



Multichannel STM-1 Port Adapter

Feature History

12.0(14)S	This feature was introduced for the Cisco 7500 series on Cisco IOS Release 12.0(14)S.
12.1(7)E	This feature was integrated into Cisco IOS Release 12.1(7)E. Support for this feature was added to Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This feature was integrated into Cisco IOS Release 12.2(8)T for Cisco Cisco 7200 and Cisco 7500 series routers.

This feature module describes the multichannel STM-1 port adapter (PA-MC-STM-1) in Cisco IOS Release 12.2(8)T and includes the following sections:

- [Feature Overview, page 1](#)
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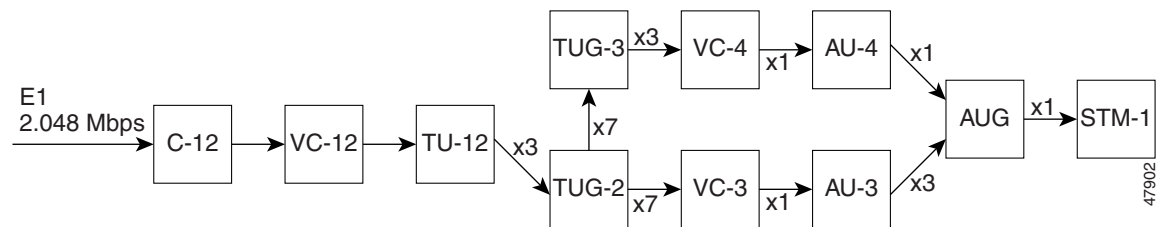
Feature Overview

The PA-MC-STM-1 is a high-speed, single-port multichannel STM-1 port adapter. You can configure the PA-MC-STM-1 as a multichannel E1/E0 STM-1 port. The PA-MC-STM-1 can be configured into 63 individual E1 links. Each E1 link can carry a single channel at full or fractional rates, or be broken down into multiple DS0 or nx64 Kbps rates. The PA-MC-STM-1 supports up to three TUG-3/AU-3 transport slots numbered 1 through 3. You can configure each TUG-3/AU-3 to carry 21 SDH TU-12s. Each SDH TU-12 is capable of carrying a channelized E1 frame, which can be unchannelized to nx64-Kbps time slots.

PA-MC-STM-1 Multiplexing Hierarchy

Figure 1 illustrates the synchronous digital hierarchy (SDH) multiplexing structure supported on the PA-MC-STM-1. The PA-MC-STM-1 multiplexing structure is a subset of that defined in ITU-T G.707. At the lowest level, containers (Cs) are input into virtual containers (VCs) with stuffing bits to create a uniform VC payload with a common bit-rate, ready for synchronous multiplexing. The VCs are then aligned into tributary units (TUs) where pointer processing operations are implemented. This allows the TUs to be multiplexed into TU groups (TUGs). Three TU-12s can be multiplexed into one TUG-2.

Figure 1 PA-STM-1 Multiplexing Structure



The TUGs are then multiplexed into higher-level VCs, which in turn are multiplexed into administrative units (AUs). The AUs are then multiplexed into an AU group (AUG), and the final payload from the AUG is then multiplexed into the Synchronous Transport Module (STM).

Benefits

The PA-MC-STM-1 port adapter provides the following benefits:

- High-density IP aggregation
- Reduction in provisioning costs
- Improved cable management
- Easier scaling of services
- Improved network availability

Restrictions

The PA-MC-STM-1 does not support the following:

- VIP2
- More than 256 logical channel groups per PA-MC-STM-1
- Channel-associated signaling (CAS) for voice channels
- E1 Facility Data Link (FDL)
- E3 and subrate E3

Related Features and Technologies

- PA-MC-T3
- PA-MC-E3

Related Documents

- *Cisco IOS Wide-Area Networking Configuration Guide, Release 12.2*
- *Cisco IOS Wide-Area Networking Command Reference, Release 12.2*
- *Multichannel STM-1 Port Adapter Installation and Configuration*
- *Multichannel STM-1 Port Adapter for the Cisco 7500 Series Router*

Supported Platforms

- Cisco 7200 series
- Cisco 7500 series

Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that support specific platforms. To get updated information regarding platform support for this feature, access Cisco Feature Navigator. Cisco Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Cisco Feature Navigator is a web-based tool that enables you to determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or release. Under the release section, you can compare releases side by side to display both the features unique to each software release and the features in common.

To access Cisco Feature Navigator, 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 at <http://www.cisco.com/register>.

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

<http://www.cisco.com/go/fn>

Availability of Cisco IOS Software Images

Platform support for particular Cisco IOS software releases is dependent on the availability of the software images for those platforms. Software images for some platforms may be deferred, delayed, or changed without prior notice. For updated information about platform support and availability of software images for each Cisco IOS software release, refer to the online release notes or, if supported, Cisco Feature Navigator.

Supported Standards, MIBs, and RFCs

Standards

- CSA C22.2, No. 950
- ITU-T G.704
- ITU-T G.706
- ITU-TG.707
- ITU-T O.151
- ITU-T O.152
- ITU-T O.153
- FCC Part 15, class A
- FCC Part 68
- UL1950 3rd Edition

MIBs

No new or modified MIBs are supported by this feature.

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:

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

RFCs

- RFC 1406, *Definitions of Managed Objects for the DS1 and E1 Interface Types*
- RFC 1595, *Definitions of Managed Objects for the SONET/SDH Interface Type*



Note

Because E1 FDL is not supported by the PA-MC-STM-1, the far-end statistics and control groups defined by RFC 1406 are not available.

Prerequisites

The PA-MC-STM-1 requires a VIP4-80 installed in a Cisco 7500 series router.

Configuration Tasks

See the following sections for configuration tasks for the PA-MC-STM-1. Each task in the list indicates if the task is optional or required.

- [Configuring the SONET Controller](#) (required)
- [Configuring an AU-3](#) (required)
- [Configuring a TUG-3](#) (required)
- [Configuring a Channel Group on an E1 of an AU-3](#) (required)

- [Configuring a Channel Group on an E1 of a TUG-3](#) (required)
- [Configuring an E1 Line Mapped to an AU-3](#) (required)
- [Configuring an E1 Line Mapped to a TUG-3](#) (required)
- [Verifying the Configuration](#) (optional)

Configuring the SONET Controller

To configure the SONET controller, use the following commands beginning in privileged EXEC mode:

	Command	Purpose
Step 1	Router# configure terminal	Enters configuration mode and specifies that the console terminal is the source of the configuration subcommands.
Step 2	<p>Cisco 7200 series</p> <pre>Router(config)# controller sonet slot/port</pre> <p>Cisco 7500 series</p> <pre>Router(config)# controller sonet slot/port-adapter/port</pre>	Selects a port of a PA-MC-STM-1 and enters controller configuration mode.
Step 3	Router(config-controller)# framing {sonet sdh}	<p>Configures the framing mode of the PA-MC-STM-1 to SONET or SDH.</p> <p>sdh—Selects SDH framing. SDH is the ITU standards equivalent of SONET.</p> <p>sonet—Selects SONET framing.</p> <p>SONET is the default.</p>
Step 4	Router(config-controller)# clock source {internal line}	<p>Configures the clock source used by the SONET controller.</p> <ul style="list-style-type: none"> • internal—The clocking source is obtained from the port adapter line. • line—The clocking source is obtained from the network. <p>Network clocking source is the default.</p>
Step 5	Router(config-controller)# loopback {local network}	<p>Enables loopback mode on a SONET controller.</p> <ul style="list-style-type: none"> • local—Data is looped from the transmit path to the receive path allowing diagnostics to send data to itself without relying on any external connections. • network—Data is looped from the external port to the transmit port and back out the external port. <p>No loopback enabled is the default.</p>
Step 6	Router(config-controller)# description string	Specifies up to 80 characters of text describing the SONET controller. No description is the default.

Configuring an AU-3

Each of the administrative unit group (AUGs) and tributary unit group (TUGs) of a PA-MC-STM-1 can be configured to carry a set of E1 links that are mapped into TU-12s. To configure the AUG mapping to AU-3, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<p>Cisco 7200 series</p> <pre>Router(config)# controller sonet slot/port</pre> <p>Cisco 7500 series</p> <pre>Router(config)# controller sonet slot/port-adapter/port</pre>	Enters SONET controller configuration mode.
Step 2	Router(config-controller)# framing sdh	Configures the framing mode to SDH.
Step 3	Router(config-controller)# aug mapping au-3	Maps the AUG to AU-3 with the following muxing, alignment, and mapping: <pre>C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> VC-3 <--> AU-3 <--> AUG</pre>
Step 4	Router(config-controller)# au-3 au-3-number	Specifies the AU-3 number to configure:. <ul style="list-style-type: none"> <i>au-3-number</i>—A number in the range of 1 to 3.
Step 5	Router(config-ctrlr-au3)# mode c-12	Specifies the mode of operation of the AU-3. <ul style="list-style-type: none"> c-12—The AU-3 is divided into 21 TU-12s, each carrying an E1.
Step 6	Router(config-ctrlr-au3)# idle pattern pattern	Configures the idle pattern that is to be transmitted for unused time slots on all E1 lines of an AU-3. <ul style="list-style-type: none"> <i>pattern</i>—Number in the range 0x0 to 0xFF (hexadecimal) or 0 to 225 (decimal).

Configuring a TUG-3

Each of the administrative unit groups (AUGs) and tributary unit groups (TUGs) of a PA-MC-STM-1 can be configured to carry a set of E1 links that are mapped into TU-12s. To configure the AUG mapping to AU-4, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<p>Cisco 7200 series</p> <pre>Router(config)# controller sonet slot/port</pre> <p>Cisco 7500 series</p> <pre>Router(config)# controller sonet slot/port-adapter/port</pre>	Enters SONET controller configuration mode.
Step 2	Router(config-controller)# framing sdh	Configures the framing mode to SDH.

	Command	Purpose
Step 3	Router(config-controller)# aug mapping au-4	Maps the AUG to AU-4 with the following muxing, alignment, and mapping: C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> TUG-3 <--> VC-4 <--> AU-4 <--> AUG
Step 4	Router(config-controller)# au-4 <i>au-4-number</i> tug-3 <i>tug-3-number</i>	Specifies the TUG-3 number to configure: <ul style="list-style-type: none"> <i>au-4-number</i>—A number in the range of 1 to <i>n</i> where <i>n</i> is the STM level. (For the PA-MC-STM-1, <i>n</i> is always 1.) <i>tug-3-number</i>—A number in the range of 1 to 3.
Step 5	Router(config-ctrlr-tug3)# mode c-12	Specifies the mode of operation of a TUG-3: <ul style="list-style-type: none"> c-12—The TUG-3 is divided into 21 TU-12s each carrying an E1.
Step 6	Router(config-ctrlr-tug3)# idle pattern <i>pattern</i>	Configures the idle pattern that is to be transmitted for unused time slots on all E1 lines of an AU-4. <ul style="list-style-type: none"> <i>pattern</i>—Number in the range 0x0 to 0xFF (hexadecimal) or 0 to 225 (decimal).

Configuring a Channel Group on an E1 of an AU-3

To configure a channel group on an E1 of an AU-3, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<p>Cisco 7200 series</p> <pre>Router(config)# controller sonet <i>slot/port</i></pre> <p>Cisco 7500 series</p> <pre>Router(config)# controller sonet <i>slot/port-adapter/port</i></pre>	Enters SONET controller configuration mode.
Step 2	Router(config-controller)# framing sdh	Configures the framing mode to SDH.
Step 3	Router(config-controller)# aug mapping au-3	Maps the AUG to an AU-3 with the following muxing, alignment, and mapping: C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> VC-3 <--> AU-3 <--> AUG
Step 4	Router(config-controller)# au-3 <i>au-3-number</i>	Specifies the AU-3 number to configure. <ul style="list-style-type: none"> <i>au-3-number</i>—A number in the range of 1 to 3.
Step 5	Router(config-ctrlr-au3)# mode c-12	Specifies the mode of operation of the AU-3. <ul style="list-style-type: none"> c-12—The AU-3 is divided into 21 TU-12s each carrying an E1.

Command	Purpose
<p>Step 6</p> <pre>Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> channel-group <i>channel-group-number</i> timeslots <i>list-of-timeslots</i></pre> <p>or</p> <pre>Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> unframed</pre>	<p>Creates a logical channel group on an E1 line.</p> <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3. • channel-group—Defines a logical channel group to be a channelized E1 line. • <i>channel-group-number</i>—A number in the range of 0 to 30. • <i>list-of-timeslots</i>—A number in the range of 1 to 31 or a combination of subranges within 1 to 31. (Each subrange is a list of time slots that makes up the E1 line.) <p>Use the no form of this command to remove a logical channel group.</p> <p>The default is no channel group configured on an E1 line.</p> <p>Creates an unframed (clear channel) logical channel group on an E1 line.</p> <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3.
<p>Step 7</p> <pre>Router(config-ctrlr-au3)# exit Router(config-controller)# exit</pre>	<p>Returns to configuration mode.</p>
<p>Step 8</p> <p>Cisco 7200 series</p> <pre>Router(config)# interface serial <i>slot/port.au-3-number/tug-2-number/</i> <i>e1-number:channel-group-number</i></pre> <p>Cisco 7500 series</p> <pre>Router(config)# interface serial <i>slot/port-adapter/port.au-3-number/tug-2-number/</i> <i>e1-number:channel-group-number</i></pre>	<p>Selects the channel group interface to configure.</p> <p>Note When an unframed (clear channel) logical channel group is configured on an E1 line, the <i>channel-group-number</i> is always 0.</p>
<p>Step 9</p> <pre>Router(config-if)# ip address <i>1.1.1.10</i> <i>255.255.255.255</i></pre>	<p>Enables IP on the channel group interface.</p>
<p>Step 10</p> <pre>Router(config-if)# encapsulation ppp</pre>	<p>Enables PPP on the channel group interface.</p>

Configuring a Channel Group on an E1 of a TUG-3

To configure a channel group on an E1 of a TUG-3, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<p>Cisco 7200 series</p> <pre>Router(config)# controller sonet slot/port</pre> <p>Cisco 7500 series</p> <pre>Router(config)# controller sonet slot/port-adapter/port</pre>	Enters SONET controller configuration mode.
Step 2	Router(config-controller)# framing sdh	Configures the framing mode to SDH.
Step 3	Router(config-controller)# aug mapping au-4	Maps the AUG to AU-4 with the following muxing, alignment, and mapping: <pre>C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> TUG-3 <--> VC-4 <--> AU-4 <--> AUG</pre>
Step 4	Router(config-controller)# au-4 au-4-number tug-3 tug-3-number	Specifies the AU-4 and TUG-3 number to configure: <ul style="list-style-type: none"> • <i>au-4-number</i>—A number in the range of 1 to <i>n</i> where <i>n</i> is the STM level. (For the PA-MC-STM-1, <i>n</i> is always 1.) • <i>tug-3-number</i>—A number in the range of 1 to 3.
Step 5	Router(config-ctrlr-tug3)# mode c-12	Specifies the mode of operation of an AU-4. <ul style="list-style-type: none"> • c-12—The TUG-3 is divided into 21 TU-12s each carrying an E1.

Command	Purpose
<p>Step 6</p> <pre>Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> channel-group <i>channel-group-number</i> timeslots <i>list-of-timeslots</i></pre> <p>or</p> <pre>Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> unframed</pre>	<p>Creates a logical channel group on an E1 line.</p> <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3. • channel-group—Defines a logical channel group to be a channelized E1 line. • <i>channel-group-number</i>—A number in the range of 0 to 30. • <i>list-of-timeslots</i>—A number in the range of 1 to 31 or a combination of subranges within 1 to 31. (Each subrange is a list of time slots that makes up the E1 line.) <p>Use the no form of this command to remove a logical channel group.</p> <p>The default is no channel group configured on an E1 line.</p> <p>Creates an unframed (clear channel) logical channel group on an E1 line.</p> <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3.
<p>Step 7</p> <pre>Router(config-ctrlr-tug3)# exit Router(config-controller)# exit</pre>	<p>Returns to configuration mode.</p>
<p>Step 8</p> <p>Cisco 7200 series</p> <pre>Router(config)# interface serial <i>slot/port.au-4-number/tug-3-number/tug-2-number/</i> <i>e1-number:channel-group-number</i></pre> <p>Cisco 7500 series</p> <pre>Router(config)# interface serial <i>slot/port-adapter/port.au-4-number/tug-3-number/tug-2-</i> <i>number/ e1-number:channel-group-number</i></pre>	<p>Selects the channel group interface to configure.</p> <p>Note When an unframed (clear channel) logical channel group is configured on an E1 line, the <i>channel-group-number</i> is always 0.</p>
<p>Step 9</p> <pre>Router(config-if)# ip address <i>1.1.1.10 255.255.255.255</i></pre>	<p>Enables IP on the channel group interface.</p>
<p>Step 10</p> <pre>Router(config-if)# encapsulation ppp</pre>	<p>Enables PPP on the channel group interface.</p>

Configuring an E1 Line Mapped to an AU-3

To configure an E1 line mapped to an AU-3, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<p>Cisco 7200 series</p> <pre>Router(config)# controller sonet slot/port</pre> <p>Cisco 7500 series</p> <pre>Router(config)# controller sonet slot/port-adapter/port</pre>	Enters SONET controller configuration mode.
Step 2	<pre>Router(config-controller)# aug mapping au-3</pre>	<p>Maps the AUG to an AU-3 with the following muxing, alignment, and mapping:</p> <pre>C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> VC-3 <--> AU-3 <--> AUG</pre>
Step 3	<pre>Router(config-controller)# au-3 au-3-number</pre>	<p>Specifies the AU-3 number to configure.</p> <ul style="list-style-type: none"> <i>au-3-number</i>—A number in the range of 1 to 3.
Step 4	<pre>Router(config-ctrlr-au3)# mode c-12</pre>	<p>Specifies the mode of operation of the AU-3.</p> <ul style="list-style-type: none"> c-12—The AU-3 is divided into 21 TU-12s each carrying an E1.
Step 5	<pre>Router(config-ctrlr-au3)# tug-2 tug-2-number e1 e1-number framing {crc4 no crc4}</pre>	<p>Specifies the type of framing used by an E1 line.</p> <ul style="list-style-type: none"> <i>tug-2-number</i>—A number in the range of 1 to 7. <i>e1-number</i>—A number in the range of 1 to 3. crc4—4-bit cyclic redundancy check. no crc4—Basic framing. <p>The default is CRC4.</p>
Step 6	<pre>Router(config-ctrlr-au3)# tug-2 tug-2-number e1 e1-number clock source {internal line}</pre>	<p>Specifies the clock source to be used by the E1 line.</p> <ul style="list-style-type: none"> <i>tug-2-number</i>—A number in the range of 1 to 7. <i>e1-number</i>—A number in the range of 1 to 3. internal—Specifies the PA-MC-STM-1 as the clock source. line—Specifies the E1 line as the clock source. <p>The default is E1 line clock source.</p>
Step 7	<pre>Router(config-ctrlr-au3)# tug-2 tug-2-number e1 e1-number national bits pattern</pre>	<p>Configures the national reserved bits for the E1 line.</p> <ul style="list-style-type: none"> <i>tug-2-number</i>—A number in the range of 1 to 7. <i>e1-number</i>—A number in the range of 1 to 3. <i>pattern</i>—The national reserved bit pattern is a hexadecimal value in the range 0x0 to 0x1F (hexadecimal) or 0 to 31 (decimal). <p>The default setting is 0x1F.</p>

	Command	Purpose
Step 8	Router(config-ctrlr-au3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> bert <i>pattern</i> <i>pattern</i> interval <i>time</i>	<p>Sends a BERT pattern on an E1 line.</p> <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3. • <i>pattern</i> <ul style="list-style-type: none"> – 2¹¹, pseudorandom test pattern (2048 bits long) – 2¹⁵, pseudorandom O.151 test pattern (32,768 bits long) – 2²⁰-O153, 2²⁰-1 O.153 test pattern – 2²⁰-QRSS, pseudorandom QRSS O.151 test pattern (1,048,575 bits long) • <i>time</i>—An interval in the range of 1 to 14,400 minutes. <p>The default is no BER test configured.</p>
Step 9	Router(config-ctrlr-au3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> loopback [local network] {line payload }	<p>Specifies a loopback for an E1 line.</p> <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3. • local—Loops transmitted E1 output back to the router via the internal E1 framer and loops E1 output to the network via the internal E1 framer. • network—Loops E1 input back to the network.
Step 10	Router(config-ctrlr-au3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> shutdown	<p>Shuts down an E1 line.</p> <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3.

Configuring an E1 Line Mapped to a TUG-3

To configure an E1 line mapped to a TUG-3, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<p>Cisco 7200 series</p> <pre>Router(config)# controller sonet <i>slot/port</i></pre> <p>Cisco 7500 series</p> <pre>Router(config)# controller sonet <i>slot/port-adapter/port</i></pre>	Enters SONET controller configuration mode.
Step 2	Router(config-controller)# aug mapping au-4	<p>Maps the AUG to AU-4 with the following muxing, alignment, and mapping:</p> <pre>C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> TUG-3 <--> VC-4 <--> AU-4 <--> AUG</pre>

	Command	Purpose
Step 3	Router(config-controller)# au-4 <i>au-4-number</i> tug-3 <i>tug-3-number</i>	Specifies the AU-4 and TUG-3 number to configure: <ul style="list-style-type: none"> • <i>au-4-number</i>—A number in the range of 1 to <i>n</i> where <i>n</i> is the STM level. (For the PA-MC-STM-1 <i>n</i> is always 1.) • <i>tug-3-number</i>—A number in the range of 1 to 3.
Step 4	Router(config-ctrlr-tug3)# mode c-12	Specifies the mode of operation of a TUG-3. <ul style="list-style-type: none"> • c-12—The TUG-3 is divided into 21 TU-12s, each carrying an E1.
Step 5	Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> framing { crc4 no crc4 }	Specifies the type of framing used an by an E1 line. <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3. • crc4—4-bit cyclic redundancy check. • no crc4—Basic framing. <p>The default is CRC4.</p>
Step 6	Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> clock source { internal line }	Specifies the clock source to be used by the E1 line. <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3. • internal—Specifies the PA-MC-STM-1 as the clock source. • line—Specifies the E1 line as the clock source. <p>The default is E1 line clock source.</p>
Step 7	Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> national bits <i>pattern</i>	Configures the national reserved bits for the E1 line. <ul style="list-style-type: none"> • <i>tug-2-number</i>—A number in the range of 1 to 7. • <i>e1-number</i>—A number in the range of 1 to 3. • <i>pattern</i>—The national reserved bit pattern is a hexadecimal value in the range 0x0 to 0x1F (hexadecimal) or 0 to 31 (decimal). <p>The default setting is 0x1F.</p>

	Command	Purpose
Step 8	Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> bert <i>pattern</i> <i>pattern</i> interval <i>time</i>	<p>Sends a BERT pattern on an E1 line.</p> <ul style="list-style-type: none"> <i>tug-2-number</i>—A number in the range of 1 to 7. <i>e1-number</i>—A number in the range of 1 to 3. <i>pattern</i> <ul style="list-style-type: none"> 2¹¹, pseudorandom test pattern (2048 bits long) 2¹⁵, pseudorandom O.151 test pattern (32,768 bits long) 2²⁰-O153, 2²⁰-1 O.153 test pattern 2²⁰-QRSS, pseudorandom QRSS O.151 test pattern (1,048,575 bits long) interval— An interval in the range of 1 to 14400 minutes. <p>The default is no BER test configured.</p>
Step 9	Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> loopback [local network] <i>{line payload}</i>	<p>Specifies a loopback for an E1 line.</p> <ul style="list-style-type: none"> <i>tug-2-number</i>—A number in the range of 1 to 7. <i>e1-number</i>—A number in the range of 1 to 3. local—Loops transmitted E1 output back to the router via the internal E1 framer and loops E1 output to the network via the internal E1 framer. network—Loops E1 input back to the network.
Step 10	Router(config-ctrlr-tug3)# tug-2 <i>tug-2-number</i> e1 <i>e1-number</i> shutdown	<p>Shuts down an E1 line.</p> <ul style="list-style-type: none"> <i>tug-2-number</i>—A number in the range of 1 to 7. <i>e1-number</i>—A number in the range of 1 to 3.

Verifying the Configuration

You can verify the configuration and status of the controller by using the **show controller** commands as detailed below.

When AUG mapping is AU-4, view information about the SONET controller on a Cisco 7200 series router using the **sonet controller sonet slot/port [brief | tabular]** command. Use the **sonet controller sonet slot/port-adapter/port [brief | tabular]** command for a Cisco 7500 series router.

The following examples show sample output for a Cisco 7500 series router:

```
Router# show controller sonet 2/0/0
SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
  H/W Version :0.2.3, ROM Version :1.2
  FREEDM version :2, F/W Version :1.2.0
  Applique type is Channelized Sonet/SDH
  Clock Source is Internal, AUG mapping is AU4.
```

```
Medium info:
  Type:SDH, Line Coding:NRZ, Line Type:Short SM
```

Regenerator Section Status:
No alarms detected.

Multiplex Section Status:
No alarms detected.

Higher Order Path Status:
Path# 1 has no defects

Lower Order Path Status:
VC-12 1/1/1/1 has no defects
VC-12 1/1/1/2 has no defects
VC-12 1/1/1/3 has no defects
VC-12 1/1/2/1 has no defects
VC-12 1/1/2/2 has no defects
VC-12 1/1/2/3 has no defects

[display text omitted]

Data in current interval (137 seconds elapsed):

Regenerator Section:
0 CVs, 0 ESs, 0 SESs, 0 SEFSs
Multiplex Section:
0 CVs, 0 ESs, 0 SESs, 0 UASs
Higher Order Path:
Path# 1: 0 CVs, 0 ESs, 0 SESs, 0 UASs
Lower Order Path:
VC-12 1/1/1/1: 0 CVs, 0 ESs, 0 SESs, 0 UASs
VC-12 1/1/1/2: 0 CVs, 0 ESs, 0 SESs, 0 UASs
VC-12 1/1/1/3: 0 CVs, 0 ESs, 0 SESs, 0 UASs
VC-12 1/1/2/1: 0 CVs, 0 ESs, 0 SESs, 0 UASs

[display text omitted]

SONET 2/0/0 E1 1/1/1/1 is up

No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.

Data in current interval (137 seconds elapsed):
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
0 Unavail Secs

SONET 2/0/0 E1 1/1/1/2 is up

No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.

Data in current interval (137 seconds elapsed):
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
0 Unavail Secs

[display text omitted]

Router# **show controller sonet 2/0/0 brief**

SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
H/W Version :0.2.3, ROM Version :1.2
FREEDM version :2, F/W Version :1.2.0
Applique type is Channelized Sonet/SDH
Clock Source is Internal, AUG mapping is AU4.

Medium info:

Type:SDH, Line Coding:NRZ, Line Type:Short SM

Regenerator Section Status:
No alarms detected.

Multiplex Section Status:
No alarms detected.

Higher Order Path Status:
Path# 1 has no defects

Lower Order Path Status:
VC-12 1/1/1/1 has no defects
VC-12 1/1/1/2 has no defects
VC-12 1/1/1/3 has no defects
VC-12 1/1/2/1 has no defects
VC-12 1/1/2/2 has no defects
VC-12 1/1/2/3 has no defects
[display text omitted]

SONET 2/0/0 E1 1/1/1/1 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
SONET 2/0/0 E1 1/1/1/2 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
SONET 2/0/0 E1 1/1/1/3 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
[display text omitted]

Router# **show controller sonet 2/0/0 tabular**
SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
H/W Version :0.2.3, ROM Version :1.2
FREEDM version :2, F/W Version :1.2.0
Applique type is Channelized Sonet/SDH
Clock Source is Internal, AUG mapping is AU4.

Medium info:
Type:SDH, Line Coding:NRZ, Line Type:Short SM

Regenerator Section Status:
No alarms detected.

Multiplex Section Status:
No alarms detected.

Higher Order Path Status:
Path# 1 has no defects

Lower Order Path Status:
VC-12 1/1/1/1 has no defects
VC-12 1/1/1/2 has no defects
VC-12 1/1/1/3 has no defects
VC-12 1/1/2/1 has no defects
[display text omitted]

Regenerator Section:
INTERVAL CV ES SES SEFS
20:47-20:50 0 0 0 0

Multiplex Section:
INTERVAL CV ES SES UAS
20:47-20:50 0 0 0 0

Higher Order Path:
Path# 1:

```

INTERVAL      CV    ES    SES    UAS
20:47-20:50   0    0    0    0

Lower Order Path:
AU-4# 1, TUG-3# 1, TUG-2# 1 VC-12# 1:
INTERVAL      CV    ES    SES    UAS
20:47-20:50   0    0    0    0

AU-4# 1, TUG-3# 1, TUG-2# 1 VC-12# 2:
INTERVAL      CV    ES    SES    UAS
20:47-20:50   0    0    0    0

AU-4# 1, TUG-3# 1, TUG-2# 1 VC-12# 3:
INTERVAL      CV    ES    SES    UAS
20:47-20:50   0    0    0    0
[display text omitted]

SONET 2/0/0  E1  1/1/1/1 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
INTERVAL      LCV  PCV  CSS  SEFS  LES  DM  ES  BES  SES  UAS  SS
20:47-20:50   0    0    0    0    0    0  0  0  0  0  0  0
SONET 2/0/0  E1  1/1/1/2 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
INTERVAL      LCV  PCV  CSS  SEFS  LES  DM  ES  BES  SES  UAS  SS
20:47-20:50   0    0    0    0    0    0  0  0  0  0  0  0
SONET 2/0/0  E1  1/1/1/3 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
INTERVAL      LCV  PCV  CSS  SEFS  LES  DM  ES  BES  SES  UAS  SS
20:46-20:50   0    1    0    0    0    0  0  0  0  0  32  0
[display text omitted]

```

When AUG mapping is AU-3, view information about the SONET controller by using the **sonet controller sonet slot/port [brief | tabular]** command for a Cisco 7200 series router. Use the **sonet controller sonet slot/port-adapter/port [brief | tabular]** command for a Cisco 7500 series router.

The following examples show sample output for a Cisco 7500 series router:

```

Router# show controller sonet 2/0/0
SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
H/W Version :0.2.3, ROM Version :1.2
FREEDM version :2, F/W Version :1.2.0
Applique type is Channelized Sonet/SDH
Clock Source is Internal, AUG mapping is AU3.

Medium info:
Type:SDH, Line Coding:NRZ, Line Type:Short SM

Regenerator Section Status:
No alarms detected.

Multiplex Section Status:
No alarms detected.

Higher Order Path Status:
Path# 1 has no defects
Path# 2 has no defects
Path# 3 has no defects

Lower Order Path Status:
VC-12 1/1/1 has no defects

```

```

VC-12 1/1/2 has no defects
VC-12 1/1/3 has no defects
VC-12 1/2/1 has no defects
[display text omitted]
Data in current interval (85 seconds elapsed):
  Regenerator Section:
    0 CVs, 0 ESs, 0 SESSs, 0 SEFSSs
  Multiplex Section:
    0 CVs, 0 ESs, 0 SESSs, 0 UASs
  Higher Order Path:
    Path# 1: 0 CVs, 0 ESs, 0 SESSs, 0 UASs
    Path# 2: 0 CVs, 0 ESs, 0 SESSs, 0 UASs
    Path# 3: 0 CVs, 0 ESs, 0 SESSs, 0 UASs
  Lower Order Path:
    VC-12 1/1/1: 0 CVs, 0 ESs, 0 SESSs, 0 UASs
    VC-12 1/1/2: 0 CVs, 0 ESs, 0 SESSs, 0 UASs
    VC-12 1/1/3: 0 CVs, 0 ESs, 0 SESSs, 0 UASs
    VC-12 1/2/1: 0 CVs, 0 ESs, 0 SESSs, 0 UASs
    VC-12 1/2/2: 0 CVs, 0 ESs, 0 SESSs, 0 UASs
[display text omitted]

```

```

SONET 2/0/0  E1  1/1/1 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
Data in current interval (85 seconds elapsed):
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
  0 Unavail Secs
SONET 2/0/0  E1  1/1/2 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
Data in current interval (85 seconds elapsed):
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
  0 Unavail Secs
[display text omitted]

```

```

Router# show controller sonet 2/0/0 brief
SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
  H/W Version :0.2.3, ROM Version :1.2
  FREEDM version :2, F/W Version :1.2.0
  Applique type is Channelized Sonet/SDH
  Clock Source is Internal, AUG mapping is AU3.

```

```

Medium info:
  Type:SDH, Line Coding:NRZ, Line Type:Short SM

```

```

Regenerator Section Status:
  No alarms detected.

```

```

Multiplex Section Status:
  No alarms detected.

```

```

Higher Order Path Status:
  Path# 1 has no defects
  Path# 2 has no defects
  Path# 3 has no defects

```

```

Lower Order Path Status:
  VC-12 1/1/1 has no defects
  VC-12 1/1/2 has no defects

```

```

VC-12 1/1/3 has no defects
VC-12 1/2/1 has no defects
[display text omitted]
SONET 2/0/0 E1 1/1/1 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
SONET 2/0/0 E1 1/1/2 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
SONET 2/0/0 E1 1/1/3 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
[display text omitted]

```

```

Router# show controller sonet 2/0/0 tabular
SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
H/W Version :0.2.3, ROM Version :1.2
FREEDM version :2, F/W Version :1.2.0
Applique type is Channelized Sonet/SDH
Clock Source is Internal, AUG mapping is AU3.

```

```

Medium info:
Type:SDH, Line Coding:NRZ, Line Type:Short SM

```

```

Regenerator Section Status:
No alarms detected.

```

```

Multiplex Section Status:
No alarms detected.

```

```

Higher Order Path Status:
Path# 1 has no defects
Path# 2 has no defects
Path# 3 has no defects

```

```

Lower Order Path Status:
VC-12 1/1/1 has no defects
VC-12 1/1/2 has no defects
VC-12 1/1/3 has no defects
VC-12 1/2/1 has no defects
[display text omitted]

```

```

Regenerator Section:
INTERVAL      CV      ES      SES      SEFS
21:22-21:24   0       0       0       0

```

```

Multiplex Section:
INTERVAL      CV      ES      SES      UAS
21:22-21:24   0       0       0       0

```

```

Higher Order Path:
Path# 1:
INTERVAL      CV      ES      SES      UAS
21:22-21:24   0       0       0       0

```

```

Path# 2:
INTERVAL      CV      ES      SES      UAS
21:22-21:24   0       0       0       0

```

```

Path# 3:
INTERVAL      CV      ES      SES      UAS
21:22-21:24   0       0       0       0

```

```

Lower Order Path:
AU-3# 1, TUG-2# 1 VC-12# 1:
INTERVAL      CV    ES    SES    UAS
21:22-21:24   0    0    0      0

AU-3# 1, TUG-2# 1 VC-12# 2:
INTERVAL      CV    ES    SES    UAS
21:22-21:24   0    0    0      0

AU-3# 1, TUG-2# 1 VC-12# 3:
INTERVAL      CV    ES    SES    UAS
21:22-21:24   0    0    0      0
[display text omitted]

SONET 2/0/0  E1  1/1/1 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
INTERVAL      LCV  PCV  CSS  SEFS  LES  DM  ES  BES  SES  UAS  SS
21:22-21:24   0    0    0    0    0    0  0  0  0  0  0
SONET 2/0/0  E1  1/1/2 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
INTERVAL      LCV  PCV  CSS  SEFS  LES  DM  ES  BES  SES  UAS  SS
21:22-21:24   0    0    0    0    0    0  0  0  0  0  0
SONET 2/0/0  E1  1/1/3 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
INTERVAL      LCV  PCV  CSS  SEFS  LES  DM  ES  BES  SES  UAS  SS
21:22-21:24   0    0    0    0    0    0  0  0  0  0  0
[display text omitted]

```

When AUG mapping is AU-4, view information about a specific E1 line of a SONET controller by using the **show controller sonet** *slot/port.au-4-number/tug-3-number/tug-2-number/e1-number* [**brief** | **tabular**] command for a Cisco 7200 series router.

Use the **show controller sonet** *slot/port-adapter/port.au-4-number/tug-3-number/tug-2-number/e1-number* [**brief** | **tabular**] command for a Cisco 7500 series router. This command displays error and performance statistics.

The following examples show sample output for a Cisco 7500 series router:

```

Router# show controller sonet 2/0/0.1/1/1/1

SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
  H/W Version :0.2.3, ROM Version :1.2
  FREEDM version :2, F/W Version :1.2.0
SONET 2/0/0  E1  1/1/1/1 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
Data in current interval (237 seconds elapsed):
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
  0 Unavail Secs

Router# show controller sonet 2/0/0.1/1/1/1 brief

SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
  H/W Version :0.2.3, ROM Version :1.2
  FREEDM version :2, F/W Version :1.2.0
SONET 2/0/0  E1  1/1/1/1 is up
No alarms detected.

```

Framing is crc4, Clock Source is internal, National bits are 0x1F.

Router# **show controller sonet 2/0/0.1/1/1/1 tabular**

```
SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
  H/W Version :0.2.3, ROM Version :1.2
  FREEDM version :2, F/W Version :1.2.0
SONET 2/0/0  E1  1/1/1/1 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
INTERVAL      LCV  PCV  CSS  SEFS  LES   DM   ES   BES  SES   UAS   SS
20:47-20:51   0    0    0    0    0    0    0    0    0    0    0    0
```

Router# **show controller sonet 0/0/0.1/2/4/1 brief**

```
SONET 0/0/0 is up.
Channelized OC-3/STM-1 SMI PA
  H/W Version : 0.2.3, ROM Version : 1.2
  FREEDM version : 2, F/W Version : 0.14.0
SONET 0/0/0  E1  1/2/4/1 is up
No alarms detected.
Framing is crc4, Clock Source is line, National bits are 0x1F.
```

Router# **show controller sonet 0/0/0.1/2/4/1 tabular**

```
SONET 0/0/0 is up.
Channelized OC-3/STM-1 SMI PA
  H/W Version : 0.2.3, ROM Version : 1.2
  FREEDM version : 2, F/W Version : 0.14.0
SONET 0/0/0  E1  1/2/4/1 is up
No alarms detected.
Framing is crc4, Clock Source is line, National bits are 0x1F.
INTERVAL      LCV  PCV  CSS  SEFS  LES   DM   ES   BES  SES   UAS   SS
16:56-16:57   0    0    0    0    0    0    0    0    0    0    1    0
```

When AUG mapping is AU-3, view information about a specific E1 line of a SONET controller by using the **show controller sonet slot/port.au-3-number/tug-2-number/e1-number [brief | tabular]** command for a Cisco 7200 series router.

Use the **show controller sonet slot/port-adapter/port.au-3-number/tug-2-number/e1-number [brief | tabular]** command for a Cisco 7500 series router. This command displays error and performance statistics.

The following examples show sample output for a Cisco 7500 series router:

Router# **show controller sonet 2/0/0.1/1/1**

```
SONET 2/0/0 is up.
Channelized OC-3/STM-1 SMI PA
  H/W Version :0.2.3, ROM Version :1.2
  FREEDM version :2, F/W Version :1.2.0
SONET 2/0/0  E1  1/1/1 is up
No alarms detected.
Framing is crc4, Clock Source is internal, National bits are 0x1F.
Data in current interval (175 seconds elapsed):
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
  0 Unavail Secs
```

Router# **show controller sonet 2/0/0.1/1/1 brief**

SONET 2/0/0 is up.
 Channelized OC-3/STM-1 SMI PA
 H/W Version :0.2.3, ROM Version :1.2
 FREEDM version :2, F/W Version :1.2.0
 SONET 2/0/0 E1 1/1/1 is up
 No alarms detected.
 Framing is crc4, Clock Source is internal, National bits are 0x1F.

Router# **show controller sonet 2/0/0.1/1/1 brief**

SONET 2/0/0 is up.
 Channelized OC-3/STM-1 SMI PA
 H/W Version : 0.2.3, ROM Version : 1.2
 FREEDM version : 2, F/W Version : 0.14.0
 SONET 2/0/0 E1 1/1/1 is down
 Transmitter is sending LOF Indication (RAI).
 Receiver has loss of frame.
 Framing is crc4, Clock Source is internal, National bits are 0x1F.

Router# **show controller sonet 2/0/0.1/1/1 tabular**

SONET 2/0/0 is up.
 Channelized OC-3/STM-1 SMI PA
 H/W Version : 0.2.3, ROM Version : 1.2
 FREEDM version : 2, F/W Version : 0.14.0
 SONET 2/0/0 E1 1/1/1 is down
 Transmitter is sending LOF Indication (RAI).
 Receiver has loss of frame.
 Framing is crc4, Clock Source is internal, National bits are 0x1F.

INTERVAL	LCV	PCV	CSS	SEFS	LES	DM	ES	BES	SES	UAS	SS
17:26-17:29	0	0	0	0	0	0	0	0	0	173	0
17:11-17:26	0	0	0	0	0	0	0	0	0	471	0
16:56-17:11	0	0	0	0	0	0	0	0	0	0	0
16:41-16:56	0	0	0	0	0	0	0	0	0	0	0
16:26-16:41	0	0	0	0	0	0	0	0	0	216	0
16:11-16:26	0	0	0	0	0	0	0	0	0	225	0
Total	0	0	0	0	0	0	0	0	0	912	0

Monitoring and Maintaining the PA-MC-STM-1

To monitor and maintain the PA-MC-STM-1, use the **show interface** command.

The following sample output displays the interface statistics of a PA-MC-STM-1 in port adapter slot 0 of a VIP4 in interface processor slot 2 of a Cisco 7500 series router:

```
Router# show interface serial 2/0/0.1.1.1.1:1

Serial2/0/0.1/1/1/1:1 is up, line protocol is up
Hardware is cyBus Channelized OC3/STM-1 PA
Internet address is 105.105.105.1/24
MTU 1500 bytes, BW 1984 Kbit, DLY 20000 usec, rely 255/255, load 36/255
Encapsulation HDLC, loopback not set
Keepalive not set
Last input 00:00:00, output 00:00:00, output hang never
Last clearing of "show interface" counters never
Input queue: 1/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
Conversations 0/1/256 (active/max active/max total)
Reserved Conversations 0/0 (allocated/max allocated)
5 minute input rate 286000 bits/sec, 36 packets/sec
5 minute output rate 284000 bits/sec, 36 packets/sec
8019 packets input, 11695347 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
7991 packets output, 11650799 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 output buffer failures, 0 output buffers swapped out
2 carrier transitions no alarm present
Timeslot(s) Used:1-31, Transmitter delay is 0 flags, transmit queue length 6
[Additional display text for remaining interfaces omitted]
```

Configuration Examples

This section provides the following configuration examples:

- [Configuring the PA-MC-STM-1 Example](#)
- [Configuring a Logical Channel Group on an E1 Line Example](#)
- [Configuring a Channel Group Interface Example](#)
- [Configuring an E1 Unframed Channel Example](#)

Configuring the PA-MC-STM-1 Example

You can configure each of the AUGs and TUGs of a PA-MC-STM-1 to carry a set of E1 links that are mapped into tributary unit level-12s (TU-12s).

In the following example, SDH framing, internal clock source, AUG mapping au-4 and idle pattern are configured:

```
Router(config)# controller sonet 1/0
Router(config-controller)# framing sdh
Router(config-controller)# clock source internal
Router(config-controller)# aug mapping au-4
```

```

Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# mode c-12
Router(config-ctrlr-tug3)# tug-2 4 e1 channel-group 15 timeslots 1-5, 20-23
Router(config-ctrlr-tug3)# idle pattern 0x0

```

Configuring a Logical Channel Group on an E1 Line Example

To configure a logical channel group on an E1 line, use the **tug-2** *tug-2-number* **e1** *e1-number* **channel-group** *channel-group-number* **timeslots** *list-of-timeslots* command. In the following example, logical channel group 15 on E1 line 1 is configured and channelized time slots 1 to 5 and 20 to 23 are assigned to the newly created logical channel group:

```

Router(config)# controller sonet 1/0/0
Router(config-controller)# framing sdh
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# mode c-12
Router(config-ctrlr-tug3)# tug-2 4 e1 1 channel-group 15 timeslots 1-5, 20-23

```

Configuring a Channel Group Interface Example

Once a channel group has been created, interface serial configuration commands may be used as in the following example:

```

Router(config)# controller sonet 1/0/0
Router(config-controller)# framing sdh
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# mode c-12
Router(config-ctrlr-tug3)# tug-2 4 e1 10 channel-group 15 timeslots 1-5, 20-23
Router(config-ctrlr-tug3)# exit
Router(config-controller)# exit
Router(config)# interface serial 1/1/0.1/2/4/1:15
Router(config-if)# ip address 1.1.1.10 255.255.255.252
Router(config-if)# encapsulation ppp

```

Configuring an E1 Unframed Channel Example

To create an unframed or clear channel logical channel group on an E1 line, use the **tug-2** *tug-2-number* **e1** *e1-number* **unframed** command, as shown in the following example:

```

Router(config)# controller sonet 1/0/0
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 unframed
Router(config-ctrlr-tug3)# mode c-12

```

Command Reference

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

- [au-3](#)
- [au-4 tug-3](#)
- [aug mapping](#)
- [framing](#)
- [mode](#)
- [tug-2 e1 bert pattern](#)
- [tug-2 e1 channel-group timeslots](#)
- [tug-2 e1 clock source](#)
- [tug-2 e1 framing](#)
- [tug-2 e1 loopback](#)
- [tug-2 e1 national bits](#)
- [tug-2 e1 shutdown](#)
- [tug-2 e1 unframed](#)

au-3

To configure a particular AU-3 of an E1 line that has been mapped to an AU-3, use the **au-3** command in configuration controller mode.

au-3 *au-3-number*

Syntax Description

<i>au-3-number</i>	A number in the range of 1 to 3.
--------------------	----------------------------------

Defaults

No default behaviors or values.

Command Modes

Configuration controller

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

An AUG of an STM-1 can be derived from either AU-3s or an AU-4. Use the **aug mapping au-3** configuration controller command to map the AUG to an AU-3 with the following muxing, alignment, and mapping:

C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> VC-3 <--> AU-3 <--> AUG

Configuring the **au-3** command enables you to enter configuration controller au3 command mode and creates a serial interface with the following name format for Cisco 7200 series routers and Catalyst 6000 family switches:

slot/port.au-3-number/tug-2-number/e1-number

Configuring the **au-3** command enables you to enter configuration controller au3 command mode and creates a serial interface with the following name format for Cisco 7500 series routers:

slot/port-adapter/port.au-3-number/tug-2-number/e1-number

The **aug mapping au-3** and **au-3** commands are available only when SDH framing is configured.

Examples

The following example shows how to configure AUG mapping to be derived from an AU-3 and selects AU-3 3 to configure as a serial interface on a Cisco 7500 series router:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-3
Router(config-ctrlr-au3)# au-3 3
```

Related Commands	Command	Description
	aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
	au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

au-4 tug-3

To specify the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4, use the **au-4 tug-3** command in configuration controller mode.

```
au-4 au-4-number tug-3 tug-3-number
```

Syntax Description

<i>au-4-number</i>	A number in the range of 1 to <i>n</i> where <i>n</i> is the STM level. (For the PA-MC-STM-1, <i>n</i> is always 1.)
<i>tug-3-number</i>	A number in the range of 1 to 3.

Defaults

No default behaviors or values.

Command Modes

Configuration controller

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

An AUG of an STM-1 can be derived from either AU-3s or an AU-4. Use the **aug mapping au-4** configuration controller command to map the AUG to an TUG-3 with the following muxing, alignment, and mapping:

```
C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> TUG-3 <--> VC-4 <--> AU-4 <--> AUG
```

Configuring the **au-4** command enables you to enter configuration controller **tug3** command mode and creates a serial interface with the following name format for Cisco 7200 series routers or Catalyst 6000 family switches:

```
slot/port.au-4-number/tug-2-number/e1-number
```

Configuring the **au-4** command enables you to enter configuration controller **tug3** command mode and creates a serial interface with the following name format for Cisco 7500 series routers:

```
slot/port-adapter/port.au-4-number/tug-2-number/e1-number
```

The **aug mapping au-4** and **au-4 tug-3** commands are available only when SDH framing is configured.

Examples

The following example shows how to configure AUG mapping to be derived from a TUG-3 and selects TUG-3 1 of AU-4 1 to configure on a Cisco 7500 series router:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-4
Router(config-ctrlr-tug3)# au-4 1 tug-3 1
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

aug mapping

To configure the AUG mapping mode of the PA-MC-STM-1, use the **aug mapping** command in configuration controller mode. To disable AUG mapping mode, use the **no** form of this command.

```
aug mapping {au-3 | au-4}
```

```
no aug mapping {au-3 | au-4}
```

Syntax Description

au-3	Configures the AUG to be derived from AU-3.
au-4	Configures the AUG to be derived from AU-4.

Defaults

au-4

Command Modes

Configuration controller

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

An AUG of an STM-1 can be derived from either AU-3s or an AU-4. If you configure the AUG mapping to AU-3, the following muxing, alignment, and mapping is configured:

```
C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> VC-3 <--> AU-3 <--> AUG
```

If you configure the AUG mapping to AU-4 the following muxing, alignment, and mapping is configured:

```
C-12 <--> VC-12 <--> TU-12 <--> TUG-2 <--> TUG-3 <--> VC-4 <--> AU-4 <--> AUG
```

This command is available only when SDH framing is configured.

Examples

The following example shows how to configure AUG mapping to be derived from an AU-3 on a Cisco 7500 series router:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-3
Router(config-ctrlr-au3)# au-3 1
```

The following example shows how to configure AUG mapping to be derived from an AU-4 on a Cisco 7200 series router:

```
Router(config)# controller sonet 2/0
Router(config-controller)# aug mapping au-4
Router(config-ctrlr-tug3)# au-4 1 tug-3 1
```

Related Commands

Command	Description
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

framing

To configure the framing mode of the PA-MC-STM-1, use the **framing** command in configuration controller mode. To disable the framing mode, use the **no** form of this command.

framing {sonet | sdh}

no framing {sonet | sdh}

Syntax Description

sonet	Configures the PA-MC-STM-1 to be used in SONET mode.
sdh	Configures the PA-MC-STM-1 to be used in SDH mode.

Defaults

SONET

Command Modes

Configuration controller

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

Use the **framing** command to select the framing mode, SONET or SDH, for the PA-MC-STM-1.

Examples

The following example shows how to configure the framing mode of the PA-MC-STM-1 to SDH on a Cisco 7500 VXR router or a Catalyst 6000 family switch:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# framing sdh
```

The following example shows how to configure the framing mode of the PA-MC-STM-1 to SDH on a Cisco 7200 series router:

```
Router(config)# controller sonet 2/0
Router(config-controller)# framing sdh
```

Related Commands

Command	Description
tug-2 e1 unframed	Creates an E1 unframed (clear channel) logical channel group on an E1 line that has been mapped to an AU-3.
tug-2 e1 framing	Sets the type of framing used by an E1 line.

mode

To configure the mode of an E1 line that has been mapped to a TUG-3, use the **mode** command in configuration controller tug3 mode.

To configure the mode of an E1 line that has been mapped to an AU-3, use the **mode** command in configuration controller au3 mode.

Use the **no** form of this command to disable the mode configuration.

```
mode {c-12}
```

```
no mode {c-12}
```

Syntax Description

c-12	The TUG-3 or AU-3 is divided into 21 TU-12s, each carrying an E1.
-------------	---

Defaults

c-12

Command Modes

Configuration controller tug3 (for an E1 line mapped to a TUG-3)
Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

You can configure each of the TUG-3s or AU-3s of a PA-MC-STM-1 to carry a set of TU-12s (E1s mapped into TU-12s). The **mode c-12** command configures the mode of operation of a TUG-3 or AU-3 and specifies that the TUG-3 or AU-3 is divided into 21 TU-12s, each carrying an E1.

Examples

The following example shows how to configure the AUG-mapping of the SONET controller to AU-3 and specifies the mode of AU-3 1 to c-12 on a Cisco 7500 series router:

```
Router(config)# controller sonet 1/0/0
Router(config-controller)# aug mapping au-3
Router(config-controller)# au3 1
Router(config-ctrlr-au3)# mode c-12
```

The following example configures the AUG-mapping of the SONET controller to AU-4 and specifies the mode of TUG-3 1 of AU-4 1 to c-12 on a Cisco 7200 series router:

```
Router(config)# controller sonet 1/0  
Router(config-controller)# aug mapping au-4  
Router(config-controller)# au-4 1 tug-3 1  
Router(config-ctrlr-tug3)# mode c-12
```

tug-2 e1 bert pattern

To send a BER test pattern on an E1 line that has been mapped to a TUG-3, use the **tug-2 e1 bert pattern** command in configuration controller tug3 mode.

To send a BER test pattern on an E1 line that has been mapped to an AU-3, use the **tug-2 e1 bert pattern** command in configuration controller au3 mode.

To stop the BER test, use the **no** form of this command.

```
tug-2 tug-2 number e1 e1-number [bert pattern pattern interval time]
```

```
no tug-2 tug-2 number e1 e1-number [bert pattern pattern interval time]
```

Syntax Description

<i>tug-2 number</i>	A number in the range of 1 to 7.
<i>e1-number</i>	A number in the range of 1 to 3.
<i>pattern</i>	<ul style="list-style-type: none"> 2¹¹, pseudorandom test pattern (2048 bits long). 2¹⁵, pseudorandom O.151 test pattern (32,768 bits long). 2²⁰-O153, 2²⁰-1 O.153 test pattern. 2²⁰-QRSS, pseudorandom QRSS O.151 test pattern (1,048,575 bits long).
<i>time</i>	An interval in the range of 1 to 14,400 minutes.

Defaults

No BER test is configured.

Command Modes

Configuration controller tug3 (for an E1 line mapped to a TUG-3)
Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

Use the **tug-2 e1 bert pattern** command in configuration controller tug3 command mode to send a BER test on an E1 line that has been mapped to a TUG-3 via the **aug mapping au-4** command.

Use the **tug-2 e1 bert pattern** command in configuration controller au3 command mode to send a BER test on an E1 line that has been mapped to an AU-3 via the **aug mapping au-3** command.

To view the test results of a BER test pattern, use the **show controller sonet** command.

Examples

The following example shows how to send a BER 2¹¹ pseudorandom pattern through E1 line 1, that has been mapped to a TUG-3 on a Cisco 7500 series router, for five minutes:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 bert pattern 2^11 interval 5
```

The following example shows how to send a BER 2¹⁵ pseudorandom pattern through E1 line 1, that has been mapped to an AU-3 on a Cisco 7200 series router, for ten minutes:

```
Router(config)# controller sonet 2/0
Router(config-controller)# aug mapping au-3
Router(config-controller)# au-3 1
Router(config-ctrlr-au3)# tug-2 4 e1 1 bert pattern 2^15 interval 10
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

tug-2 e1 channel-group timeslots

To create a logical channel group on an E1 line that has been mapped to a TUG-3, use the **tug-2 e1 channel-group timeslots** command in configuration controller tug3 mode.

To create a logical channel group on an E1 line that has been mapped to an AU-3, use the **tug-2 e1 channel-group timeslots** command in configuration controller au3 mode.

To remove a logical channel group, use the **no** form of this command.

```
tug-2 tug-2 number e1 e1-number [[channel-group channel-group-number] [timeslots
list-of-timeslots]]
```

```
no tug-2 tug-2 number e1 e1-number [[channel-group channel-group-number] [timeslots
list-of-timeslots]]
```

Syntax Description

<i>tug-2 number</i>	A number in the range of 1 to 7.
<i>e1-number</i>	A number in the range of 1 to 31.
channel-group	Defines a logical channel group to be a channelized E1 line.
<i>channel-group-number</i>	A number in the range of 0 to 30.
timeslots	Creates the time slots that make up the E1 line.
<i>list-of-timeslots</i>	A number in the range of 1 to 31 or a combination of subranges within 1 to 31.

Defaults

No channel groups are configured on an E1 line.

Command Modes

Configuration controller tug3 (for an E1 line mapped to a TUG-3)

Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

Use the **tug-2 e1 channel-group timeslots** command in configuration controller tug3 command mode to configure a logical channel group on an E1 line that has been mapped to a TUG-3 via the **aug mapping au-4** command.

Use the **tug-2 e1 channel-group timeslots** command in configuration controller au3 command mode to configure a logical channel group on an E1 line that has been mapped to an AU-3 via the **aug mapping au-3** command.

Examples

The following example shows how to configure logical channel group 15 on E1 1, that is mapped to a TUG-3, and assigns channelized time slots 1 to 5 and 20 to 23 on a Cisco 7500 series router:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# framing sdh
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 channel group 15 timeslots 1-5, 20-23
```

The following example shows how to configure logical channel group 10 on E1 1, that is mapped to an AU-3, and assigns channelized time slots 1 to 5 and 20 to 23 on a Cisco 7200 series router:

```
Router(config)# controller sonet 2/0
Router(config-controller)# framing sdh
Router(config-controller)# aug mapping au-3
Router(config-controller)# au-3 1
Router(config-ctrlr-au3)# tug-2 4 e1 1 channel group 10 timeslots 1-5, 20-23
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.
tug-2 e1 unframed	Creates an unframed (clear channel) logical channel group on an E1 line.
tug-2 e1 framing	Specifies the type of framing used by the E1 lines.

tug-2 e1 clock source

To set the clock source on an E1 line that has been mapped to a TUG-3, use the **tug-2 e1 clock source** command in configuration controller tug3 mode.

To set the clock source on an E1 line that has been mapped to an AU-3, use the **tug-2 e1 clock source** command in configuration controller au3 mode.

```
tug-2 tug-2 number e1 e1-number clock source {internal | line}
```

Syntax Description

<i>tug-2 number</i>	A number in the range of 1 to 7.
<i>e1-number</i>	A number in the range of 1 to 3.
internal	Specifies the PA-MC-STM-1 as the clock source.
line	Specifies the E1 line as the clock source.

Defaults

Clock source is configured from the E1 line.

Command Modes

Configuration controller tug3 (for an E1 line mapped to a TUG-3)
Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

Use the **tug-2 e1 clock source** command in configuration controller tug3 command mode to configure the clock source of an E1 line that has been mapped to a TUG-3 via the **aug mapping au-4** command.

Use the **tug-2 e1 clock source** command in configuration controller au3 command mode to configure the clock source of an E1 line that has been mapped to an AU-3 via the **aug mapping au-3** command.

Examples

The following example shows how to configure E1 line 1, that has been mapped to an AU-3 on a Cisco 7500 series router, to be the clock source:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-3
Router(config-controller)# au-3 1
Router(config-ctrlr-au3)# tug-2 4 e1 1 clock source line
```

The following example shows how to configure E1 line 1, that has been mapped to a TUG-3 on a Cisco 7200 series router to use the PA-MC-STM-1, as the clock source:

```
Router(config)# controller sonet 2/0
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 clock source internal
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

tug-2 e1 framing

To set the type of framing used by an E1 line that has been mapped to a TUG-3, use the **tug-2 e1 framing** command in configuration controller tug3 mode.

To set the type of framing used by an E1 line that has been mapped to an AU-3, use the **tug-2 e1 framing** command in configuration controller au3 mode.

To disable the framing mode, use the **no** form of this command.

```
tug-2 tug-2 number e1 e1-number framing {crc4 | no-crc4}
```

```
no tug-2 tug-2 number e1 e1-number framing {crc4 | no-crc4}
```

Syntax Description

<i>tug-2 number</i>	A number in the range of 1 to 7.
<i>e1-number</i>	A number in the range of 1 to 3.
crc4	Specifies 4-bit cyclic redundancy check framing.
no-crc4	Specifies basic framing.

Defaults

Framing format is crc4.

Command Modes

Configuration controller tug3 (for an E1 line mapped to a TUG-3)
Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

Use the **tug-2 e1 framing** command in configuration controller tug3 command mode to configure the type of framing used by an E1 line that has been mapped to a TUG-3 via the **aug mapping au-4** command.

Use the **tug-2 e1 framing** command in configuration controller au3 command mode to configure the type of framing used by an E1 line that has been mapped to an AU-3 via the **aug mapping au-3** command.

Examples

The following example shows how to configure E1 line 1, that has been mapped to a TUG-3 on a Cisco 7500 series router, to use crc4 framing:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 framing crc4
```

The following example configures E1 line 1, that has been mapped to an AU-3 on a Cisco 7200 series router, to use basic framing:

```
Router(config)# controller sonet 2/0
Router(config-controller)# aug mapping au-3
Router(config-controller)# au-3 1
Router(config-ctrlr-au3)# tug-2 4 e1 1 framing no-crc4
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.
tug-2 e1 unframed	Creates an unframed (clear channel) logical channel group on an E1 line.

tug-2 e1 loopback

To specify a loopback on an E1 line that has been mapped to a TUG-3, use the **tug-2 e1 loopback** command in configuration controller tug3 mode.

To specify a loopback on an E1 line that has been mapped to an AU-3, use the **tug-2 e1 loopback** command in configuration controller au3 mode.

To disable the loopback, use the **no** form of this command.

```
tug-2 tug-2 number e1 e1-number loopback {local | network {line | payload}}
```

```
no tug-2 tug-2 number e1 e1-number loopback {local | network {line | payload}}
```

Syntax Description

<i>tug-2 number</i>	A number in the range of 1 to 7.
<i>e1-number</i>	A number in the range of 1 to 3.
local	Loops transmitted E1 output back to the router via the internal E1 framer.
network {line payload}	Sets the loopback toward the network before going through the framer (line) or after going through the framer (payload).

Defaults

No loopbacks are set on an E1 line.

Command Modes

Configuration controller tug3 (for an E1 line mapped to a TUG-3)
Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

Use the **tug-2 e1 loopback** command in configuration controller tug3 command mode to specify a loopback for an E1 line that has been mapped to a TUG-3 via the **aug mapping au-4** command.

Use the **tug-2 e1 loopback** command in configuration controller au3 command mode to specify a loopback for an E1 line that has been mapped to an AU-3 via the **aug mapping au-3** command.

Examples

The following example shows how to set E1 line 1, that has been mapped to an AU-3 on a Cisco 7500 series router, into network line loopback:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-3
Router(config-controller)# au-3 1
Router(config-ctrlr-au3)# tug-2 4 e1 1 loopback network line
```

The following example shows how to set E1 line 1, that has been mapped to a TUG-3 on a Cisco 7200 series router, into local loopback:

```
Router(config)# controller sonet 2/0
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 loopback local
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

tug-2 e1 national bits

To set the national reserved bits on an E1 line that has been mapped to a TUG-3, use the **tug-2 e1 national bits** command in configuration controller tug3 mode.

To set the national reserved bits on an E1 line that has been mapped to an AU-3, use the **tug-2 e1 national bits** command in configuration controller au3 mode.

tug-2 *tug-2 number* **e1** *e1-number* **national bits** *pattern*

Syntax Description		
<i>tug-2 number</i>		A number in the range of 1 to 7.
<i>e1-number</i>		A number in the range of 1 to 3.
<i>pattern</i>		The national reserved bit pattern is a hexadecimal value in the range 0x0 to 0x1F (hexadecimal) or 0 to 31 (decimal).

Defaults 0x1F

Command Modes Configuration controller tug3 (for an E1 line mapped to a TUG-3)
Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History	Release	Modification
	12.0(14)S	This command was introduced.
	12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
	12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines Use the **tug-2 e1 national bits** command in configuration controller tug3 command mode to configure the national reserved bits for an E1 line that has been mapped to a TUG-3 via the **aug mapping au-4** command.

Use the **tug-2 e1 national bits** command in configuration controller au3 command mode to configure the national reserved bits for an E1 line that has been mapped to an AU-3 via the **aug mapping au-3** command.

Examples The following example shows how to configure the national reserved bits for E1 line 1, that has been mapped to a TUG-3 on a Cisco 7500 series router, into a 0x0 hexadecimal pattern:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 national bits 0x0
```

The following example shows how to configure the national reserved bits for E1 line 1, that has been mapped to an AU-3 on a Cisco 7200 series router, into decimal pattern 0:

```
Router(config)# controller sonet 2/0
Router(config-controller)# aug mapping au-3
Router(config-controller)# au-3 1
Router(config-ctrlr-au3)# tug-2 4 e1 1 national bits 0
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

tug-2 e1 shutdown

To shut down an individual E1 line that has been mapped to a TUG-3, use the **tug-2 e1 shutdown** command in configuration controller tug3 mode.

To shut down an individual E1 line that has been mapped to an AU-3, use the **tug-2 e1 shutdown** command in configuration controller au3 mode.

To enable an individual E1 line, use the **no** form of this command.

tug-2 *tug-2 number* **e1** *e1-number* **shutdown**

no **tug-2** *tug-2 number* **e1** *e1-number* **shutdown**

Syntax Description

<i>tug-2 number</i>	A number in the range of 1 to 7.
<i>e1-number</i>	A number in the range of 1 to 3.
shutdown	Shuts down an individual E1 line.

Defaults

E1 lines are not shut down.

Command Modes

Configuration controller tug3 (for an E1 line mapped to a TUG-3)
Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

Use the **tug-2 e1 shutdown** command in configuration controller tug3 command mode to shut down an individual E1 line that has been mapped to a TUG-3 via the **aug mapping au-4** command.

Use the **tug-2 e1 shutdown** command in configuration controller au3 command mode to shut down an individual E1 line that has been mapped to an AU-3 via the **aug mapping au-3** command.

Examples

The following example shows how to shut down E1 line 1 that has been mapped to an AU-3 on a Cisco 7500 series router:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-3
Router(config-controller)# au-3 1
Router(config-ctrlr-au3)# tug-2 4 e1 1 shutdown
```

The following example shows how to shut down E1 line 1 that has been mapped to a TUG-3 on a Cisco 7200 series router:

```
Router(config)# controller sonet 2/0
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 shutdown
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

tug-2 e1 unframed

To create an E1 unframed (clear channel) logical channel group on an E1 line that has been mapped to a TUG-3, use the **tug-2 e1 unframed** command in configuration controller tug3 mode.

To create an E1 unframed (clear channel) logical channel group on an E1 line that has been mapped to an AU-3, use the **tug-2 e1 unframed** command in configuration controller au3 mode.

To remove a logical channel group, use the **no** form of this command.

```
tug-2 tug-2 number e1 e1-number unframed
```

```
no tug-2 tug-2 number e1 e1-number unframed
```

Syntax Description

<i>tug-2 number</i>	A number in the range of 1 to 7.
<i>e1-number</i>	A number in the range of 1 to 3.
unframed	Configures an E1 unframed channel.

Defaults

No default behavior or values.

Command Modes

Configuration controller tug3 (for an E1 line mapped to a TUG-3)
Configuration controller au3 (for an E1 line mapped to an AU-3)

Command History

Release	Modification
12.0(14)S	This command was introduced.
12.1(7)E	This command was integrated into Cisco IOS Release 12.1(7)E. Support for this command was added for Cisco 7200 VXR routers and Catalyst 6000 family switches.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

Use the **tug-2 e1 unframed** command in configuration controller tug3 command mode to create an unframed (clear channel) logical channel group on an E1 line that has been mapped to a TUG-3 via the **aug mapping au-4** command.

Use the **tug-2 e1 unframed** command in configuration controller au3 command mode to create an unframed (clear channel) logical channel group on an E1 line that has been mapped to an AU-3 via the **aug mapping au-3** command.

The channel group number for unframed E1 lines is always 0.

Examples

The following example shows how to configure an unframed logical channel group on E1 line 1 that has been mapped to a TUG-3 on a Cisco 7500 series router:

```
Router(config)# controller sonet 2/0/0
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 2
Router(config-ctrlr-tug3)# tug-2 4 e1 1 unframed
```

The following example shows how to configure an unframed logical channel group on E1 line 1 that has been mapped to an AU-3 on a Cisco 7200 series router:

```
Router(config)# controller sonet 2/0
Router(config-controller)# aug mapping au-3
Router(config-controller)# au-3 1
Router(config-ctrlr-au3)# tug-2 4 e1 1 unframed
```

Related Commands

Command	Description
aug mapping	Configures the AUG mapping mode of the PA-MC-STM-1.
au-3	Configures a particular AU-3 of an E1 line that has been mapped to an AU-3.
au-4 tug-3	Specifies the AU-4 and TUG-3 number of an E1 line that has been mapped to an AU-4.

Glossary

AUG—administrative unit group in SDH mode

BER—bit error rate

CAS—channel-associated signalling

CRC4—cyclic redundancy check. Error-checking technique in which the frame recipient calculates a remainder by dividing frame contents by a prime binary divisor and compares the calculated remainder to a value stored in the frame by the sending node.

E1—A digital carrier used to transmit a formatted signal at 2.048 Mbps.

ITU—International Telecommunication Union—Telecommunication standards sector

PRI—Primary Rate Interface

SDH—synchronous digital hierarchy. The ITU equivalent of SONET.

SONET—Synchronous Optical Network. The ANSI specification describing the data format used in high-speed optical data transmission

STM-n—Synchronous Transport Module level-n (STM-1 is 155.52 Mbps.)

TU-n—tributary unit level-n

TUG-n—tributary unit group-n

VC—virtual circuit

VC-n—virtual container level-n

VIP—Virtual Interface Processor

