Chapter 30

Configuring T3 Interfaces

T3 is the physical layer protocol used by the Digital Signal level 3 (DS3) multiplexing method in North America. A T3 interface operates at a bit rate of 44.736 Mbps. The JUNOS software supports payload scrambling and subrate operation on each physical T3 interface. One encapsulation format—Point-to-Point Protocol (PPP), Frame Relay, or High-level Data Link Control (HDLC)—must be configured for the interface. DS3 standards supported include:

- ANSI TI.107, TI.102
- GR 499-core, GR 253-core
- Bellcore TR-TSY-000009
- AT&T Pub 5404
- ITU G.751, G.703, G823

To configure T3-specific physical interface properties, include the t3-options statement at the [edit interfaces *interface-name*] hierarchy level:

```
[edit interfaces interface-name]
t3-options {
    bert-algorithm algorithm;
    bert-error-rate rate;
    bert-period seconds;
    (cbit-parity | no-cbit-parity);
    compatibility-mode (adtran | digital-link | kentrox | larscom | verilink)
      <subrate value>;
    fcs (16 | 32);
    (feac-loop-respond | no-feac-loop-respond);
    idle-cycle-flag value;
    (long-buildout | no-long-buildout);
    (loop-timing | no-loop-timing);
    loopback (local | payload | remote);
    (payload-scrambler | no-payload-scrambler);
    start-end-flag value;
}
```

You can configure the following T3 interface-specific properties:

- Configuring T3 BERT Properties on page 622
- Disabling T3 C-Bit Parity Mode on page 623
- Configuring the T3 CSU Compatibility Mode on page 624
- Configuring the T3 Frame Checksum on page 626
- Configuring the T3 FEAC Response on page 626
- Configuring the T3 Idle Cycle Flag on page 627
- Configuring the T3 Line Buildout on page 627
- Configuring the Channelized T3 Loop Timing on page 628
- Configuring T3 Loopback Capability on page 628
- Configuring T3 HDLC Payload Scrambling on page 630
- Configuring T3 Start and End Flags on page 631

See also the following section, which applies to a number of different interfaces:

- Configuring an ISDN Dialer Interface as a Backup Interface on page 528

For an example of T3 interface configuration, see "Examples: Configuring T3 Interfaces" on page 631.

Configuring T3 BERT Properties

This section discusses BERT properties for the T3 interface specifically. For general information about the JUNOS implementation of the BERT procedure, see "Interface Diagnostics" on page 111.

You can configure a T3 interface to execute a bit error rate test (BERT) when the interface receives a request to run this test. You specify the duration of the test, the pattern to send in the bit stream, and the error rate to include in the bit stream by including the bert-period, bert-algorithm, and bert-error-rate statements at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
bert-algorithm algorithm;
bert-error-rate rate;
bert-period seconds;
```

By default, the BERT period is 10 seconds. You can configure the BERT period to last from 1 through 239 seconds on some PICs and from 1 through 240 seconds on other PICs.

rate is the bit error rate. This can be an integer from 0 through 7, which corresponds to a bit error rate from 10^{-0} (1 error per bit) to 10^{-7} (1 error per 10 million bits).

algorithm is the pattern to send in the bit stream. The default algorithm for the DS3 BERT procedure is pseudo-2e15-o151 (pattern is $2^{15}-1$, as defined in the CCITT/ITU O.151 standard).

On T3 interfaces, you can also select the pattern to send in the bit stream by including the bert-algorithm statement at the [edit interfaces *interface-name interface*-options] hierarchy level:

```
[edit interfaces interface-name interface-options]
bert-algorithm algorithm;
```

For a list of supported algorithms, enter a ? after the bert-algorithm statement; for example:

```
[edit interfaces t3-0/0/0 t3-options]
user@host# set bert-algorithm ?
Possible completions:
all-ones-repeating   Repeating one bits
all-zeros-repeating  Repeating zero bits
alternating-double-ones-zeros  Alternating pairs of ones and zeros
alternating-ones-zeros  Alternating ones and zeros
pseudo-2e10          Pattern is 2^10 - 1
...
```

For specific hierarchy information, see individual interface types. For information about running the BERT procedure, see the *JUNOS System Basics and Services Command Reference*.

Disabling T3 C-Bit Parity Mode

C-bit parity mode controls the type of framing that is present on the transmitted T3 signal. When C-bit parity mode is enabled, the C-bit positions are used for the FEBE, FEAC, terminal data link, path parity, and mode indicator bits, as defined in ANSI T1.107a-1989. When C-bit parity mode is disabled, the basic T3 framing mode (M13) is used.

By default, C-bit parity mode is enabled. To disable C-bit parity mode and use M13 framing for your T3 link, include the no-cbit-parity statement at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
no-cbit-parity;
```

To return to the default, enabling C-bit parity mode, delete the no-cbit-parity statement from the configuration:

```
[edit]
user@host# delete interfaces t3-fpc/pic/port t3-options no-cbit-parity
```

To explicitly enable C-bit parity mode, include the cbit-parity statement at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
cbit-parity;
```

Configuring the T3 CSU Compatibility Mode

Subrating a T3 interface reduces the maximum allowable peak rate by limiting the HDLC-encapsulated payload. Subrate modes configure the PIC to connect with channel service units (CSUs) that use proprietary methods of multiplexing.

You can configure T3 interfaces to be compatible with a Digital Link, Kentrox, or Larscom CSUs. For T3 intelligent queuing (IQ) channels only, you can also configure Adtran or Verilink CSU compatibility.

NOTE: To subrate an E3 interface to be compatible with a Kentrox CSU, you must have an IQ-based PIC. Non-IQ PICs allow a commit of the configuration, but the interfaces remain at the full E3 rate for the Kentrox compatibility mode.

To configure a T3 interface so that it is compatible with the CSU at the remote end of the line, include the compatibility statement at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
compatibility-mode (adtran | digital-link | kentrox | larscom | verilink)
<subrate value>;
```

The subrate of a T3 interface must exactly match that of the remote CSU. To specify the subrate, include the subrate statement in the configuration:

- For Adtran CSUs, specify the subrate as a number from 1 through 588 that exactly matches the value configured on the CSU. A subrate value of 588 corresponds to 44.2 Mbps, or 100 percent of the HDLC-encapsulated payload. A subrate value of 1 corresponds to 44.2 / 588, which is 75.17 Kbps, or 0.17 percent of the HDLC-encapsulated payload.

- For Digital Link CSUs, specify the subrate as the data rate you configured on the CSU in the format xKb or x.xMb. For Digital Link CSUs, you can specify the subrate value to match the data rate configured on the CSU in the format *x*kb or *x.x*Mb. You can configure the subrate values shown in Table 56 on page 625.

- For Kentrox CSUs, specify the subrate as a number from 1 through 69 that exactly matches the value configured on the CSU. A subrate value of 69 corresponds to 34.995097 Mbps, or 79.17 percent of the HDLC-encapsulated payload (44.2 Mbps). A subrate value of 1 corresponds to 999.958 Kbps, which is 2.26 percent of the HDLC-encapsulated payload. Each increment of the subrate value corresponds to a rate increment of about 0.5 Mbps.

- For Larscom CSUs, specify the subrate as a number from 1 through 14 that exactly matches the value configured on the CSU. A subrate value of 14 corresponds to 44.2 Mbps, or 100 percent of the HDLC-encapsulated payload. A subrate value of 1 corresponds to 44.2 / 14, which is 3.16 Mbps, 7.15 percent of the HDLC-encapsulated payload.

- For Verilink CSUs, specify the subrate as a number from 1 through 28 that exactly matches the value configured on the CSU. To calculate the maximum allowable peak rate, multiply the configured subrate by 1.578 Mbps. For example, a subrate value of 28 corresponds to 28 x 1.578 Mbps, which is 44.2 Mbps, 100 percent of the HDLC-encapsulated payload. A subrate value of 1 corresponds to 1.578 Mbps, 3.57 percent of the HDLC-encapsulated payload. A subrate value of 20 corresponds to 20 x 1.578 Mbps, which is 31.56 Mbps, 71.42 percent of the HDLC-encapsulated payload.

Table 56: Subrate Values for T3 Digital Link Compatibility Mode (1 of 2)

301 Kbps	9.3 Mbps	18.3 Mbps	27.4 Mbps	36.4 Mbps
601 Kbps	9.6 Mbps	18.6 Mbps	27.7 Mbps	36.7 Mbps
902 Kbps	9.9 Mbps	18.9 Mbps	28.0 Mbps	37.0 Mbps
1.2 Mbps	10.2 Mbps	19.2 Mbps	28.3 Mbps	37.3 Mbps
1.5 Mbps	10.5 Mbps	19.5 Mbps	28.6 Mbps	37.6 Mbps
1.8 Mbps	10.8 Mbps	19.8 Mbps	28.9 Mbps	37.9 Mbps
2.1 Mbps	11.1 Mbps	20.1 Mbps	29.2 Mbps	38.2 Mbps
2.4 Mbps	11.4 Mbps	20.5 Mbps	29.5 Mbps	38.5 Mbps
2.7 Mbps	11.7 Mbps	20.8 Mbps	29.8 Mbps	38.8 Mbps
3.0 Mbps	12.0 Mbps	21.1 Mbps	30.1 Mbps	39.1 Mbps
3.3 Mbps	12.3 Mbps	21.4 Mbps	30.4 Mbps	39.4 Mbps
3.6 Mbps	12.6 Mbps	21.7 Mbps	30.7 Mbps	39.7 Mbps
3.9 Mbps	12.9 Mbps	22.0 Mbps	31.0 Mbps	40.0 Mbps
4.2 Mbps	13.2 Mbps	22.3 Mbps	31.3 Mbps	40.3 Mbps
4.5 Mbps	13.5 Mbps	22.6 Mbps	31.6 Mbps	40.6 Mbps
4.8 Mbps	13.8 Mbps	22.9 Mbps	31.9 Mbps	40.9 Mbps
5.1 Mbps	14.1 Mbps	23.2 Mbps	32.2 Mbps	41.2 Mbps
5.4 Mbps	14.4 Mbps	23.5 Mbps	32.5 Mbps	41.5 Mbps
5.7 Mbps	14.7 Mbps	23.8 Mbps	32.8 Mbps	41.8 Mbps
6.0 Mbps	15.0 Mbps	24.1 Mbps	33.1 Mbps	42.1 Mbps
6.3 Mbps	15.3 Mbps	24.4 Mbps	33.4 Mbps	42.4 Mbps
6.6 Mbps	15.6 Mbps	24.7 Mbps	33.7 Mbps	42.7 Mbps
6.9 Mbps	15.9 Mbps	25.0 Mbps	34.0 Mbps	43.0 Mbps
7.2 Mbps	16.2 Mbps	25.3 Mbps	34.3 Mbps	43.3 Mbps
7.5 Mbps	16.5 Mbps	25.6 Mbps	34.6 Mbps	43.6 Mbps
7.8 Mbps	16.8 Mbps	25.9 Mbps	34.9 Mbps	43.9 Mbps
8.1 Mbps	17.1 Mbps	26.2 Mbps	35.2 Mbps	44.2 Mbps

Table 56: Subrate Values for T3 Digital Link Compatibility Mode (2 of 2)

8.4 Mbps	17.4 Mbps	26.5 Mbps	35.5 Mbps
8.7 Mbps	17.7 Mbps	26.8 Mbps	35.8 Mbps
9.0 Mbps	18.0 Mbps	27.1 Mbps	36.1 Mbps

For information about subrating an E3 interface, see "Configuring the E3 CSU Compatibility Mode" on page 409.

Configuring the T3 Frame Checksum

By default, T3 interfaces use a 16-bit frame checksum. You can configure a 32-bit checksum, which provides more reliable packet verification. However, some older equipment might not support 32-bit checksums.

On a channelized OC12 interface, the fcs statement is not supported. To configure FCS on each DS3 channel, you must include the t3-options fcs statement in the configuration for each channel.

To configure a 32-bit checksum, include the fcs statement at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
fcs 32;
```

To return to the default 16-bit frame checksum, delete the fcs 32 statement from the configuration:

```
[edit]
user@host# delete interfaces t3-fpc/pic/port t3-options fcs 32
```

To explicitly configure a 16-bit checksum, include the fcs statement at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
fcs 16;
```

Configuring the T3 FEAC Response

The T3 far-end alarm and control (FEAC) signal is used to send alarm or status information from the far-end terminal back to the near-end terminal and to initiate T3 loopbacks at the far-end terminal from the near-end terminal.

By default, the routing platform does not respond to FEAC requests. To allow the remote CSU to place the local routing platform into loopback, you must configure the routing platform to respond to the CSU's FEAC request by including the feac-loop-respond statement at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
feac-loop-respond;
```

If you configure remote or local loopback with the T3 **loopback** statement, the routing platform does not respond to FEAC requests from the CSU even if you include the **feac-loop-respond** statement in the configuration. For the routing platform to respond, you must delete the **loopback** statement from the configuration.

To explicitly configure the routing platform not to respond to FEAC requests, include the **no-feac-loop** statement at the [**edit interfaces** *interface-name* **t3-options**] hierarchy level:

```
[edit interfaces interface-name t3-options]
no-feac-loop-respond;
```

Configuring the T3 Idle Cycle Flag

By default, a T3 interface transmits the value 0x7E in the idle cycles. To have the interface transmit the value 0xFF (all ones) instead, include the **idle-cycle-flag** statement at the [**edit interfaces** *interface-name* **t3-options**] hierarchy level, specifying the **ones** option:

```
[edit interfaces interface-name t3-options]
idle-cycle-flag ones;
```

To explicitly configure the default value of 0x7E, include the **idle-cycle-flag** statement with the **flags** option:

```
[edit interfaces interface-name t3-options]
idle-cycle-flag flags;
```

Configuring the T3 Line Buildout

A T3 interface has two settings for the T3 line buildout: a short setting, which is less than 255 feet (about 68 meters), and a long setting, which is greater than 255 feet and less than 450 feet (about 137 meters). By default, the interface uses the short setting.

The **long-buildout** and **no-long-buildout** statements apply only to copper-cable-based T3 interfaces. You cannot configure a line buildout for a DS3 channel on a channelized OC12 interface, which runs over fiber-optic cable. If you configure this statement on a channelized OC12 interface, it is ignored.

To have the interface drive a line that is longer than 255 feet and shorter than 450 feet, include the **long-buildout** statement at the [**edit interfaces** *interface-name* **t3-options**] hierarchy level:

```
[edit interfaces interface-name t3-options]
long-buildout;
```

To explicitly configure the default short line buildout, include the **no-long-buildout** statement at the [**edit interfaces** *interface-name* **t3-options**] hierarchy level:

```
[edit interfaces interface-name t3-options]
no-long-buildout;
```

Configuring the Channelized T3 Loop Timing

By default, internal clocking (line timing) is used on channelized IQ interfaces. To configure SONET/SDH or DS3-level external clocking, include the loop-timing statement:

```
loop-timing;
```

You can include this statement at the following hierarchy levels:

- [edit interfaces ct3-*fpc/pic/port* t3-options]
- [edit interfaces stm1-*fpc/pic/port* sonet-options]

To explicitly configure the default line timing, include the no-loop-timing statement in the configuration:

```
no-loop-timing;
```

The loop-timing and no-loop-timing statements apply only to E1 and T1 interfaces you configure on channelized IQ PICs. If you attempt to include these statements on any other interface type, they are ignored.

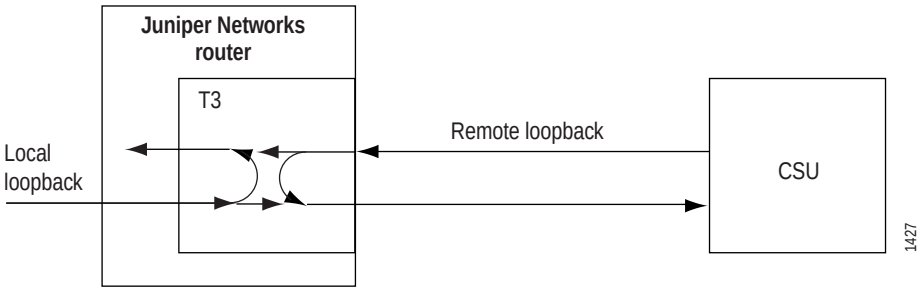
For all channelized IQ PICs, the clocking statement is supported on all channels. To configure clocking on individual interfaces, include the clocking statement at the [edit interfaces *type-fpc/pic/port*:*channel*] hierarchy level. If you do not include the clocking statement, the individual interfaces use internal clocking by default.

For more information, see "Configuring the Clock Source" on page 105 and "Clock Sources on Channelized Interfaces" on page 300.

Configuring T3 Loopback Capability

You can configure loopback capability between the local T3 interface and the remote CSU, as shown in Figure 44. You can configure the loopback to be local or remote. With local loopback, the T3 interface can transmit packets to the CSU, but receives its own transmission back again and ignores data from the CSU. With remote loopback, packets sent from the CSU are received by the T3 interface, forwarded if there is a valid route, and immediately retransmitted to the CSU.

Figure 44: Remote and Local T3 Loopback



To configure loopback capability on a T3 interface, include the **loopback** statement at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
loopback (local | payload | remote);
```

Packets can be looped on either the local routing platform or the remote CSU. Local and remote loopback loop back both data and clocking information.

To exchange BERT patterns between a local routing platform and a remote routing platform, include the **loopback remote** statement in the interface configuration at the remote end of the link. From the local routing platform, you issue the **test interface** command.

For more information about configuring BERT, see "Interface Diagnostics" on page 111. For more information about using operational mode commands to test interfaces, see the *JUNOS System Basics and Services Command Reference*.

For channelized T3, T1, and *N*xDS0 IQ interfaces only, you can include the **loopback payload** statement in the configuration to loop back data only (without clocking information) on the remote routing platform's PIC. In payload loopback, overhead is recalculated. For T3 IQ interfaces, you can include the **loopback payload** statement at the [edit interfaces ct3-*fpc/pic/port*] and [edit interfaces t3-*fpc/pic/port*:*channel*] hierarchy levels. For T1 interfaces, you can include the **loopback payload** statement in the configuration at the [edit interfaces t1-*fpc/pic/port*:*channel*] hierarchy level; it is ignored if included at the [edit interfaces ct1-*fpc/pic/port*] hierarchy level. For *N*xDS0 interfaces, payload and remote loopback are the same. If you configure one, the other is ignored. *N*xDS0 IQ interfaces do not support local loopback.

To determine whether a problem is internal or external, you can loop packets on both the local and the remote routing platform. To do this, include the **no-keepalives** and **encapsulation cisco-hdlc** statements at the [edit interfaces *interface-name*] hierarchy level and the **loopback local** statement at the [edit interfaces *interface-name* t3-options] hierarchy level, as shown in the following example:

```
[edit interfaces]
t3-1/0/0 {
    no-keepalives;
    encapsulation cisco-hdlc;
    t3-options {
        loopback local;
    }
    unit 0 {
        family inet {
            address 10.100.100.1/24;
        }
    }
}
```

With this configuration, the link stays up, so you can loop ping packets to a remote routing platform. The **loopback local** statement causes the interface to loop within the PIC just before the data reaches the transceiver.

To turn off the loopback capability, remove the loopback statement from the configuration:

```
[edit]
user@host# delete interfaces t3-fpc/pic/port t3-options loopback
```

You can determine whether there is an internal problem or an external problem by checking the error counters in the output of the show interface *interface-name* extensive command, for example:

```
user@host> show interfaces t3-fpc/pic/port extensive
```

For channel 0 on channelized interfaces only, you can include the loopback statement at the [edit interfaces *interface-name interface-type*-options] hierarchy level. The loopback setting configured for channel 0 applies to all channels on the channelized interface. The loopback statement is ignored if you include it at this hierarchy level in the configuration of other channels. To configure loopbacks on individual channels, you must include the *channel-type*-options loopback statement in the configuration for each channel. This allows each channel to be put in loopback mode independently.

For example, for DS3 channels on a channelized OC12 interface, the sonet-options loopback statement is supported only for channel 0; it is ignored if included in the configuration for channels 1 through 11. The SONET loopback configured for channel 0 applies to all 12 channels equally. To configure loopbacks on the individual DS3 channels, you must include the t3-options loopback statement in the configuration for each channel. This allows each DS3 channel can be put in loopback mode independently.

Configuring T3 HDLC Payload Scrambling

T3 HDLC payload scrambling, which is disabled by default, provides better link stability. Both sides of a connection must either use or not use scrambling.

On a channelized OC12 interface, the SONET payload-scrambler statement is ignored. To configure scrambling on the DS3 channels on the interface, you can include the t3-options payload-scrambler statement at the [edit interfaces *interface-name* t3-options] hierarchy level for each DS3 channel:

```
[edit interfaces interface-name t3-options]
payload-scrambler;
```

To explicitly disable HDLC payload scrambling, include the no-payload-scrambler statement at the [edit interfaces *interface-name* t3-options] hierarchy level:

```
[edit interfaces interface-name t3-options]
no-payload-scrambler;
```

To disable payload scrambling again (return to the default), delete the payload-scrambler statement from the configuration:

```
[edit]
user@host# delete interfaces t3-fpc/pic/port t3-options payload-scrambler
```

Configuring T3 Start and End Flags

By default, a T3 interface shares the transmission of the start and end flags

To configure a T3 interface to wait two idle cycles between the start and end flags, include the start-end-flag statement at the [edit interfaces *interface-name* t3-options] hierarchy level and specify the filler option:

```
[edit interfaces interface-name t3-options]
start-end-flag filler;
```

To revert to the default behavior, sharing the transmission of start and end flags, include the start-end-flag statement at the [edit interfaces *interface-name* t3-options] hierarchy level and specify the shared option:

```
[edit interfaces interface-name t3-options]
start-end-flag shared;
```

Examples: Configuring T3 Interfaces

T3 interfaces can use PPP, Cisco HDLC, or Frame Relay encapsulation.

PPP Encapsulation on a DS3 PIC

```
[edit]
interfaces {
    t3-fpc/pic/port {
        encapsulation ppp;
        t3-options {
            no-long-buildout;
            compatibility-mode larscom;
            payload-scrambler;
        }
        unit 0 {
            family inet {
                address 10.0.0.1/32 {
                    destination 10.0.0.2;
                }
            }
            family iso;
        }
    }
}
```

Cisco HDLC Encapsulation on a DS3 PIC

```
[edit]
interfaces {
    t3-fpc/pic/port {
        encapsulation cisco-hdlc;
        t3-options {
            no-long-buildout;
            compatibility-mode larscom;
            payload-scrambler;
        }
        unit 0 {
            family inet {
                address 10.0.0.1/32 {
                    destination 10.0.0.2;
                }
            }
            family iso;
        }
    }
}
```

Configure Frame Relay encapsulation on two platforms, where one platform is a DTE device and the other is a DCE device:

On DTE Router

```
[edit]
interfaces {
    t3-fpc/pic/port {
        encapsulation frame-relay;
        t3-options {
            no-long-buildout;
            compatibility-mode larscom;
            payload-scrambler;
        }
        unit 1 {
            dlci 1;
            family inet {
                address 10.0.0.1/32 {
                    destination 10.0.0.2;
                }
            }
            family iso;
        }
        unit 2 {
            dlci 2;
            family inet {
                address 10.0.0.3/32 {
                    destination 10.0.0.4;
                }
            }
            family iso;
        }
    }
}
```

On DCE Router

```
[edit]
interfaces {
    t3-fpc/pic/port {
        dce;
        encapsulation frame-relay;
        t3-options {
            no-long-buildout;
            compatibility-mode larscom;
            payload-scrambler;
        }
        unit 1 {
            dlci 1;
            family inet {
                address 10.0.0.2/32 {
                    destination 10.0.0.1;
                }
            }
            family iso;
        }
        unit 2 {
            dlci 2;
            family inet {
                address 10.0.0.4/32 {
                    destination 10.0.0.3;
                }
            }
            family iso;
        }
    }
}
```