channelized your T3 controller into 21 E1 controllers, configure the E1 controllers and assign DS0 time slots to them, as described in the “Configuring an E1 Controller” section on page 470.

## Configuring a T1 Controller

This task describes how to configure an individual T1 controller and channelize it into 24 individual DS0 timeslots.

### Before you begin

Before you configure a T1 controller, be sure that the following requirements are met:

- You have one of the following SPAs installed:
  - 1-Port Channelized OC-3/STM-1 SPA
  - 2-Port Channelized OC-12/DS0 SPA
  - 4-Port Channelized T3/DS0 SPA
  - 8-Port Channelized T1/E1 SPA
- If you have a 1-Port Channelized OC-3/STM-1 SPA or 2-Port Channelized OC-12/DS0 SPA, you must complete the following configuration:
  - Configure an STS stream channelized for T3. For more information, see the [Configuring Channelized SONET/SDH](#) module.

- Configure a channelized T3 controller running in T1 mode, as described in the [Configuring a Channelized T3 Controller](#).
- If you have a 4-Port Channelized T3/DS0 SPA, you must configure a channelized T3 controller to run in T1 mode, as described in the [Configuring a Channelized T3 Controller](#).

**Restrictions**

If you configure an option that is not valid for your controller type, you receive an error when you commit the configuration.

Before you configure a T1 controller on the 8-Port Channelized T1/E1 SPA, consider the following restrictions:

**SUMMARY STEPS**

1. **show controllers t1** *interface-path-id*
2. **configure**
3. **controller t1** *interface-path-id*
4. **framing** {sf | esf}
5. **yellow** {detection | generation} {disable | enable}
6. **clock source** {internal | line}
7. **fdl** {ansi | att} {enable | disable}
8. **no shutdown**
9. **channel-group** *channel-group-number*
10. **timeslots** *range*
11. **speed** *kbps*
12. **exit**
13. Repeat Step 9 through Step 12 to assign time slots to a channel group. Each controller can contain up to 24 time slots.
14. **exit**
15. Repeat Step 2 through Step 14 to assign more channel groups to a controller as desired.
16. **end** or **commit**

**DETAILED STEPS**

	Command or Action	Purpose
Step 1	<b>show controllers t1</b> <i>interface-path-id</i> <b>Example:</b> RP/0/RSP0/CPU0:router# show controllers t3 0/1/0/0	(Optional) Displays information about the T1 controllers you created in Step 3.
Step 2	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
Step 3	<b>controller t1</b> <i>interface-path-id</i> <b>Example:</b>	Enters T1 configuration mode.

	Command or Action	Purpose
	RP/0/RSP0/CPU0:router(config)# controller t1 0/3/0/0/0	
<b>Step 4</b>	<b>framing</b> {sf   esf} <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1)# framing esf	(Optional) Selects the frame type for the T1 data line: <ul style="list-style-type: none"> <li>• <b>sf</b>—Superframe</li> <li>• <b>esf</b>—Extended super frame</li> </ul>
<b>Step 5</b>	<b>yellow</b> {detection   generation} {disable   enable} <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1e1)# yellow detection enable	(Optional) Enables or disables the detection and generation of T1 yellow alarms.  Yellow alarms are detected and generated on the T1 channel by default.
<b>Step 6</b>	<b>clock source</b> {internal   line} <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1e1)# clock source internal	(Optional) Sets the clocking for individual T1 links.  The default clock source is <b>internal</b> .  When configuring clocking on a serial link, you must configure one end to be <b>internal</b> , and the other end to be <b>line</b> . If you configure <b>internal</b> clocking on both ends of a connection, framing slips occur. If you configure <b>line</b> clocking on both ends of a connection, the line does not come up.
<b>Step 7</b>	<b>fdl</b> {ansi   att} {enable   disable} <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1e1)# fdl ansi enable	(Optional) Enables the transmission of ANSI T1.403 or AT&T TR54016 once-per-second performance reports through Facility Data Link (FDL).  FDL ansi and att are disabled by default.
<b>Step 8</b>	<b>no shutdown</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1e1)# no shutdown	Removes the shutdown configuration. <ul style="list-style-type: none"> <li>• The removal of the shutdown configuration removes the forced administrative down on the controller, enabling the controller to move to an up or a down state.</li> </ul>
<b>Step 9</b>	<b>channel-group</b> <i>channel-group-number</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1)# channel-group 0	Creates a T1 channel group and enters channel group configuration mode for that channel group.
<b>Step 10</b>	<b>timeslots</b> <i>range</i> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 7-12	Associates DS0 time slots to a channel group and creates an associated serial subinterface on that channel group. <ul style="list-style-type: none"> <li>• Range is from 1 to 24 time slots.</li> </ul>



	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>You can assign all 24 time slots to a single channel group, or you can divide the time slots among several channel groups.</li> </ul> <p><b>Note</b> Each individual T1 controller supports a total of 24 DS0 time slots.</p>
<b>Step 11</b>	<p><b>speed</b> <i>kbps</i></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t1e1-channel_group)# speed 64</pre>	<p>(Optional) Specifies the speed of the DS0s in kilobits per second. Valid values are 56 and 64.</p> <p>The default speed is 64 kbps.</p>
<b>Step 12</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit</pre>	Exits channel group configuration mode.
<b>Step 13</b>	Repeat Step 9 through Step 12 to assign time slots to a channel group. Each controller can contain up to 24 time slots.	—
<b>Step 14</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t1)# exit</pre>	Exits T1 configuration mode and enters global configuration mode.
<b>Step 15</b>	Repeat Step 2 through Step 14 to assign more channel groups to a controller as desired.	—
<b>Step 16</b>	<p><b>end</b> or <b>commit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-sonet)# end</pre> <p>or</p> <pre>RP/0/RSP0/CPU0:router(config-sonet)# commit</pre>	<p>Saves configuration changes.</p> <ul style="list-style-type: none"> <li>When you issue the <b>end</b> command, the system prompts you to commit changes:</li> </ul> <pre>Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> <li>Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>

## Configuring an E1 Controller

This task describes how to configure an individual E1 controller and channelize it into 31 individual DS0 timeslots.

### Before you begin

Before you configure an E1 controller, be sure that the following requirements are met:

- You have one of the following SPAs installed:
  - 1-Port Channelized OC-3/STM-1 SPA
  - 2-Port Channelized OC-12/DS0 SPA
  - 4-Port Channelized T3/DS0 SPA
  - 8-Port Channelized T1/E1 SPA
- If you have a 1-Port Channelized OC-3/STM-1 SPA or 2-Port Channelized OC-12/DS0 SPA, you must complete the following configuration:
  - Configure an STS stream channelized for T3. For more information, see the [Configuring Channelized SONET/SDH](#) module.
  - Configure a channelized T3 controller running in E1 mode, as described in the [Configuring a Channelized T3 Controller](#).
- If you have a 4-Port Channelized T3/DS0 SPA, you must configure a channelized T3 controller to run in E1 mode, as described in the [Configuring a Channelized T3 Controller](#).

### Restrictions

If you configure an option that is not valid for your controller type, you receive an error when you commit the configuration.

Before you configure an E1 controller on the 8-Port Channelized T1/E1 SPA, consider the following restrictions:

- The SPA controller is not visible until it is explicitly configured for E1 mode.
- For each individual SPA, the SPA ports must all be in the same mode (all E1).

### SUMMARY STEPS

- show controllers e1** *interface-path-id*
- configure**
- controller e1** *interface-path-id*
- clock source** {**internal** | **line**}

5. **framing** {**crc4** | **no-crc4** | **unframed**}
6. **national bits** *bits*
7. **no shutdown**
8. **channel-group** *channel-group-number*
9. **timeslots** *range*
10. **exit**
11. Repeat Step 8 through Step 11 to assign time slots to a channel group.
12. **exit**
13. Repeat Step 2 through Step 13 to assign more channel groups to a controller as desired.
14. **end** or **commit**

**DETAILED STEPS**

	<b>Command or Action</b>	<b>Purpose</b>
<b>Step 1</b>	<p><b>show controllers e1</b> <i>interface-path-id</i></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# show controllers e1 0/1/0/0</pre>	(Optional) Displays information about the E1 controllers.
<b>Step 2</b>	<p><b>configure</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# configure</pre>	Enters global configuration mode.
<b>Step 3</b>	<p><b>controller e1</b> <i>interface-path-id</i></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config)# controller e1 0/3/0/0/0</pre>	Enters E1 configuration mode.
<b>Step 4</b>	<p><b>clock source</b> {<b>internal</b>   <b>line</b>}</p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e1)# clock source internal</pre>	<p>(Optional) Sets the clocking for individual E1 links.</p> <p><b>Note</b></p> <ul style="list-style-type: none"> <li>• The default clock source is <b>internal</b>.</li> <li>• When configuring clocking on a serial link, you must configure one end to be <b>internal</b>, and the other end to be <b>line</b>. If you configure <b>internal</b> clocking on both ends of a connection, framing slips occur. If you configure <b>line</b> clocking on both ends of a connection, the line does not come up.</li> </ul>
<b>Step 5</b>	<p><b>framing</b> {<b>crc4</b>   <b>no-crc4</b>   <b>unframed</b>}</p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e1)# framing unframed</pre>	<p>(Optional) Selects the frame type for the E1 data line. The following frame types are valid for E1:</p> <ul style="list-style-type: none"> <li>• <b>crc4</b>—Framing with CRC-4 error monitoring capabilities</li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• <b>no-crc4</b>—Framing without CRC-4 error monitoring capabilities</li> <li>• <b>unframed</b>—Unframed E1</li> </ul> <p><b>Note</b> • The default frame type for E1 is <b>crc4</b>.</p>
<b>Step 6</b>	<p><b>national bits</b> <i>bits</i></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e1)# national bits 10</pre>	<p>(Optional) Specifies the national reserved bits for an E1 port. Range is from 0 to 31.</p> <p><b>Note</b> • The default bit pattern is 0, which corresponds to the hexadecimal value <i>0x1f</i>.</p>
<b>Step 7</b>	<p><b>no shutdown</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e1)# no shutdown</pre>	<p>Removes the shutdown configuration.</p> <ul style="list-style-type: none"> <li>• The removal of the shutdown configuration removes the forced administrative down on the controller, enabling the controller to move to an up or a down state.</li> </ul>
<b>Step 8</b>	<p><b>channel-group</b> <i>channel-group-number</i></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e1)# channel-group 0</pre>	<p>Creates an E1 channel group and enters channel group configuration mode for that channel group.</p>
<b>Step 9</b>	<p><b>timeslots</b> <i>range</i></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e1-channel_group)# timeslots 1-16</pre>	<p>Associates one or more time slots to a channel group and creates an associated serial subinterface on that channel group.</p> <ul style="list-style-type: none"> <li>• Range is from 1 to 31 time slots.</li> <li>• You can assign all 31 time slots to a single channel group, or you can divide the time slots among several channel groups.</li> </ul> <p><b>Note</b> • Each E1 controller supports a total of 31 DS0 time slots.</p>
<b>Step 10</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e1-channel_group)# exit</pre>	<p>Exits channel group configuration mode</p>
<b>Step 11</b>	<p>Repeat Step 8 through Step 11 to assign time slots to a channel group.</p>	—

	Command or Action	Purpose
Step 12	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e1)# exit</pre>	Exits E1 configuration mode
Step 13	Repeat Step 2 through Step 13 to assign more channel groups to a controller as desired.	—
Step 14	<p><b>end</b> or <b>commit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-e3)# end</pre> <p>or</p> <pre>RP/0/RSP0/CPU0:router(config-e3)# commit</pre>	<p>Saves configuration changes.</p> <ul style="list-style-type: none"> <li>When you issue the <b>end</b> command, the system prompts you to commit changes:                     <pre>Uncommitted changes found, commit them before     exiting(yes/no/cancel)?     [cancel]:</pre> <ul style="list-style-type: none"> <li>Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> </ul> </li> <li>Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>

**What to do next**

- Configure BERT on the controller to test its integrity, as described in the “Configuring BERT” section on page 474 in this module.
- Configure the associated serial interface, as described in the *Configuring Serial Interfaces on the Cisco ASR 9000 Series Router* module later in this document.

## Configuring BERT

Depending on your hardware support, BERT is supported on each of the T3/E3 or T1/E1 controllers, and on the DS0 channel groups. It is done only over an unframed T3/E3 or T1/E1 signal and is run on only one port at a time. It is also supported on individual channel groups.

To view the BERT results, use the **show controllers t1** or **show controllers t3** command in EXEC mode. 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

BERT is data intrusive. Regular data cannot flow on a line while the test is in progress. The line is put in an alarm state when BERT is in progress and restored to a normal state after BERT has been terminated.

## Configuring BERT on T3/E3 and T1/E1 Controllers

This task explains how to enable a bit error rate test (BERT) pattern on a T3/E3 or T1/E1 line or an individual channel group.

You must have configured a clear channel T3/E3 controller, or a channelized T3-to-T1/E1 controller.

### Restrictions

Before configuring BERT on the 1-Port Channelized OC-48/STM-16 SPA, consider the following restrictions:

Only two simultaneous BERT tests are possible per STS-12 stream.

These test patterns are supported:

2<sup>15</sup>-1 (O.151)

2<sup>20</sup>-1 (O.151) - QRSS

2<sup>23</sup>-1 (O.151)

Fixed Patterns (all 0s, all 1s etc.)

Single bit error injection

Data inversion

Before configuring BERT on the 4-Port Channelized T3/DS0 SPA, consider the following restrictions:

A maximum of 12 BERT sessions is supported.

6 simultaneous BERT sessions among the first three physical ports and 6 simultaneous BERT sessions on the fourth port are supported.

Only one BERT session per T1 is supported.

These test patterns are supported on the 4-Port Channelized T3/DS0 SPA:

2<sup>11</sup>-1—T1/E1/DS0 only

2<sup>15</sup>-1 (O.151)

2<sup>20</sup>-1 (O.153)—T3 only

2<sup>20</sup>-1 (QRSS)

2<sup>23</sup>-1 (O.151)

Alternating 0s/1s

Fixed Patterns (all 0s, all 1s etc.)

1 in 8 DS1 insertion—T1/E1/DS0 only

3 in 24 DS1 insertion—T1/E1/DS0 only

These test patterns are supported on the 8-Port Channelized T1/E1 SPA for T1/E1/DS0:

2<sup>11</sup>-1

2<sup>15</sup>-1 (O.153)

2<sup>20</sup>-1 (QRSS)

2<sup>23</sup>-1 (O.151)

Alternating 0s/1s

Fixed Patterns (all 0s, all 1s etc.)

For other cards, valid patterns for all controllers and channel groups include: 0s, 1s, 2<sup>15</sup>, 2<sup>20</sup>, 2<sup>20</sup>-QRSS, 2<sup>23</sup>, and alt-0-1.

Additional valid patterns for T1 and E1 controllers include: 1in8, 3in24, 55Daly, and 55Octet. Additional valid patterns for channel groups include: 2<sup>11</sup>, 2<sup>9</sup>, ds0-1, ds0-2, ds0-3, and ds0-4.

**Before you begin**

You must have configured a clear channel T3/E3 controller, or a channelized T3-to-T1/E1 controller.

**SUMMARY STEPS**

1. **configure**
2. **controller** [**t3** | **e3** | t1 | e1] *interface-path-id*
3. **bert pattern** *pattern*
4. **bert interval** *time*
5. **bert error** [*number*]
6. **end** or **commit**
7. **exit**
8. **exit**
9. **bert** [**t3** | **e3** | t1 | e1] *interface-path-id* [**channel-group** *channel-group-number*] [**error**] **start**
10. **bert** [**t3** | **e3** | t1 | e1] *interface-path-id* [**channel-group** *channel-group-number*] **stop**
11. **show controllers** [**t3** | **e3** | t1 | e1] *interface-path-id*

**DETAILED STEPS**

	Command or Action	Purpose
Step 1	<p><b>configure</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# configure</pre>	Enters global configuration mode.

	Command or Action	Purpose
<b>Step 2</b>	<b>controller</b> [ <b>t3</b>   <b>e3</b>   <b>t1</b>   <b>e1</b> ] <i>interface-path-id</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config)# controller t3 0/1/0/0</pre>	Specifies the controller name and instance in the notation <i>rack/slot/module/port</i> , and enters T3, E3, T1, or E1 controller configuration mode.
<b>Step 3</b>	<b>bert pattern</b> <i>pattern</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-t3)# bert pattern 2^15</pre>	Enables a specific bit error rate test (BERT) pattern on a controller.  <b>Note</b> You must use the <b>bert</b> command in EXEC mode to start the BER test.
<b>Step 4</b>	<b>bert interval</b> <i>time</i> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-t3)# bert pattern 2^15</pre>	(Optional) Specifies the duration of a bit error rate test (BERT) pattern on a T3/E3 or T1/E1 line. The interval can be a value from 1 to 14400.
<b>Step 5</b>	<b>bert error</b> [ <i>number</i> ] <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-t3)# bert error 10</pre>	Specifies the number of BERT errors to introduce into the bit stream. Range is from 1 to 255.
<b>Step 6</b>	<b>end</b> or <b>commit</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-t3)# end</pre> or <pre>RP/0/RSP0/CPU0:router(config-t3)# commit</pre>	Saves configuration changes.  <ul style="list-style-type: none"> <li>When you issue the <b>end</b> command, the system prompts you to commit changes:   <pre>Uncommitted changes found, commit them before   exiting (yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> <li>Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> </ul> </li> <li>Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>
<b>Step 7</b>	<b>exit</b> <b>Example:</b>	Exits T3/E3 or T1/E1 controller configuration mode.



	Command or Action	Purpose
	RP/0/RSP0/CPU0:router(config-t3)# exit	
<b>Step 8</b>	<b>exit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# exit	Exits global configuration mode.
<b>Step 9</b>	<b>bert [t3   e3   t1   e1] interface-path-id [channel-group channel-group-number] [error] start</b> <b>Example:</b> RP/0/RSP0/CPU0:router# bert t3 0/3/0/0 start RP/0/RSP0/CPU0:router# bert t3 0/3/0/0 error	Starts the configured BERT test on the specified T3/E3 or T1/E1 controller.  <b>Note</b> <ul style="list-style-type: none"> <li>You can include the optional <b>error</b> keyword to inject errors into the running BERT stream.</li> </ul>
<b>Step 10</b>	<b>bert [t3   e3   t1   e1] interface-path-id [channel-group channel-group-number] stop</b> <b>Example:</b> RP/0/RSP0/CPU0:router# bert t3 0/3/0/0 stop	Stops the configured BERT test on the specified T3/E3 or T1/E1 controller.
<b>Step 11</b>	<b>show controllers [t3   e3   t1   e1] interface-path-id</b> <b>Example:</b> RP/0/RSP0/CPU0:router# show controllers t3 0/3/0/0	Displays the results of the configured BERT.  Configure the serial interfaces that are associate with the controllers you tested, as described in the <i>Configuring Serial Interfaces on the Cisco ASR 9000 Series Router</i> module.

### What to do next

Configure the serial interfaces that are associate with the controllers you tested, as described in the *Configuring Serial Interfaces on the Cisco ASR 9000 Series Router* module.

## Configuring BERT on a DS0 Channel Group

This task explains how to enable a bit error rate test (BERT) pattern on an individual DS0 channel group.

### Before you begin

You must have configured a clear channel T1/E1 controller, or a channelized T3-to-T1/E1 controller.

### SUMMARY STEPS

1. **configure**
2. **controller {t1 | e1} interface-path-id**
3. **channel-group channel-group-number**
4. **bert pattern pattern**
5. **bert interval time**
6. **end** or **commit**
7. **exit**

8. `exit`
9. `exit`
10. `bert [t1 | e1] interface-path-id [channel-group channel-group-number] [error] start`
11. `bert [t1 | e1] interface-path-id [channel-group channel-group-number] stop`
12. `show controllers [t1 | e1] interface-path-id`

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router# configure</pre>	Enters global configuration mode.
Step 2	<b>controller {t1   e1} interface-path-id</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config)# controller t3 0/1/0/0</pre>	Specifies the controller name and instance in the notation <i>rack/slot/module/port</i> , and enters T1 or E1 controller configuration mode.
Step 3	<b>channel-group channel-group-number</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-t1)# channel-group 1 RP/0/RSP0/CPU0:router(config-t1-channel_group)#</pre>	Enters channel group configuration mode for a specific channel group. Replace <i>channel-group-number</i> with the number that identifies the channel group on which you want to configure a BERT.
Step 4	<b>bert pattern pattern</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-t1-channel_group)# bert pattern 2^15</pre>	<p>Enables a specific bit error rate test (BERT) pattern on a T1 line. Valid patterns for all controllers and channel groups include: <b>0s</b>, <b>1s</b>, <b>2^15</b>, <b>2^20</b>, <b>2^20-QRSS</b>, <b>2^23</b>, and <b>alt-0-1</b>. Additional valid patterns for T1 and E1 controllers include: <b>1in8</b>, <b>3in24</b>, <b>55Daly</b>, and <b>55Octet</b>. Additional valid patterns for channel groups include: <b>2^11</b>, <b>2^9</b>, <b>ds0-1</b>, <b>ds0-2</b>, <b>ds0-3</b>, and <b>ds0-4</b>.</p> <p><b>Note</b></p> <ul style="list-style-type: none"> <li>You must use the <b>bert</b> command in EXEC mode to start the BER test.</li> </ul>
Step 5	<b>bert interval time</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-t1-channel_group)# bert interval 5</pre>	(Optional) Specifies the duration, in minutes, of a bit error rate test (BERT) pattern on a T1/E1 line. The interval can be a value from 1 to 14400.
Step 6	<b>end or commit</b> <b>Example:</b> <pre>RP/0/RSP0/CPU0:router(config-t1-channel_group)# end</pre>	<p>Saves configuration changes.</p> <ul style="list-style-type: none"> <li>When you issue the <b>end</b> command, the system prompts you to commit changes:</li> </ul> <pre>Uncommitted changes found, commit them before</pre>

	Command or Action	Purpose
	<p>or</p> <pre>RP/0/RSP0/CPU0:router(config-t1-channel_group)# commit</pre>	<pre>  exiting(yes/no/cancel)?   [cancel]:</pre> <ul style="list-style-type: none"> <li>- Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>- Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>- Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> </ul> <ul style="list-style-type: none"> <li>• Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>
<b>Step 7</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit</pre>	Exits channel group configuration mode.
<b>Step 8</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config-t1)# exit</pre>	Exits T1 or E1 configuration mode.
<b>Step 9</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router(config)# exit</pre>	Exits global configuration mode.
<b>Step 10</b>	<p><b>bert [t1   e1] interface-path-id [channel-group channel-group-number] [error] start</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# bert t1 0/3/0/0/0 start RP/0/RSP0/CPU0:router# bert t1 0/3/0/0/0 error</pre>	<p>Starts the configured BERT test on the specified channel group.</p> <p><b>Note</b></p> <ul style="list-style-type: none"> <li>• You can include the optional <b>error</b> keyword to inject errors into the running BERT stream.</li> </ul>
<b>Step 11</b>	<p><b>bert [t1   e1] interface-path-id [channel-group channel-group-number] stop</b></p> <p><b>Example:</b></p> <pre>RP/0/RSP0/CPU0:router# bert t1 0/3/0/0/0 stop</pre>	Stops the configured BERT test on the specified channel group.
<b>Step 12</b>	<p><b>show controllers [t1   e1] interface-path-id</b></p> <p><b>Example:</b></p>	Displays the results of the configured BERT.

	Command or Action	Purpose
	RP/0/RSP0/CPU0:router# show controllers t3 0/3/0/0	

### What to do next

Configure the serial interfaces that are associate with the controllers you tested, as described in the *Configuring Serial Interfaces on the Cisco ASR 9000 Series Router* module later in this document.

## Configuring Link Noise Monitoring on a T1 or E1 Channel

This section describes how to configure Link Noise Monitoring (LNM) on a T1 or E1 channel on the Cisco ASR 9000 Series Router.

### Before you begin

Before you configure LNM on the Cisco ASR 9000 Series Router, be sure that these requirements are met:

- A 2-Port Channelized OC-12c/DS0 SPA is installed.
- The 2-Port Channelized OC-12/DS0 SPA is configured as a channelized T3 controller running in T1 or E1 mode, as described in the [Configuring a Channelized T3 Controller](#).
- The T1 or E1 controller is configured as a single channel supporting the full 24 or 31 DS0 time slots, as described in the [Configuring a T1 Controller](#) or [Configuring an E1 Controller](#). LNM is not supported on a fractional T1 or E1 link.

### Restrictions

Before you configure LNM on the Cisco ASR 9000 Series Router, consider these restrictions:

- The **lnm major-warning** and **lnm remove** commands are mutually exclusive. You can only configure one of these LNM functions on a controller.
- The **lnm minor-warning** command can be configured with the **lnm major-warning** or **lnm remove** commands on a controller.
- When the **lnm remove** command is configured, links in an MLPPP bundle are removed only up to the threshold set by the **ppp multilink minimum-active links** command.

### SUMMARY STEPS

1. **configure**
2. **controller {t1 | e1} interface-path-id**
3. **lnm {major-warning | remove} [clear | set] [[line-code-violation lcv-value [path-code-violation pcv-value]] [duration seconds]**
4. **lnm minor-warning [clear | set] [[line-code-violation lcv-value [path-code-violation pcv-value]] [duration seconds]**
5. **lnm syslog**
6. **end** or **commit**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure</b> <b>Example:</b> RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
Step 2	<b>controller {t1   e1} interface-path-id</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config)# controller t1 0/1/1/0/1/1	Enters T1 or E1 configuration mode.
Step 3	<b>lnm {major-warning   remove} [clear   set][line-code-violation lcv-value [path-code-violation pcv-value]][duration seconds]</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1)# lnm major-warning	(Optional) Enables link noise monitoring and specifies thresholds for noise errors on T1/E1 links that are used to signal major warning events or link removal and recovery from those events.  The default values for both set and clear thresholds are: <ul style="list-style-type: none"> <li>• For T1 links—<b>line-code-violation</b> is 1544, <b>path-code-violation</b> is 320, and <b>duration</b> is 10.</li> <li>• For E1 links—<b>line-code-violation</b> is 2048, <b>path-code-violation</b> is 831, and <b>duration</b> is 10.</li> </ul>
Step 4	<b>lnm minor-warning [clear   set][line-code-violation lcv-value [path-code-violation pcv-value]][duration seconds]</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1)# lnm minor-warning	(Optional) Enables link noise monitoring and specifies thresholds for noise errors on T1/E1 links that are used to signal minor warning events and recovery from those events.  The default values for both set and clear thresholds are: <ul style="list-style-type: none"> <li>• For T1 links—<b>line-code-violation</b> is 154, <b>path-code-violation</b> is 145, and <b>duration</b> is 10.</li> <li>• For E1 links—<b>line-code-violation</b> is 205, <b>path-code-violation</b> is 205, and <b>duration</b> is 10.</li> </ul>
Step 5	<b>lnm syslog</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-t1)# lnm syslog	(Optional) Enables logging of link noise monitoring major and minor events and alarms.  <b>Note</b> You must use this command for LNM messages to appear in both the system log and in the log events buffer.
Step 6	<b>end</b> or <b>commit</b> <b>Example:</b> RP/0/RSP0/CPU0:router(config-sonet)# end or	Saves configuration changes. <ul style="list-style-type: none"> <li>• When you issue the <b>end</b> command, the system prompts you to commit changes:</li> </ul> <pre>Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:</pre>

	Command or Action	Purpose
	RP/0/RSP0/CPU0:router(config-sonet)# commit	<ul style="list-style-type: none"> <li>- Entering <b>yes</b> saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.</li> <li>- Entering <b>no</b> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</li> <li>- Entering <b>cancel</b> leaves the router in the current configuration session without exiting or committing the configuration changes.</li> <li>• Use the <b>commit</b> command to save the configuration changes to the running configuration file and remain within the configuration session.</li> </ul>

## Verifying Link Noise Monitoring Configuration and Status

To verify LNM configuration and state information, as well as statistics and events, use the **show controllers lnm** command as shown in the following example:



**Note** When the **lnm remove** command is configured, the word “Remove” appears in the show controllers output headers and events in place of “major-warning” and “Major-Warn.”

```
RP/0/RSP0/CPU0:Router# show controllers t1 0/1/1/0/1/1 lnm all
Thu May 13 10:28:26.474 PDT

Controller T1 0/1/1/0/1/1

Syslog   Monitoring type  State   Thresholds (lcv/pcv/duration)
-----
enabled  minor-warning    stable  Set( 15/ 15/  4) Clear( 15/ 15/  4)
          major-warning  stable  Set( 154/ 145/  4) Clear( 154/ 145/  4)

Monitoring type           Minor-Warn   Major-Warn
-----
Create                     1             1
Update                     0             0
Delete                     0             0
Clear                      0             0
Noise Crossed              1             1
Noise Cleared              1             1

Last Five Events
-----
MINWARNCROSS: Noise crossed minor-warn threshold at Thu May 13 09:54:10 2010
MAJWARNCROSS: Noise crossed major-warn threshold at Thu May 13 09:54:11 2010
MAJWARNCLEAR: Noise cleared major-warn threshold at Thu May 13 10:27:25 2010
MINWARNCLEAR: Noise cleared minor-warn threshold at Thu May 13 10:28:14 2010
```

## Clearing Link Noise Monitoring States and Statistics

You can use the **clear controller lnm** command to reset LNM states or clear statistics and reset them to zero.

There should not normally be any need to clear the LNM controller states. The **state** option resets the LNM configuration which causes an update of the current LNM states in the system. Therefore, under normal conditions, if the controller is in alarm state, the reset should continue to report the alarm state; alternatively, if the controller is clear of any alarms, the reset will show the stable state. The use of the **clear controller lnm state** command does not actually clear any alarms, but causes a refresh of their values in the system. Therefore, this command can be used if the reported controller state should happen to be out of synchronization with the actual controller state.

To reset LNM states, use the **clear controller lnm** command as shown in the following example:

```
RP/0/RSP0/CPU0:Router# clear controller t1 0/1/0/0/1/1 lnm state
```

To clear LNM statistics and reset counters to zero, use the **clear controller lnm** command as shown in the following example:

```
RP/0/RSP0/CPU0:Router# clear controller t1 0/1/0/0/1/1 lnm statistics
```

```
RP/0/RSP0/CPU0:Router# show controller T1 0/1/0/1/1/1 lnm statistics
Thu May 13 11:26:20.991 PDT
```

```
Controller T1 0/1/0/1/1/1
```

Monitoring type	Minor-Warn	Major-Warn
-----	-----	-----
Create	0	0
Update	0	0
Delete	0	0
Clear	0	0
Noise Crossed	0	0
Noise Cleared	0	0

## Configuration Examples

This section contains the following examples:

### Configuring a Clear Channel T3 Controller: Example

The following example shows configuration for a clear channel T3 controller:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)#controller T3 0/3/2/0
RP/0/RSP0/CPU0:router(config-t3)#clock source internal
RP/0/RSP0/CPU0:router(config-t3)#mode serial
RP/0/RSP0/CPU0:router(config-t3)#cablelength 4
RP/0/RSP0/CPU0:router(config-t3)#framing c-bit
RP/0/RSP0/CPU0:router(config-t3)#commit
```

### Configuring a T3 Controller with Channelized T1 Controllers: Example

The following example shows how to configure a T3 controller that has been channelized 28 T1 controllers:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# controller T3 0/3/0/0
```

## Configuring a T3 Controller with Channelized T1 Controllers: Example

```

RP/0/RSP0/CPU0:router(config-t3)# mode t1
RP/0/RSP0/CPU0:router(config-t3)# framing m23
RP/0/RSP0/CPU0:router(config-t3)# cablelength 11
RP/0/RSP0/CPU0:router(config-t3)# clock source line
RP/0/RSP0/CPU0:router(config-t3)#commit
RP/0/RSP0/CPU0:router(config-t3)#exit
RP/0/RSP0/CPU0:router(config)# exit
RP/0/RSP0/CPU0:router# show controllers T1 ?

0/3/0/0/0   T1 Interface Instance
0/3/0/0/1   T1 Interface Instance
0/3/0/0/10  T1 Interface Instance
0/3/0/0/11  T1 Interface Instance
0/3/0/0/12  T1 Interface Instance
0/3/0/0/13  T1 Interface Instance
0/3/0/0/14  T1 Interface Instance
0/3/0/0/15  T1 Interface Instance
0/3/0/0/16  T1 Interface Instance
0/3/0/0/17  T1 Interface Instance
0/3/0/0/18  T1 Interface Instance
0/3/0/0/19  T1 Interface Instance
0/3/0/0/2   T1 Interface Instance
0/3/0/0/20  T1 Interface Instance
0/3/0/0/21  T1 Interface Instance
0/3/0/0/22  T1 Interface Instance
0/3/0/0/23  T1 Interface Instance
0/3/0/0/24  T1 Interface Instance
0/3/0/0/25  T1 Interface Instance
0/3/0/0/26  T1 Interface Instance
0/3/0/0/27  T1 Interface Instance
0/3/0/0/3   T1 Interface Instance
0/3/0/0/4   T1 Interface Instance
0/3/0/0/5   T1 Interface Instance
--More--
!
RP/0/RSP0/CPU0:router#
RP/0/RSP0/CPU0:router(config)#configure
RP/0/RSP0/CPU0:router(config)# controller t1 0/3/0/0/0
RP/0/RSP0/CPU0:router(config-t1)# channel-group 0
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 1-24
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# exit
RP/0/RSP0/CPU0:router(config)# controller t1 0/3/0/0/1
RP/0/RSP0/CPU0:router(config-t1)# channel-group 0
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 1-24
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# exit
RP/0/RSP0/CPU0:router(config)# controller t1 0/3/0/0/2
RP/0/RSP0/CPU0:router(config-t1)# channel-group 0
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 1-12
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# channel-group 1
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 13-24
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# exit
RP/0/RSP0/CPU0:router(config)# controller t1 0/3/0/0/3
RP/0/RSP0/CPU0:router(config-t1)# channel-group 0
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 1-6
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# channel-group 1
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 7-12
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# channel-group 2

```



```

RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 13-18
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# channel-group 3
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 19-24
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1-channel_group)#commit

```

## Configuring BERT on a T3 Controller: Example

The following example shows how to configure a BERT on a T3 controller, and then display the results of the BERT:

```

RP/0/RSP0/CPU0:router# config
RP/0/RSP0/CPU0:router(config)# controller t3 0/3/0/1
RP/0/RSP0/CPU0:router(config-t3)# bert pattern 0s

Run bert from exec mode for the bert config to take effect

RP/0/RSP0/CPU0:router(config-t3)#exit
RP/0/RSP0/CPU0:router(config)# exit

Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]
RP/0/RSP0/CPU0:router# bert t3 0/3/0/1 start

```

```

RP/0/RSP0/CPU0:router# bert t3 0/3/0/1 stop

```

```

RP/0/RSP0/CPU0:router# show controllers t3 0/3/0/1

T30/3/0/1 is up
No alarms detected.
MDL transmission is disabled
  EIC: , LIC: , FIC: , UNIT:
  Path FI:
  Idle Signal PORT_NO:
  Test Signal GEN_NO:
FEAC code received: No code is being received
Framing is C-BIT Parity, Line Code is B3ZS, Clock Source is Internal
Data in current interval (108 seconds elapsed):
  0 Line Code Violations, 0 P-bit Coding Violation
  0 C-bit Coding Violation, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
Data in Interval 1:
  0 Line Code Violations, 0 P-bit Coding Violation
  0 C-bit Coding Violation, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
Data in Interval 2:
  0 Line Code Violations, 0 P-bit Coding Violation
  0 C-bit Coding Violation, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
Data in Interval 3:
  0 Line Code Violations, 0 P-bit Coding Violation
  0 C-bit Coding Violation, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs

```

```
0 Unavailable Secs, 0 Line Errored Secs
0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
```

## Configuring Link Noise Monitoring on a T1 Controller: Examples

The following example shows how to configure a channelized T3 controller for T1 configuration mode using the full 24 DS0 timeslots as a single channel before configuring LNM on the link. In this example, the values shown are actually the system defaults for the set thresholds:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# controller T3 0/1/1/0/1
RP/0/RSP0/CPU0:router(config-t3)# mode t1
RP/0/RSP0/CPU0:router(config-t3)# framing m23
RP/0/RSP0/CPU0:router(config-t3)# cablelength 11
RP/0/RSP0/CPU0:router(config-t3)# clock source line
RP/0/RSP0/CPU0:router(config-t3)#commit
RP/0/RSP0/CPU0:router(config-t3)#exit
RP/0/RSP0/CPU0:router(config)# controller t1 0/1/1/0/1/1
RP/0/RSP0/CPU0:router(config-t1)# channel-group 0
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 1-24
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# lnm syslog
RP/0/RSP0/CPU0:router(config-t1)# lnm major-warning set line-code-violation 1544
path-code-violation 320 duration 10
RP/0/RSP0/CPU0:router(config-t1)# lnm minor-warning set line-code-violation 154
path-code-violation 145 duration 10
```

The following example shows how to configure a channelized T3 controller for T1 configuration mode using the full 24 DS0 timeslots as a single channel before configuring LNM on the link. In this example, the values shown are actually the system defaults for the set thresholds, and LNM is configured to signal the Noise Attribute to PPP for MLPPP link removal when those thresholds are crossed:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# controller T3 0/1/1/0/1
RP/0/RSP0/CPU0:router(config-t3)# mode t1
RP/0/RSP0/CPU0:router(config-t3)# framing m23
RP/0/RSP0/CPU0:router(config-t3)# cablelength 11
RP/0/RSP0/CPU0:router(config-t3)# clock source line
RP/0/RSP0/CPU0:router(config-t3)#commit
RP/0/RSP0/CPU0:router(config-t3)#exit
RP/0/RSP0/CPU0:router(config)# controller t1 0/1/1/0/1/1
RP/0/RSP0/CPU0:router(config-t1)# channel-group 0
RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 1-24
RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit
RP/0/RSP0/CPU0:router(config-t1)# lnm syslog
RP/0/RSP0/CPU0:router(config-t1)# lnm remove set line-code-violation 1544 path-code-violation
320 duration 10
RP/0/RSP0/CPU0:router(config-t1)# lnm minor-warning set line-code-violation 154
path-code-violation 145 duration 10
```

## QoS on T3 Channels: Example

QoS on the T3 channels is supported for both PPP and HDLC encapsulation. The following example shows a typical QoS configuration for T3 interfaces:

```
class-map VOIP
```

```
match dscp EF
end-class-map
class-map OAM
match dscp AF43
end-class-map
!
Policy-map T3-no-priority
class OAM
bandwidth percent 30
!
class class-default
!
end-policy-map
!
Policy-map T3-priority
class VOIP
priority level 1
    police rate percent 60
!
class OAM
bandwidth percent 30
!
class class-default
!
end-policy-map
```

