Configuring the 2-Port and 4-Port T3/E3 SPAs

This chapter provides information about configuring the 2-Port and 4-Port T3/E3 Shared Port Adapters (SPAs) on the Cisco 7304 router. It includes the following sections:

For information about managing your system images and configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide, Release 12.2* and *Cisco IOS Configuration Fundamentals Command Reference, Release 12.2* publications.

For more information about the commands used in this chapter, see Chapter 18, "Command Reference," in this guide, which documents new and modified commands. Also refer to the related Cisco IOS Release 12.2 software command reference and master index publications. For more information about accessing these publications, see the "Related Documentation" section on page -xiv section of this document.

Configuration Tasks

This section describes how to configure the 2-Port or 4-Port T3/E3 SPA for the Cisco 7304 router and includes information about verifying the configuration.

It includes the following topics:

Required Configuration Tasks

This section lists the required configuration steps to configure the 2-Port or 4-Port T3/E3 SPA. Some of the required configuration commands implement default values that might be appropriate for your network. If the default value is correct for your network, then you do not need to configure the command.

- Setting the Card Type
- Configure the Interface

Note To better understand the address format used to specify the physical location of the Spa Interface Processor (SIP), SPA, and interfaces, see the: "Specifying the Interface Address on a SPA" section on page 13-5.

Setting the Card Type

The SPA is not functional until the card type is set. Information about the SPA is not indicated in the output of any show commands until the card type has been set. There is no default card type.

Note Mixing of interface types is not supported. All ports on a SPA will be the of the same type.

To set the card type for the 2-Port or 4-Port T3/E3 SPA, complete these steps:

	Command	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Router(config)# **card type** {**t3** | **e3**} *slot subslot*	Sets the serial mode for the SPA: • **t3**—Specifies T3 connectivity of 44210 kbps through the network, using B3ZS coding. • **e3**—Specifies a wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 34010 kbps. • *slot subslot*—Specifies the location of the SPA. See the: "Specifying the Interface Address on a SPA" section on page 13-5
Step 3	Router(config)# **exit**	Exit configuration mode and return to the EXEC command interpreter prompt.

Configure the Interface

To set the ip address for the 2-Port or 4-Port T3/E3 SPA, complete these steps:

	Command	Purpose
Step 1	Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5
Step 2	Router(config-if)# **ip address** *address mask*	Sets the IP address and subnet mask. • *address*—IP address • *mask*—Subnet mask
Step 3	Router(config-if)# **clock source** {**internal** | **line**}	Sets the clock source to internal. • **internal**—Specifies that the internal clock source is used. • **line**—Specifies that the network clock source is used. This is the default.
Step 4	Router(config-if)# **no shut**	Enables the interface.
Step 5	Router(config)# **exit**	Exits configuration mode and returns to the EXEC command interpreter prompt.

Verifying Controller Configuration

Use the **show controllers** command to verify the controller configuration:

```
router# show controllers serial 6/0/0
Serial6/0/0 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 2, since reset 0
   Data in current interval (546 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
.
.
.
Data in Interval 44:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     560 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
   Total Data (last 44 15 minute intervals):
     0 Line Code Violations, 0 P-bit Coding Violation,
```

```
     0 C-bit Coding Violation,
     0 P-bit Err Secs, 0 P-bit Sev Err Secs,
     0 Sev Err Framing Secs, 0 Unavailable Secs,
     24750 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs

   Transmitter is sending AIS.

   Receiver has loss of signal.

    40434 Sev Err Line Secs, 0 Far-End Err Secs, 0 Far-End Sev Err Secs
    0 P-bit Unavailable Secs, 0 CP-bit Unavailable Secs
    0 CP-bit Far-end Unavailable Secs
    0 Near-end path failures, 0 Far-end path failures

   No FEAC code is being received
  MDL transmission is disabled
```

Use the **show controllers brief** command to view a subset of the **show controllers** output:

```
Router# show controllers serial 6/0/2 brief
Serial6/0/2 -
   Framing is c-bit, Clock Source is Internal
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 0, since reset 22

   No alarms detected.

   No FEAC code is being received
  MDL transmission is disabled
```

Verifying Interface Configuration

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

```
router# show interfaces serial 6/0/0
Serial6/0/0 is up, line protocol is up
  Hardware is SPA-4T3E3
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 12/255, rxload 56/255
  Encapsulation FRAME-RELAY, crc 16, loopback not set
  Keepalive set (10 sec)
  LMI enq sent  13477, LMI stat recvd 13424, LMI upd recvd 0, DTE LMI up
  LMI enq recvd 19, LMI stat sent  0, LMI upd sent  0
  LMI DLCI 1023  LMI type is CISCO  frame relay DTE
  FR SVC disabled, LAPF state down
  Broadcast queue 0/256, broadcasts sent/dropped 0/0, interface broadcasts 0
  Last input 00:00:09, output 00:00:09, output hang never
  Last clearing of "show interface" counters 1d13h
  Input queue: 0/75/3/3891 (size/max/drops/flushes); Total output drops: 5140348
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 9716000 bits/sec, 28149 packets/sec
  5 minute output rate 2121000 bits/sec, 4466 packets/sec
     14675957334 packets input, 645694448563 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
              0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     14562482078 packets output, 640892196653 bytes, 0 underruns
     0 output errors, 0 applique, 4 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
    rxLOS inactive, rxLOF inactive, rxAIS inactive
    txAIS inactive, rxRAI inactive, txRAI inactive
```

```
Serial6/0/0.16 is up, line protocol is up
  Hardware is SPA-4T3E3
  Internet address is 110.1.1.2/24
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 11/255, rxload 53/255
  Encapsulation FRAME-RELAY
```

Specifying the Interface Address on a SPA

SPA interface ports begin numbering with “0” from left to right. Single-port SPAs use only the port number 0. To configure or monitor SPA interfaces, you need to specify the physical location of the MSC, SPA and interface in the CLI. The interface address format is *slot*/*subslot*/*port*, where:

- *slot*—Specifies the chassis slot number in the Cisco 7304 router where the MSC is installed.
- *subslot*—Specifies the secondary slot of the MSC where the SPA is installed.
- *port*—Specifies the number of the individual interface port on a SPA.

For example, to configure the first interface (0) on a serial SPA installed in the first subslot of an MSC (0) installed in chassis slot 3, use the the following command:

```
Router(config)# interface serial 3/0/0
```

The same *slot*/*subslot*/*port* format is used in similar commands for other non-channelized SPAs.

Optional Configurations

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

Note For additional command output details, see Chapter 18, “Command Reference”.

Configuring Data Service Unit Mode

Configure the SPA to connect with customer premise Data Service Units (DSUs) by setting the DSU mode. Subrating a T3 or E3 interface reduces the peak access rate by limiting the data transfer rate. To configure the DSU mode and bandwidth, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** s*lot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5
T3: Router(config-if)# **dsu mode** {**0** | **1** | **2** | **3** | **4**} E3: Router(config-if)# **dsu mode** {**0** | **1**}	Specifies the interoperability mode used by a T3 controller. • **0**—Connects a T3/E3 controller to another T3/E3 controller or to a Digital Link DSU (DL3100 in T3 mode and DL3100E in E3 mode). This is the default. • **1**—Connects a T3/E3 controller to a Kentrox DataSMART T3/E3 IDSU. • **2**—Connects a T3 controller to a Larscom Access-T45 DS3 DSU. • **3**—Connects a T3 controller to an Adtran T3SU 300. • **4**—Connects a T3 controller to a Verilink HDM 2182.

Command	Purpose
Router(config-if)# **dsu bandwidth** *kbps*	Specifies the allowable bandwidth. • *kbps*—The bandwidth range and increment values are based on the specific DSU. Default for T3 mode is 44010 kbps and 34010 kbps for E3 mode. • Digital Link DL3100 – range: 300 to 44210 kbps – increments: 300 kbps • Digital Link DL3100E – range: 358 to 34010 kbps – increments: 358 kbps • Kentrox DataSMART T3/E3 IDSU – range: 1000 to 34000 kbps (E3 mode) – range: 1500 to 44210 kbps (T3 mode) – increments: 500 kbps • Larscom Access-T45 DS3 – range: 3100 to 44210 kbps – increments: 3100 kbps • Adtran T3SU 300 – range: 80 to 44210 kbps – increments: 80 kbps • Verilink HDM 2182 – range: 1600 to 31600 kbps – increments: 1600 kbps
Router(config-if)# **remote** {**accept** | **fullrate**}	Specifies where the DSU bandwidth is set. • **accept**—Accept incoming remote requests to reset the DSU bandwidth. • **fullrate**—Set far end DSU to its fullrate bandwidth.

Verifying DSU Mode

Use the **show controllers serial** command to display the DSU settings:

```
router# show controllers serial 6/0/0
Serial6/0/0 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 2, since reset 0
   Data in current interval (546 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
```

```
    0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
    0 Line Code Violations, 0 P-bit Coding Violation
    0 C-bit Coding Violation
    0 P-bit Err Secs, 0 P-bit Sev Err Secs
    0 Sev Err Framing Secs, 0 Unavailable Secs
    0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
.
.
.
```

Configuring Maintenance Data Link

MDL messages are used to communicate identification information between local and remote ports. The type of information included in MDL messages includes the equipment identification code (EIC), location identification code (LIC), frame identification code (FIC), unit, Path Facility Identification (PFI), port number, and Generator Identification numbers.

Note C-bit framing has to be enabled in order to transport MDL messages between source and destination T3 ports.

To configure Maintenance Data Link (MDL), use the following commands.

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure. • *slot/subslot/port*—Specifies the location of the interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5

Command	Purpose
Router(config-if)# **mdl** [**string** {**eic** | **fic** | **generator** | **lic** | **pfi** | **port** | **unit**} *string*}] | [**transmit** {**idle-signal** | **path** | **test-signal**}]	Configures the Maintenance Data Link (MDL) message. • **eic** *string*—Equipment identification code (up to 10 characters), which is a value used to describe a specific piece of equipment according to ANSI T1.107-1995. • **fic** *string*—Frame identification code (up to 10 characters), which is a value used to identify where the equipment is located within a building at a given location according to ANSI T1.107-1995. • **generator** *string*—Specifies the Generator number string sent in the MDL Test Signal message; can be up to 38 characters. • **lic** *string*—Location identification code (up to 11 characters), which is a value used to describe a specific location according to ANSI T1.107-1995. • **pfi** *string*—Specifies the Path Facility Identification Code sent in the MDL Path message; can be up to 38 characters. • **port** *string*—Specifies the Port number string sent in the MDL Idle Signal message; can be up to 38 characters. • **unit** *string*—Unit identification code (up to 6 characters), which is a value that identifies the equipment location within a subslot according to ANSI T1.107-1995. • **transmit idle-signal**—Enables transmission of the MDL idle signal message. An MDL idle signal message, as defined by ANSI T1.107, is distinguished from path and test signal messages in that it contains a port number as its final data element. • **transmit path**—Enables transmission of the MDL path message. An MDL path message, as defined by ANSI T1.107, is distinguished from idle and test signal messages in that it contains a facility identification code as its final data element. • **transmit test-signal**—Enables transmission of the MDL test signal message. An MDL test signal message, as defined by ANSI T1.107, is distinguished from path and idle signal messages in that it contains a generator number as its final data element.

Verifying MDL

Use the **show controllers serial** command to display the MDL settings:

```
router# show controllers serial 6/0/0
Serial6/0/0 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 2, since reset 0
   Data in current interval (546 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
.
.
.

  Data in Interval 96:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
   Total Data (last 24 hours)
     0 Line Code Violations, 0 P-bit Coding Violation,
     0 C-bit Coding Violation,
     0 P-bit Err Secs, 0 P-bit Sev Err Secs,
     0 Sev Err Framing Secs, 0 Unavailable Secs,
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs

   No alarms detected.

    0 Sev Err Line Secs, 1 Far-End Err Secs, 0 Far-End Sev Err Secs
    0 P-bit Unavailable Secs, 0 CP-bit Unavailable Secs
    0 CP-bit Far-end Unavailable Secs
    0 Near-end path failures, 0 Far-end path failures

No FEAC code is being received
  MDL transmission is enabled
     EIC: tst, LIC: 67,
     Test Signal GEN_NO: test
  Far-End MDL Information Received
     EIC: tst, LIC: 67,
     Test Signal GEN_NO: test
```

Configuring Scramble

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

Scrambling can prevent some bit patterns from being mistakenly interpreted as alarms by switches placed between the Data Service Units (DSUs).

To configure scrambling, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure. • *slot/subslot/port*—Specifies the location of the interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5
Router(config-if)# [**no**] **scramble**	Enables scrambling. Scrambling is disabled by default. • **scramble**—Enable scramble. • **no scramble**—Disable scramble. **Note** When using framing bypass, **no scrambling** must be configured.

Verifying Scramble Configuration

Use the **show controllers serial** command to display the scrambling setting:

```
router# show controllers serial 6/0/0
Serial6/0/0 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 2, since reset 0
   Scrambling is enabled
   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 Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
.
.
.
```

Configuring Framing

Framing is used to synchronize data transmission on the line. Framing allows the hardware to determine when each packet starts and ends. To configure framing, use the following commands.

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure. • *slot/subslot/port*—Specifies the location of the T3/E3 interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5
T3: Router(config-if)# **framing {bypass** | **c-bit** | **m13}** E3: Router(config-if)# **framing {bypass** | **g751**| **g832}**	Sets the framing on the interface. • **bypass**—Configure framing bypass to use the full T3 or E3 bandwidth • **c-bit**—Specifies C-bit parity framing. This is the default for T3. • **m13**—Specifies M13 framing. • **g751**— Specifies g751 framing. This is the default for E3. • **g832**—Specifies g832 framing.

Verifying Framing Configuration

Use the **show controllers serial** command to display the framing method:

```
router# show controllers serial 6/0/0
Serial6/0/0 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 2, since reset 0
   Data in current interval (546 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
.
.
.
```

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
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure. • *slot/subslot/port*—Specifies the location of the interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5
Router(config-if)# **encapsulation** {**hdlc** | **ppp** | **frame-relay**}	Sets the encapsulation method on the interface. • **hdlc**—High-Level Data Link Control (HDLC) protocol for serial interface. This is the default. • **ppp**—PPP (for serial interface). • **frame-relay**—Frame Relay (for serial interface).

Verifying Encapsulation

Use the **show interfaces** command to display the encapsulation method:

```
router# show interfaces serial 6/0/1
Serial6/0/1 is up, line protocol is up
  Hardware is SPA-4T3E3
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 223/255, rxload 222/255
  Encapsulation FRAME-RELAY, crc 16, loopback not set
  Keepalive set (10 sec)
  LMI enq sent  13076, LMI stat recvd 13076, LMI upd recvd 0, DTE LMI up
  LMI enq recvd 0, LMI stat sent  0, LMI upd sent  0
  LMI DLCI 0  LMI type is ANSI Annex D  frame relay DTE
  FR SVC disabled, LAPF state down
  Broadcast queue 0/256, broadcasts sent/dropped 0/0, interface broadcasts 0
  Last input 00:00:04, output 00:00:04, output hang never
  Last clearing of "show interface" counters 1d12h
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 38579000 bits/sec, 109611 packets/sec
  5 minute output rate 38671000 bits/sec, 109852 packets/sec
     14374551065 packets input, 632486376132 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
              0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     14408526130 packets output, 633974757440 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
   rxLOS inactive, rxLOF inactive, rxAIS inactive
   txAIS inactive, rxRAI inactive, txRAI inactive
```

Configuring Cable Length

The **cablelength** command compensates for the loss in decibels based on the distance from the device to the first repeater in the circuit. A longer distance from the device to the repeater requires that the signal strength on the circuit be boosted to compensate for loss over that distance. To configure cable length, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5
Router(config-if)# **cablelength** *length*	Sets the cable length. • *length*—Range is 0-450 feet. The default is 10 feet.

Verify Cable Length Setting

Use the **show interfaces serial** command to verify the cable length setting:

```
router# show interfaces serial 4/0/0
Serial4/0/0 -
   Framing is c-bit, Clock Source is Internal
   Bandwidth limit is 44210, DSU mode 0, Cable length is 200
   rx FEBE since last clear counter 0, since reset 22
   Data in current interval (446 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 2:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
.
.
.
```

Configuring Invert Data

Delays between the TE clock and data transmission indicate that the transmit clock signal might not be appropriate for the interface rate and length of cable being used. Different ends of the wire may have variances that differ slightly. Invert the clock signal to compensate for these factors. To configure invert data, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5
Router(config-if)# **invert** {**data**}	Inverts the data. • **data**—Invert the data stream.

Verify Invert Data Setting

Use the **show running configuration** command to verify that invert data was set on the interface:

```
router# show running configuration
.
.
.
interface Serial6/0/0
 ip address 51.1.1.1 255.255.255.0
 logging event link-status
 dsu bandwidth 44210
 framing c-bit
 cablelength 10
 clock source internal
 invert data
 mdl string eic tst
 mdl string lic 67
 mdl string generator test
 mdl transmit path
 mdl transmit test-signal
 no cdp enable
!
.
.
.
```

Configuring the Trace Trail Buffer

Configure TTB to send messages to the remote device. The TTB messages check for the continued presence of the transmitter. To configure TTB, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the interface. See the: "Specifying the Interface Address on a SPA" section on page 13-5
Router(config-if)# **ttb** {**country** | **rnode** | **serial** | **snode** | **soperator** | **x**} *string*	Sends a Trace Trail Buffer message in E3 g.832 framing mode. • **country**—Two character country code • **rnode**—Receive node code • **serial**—M.1400 serial • **snode**—Sending location/Node ID code • **soperator**—Sending operator code. (must be numeric) • **x**—X0 • *string*—TTB message.

Verify TTB Settings

Use the **show controllers serial** command to display the TTB settings for the interface:

```
router# show controllers serial 6/0/0
Serial6/0/0 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 2, since reset 0
   Data in current interval (546 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
.
.
.
No alarms detected.
TTB transmission is disabled
TTB Rx: country: us soperator: s snode: sn rnode: rn x: x serial: 1
```

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, Release 12.2* and *Cisco IOS Configuration Fundamentals Command Reference, Release 12.2* publications.

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display your Cisco 7304 router configuration settings, you can use the **show interfaces serial** and the **show controllers serial** commands to get detailed information on a per-port basis for your 2-Port or 4-Port T3/E3 SPA.

Verifying Per-Port Interface Status

To find detailed interface information on a per-port basis for the 2-Port or 4-Port T3/E3 SPA, use the **show interfaces serial** command. For a description of the command output, see Chapter 18, "Command Reference."

The following example provides sample output for interface port 1 on the SPA located in the first subslot of the SIP installed in slot 5 of a Cisco 7304 router:

```
Router# show interface serial 5/0/1
Serial5/0/1 is up, line protocol is up
  Hardware is SPA-4T3E3
  Internet address is 120.1.1.1/24
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 234/255, rxload 234/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:00, output 00:00:01, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 40685000 bits/sec, 115627 packets/sec
  5 minute output rate 40685000 bits/sec, 115624 packets/sec
     4652915554 packets input, 204728203496 bytes, 0 no buffer
     Received 4044 broadcasts (0 IP multicast)
     130 runts, 0 giants, 0 throttles
              0 parity
     1595 input errors, 543 CRC, 0 frame, 0 overrun, 0 ignored, 922 abort
     4653081242 packets output, 204735493748 bytes, 0 underruns
     0 output errors, 0 applique, 4 interface resets
     0 output buffer failures, 0 output buffers swapped out
     2 carrier transitions
```

Monitoring Per-Port Interface Statistics

To find detailed status and statistical information on a per-port basis for the 2-Port or 4-Port T3/E3 SPA, use the **show controllers serial** command. For a description of the command output, see Chapter 18, "Command Reference."

The following example provides sample output for interface port 1 on the SPA located in the first subslot of the SIP that is installed in slot 5 of the Cisco 7304 router:

```
show controller serial 5/0/2
Serial5/0/2 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 0, since reset 0
   Data in current interval (807 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 306 Unavailable Secs
     500 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     564 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 2:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     564 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 3:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     562 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 4:
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     560 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
    .
    .
    .
    Total Data (last 44 15 minute intervals):
         0 Line Code Violations, 0 P-bit Coding Violation,
         0 C-bit Coding Violation,
         0 P-bit Err Secs, 0 P-bit Sev Err Secs,
         0 Sev Err Framing Secs, 0 Unavailable Secs,
         24750 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs

       Transmitter is sending AIS.

       Receiver has loss of signal.

        40434 Sev Err Line Secs, 0 Far-End Err Secs, 0 Far-End Sev Err Secs
        0 P-bit Unavailable Secs, 0 CP-bit Unavailable Secs
        0 CP-bit Far-end Unavailable Secs
        0 Near-end path failures, 0 Far-end path failures
```

```
  No FEAC code is being received
MDL transmission is disabled
```

Configuration Examples

This section includes the following configuration examples:

DSU Configuration Example

The following example confgiures DSU on interface port 0 on slot 4, subslot 1.

```
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 4/1/0
!
! Specify the DSU mode
!
Router(config-if)# dsu mode 0
!
! Specify the DSU bandwidth
!
Router(config-if)# dsu bandwidth 10000
!
! Set the DSU bandwidth to accept or reject the incoming remote requests
!
Router(config-if)# dsu remote accept
```

MDL Configuration Example

The following example configures the MDL strings on interface port 0 on slot 4, subslot 1.

```
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 4/1/0
!
! Specify the MDL strings
!
Router(config-if)# mdl string eic beic
Router(config-if)# mdl string lic beic
Router(config-if)# mdl string fic bfix
Router(config-if)# mdl string unit bunit
Router(config-if)# mdl string pfi bpfi
Router(config-if)# mdl string port bport
Router(config-if)# mdl string generator bgen
```

```
Router(config-if)# mdl transmit path
Router(config-if)# mdl transmit idle-signal
Router(config-if)# mdl transmit test-signal
```

Scrambling Configuration Example

The following example configures scrambling on the T3/E3 interface:

```
! Enter global configuration mode
!
Router# configure terminal
!
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 4/1/3
!
! Enable scrambling
!
Router(config-if)# scrambling
```

Framing Configuration Example

The following example configures framing on interface port 1 on slot 4, subslot 1.

```
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 4/1/1
!
! Specify the framing method
!
Router(config-if)# framing m13
```

Encapsulation Configuration Example

The following example configures encapsulation on interface port 1 on slot 4, subslot 1.

```
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 4/1/1
!
! Specify the encapsulation method
!
Router(config-if)# encapsulation PPP
```

Cable Length Configuration Example

The following example configures sets the cable length to 200 feet:

```
! Enter global configuration mode
!
Router# configure terminal
!
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 4/1/3
!
```

```
! Specify the cable length
!
Router(config-if)# cablelength 200
```

Invert Data Configuration Example

The following example enables invert data:

```
! Enter global configuration mode
!
Router# configure terminal
!
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 4/1/3
!
! Enable invert data
!
Router(config-if)# invert data
```

Trace Trail Buffer Configuration Example

The following example configures the TTB attributes:

```
! Enter global configuration mode
!
Router# configure terminal
!
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 4/1/3
!
! Specify the TTB attributes
!
Router(config-if)# ttb country ab
Router(config-if)# ttb soperator 56
Router(config-if)# ttb snode 34
Router(config-if)# ttb rnode cd
Router(config-if)# ttb x 7
Router(config-if)# ttb serial 12
```