



Clear Channel T3/E3 with Integrated CSU/DSU

The Clear Channel T3/E3 NM-1 Network Module with Integrated CSU/DSU feature provides a software configurable T3/E3 product. This flexible network module allows you to switch between T3 and E3 applications with a single Cisco IOS command.

The T3/E3 NM-1 network module supports a single-port T3 or E3 with an integrated channel service unit (CSU) and a data service unit (DSU). It supports High-Level Data Link Control (HDLC), PPP, and Frame Relay. It includes the following features:

- Single port—universal T3/E3 version
- Clear and subrate support on both T3 and E3 modes
- Online insertion and removal (OIR) support on Cisco 3660 series and Cisco 3745 routers
- Onboard processing of Cisco Message Definition Language (MDL) and performance monitoring
- Support for scrambling and subrate can be independently or simultaneously enabled in each DSU mode
- Support for full T3 and E3 line rates

T3/E3 Applications and Positioning

The T3/E3 NM-1 network module provides high-speed performance for advanced, fully converged networks supporting a wide array of applications and services such as security and advanced QoS for voice and video. T3/E3 and subrate T3/E3 connectivity optimizes WAN bandwidth for deploying the new applications and service delivery. All the supported platforms, except the Cisco 2650XM or Cisco 2651XM routers, are capable of supporting line rate performance but impose varying levels of CPU overhead and therefore affect the overall platform performance. See [Table 1](#) for recommended branch office positioning.

Table 1 T3/E3 NM-1 Branch Office Positioning and Support Comparison

Supported Platforms	Recommended Type of Service	Recommended Branch Office Sizes	Maximum T3/E3 Modes Supported
Cisco 2650/2651XM	Subrate T3/E3	Small to medium offices	1 ¹
Cisco 2691	Subrate T3/E3	Small to medium offices	1
Cisco 3660 series	Subrate and full-rate T3/E3	Large and regional offices	1
Cisco 3725	Subrate and full-rate T3/E3	Medium and large offices	1
Cisco 3745	Subrate and full-rate T3/E3	Medium, large, and regional offices	2

- For Cisco 2650XM and Cisco 2651XM platforms only, we recommend that you configure the NM-1 T3/E3 in subrate mode with a DSU setting of 15000 (15 mbps). All other platforms can operate with full DSU bandwidth.

Feature Specifications for the Clear Channel T3/E3 with Integrated CSU/DSU Feature

Feature History

Release	Modification
12.2(11)YT	This feature was introduced.
12.2(15)T	This feature was integrated into Cisco IOS Release 12.2(15)T.

Supported Platforms

Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for Clear Channel T3/E3 with Integrated CSU/DSU

- Implementation of this feature requires Cisco IOS Release 12.2(11)YT or a later release.
- See [Table 2](#) for the minimum platform memory recommended.

Table 2 Minimum Memory Requirements

Supported Platforms	Flash Memory	DRAM Memory
Cisco 2650/2651XM	8 MB	32 MB
Cisco 2691	32 MB	64 MB
Cisco 3660 series	8 MB	64 MB

Table 2 Minimum Memory Requirements

Supported Platforms	Flash Memory	DRAM Memory
Cisco 3725	32 MB	128 MB
Cisco 3745	32 MB	128 MB

Information About Clear Channel T3/E3 with Integrated CSU/DSU

Configuration of the Clear Channel T3/E3 with Integrated CSU/DSU feature can be set up for a T3 interface and for an E3 interface:

- [How to Configure the Clear Channel T3/E3 with Integrated CSU/DSU Feature for a T3 Interface, page 3](#)
- [How to Configure the Clear Channel T3/E3 with Integrated CSU/DSU Feature for an E3 Interface, page 11](#)

How to Configure the Clear Channel T3/E3 with Integrated CSU/DSU Feature for a T3 Interface

This section describes the tasks used to configure the Clear Channel T3/E3 with Integrated CSU/DSU feature for a T3 interface:

- [Configuring the Card Type and Controller for a T3 Interface](#) (required)
- [Configuring DSU Mode and Bandwidth for T3](#) (required)
- [Configuring Scrambling for T3](#) (optional)
- [Configuring the BERT for T3](#) (optional)
- [Configuring Loopback for T3](#) (optional)
- [Configuring the T3 Maintenance Data Link](#) (optional)

Configuring the Card Type and Controller for a T3 Interface

When the Clear Channel T3/E3 network module is used for the first time, the running configuration does not show the T3/E3 controller and its associated serial interface. You can use the **show version** command to learn if the router recognized the T3/E3 card and was able to initialize the card properly. After the card type is configured for the slot, the respective controller and serial interface appear in the running configuration. See the [“Use the show version Command”](#) section on page 19.

After the network module has ascertained that the card has been initialized properly, use the **card type** command to configure the card. If the command is accepted successfully, Cisco IOS software creates a controller and a serial interface for the card.

Perform this task to select and configure a card type and controller as T3.

**Note**

The autoconfig/setup utility does not support configuring the card type for the T3/E3 network module.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **card type t3 slot**
4. **controller t3 slot/port**
5. **framing {c-bit | m23}**
6. **cablelength feet**
7. **clock source {internal | line}**
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	card type t3 slot Example: Router(config)# card type t3 1	Selects the card type. <ul style="list-style-type: none"> • Creates a T3 controller and a serial interface. • t3—Selects the T3 controller. • <i>slot</i>—Slot number of the interface. • By default, the T3 controller does not show up in the show running-config output.
Step 4	controller t3 slot/port Example: Router(config)# controller t3 1	Specifies the T3 controller and enters controller configuration mode. <ul style="list-style-type: none"> • <i>slot/port</i>—Backplane slot number and port number on the controller.
Step 5	framing {c-bit m23} Example: Router(config-controller)# framing c-bit	Specifies the framing type. <ul style="list-style-type: none"> • c-bit—Specifies C-bit framing as the T3 framing type. • m23—Specifies M23 framing as the T3 framing type.
Step 6	cablelength feet Example: Router(config-controller)# cablelength 250	Specifies the distance from the routers to the network equipment. <ul style="list-style-type: none"> • <i>feet</i>—Number of feet in the range from 0 to 450. • The default value is 224 feet.

	Command or Action	Purpose
Step 7	clock source { <i>internal</i> <i>line</i> } Example: Router(config-controller)# clock source line	Selects the clock source. <ul style="list-style-type: none"> • internal—Specifies that the internal clock source is used. This is the default for T3. • line—Specifies that the network clock source is used. This is the default for E3.
Step 8	exit Example: Router(config-controller)# exit	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring DSU Mode and Bandwidth for T3


Perform this task to specify the interoperability mode and maximum allowable bandwidth used by a T3 controller.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/port*
4. **dsu mode** {*0* | *1* | *2* | *3* | *4*}
5. **dsu bandwidth** *kbps*
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface serial <i>slot/port</i> Example: Router(config)# interface serial 1/1	Specifies the serial interface created on the controller.

	Command	Purpose
Step 4	<p><code>dsu mode { 0 1 2 3 4 }</code></p> <p>Example: <code>Router(config-if)# dsu mode 0</code></p>	<p>Specifies the interoperability mode used by a T3 controller.</p> <ul style="list-style-type: none"> • 0—Connects a T3 controller to another T3 controller or to a Digital Link DSU (DL3100). Bandwidth range is from 300 to 44210 kbps. This is the default. • 1—Connects a T3 controller to a Kentrox DSU. Bandwidth range is from 1500 to 35000/44210 kbps. <p> Note If the bandwidth is set to greater than 35000 kbps, it defaults to 44210 kbps.</p> <ul style="list-style-type: none"> • 2—Connects a T3 controller to a Larscom DSU. Bandwidth range is from 3100 to 44210 kbps. • 3—Connects a T3 controller to an Adtran T3SU 300. Bandwidth range is from 75 to 44210 kbps. • 4—Connects a T3 controller to a Verilink HDM 2182. Bandwidth range is from 1500 to 44210 kbps.
Step 5	<p><code>dsu bandwidth kbps</code></p> <p>Example: <code>Router(config-if)# dsu bandwidth 44210</code></p>	<p>Specifies the maximum allowable bandwidth in the range from 1 to 44210 kbps.</p> <ul style="list-style-type: none"> • The real (actual) vendor-supported bandwidth is in the range from 75 to 44210 kbps. See Table 2 on page 33. <p>Note For the Cisco 2650XM and Cisco 2651XM platforms only, we recommend that you set the DSU bandwidth to 15000 in any subrate mode.</p>
Step 6	<p><code>exit</code></p> <p>Example: <code>Router(config-if)# exit</code></p>	<p>Exits interface configuration mode and returns to privileged EXEC mode.</p>

Configuring Scrambling for T3

Perform this task to enable encryption of the payload on the T3 controller.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface serial slot/port`
4. `scramble`
5. `exit`

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface serial slot/port Example: Router(config)# interface serial 1/1	Enters interface configuration mode.
Step 4	scramble Example: Router(config-if)# scramble	Enables the scrambling of the payload. <ul style="list-style-type: none"> Default is off.
Step 5	exit Example: Router(config-if)# exit	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring the BERT for T3

Perform this task to configure a bit error rate (BER) test pattern on a T3 controller.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller t3 slot/port**
4. **bert pattern {2^23 | 2^20 | 2^15 | 1s | 0s | alt-0-1} interval time**
5. **no bert**
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	controller t3 slot/port Example: Router(config)# controller t3 1/1	Selects the T3 controller and enters controller configuration mode. <ul style="list-style-type: none"> <i>slot/port</i>—Backplane slot number and port number on the controller.
Step 4	bert pattern {2^23 2^20 2^15 1s 0s alt-0-1} interval time Example: Router(config-controller)# bert pattern 2^20 interval 10000	Configures a bit error rate test pattern. <ul style="list-style-type: none"> Acceptable values are: <ul style="list-style-type: none"> 2^23—Pseudorandom 0.151 test pattern that is 8,388,607 bits in length. 2^20—Pseudorandom 0.153 test pattern that is 1,048,575 bits in length. 2^15—Pseudorandom 0.151 test pattern that is 32,768 bits in length. 1s—Repeating pattern of ones (...111...). 0s—Repeating pattern of zeros (...000...). alt-0-1—Repeating pattern of alternating zeros and ones (...01010...). interval time—Specifies the duration of the BER test. The interval can be a value from 1 to 14,400 minutes.
Step 5	no bert Example: Router(config-controller)# no bert	Disables the BERT test pattern.
Step 6	exit Example: Router(config-controller)# exit	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring Loopback for T3

Perform this task to loop an entire T3 line toward the line and back toward the router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller t3 slot/port**
4. **loopback {local | network {line | payload} | remote}**
5. **no loopback**
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	controller t3 slot/port Example: Router(config)# controller t3 1/1	Selects the T3 controller and enters controller configuration mode. <ul style="list-style-type: none"> • <i>slot/port</i>—Backplane slot number and port number on the controller.
Step 4	loopback {local network {line payload} remote} Example: Router(config-controller)# loopback local	Loops the T3 line toward the line and back toward the router, <ul style="list-style-type: none"> • local—Loops the data back toward the router and sends an AIS signal out toward the network. On a dual port card, it is possible to run channelized on one port and primary rate on the other port. • network {line payload}—Sets the loopback toward the network before going through the framer (line) or after going through the framer (payload). • remote—Sends a far-end alarm control (FEAC) request to the remote end requesting that it enter into a network line loopback. FEAC requests (and therefore remote loopbacks) are possible only when the T3 is configured for C-bit framing. M23 format does not support remote loopbacks.

	Command	Purpose
Step 5	<code>no loopback</code>	Removes the loop.
	Example: Router(config-controller)# no loopback	
Step 6	<code>exit</code>	Exits controller configuration mode and returns to privileged EXEC mode.
	Example: Router(config-controller)# exit	

Configuring the T3 Maintenance Data Link

Perform this task to configure the MDL message.



Note

This configuration information is applicable only to C-bit parity T3.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `controller t3 slot/port`
4. `mdl {transmit {path | idle-signal | test-signal} | string {eic | lic | fic | unit | pfi | port | generator} string}`
5. `exit`

DETAILED STEPS

	Command	Purpose
Step 1	<code>enable</code>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
	Example: Router> enable	
Step 2	<code>configure terminal</code>	Enters global configuration mode.
	Example: Router# configure terminal	
Step 3	<code>controller t3 slot/port</code>	Selects the T3 controller and enters controller configuration mode. <ul style="list-style-type: none"> • <i>slot/port</i>—Backplane slot number and port number on the controller.
	Example: Router(config)# controller t3 1/1	

	Command	Purpose
Step 4	<pre>mdl {transmit {path idle-signal test-signal} string {eic lic fic unit pfi port generator} string}</pre> <p>Example: Router(config-controller)# mdl transmit path</p>	<p>Configures the MDL message.</p> <ul style="list-style-type: none"> • transmit path—Enables transmission of the MDL Path message. • transmit idle-signal—Enables transmission of the MDL idle signal message. • transmit test-signal—Enables transmission of the MDL test signal message. • string eic string—Specifies the equipment identification code (EIC); can be up to 10 characters. • string lic string—Specifies the location identification code (LIC); can be up to 11 characters. • string fic string—Specifies the frame identification code (FIC); can be up to 10 characters. • string unit string—Specifies the unit identification code (UIC); can be up to 6 characters. • string pfi string—Specifies the facility identification code (PFI) sent in the MDL path message; can be up to 38 characters. • string port string—Specifies the port number string sent in the MDL idle signal message; can be up to 38 characters. • string generator string—Specifies the generator number string sent in the MDL test signal message; can be up to 38 characters.
Step 5	<pre>exit</pre> <p>Example: Router(config-controller)# exit</p>	<p>Exits controller configuration mode and returns to privileged EXEC mode.</p>

How to Configure the Clear Channel T3/E3 with Integrated CSU/DSU Feature for an E3 Interface

The section describes the commands used to configure the Clear Channel T3/E3 with Integrated CSU/DSU feature for an E3 interface:

- [Configuring the Card Type and Controller for an E3 Interface](#) (required)
- [Configuring Scrambling for E3](#) (required)
- [Configuring the BERT for E3](#) (optional)
- [Configuring Loopback for E3](#) (optional)
- [Configuring National Bit for E3](#) (optional)

Configuring the Card Type and Controller for an E3 Interface

Perform this task to configure the card type and controller for a E3 interface.



Note

The autoconfig/setup utility does not support configuring the card type for the T3/E3 network module.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **card type e3 slot**
4. **controller e3 slot/port**
5. **framing {bypass | g751}**
6. **clock source {internal | line}**
7. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	card type e3 slot Example: Router(config)# card type e3 1	Selects the card type. <ul style="list-style-type: none"> • Creates an E3 controller and a serial interface. • e3—Specifies the E3 transmission scheme predominantly used in Europe. • Provides 34010 kbps. • <i>slot</i>—Slot number of the interface. • By default, the E3 controller does not show up in the show running config output.
Step 4	controller e3 slot/port Example: Router(config)# controller e3 1	Specifies the E3 controller and enters controller configuration mode. <ul style="list-style-type: none"> • <i>slot/port</i>—Backplane slot number and port number on the controller.

	Command or Action	Purpose
Step 5	framing { bypass g751 } Example: Router(config-controller)# framing bypass	Specifies the framing type. <ul style="list-style-type: none"> • bypass—Specifies that the G.751 framing be bypassed. • g751—Specifies G.751 as the E3 framing type. • Default is g751.
Step 6	clock source { internal line } Example: Router(config-controller)# clock source line	Selects the clock source. <ul style="list-style-type: none"> • internal—Specifies that the internal clock source is used. This is the default for T3. • line—Specifies that the network clock source is used. This is the default for E3.
Step 7	exit Example: Router(config-controller)# exit	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring DSU Mode and Bandwidth for E3


Perform this task to specify the interoperability mode used by an E3 controller.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/port*
4. **dsu mode** {**0** | **1**}
5. **dsu bandwidth** *kbps*
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

	Command	Purpose
Step 3	<code>interface serial slot/port</code> Example: Router(config)# interface serial 1/1	Enters interface configuration mode and specifies the serial interface created on the controller.
Step 4	<code>dsu mode {0 1}</code> Example: Router(config-if)# dsu mode 0	Specifies the interoperability mode used by an E3 controller. <ul style="list-style-type: none"> 0—Sets the interoperability mode to 0. This is the default. Specify mode 0 to connect an E3 controller to another E3 controller or to a Digital Link DSU (DL3100). Bandwidth range is from 358 to 24500/34010 kbps. <p> Note If the bandwidth is set to greater than 24500 kbps, it defaults to 34010 kbps.</p> <ul style="list-style-type: none"> 1—Sets the interoperability mode to 1. Specify mode 1 to connect an E3 controller to a Kentrox DSU. Bandwidth range is from 500 to 34010 kbps.
Step 5	<code>dsu bandwidth kbps</code> Example: Router(config-if)# dsu bandwidth 44210	Specifies the maximum allowable bandwidth in the range from 22 to 34010 kbps. <ul style="list-style-type: none"> The real (actual) vendor-supported bandwidth is in the range from 358 to 34010 kbps. See Table 2 on page 33. <p>Note For the Cisco 2650XM and Cisco 2651XM platforms only, we recommend that you set the DSU bandwidth to 15000 in any subrate mode.</p>
Step 6	<code>exit</code> Example: Router(config-if)# exit	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring Scrambling for E3

Perform this task to enable encryption of the payload on the E3 controller.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface serial slot/port`
4. `scramble`
5. `exit`

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none">Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface serial slot/port Example: Router(config)# interface serial 1/1	Enters interface configuration mode.
Step 4	scramble Example: Router(config-if)# scramble	Enables the scrambling of the payload. <ul style="list-style-type: none">Default is off.
Step 5	exit Example: Router(config-if)# exit	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring the BERT for E3

Perform this task to configure a BER test pattern on an E3 controller.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller t3 slot/port**
4. **bert pattern {2^23 | 2^20 | 2^15 | 1s | 0s | alt-0-1}**
5. **no bert**
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	controller e3 slot/port Example: Router(config)# controller e3 1/0	Selects the E3 controller and enters controller configuration mode. <ul style="list-style-type: none"> • <i>slot/port</i>—Backplane slot number and port number on the controller.
Step 4	bert pattern {2^23 2^20 2^15 1s 0s alt-0-1} Example: Router(config-controller)# bert pattern 2^20	Configures a bit error rate test pattern. <ul style="list-style-type: none"> • Acceptable values are: <ul style="list-style-type: none"> – 2^23—Pseudorandom 0.151 test pattern that is 8,388,607 bits in length. – 2^20—Pseudorandom 0.153 test pattern that is 1,048,575 bits in length. – 2^15—Pseudorandom 0.151 test pattern that is 32,768 bits in length. – 1s—Repeating pattern of ones (...111...). – 0s—Repeating pattern of zeros (...000...). – alt-0-1—Repeating pattern of alternating zeros and ones (...01010...).
Step 5	no bert Example: Router(config-controller)# no bert	Disables the BERT test pattern.
Step 6	exit Example: Router(config-controller)# exit	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring Loopback for E3

Perform this task to loop an entire E3 line toward the line and back toward the router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller e3 slot/port**
4. **loopback {local | network {line | payload}}**
5. **no loopback**
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	controller e3 slot/port Example: Router(config)# controller e3 1/1	Selects the E3 controller and enters controller configuration mode. <ul style="list-style-type: none"> • <i>slot/port</i>—Backplane slot number and port number on the controller.
Step 4	loopback {local network {line payload}} Example: Router(config-controller)# loopback local	Loops the E3 line toward the line and back toward the router, <ul style="list-style-type: none"> • local—Loops the data back toward the router and sends an AIS signal out toward the network. • network {line payload}—Sets the loopback toward the network before going through the framer (line) or after going through the framer (payload).
Step 5	no loopback Example: Router(config-controller)# no loopback	Removes the loop.
Step 6	exit Example: Router(config-controller)# exit	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring National Bit for E3

Perform this task to set the E3 national bit in the G.751 frame used by the E3 controller. This configuration is used to set the bit when the E3 line crosses national boundaries.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller e3 *slot/port***
4. **national bit {1 | 0}**
5. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	controller e3 <i>slot/port</i> Example: Router(config)# controller e3 1/1	Selects the E3 controller and enters controller configuration mode. <ul style="list-style-type: none"> • <i>slot/port</i>—Backplane slot number and port number on the controller.
Step 4	national bit {1 0} Example: Router(config-controller)# national bit 1	Sets the E3 national bit in the G.751 frame used by the E3 controller. <ul style="list-style-type: none"> • 1 0—Specifies the E3 national bit in the G.751 frame. • The default is 1.
Step 5	exit Example: Router(config-controller)# exit	Exits controller configuration mode and returns to privileged EXEC mode.

Verifying the T3 or E3 Configuration

Perform this task to verify that the T3 or E3 controller is configured correctly. Enter the **show running-config**, **show controllers**, or **show interfaces serial** privileged EXEC command to display the command settings for the router.

Troubleshooting Tips

You can use the methods described in this section to troubleshoot the T3/E3 network module using Cisco IOS software.

Set Loopbacks

The T3/E3 local loopback can be used to ensure that the router and the T3/E3 network module are working properly. The controller clock source should be configured to “internal.”

Use T3/E3 network loopback and remote loopback to diagnose problems with cables between the T3/E3 controller and the central switching office at the link level. For this diagnostic setup to work, if the network module is looped toward the network, the network module must be configured with the clock source as “line.”

Run Bit Error Rate Test

The network module contains onboard BERT circuitry. With this circuitry present, the software can send and detect a programmable pattern that is compliant with CCITT/ITU pseudorandom and repetitive test patterns. BERT allows you to test cables and signal problems in the field.

When a BERT is running, your system expects to receive the same pattern that it is sending. To help ensure this, two common options are available.

- Use a loopback somewhere in the link or network.
- Configure remote testing equipment to send the same BERT pattern at the same time.

Please refer to the [bert pattern \(t3/e3\)](#) command in the “[Command Reference](#)” section for instructions on how to run BERT and check the results.

Use the show version Command

Use the **show version** command to learn if the router recognized the T3/E3 card and was able to initialize the card properly. The **show version** command lists the hardware interfaces and controllers present in the router. You should find “1 Subrate T3/E3 port(s)” as shown in the following example.

```
Router# show version
.
.
.
Router uptime is 2 hours, 6 minutes
System returned to ROM by power-on
System image file is "flash:c3725-i-mz"

cisco 3725 (R7000) processor (revision 0.4) with 111616K/19456K bytes of memory.
Processor board ID 12345678901
R7000 CPU at 240Mhz, Implementation 39, Rev 3.3, 256KB L2 Cache
Bridging software.
X.25 software, Version 3.0.0
Primary Rate ISDN software, Version 1.1
2 FastEthernet/IEEE 802.3 interface(s)
1 Serial network interface(s)
2 Channelized T1/PRI port(s)
1 Subrate T3/E3 port(s)
DRAM configuration is 64 bits wide with parity disabled.
55K bytes of non-volatile configuration memory.
15680K bytes of ATA System CompactFlas (Read/Write)

Configuration register is 0x0
```

Configuration Example for the Clear Channel T3/E3 with Integrated CSU/DSU Feature

The following is sample output from the **show running-config** command for an E3 controller:

```
Router# show running-config

Building configuration...
%AIM slot 0 doesn't exist

Current configuration :1509 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router1
!
card type e3 1
no logging console
!
ip subnet-zero
no ip routing
!
!
!
!
voice call carrier capacity active
!
!
!
!
!
!
mta receive maximum-recipients 0
!
!
controller E3 1/0
  clock source internal
!
!
!
!
interface Loopback0
  no ip address
  no ip route-cache
  shutdown
  no keepalive
!
interface FastEthernet0/0
  ip address 10.0.145.34 255.255.255.0
  no ip route-cache
  no ip mroute-cache
  duplex auto
  speed auto
  no cdp enable
!
```

```
interface Serial0/0
 no ip address
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 shutdown
 clockrate 2000000
 no fair-queue
!
interface FastEthernet0/1
 no ip address
 no ip route-cache
 no ip mroute-cache
 shutdown
 duplex auto
 speed auto
 no keepalive
 no cdp enable
!
interface Serial0/1
 no ip address
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 shutdown
 clockrate 2000000
!
interface Serial0/2:0
 ip address 172.27.27.2 255.255.255.0
 no ip route-cache
 no keepalive
!
interface Serial1/0
 no ip address
 no ip route-cache
 no keepalive
 dsu bandwidth 34010
!
ip classless
no ip http server
!
ip pim bidir-enable
!
!
!
!
!
call rsvp-sync
!
!
mgcp profile default
!
!
!
dial-peer cor custom
!
!
!
!
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
 login
```

```
!
end
```

Additional References

The following sections provide additional references related to the Clear Channel T3/E3 with Integrated CSU/DSU feature:

- [Related Documents, page 22](#)
- [Standards, page 22](#)
- [MIBs, page 22](#)
- [RFCs, page 23](#)

Related Documents

Related Topic	Document Title
Basic information about configurations	<i>Cisco IOS Configuration Fundamentals Configuration Guide</i> , Release 12.2
Detailed information about configuring interfaces	<i>Cisco IOS Interface Configuration Guide</i> , Release 12.2
Detailed information about Cisco IOS commands	<i>Cisco IOS Interface Command Reference</i> , Release 12.2 T
Detailed information about configuring voice, video, and fax applications	<i>Cisco IOS Voice, Video, and Fax Configuration Guide</i> , Release 12.2
Detailed information about Cisco IOS commands	<i>Cisco IOS Voice, Video, and Fax Command Reference</i> , Release 12.2 T
Information on connecting network modules	<i>Connecting T3/E3 Network Modules</i> , Release 12.2

Standards

Standards	Title
None	

MIBs

MIBs	MIBs Link
<ul style="list-style-type: none"> • RFC 1407 MIB • CISCO-ICSUDSU-MIB 	<p>To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL:</p> <p>http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml</p>

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

<http://tools.cisco.com/ITDIT/MIBS/servlet/index>

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

To access Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

<http://www.cisco.com/register>

RFCs

RFCs	Title
RFC 1407	<i>Definitions of Managed Objects for the DS3/E3 Interface Type</i>

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, tools, and lots more. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

Command Reference

This section documents modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.2 T command reference publications.

- [bert pattern \(t3/e3\)](#)
- [cablelength \(t3\)](#)
- [card type \(t3/e3\)](#)
- [clock source \(t3/e3\)](#)
- [controller e3](#)
- [dsu bandwidth \(e3\)](#)
- [dsu bandwidth \(t3\)](#)
- [dsu mode \(e3\)](#)
- [dsu mode \(t3\)](#)
- [framing \(e3\)](#)
- [framing \(t3\)](#)
- [loopback \(e3\)](#)
- [loopback \(t3\)](#)
- [mdl \(t3\)](#)
- [national bit \(e3\)](#)
- [scramble \(t3/e3\)](#)
- [show controllers \(t3/e3\)](#)

bert pattern (t3/e3)

To enable a bit error rate (BER) test pattern on a T3 or E3 controller, use the **bert pattern** command in controller configuration mode. To disable a BER test pattern, use the **no** form of this command.

```
bert pattern {2^23 | 2^20 | 2^15 | 1s | 0s | alt-0-1} interval time
```

```
no bert
```

Syntax Description		
2^23		Invokes pseudorandom 0.151 test pattern that is 8,388,607 bits in length.
2^20		Invokes pseudorandom 0.153 test pattern that is 1,048,575 bits in length.
2^15		Invokes pseudorandom 0.151 test pattern that is 32,768 bits in length.
1s		Invokes repeating pattern of ones (...111...).
0s		Invokes repeating pattern of zeros (...000...).
alt-0-1		Invokes repeating pattern of alternating zeros and ones (...01010...).
interval <i>time</i>		Specifies the duration (in minutes) of the BER test. The interval can be a value from 1 to 14,400 minutes.

Defaults Disabled

Command Modes Controller configuration

Command History	Release	Modification
	11.1 CC	This command was introduced.
	12.0(5)XE	The command was enhanced as an ATM interface configuration command.
	12.0(7)XE1	Support for Cisco 7100 series routers was added.
	12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines BER testing is supported on T3/E3 links and is done only over framed T3 or E3 signal, unless E3 framing is in bypass mode.

To display the BER test results, use the **show controllers (t3/e3) EXEC** command. The BER test results include the following information:

- Type of test pattern selected
- Status of the test
- Interval selected

■ bert pattern (t3/e3)

- Time remaining on the BER test
- Total bit errors
- Total bits received

When the T3 or E3 line has a BER test running, the line state is **DOWN** and the status field shows the current or last result of the test.

The **bert pattern** command is not written to NVRAM. This command is used only to test the T3 or E3 line for a short predefined interval and to avoid accidentally saving the command, which could cause the interface not to come up the next time the router reboots.

Examples

In the following example, a BER test pattern of all zeros is run for 30 minutes on the T3 controller in slot 1:

```
controller t3 1/0
 bert pattern 0s interval 30
```

Related Commands

Command	Description
show controllers (t3/e3)	Displays information about the T3 or E3 controllers.

cablelength (t3)

To specify the distance of the cable from the routers to the network equipment, use the **cablelength** command in controller configuration mode. To restore the default cable length, use the **no** form of this command.

cablelength *feet*

no cablelength

Syntax Description	<i>feet</i>	Number of feet in the range from 0 to 450. The default value is 224 feet.
---------------------------	-------------	---

Defaults	224 feet
-----------------	----------

Command Modes	Controller configuration
----------------------	--------------------------

Command History	Release	Modification
	11.1 CA	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.	
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.	

Usage Guidelines	The default cable length of 224 feet is used by the clear T3.
-------------------------	---

Examples	The following example shows the cable length for the router set to 300 feet:
-----------------	--

```
controller t3 1/0
cablelength 300
```

card type (t3/e3)

To configure the card type on the T3 or E3 controller, use the **card type** command in global configuration mode. To restore the default value, use the **no** form of this command.

card type {t3 | e3} *slot*

no card type {t3 | e3} *slot*

Syntax Description

t3	Specifies T3 connectivity of 44210 kbps through the network, using B8ZS coding.
e3	Specifies a wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 34010 kbps.
<i>slot</i>	Slot number of the interface.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines

Once a card type is issued, the user can enter the **no card type** command and then another **card type** command to configure a new card type. The user must save the configuration to the NVRAM and reboot the router in order for the new configuration to take effect.

When the router comes up, the software comes up with the new card type. Note that the software will reject the configuration associated with the old controller and old interface. The user will now have to configure the new controller and serial interface and save it.

Examples

The following example shows T3 data transmission configured in slot 1:

```
card type t3 1
```

clock source (t3/e3)

To specify where the clock source is obtained for use by a T3 or E3 controller, use the **clock source** command in controller configuration mode. To restore the default clock source, use the **no** form of this command.

clock source {internal | line}

no clock source

Syntax Description

internal	Specifies that the internal clock source is used. This is the default for T3.
line	Specifies that the network clock source is used. This is the default for E3.

Defaults

The internal clock source is used for T3 controllers. The line clock source is used for E3 controllers.

Command Modes

Controller configuration

Command History

Release	Modification
11.3	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines

If you do not specify the **clock source** command, the default clock source is used.

Configure clock source line if your telephone company or the remote data service unit provides the master clock of the T3 or E3 connection.

Configure clock source internal if your router provides the master clock of the T3 or E3 connection.



Note

For a back-to-back connection between two T3 or E3 network modules, one controller must be configured for clock source internal while the other must be configured for clock source line.

Examples

The following example shows the clock source set to line:

```
controller t3 1/0
clock source line
```

controller e3

To select the E3 controller, use the **controller e3** command in global configuration mode.

controller e3 *slot/port*

Syntax Description	<i>slot/port</i>	Number of the slot and port being configured. Refer to the appropriate hardware manual for slot and port information. The slash mark is required.
---------------------------	------------------	---

Defaults	No default values or behaviors
-----------------	--------------------------------

Command Modes	Global configuration
----------------------	----------------------

Command History	Release	Modification
	11.1	This command was introduced.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Examples	The following example shows the E3 controller configured in slot 0, port 0:
-----------------	---

```
controller e3 0/0
```

Related Commands	Command	Description
	controller t3	Selects a T3 controller.
	show controllers (t3/e3)	Displays information about the T3 or E3 controllers.

dsu bandwidth (e3)

To specify the maximum allowable bandwidth used by an E3 controller, use the **dsu bandwidth** command in interface configuration mode. To return to the default bandwidth, use the **no** form of this command.

dsu bandwidth *kbps*

no dsu bandwidth *kbps*

Syntax Description	<i>kbps</i>	The maximum allowable bandwidth in the range from 22 to 34010 kbps.
--------------------	-------------	---

Defaults	The default value is 34010 kbps.
----------	----------------------------------

Command Modes	Interface configuration
---------------	-------------------------

Command History	Release	Modification
	11.1 CA	This command was introduced.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines	The local interface configuration must match the remote interface configuration. For example, if you reduce the maximum bandwidth to 16000 kbps on the local port, you must also do the same on the remote port.
------------------	--

The **dsu bandwidth** command reduces the bandwidth by padding the E3 frame.

To verify the data service unit (DSU) bandwidth configured on the interface, use the **show interface serial EXEC** command.

When G.751 framing is used, DSU bandwidth can be used to select a payload subrate from 34010 kbps down to 22 kbps.

Before framing bypass can be used, DSU bandwidth of 34010 kbps must be configured.

Even though software allows the user to configure a continuous range of bandwidths in subrate modes, vendors support bandwidths only in quantums (for example, in an E3 digital link, bandwidth must be in multiples of 358 kbps). Therefore, the software sets the user-configured bandwidth to the closest vendor-supported bandwidth. Use the **show interfaces serial slot/port** command to display the actual bandwidth that is configured.

The user-configured subrate mode, subrate bandwidth, actual subrate bandwidth configured, and scramble configuration are displayed near the end of the **show interfaces serial** command output. See the “Examples” section for more information.

The following table shows DSU Mode and Bandwidth for NM-1.

Mode	DSU	Bandwidth Range	Bandwidth Multiples
0	Digital Link or Cisco	358–34010 kbps	358 kbps
1	Kentrox	1000–24500/34010 kbps	500 kbps



Note If the bandwidth is set to greater than 24500 kbps, it will default to 34010 kbps.



Note For the Cisco 2650XM and Cisco 2651XM platforms only, we recommend that you override the default DSU bandwidth of 34010 kbps and set the DSU bandwidth to 15000 kbps in any subrate mode.

Examples

The following example shows the DSU bandwidth set to 16,000 kbps on serial interface 1/0:

```
interface serial 1/0
 dsu bandwidth 16000
```

The following example shows the user-configured subrate bandwidth and actual-configured subrate bandwidth displayed in the **show interfaces serial** command output.

```
Serial1/0 is up, line protocol is up
Hardware is DSXPNM Serial
MTU 1500 bytes, BW 44210 Kbit, DLY 20000 usec,
  reliability 253/255, txload 1/255, rxload 1/255
Encapsulation HDLC, crc 16, loopback not set
Keepalive not set
DTR is pulsed for 0 seconds on reset, Restart-Delay is 1637167 secs
Last input 04:59:04, output 04:59:04, output hang never
Last clearing of "show interface" counters 00:00:02
Input queue:0/75/0/0 (size/max/drops/flushes); Total output drops:0
Queueing strategy:fifo
Output queue :0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions
DSU mode 0, bandwidth 34010, real bandwidth 34010, scramble 0
```

Related Commands

Command	Description
show interfaces serial	Displays information that is specific to the interface hardware.

dsu bandwidth (t3)

To specify the maximum allowable bandwidth used by a T3 controller, use the **dsu bandwidth** command in interface configuration mode. To return to the default bandwidth, use the **no** form of this command.

dsu bandwidth *kbps*

no dsu bandwidth *kbps*

Syntax Description	<i>kbps</i>	The maximum allowable bandwidth in the range from 1 kbps to 44210 kbps.
--------------------	-------------	---

Defaults	The default value is 44210 kbps.
----------	----------------------------------

Command Modes	Interface configuration
---------------	-------------------------

Command History	Release	Modification
	11.1 CA	This command was introduced.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines	The local interface configuration must match the remote interface configuration. For example, if you reduce the maximum bandwidth to 16000 kbps on the local port, you must also do the same on the remote port.
------------------	--

The **dsu bandwidth** command reduces the bandwidth by padding the T3 frame.

Even though software allows the user to configure a continuous range of bandwidths in subrate modes, vendors support bandwidths only in quantums (for example, in T3 digital link the bandwidth must be in multiples of 300 kbps). Therefore, the software sets the user-configured bandwidth to the closest vendor-supported bandwidth. Use the **show interfaces serial slot/port** command to display the real (actual) bandwidth that is configured.

The user-configured subrate mode, subrate bandwidth, actual subrate bandwidth configured, and scramble configuration are displayed near the end of the **show interfaces serial** command output. See the “Examples” section for more information.

The following table shows DSU Modes and Bandwidths for NM-1

Mode	DSU	Bandwidth Range	Bandwidth Multiples
0	Digital Link or Cisco	300–44210 kbps	300.746 kbps
1	ADC Kentrox T3/E3 IDSU	1500–35000/44210 kbps	500 kbps
2	Larscom Access T45	3100–44210 kbps	3158 kbps

Mode	DSU	Bandwidth Range	Bandwidth Multiples
3	Adtran T3SU 300	75-44210 kbps	75.186 kbps
4	Verilink HDM 2182	1500-44210 kbps	1579 kbps



Note For the Cisco 2650XM and Cisco 2651XM platforms only, we recommend that you override the default DSU bandwidth of 44210 kbps and set the DSU bandwidth to 15000 kbps in any subrate mode.

Examples

The following example shows the data service unit bandwidth set to 16000 kbps on serial interface 1/0:

```
interface serial 1/0
 dsu bandwidth 16000
```

The following example shows the user-configured subrate bandwidth and the actual configured subrate bandwidth displayed in the **show interfaces serial** command output:

```
Serial1/0 is up, line protocol is up
 Hardware is DSXPNM Serial
 MTU 1500 bytes, BW 44210 Kbit, DLY 20000 usec,
   reliability 253/255, txload 1/255, rxload 1/255
 Encapsulation HDLC, crc 16, loopback not set
 Keepalive not set
 DTR is pulsed for 0 seconds on reset, Restart-Delay is 1637167 secs
 Last input 04:59:04, output 04:59:04, output hang never
 Last clearing of "show interface" counters 00:00:02
 Input queue:0/75/0/0 (size/max/drops/flushes); Total output drops:0
 Queueing strategy:fifo
 Output queue :0/40 (size/max)
 5 minute input rate 0 bits/sec, 0 packets/sec
 5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
   Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions
 DSU mode 0, bandwidth 34010, real bandwidth 34010, scramble 0
```

Related Commands

Command	Description
show interfaces serial	Displays information that is specific to the interface hardware.

dsu mode (e3)

To specify the interoperability mode used by an E3 controller, use the **dsu mode** command in interface configuration mode. To return to the default mode, use the **no** form of this command.

dsu mode {0 | 1}

no dsu mode

Syntax Description	0	1
	Sets the interoperability mode to 0. This is the default. Specify mode 0 to connect an E3 controller to another E3 controller or to a Digital Link data service unit (DL3100).	Sets the interoperability mode to 1. Specify mode 1 to connect an E3 controller to a Kentrox DSU.

Defaults The default value is 0.

Command Modes Interface configuration

Command History	Release	Modification
	11.1 CA	This command was introduced.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms for E3: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines The local interface configuration must match the remote interface configuration. For example, if you define the DSU interoperability mode as 1 on the local port, you must also do the same on the remote port.

You must know what type of DSU is connected to the remote port to determine if it interoperates with a T3 or E3 controller.

To verify the DSU mode configured on the interface, use the **show interfaces serial EXEC** command.

Examples The following example shows the DSU mode set to 1 on serial interface 1/0:

```
interface serial 1/0
dsu mode 1
```

Related Commands

Command	Description
show controllers serial	Displays information that is specific to the serial controllers.
show interfaces serial	Displays information that is specific to the interface hardware.

dsu mode (t3)

To specify the interoperability mode used by a T3 controller, use the **dsu mode** command in interface configuration mode. To return to the default mode, use the **no** form of this command.

```
dsu mode {0 | 1 | 2 | 3 | 4}
```

```
no dsu mode
```

Syntax Description		
0	Sets the interoperability mode to 0. This is the default. Specify mode 0 to connect a T3 controller to another T3 controller or to a Digital Link data service unit (DL3100). This is the default.	
1	Sets the interoperability mode to 1. Specify mode 1 to connect a T3 controller to a Kentrox DSU.	
2	Sets the interoperability mode to 2. Specify mode 2 to connect a T3 controller to a Larscom DSU.	
3	Sets the interoperability mode to 3. Specify mode 3 to connect a T3 controller to an Adtran T3SU 300.	
4	Sets the interoperability mode to 4. Specify mode 4 to connect a T3 controller to a Verilink HDM 2182.	

Defaults The default value is 0.

Command Modes Interface configuration

Command History	Release	Modification
	11.1 CA	This command was introduced.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms for T3: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines The local interface configuration must match the remote interface configuration. For example, if you define the data service unit (DSU) interoperability mode as 1 on the local port, you must also do the same on the remote port.

You must know what type of DSU is connected to the remote port to determine if it interoperates with a T3 or E3 controller.

To verify the DSU mode configured on the interface, use the **show interfaces serial EXEC** command.

Examples

The following example shows the DSU mode set to 1 on serial interface 1/0:

```
interface serial 1/0
dsu mode 1
```

Related Commands

Command	Description
show interfaces serial	Displays information that is specific to the interface hardware.

framing (e3)

To specify the type of framing used by the E3 controller, use the **framing** command in controller configuration mode. To restore the default framing type, use the **no** form of this command.

```
framing {bypass | g751}
```

```
no framing
```

Syntax Description	Command	Description
	bypass	Specifies that the G.751 framing be bypassed.
	g751	Specifies G.751 framing as the E3 framing type. This is the default.

Defaults The default is G.751.

Command Modes Controller configuration

Command History	Release	Modification
	11.1 CA	This command was introduced.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms for E3: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines If you do not specify the **framing** command, the default, **g751**, is used by the E3 controller to automatically determine the framing type received from the far-end equipment.

Configure framing as G.751 when the E3 connection terminates remotely on a Digital Link or Kentrox data service unit, or when needing a subrate on an E3 connection between two T3 or E3 network modules.



Note The local interface configuration must match the remote interface, or DSU, configuration.

When framing G.751 is used, DSU bandwidth can be used to select a payload subrate from 34010 kbps down to 22 kbps.

When framing bypass is used, DSU bandwidth of 34010 kbps must be configured.

When framing G.751 is used, configuring the **scrambling** command can prevent some payload data from being mistakenly interpreted as G.751 framing bits by switches placed between the DSUs. By default, the **no scrambling** command is configured.

When framing bypass is used, the **no scrambling** command must be configured.

When framing G.751 is used, bit 11 of the G.751 frame is reserved for national use and is set to 1 by default.

Configure national bit 1 only when required for interoperability with your telephone company.

Examples

The following example shows the framing for the E3 controller set to bypass:

```
controller e3 1/0  
  framing bypass
```

framing (t3)

To specify the type of framing used by the T3 controller, use the **framing** command in controller configuration mode. To restore the default framing type, use the **no** form of this command.

framing { c-bit | m23 }

no framing

Syntax Description	Command	Description
	c-bit	Specifies C-bit framing as the T3 framing type. This is the default.
	m23	Specifies M23 framing as the T3 framing type.

Defaults The default is C-bit.

Command Modes Controller configuration

Command History	Release	Modification
	11.1 CA	This command was introduced.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms for T3: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines If you do not specify the **framing** command, the default, **c-bit**, is used by the T3 controller to automatically determine the framing type received from the far-end equipment.

Examples The following example shows the framing for the T3 controller set to C-bit:

```
controller t3 1/0
 framing c-bit
```

loopback (e3)

To loop an entire E3 line toward the line and back toward the router, use the **loopback** command in controller configuration mode. To remove the loop, use the **no** form of this command.

loopback {local | network {line | payload}}

no loopback

Syntax Description

local	Loops the data back toward the router and sends an AIS signal out toward the network.
network {line payload}	Sets the loopback toward the network before going through the framer (line) or after going through the framer (payload).

Defaults

The default is **local**.

Command Modes

Controller configuration

Command History

Release	Modification
11.3	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms for E3: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines

Use this command for troubleshooting purposes. To verify that a loopback is configured on the interface, use the **show controllers (t3/e3) EXEC** command. Note that line loopback is available only in C-bit parity mode.

Examples

The following example configures the controller located in slot 1, port 0 for a local loopback:

```
controller e3 1/0
 loopback local
```

Related Commands

Command	Description
show controllers (t3/e3)	Displays information about the T3 or E3 controllers.

loopback (t3)

To loop an entire T3 line toward the line and back toward the router, use the **loopback** command in controller configuration mode. To remove the loop, use the **no** form of this command.

loopback { **local** | **network** { **line** | **payload** } | **remote** }

no loopback

Syntax Description

local	Loops the data back toward the router and sends an alarm indication signal (AIS) out toward the network.
network { line payload }	Sets the loopback toward the network before going through the framer (line) or after going through the framer (payload).
remote	Sends a far-end alarm control (FEAC) request to the remote end requesting that it enter into a network line loopback. FEAC requests (and therefore remote loopbacks) are possible only when the T3 is configured for C-bit framing. M23 format does not support remote loopbacks.

Defaults

The default is **local**.

Command Modes

Controller configuration

Command History

Release	Modification
11.3	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms for T3: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines

Use this command for troubleshooting purposes. To verify that a loopback is configured on the interface, use the **show controllers (t3/e3) EXEC** command. Note that remote loopback is available only in C-bit parity mode.

Examples

The following example configures the controller located in slot 1, port 0 for a local loopback:

```
controller t3 1/0
 loopback local
```

Related Commands

Command	Description
show controllers (t3/e3)	Displays information about the T3 or E3 controllers.

mdl (t3)

To configure the Maintenance Data Link (MDL) message defined in the ANSI T1.107a-1990 specification, use the **mdl** command in interface configuration mode. To remove the message, use the **no** form of this command.

```
mdl { transmit { path | idle-signal | test-signal } | string { eic | lic | fic | unit | pfi | port | generator } string }
```

```
no mdl { transmit { path | idle-signal | test-signal } | string { eic | lic | fic | unit | pfi | port | generator } string }
```

Syntax Description

transmit path	Enables transmission of the MDL path message.
transmit idle-signal	Enables transmission of the MDL idle signal message.
transmit test-signal	Enables transmission of the MDL test signal message.
string eic <i>string</i>	Specifies the equipment identification code (EIC); can be up to 10 characters.
string lic <i>string</i>	Specifies the location identification code (LIC); can be up to 11 characters.
string fic <i>string</i>	Specifies the frame identification code (FIC); can be up to 10 characters.
string unit <i>string</i>	Specifies the unit identification code (UIC); can be up to 6 characters.
string pfi <i>string</i>	Specifies the facility identification code (FIC) sent in the MDL path message; can be up to 38 characters.
string port <i>string</i>	Specifies the port number string sent in the MDL idle signal message; can be up to 38 characters.
string generator <i>string</i>	Specifies the generator number string sent in the MDL test signal message; can be up to 38 characters.

Defaults

No MDL message is configured.

Command Modes

Interface configuration

Command History

Release	Modification
11.3	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines

Use the **show controllers** command to display MDL information (received strings). MDL information is displayed only when framing is set to C-bit.

**Note**

MDL is supported only when framing is set to C-bit parity.

Examples

The following example shows the **mdl** commands configured on a T3 controller in slot 1, port 0:

```
!  
controller T3 1/0  
  clock source line  
  mdl string eic ID  
  mdl string lic LocationID  
  mdl string fic FrameID  
  mdl string unit Unit  
  mdl string pfi Facility  
  mdl string port PortNumber  
  mdl string generator factoryA  
  mdl transmit path  
  mdl transmit idle-signal  
  mdl transmit test-signal
```

Related Commands

Command	Description
show controllers (t3/e3)	Displays information about the T3 or E3 controllers.

national bit (e3)

To set the E3 national bit in the G.751 frame used by the E3 controller, use the **national bit** command in controller configuration mode. To return to the default national bit, use the **no** form of this command.

national bit {0 | 1}

no national bit

Syntax Description	0 1	Specifies the E3 national bit in the G.751 frame. The default is 1.
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Defaults	The default value is 1 .
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Command Modes	Controller configuration
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Command History	Release	Modification
	11.1 CA	This command was introduced.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines	<p>The national bit command sets bit 12 in the E3 frame.</p> <p>When framing G.751 is used, bit 11 of the G.751 frame is reserved for national use and is set to 1 by default.</p> <p>Configure national bit 1 only when required for interoperability with your telephone company.</p>
-------------------------	--

Examples	The following example sets the national bit to 1:
-----------------	---

```
controller t3 1/0
  national bit 1
```

scramble (t3/e3)

To enable scrambling (encryption) of the payload on the T3 or E3 controller, use the **scramble** command in interface configuration mode. To disable scrambling, use the **no** form of this command.

scramble

no scramble

Syntax Description

This command has no arguments or keywords.

Defaults

Scrambling is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.1 CA	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Usage Guidelines

T3 or E3 scrambling is used to assist clock recovery on the receiving end. Scrambling is designed to randomize the pattern of 1s and 0s carried in the physical layer frame. Randomizing the digital bits can prevent continuous, nonvariable bit patterns—in other words, long strings of all 1s or all 0s. Several physical layer protocols rely on transitions between 1s and 0s to maintain clocking.

Scrambling prevents some bit patterns from being mistakenly interpreted as alarms by switches placed between the data service units.

The local interface configuration must match the remote interface configuration. For example, if you enable scrambling on the local port, you must also do the same for the remote port.

To verify that scrambling is configured on the interface, use the **show interfaces serial EXEC** command.

For T3 controllers, all the DSU modes support scrambling except the Clear mode.

For E3 controllers, only Kentrox mode supports scrambling.

Examples

The following example enables scrambling on the controller in slot 1, port 0:

```
interface serial 1/0
  scramble
```

Related Commands

Command	Description
show interfaces serial	Displays information that is specific to the interface hardware.

show controllers (t3/e3)

To display information about a T3 or E3 controller, use the **show controllers** command in EXEC mode.

```
show controllers {t3 | e3} slot/port [brief | tabular]
```

Syntax Description	slot/port	Number of the slot and port being configured. Refer to the appropriate hardware manual for slot and port information. The slash mark is required.
	brief	(Optional) Displays a list of configurations only.
	tabular	(Optional) Displays a list of configurations and MIB information in a tabular format.

Defaults No default behavior or values

Command Modes EXEC

Command History	Release	Modification
	11.1 CC	This command was introduced on the E3 controller.
	11.3	This command was introduced on the T3 controller.
	12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.

Examples The following are samples of output from the **show controllers** command:

```
Router# show controllers e3 2/0

E3 2/0 is down.
Applique type is Subrate E3
Transmitter is sending remote alarm.
Receiver has loss of signal.
Framing is G751, Clock Source is Internal.
Data in current interval (450 seconds elapsed):
 0 C-bit Coding Violation
 0 P-bit Err Secs, 0 P-bit Severely Err Secs
 0 Severely Err Framing Secs, 450 Unavailable Secs
 0 Line Errored Secs, 0-C-bit Errored Secs, 0 C-bit Severely Errored Secs
Data in Interval 1:
 0 C-bit Coding Violation
 0 P-bit Err Secs, 0 P-bit Severely Err Secs
 0 Severely Err Framing Secs, 900 Unavailable Secs
 0 Line Errored Secs, 0-C-bit Errored Secs, 0 C-bit Severely Errored Secs
Total Data (last 1 15 minute intervals):
 0 C-bit Coding Violation
 0 P-bit Err Secs, 0 P-bit Severely Err Secs
 0 Severely Err Framing Secs, 900 Unavailable Secs
```

■ show controllers (t3/e3)

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

Router# **show controllers e3 2/0 brief**

E3 2/0 is down.
 Applique type is Subrate E3
 Transmitter is sending remote alarm.
 Receiver has loss of signal.
 Framing is G571, Clock Source is Internal.

Router# **show controllers e3 2/0 tabular**

E3 2/0 is down.
 Applique type is Subrate E3
 Transmitter is sending remote alarm.
 Receiver has loss of signal.
 Framing is G571, Clock Source is Internal.

INTERNAL	LCV	PCV	CCV	PES	PSES	SEFS	UAS	LES	CES	CSES
18:10-18:21	0	0	0	0	0	0	680	0	0	0
17:55-18:10	0	0	0	0	0	0	900	0	0	0
Total	0	0	0	0	0	0	900	0	0	0

The following table describes the significant fields shown in this display and includes other fields that might occur in different configurations.

Field	Description
E3 2/0 is down.	The T3/E3 controller 3 in slot 0 shows the state in which it is operating. The controller's state can be up, down, or administratively down. Loopback conditions are shown by (Locally Looped) or (Remotely Looped).
Applique type	Controller type.
Description	User-specified information about the E3 controller.
No alarms detected	Any alarms detected by the controller are displayed here. Possible alarms are as follows: <ul style="list-style-type: none"> • Transmitter is sending remote alarm. • Transmitter is sending AIS. • Receiver has loss of signal. • Receiver is getting AIS. • Receiver has loss of frame. • Receiver has remote alarm. • Receiver has no alarms.
Linecode is	Line coding format on the E3.
Clock Source	User-specified clock source (Line or Internal).
Data in current interval (450 seconds elapsed)	Shows the current accumulation period, which rolls into the 24-hour accumulation every 15 minutes. Accumulation period is from 1 to 900 seconds. The oldest 15-minute period falls off the back of the 24-hour accumulation buffer.
PCV	Path coding violation (PCV) error event is a frame synchronization bit error in the E1-no CRC formats or a CRC error in the E1-CRC formats.

Field	Description
CCV	C-bit coding violation (CCV) error event for C-bit parity. This is the count of coding violations reported via the C-bits occurring in the accumulation interval.
PES	P-bit errored seconds (PES) is a second with one or more PCVs, one or more out of frame defects, or a detected incoming AIS. This gauge is not incremented when unavailable seconds are counted.
PSES	P-bit severely errored seconds (PSES) is a second with 44 or more PCVs, one or more out of frame defects, or a detected incoming AIS. This gauge is not incremented when unavailable seconds are counted.
SEFS	Severely errored framing seconds (SEFS) is a second with one or more out of frame defects or a detected incoming AIS.
UAS	Unavailable seconds (UAS) are calculated by counting the number of seconds that the interface is unavailable. For more information, refer to RFC 1407.
LES	Line errored seconds (LES) is a second in which one or more code violations occurred or one or more LOS defects.
CES	C-bit errored seconds (CES) is a second with one or more out of frame defects, or a detected incoming AIS. This gauge is not incremented when UASes are counted.
CSES	C-bit severely errored seconds (CSES) is a second with one or more out of frame defects, or a detected incoming AIS. This gauge is not incremented when UASes are counted.
Total	Displays the last 15-minute accumulation period.

Glossary

backplane—The physical connection between an interface processor or card and the data buses and the power distribution buses inside a chassis.

BER—bit error rate. Ratio of received bits that contain errors.

CSU—channel service unit. Digital interface device that connects end-user equipment to the local digital telephone loop. Often referred to together with DSU as CSU/DSU.

DS-3—digital signal level 3. Framing specification used for sending digital signals at 44.736 Mbps on a T3 facility.

DSU—data service unit. Device used in digital transmission that adapts the physical interface on a DTE device to a transmission facility, such as T1 or E1. The DSU also is responsible for such functions as signal timing. Often referred to together with CSU as CSU/DSU.

E3—Wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 34.368 Mbps. E3 lines can be leased for private use from common carriers.

FEAC—far-end alarm code.

Frame Relay— industry-standard, switched data link layer protocol that handles multiple virtual circuits using HDLC encapsulation between connected devices. Frame Relay is more efficient than X.25, the protocol for which it generally is considered a replacement.

HDLC—High-Level Data Link Control. Bit-oriented synchronous data link layer protocol developed by ISO. Derived from SDLC, HDLC specifies a data encapsulation method on synchronous serial links using frame characters and checksums.

MDL—Maintenance Data Link (MDL) message defined in the ANSI T1.107a-1990 specification. Also, the Cisco Message Definition Language—a high-level language used to specify protocols and protocol conversion operations on the VSC.

OIR—online insertion and removal. Feature that permits the addition, the replacement, or the removal of cards without interrupting the system power, entering console commands, or causing other software or interfaces to shut down.

PPP—Point-to-Point Protocol. Successor to SLIP that provides router-to-router and host-to-network connections over synchronous and asynchronous circuits. Whereas SLIP was designed to work with IP, PPP was designed to work with several network layer protocols, such as IP, IPX, and ARA. PPP also has built-in security mechanisms, such as CHAP and PAP. PPP relies on two protocols: LCP and NCP.

Subrate—Less than the standard rate of transmission, which is defined at the voice-grade rate of 64 kbps.

T3—Digital WAN carrier facility. T3 sends DS3-formatted data at 44.736 Mbps through the telephone switching network.

TDM—time-division multiplexing. Technique in which information from multiple channels can be allocated bandwidth on a single wire based on preassigned time slots. Bandwidth is allocated to each channel regardless of whether the station has data to send.