



# Configuring Clear Channel T3 Controllers and Channelized T3 Controllers on the Cisco ASR 9000 Series Router

This module describes the configuration of clear channel T3 controllers and channelized T3 controllers on the Cisco ASR 9000 Series Aggregation Services Routers.

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

## Feature History for Configuring T3 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-12/DS0 SPA. |

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## Prerequisites for Configuring T3 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 controllers, be sure that you have one of the following supported SPAs installed in the router:

- 2-Port Channelized OC-12/DS0 SPA
- Before you can configure a clear channel T3 controller on the 2-Port Channelized OC-12/DS0 SPA, you must configure the SPA for an STS stream channelized for T3. For more information, see the [“Configuring Channelized SONET on the Cisco ASR 9000 Series Router”](#) module.

## Information About T3 Controllers and Serial Interfaces

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.


**Note**

In this release, only T3-to-T1 channelization is supported.

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

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


**Note**

The 2-Port Channelized OC-12/DS0 SPA only supports configuration of the full 24 DS0 time slots. These time slots can not be subdivided.

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 T1 controller supports up to 1.536 MB.


**Note**

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

## Features Supported for Channelized T3 on the Cisco ASR 9000 Series Router

Channelized T3 SONET on the Cisco ASR 9000 Series Router supports the following features:

- DSU modes—Adtran, Digital-link, Cisco, Kentrox, Larscom, Verilink
- PPP encapsulation
- HDLC encapsulation
- T3 channels on MR-APS SONET ports
- 48 T3 channels per SIP
- 24 T3 channels per SPA
- 12 T3 channels per interface
- Sending and receiving at full wire rate on all 48 T3 channels
- 64 byte packets and larger
- Equal Cost Multipath (ECMP)
  - 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
- Support of intermixed T3 and T1 channels on the same SIP, SPA, or port
- IC-SSO for PPP on T3 channels
- IC-SSO for T1 when T3 channels are configured on the same system, SIP, SPA or port
- Bit Error Rate Tests (BERT) on T3 channels
- QoS on T3 channels
- Loopback
  - Local loopback for T3 channels
  - Local line loopback for ports
  - Network line loopback for ports
  - Network line loopback for T3 channels
- IP Fast Reroute (IP-FRR) for PPP only
- XML support for all T3 related CLI configuration commands
- Alarms
- AIS
- RAI
- LOF
- Idle

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

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- Step 1** Configure the T3 controller, and set the mode for that controller to T1.
  - Step 2** Configure the T1 controller.
  - Step 3** Create channel groups and assign DS0 time slots to these channel groups as desired.
  - Step 4** Configure the serial interfaces that are associated with the individual channel groups, as described in the *Configuring Serial Interfaces on the Cisco ASR 9000 Series Router* module later in this document.
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## Default Configuration Values for T3 Controllers

Table 5 describes the default configuration parameters that are present on the T3 controllers.

**Table 5 T3 Controller Default Configuration Values**

| Parameter                        | Default Value         | Configuration File Entry              |
|----------------------------------|-----------------------|---------------------------------------|
| Frame type for the data line     | For T3: C-bit framing | <b>framing {c-bit   m23}</b>          |
| Clocking for individual T3 links | <b>internal</b>       | <b>clock source {internal   line}</b> |

**Table 5** T3 Controller Default Configuration Values

| Parameter   | Default Value  | Configuration File Entry  |
|---|----------------|---|
| Cable length                                      | 224 feet       | <b>cablelength</b> <i>feet</i>  |
| Maintenance data link (MDL) messages<br>(T3 only) | <b>disable</b> | <b>mdl transmit</b> {idle-signal   path   test-signal} { <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 Controllers

Table 6 describes the default configuration parameters that are present on the T1 controllers.

**Table 6** 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 T1: <b>framing</b> { <b>sf</b>   <b>esf</b> }   |
| Detection and generation of T1 yellow alarms.<br>(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 links   | <b>internal</b>  | <b>clock source</b> { <b>internal</b>   <b>line</b> }   |
| Cable length<br>(T1 only)  | For <b>cablelength long</b> command: <i>db-gain-value</i> : gain26; <i>db-loss-value</i> : 0db.<br><br>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><br><br>To set a cable length of 655 feet or shorter: <b>cablelength short</b> <i>length</i> |
| Transmission of ANSI T1.403 or AT&T TR54016 once-per-second performance reports through Facility Data Link (FDL) for a T1 channel<br>(T1 only) | <b>disable</b>   | <b>fdl</b> { <b>ansi</b>   <b>att</b> } { <b>enable</b>   <b>disable</b> }  |

# How to Configure Clear Channel T3 Controllers and Channelized T1 Controllers

The T3 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 T3 Controller, page 203](#)
- [Configuring a Channelized T3 Controller, page 205](#)
- [Modifying the Default T3 Controller Configuration, page 207](#)
- [Configuring a T1 Controller, page 209](#)
- [Configuring BERT, page 213](#)

## Configuring a Clear Channel T3 Controller

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.

### Prerequisites

Before you can configure a clear channel T3 controller on the 2-Port Channelized OC-12/DS0 SPA, you must configure the SPA for an STS stream channelized for T3. For more information, see the [“Configuring Channelized SONET on the 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.

### 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   |
|--------|---|---|
| Step 1 | <b>configure</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# configure   | Enters global configuration mode.   |
| Step 2 | <b>controller t3 interface-path-id</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config)# controller t3<br>0/1/0/0                            | Specifies the T3 controller name in the <i>rack/slot/module/port</i> notation and enters T3 configuration mode.   |
| Step 3 | <b>mode serial</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# mode serial  | <b>Note</b> Configures the mode of the port to be clear channel serial.   |
| Step 4 | <b>no shutdown</b><br><br><b>Example:</b><br>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>   |
| Step 5 | <b>end</b><br>OR<br><b>commit</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# end<br>OR<br>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: <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 6 | <b>show controllers t3 interface-path-id</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# show controllers t3<br>0/1/0/0                        | (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 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.

## Configuring a Channelized T3 Controller

The 2-Port Channelized OC-12/DS0 SPA supports channelization to T1, and DS0. The steps in this section describe how to channelize a single T3 controller into 28 T1 controllers. Once you have created T1 controllers, you can further channelize those controllers into DS0 time slots, as described in the following section:

- [Configuring a T1 Controller](#)

Each individual T1 controller supports a total of 24 DS0 time slots. The 2-Port Channelized OC-12/DS0 SPA supports configuration of only the full range of 24 DS0 time slots on each T1 controller.



### 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   |
|--------|---|---|
| Step 1 | <b>configure</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# configure   | Enters global configuration mode.   |
| Step 2 | <b>controller T3 interface-path-id</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config)# controller t3<br>0/1/0/0                            | Specifies the T3 controller name in the notation <i>rack/slot/module/port</i> and enters T3 configuration mode.   |
| Step 3 | <b>mode t1</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# mode t1  | Sets the mode of the channelized controllers to be T1, and creates 28 T1 controllers.   |
| Step 4 | <b>no shutdown</b><br><br><b>Example:</b><br>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>   |
| Step 5 | <b>end</b><br>OR<br><b>commit</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# end<br>OR<br>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: <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 6 | <b>show controllers t3 interface-path-id</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# show controllers t3<br>0/1/0/0                        | (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 207](#).
- 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 209](#).

## 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 Controllers” section on page 201](#).

### Prerequisites

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** {**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  |
|--------|--|--|
| Step 1 | <b>configure</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# configure  | Enters global configuration mode.  |
| Step 2 | <b>controller T3 interface-path-id</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config)# controller t3<br>0/1/0/0   | Specifies the T3 controller name in the notation <i>rack/slot/module/port</i> and enters T3 configuration mode.  |
| Step 3 | <b>clock source {internal   line}</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# clock source<br>internal   | (Optional) Sets the clocking for the T3 port.<br><br><b>Note</b> The default clock source is <b>internal</b> .<br><br><b>Note</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. |
| Step 4 | <b>cablelength feet</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# cablelength<br>250   | (Optional) Specifies the distance of the cable from the router to the network equipment.<br><br><b>Note</b> The default cable length is 224 feet.  |
| Step 5 | <b>framing {c-bit   m23}</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# framing c-bit   | (Optional) Selects the frame type for the T3 port.<br><br><b>Note</b> The default frame type for T3 is C-bit.  |
| Step 6 | <b>mdl transmit {idle-signal   path   test-signal} {disable   enable}</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# mdl transmit<br>path enable                    | (Optional) Enables Maintenance Data Link (MDL) messages on the T3 port.<br><br><b>Note</b> MDL messages are supported only when the T3 framing is C-bit parity.<br><br><b>Note</b> MDL message are disabled by default.  |
| Step 7 | <b>mdl string {eic   fi   fic   gen-number   lic   port-number   unit} string</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# mdl fi<br>facility identification code | (Optional) Specifies the values of the strings sent in the MDL messages.   |
| Step 8 | <b>no shutdown</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# no shutdown   | Removes the shutdown configuration.<br><br><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   |
|-----------------------|---|---|
| <p><b>Step 9</b></p>  | <pre>end or commit</pre> <p><b>Example:</b><br/> RP/0/RSP0/CPU0:router(config-t3)# end<br/> or<br/> RP/0/RSP0/CPU0:router(config-t3)# commit </p> | <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:<br/> <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> |
| <p><b>Step 10</b></p> | <pre>show controllers t3 interface-path-id</pre> <p><b>Example:</b><br/> RP/0/RSP0/CPU0:router# show controllers t3<br/> 0/1/0/0 </p>             | <p>(Optional) Displays information about the T3 controllers.</p>  |

## What to Do Next

- If you configured a clear channel T3 controller, perform the following tasks:
  - Configure a bit error rate test (BERT) on the controller to test its integrity, as described in the [“Configuring BERT”](#) section on page 213 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 209.

## Configuring a T1 Controller

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

### Prerequisites

- You must configure the 2-Port Channelized OC-12/DS0 SPA for an STS stream channelized for T3. For more information, see the [“Configuring Channelized SONET on the Cisco ASR 9000 Series Router”](#) module.

- You also must configure the 2-Port Channelized OC-12/DS0 SPA as a channelized T3 controller running in T1 mode, as described in the [“Configuring a Channelized T3 Controller” section on page 205](#).

## Restrictions

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

## SUMMARY STEPS

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

## DETAILED STEPS

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

|         |   |  |
|---------|---|--|
| Step 3  | <p><b>controller t1</b> <i>interface-path-id</i></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config)# controller t1 0/3/0/0/0</p>  | <p>Enters T1 configuration mode.</p>   |
| Step 4  | <p><b>framing</b> {<b>sf</b>   <b>esf</b>}</p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t1)# framing esf</p>   | <p>(Optional) Selects the frame type for the T1 data line:</p> <ul style="list-style-type: none"> <li>• <b>sf</b>—Superframe</li> <li>• <b>esf</b>—Extended super frame</li> </ul> <p><b>Note</b> The default frame type for T1 is Extended superframe (<b>esf</b>).</p>   |
| Step 5  | <p><b>yellow</b> {<b>detection</b>   <b>generation</b>} {<b>disable</b>   <b>enable</b>}</p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t1el)# yellow detection enable</p> | <p>(Optional) Enables or disables the detection and generation of T1 yellow alarms.</p> <p><b>Note</b> Yellow alarms are detected and generated on the T1 channel by default.</p>  |
| Step 6  | <p><b>clock source</b> {<b>internal</b>   <b>line</b>}</p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t1el)# clock source internal</p>                                     | <p>(Optional) Sets the clocking for individual T1 links.</p> <p><b>Note</b> The default clock source is <b>internal</b>.</p> <p><b>Note</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.</p> |
| Step 7  | <p><b>fdl</b> {<b>ansi</b>   <b>att</b>} {<b>enable</b>   <b>disable</b>}</p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t1el)# fdl ansi enable</p>                        | <p>(Optional) Enables the transmission of ANSI T1.403 or AT&amp;T TR54016 once-per-second performance reports through Facility Data Link (FDL).</p> <p><b>Note</b> FDL ansi and att are disabled by default.</p>   |
| Step 8  | <p><b>no shutdown</b></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t1el)# no shutdown</p>  | <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>   |
| Step 9  | <p><b>channel-group</b> <i>channel-group-number</i></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t1)# channel-group 0</p>  | <p>Creates a T1 channel group and enters channel group configuration mode for that channel group.</p>  |
| Step 10 | <p><b>timeslots</b> <i>range</i></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t1-channel_group)# timeslots 1-24</p>  | <p>Associates DS0 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 24 time slots. The full range must be configured on the 2-Port Channelized OC-12/DS0 SPA.</li> <li>• You can assign all 24 time slots to a single channel group.</li> </ul> <p><b>Note</b> Each individual T1 controller supports a total of 24 DS0 time slots.</p>                       |

|         |  |   |
|---------|--|---|
| Step 11 | <p><code>speed kbps</code></p> <p><b>Example:</b><br/> RP/0/RSP0/CPU0:router(config-t1e1-channel_group)<br/> )# speed 64</p>   | <p>(Optional) Specifies the speed of the DS0s in kilobits per second. Valid values are 56 and 64.</p> <p><b>Note</b> The default speed is 64 kbps.</p>  |
| Step 12 | <p><code>exit</code></p> <p><b>Example:</b><br/> RP/0/RSP0/CPU0:router(config-t1-channel_group)#<br/> exit</p>   | <p>Exits channel group configuration mode.</p>  |
| Step 13 | <p>Repeat Step 9 through Step 12 to assign time slots to a channel group. Each controller can contain up to 24 time slots.</p>   | <p>—</p>  |
| Step 14 | <p><code>exit</code></p> <p><b>Example:</b><br/> RP/0/RSP0/CPU0:router(config-t1)# exit</p>  | <p>Exits T1 configuration mode and enters global configuration mode.</p>  |
| Step 15 | <p>Repeat Step 2 through Step 14 to assign more channel groups to a controller as desired.</p>   | <p>—</p>  |
| Step 16 | <p><code>end</code><br/> or<br/> <code>commit</code></p> <p><b>Example:</b><br/> RP/0/RSP0/CPU0:router(config-t3)# end<br/> or<br/> RP/0/RSP0/CPU0:router(config-t3)# commit</p> | <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 a bit error rate test (BERT) on the controller to test its integrity, as described in the [“Configuring BERT” section on page 213](#).
- Configure the associated serial interface, as described in the [Configuring Serial Interfaces on the Cisco ASR 9000 Series Router](#) module.

## Configuring BERT

Bit error rate testing (BERT) is supported on each of the T3 or T1 controllers, and on the DS0 channel groups. It is done only over an unframed T3 or T1 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 and T1 Controllers

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

### Prerequisites

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

### SUMMARY STEPS

1. **configure**
2. **controller** [t3 | t1] *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 | t1] *interface-path-id* [**channel-group** *channel-group-number*] [**error**] **start**
10. **bert** [t3 | t1] *interface-path-id* [**channel-group** *channel-group-number*] **stop**
11. **show controllers** [t3 | t1] *interface-path-id*

## DETAILED STEPS

|        | Command or Action  | Purpose  |
|--------|--|--|
| Step 1 | <b>configure</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# configure  | Enters global configuration mode.  |
| Step 2 | <b>controller</b> [ <b>t3</b>   <b>t1</b> ] <i>interface-path-id</i><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config)# controller t3<br>0/1/0/0 | Specifies the controller name and instance in the notation <i>rack/slot/module/port</i> , and enters T3 or T1 controller configuration mode.   |
| Step 3 | <b>bert pattern</b> <i>pattern</i><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# bert pattern<br>2^15                                    | Enables a specific bit error rate test (BERT) pattern on a controller. 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 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> .<br><br><b>Note</b> You must use the <b>bert</b> command in EXEC mode to start the BER test. |
| Step 4 | <b>bert interval</b> <i>time</i><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# bert pattern<br>2^15                                      | (Optional) Specifies the duration of a bit error rate test (BERT) pattern on a T3 or T1 line. The interval can be a value from 1 to 14400.   |
| Step 5 | <b>bert error</b> [ <i>number</i> ]<br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config-t3)# bert error 10  | Specifies the number of BERT errors to introduce into the bit stream. Range is from 1 to 255.  |



|         | Command or Action  | Purpose   |
|---------|--|---|
| Step 6  | <p><b>end</b><br/>or<br/><b>commit</b></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t3)# end<br/>or<br/>RP/0/RSP0/CPU0:router(config-t3)# commit</p>  | <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:<br/>Uncommitted changes found, commit them before exiting (yes/no/cancel)?<br/>[cancel]:</li> <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> |
| Step 7  | <p><b>exit</b></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config-t3)# exit</p>   | Exits T3 or T1 controller configuration mode.   |
| Step 8  | <p><b>exit</b></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router(config)# exit</p>  | Exits global configuration mode.  |
| Step 9  | <p><b>bert [t3   t1] interface-path-id [channel-group channel-group-number] [error] start</b></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router# bert t3 0/3/0/0 start<br/>RP/0/RSP0/CPU0:router# bert t3 0/3/0/0 error</p> | <p>Starts the configured BERT test on the specified T3 or T1 controller.</p> <p><b>Note</b> You can include the optional <b>error</b> keyword to inject errors into the running BERT stream.</p>  |
| Step 10 | <p><b>bert [t3   t1] interface-path-id [channel-group channel-group-number] stop</b></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router# bert t3 0/3/0/0 stop</p>  | Stops the configured BERT test on the specified T3 or T1 controller.  |
| Step 11 | <p><b>show controllers [t3   t1] interface-path-id</b></p> <p><b>Example:</b><br/>RP/0/RSP0/CPU0:router# show controllers t3 0/3/0/0</p>   | Displays the results of the configured BERT.  |

## What to Do Next

Configure the serial interfaces that are associated 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.

## Prerequisites

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

## SUMMARY STEPS

1. **configure**
2. **controller t1** *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** *interface-path-id* [**channel-group** *channel-group-number*][**error**] **start**
11. **bert t1** *interface-path-id* [**channel-group** *channel-group-number*] **stop**
12. **show controllers t1** *interface-path-id*

## DETAILED STEPS

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 1 | <b>configure</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# configure   | Enters global configuration mode.  |
| Step 2 | <b>controller t1</b> <i>interface-path-id</i><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config)# controller t3<br>0/1/0/0 | Specifies the controller name and instance in the notation <i>rack/slot/module/port</i> , and enters T1 controller configuration mode. |

|        | Command or Action  | Purpose  |
|--------|--|--|
| Step 3 | <p><b>channel-group</b> <i>channel-group-number</i></p> <p><b>Example:</b><br/>                     RP/0/RSP0/CPU0:router(config-t1)# channel-group 1<br/>                     RP/0/RSP0/CPU0:router(config-t1-channel_group)#</p>   | 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 | <p><b>bert pattern</b> <i>pattern</i></p> <p><b>Example:</b><br/>                     RP/0/RSP0/CPU0:router(config-t1-channel_group)# bert pattern 2^15</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 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> . <p><b>Note</b> You must use the <b>bert</b> command in EXEC mode to start the BER test.</p>  |
| Step 5 | <p><b>bert interval</b> <i>time</i></p> <p><b>Example:</b><br/>                     RP/0/RSP0/CPU0:router(config-t1-channel_group)# bert interval 5</p>  | (Optional) Specifies the duration, in minutes, of a bit error rate test (BERT) pattern on a T1 line. The interval can be a value from 1 to 14400.  |
| Step 6 | <p><b>end</b><br/>                     OR<br/> <b>commit</b></p> <p><b>Example:</b><br/>                     RP/0/RSP0/CPU0:router(config-t1-channel_group)# end<br/>                     OR<br/>                     RP/0/RSP0/CPU0:router(config-t1-channel_group)# commit</p> | 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:<br/> <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 7 | <p><b>exit</b></p> <p><b>Example:</b><br/>                     RP/0/RSP0/CPU0:router(config-t1-channel_group)# exit</p>  | Exits channel group configuration mode.  |
| Step 8 | <p><b>exit</b></p> <p><b>Example:</b><br/>                     RP/0/RSP0/CPU0:router(config-t1)# exit</p>  | Exits T1 configuration mode.   |

|         | Command or Action  | Purpose   |
|---------|--|---|
| Step 9  | <b>exit</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router(config)# exit  | Exits global configuration mode.  |
| Step 10 | <b>bert t1 interface-path-id [channel-group channel-group-number] [error] start</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# bert t1 0/3/0/0/0 start<br>RP/0/RSP0/CPU0:router# bert t1 0/3/0/0/0 error | Starts the configured BERT test on the specified channel group.<br><br><b>Note</b> You can include the optional <b>error</b> keyword to inject errors into the running BERT stream. |
| Step 11 | <b>bert t1 interface-path-id [channel-group channel-group-number] stop</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# bert t1 0/3/0/0/0 stop   | Stops the configured BERT test on the specified channel group.  |
| Step 12 | <b>show controllers t1 interface-path-id</b><br><br><b>Example:</b><br>RP/0/RSP0/CPU0:router# show controllers t3<br>0/3/0/0   | Displays the results of the configured BERT.  |

## 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.

# Configuration Examples

This section contains the following examples:

- [Configuring a Clear Channel T3 Controller: Example, page 218](#)
- [Configuring a T3 Controller with Channelized T1 Controllers: Example, page 219](#)
- [Configuring BERT on a T3 Controller: Example, page 219](#)

## 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
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-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

```

# Additional References

The following sections provide references related to T3 and T1 controllers.

## Related Documents

| Related Topic  | Document Title  |
|--|---|
| Cisco IOS XR master command reference  | <i>Cisco IOS XR Master Commands List</i>  |
| Cisco IOS XR interface configuration commands  | <i>Cisco IOS XR Interface and Hardware Component Command Reference</i>  |
| Initial system bootup and configuration information for a router using Cisco IOS XR software | <i>Cisco IOS XR Getting Started Guide</i>   |
| Cisco IOS XR AAA services configuration information  | <i>Cisco IOS XR System Security Configuration Guide</i> and <i>Cisco IOS XR System Security Command Reference</i> |

## Standards

| Standards   | Title |
|---|-------|
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | —     |

## MIBs

| MIBs   | MIBs Link  |
|--|--|
| No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature | To locate and download MIBs for selected platforms using Cisco IOS XR software, use the Cisco MIB Locator found at the following URL:<br><a href="http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml">http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml</a> |

## RFCs

| RFCs  | Title |
|---|-------|
| No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature. | —     |

## Technical Assistance

| Description   | Link  |
|---|---|
| The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content. | <a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a> |