



CHAPTER 19

Configuring the 1-Port Channelized STM-1/OC-3 SPA

This chapter provides information about configuring the 1-Port Channelized STM-1/OC-3 SPA on Cisco ASR 1000 Series Routers. It includes the following sections:

- [Configuration Tasks, page 19-1](#)
- [Verifying the Interface Configuration, page 19-24](#)
- [Configuration Examples, page 19-26](#)

For information about managing your system images and configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications.

For more information about the commands used in this chapter, refer to the *Cisco IOS Software Releases Command Reference* for your Cisco IOS release. For more information, see the “[Related Documentation](#)” section on page -xx.

Configuration Tasks

This section describes how to configure the 1-Port Channelized STM-1/OC-3 SPA for the Cisco ASR 1000 Series Router and includes information about verifying the configuration. This document shows how to configure the 1-Port Channelized STM-1/OC-3 SPA in either synchronous optical network (SONET) or synchronous digital hierarchy (SDH) framing modes.

It includes the following topics:

- [Selecting the Physical Port and Controller Configuration, page 19-2](#)
- [Required Configuration Tasks, page 19-3](#)
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Selecting the Physical Port and Controller Configuration

This section describes how to understand the address format used to specify the physical location of the SIP, SPAs, and interfaces.

To select the physical port and controller configuration, use the **controller sonet** *slot / subslot / port* command, where:

- *slot*—Specifies the chassis slot number in the Cisco 7600 series router where the SIP is installed.
- *subslot*—Specifies the slot of the SIP where the SPA is installed.

If the 1-Port Channelized STM-1/OC-3 SPA sits in subslot 0 of a Cisco ASR 1000 SIP in slot 3, the 1-Port Channelized STM-1/OC-3 SPA port would be identified as controller SONET 3/0/0. Since there is only 1 port on a 1-Port Channelized STM-1/OC-3 SPA, the port number is always 0.

For the channelized 1-Port Channelized STM-1/OC-3 SPA, the interface address format is: *slot/subslot/port:channel-group*, where:

- *channel-group*—Specifies the logical channel group assigned to the time slots within the T1 link.

For more information about identifying slots and subslots, see the [“Identifying Slots and Subslots for the SIP and SPAs” section on page 4-1](#).

Naming the Interface

Interface names are automatically generated, and the format will be dependent on the mode each particular linecard is operating on. The name formats of the serial interface created are listed below.

SONET Mode

- If framing is SONET and mode is vt-15:
interface serial [*slot / subslot / port*].[*sts1 / vtg / t1*]:[*channel-group*]
- If framing is SONET and mode is CT3
interface serial [*slot / subslot / port*].[*ds3 / t1*]:[*channel-group*]
- If framing is SONET and mode is T3:
interface serial [*slot / subslot / port*].[*ds3*]

SDH Mode

If the aug mapping is au-4, the au-4 value is always 1; if the aug mapping is au-3, then the only supported mode is c-11 (carrying a T1).

- If SDH-AUG mapping is au-4 and if the tug-3 is mode t3/e3:
interface serial [*slot / subslot / port*].[*au-4 / tug-3 / tug-2 / e1*]:[*channel-group*]
- If SDH-AUG mapping is au-3:
interface serial [*slot / subslot / port / au-3 / tug-2 / t1*]:[*channel-group*]

For channelized T3 mode

- If framing is SONET or SDH with au-3:
interface serial [*slot \ subslot \ port*] [*ds3 \ ds1*]:[*channel-group*]

Selecting the Physical Port and Controller Configuration—SONET or SDH Mode

To create the interface for the 1-Port Channelized STM-1/OC-3 SPA, complete this step:

	Command	Purpose
Step 1	Router(config)# controller sonet <i>slot/subslot/port</i>	Selects the controller to configure and enter controller configuration mode. <ul style="list-style-type: none"> <i>slot/subslot/port</i>—Specifies the location of the interface. <p>The port number is always zero on the 1-Port Channelized STM-1/OC-3 SPA.</p>


Note

You must complete this step to configure the 1-Port Channelized STM-1/OC-3 SPA in SDH mode as well as SONET mode.

Required Configuration Tasks

This section lists the required configuration steps to configure the 1-Port Channelized STM-1/OC-3 SPA. Some of the required configuration commands implement default values that might be appropriate for your network.

This section includes the following topics:

- [Configuring SONET Mode, page 19-4](#)
- [Configuring SDH Mode, page 19-5](#)
- [Configuring Channelized DS3 Mode, page 19-7](#)
- [Configuring DS1 \(Channelized T3 mode\), page 19-9](#)
- [Configuring E1 \(Channelized T3/E3 mode\), page 19-11](#)
- [Configuring Unchannelized E3 Serial Interface, page 19-12](#)
- [Verifying the Interface Configuration, page 19-13](#)

Configuring SONET Mode

To configure the SONET controller, complete these steps:

	Command	Purpose
Step 1	Router(config-controller)# [no] framing { sonet sdh }	Selects the framing type. <ul style="list-style-type: none"> • sonet—Specifies SONET as the frame type. This is the default. • sdh—Specifies SDH as the frame type.
Step 2	Router(config-controller)# [no] clock source { internal line }	Sets the clock source. <ul style="list-style-type: none"> • internal—Specifies that the internal clock source is used. • line—Specifies that the network clock source is used. This is the default for T1 and E1.
Step 3	Router(config-controller)# [no] loopback { local network }	Enables or disables loopback mode on a SONET controller. <ul style="list-style-type: none"> • local loopback—Loops data from the transmit path to the receive path. • network loopback—Loops data received on the external port to the transmit path and back out the external port. <p>The default is disabled loopback.</p>
Step 4	Router(config-controller)# sts-1 sts1-#	Specifies the SONET Synchronous Transport Signal (STS) level and enters STS1 configuration mode. <ul style="list-style-type: none"> • <i>sts-1 #</i>—STS values are 1 to 3.
Step 5	Router(config-ctrlr-sts1)# [no] mode { ct3 ct3-e1 t3 vt-15 }	Specifies the mode of operation of an STS-1 path. <ul style="list-style-type: none"> • ct3—A STS-1 carrying a DS3 signal is divided into 28 T1s (Plesiochronous Digital Hierarchy [PDH]). • ct3-e1—The channelized T3 is carrying E1 circuits. • t3—STS-1 carries an unchannelized (clear channel) T3. • vt-15—A STS-1 is divided into seven Virtual Tributary Groups (VTG). Each VTG is then divided into four VT1.5's, each carrying a T1.
Step 6	Router(config-ctrlr-sts1)# vtg vtg#	Configures the T1 on the VTG. <ul style="list-style-type: none"> • <i>vtg#</i>—Specifies the VTG number. For SONET framing, values are 1 to 7.

Configuring SDH Mode

To configure SDH mode, complete the following steps:

	Command	Purpose
Step 1	Router(config-controller)# framing { sonet sdh }	Selects the framing type. <ul style="list-style-type: none"> • sonet—Specifies SONET as the frame type. This is the default. • sdh—Specifies SDH as the frame type.
Step 2	Router(config-controller)# [no] aug mapping { au-3 au-4 }	Configures AUG mapping for SDH framing. If the AUG mapping is configured to be AU-4, then the following muxing, alignment, and mapping will be used: TUG-3 <--> VC-4 <--> AU-4 <--> AUG If the mapping is configured to be AU-3, then the following muxing, alignment, and mapping will be used: VC-3 <--> AU-3 <--> AUG Default is au-4 .
Step 3	Router(config-controller)# [no] clock source { internal line }	Sets the clock source. <ul style="list-style-type: none"> • internal—Specifies that the internal clock source is used. • line—Specifies that the network clock source is used. This is the default for T1 and E1.

	Command	Purpose
Step 4	Router(config-controller)# [no] au-4 1 tug-3 tug-3# or Router(config-controller)# [no] au-3 au-3#	<p>Configures AU-3, AU-4, and tributary unit groups, type 3 (TUG-3) for AU-4 and enters specific configuration mode.</p> <p>Depending on the framing mode of SONET or SDH, each STS-1, AU-3, TUG-3, and AU-4 of a 1-Port Channelized STM-1/OC-3 SPA can be configured with one of these commands.</p> <p>Depending on currently configured AUG mapping setting, this command further specifies TUG-3, AU-3, AU-4 or STS-1 muxing. The CLI command parser enters into config-ctrlr-tug3 (SDH mode), config-ctrlr-au3 (SDH mode), or config-ctrlr-sts1 parser mode (SONET mode), which makes only relevant commands visible.</p> <ul style="list-style-type: none"> • au-4—Value is 1. • tug-3#—Range is from 1 to 3. • au-3#—Range is from 1 to 3.
Step 5	<p>In SDH framing in AU-4 mode:</p> Router(config-ctrlr-tug3)# [no] mode {c-12 t3 e3} <p>In SDH framing AU-3 mode:</p> Router(config-ctrlr-au3)# [no] mode c-11	<p>Configures mode of operation for AU-3 or AU-4 mode.</p> <p>C-11 and C-12 are container level-n (SDH) channelized T3s. They are types of T3 channels that are subdivided into 28 T1 channels.</p> <ul style="list-style-type: none"> • c-11—Specifies an AU-3 is divided into seven TUG2s. Each TUG2 is then divided into four TU11s, each carrying a C-11 T1. • c-12—Specifies an AU-4 TUG-3 is divided into seven TUG2. Each TUG2 is then divided into three TU12s, each carrying a C-12 E1. • t3—Specifies an AU-4 TUG3 carries an unchannelized (clear channel) T3. • e3—Specifies an AU-4 TUG3 carries an unchannelized (clear channel) E3.

Configuring Channelized DS3 Mode

To configure channelized DS3 mode, complete the following steps:

	Command	Purpose
Step 1	Router(config)# controller sonet <i>slot/subslot/port</i>	Selects the controller to configure and enters controller configuration mode. <ul style="list-style-type: none"> <i>slot/subslot/port</i>—Specifies the location of the interface. See the “Configuring SONET Mode” section on page 19-4.
Step 2	Router(config-controller)# sts-1 <i>sts1-#</i>	Selects STS mode and enters sts1 configuration mode. <ul style="list-style-type: none"> <i>sts-1#</i>—A value from 1 to y, y being the SONET STS level.
Step 3	Router(config-ctrlr-sts1)# [no] t3 framing { c-bit m23 auto-detect }	Specifies the framing mode. <ul style="list-style-type: none"> c-bit—Specifies C-bit parity framing. m23—Specifies M23 framing. auto-detect—Detects the framing type of the device at the end of the line and switches to that framing type. If both devices are set to auto-detect, c-bit framing is used. This is the default.
Step 4	Router(config-ctrlr-sts1)# [no] t3 clock source { internal line }	Sets the clock source. <p>Note The clock source is set to internal if the opposite end of the connection is set to line and the clock source is set to line if the opposite end of the connection is set to internal.</p> <ul style="list-style-type: none"> internal—Specifies that the internal clock source is used. line—Specifies that the network clock source is used. This is the default.
Step 5	Router(config-ctrlr-sts1)# [no] t3 loopback { local network [line payload] remote [line payload]}	Enables or disables loopback mode on a SONET controller. <ul style="list-style-type: none"> local loopback—Loops data from the transmit path to the receive path. network loopback—Loops data received on the external port to the transmit path and back out the external port. remote loopback—Applicable only to c-bit framing. <p>The default is no loopback.</p>

	Command	Purpose
Step 6	Router(config-ctrlr-sts1)# [no] t3 mdl string { eic fic generator lic pfi port unit } string	Configures maintenance data link (MDL) support parameters. <ul style="list-style-type: none"> • eic—Specifies equipment ID code. • fic—Specifies frame ID code. • generator—Specifies the generator number in MDL test signal. • lic—Specifies location ID code. • pfi—Specifies the Path Facility Identification code in MDL the path message. • port— Specifies the port number in the MDL idle string message. • unit—Specifies unit identification code. • <i>string</i>—Specifies user identifier for the chosen support parameter. <p>The default is no mdl string.</p>
Step 7	Router(config-ctrlr-sts1)# [no] t3 mdl transmit { path idle-signal test-signal }	Configures MDL transmit parameters. <ul style="list-style-type: none"> • path—Enables MDL path message transmission. • idle-signal—Enables MDL idle signal message transmission. • test-signal—Enables MDL test-signal message transmission. <p>The default is no mdl transmit.</p>
Step 8	Router(config-ctrlr-sts1)# [no] t3 equipment { customer network } loopback	Enables the port to honor remote loopback request. Equipment network loopback disables this functionality. <p>Note Remote loopbacks are only available in c-bit framing mode.</p>
Step 9	Router(config-ctrlr-sts1)# [no] t3 bert pattern pattern interval 1-14400	Enables Bit Error Rate Testing (BERT). <ul style="list-style-type: none"> • <i>pattern</i>—Specifies the length of the repeating BERT test pattern. Allowed values are 0s, 1s, 2^15, 2^20, 2^23, and alt-0-1. • interval—Specifies the duration of the BERT test, in minutes. The interval can be a value from 1 to 14400.

Configuring DS1 (Channelized T3 mode)

To configure DS1, complete the following steps:

	Command	Purpose
Step 1	Router(config)# controller sonet <i>slot/subslot/port</i>	Selects the controller to configure and enters controller configuration mode. <ul style="list-style-type: none"> <i>slot/subslot/port</i>—Specifies the location of the interface.
Step 2	Router(config-controller)# sts-1 <i>sts-1#</i>	Specifies the SONET Synchronous Transport Signal (STS) level and enters STS configuration mode. <ul style="list-style-type: none"> <i>sts-1#</i>—STS values are 1 to 3.
Step 3	Router(config-ctrlr-sts1)# [no] mode {ct3 vt-15}	Specifies the mode of operation of an STS-1 path. <ul style="list-style-type: none"> ct3—A STS-1 carrying a DS31 signal is divided into 28 T1s (Plesiochronous Digital Hierarchy [PDH]) vt-15—A STS-1 is divided into seven Virtual Tributary Groups (VTG). Each VTG is then divided into four VT1.5's, each carrying a T1.
Step 4	Router(config-ctrlr-sts1)# [no] t1 <i>t1# clock source {internal line}</i>	Configures the clocking source. <ul style="list-style-type: none"> <i>t1#</i>—Number indicating the T1 channel. internal—Specifies that the internal clock source is used. line—Specifies that the network clock source is used. This is the default.
Step 5	Router(config-ctrlr-sts1)# [no] t1 <i>t1# fdl ansi</i>	Enables the one-second transmission of the remote performance reports using Facility Data Link (FDL). <ul style="list-style-type: none"> <i>t1#</i>—Number indicating the T1 channel. fdl ansi—Specifies FDL and ANSI T1.403 standard. Without this command, FDL runs in ATT, the default mode. ATT is the AT&T TR54016 standard.
Step 6	Router(config-ctrlr-sts1)# [no] t1 <i>t1# framing {sf esf}</i>	Specifies the type of framing. <ul style="list-style-type: none"> <i>t1#</i>—Number indicating the T1 channel. sf— Specifies that Super Frame (SF) is used as the T1 framing type. esf—Specifies that Extended Super Frame (ESF) is used as the T1 framing type.
Step 7	Router(config-ctrlr-sts1)# [no] t1 <i>t1# yellow {detection generation}</i>	Enables detection and generation of DS1 yellow alarms. <ul style="list-style-type: none"> detection—Detects yellow alarms. generation—Generates yellow alarms.

	Command	Purpose
Step 8	Router(config-ctrlr-sts1)# [no] t1 t1# channel-group <i>channel-group#</i> timeslots <i>list-of-timeslots</i> speed [56 64]	Configures a T1 or E1 interface. <ul style="list-style-type: none"> • <i>t1#</i>—Number indicating the T1 channel. • <i>channel-group#</i>—Specifies the channel-group number, from 0 to 23. • <i>list-of-timeslots</i>—Specifies one or more time slots. • speed [56 64]—(Optional) Specifies the line speed in kilobits per second. Valid values are 56 and 64.
Step 9	Router(config-ctrlr-sts1)# [no] t1 t1# loopback [local network {line payload} remote {line {fdl {ansi bellcore} inband} payload [fdl] [ansi]]]	Enables specific t1 channels to loopback. <ul style="list-style-type: none"> • <i>t1#</i>—Number indicating the T1 channel. • local loopback—(Optional) Loops data from the transmit path to the receive path. • network loopback—(Optional) Loops data received on the external port to the transmit path and back out the external port. • remote line fdl {ansi bellcore}—(Optional) Sends a repeating, 16-bit Extended Superframe (ESF) data link code word to the remote end requesting that it enter into a network line loopback. Specify the ansi keyword to enable the remote line Facility Data Link (FDL) ANSI bit loopback on the T1 channel. Specify the bellcore keyword to enable the remote SmartJack loopback on the T1 channel. • remote line inband— (Optional) Sends a repeating, 5-bit inband pattern (00001) to the remote end requesting that it enter into a network line loopback. • remote payload [fdl] [ansi]—(Optional) Sends a repeating, 16-bit ESF data link code word to the remote end requesting that it enter into a network payload loopback. Enables the remote payload FDL ANSI bit loopback on the T1 channel.
Step 10	Router(config-ctrlr-sts1)# [no] t1 t1# shutdown	Shuts down the specified T1 channel. <ul style="list-style-type: none"> • <i>t1#</i>—Number indicating the T1 channel.

Configuring E1 (Channelized T3/E3 mode)

E1 configuration must be done in channelized DS3 mode. To configure E1, complete the following steps:

	Command	Purpose
Step 1	Router(config-controller)# [no] e1 e1# channel-group channel-group# timeslots list-of-timeslots speed [56 64]	Creates a logical channel group on an E1 line. <ul style="list-style-type: none"> • <i>e1#</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#</i>—Specifies the channel group number. • <i>list-of-timeslots</i>—Specifies the number of timeslots that make up the E1 line. • speed [56 64]—Specifies the line speed in kilobits per second. Valid values are 56 and 64
Step 2	Router(config-controller)# [no] e1 e1# unframed	Creates an E1 unframed (clear channel) logical channel group on an E1 line. <ul style="list-style-type: none"> • <i>e1#</i>—A number in the range of 1 to 3.
Step 3	Router(config-controller)# [no] e1 e1# [unframed framing] { crc4 no-crc4 }	Sets the type of framing (including unframed) used by an E1 line. <ul style="list-style-type: none"> • <i>e1#</i>—A number in the range of 1 to 3. • crc4—Specifies 4-bit cyclic redundancy check (CRC) framing. • no-crc4—Specifies basic framing.
Step 4	Router(config-controller)# [no] e1 e1# clock source {internal line}	Sets the clock source on an E1 line. <ul style="list-style-type: none"> • internal—Specifies that the internal clock source is used. • line—Specifies the E1 line as the clock source.
Step 5	Router(config-controller)# [no] e1 e1# national bits pattern	Sets the national reserved bits on an E1 line. <ul style="list-style-type: none"> • <i>e1#</i>—A number in the range of 1 to 3. • <i>pattern</i>—A hexadecimal value in the range 0x0 to 0x1F (hexadecimal) or 0 to 31 (decimal).
Step 6	Router(config-controller)# [no] e1 e1# loopback [local network]	Specifies a loopback on an E1 line. <ul style="list-style-type: none"> • <i>e1#</i>—A number in the range of 1 to 3. • local loopback—(Optional) Loops data from the transmit path to the receive path. • network loopback—(Optional) Loops data received on the external port to the transmit path and back out the external port.
Step 7	Router(config-controller)# [no] e1 e1# shutdown	Shuts down an individual E1 line. <ul style="list-style-type: none"> • <i>e1#</i>—A number in the range of 1 to 3.

Configuring Unchannelized E3 Serial Interface



Note E3 channelization is not supported.

To configure an unchannelized E3 serial interface, complete the following:

	Command	Purpose
Step 1	Router(config-controller)# [no] dsu mode { cisco digital-link kentrox }	Specifies the interoperability mode used by a T3 or E3 controller. <ul style="list-style-type: none"> cisco—Specifies cisco as the data service unit (DSU) mode. digital-link—Specifies Digital link as the DSU mode. Range is from 300-34010. kentrox—Specifies kentrox as the DSU mode. Range is 1000-24500, or 34010. The default is cisco .
Step 2	Router(config-controller)# [no] dsu bandwidth <i>number</i>	Specifies the maximum allowed bandwidth in Kpbs. <ul style="list-style-type: none"> <i>number</i>—Allowed values are 0 to 34368. The default is 34368.
Step 3	Router(config-controller)# [no] scramble	Enables scrambling for the E3 physical layer interface. The default is no scramble.
Step 4	Router(config-controller)# [no] national bit { 0 1 }	Sets the national reserved bits on an E3 line. The default is 0.
Step 5	Router(config-controller)# [no] framing { bypass g751 g832 }	Sets the framing on the interface. <ul style="list-style-type: none"> bypass—Configures framing bypass to use the full E3 bandwidth. g751— Specifies g751 framing. This is the default for E3. g832—Specifies g832 framing.
Step 6	Router(config-controller)# [no] crc { 16 32 }	Selects the CRC size in bits. <ul style="list-style-type: none"> 16—16-bit CRC. This is the default 32—32-bit CRC.
Step 7	Router(config-controller)# [no] loopback { network local remote }	Specifies loopback is enabled for the unchannelized E3 serial interface. <ul style="list-style-type: none"> local loopback—Loops data from the transmit path to the receive path. network loopback—Loops data received on the external port to the transmit path and back out the external port. remote loopback—Sends a far-end alarm control request to the remote end requesting that it enter into a network line loopback.

	Command	Purpose
Step 8	Router(config-controller)# [no] shutdown	Shuts down the E3 interface.
Step 9	Router(config-controller)# [no] bert pattern <i>pattern</i> interval <i>1-14400</i>	Sends a BERT pattern on an E3 line. <ul style="list-style-type: none"> <i>pattern</i>—Specifies the length of the repeating BERT test pattern. Allowed values are 2¹⁵, 2²⁰, 2²³, 0s, 1s, and alt-0-1. <i>interval time</i>—Specifies the duration of the BERT test, in minutes. The interval can be a value from 1 to 14400.

Verifying the Interface Configuration

Use the **show interface serial** command to verify the interface configuration:

```
Router# show interface serial 1/0/0.1/1:0
Serial1/0/0.1/1:0 is up, line protocol is up
  Hardware is SPA-1XCHSTM1/OC3
  Internet address is 10.1.1.1/16
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (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 IP multicasts)
    0 runs, 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, 2 interface resets
    0 output buffer failures, 0 output buffers swapped out
    1 carrier transitions no alarm present
  VC 0: timeslot(s): 1, Transmitter delay 0, non-inverted data
```

Optional Configurations

There are several standard, but optional, configurations that might be necessary to complete the configuration of your serial SPA.

- [Configuring Encapsulation, page 19-14](#)
- [Configuring the CRC Size for T1, page 19-14](#)
- [Configuring FDL, page 19-15](#)
- [Configuring Multilink Point-to-Point Protocol \(Hardware-based\), page 19-16](#)
- [Configuring MLFR, page 19-19](#)
- [Inverting Data on the T1/E1 Interface, page 19-21](#)
- [Changing a Channel Group Configuration, page 19-22](#)

- [Configuring BERT Test, page 19-22](#)
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- [Configuring QoS Features on Serial SPAs, page 19-23](#)

Configuring Encapsulation

When traffic crosses a WAN link, the connection needs a Layer 2 protocol to encapsulate traffic. To set the encapsulation method, use the following commands:

	Command	Purpose
Step 1	Router# configure terminal	Enters global configuration mode.
Step 2	Router(config)# interface serial <i>slot/subslot/port:channel-group</i>	Selects the interface to configure and enters interface configuration mode. <ul style="list-style-type: none"> • <i>slot/subslot/port:channel-group</i>—Specifies the location of the interface. For addressing information, refer to the “Naming the Interface” section on page 19-2 .
Step 3	Router(config-if)# encapsulation <i>encapsulation-type {hdlc ppp frame-relay}</i>	Sets the encapsulation method on the interface. <ul style="list-style-type: none"> • hdlc—Sets the High-Level Data Link Control (HDLC) protocol for serial interface. This encapsulation method provides the synchronous framing and error detection functions of HDLC without windowing or retransmission. This is the default for synchronous serial interfaces. • ppp—Sets point-to-point protocol (PPP) for serial interface. • frame-relay—Sets Frame Relay (for serial interface).
Step 4	Router(config-if)# crc {16 32}	Selects the CRC size in bits. <ul style="list-style-type: none"> • 16—16-bit CRC. This is the default • 32—32-bit CRC.

Configuring the CRC Size for T1

CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. The 1-Port Channelized STM-1/OC-3 SPA interface uses a 16-bit cyclic redundancy check (CRC) by default, but also supports a 32-bit CRC. The designators 16 and 32 indicate the length (in bits) of the frame check sequence (FCS). A CRC of 32 bits provides more powerful error detection, but adds overhead. Both the sender and receiver must use the same setting.

To set the length of the cyclic redundancy check (CRC) on a T1 interface, use these commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface serial <i>slot/subslot/port:channel-group</i>	Selects the interface to configure and enters interface configuration mode. <ul style="list-style-type: none"> <i>slot/subslot/port:channel-group</i>—Specifies the location of the interface. For addressing information, refer to the “Naming the Interface” section on page 19-2 .
Router(config-if)# [no] crc { 16 32 }	Selects the CRC size in bits. <ul style="list-style-type: none"> 16—16-bit CRC. This is the default 32—32-bit CRC.

Configuring FDL

Facility Data Link (FDL) is a 4-kbps channel provided by the Extended Super Frame (ESF) T1 framing format. The FDL performs outside the payload capacity and allows you to check error statistics on terminating equipment without intrusion. To configure FDL, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# controller sonet <i>slot/subslot/port</i>	Selects the controller to configure and enters controller configuration mode. <ul style="list-style-type: none"> <i>slot/subslot/port</i>—Specifies the location of the controller. See the “Naming the Interface” section on page 19-2 .
Router(config)# sts-1 <i>sts-#</i>	Specifies the SONET Synchronous Transport Signal (STS) level and enters STS1 configuration mode. <p><i>sts-1#</i>—STS values are 1 to 3.</p>
Router(config-ctrlr-sts1)# mode { ct3 ct3-e1 t3 vt-15 }	Specifies the mode of operation of an STS-1 path. <ul style="list-style-type: none"> ct3—A STS-1 carrying a DS3 signal is divided into 28 T1s (Plesiochronous Digital Hierarchy [PDH]). ct3-e1—The channelized T3 is carrying E1 circuits. t3—STS-1 carries an unchannelized (clear channel) T3. vt-15—A STS-1 is divided into seven Virtual Tributary Groups (VTG). Each VTG is then divided into four VT1.5's, each carrying a T1.

Command	Purpose
If vt-15 mode was selected: Router(config-ctrlr-sts1)# [no] vtg <i>vtg#</i>	Configures the T1 on the VTG. <ul style="list-style-type: none"> <i>vtg#</i>—Specifies the VTG number. Values are 1 to 7.
Router(config-ctrlr-sts1)# [no] t1 <i>t1#</i> framing { sf esf }	Specifies the type of framing. Select esf to configure FDL. <ul style="list-style-type: none"> <i>t1#</i>—Number indicating the T1 channel. sf—Specifies that Super Frame (SF) is used as the T1 framing type. esf—Specifies that Extended Super Frame (ESF) is used as the T1 framing type.
Router(config-ctrlr-sts1)# [no] t1 <i>t1#</i> fdl <i>ansi</i>	Configures the format used for Facility Data Link (FDL) if the framing format was configured for esf . <ul style="list-style-type: none"> <i>t1#</i>—Number indicating the T1 channel. fdl <i>ansi</i>—Selects ANSI for FDL to use the ANSI T1.403 standard.

Verifying FDL

Use the **show controllers t1** command to verify the **fdl** setting:

```
router# show controllers t1
T1 6/0/1 is up.
  Applique type is Channelized T1
  Cablelength is long gain36 0db
  No alarms detected.
  alarm-trigger is not set
  Framing is ESF, FDL is ansi, Line Code is B8ZS, Clock Source is Line.
  Data in current interval (742 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
  Total Data (last 73 15 minute intervals):
    1278491 Line Code Violations, 3 Path Code Violations,
    0 Slip Secs, 1 Fr Loss Secs, 177 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 1 Severely Err Secs, 227 Unavail Secs
.
.
.
```

Configuring Multilink Point-to-Point Protocol (Hardware-based)

Multilink Point-to-Point Protocol (MLPPP) allows you to combine interfaces which correspond to an entire T1 or E1 multilink bundle. You can choose the number of bundles and the number of T1 or E1 lines in each bundle.

MLPPP Configuration Guidelines

The required conditions are:

- Only T1 or E1 links in a bundle
- PPP encapsulation must be enabled before configuring multilink-related commands.

Hardware-based MLPPP Usage

Fragmentation size is configured using the **ppp multilink fragment-delay** command after using the **interface multilink** command. The least of the fragmentation sizes (among the 3 sizes possible) satisfying the delay criteria is configured. For example, a 192-byte packet causes a delay of 1 millisecond on a T1 link, so the nearest fragmentation size is 128 bytes.

The required conditions are:

- Only 3 fragmentation sizes are possible: 128, 256 and 512 bytes.
- Fragmentation is enabled by default and the default size is 512 bytes.

Creating a Multilink Bundle

To create a multilink bundle, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface multilink <i>group-number</i>	Creates a multilink interface and enters multilink interface mode. <ul style="list-style-type: none"> • <i>group-number</i>—The group number for the multilink bundle.
Router(config-if)# ip address <i>address mask</i>	Sets the IP address for the multilink group. <ul style="list-style-type: none"> • <i>address</i>—The IP address. • <i>mask</i>—The IP netmask.

Assigning an Interface to a Multilink Bundle

To assign an interface to a multilink bundle, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface serial <i>slot/subslot/port</i>	Selects the interface to configure and enters interface configuration mode. <ul style="list-style-type: none"> • <i>slot/subslot/port</i>—Specifies the location of the controller. For addressing information, refer to the “Naming the Interface” section on page 19-2 .
Router(config-if)# encapsulation ppp	Enables PPP encapsulation.

Command	Purpose
Router(config-if)# multilink-group <i>group-number</i>	Assigns the interface to a multilink bundle. <ul style="list-style-type: none"> <i>group-number</i>—The multilink group number for the T1 or E1 bundle.
Router(config-if)# ppp multilink	Enables multilink PPP on the interface.
Note Repeat these commands for each interface you want to assign to the multilink bundle.	

Configuring Fragmentation Size on an MLPPP Bundle (Optional)

To configure the fragmentation size on a multilink PPP bundle, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface multilink <i>group-number</i>	Creates a multilink interface and enters multilink interface mode. <ul style="list-style-type: none"> <i>group-number</i>—The group number for the multilink bundle. Range 1-2147483647
Router(config-if)# [no] multilink fragment <i>fragment-size {128 256 512}</i>	Sets the fragmentation size in bytes. Fragmentation is disabled by default.
Router(config-if)# ppp multilink fragment-delay <i>delay</i>	Sets the configured delay on the multilink bundle that satisfies the fragmentation size. <ul style="list-style-type: none"> <i>delay</i>—delay in milliseconds

The following **show ppp multilink** command indicates the MLPPP type and the fragmentation size:

```
Router# show ppp multilink
Multilink1, bundle name is Patriot2
Bundle up for 00:00:13
Bundle is Distributed
0 lost fragments, 0 reordered, 0 unassigned
0 discarded, 0 lost received, 206/255 load
0x0 received sequence, 0x0 sent sequence
Member links: 2 active, 0 inactive (max not set, min not set)
Se4/2/0/1:0, since 00:00:13, no frags rcvd
Se4/2/0/2:0, since 00:00:10, no frags rcvd
Distributed fragmentation on. Fragment size 512. Multilink in Hardware..
```

Disabling Fragmentation on an MLPPP Bundle (Optional)

To assign an interface to a multilink bundle, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface multilink <i>group-number</i>	Creates a multilink interface and enters multilink interface mode. <ul style="list-style-type: none"> <i>group-number</i>—The group number for the multilink bundle. Range 1-2147483647
Router(config-if)# no ppp multilink fragmentation	Disables the fragmentation on the multilink bundle.

Configuring MLFR

Multilink Frame Relay (MLFR) allows you to combine T1/E1 lines into a bundle that has the combined bandwidth of multiple T1/E1 lines. You choose the number of bundles and the number of T1/E1 lines in each bundle. This allows you to increase the bandwidth of your network links beyond that of a single T1/E1 line.

MLFR Configuration Guidelines

MLFR functions in hardware if all of the following conditions are met:

- Only T1 or E1 member links
- Maximum of 12 links in a bundle

Creating a Multilink Bundle

To create a multilink bundle, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface mfr <i>number</i>	Configures a multilink Frame Relay bundle interface and enters interface configuration mode. <ul style="list-style-type: none"> <i>number</i>—The number for the Frame Relay bundle.
Router(config-if)# frame-relay multilink bid <i>name</i>	(Optional) Assigns a bundle identification (BID) name to a multilink Frame Relay bundle. <ul style="list-style-type: none"> <i>name</i>—The name for the Frame Relay bundle. <p>Note The bundle identification does not go into effect until the interface has gone from the down state to the up state. One way to bring the interface down and back up again is by using the shut and no shut commands in interface configuration mode.</p>

Assigning an Interface to a Multilink Bundle

To assign an interface to a multilink bundle, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface serial <i>slot/subslot/port</i>	Selects the interface to assign and enters interface configuration mode. <ul style="list-style-type: none"> <i>slot/subslot/port</i>—Specifies the location of the controller. For addressing information, refer to the “Naming the Interface” section on page 19-2.
Router(config-if)# encapsulation frame-relay mfr <i>number</i> [<i>name</i>]	Creates a multilink Frame Relay bundle link and associates the link with a bundle. <ul style="list-style-type: none"> <i>number</i>—The number for the Frame Relay bundle. <i>name</i>—The name for the Frame Relay bundle.
Router(config-if)# frame-relay multilink lid <i>name</i>	(Optional) Assigns a bundle link identification name with a multilink Frame Relay bundle link. <ul style="list-style-type: none"> <i>name</i>—The name for the Frame Relay bundle. <p>Note The bundle link identification (LID) will not go into effect until the interface has gone from the down state to the up state. One way to bring the interface down and back up again is by using the shut and no shut commands in interface configuration mode.</p>
Router(config-if)# frame-relay multilink hello <i>seconds</i>	(Optional) Configures the interval at which a bundle link will send out hello messages. The default value is 10 seconds. <ul style="list-style-type: none"> <i>seconds</i>—Number of seconds between hello messages sent out over the multilink bundle.
Router(config-if)# frame-relay multilink ack <i>seconds</i>	(Optional) Configures the number of seconds that a bundle link will wait for a hello message acknowledgment before resending the hello message. The default value is 4 seconds. <ul style="list-style-type: none"> <i>seconds</i>—Number of seconds a bundle link will wait for a hello message acknowledgment before resending the hello message.
Router(config-if)# frame-relay multilink retry <i>number</i>	(Optional) Configures the maximum number of times a bundle link will resend a hello message while waiting for an acknowledgment. The default value is 2 tries. <ul style="list-style-type: none"> <i>number</i>—Maximum number of times a bundle link will resend a hello message while waiting for an acknowledgment.

Verifying Multilink Frame Relay

Use the **show frame-relay multilink detailed** command to verify the Frame Relay multilinks:

```
router# show frame-relay multilink detailed

Bundle: MFR49, State = down, class = A, fragmentation disabled
  BID = MFR49
  No. of bundle links = 1, Peer's bundle-id =
  Bundle links:

  Serial6/0/0:0, HW state = up, link state = Add_sent, LID = test
    Cause code = none, Ack timer = 4, Hello timer = 10,
    Max retry count = 2, Current count = 0,
    Peer LID = , RTT = 0 ms
    Statistics:
    Add_link sent = 21, Add_link rcv'd = 0,
    Add_link ack sent = 0, Add_link ack rcv'd = 0,
    Add_link rej sent = 0, Add_link rej rcv'd = 0,
    Remove_link sent = 0, Remove_link rcv'd = 0,
    Remove_link_ack sent = 0, Remove_link_ack rcv'd = 0,
    Hello sent = 0, Hello rcv'd = 0,
    Hello_ack sent = 0, Hello_ack rcv'd = 0,
    outgoing pak dropped = 0, incoming pak dropped = 0
```

Inverting Data on the T1/E1 Interface

If the interface on the 1-Port Channelized STM-1/OC-3 SPA is used to drive a dedicated T1 line that does not have B8ZS encoding, you must invert the data stream on the connecting CSU/DSU or on the interface. Be careful not to invert data on both the CSU/DSU and the interface, as two data inversions will cancel each other out. To invert data on a T1/E1 interface, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface serial <i>slot/subslot/port</i>	Selects the serial interface and enters interface configuration mode. <ul style="list-style-type: none"> <i>slot/subslot/port</i>—Specifies the location of the controller. For addressing information, refer to the “Naming the Interface” section on page 19-2
Router(config-if)# invert data	Inverts the data stream.

Use the **show running configuration** command to verify that invert data has been set:

```
router# show running configuration
.
.
.
interface Serial6/0/0:0
  no ip address
  encapsulation ppp
  logging event link-status
  load-interval 30
  invert data
  no cdp enable
  ppp chap hostname group1
```

```

ppp multilink
multilink-group 1
.
.
.

```

Changing a Channel Group Configuration

To alter the configuration of an existing channel group, the channel group needs to be removed first using the **no** form of the **channel-group** command. To remove an existing channel group, use the following commands:

Command	Purpose
Router# configure terminal	Enters global configuration mode.
Router(config)# interface serial <i>slot/subslot/port</i>	Select the controller to configure and enters controller configuration mode. <ul style="list-style-type: none"> <i>slot/subslot/port</i>—Specifies the location of the controller. For addressing information, refer to the “Naming the Interface” section on page 19-2 .
Router(config-controller)# no channel-group t1 <i>t1-number</i>	Selects the channel group you want to remove. <ul style="list-style-type: none"> <i>t1-number</i>—Channel-group number.

Configuring BERT Test

To configure BERT test, complete the following:

	Command	Purpose
Step 1	Router(config-controller)# [no] t1 <i>t1# bert pattern pattern interval time</i> or Router(config-controller)# [no] t3 <i>t3# bert pattern pattern interval time</i> or Router(config-controller)# [no] e1 <i>e1# bert pattern pattern interval time</i>	Sends a BERT pattern on a line. <ul style="list-style-type: none"> <i>t1#, t3#, or e1#</i>—Number identifying the specific channel. <i>pattern</i>—Specifies the length of the repeating BERT test pattern. <ul style="list-style-type: none"> T1 and E1—Allowed values are 0s, 1s, 1-in-8, 2¹¹, 2¹⁵, 2¹⁵-inverted, 2²⁰ O.153, 2²⁰ QRSS, 2²³, 2²³-inverted, 2⁹, 3-in-24, and alt-0-1. T3—Allowed values are 0s, 1s, 2¹⁵, 2²⁰, 2²³, and alt-0-1. <i>interval time</i>—Specifies the duration of the BERT test, in minutes. The interval can be a value from 1 to 14400.

FRF.12 Guidelines

FRF.12 functions in hardware. Note the following:

- The fragmentation is configured at the main interface
- Only 3 fragmentation sizes are available: 128 bytes, 256 bytes, and 512 bytes.

LFI Guidelines

Link Fragmentation and Interleaving (LFI) can function two ways: by using FRF.12 or by using MLPPP. MLPPP LFI can be done in both hardware and software while FRF.12 LFI is done only in hardware.

HW MLPPP LFI Guidelines

LFI using MLPPP will function only in hardware if there is just one member link in the MLPPP bundle. The link can be a fractional T1 or full T1. Note the following:

- The **ppp multilink interleave** command needs to be configured to enable interleaving.
- Only three fragmentation sizes are supported: 128 bytes, 256 bytes, and 512 bytes.
- Fragmentation is enabled by default and the default size is 512 bytes.
- A policy-map having a priority class needs to be applied to main interface.

FRF.12 LFI Guidelines

LFI using FRF.12 is always done in hardware. Note the following:

- The fragmentation is configured at the main interface
- Only 3 fragmentation sizes are available: 128 bytes, 256 bytes, and 512 bytes.
- A policy-map having a priority class needs to be applied to main interface.

Configuring QoS Features on Serial SPAs

The SIPs and SPAs support many QoS features using modular QoS CLI (MQC) configuration. Since there are no serial SPA-specific QoS features, refer to your network processor documentation for QoS configuration information.

Saving the Configuration

To save your running configuration to nonvolatile random-access memory (NVRAM), use the following command in privileged EXEC configuration mode:

Command	Purpose
Router# copy running-config startup-config	Writes the new configuration to NVRAM.

For more information about managing configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications for your specific Cisco IOS software version.

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display your Cisco ASR 1000 Series Router configuration settings, you can use the **show interface serial** and the **show controllers sonet** commands to get detailed information on a per-port basis for your 1-Port Channelized STM-1/OC-3 SPA.

Verifying Per-Port Interface Status

To find detailed interface information on a per-port basis for the 1-Port Channelized STM-1/OC-3 SPA, use the **show interface serial** and **show controllers sonet** commands.

See the “[Verifying the Interface Configuration](#)” section on page 13 for an example of the **show interface serial** command.

The following example provides sample output for interface port 0 on the SPA located in subslot 0 of the Cisco ASR 1000 SIP installed in slot 1of a Cisco ASR 1000 Series Router:

```
Router#show controllers sonet 1/0/0

SONET 1/0/0 is up.
  Hardware is SPA-1XCHSTM1/OC3
  IO FPGA version: 1.7, HDLC Framer version: 0
  T3/T1 Framer(1) version: 1
  Sonet/SDH Framer version: 0
  SUBRATE FPGA version: 1.4
  HDLC controller available FIFO buffers 3760
  Applique type is Channelized Sonet/SDH

  Clock Source is Line
  Medium info:
    Type: Sonet, Line Coding: NRZ,
  SECTION:
    LOS = 0          LOF = 0          BIP(B1) = 85

SONET/SDH Section Tables
  INTERVAL      CV      ES      SES      SEFS
  23:15-23:20   0       0       0       0
  23:00-23:15   0       0       0       0
  22:45-23:00   85      1       1       0
  Total of Data in Current and Previous Intervals
  22:45-23:20   85      1       1       0

LINE:
  AIS = 0          RDI = 1          REI = 65          BIP(B2) = 207
  Active Defects: None
  Active Alarms: None
  Alarm reporting enabled for: SF SLOS SLOF B1-TCA B2-TCA
  BER thresholds: SF = 10e-3 SD = 10e-6
  TCA thresholds: B1 = 10e-6 B2 = 10e-6

SONET/SDH Line Tables
  INTERVAL      CV      ES      SES      UAS
  23:15-23:20   0       0       0       0
  23:00-23:15   0       0       0       0
  22:45-23:00   272     1       0       5
  Total of Data in Current and Previous Intervals
  22:45-23:20   272     1       0       5
.
.
```

```

SONET/SDH Path Tables
INTERVAL      CV    ES    SES    UAS
23:15-23:20   0     0     0     0
23:00-23:15   0     0     0     0
22:45-23:00 187382  2     0     0
Total of Data in Current and Previous Intervals
22:45-23:20 187382  2     0     0
.
.
.
T3 1/0/0 Path 1 is up.
Hardware is SPA-1XCHSTM1/OC3
IO FPGA version: 1.7, HDLC Frammer version: 0
T3/T1 Frammer(1) version: 1
Sonet/SDH Frammer version: 0
SUBRATE FPGA version: 1.4
HDLC controller available FIFO buffers 3760
Applique type is T3
No alarms detected.
MDL transmission is enabled

FEAC code received: No code is being received
Framing is C-BIT Parity, Cablelength is 224
Clock Source is Line
Equipment customer loopback
Data in current interval (346 seconds elapsed):
  0 Line Code Violations, 0 P-bit Coding Violation
  0 C-bit Coding Violation, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  0 Severely Errored Line Secs
  0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
  0 CP-bit Far-end Unavailable Secs
  0 Near-end path failures, 0 Far-end path failures
  0 Far-end code violations, 0 FERF Defect Secs
  0 AIS Defect Secs, 0 LOS Defect Secs
.
.
.
CT3 1/0/0.2 is up.
Hardware is SPA-1XCHSTM1/OC3
IO FPGA version: 1.7, HDLC Frammer version: 0
T3/T1 Frammer(1) version: 1
Sonet/SDH Frammer version: 0
SUBRATE FPGA version: 1.4
HDLC controller available FIFO buffers 3760
Applique type is Channelized T3 to T1
No alarms detected.
Framing is M23, Cablelength is 224
Clock Source is Internal
Equipment customer loopback
Data in current interval (356 seconds elapsed):
  0 Line Code Violations, 0 P-bit Coding Violation
  0 C-bit Coding Violation, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  0 Severely Errored Line Secs
  0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
  0 CP-bit Far-end Unavailable Secs
  0 Near-end path failures, 0 Far-end path failures
  0 Far-end code violations, 0 FERF Defect Secs

```

```
0 AIS Defect Secs, 0 LOS Defect Secs
```

```
(Remaining output omitted)
```

Configuration Examples

This section includes the following configuration examples:

- [T3 Framing Configuration Example, page 19-26](#)
- [Cyclic Redundancy Check Configuration Example, page 19-26](#)
- [Facility Data Link Configuration Example, page 19-26](#)
- [Invert Data on T1/E1 Interface Example, page 19-27](#)

T3 Framing Configuration Example

The following example configures framing on a T3 interface:

```
! Specify the interface to configure and enter interface configuration mode.
!
Router(config)# controller sonet 3/0/0
!
! Select the STS mode.
!
Router(config-controller)# sts-1 2
!
! Select the framing mode.
!
Router(config-controller)# t3 framing m23
```

Cyclic Redundancy Check Configuration Example

The following example configures CRC on a T1 interface:

```
! Specify the interface to configure and enter interface configuration mode.
!
Router(config)# interface serial 2/0/0.1
!
! Specify the CRC type.
!
Router(config-if)# crc 32
```

Facility Data Link Configuration Example

The following example configures FDL on a T1 interface:

```
! Specify the interface to configure and enter interface configuration mode.
!
Router(config)# interface serial 1/0/0.2
!
! Specify the T1 number and select fdl.
!
Router(config-controller)#t1 2 fdl ansi
```

Invert Data on T1/E1 Interface Example

The following example inverts the data on the serial interface:

```
! Specify the interface to configure and enter interface configuration mode.
!
Router(config)# interface serial 3/0/0.1/2/1:0
!
! Configure invert data.
!
Router(config-if)# invert data
```

