Chapter 15
# Locate SONET Alarms and Errors

This chapter describes the most common SONET alarms and errors you can encounter when investigating line problems on a Juniper Networks router. (See Table 31.) For a useful reference for details on SONET interfaces, refer to the Telcordia/Bellcore Standard GR-253 CORE, available from www.telcordia.com.

**Table 31: List of Common SONET Alarms and Errors**

| SONET Alarm and Error Tasks | Command or Action |
|---|---|
| **Display SONET Alarms and Errors on page 152** | show interfaces so-*fpc/pic/port* extensive |
| **Locate Most Common SONET Alarms and Errors on page 155** | |
| 1. Locate Loss of Signal Alarms on page 156 | Check the connection between the router port and the first SONET network element. |
| 2. Locate Alarm Indication Signal Alarms on page 157 | Downstream from the router, check the path-terminating equipment, section-terminating equipment, and line-terminating equipment for a loss of signal or loss of frame. |
| 3. Locate Remote Defect Indication Alarms on page 159 | Upstream from the router, check the path-terminating equipment, section-terminating equipment, and line-terminating equipment for a loss of signal or loss of frame. |
| 4. Locate Remote Error Indication Line Errors on page 161 | Upstream from the router, check the line-terminating equipment and path-terminating equipment for an error in the B2 or B3 byte. |
| 5. Locate Bit Error Rate Alarms on page 163 | Check the following:<br>Optical fiber<br>Optical transmitter and receiver<br>Clocking<br>Attenuation in the optical signal |
| 6. Locate Payload Label Mismatch Path Alarms on page 164 | Check the received and transmitted C2 byte. |
| 7. Locate Loss of Pointer Path Alarms on page 166 | Check that both sides of the connection are configured for concatenate or nonconcatenate mode. |
| 8. Locate Unequipped Payload Alarms on page 167 | Check provisioning with the SONET provider, and if possible, check the configuration of the add/drop multiplexer (ADM). |
| 9. Locate Phase Lock Loop Alarms on page 168 | Investigate the timing source, and configure the clocking to external or internal depending on the situation. |

## Display SONET Alarms and Errors

**Action** To display SONET alarms and errors, use the following JUNOS command-line interface (CLI) operational mode command:

user@host> **show interfaces so-***fpc***/***pic***/***port* **extensive**

**Sample Output**

```
user@host> show interfaces so-1/1/1 extensive
[...Output truncated...]
  Active alarms  : None
  Active defects : None
  SONET PHY:           Seconds        Count  State
    PLL Lock                 0            0  OK
    PHY Light                0            0  OK
  SONET section:
    BIP-B1                   0            0
    SEF                      0            0  OK
    LOS                      0            0  OK
    LOF                      0            0  OK
    ES-S                     0
    SES-S                    0
    SEFS-S                   0
  SONET line:
    BIP-B2                   0            0
    REI-L                    0            0
    RDI-L                    0            0  OK
    AIS-L                    0            0  OK
    BERR-SF                  0            0  OK
    BERR-SD                  0            0  OK
    ES-L                     0
    SES-L                    0
    UAS-L                    0
    ES-LFE                   0
    SES-LFE                  0
    UAS-LFE                  0
  SONET path:
    BIP-B3                   0            0
    REI-P                    0            0
    LOP-P                    0            0  OK
    AIS-P                    0            0  OK
    RDI-P                    0            0  OK
    UNEQ-P                   0            0  OK
    PLM-P                    0            0  OK
    ES-P                     0
    SES-P                    0
    UAS-P                    0
    ES-PFE                   0
    SES-PFE                  0
    UAS-PFE                  0
[...Output truncated...]
```

**What It Means** The sample output shows where you find SONET alarms and errors. SONET alarms and errors fall into three different areas of the output: section, line, and path.

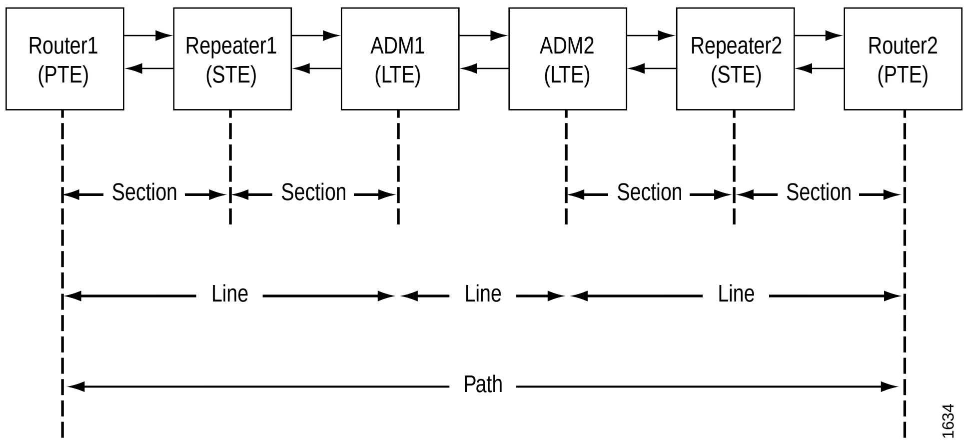
Section, line, and path errors occur over different spans of the SONET network and between different pieces of equipment. Figure 11 shows an example of a SONET network with the section, line, and path areas delimited. Figure 11 also shows the different pieces of equipment that comprise a SONET network:

A router, usually a path-terminating equipment (PTE)

An add/drop multiplexer (ADM), usually a line-terminating equipment (LTE)

A repeater, usually a section-terminating equipment (STE)

**Figure 11: Example of a SONET Network**




## SONET Section

The SONET section is the connection between two STEs. The STE performs the simple regeneration of the SONET signal to the next SONET equipment span between itself, the PTE, and the ADM. For example, Repeater1 (STE) regenerates the SONET signal between itself and ADM1, and the section between itself and Router1 (PTE). The STE checks to make sure that the incoming SONET frame, arriving from a directly connected neighbor, is good. An STE does not have any knowledge of the rest of the span.

An STE looks at the section overhead bytes of the SONET frame even though it can rewrite the other overhead bytes if an alarm is generated.

## SONET Line

The SONET line is the span between two LTEs. The LTE pays particular attention to the line overhead bytes of the SONET frame, can add and remove payload, and has more knowledge of the SONET network than the STEs. The LTE does not do the final processing of the SONET payload as does the PTE. The ADM is an LTE.

## SONET Path

The SONET path is the span between two PTEs. The PTE is the final destination where the SONET frame is terminated and the payload it carries is processed. A PTE pays particular attention to the path overhead bytes of the SONET frame.

## SONET System Hierarchy

The SONET system hierarchy is comprised of PTEs, LTEs, and STEs. The characteristics of each are as follows:

The main role of a PTE is to read the path overhead bytes. However, it also reads the line overhead bytes and the section overhead bytes. Therefore the PTE also plays the role of an LTE and an STE.

The main role of an LTE is to read the line overhead bytes. However, it also reads the section overhead bytes. Therefore the LTE also plays the role of an STE.

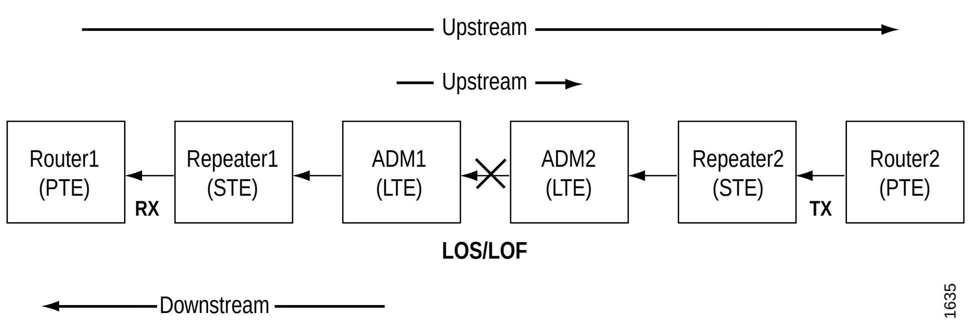
An STE reads only the section overhead bytes of the SONET frame. (See Figure 12.)

## Upstream and Downstream

The terms *upstream* and *downstream* are used in defining SONET alarms and errors. The terms are meaningful when viewed from the point of view of the failure in the circuit.

For example, in Figure 12 the failure occurs in the section between ADM1 and ADM2. The signal is transmitted from Router2 in the direction of Router1(from right to left). In this example, Router1, Repeater1, and ADM1 are downstream from the failure. ADM2, Repeater2, and Router2 are upstream from the failure.

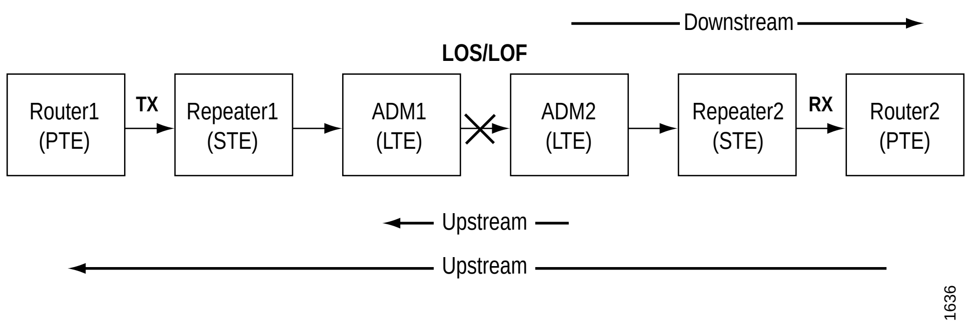
**Figure 12: Example of an Upstream or Downstream Failure**




The failure sends an alarm from ADM1 to Router1 in the direction of the signal transmission (downstream). Alarms are also sent from ADM1 to ADM2 and from Router1 to Router2 in the opposite direction of the signal transmission (upstream).

In Figure 13, the failure is also between ADM1 and ADM2. However, the signal is transmitted from Router1 in the direction of Router2 (from left to right). Router2, Repeater2, and ADM2 are downstream from the failure. ADM1, Repeater1, and Router1 are upstream from the failure.

**Figure 13: Another Example of an Upstream or Downstream Failure**




This failure sends an alarm from ADM2 to Router2 in the direction of the signal transmission (downstream). Alarms are also sent from ADM2 to ADM1 and from Router2 to Router1 in the opposite direction of the signal transmission (upstream).

All diagnostics are from the perspective of the PTE (the Juniper Networks router). Although the exact source of the problem can be difficult to find without having access to the LTE or the STE, you can at least determine from the PTE output whether the problem is remote or local.

## Locate Most Common SONET Alarms and Errors

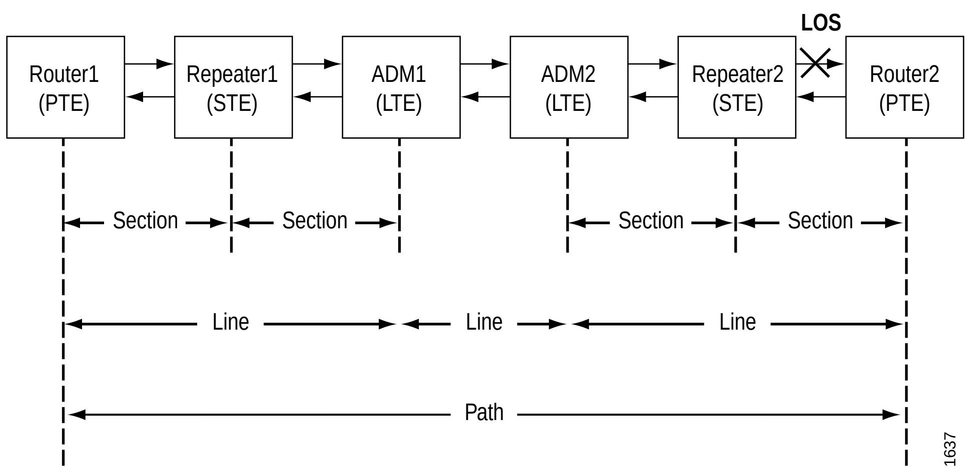
The following alarms and errors are described in this section:

## Locate Loss of Signal Alarms

**Purpose** A loss of signal (LOS) alarm indicates that there is a physical link problem with the connection to the router receive port from the neighboring SONET equipment transmit port.

**Action** To locate the LOS alarm, check the connection between the router port and the first SONET network element. In the example network in Figure 14, the X indicates that there is a connection problem between Repeater2 and Router2.

**Figure 14: Location of an LOS Alarm in a SONET Network**




To display SONET alarms and errors, use the following JUNOS CLI operational mode command:

user@host> **show interfaces so-***fpc***/***pic***/***port* **extensive**

**Sample Output**

```
user@router2> show interfaces s0-1/1/1 extensive
[... Output truncated...]
 Active alarms  : LOL, PLL, LOS
 Active defects : LOL, PLL, LOF, LOS, SEF, AIS-L, AIS-P, PLM-P
 SONET PHY:          Seconds        Count  State
   PLL Lock             51            0  PLL Lock Error
   PHY Light            51            0  Light Missing
 SONET section:
   BIP-B1               0             0
   SEF                 51             0  Defect Active
   LOS                 51             0  Defect Active
   LOF                 51             0  Defect Active
[...Output truncated...]
```

**What It Means** The sample output shows that Router2 detected an LOS that lasted 51 seconds.

## *Locate Alarm Indication Signal Alarms*

**Purpose** An alarm indication signal (AIS) is sent downstream to signal an error condition. There are two types of AIS alarms:

Alarm indication signal path (AIS-P) is sent by an LTE to a downstream PTE when an LOS or LOF is detected on a upstream SONET section.

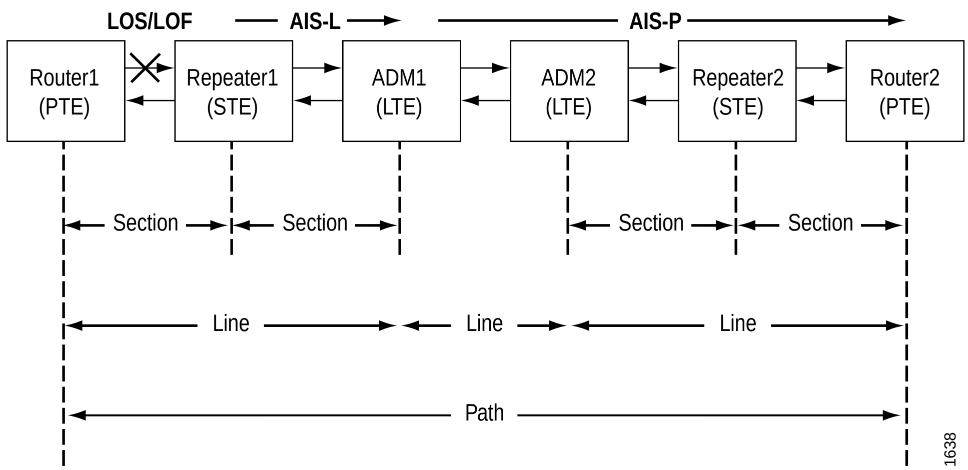
Alarm indication signal line (AIS-L) is sent by an STE to a downstream LTE when an LOS or LOF is detected on an incoming SONET section.

### Example of a Router Receiving Only an AIS-P Alarm

In Figure 15, the X indicates that the LOS or LOF occurs in the section between Router1 and Repeater1.

All diagnostics are from the perspective of Router2 (the Juniper Networks router).

**Figure 15: Example of a Router Receiving Only an AIS-P Alarm**




**What It Means** In Figure 15, the progression of events occurring after the failure is as follows:

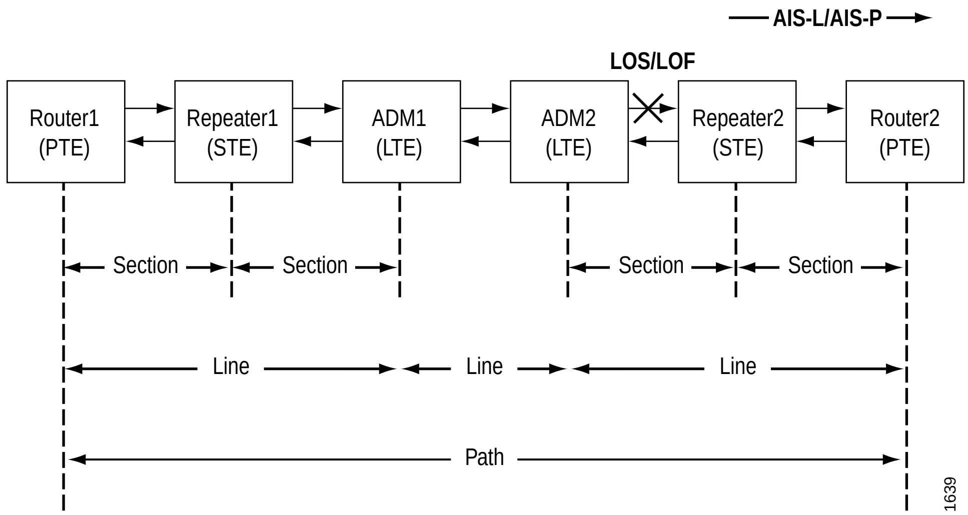
1. Repeater1 detects an LOS or LOF on an incoming SONET section.
2. Repeater1 sends an AIS-L downstream to ADM1 (LTE).
3. ADM1 sends an AIS-P to Router2 (PTE).
4. The only alarm that Router2 receives is the AIS-P alarm from ADM1.

## Example of a Router Receiving Both an AIS-L and AIS-P Alarm

In Figure 16, the X indicates that the LOS or LOF occurs in the section between ADM2 and Repeater2.

All diagnostics are from the perspective of Router2 (the Juniper Networks router).

**Figure 16: Example of a Router Receiving Both an AIS-L and an AIS-P Alarm**




**What It Means** In Figure 16, the progression of events occurring after the failure is as follows:

1. Repeater2 detects an LOS or LOF on the incoming section.
2. Repeater2 sends an AIS-L and AIS-P downstream to Router2.
3. Router2 receives both an AIS-L and an AIS-P from Repeater2.

## *Locate Remote Defect Indication Alarms*

**Purpose** A remote defect indication (RDI) is sent upstream to signal an error condition. There are two types of RDI alarms:

Remote defect indication line (RDI-L) is sent upstream to a peer LTE when an alarm indication signal line (AIS-L) or low-level defects are detected.

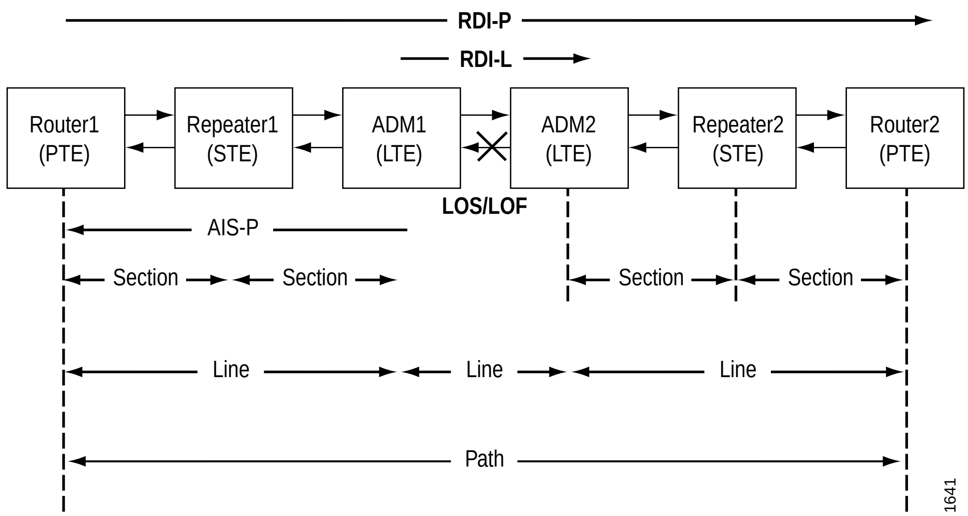
Remote defect indication path (RDI-P) is sent upstream to a peer PTE when a defect in the signal, typically an AIS-P, is detected.

### Example of a Router Receiving Only an RDI-P Alarm

In Figure 17, the X indicates that the LOS or LOF occurs in the section between ADM1 and ADM2.

All diagnostics are from the perspective of Router2 (the Juniper Networks router).

**Figure 17: Example of a Router Receiving Only an RDI-P Alarm**




**What It Means** In Figure 17, the progression of events occurring after the failure is as follows:

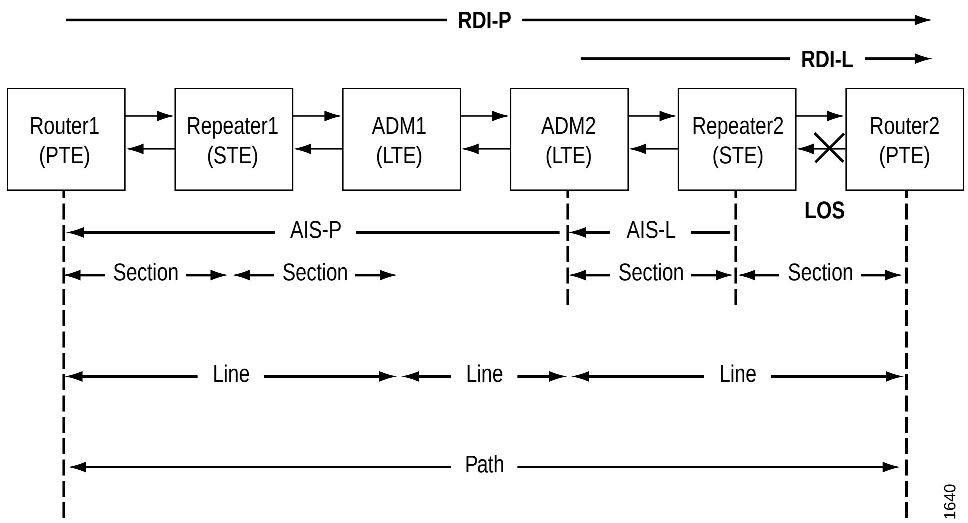
1. ADM1 detects an LOS or LOF on an incoming SONET section.
2. ADM1 sends an RDI-L to ADM2.
3. ADM1 sends an AIS-P downstream to Router1.
4. Router1 sends an RDI-P upstream to Router2.
5. Router2 only receives an RDI-P alarm.

## Example of a Router Receiving Both an RDI-L and RDI-P Alarm

In Figure 18, the X indicates that the LOS occurs in the section between Repeater2 and Router2.

All diagnostics are from the perspective of Router2 (the Juniper Networks router).

**Figure 18: Example of a Router Receiving Both an RDI-L and RDI-P Alarm**




**What It Means** In Figure 18, the progression of events occurring after the failure is as follows:

1. Repeater2 detects an LOS on an incoming section.
2. Repeater2 sends an AIS-L downstream to ADM2.
3. ADM2 sends an RDI-L upstream to Router2.
4. ADM2 sends an AIS-P downstream to Router1.
5. Router1 sends an RDI-P upstream to Router2.
6. Router2 receives both RDI-P and RDI-L alarms.

## *Locate Remote Error Indication Line Errors*

**Purpose** A remote error indication (REI) is sent upstream to signal an error condition. There are two types of REI alarms:

Remote error indication line (REI-L) is sent to the upstream LTE when errors are detected in the B2 byte.

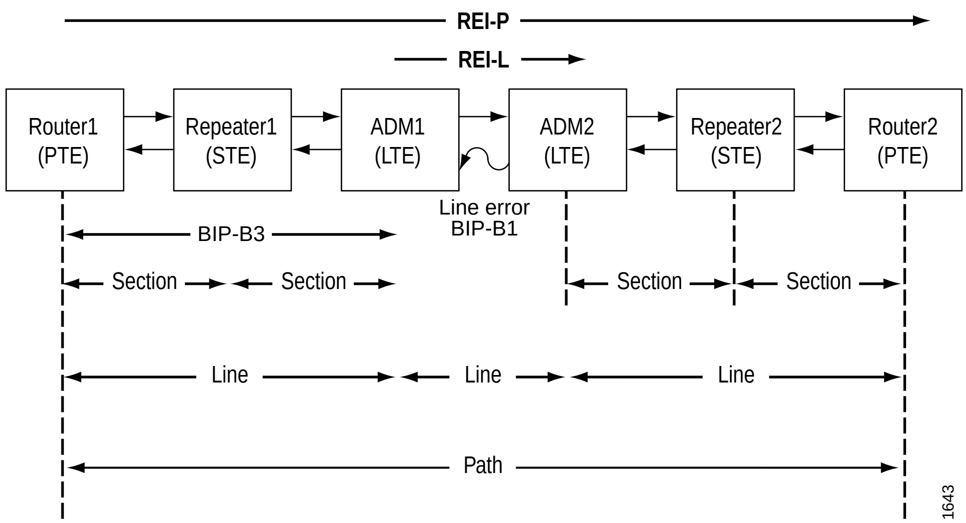
Remote error indication path (REI-P) is sent to the upstream PTE when errors are detected in the B3 byte.

### Example of Only an REI-P Counter Incrementing

In Figure 19, the wavy line indicates that there is a line error in the section between ADM1 and ADM2.

All diagnostics are from the perspective of Router2 (the Juniper Networks router).

**Figure 19: Example of a Router Receiving Only an REI-P Counter Incrementing**




**What It Means** In Figure 19, the progression of events occurring after the failure is as follows:

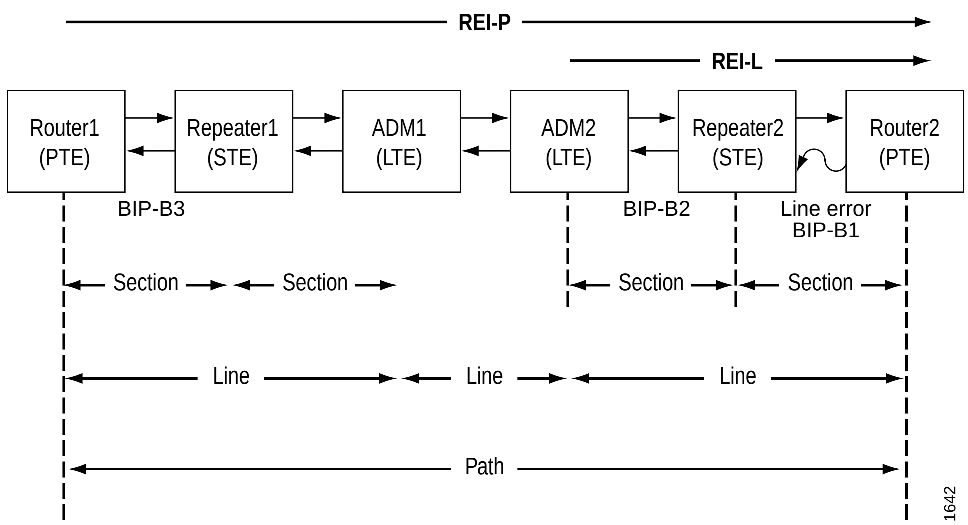
1. ADM1 detects parity errors in the B1 byte.
2. ADM1 sends an REI-L upstream to ADM2.
3. Router1 detects parity errors in the B3 byte.
4. Router1 sends an REI-P upstream to Router2.
5. Router2 only sees an REI-P incrementing counter.

## Example of Both REI-L and REI-P Counters Incrementing

In Figure 20, the wavy line indicates that there is a line error in the section between Repeater2 and Router2.

All diagnostics are from the perspective of Router2 (the Juniper Networks router).

**Figure 20: Example of a Router Receiving Both An REI-L and REI-P Counter Incrementing**




**What It Means** In Figure 20, the progression of events occurring after the failure is as follows:

1. Repeater2 detects some parity errors in the B1 byte from a corrupted SONET frame.
2. ADM2 detects parity errors in the B2 byte.
3. ADM2 sends an REI-L upstream to Router2.
4. Router1 detects parity errors in the B3 byte.
5. Router1 sends back an REI-P upstream to Router2.
6. Router2 sees incrementing REI-L and REI-P errors.

## *Locate Bit Error Rate Alarms*

**Purpose** Bit error rate (BER) alarms are declared when the number of BIP-B2 errors hits a certain threshold. Depending on the threshold, there are two types of BER alarms. In both cases the interface is taken down.

Bit error rate-signal degrade (BERR-SD) is declared when a bit error rate of 10^-6 is reached.

Bit error rate-signal failure (BERR-SF) is declared when a bit error rate of 10^-3 is reached.

**Action** To display SONET alarms and errors, use the following JUNOS CLI operational mode command:

user@host> **show interfaces so-***fpc***/***pic***/***port* **extensive**

**Sample Output** The following sample output displays a BERR-SD error:

```
user@router2> show interfaces so-1/1/1 extensive
[... Output truncated...]
 Active alarms  : BERR-SD
 Active defects : None
 SONET PHY:          Seconds       Count  State
   PLL Lock             0           0  OK
   PHY Light            0           0  OK
 SONET section:
   BIP-B1              22         101
   SEF                  0           0  OK
   LOS                  0           0  OK
   LOF                  0           0  OK
   ES-S                22
   SES-S                0
   SEFS-S               0
 SONET line:
   BIP-B2              22         103
   REI-L                0           0
   RDI-L                0           0  OK
   AIS-L                0           0  OK
   BERR-SF              0           0  OK
   BERR-SD             11          53  OK
   ES-L                22
   SES-L                4
   UAS-L                2
   ES-LFE               0
   SES-LFE              0
   UAS-LFE              0
 SONET path:
   BIP-B3              22         166
   REI-P                0           0
   LOP-P                0           0  OK
   AIS-P                0           0  OK
   RDI-P                0           0  OK
   UNEQ-P               0           0  OK
   PLM-P                0           0  OK
```

```
    ES-P           22
    SES-P           3
    UAS-P           1
    ES-PFE          0
    SES-PFE         0
    UAS-PFE         0
```

**What It Means** Bit error rates can be caused by any of the following situations:

- Degrading optical fiber
- Optical transmitter or receiver problems
- Dirty fiber-optic connector
- Clocking issues
- Too much attenuation in the optical signal

## *Locate Payload Label Mismatch Path Alarms*

**Purpose** Payload mismatch path (PLM-P) alarms are reported by PTEs because the SONET byte used to determine the PLM-P alarm is located in the path overhead (the C2 byte). PLM-P alarms occur when the C2 byte received does not match the C2 byte transmitted by the PTE; for example, when the received C2 value is 0xcf, the transmitted C2 value must also be 0xcf.

**NOTE:** When the received C2 byte has a value of 0x01, the PTE accepts this value (regardless of the PTE setting) since 0x01 is considered a wildcard value.

**Action** To display SONET alarms and errors, use the following JUNOS CLI operational mode command:

user@host> **show interfaces so-***fpc*/*pic*/*port* **extensive**

**Sample Output**

```
user@router2> show interfaces so-1/1/1 extensive
[...Output truncated...]
SONET alarms   : PLM-P
SONET defects  : PLM-P
  [...Output truncated...]
SONET path:
    BIP-B3          0          0
    REI-P           0          0
    LOP-P           0          0  OK
    AIS-P           0          0  OK
    RDI-P           2          1  OK
    UNEQ-P          0          0  OK
    PLM-P          96          1  Defect Active
    ES-P            0
    SES-P           0
    UAS-P           0
    ES-PFE          2
    SES-PFE         2
    UAS-PFE         0
  Received SONET overhead:
    F1    : 0x00, J0    : 0x00, K1    : 0x00, K2    : 0x00
    S1    : 0x00, C2    : 0x13, C2(cmp) : 0xcf, F2    : 0x00
```

```
 Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00, V5      : 0x00
 V5(cmp) : 0x00
Transmitted SONET overhead:
 F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
 S1      : 0x00, C2      : 0xcf, F2      : 0x00, Z3      : 0x00
 Z4      : 0x00, V5      : 0x00
```

**What It Means** In the SONET path section of the sample output, the PLM-P counter is incrementing and defective. In the Received SONET overhead and Transmitted SONET overhead sections, the received C2 value is 0x13 and the transmitted C2 value is 0xcf. The C2 byte mismatch has caused a PLM-P alarm.

The C2 byte tells the PTE what kind of information is in the synchronous payload envelope (SPE). For example, when the SPE contains Asynchronous Transfer Mode (ATM) cells, the C2 byte has a value of 0x13. If a Packet over SONET (POS) card is used on the Juniper Networks router, the link does not come up and a PLM-P alarm is raised (since the Juniper Networks router sends 0xcf and receives 0x13). However, if the C2 byte has a value of 0x01, the PTE accepts this value (regardless of what the PTE is set to) since 0x01 is considered a wildcard value.

The SONET specifications have assigned a small handful of values (of the 256 possible binary values), but Juniper Networks routers only use a few of these (0xcf or 0x16 for POS, 0x13 for ATM, and so on). Table 32 shows the synchronous transport signal (STS) path signal label assignments as described in Issue 3 (Sept. 2000) of the GR-253 CORE.

**Table 32: STS Path Signal Label Assignments**

| Code (Hex) | Content of the STS SPE |
|---|---|
| 00 | Unequipped |
| 01 | Equipped - Nonspecific Payload |
| 02 | VT-Structured STS-1 SPE a |
| 03 | Locked VT Mode a |
| 04 | Asynchronous Mapping for DS-3 |
| 12 | Asynchronous Mapping for DS-4NA |
| 13 | Mapping for ATM |
| 14 | Mapping for DQDB |
| 15 | Asynchronous Mapping for FDDI |
| 16 | HDLC-over-SONET Mapping |
| FE | O.181 Test Signal (TSS1 to TSS3) Mapping b |

On POS interfaces, Juniper Networks routers by default accept a C2 value of either 0xcf or 0x16. Any other values raise a PLM-P alarm. An important thing to remember is that the C2 byte value of 0x16 is a standardized value (per RFC 2615, G.707, and GR-253) used for POS interfaces. 0xcf is used by default since much SONET equipment still uses this value. If you need to change this byte, use the rfc-2615 option as follows:

user@host# **set interface so-***fpc*/*pic*/*port* **sonet-options rfc-2615**

This option changes the following values:

```
C2 byte 22 (0x16)
FCS 32
payload-scrambling (this was already the default)
```

## Locate Loss of Pointer Path Alarms

**Purpose** A loss of pointer path (LOP-P) alarm indicates a possible provisioning problem and occurs when the Juniper Networks router cannot determine a valid payload pointer. The Juniper Networks router monitors the H1/H2 bytes, located in the line overhead area. This alarm is usually discovered upon initial provisioning of SONET circuits, and is not generally seen after the router has been deployed in the network for some time.

**Action** To display SONET alarms and errors, use the following JUNOS CLI operational mode command:

user@host> **show interfaces so-***fpc*/*pic*/*port* **extensive**

**Sample Output**

```
user@host> show interfaces so-1/1/1 extensive
[...Output truncated...]
SONET alarms   : LOP
 SONET defects  : LOP
 SONET PHY:         Seconds       Count  State
   PLL Lock             0           0  OK
   PHY Light            0           0  OK
 SONET section:
   BIP-B1               0           0
   SEF                  0           0  OK
   LOS                  0           0  OK
   LOF                  0           0  OK
   ES-S                 0
   SES-S                0
   SEFS-S               0
 SONET line:
   BIP-B2               0           0
   REI-L                0           0
   RDI-L                0           0  OK
   AIS-L                0           0  OK
   BERR-SF              0           0  OK
   BERR-SD              0           0  OK
   ES-L                 0
   SES-L                0
   UAS-L                0
   ES-LFE               0
   SES-LFE              0
   UAS-LFE              0
 SONET path:
   BIP-B3               0           0
```

```
  REI-P              0          0
  LOP-P            174          0  Defect Active
  AIS-P              0          0  OK
  RDI-P              0          0  OK
  UNEQ-P             0          0  OK
  PLM-P              0          0  OK
  ES-P             174
  SES-P            174
  UAS-P            174
  ES-PFE             0
  SES-PFE            0
  UAS-PFE            0
[...Output truncated...]
```

**What It Means** The sample output shows that an LOP-P alarm occurred for 174 seconds. An LOP-P alarm can occur when the ADM on the other end is configured for nonconcatenate mode, while the Juniper Networks router is configured for concatenate mode (the default setting). In this instance, the pointer word in the required STS frame does not have the concatenation indicator set.

The condition of 8, 9, or 10 consecutive frames without valid pointer values can raise an LOP-P alarm.

**NOTE:** Although Juniper routers do not report pointer adjustments, an LOP-P alarm will not occur as long as the pointer adjustments stay within tolerance levels.

## *Locate Unequipped Payload Alarms*

**Purpose** An unequipped payload (UNEQ-P) alarm indicates a possible provisioning problem and occurs when the Juniper Networks router detects a value of 0x00 in the C2 byte.

**Action** To display SONET alarms and errors, use the following JUNOS CLI operational mode command:

user@host> **show interfaces so-***fpc***/***pic***/***port* **extensive**

**Sample Output**

```
user@host> show interfaces so-1/1/1 extensive
[...Output truncated...]
SONET alarms   : UNEQ-P
 SONET defects  : UNEQ-P
 SONET PHY:          Seconds       Count  State
  PLL Lock             0          0  OK
  PHY Light            0          0  OK
 SONET section:
  BIP-B1               0          0
  SEF                  0          0  OK
  LOS                  0          0  OK
  LOF                  0          0  OK
  ES-S                 0
  SES-S                0
  SEFS-S               0
 SONET line:
  BIP-B2               0          0
  REI-L                0          0
  RDI-L                0          0  OK
  AIS-L                0          0  OK
  BERR-SF              0          0  OK
  BERR-SD              0          0  OK
```

```
    ES-L              0
    SES-L             0
    UAS-L             0
    ES-LFE            0
    SES-LFE           0
    UAS-LFE           0
  SONET path:
    BIP-B3            0          0
    REI-P             0          0
    LOP-P             0          0  OK
    AIS-P             0          0  OK
    RDI-P             0          0  OK
    UNEQ-P           10          2  Defect Active
    PLM-P             0          0  OK
    ES-P             10
    SES-P            10
    UAS-P             0
    ES-PFE            0
    SES-PFE           0
    UAS-PFE           0
[...Output truncated...]
```

**What It Means** The sample output shows that an UNEQ-P alarm occurred within 10 seconds and was declared twice. An UNEQ-P alarm can occur when the ADM on the other end has not provisioned the SPE. An UNEQ-P alarm sets the STS SPE to all zeros when it is provisioned. If the alarm occurs, the problem is probably with the configuration of the ADM. Since the UNEQ-P is not a common alarm reported by Juniper Networks routers, it is a good idea to first check with the SONET provider.

## *Locate Phase Lock Loop Alarms*

**Purpose** The phase lock loop (PLL) alarm occurs when the PLL cannot lock on to a timing device, and indicates a possible hardware or network timing problem.

**Action** To display SONET alarms and errors, use the following JUNOS CLI operational mode command:

user@host> **show interfaces so-***fpc*/*pic*/*port* **extensive**

**Sample Output**

```
user@host> show interfaces so-1/1/1 extensive
[...Output truncated...]
Active alarms  : PLL
  Active defects : PLL
  SONET PHY:         Seconds       Count  State
    PLL Lock           26           0  PLL Lock Error
    PHY Light           0           0  OK
  SONET section:
    BIP-B1            0          0
    SEF               0          0  OK
    LOS               0          0  OK
    LOF               0          0  OK
    ES-S              0
    SES-S             0
    SEFS-S            0
  SONET line:
    BIP-B2            0          0
    REI-L             0          0
    RDI-L             3          3  OK
    AIS-L             0          0  OK
    BERR-SF           0          0  OK
```

```
  BERR-SD              0          0  OK
  ES-L             0
  SES-L             0
  UAS-L             0
  ES-LFE            0
  SES-LFE            0
  UAS-LFE            0
 SONET path:
  BIP-B3            0          0
  REI-P             0          0
  LOP-P             0          0  OK
  AIS-P             0          0  OK
  RDI-P             0          0  OK
  UNEQ-P             0          0  OK
  PLM-P             0          0  OK
  ES-P             0
  SES-P             0
  UAS-P             0
  ES-PFE            0
  SES-PFE            0
  UAS-PFE            0
[...Output truncated...]
```

**What It Means**

The sample output shows a PLL alarm lasting for 26 seconds. You must investigate the timing source to diagnose the problem. The timing source is derived from an incoming SONET circuit (when clock external is configured), or from the onboard Stratum 3 clock (when clock internal is configured). Internal clocking is the default for Juniper Networks routers.

The cause of the problem differs depending on the type of system board on the router. (See Table 33 on page 170.) For example:

- On the M20 and M40 Internet router OC-48-SM-IR PIC and the M160 Internet router OC-192 board, the problem might be caused by the following:
  - An out-of-tolerance clock coming from the far end, if clocking external is configured.
  - An out-of-tolerance clock coming from the far end or a problem with the board being unable to lock on to its internal clock to derive the transmit clock, if clocking internal is configured.
- On OC-3 and OC-12 PICs, the PIC not establishing a lock to the onboard clock to derive the outgoing clock.

To further diagnose the problem, try the following:

- Configure clocking to external. If the alarm disappears, the board might not have locked to the internal clock used to derive the outgoing clock.
- Configure clocking to internal and make sure that a loopback fiber is plugged in. If the PLL alarm persists, it is most likely a hardware problem. However, you may not be able to determine if the direction is on the inbound or outbound side of the board.

Table 33 shows the location of the onboard clock on the various system boards of Juniper Networks routers.

**Table 33: Location of the Onboard Clock**

| Router | System Board |
|---|---|
| M5, M10, M20, and M40 routers | System Control Board (SCB), System and Switch Board (SSB), Switching and Forwarding Module (SFM), and Single Board Router (SBR) |
| OC-48-SM-IR PIC used on the M20 and M40 routers | Flexible PIC Concentrator (FPC) |
| M40e and M160 routers | Miscellaneous Control Subsystem (MCS) |
| T-series routing platforms | SONET Clock Generator (SCG) |