

Configuring E1 and T1 Interfaces

Contents

Overview of E1 and T1 WAN Connections	4-3
Elements of an E1- or T1-Carrier Line	4-3
Connecting Your Premises to the Public Carrier: the Local Loop ...	4-4
External or Built-in CSU/DSU	4-6
ProCurve Secure Router Modules	4-8
E1 Modules with a Built-in DSU	4-8
Supported Standards	4-8
T1 Modules with a Built-in CSU/DSU	4-9
Supported Standards	4-9
E1 or T1 Interfaces: Configuring the Physical Layer	4-10
E1 or T1 Interface Configuration Mode Context	4-11
interface range Command	4-12
Channels	4-13
Line Coding	4-15
Frame Format	4-16
Clock Source, or Timing, for the E1- or T1-Carrier Line	4-18
Transmit Signal Level (T1 Interfaces Only)	4-19
Set the FDL (T1 Interfaces Only)	4-20
Activate the E1 or T1 Interface	4-21
Threshold Commands	4-22
Types of Line Errors	4-23
Viewing Information about E1 and T1 Interfaces	4-27
show interfaces Command	4-28
show running-config Command	4-29
show running-config verbose Command	4-30

Troubleshooting E1 and T1 WAN Connections	4-31
No Light	4-33
Red Light	4-33
Yellow Light	4-35
Green Light	4-36
Viewing Performance Statistics	4-36
Quick Start	4-39
Configuring an E1 or T1 Interface	4-39

Overview of E1 and T1 WAN Connections

Public carriers offer E1- and T1-carrier lines for customers who need dedicated, secure, point-to-point wide area network (WAN) connections. The connection is always active, so data can be immediately transmitted at any time, with no wait for a dial-up process.

In Europe, Australia, South America, and Asia, Public Telephone and Telegraph (PTT) authorities offer E1-carrier lines, which provide 2.048 Mbps bandwidth. In the United States, Canada, and sometimes Japan, telcos offer T1-carrier lines, which provide 1.544 Mbps bandwidth.

Note

In Japan, PTTs offer T1-carrier lines and sometimes E1-carrier lines for data. For traditional analog voice, these PTTs offer J1-carrier lines. (J1 lines are outside the scope of the *ProCurve Secure Router Management and Configuration Guide*.)

An E1- or T1-carrier line can be used for both traditional analog voice and data—a characteristic that can make it an appealing option for some companies. By combining analog voice and data on an E1- or T1-carrier line, companies may be able to save money on their telephone and data communications costs.

Elements of an E1- or T1-Carrier Line

All WAN connections, including E1- and T1-carrier lines, consist of three basic elements:

- the physical transmission media, such as the cabling, switches, routers, and other infrastructure required to create and maintain the connection
- electrical signaling specifications for generating, transmitting, and receiving signals through the various transmission media
- Data Link Layer protocols, which provide logical flow control for moving data between the peers in the WAN (peers are the devices at either end of a WAN connection)

Physical transmission media and electrical specifications are part of the Physical Layer (Layer 1) of the Open Systems Interconnection (OSI) model, and Data Link Layer protocols are part of the Data Link Layer (Layer 2). (See Figure 4-1.)

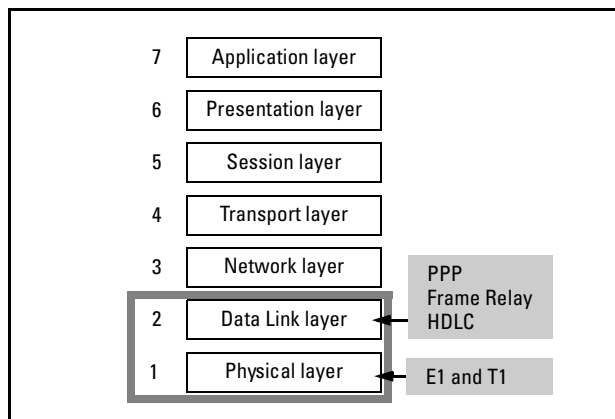


Figure 4-1. Physical and Data Link Layers of the OSI model

When you configure an E1 or T1 WAN connection, you must configure both the Physical Layer and the Data Link Layer (which is also called the logical layer).

Connecting Your Premises to the Public Carrier: the Local Loop

In the United States and Canada, the network that provides the infrastructure for T1-carrier lines is called the public switched telephone network (PSTN). In all other countries, PTT authorities provide the infrastructure for WAN connections.

When you lease an E1- or T1-carrier line, your LAN must be connected to the public carrier's nearest central office (CO). All of the telecommunications infrastructure that is used to connect your LAN to the CO is collectively called the *local loop*. Because the CO may be located miles away from your premises, this telecommunications infrastructure may include repeaters, as well as switches, cable, and connectors. (See Figure 4-2.)

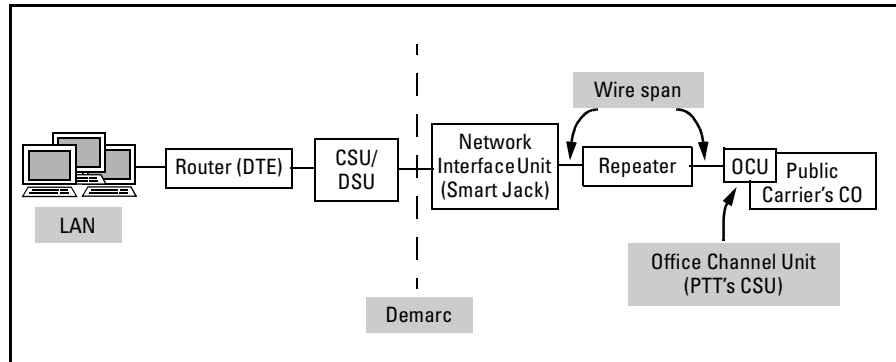


Figure 4-2. Local Loop

All carrier lines require the same basic components on the local loop, although the components may differ slightly in form and design. (See Figure 4-2.) These components are listed below:

- **CSU/DSU**—The Channel Service Unit/Digital Service Unit (CSU/DSU) has two purposes: The DSU accepts traffic from the router and translates it from the signaling format used on the LAN to the format necessary for transmission on the WAN. The CSU then generates the signal to be sent across the WAN. For incoming traffic, the CSU regenerates the signal for transmission across the LAN.
- **Demarc**—A line of demarcation, or demarc, separates your wiring and equipment from the public carrier's wiring and equipment. As a general rule, you own, operate, and maintain the wiring and equipment on your side of the demarc, and the public carrier owns, operates, and maintains the wiring and equipment on its side of the demarc.
- **Network interface unit (NIU)**—The NIU automatically maintains the WAN connection and enables public carrier employees to perform simple management tasks from a remote location. The NIU is usually located outside the subscriber's premises so that public carrier employees can always access it. In the United States and Canada, the NIU is commonly referred to as the smart jack.
- **Wire span**—Because public carrier networks were originally designed to carry analog voice calls, copper wire is still the most common physical transmission medium used on the local loop. Because copper wire has a limited capacity to carry signals, local loops that use copper wire are the slowest, least capable component of the WAN connection.

- Repeater—A repeater receives, amplifies, and retransmits the digital signal so that the signal is always strong enough to be read. The distance between repeaters depends on the type of connection, including the transmission media used. On an E1 or T1 connection over unshielded twisted pair (UTP) wiring, the distance between repeaters is one mile or less.
- Office channel unit—Located at the CO, the office channel unit (OCU) performs the same function at the public carrier's site that the CSU performs at each subscriber's site: It generates the signal to be sent across the WAN—either to be sent to a subscriber's premises or to be transmitted on to the public carrier network.

Although you will never see most of these components, having a basic understanding of the local loop can help you work with your public carrier to troubleshoot problems if your E1- or T1-carrier line ever goes down.

In addition, two of these components directly affect your E1 or T1 WAN connection: the demarc and the CSU/DSU. The demarc determines which part of the E1 or T1 WAN connection you are responsible for. Again, this becomes important if your E1- or T1-carrier line ever goes down and you have to work with the public carrier to identify and fix the problem.

The CSU/DSU is important because its form and design not only determines which ProCurve Secure Router module you purchase but also which settings you must configure for the E1- or T1-carrier line.

External or Built-in CSU/DSU

Your public carrier determines the type of CSU/DSU that will be used in your WAN connection. There are three options:

- The public carrier provides the CSU/DSU and installs it on your premises.
- The public carrier provides the CSU but not the DSU.
- The public carrier does not provide the CSU/DSU.

In Europe, Australia, South America, and Asia (except Japan), the PTT authority will provide both the CSU/DSU or just the CSU. In the United States and Canada, public carriers will either provide the entire CSU/DSU, or they will not provide either one at all.

If the public carrier provides an external CSU/DSU, you should purchase a serial module. (See Figure 4-3.) For information about the serial module, see *Chapter 5: Configuring Serial Interfaces for E1- and T1-Carrier Lines*.

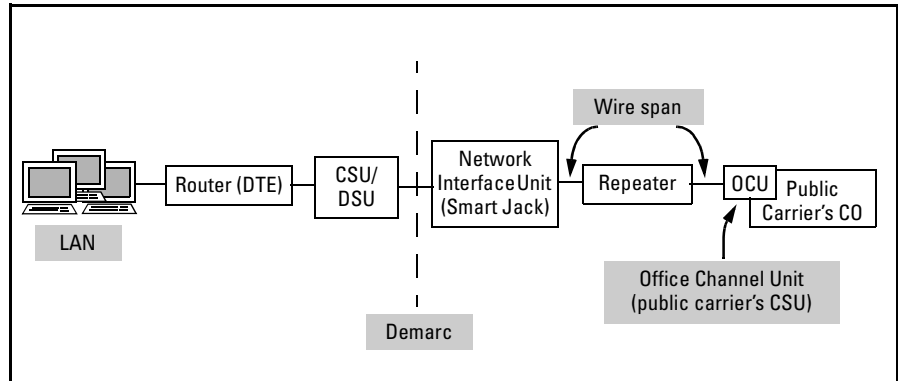


Figure 4-3. Router Connects Directly to an External CSU/DSU.

If your public carrier does not provide the DSU, the router must include a built-in DSU. You will then use UTP cable with RJ-48C connectors to connect the router to the external CSU. (See Figure 4-4.)

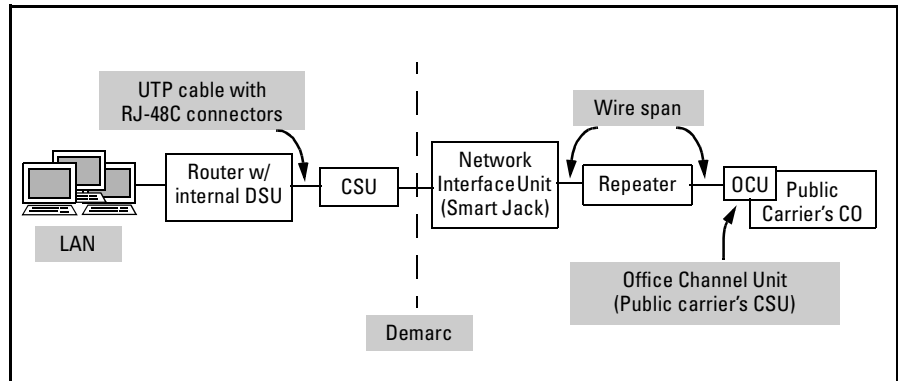


Figure 4-4. Router with a Built-in DSU Connects Directly to the External CSU.

If your public carrier does not provide the CSU/DSU, the router must include a built-in CSU/DSU. In this case, the public carrier provides a wall jack on your premises to connect your router to the local loop, and you use UTP cable with RJ-48C connectors to connect the router to the wall jack. (See Figure 4-5.)

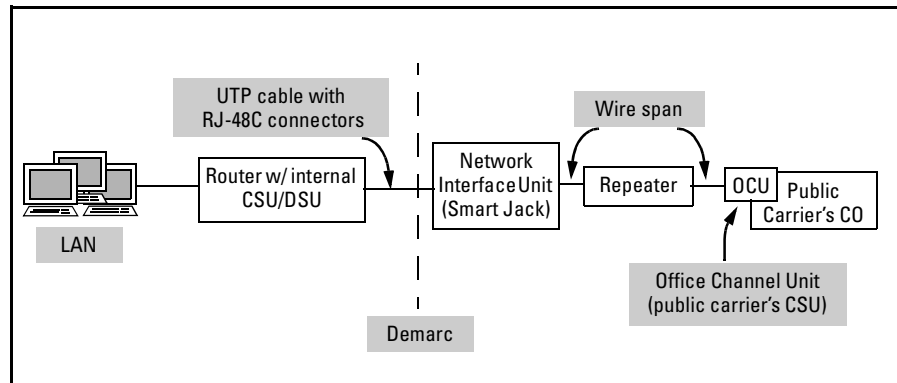


Figure 4-5. Router with a Built-in CSU/DSU

ProCurve Secure Router Modules

ProCurve Networking provides several E1 and T1 modules, which are described in the next sections.

E1 Modules with a Built-in DSU

If your public carrier does not provide an external DSU, you should use one of the E1 modules, which include a built-in DSU:

- one-port E1 module
- two-port E1 module
- eight-port wide-option module (ProCurve Secure Router 7203dl only)

Supported Standards

The ProCurve Secure Router E1 modules are standards based. Specifically, they support the standards listed in Table 4-1.

Table 4-1. Standards Supported by E1 Modules

Type of Standard	Port
E-carrier line	• International Telecommunications Union (ITU) G.703 • ITU-T G.704 (CRC-4) • ITU-T G.823 • ITU-T G.797
Electrical/power	• Norme Europeenne (EN) 60950 (EN is also referred to as European Standards.) • International Electrotechnical Commission (IEC) 60950 • Australian Standard/New Zealand Standard (AS/NZS) 60950

For instructions on configuring E1 modules, see “E1 or T1 Interfaces: Configuring the Physical Layer” on page 4-10.

T1 Modules with a Built-in CSU/DSU

If your public carrier does not provide a CSU/DSU, you should use one of the ProCurve Secure Router T1 modules, which include a built-in CSU/DSU:

- one-port T1 module
- two-port T1 module
- eight-port wide-option module (ProCurve Secure Router 7203dl only)

Supported Standards

The ProCurve Secure Router T1 modules support the standards listed in Table 4-2.

Table 4-2. Standards Supported by T1 Modules

Type of Standard	Port
T-carrier line	• AT&T TR194 • AT&T TR54016 • American National Standards Institute (ANSI) T1.403
Electrical/power	• AT&T Pub 62411 (jitter tolerance) • U.S. Federal Communications Commission (FCC) Part 15 Class A • EN 55022 Class A • American Council for Terminal Attachments (ACTA)/FCC Part 68 • Industry Canada (IC) CS-03 • UL/cUL 60950 • IEC 60950

Instructions for configuring the T1 modules begin below.

E1 or T1 Interfaces: Configuring the Physical Layer

When you configure an E1 or T1 interface, the settings you enter must match the settings that your public carrier is using. Your public carrier will provide you with the settings you should enter for the following:

- number of channels
- line coding
- frame format
- clock source

For T1-carrier lines, your public carrier may also provide you with settings for the following:

- line build out (LBO), or signal level
- facility data link (FDL), if you are using the Extended SuperFrame (ESF) frame format

In addition to configuring these options, you must activate the E1 or T1 interface.

These are the minimal configuration options that you must enter to establish the Physical Layer of the WAN connection. In fact, you may not have to enter all of these options: if the public carrier's setting for an option matches the default setting for the E1 or T1 interface, you do not have to configure that option.

The rest of this section describes these options in more detail and explains how to configure them from the command line interface (CLI). If you want to configure the E1 or T1 connection from the Web browser interface, see *Chapter 14: Using the Web Browser Interface for Basic Configuration Tasks*.

E1 or T1 Interface Configuration Mode Context

To begin configuring the E1 or T1 interface that will provide the WAN connection, you must access the appropriate configuration mode context. In the ProCurve Secure Router CLI, move to the global configuration mode context and enter:

Syntax: `interface <interface> <slot>/<port>`

Replace **<interface>** with e1 or t1, depending on the type of connection you are configuring. On the ProCurve Secure Router, the interface for each physical port is identified by its slot number and port number.

The possible slot numbers for an E1 or T1 interface are:

- 1 = dl option module slot 1
- 2 = dl option module slot 2
- 3 = dl wide option module slot (ProCurve Secure Router 7203dl only)

The port number you enter depends on the number of ports included in the E1 or T1 module. For example, two-port E1 modules have two E1 ports plus one backup port. (For more information about backup ports, see the *ProCurve Secure Router Advanced Management and Configuration Guide, Chapter 3: Configuring Backup WAN Connections*.) If the E1 module is located in slot 1 and you are configuring the interface for port 1, enter:

```
ProCurve(config)# interface e1 1/1
```

Likewise, if the T1 module is located in slot 2 and you are configuring the interface for port 2, enter:

```
ProCurve(config)# interface t1 2/2
```

The router prompt should indicate that you have entered the appropriate interface configuration mode context:

```
ProCurve(config-t1 2/2)#
```

interface range Command

To save time, you can use the **interface range** command to configure multiple E1 or T1 interfaces at the same time. You can configure a range of contiguous interfaces, or you can configure multiple noncontiguous interfaces. The interfaces can be on different modules, but they must all be the same type of interface—either E1 or T1 interfaces.

To configure multiple E1 or T1 interfaces, move to the global configuration mode context and enter:

Syntax: interface range [e1 | t1] [<slot/port-port> | <slot/port>, <slot/port>]

Specify **e1** or **t1**, depending on the type of interfaces you want to configure.

To configure a range of contiguous interfaces, use the syntax **<slot/port-port>**. Replace the first **<slot/port>** with the slot and port number for the first interface in the range, followed by a hyphen. Then, replace the second **<port>** with the port for last interface in the range.

To configure noncontiguous interfaces, use the syntax **<slot/port>, <slot/port>**. Replace the first **<slot/port>** with the slot and port for an interface, followed by a comma. Then replace the second **<slot/port>** with the slot and port for another noncontiguous interface.

You can include both a range of contiguous interfaces and separate noncontiguous interfaces in the same command.

After you enter the **interface range** command, you are moved to the configuration context for all of the interfaces you specified. When you enter configuration commands, your changes are applied to all of these interfaces.

Examples. To configure the first seven interfaces of an octal E1 module that is installed in slot 3, enter:

```
ProCurve(config)# interface range e1 3/1-7
```

The context indicates that you have entered the configuration mode context for all seven E1 interfaces:

```
ProCurve(config-e1 3/1-7)#
```

To specify noncontiguous E1 ports for configuration, enter:

```
ProCurve(config)# interface range e1 3/2, 3/6, 3/8
```

Again, the router context should indicate all of the interfaces you specified:

```
ProCurve(config-e1 3/2, 3/6, 3/8)#
```

To specify a range of contiguous interfaces and multiple noncontiguous T1 ports, enter:

```
ProCurve(config)# interface range t1 3/1-4, 3/6, 3/8
```

The settings that you must configure to establish an E1 or T1 WAN connection are explained in the following sections.

Channels

As mentioned earlier, E1- and T1-carrier lines provide different transmission speeds. An E1-carrier line provides 2.048 Mbps in total bandwidth, which is divided into 32 channels. A T1-carrier line, on the other hand, provides 1.544 Mbps in total bandwidth, which is divided into 24 channels.

Called digital signal zero (DS0), each channel operates at 64 Kbps, the amount of bandwidth required to transmit a single analog voice call through a digital telecommunications network. The channels in these dedicated circuits are created using time division multiplexing (TDM). By combining, or multiplexing, multiple channels into a larger, more complex signal, TDM creates a high-bandwidth channel. (See Figure 4-6.)

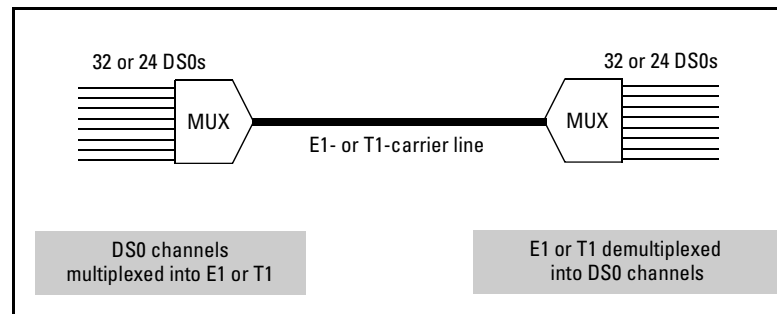


Figure 4-6. Multiplexing Multiple Channels into One E1- or T1-Carrier Line

Each channel receives an equal time slice within the complex signal in a rotating, repeating sequence and thus receives an equal amount of bandwidth. On the receiving end, TDM is used to recover the original signals through a reverse process called demultiplexing.

E1 Channels. When you configure an E1 module with a built-in DSU, you must configure the number of channels that the E1 WAN connection uses. You can configure channels 1-31. One channel—channel 0—is used to maintain the connection and cannot be used for data or voice.

If you purchase an entire E1-carrier line, you configure channels 1-31. If you purchase a fractional E1-carrier line, your public carrier will tell you which channels to configure for that connection. (If you want to use some of the channels for voice, see *Chapter 9: Configuring the E1 + G.703 and T1 + DSX-1 Modules*.)

T1 Channels. When you configure a T1 module with a built-in CSU/DSU, you must configure the number of channels that the T1 WAN connection uses. If you lease an entire T1 line, you configure channels 1-24. If you lease a fractional T1 line, your public carrier will tell you which channels to configure for that connection. (If you want to use some of the channels for voice, see *Chapter 9: Configuring the E1 + G.703 and T1 + DSX-1 Modules*.)

Configuring the Number of Channels. To configure the number of channels used for an E1 or T1 WAN connection, you use the **tdm-group** command:

Syntax: `tdm-group <number> timeslots <range of numbers> speed [56 | 64]`

This command creates a TDM group and assigns it a number of channels. Replace **<number>** with a number between 1 and 255, and replace **<range of numbers>** with the channels that will be used for this connection.

The TDM-group number relates directly to the interface that you are configuring. This means that you can create a TDM group 1 for each E1 or T1 interface on the ProCurve Secure Router.

You enter the **tdm-group** command from the E1 or T1 interface configuration mode context. For example, to configure the E1 1/1 interface to use all 31 channels, enter:

```
ProCurve(config-e1 1/1)# tdm-group 1 timeslots 1-31
```

To configure the T1 2/2 interface to use all 24 channels, enter:

```
ProCurve(config-t1 2/2)# tdm-group 1 timeslots 1-24
```

Speed Option. If you view the syntax for the **tdm-group** command from the CLI, you will notice that it includes a **speed** option, as shown below:

Syntax: `tdm-group <number> timeslots <range of numbers> speed [56 | 64]`

By default, the speed for channels is 64 kbps, and this setting will be used for all E1-carrier lines and most T1-carrier lines. The **speed 56** setting is used only if your public carrier is using a 56 Kbps setting for the connection. In this case, your public carrier will tell you to set the speed for each channel to 56 kbps. For all other environments, you should simply accept the default setting of 64 kbps.

Line Coding

In addition to configuring the number of channels for the E1 or T1 connection, you must configure the interface to use the same line coding that your public carrier is using. Line coding defines how digital signals are configured for transport through a physical transmission medium. Line coding schemes use electrical signals to represent the logical 0 and 1 bits in a data stream.

E1- and T1-carrier lines have slightly different options for line coding.

E1 Line Coding. E1-carrier lines use the following line coding schemes:

- Alternate mark inversion (AMI)
- High-density bipolar of order 3 (HDB3)

AMI uses alternating positive and negative voltage (referred to as alternating polarity or bipolarity) to represent logical ones, and zero voltage to represent logical zeros. Because AMI uses zero voltage for logical zeros, it can cause synchronization loss between peers at each end of a WAN connection if a data stream contains a long string of logical zeros.

Although HDB3 is based on AMI, HDB3 prevents synchronization loss by limiting the number of consecutive zero signals in a data stream to three. HDB3 replaces four logical zeros with three signals at zero voltage and a violation bit with the same polarity as the last AMI logical one detected.

Because HDB3 is the most common line coding scheme used in E1 lines, it is the default setting for all E1 interfaces on the ProCurve Secure Router.

To configure line coding on an E1 interface, enter the following command from the E1 interface configuration mode context:

Syntax: coding [ami | hdb3]

For example, to configure the line coding as AMI, enter:

```
ProCurve(config-e1 1/1)# coding ami
```

T1 Line Coding. T1-carrier lines use the following line coding schemes:

- AMI
- Bipolar 8-Zero Substitution (B8ZS)

Like HDB3, B8ZS was designed to overcome the deficiencies of AMI. To prevent synchronization loss, B8ZS replaces a string of eight zeros with a string that includes two logical ones of the same polarity as a timing mark. Because B8ZS has become the standard line coding used on T1-carrier lines, it is the default setting on the ProCurve Secure Router.

To configure line coding on a T1 interface, enter the following command from the T1 interface configuration mode context:

Syntax: coding [ami | b8zs]

For example, to configure the T1 interface to use the **ami** option, enter:

```
ProCurve(config-t1 1/1)# coding ami
```

Note

If you want to accept a default setting, it is not necessary to enter the command. For an E1-carrier line, you can simply accept the default setting of HDB3. For a T1-carrier line, you can simply accept the default setting of B8ZS.

Frame Format

You must configure the E1 or T1 interface to use the same frame format as that used by the public carrier. Otherwise, the WAN connection cannot be established.

E1-carrier lines and T1-carrier lines use different frame formats.

E1 Frame Formats. E1 interfaces on the ProCurve Secure Router support two frame formats:

- E1
- Cyclic Redundancy Check 4 (CRC4)

In the E1 frame format, a channel (or timeslot) is called a TS, and the 32 channels are numbered TS0 to TS31. Two channels are used to establish and maintain synchronization and signaling: specifically, TS0 is used for synchronization, error detection, and alarms, and TS16 is used for signaling. The other channels are used to transmit data.

CRC4 is based on the E1 frame format but includes additional error detection. A checksum bit is included in all even frames of the 16-frame multiframe: frames 0, 2, 4, 6, 8, 10, 12, and 14. A total of 8 checksum bits are used.

Although E1 interfaces, including those for the G.703 port, support two frame formats, only one option is listed if you enter the following command from the E1 interface configuration mode context:

```
ProCurve(config-e1 1/1)# framing ?
```

Only the **crc4** option is listed.

By default, the frame format is E1. If your public carrier is using the E1 frame format, you simply accept the default setting by not entering a **framing** command.

However, if your public carrier is using the CRC4 frame format, enter:

Syntax: framing crc4

```
ProCurve(config-e1 1/1)# framing crc4
```

To return to the E1 frame format, enter:

```
ProCurve(config-e1 1/1)# no framing crc4
```

T1 Frame Formats. For T1-carrier lines, public carriers use one of two frame formats:

- D4
- ESF

D4 framing aggregates 12 DS0 frames into a single superframe. The ESF standard multiplexes 24 DS0 frames into an extended superframe.

The ESF format has essentially replaced the D4 framing standard because it frees up bits that can be used to maintain the connection. Due to its popularity, ESF is the default setting for T1 modules on the ProCurve Secure Router.

To configure the frame format, enter the following command from the T1 interface configuration mode context:

Syntax: framing [d4 | esf]

If you want to use the default frame format, ESF, you do not have to enter a command. However, if you want to configure the T1 interface to use D4, enter:

```
ProCurve(config-t1 1/1)# framing d4
```

Clock Source, or Timing, for the E1- or T1-Carrier Line

Because data transmission requires hosts to be synchronized, you must configure the clock source, or timing, for the E1 or T1 interface. You can configure the E1 or T1 interface with one of the following clock sources:

- **Line**—Use the **line** setting if the E1 or T1 interface will take the clock source from the public carrier.
- **Internal**—Use the **internal** setting if the E1 or T1 interface will provide the clock for the connection. For example, if you connect the ProCurve Secure Router to another router, one of the routers must provide the clock source. If the local ProCurve Secure Router is providing the clock source, use the **internal** setting.
- **Through**—Use the **through** setting if you want the E1 or T1 interface to take the clock from the other interface on that module.

Each narrow E1 or T1 module can have only one clock source. If the module has two ports, one port must be set to **line** or **internal**; the other port must be set to **through**.

Each port on the eight-port E1 or T1 module can have its own clock source. You can set the clock source for each port to **line**.

Table 4-3 shows the default clock source settings for the different ports on the E1 or T1 modules.

Table 4-3. Default Clock Source Settings for E1 and T1 Modules

Module	Port	Default Clock Source
One-port E1 or T1 module	1	line
Two-port E1 or T1 module	1	line
	2	through
E1 + G.703 module	1	line
T1 + DSX-1 module	2	through
Eight-port module	1–8	line

Note

On the one-port E1 and T1 modules, the only **clock source** options are **internal** and **line**. This is because when an E1 or T1 line accepts a **clock source through** setting, the timing must come from another port on the same module.

To configure the clock source, enter the following command from the E1 or T1 interface configuration mode context:

Syntax: clock source [internal | line | through]

For example, to configure the clock source as line, enter:

```
ProCurve(config-e1 2/1)# clock source line
```

Note

You cannot connect two interfaces on one module to different service providers because each module can have only one clock source. If you want to use two different service providers, you must purchase two separate modules, or you must purchase the eight-port module.

Transmit Signal Level (T1 Interfaces Only)

With T1 interfaces, you can configure the level of the transmit signal. As the distance between the ends of a T1-carrier line increases, so does attenuation, or loss in signal strength. Long cables (which are defined as cables longer than 655 feet) must send stronger signals and boost these signals with repeaters to overcome attenuation.

When two devices are connected at close proximity, the opposite problem can occur: a strong signal can cause the line to become too “hot.”

The Line Build Out (**lbo**) command allows the T1 interface to take cable length into account when setting the signal strength. The longer the cable, the stronger the signal needs to be. For short cables, you can set the LBO lower, so that the interface artificially attenuates a T1 output signal, thereby simulating a degraded signal.

There are two commands for configuring LBO:

Syntax: lbo long <value>

Syntax: lbo short <value>

The command you use depends on the distance between the T1 equipment. This distance is measured in cable length. If the cable is longer than 655 feet, you use the **lbo long** command. If the cable is shorter than 655 feet, you use the **lbo short** command.

lbo long Command. If you are configuring LBO for a T1 interface connected by a cable that is longer than 655 feet, use the following command:

Syntax: lbo long <value>

Replace *<value>* with one of the following numbers, which are in decibels (db):

- -22.5
- -15
- -7.5
- 0

You should set the LBO to avoid overloading a receiver's circuits. For sensitive interfaces or for interfaces that are connected with a long cable but separated by a short distance, use the more negative values to prevent the line from becoming too hot. For example, two units in close proximity should be configured for the maximum attenuation of -22.5 dB:

```
ProCurve(config-t1 1/1)# lbo long -22.5
```

To configure LBO for a long cable to -7.5, enter:

```
ProCurve(config-t1 1/1)# lbo long -7.5
```

The default setting for LBO is **0** db.

lbo short Command. If the cable that connects the T1 interface is less than 655 feet long, use the following command:

Syntax: lbo short *<value>*

Replace *<value>* with the actual length of the cable, in feet, that separates the two devices. You can enter a number between 0 and 655. For example, if the ProCurve Secure Router is 500 feet of cable away from the other device, you would enter:

```
ProCurve(config-t1 1/1)# lbo short 500
```

Based on the number of feet between the two units, the ProCurve Secure Router will set an appropriate signal level.

Set the FDL (T1 Interfaces Only)

T1-carrier lines that use the ESF frame format support an out-of-band channel that is used to transmit performance-monitoring and maintenance information about the line. The facility data link (FDL) channel allows the transmission of monitoring and maintenance flags such as the yellow alarm signal.

If used on a T1-carrier line, the FDL channel must conform to one of the following standards:

- ANSI T1.403 standard
- ATT TR 54016 standard

By default, the T1 interfaces on the ProCurve Secure Router use the ANSI standard.

If your public carrier tells you to change this setting, use the following command:

Syntax: `fdl [ansi | att | none]`

For example, to configure FDL to use the ATT standard, enter:

```
ProCurve(config-t1 1/1)# fdl att
```

Use the **no** form of this command to return to the default value.

If your service provider does not use FDL, you should deactivate the FDL channel by entering:

```
ProCurve(config-t1 1/1)# fdl none
```

Activate the E1 or T1 Interface

By default, all physical interfaces on the ProCurve Secure Router are shut down. You must activate the E1 or T1 interface. From the E1 or T1 interface configuration mode context, enter:

Syntax: `no shutdown`

After you enter this command, the status of the interface will change from down to administratively up.

By default, the ProCurve Secure Router displays a message on the CLI when the status of an interface changes. For example, when you enter **no shutdown** to activate the E1 interface, you receive this message:

```
INTERFACE_STATUS.e1 1/1 changed state to administratively up
```

If you have connected the interface to either to the wall jack or the external CSU, the interface will try to establish the Physical Layer of the WAN connection. If the E1 or T1 interface successfully establishes that Physical Layer, another message should be displayed:

```
INTERFACE_STATUS.e1 1/1 changed state to up
```

or

```
INTERFACE_STATUS.t1 1/1 changed state to up
```

These messages are part of the event-history log and can help you quickly determine if an interface is functional. However, you can suppress these messages if, for example, you feel they disrupt your efforts to configure the router. Move to the enable mode context and enter:

```
ProCurve# no events
```

To return to the default setting, enter:

```
ProCurve# events
```

Note

The events display should not be confused with event-history, which is a collection of *all* logs of interface events, as well as other logs. To display this information, enter the **show event-history** command from the global configuration mode context.

If the status of the interface does not change to up, you may need to troubleshoot the connection, as explained in “Troubleshooting E1 and T1 WAN Connections” on page 4-31.

If the interface is up, you must configure the appropriate Data Link Layer protocol for the connection, as described in *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.

Threshold Commands

When you configure and activate an E1- or T1-carrier line, line error thresholds are enabled by default. When a threshold is reached, an events notification is displayed on the router’s CLI.

Table 4-4 lists the default settings for line error thresholds.

Table 4-4. Threshold Commands

Setting	Description	15-Minute Default	24-Hour Default
BES	Bursty Errored Seconds	10	100
CSS	Controlled Slip Seconds	1	4
DM	Degraded Minutes	1	4
ES	Errored Seconds	65	648
LCV	Line Code Violations	13340	133400
LES	Line Errored Seconds	65	648
PCV	Path Coding Violations	72	691
SEFS	Severely Errored Framing Seconds	2	17
SES	Severely Errored Seconds	10	100
UAS	Unavailable Seconds	10	10

To set a line error threshold, enter the following command from the E1 or T1 interface configuration mode context:

Syntax: threshold [BES | CSS | DM | ES | LCV | LES | PCV | SEFS | SES | UAS] [15Min | 24Hr] <number of errors>

Use the **15Min** option to set the thresholds for 15-minute intervals. Use the **24Hr** option to set the threshold for 24-hour intervals. The time period for these intervals is based on the past 15 minutes or 24 hours at any given moment, not on set 15 minute or 24 hour blocks of time. By default, both 15 minute and 24 hour thresholds are set.

Types of Line Errors

The ProCurve Secure Router reports 10 types of line errors. Each line error type has its own error triggers. Table 4-5 lists the line errors that the ProCurve Secure Router reports and the triggers for each of these line errors.

Table 4-5. Events That Trigger Line Errors

Error Type	Triggers
BES	1-320 Path Coding Violations (PCV)
CSS	Controlled Slip Seconds (CSS)
DM	Bit Error Rate (BER) between .000001 and .001
ES	ESF and CRC4: – PCV – Out Of Frame (OOF) – CSS – Alarm Indication Signal (AIS) D4 or E1: – PCV – Out of Frame – CSS – AIS – BPV
LCV	Bipolar Violations (BPVs) and Excessive Zeros (EXZs)
LES	• Seconds with BPVs or EXZs or Loss Of Signal (LOS) • Seconds with Line Code Violations (LCVs)
PCV	E1/D4 frame synchronization errors CRC4 or ESF checksum error
SEFS	• OOF • LOS
SES	• ESF errors: – 320+ PCVs – OOF – AIS • CRC errors: – Severely Errored Seconds (SES) – 832+PCVs • E1 framing 2048+ LCVs

Error Type	Triggers
	• D4 errors: – Framing error – OOF – 1544+ LCVs
UAS	• 10+ SESs • Line failure + SES

The following is a list of the line errors and a brief description of each.

BES. A Bursty Errored Second (BES) is a one-second time period with between one and 320 Path Coding Violation (PCV) events, no Severely Errored Framing Seconds (SEFS) defects, and no detected incoming Alarm Indication Signal (AIS) defects.

CSS. A Controlled Slip Second (CSS) is a one-second interval containing one or more controlled slips. A controlled slip is the replication or deletion of the payload bits in a DS1 or E1 frame. This problem may be caused by a difference between the timing of the interface sending and the interface receiving the signal.

DM. A Degraded Minute (DM) is a one-minute interval with a bit error rate (BER) that is higher than .000001. The one-minute intervals are derived by removing severely errored seconds (SESSs) from the total time and then consecutively grouping the remaining seconds into blocks of 60.

ES. An Errored Second (ES) is a one-second period with one or more errored blocks or bit errors. For T1-carrier lines that use ESF and E1-carrier lines that use CRC4, one of the following occurs during the one-second period:

- one or more PCVs
- one or more Out of Frame (OOF) defects (seven or more consecutive errored framing patterns)
- one or more CSSs
- an AIS defect

For carrier lines that use D4 and E1 framing, Bipolar Violations (BPVs) also trigger an ES.

LCV. A Line Code Violation (LCV) occurs when a carrier line experiences either BPVs (when using AIM) or excessive zeros (EXZ) (when using HDB3 or B8ZS). A BPV is an error in which an interface receives two pulses of the

same polarity without an intervening pulse of the opposite polarity. An EXZ is the occurrence of any zero string length equal to or greater than three for B3ZS or greater than four for HDB3. LCVs usually signal a mismatch in line coding type. For example, the local interface uses AIM, but the remote endpoint uses HDB3.

LES. A Line Errored Second (LES) occurs if one or more of the following are detected in a one-second time interval:

- LCVs (that is, one or more BPVs or EXZs)
- LOS

The LES count lists the number that have occurred.

PCV. A PCV is caused by a frame synchronization bit error in a D4 or E1 frame. If a T1-carrier line uses ESF or if an E1-carrier line uses CRC4, a PCV is an error detected by the CRC.

SEFS. The number of seconds during which an OOF or LOS occurred.

SES. For a T1-carrier line using ESF, a Severely Errored Second (SES) is one-second time interval during which one of the following occurs:

- 320 or more PCVs
- one or more OOF defects
- an AIS

For an E1-carrier line using CRC4, an SES occurs in one of the following is detected during a one-second interval:

- 832 or more PCVs
- one or more OOF defects

For a T1-carrier line using D4 frame formatting, an SES is a second with at least one framing error, OOF defect, or 1544 or more LCVs.

For an E1-carrier line, an SES is caused by 2048 or more LCVs in a second.

UAS. Unavailable Seconds (UAS) are calculated by counting the number of seconds that the interface is unavailable. An E1 or T1 interface becomes unavailable after ten contiguous SESs or the onset of the condition that led to the failure. If the condition leading to the failure was immediately preceded by one or more contiguous SESs, then the UAS are counted from the onset of these SESs.

To return a threshold to its default setting, enter this command from the global configuration mode context:

Syntax: no thresholds [BES | CSS | DM | ES | LCV | LES | PCV | SEFS | SES | UAS] [15Min | 24Hr]

For example, to return the 15-minute SES threshold to its default setting of 10, enter:

```
ProCurve(config)# no threshold SES 15Min
```

To return all thresholds to their default setting, enter:

```
ProCurve(config)# no thresholds
```

Viewing Information about E1 and T1 Interfaces

To view status or configuration information about a E1 or T1 interface, you can use the **show** commands listed in Table 4-6.

Table 4-6. show Commands

Command	Explanation
show interfaces	displays information about all the interfaces—active or inactive—on the ProCurve Secure Router
show interface <interface> <slot>/<port> [realtime performance-statistics]	displays information about a specific physical interface
show running-config	displays all of the settings that you have configured for the ProCurve Secure Router
show running-config verbose	displays the entire running-config, including the settings that you have configured and the default settings that you have not altered
show running-config interface <interface> <slot>/<port>	displays the settings that you have configured for a particular physical interface
show running-config interface <interface> <slot>/<port> verbose	displays the entire running-config for a particular interface, including the settings you configured and the default settings that you have not altered

show interfaces Command

You can use the **show interfaces <interface> <slot>/<port>** command to view detailed information about the status of the E1 or T1 interface. For example, if you want to view the status of the E1 1/1 interface, enter the following command from the enable mode context:

```
ProCurve# show interfaces e1 1/1
```

Figure 4-7 shows the results of this command for an E1 interface. In this example, the E1 interface has been configured, but the Data Link Layer protocol has not.

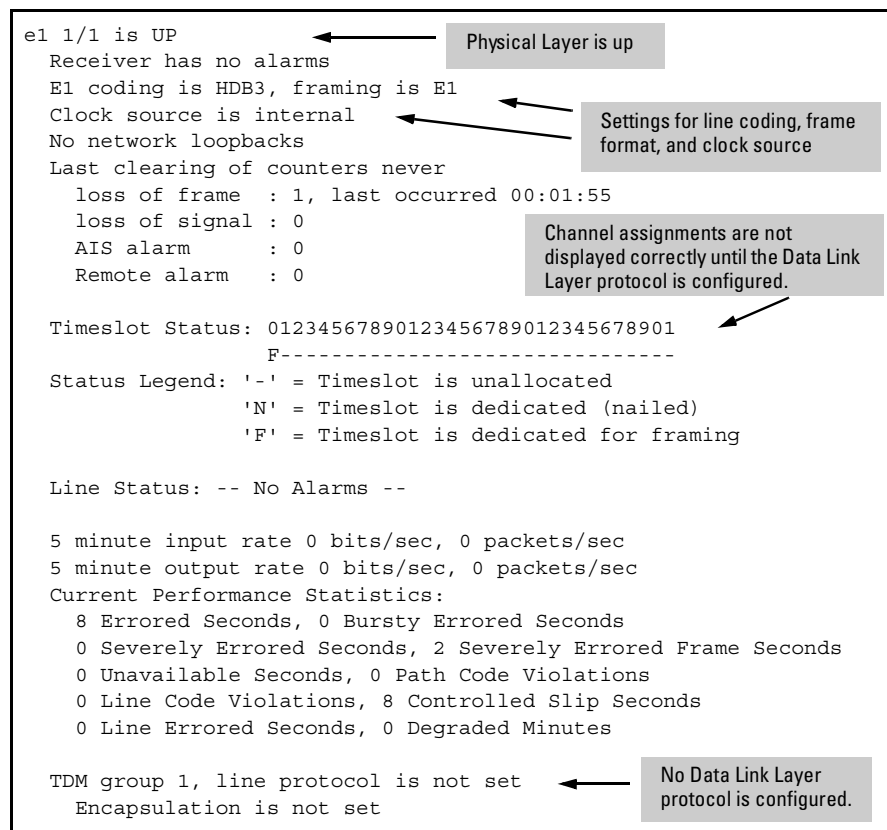


Figure 4-7. show interface E1

The first line indicates whether the interface is up or down. The second line lists alarms, if there are any. The next two lines show current configurations for line coding, framing, and clock source. For T1 interfaces, the FDL type and the line build out settings are also listed. If the line is in loopback, this information is listed as well.

The channels are listed as a series of digits: for an E1 interface, the channels are listed as 0-9, 0-9, 0-9, and 1. As shown in Figure 4-7, the first channel 0 is reserved for framing. For a T1 interface, the channels are listed as 1-9, 0-9, and 0-4.

Underneath the digits, a series of Ns or dashes indicate how the channels are being used. Channels marked with N are dedicated to the E1- or T1-carrier line. Channels that are marked by a – are not being used.

Although the E1 interface shown in Figure 4-7 has been configured to use channels 1-31, these channels do not appear to be allocated to the line. The channel assignment is not displayed correctly until you properly configure the Data Link Layer protocol. After the protocol is configured for the E1 or T1 interface, the **show interfaces** command will indicate that the channels are allocated. (For more information, see *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.)

If you are configuring an E1 interface for an E1 + G.703 module, the channels that you do not allocate to the E1 interface are marked with a D and are allocated to the G.703 interface. Likewise, if you are configuring a T1 interface for a T1 + DSX-1 module, the channels that you do not assign to the T1 interface are marked with a D and allocated to the DSX-1 module.

Note

By default, all channels are allocated to the G.703 or DSX-1 interface until you change this configuration. For more information about allocating channels to the G.703 or DSX-1 interface, see *Chapter 9: Configuring the E1 + G.703 and T1 + DSX-1 Modules*.

As Figure 4-7 shows, the section under the channel assignment displays the line status and informs you of any alarms.

show running-config Command

To check all of the settings that have been entered for the E1 or T1 interface, enter the following command:

Syntax: show running-config

This command displays the configuration that you have entered for the entire router. You must then scroll through the running-config until you locate the appropriate E1 or T1 interface.

To save time, you can enter the following command from the enable mode context:

Syntax: show running-config interface <interface> <slot>/<port>

For example, if you want to display the commands that you have entered for the E1 1/1 interface, enter:

```
ProCurve# show running-config interface e1 1/1
```

Figure 4-8 shows the output for a sample network.

```
interface e1 1/1
  clock source internal
  tdm-group 1 timeslots 1-31 speed 64
  no shutdown
```

This output shows only the commands that you have manually entered.

Figure 4-8. show running-config <interface> <slot>/<port>

According to this display, the network administrator has entered only three commands for this E1 interface:

```
ProCurve(config-e1 1/1)# clock source internal
ProCurve(config-e1 1/1)# tdm-group 1 timeslots 1-31
ProCurve(config-e1 1/1)# no shutdown
```

show running-config verbose Command

To view all of the settings—the commands you have entered and the default settings—for an interface, enter the following command from the enable mode context:

Syntax: show running-config interface <interface> <slot>/<port> verbose

For example, to view all of the settings for the E1 1/1 interface, enter:

```
ProCurve# show running-config interface e1 1/1 verbose
```

Figure 4-9 shows the verbose output for a sample network. Compare this output with the output shown in Figure 4-8.

```
interface e1 1/1
  description
  no framing crc4
  clock source internal
  tdm-group 1 timeslots 1-31
  coding hdb3
  lbo long 0
  remote-loopback
  sa4tx-bit 0
  loop-alarm-detect
  remote-alarm rai
  alias
  snmp trap link-status
  no ts16
  no shutdown
```

← This is the default setting; the E1-carrier line is using the E1 frame format.

Figure 4-9. show running-config <interface> <slot>/<port> verbose

Troubleshooting E1 and T1 WAN Connections

Troubleshooting problems with WAN connections is a two-step process:

1. Check the Physical Layer:
 - a. Check whether the E1 or T1 interface is up or down.
 - b. Check for alarms.
 - c. Check the configurations to ensure that you are using the correct settings.
 - d. Check the cabling and the connections.
2. Check the logical layer:
 - a. Check to ensure that a Data Link Layer protocol has been defined and is bound to the E1 or T1 interface.
 - b. Check the configurations to ensure that you are using the correct settings.

This chapter provides information about troubleshooting the Physical Layer. For information about troubleshooting the Data Link Layer, see *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.

You should start by troubleshooting the physical interface because it must be up before the logical connection can be established. You can quickly check the LEDs on the front of the ProCurve Secure Router to determine the status of a physical interface. Locate the LED that corresponds to the slot in which the E1 or T1 module is installed. (See Figure 4-10.)

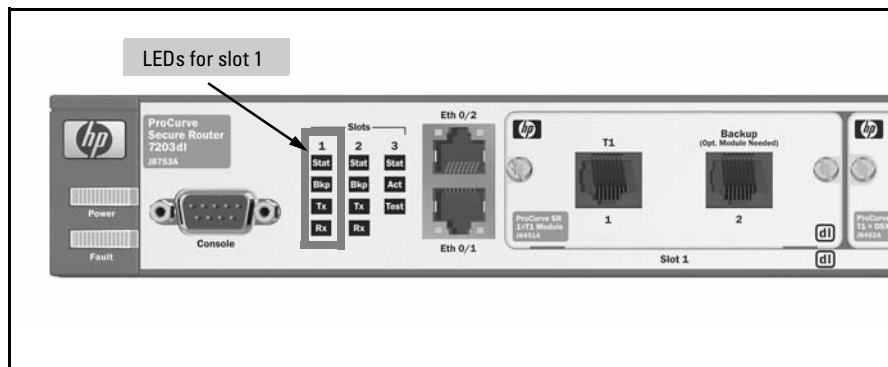


Figure 4-10. Use the Stat LED to Check the Status of a Physical Interface

Table 4-7 shows the possible color of the stat LED, lists the meaning, and outlines the action you might take next.

Table 4-7. Check the LEDs

Color	Meaning	Action
No light	No module is installed, or the interface is not activated.	- Ensure you are checking the LED for the slot in which the E1 or T1 module is installed. - Enter the show interface <interface> <slot>/<port> command to determine if you need to activate the interface. - If the line is administratively down, enter no shutdown.
Red	Interface is activated, but there are alarms.	- Use the show interface <interface> <slot>/<port> command to determine what alarms are being reported. - Check the configuration. - Check the connections and the cable itself.
Yellow	The interface is in loopback mode	Cancel the loopback, or call your public carrier and ask for the loopback to be canceled.
Green	The Physical Layer is up.	- Enter the show interface <interface> <slot>/<port> command to ensure that you have configured the correct Data Link Layer protocol for the line. - Ensure that you have configured the correct channels for the connection. - Check the status of the logical interface and follow the troubleshooting steps for the protocol you are using.

The color of the lights and a more detailed explanation are provided below.

No Light

If no light appears, ensure that you are checking the LED that corresponds to the slot in which the E1 or T1 module is installed, as shown in Figure 4-10.

Next, view the status of the E1 or T1 interface by entering:

```
ProCurve# show interfaces <interface> <slot>/<port>
```

If the E1 or T1 interface is administratively down, move to the appropriate interface configuration mode context and enter **no shutdown**. For example, you might enter:

```
ProCurve(config-e1 1/1)# no shutdown
```

The status of the interface should change.

Red Light

If the LED is red, the interface is administratively up, but it is receiving alarms. View the status of the interface by entering:

```
ProCurve# show interface <interface> <slot>/<port>
```

Note any alarms that are being reported. (See Figure 4-11.)

```
e1 1/1 is DOWN
Encapsulation is not set
Transmitter is sending remote alarm
Receiver has loss of signal, loss of frame
E1 coding is HDB3, framing is E1
Clock source is internal
No network loopbacks
Last clearing of counters never
  loss of frame : 1, current duration 00:00:54
  loss of signal : 1, current duration 00:00:53
  AIS alarm : 0
  Remote alarm : 0

Timeslot Status: 01234567890123456789012345678901
                  FNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
Status Legend: '-' = Timeslot is unallocated
               'N' = Timeslot is dedicated (nailed)
               'F' = Timeslot is dedicated for framing

Line Status: -- LOS -- LOF -- Tx LOF --

5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
Current Performance Statistics:
  10 Errored Seconds, 0 Bursty Errored Seconds
  0 Severely Errored Seconds, 56 Severely Errored Frame Seconds
  56 Unavailable Seconds, 0 Path Code Violations
  1 Line Code Violations, 0 Controlled Slip Seconds
  0 Line Errored Seconds, 0 Degraded Minutes

TDM group 1, line protocol is DOWN
Encapsulation PPP (ppp 1)
  0 packets input, 0 bytes, 0 no buffer
  0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame
  0 abort, 0 discards, 0 overruns
```

If the interface is down, look for reported alarms

Check configuration settings: line coding and framing

Figure 4-11. Using the show interfaces Command to Troubleshoot Problems

The most common alarms and some possible solutions are listed in Table 4-8.

Table 4-8. Alarms and Their Possible Causes

Alarm	Possible Cause	Possible Solutions
LOS—loss of signal	- You may be using a different type of line coding than that used by the public carrier. - The cable connection may be loose. - The cable may be bad.	- Check all the settings, including the setting for line coding. - Check the connections to ensure that the cable is plugged securely into the E1 or T1 port on one end and the CSU or wall-jack at the other end. - Substitute a different cable.
LOF—loss of frame	- You may be using a different type of frame format than that used by the public carrier. - The cable connection may be loose. - The cable may be bad.	- Check the setting for frame format. - Check the connections to ensure that the cable is plugged securely into the E1 or T1 port on one end and the CSU or wall-jack at the other end. - Substitute a different cable.

Check the Configuration. Review your configuration and ensure that you have entered the settings that match those used by your public carrier. In addition to checking the line coding and frame format, check:

- channels dedicated, or “nailed,” to the interface
- clock source
- line protocol, or the Data Link Layer protocol

Resolve any problems, such as incompatible line coding or loss of synchronization due to conflicting clock sources. If a line protocol is not listed, you must configure a logical interface (the Data Link Layer), and then you must bind the E1 or T1 interface to that logical interface.

Check the Hardware. If the configuration of the E1 or T1 interface appears to be correct, but the E1 or T1 interface is still down, examine the hardware. Is the cable attached correctly? Is the cable bad? Use a different cable to see if this makes a difference. Try looping the signal back through the interface to determine whether the source of the problem is the interface on the ProCurve Secure Router or the other end of the link.

Yellow Light

If one of the IT staff initiated a loopback test, enter the appropriate command to cancel it. From the E1 or T1 interface configuration mode context, enter:

E1 Syntax: no loopback remote

T1 Syntax: no loopback remote [line {fdl | inband} | payload]

E1 and T1 Syntax: no loopback network [line | payload]

If the loopback was not initiated on the ProCurve Secure Router, your public carrier is testing the line. Call your public carrier to have the loopback canceled or to determine the reason for the loopback test.

Green Light

If the stat LED for the physical interface is green but the WAN connection is down, you should still check the configuration for the E1 or T1 interface. In some cases, the physical connection may be established even though there is a problem with the configuration.

For example, the router and the public carrier's equipment may be able to establish the Physical Layer connection even though the channels configured on the E1 or T1 interface do not match the channels that the public carrier has configured for the connection. When the Data Link Layer protocol tries to establish its connection, however, the connection fails. Although the problem appears to be with the Data Link Layer, it is actually a configuration problem with the E1 or T1 interface.

If the E1 or T1 interface is up and the configuration appears to be correct, you should begin troubleshooting the logical interface. For tips on troubleshooting PPP, Frame Relay, or High-Level Data Link Control (HDLC), see *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.

Viewing Performance Statistics

The **show interface** command provides two options for physical interfaces:

- **performance-statistics**
- **realtime**

The **performance-statistics** option displays interval snapshots of errors occurring on the connection. You can view snapshots of all 15-minute intervals in the past 24 hours, or you can specify that the Secure Router OS display:

- a summary of the total statistics over the last 24 hours
- a specific 15-minute interval or a range of specific intervals

To view performance statistics, enter:

Syntax: show interfaces <interface> <slot>/<port> performance-statistics [Total-24-hour | <range of intervals>]

For example, to view performance statistics accumulated on the T1 1/1 interface over all 15-minute intervals in the past 24 hours, enter:

```
ProCurve# show interfaces t1 1/1 performance-statistics
```

To view only certain 15-minute intervals, replace **<range of intervals>** with numbers between 1 and 96. The intervals are numbered from the interval that occurred 24 hours earlier (1) to the present interval (96). For example, enter:

```
ProCurve# show interface t1 1/1 performance statistics 32-34
```

Figure 4-12 shows the output for a T1 interface that is experiencing no errors.

```
Interval 32 Performance Statistics:
  0 Errored Seconds, 0 Bursty Errored Seconds
  0 Severely Errored Seconds, 0 Severely Errored Frame Seconds
  0 Unavailable Seconds, 0 Path Code Violations
  0 Line Code Violations, 0 Controlled Slip Seconds
  0 Line Errored Seconds, 0 Degraded Minutes
Interval 33 Performance Statistics:
  0 Errored Seconds, 0 Bursty Errored Seconds
  0 Severely Errored Seconds, 0 Severely Errored Frame Seconds
  0 Unavailable Seconds, 0 Path Code Violations
  0 Line Code Violations, 0 Controlled Slip Seconds
  0 Line Errored Seconds, 0 Degraded Minutes
Interval 34 Performance Statistics:
  0 Errored Seconds, 0 Bursty Errored Seconds
  0 Severely Errored Seconds, 0 Severely Errored Frame Seconds
  0 Unavailable Seconds, 0 Path Code Violations
  0 Line Code Violations, 0 Controlled Slip Seconds
  0 Line Errored Seconds, 0 Degraded Minutes
```

Figure 4-12. Viewing Performance Statistics for a Physical Interface

To end the output, enter **Ctrl+C**.

To view the output for the **show interfaces** command in real-time, enter:

Syntax: show interface <interface> <slot>/<port> realtime

For example, to view real-time information for the T1 1/1 interface, enter:

```
ProCurve# show interface t1 1/1 realtime
```

Figure 4-13 shows the type of information that is displayed.

```
-----
t1 1/1 is UP
  Receiver has no alarms
  T1 coding is B8ZS, framing is ESF
  Clock source is through t1 1/2, FDL type is ANSI
  Line build-out is 0dB
  No remote loopbacks, No network loopbacks
  Acceptance of remote loopback requests enabled
  Tx Alarm Enable: rai
  Last clearing of counters never
    loss of frame   : 1, last occurred 00:10:27
    loss of signal  : 1, last occurred 00:10:41
    AIS alarm       : 0                      40
    Remote alarm    : 0

DS0 Status: 123456789012345678901234
             NNNNNNNNNNNNNNNNNNNNNNNNN
Status Legend: '-' = DS0 is unallocated
               'N' = DS0 is dedicated (nailed)

Line Status: -- No Alarms --
(OUTPUT TRUNCATED)-----
Exit - 'Ctrl-C', Freeze - 'f', Resume - 'r'
```

Instructions
for pausing
or ending
the output

Figure 4-13. Viewing the show interfaces Output in Real-Time

To end the output and return to troubleshooting the router, enter **Ctrl+C**.

Quick Start

This section provides the commands you must enter to quickly configure an E1 or T1 interface on the ProCurve Secure Router. Only a minimal explanation is provided.

If you need additional information about any of these options, see “Contents” on page 4-1 to locate the section and page number that contains the explanation you need.

Configuring an E1 or T1 Interface

Before you begin to configure an E1 or T1 interface, you should know the settings that you must enter for the following:

- number of channels used
- line coding
- frame format
- clock source

Your public carrier should provide you with this information.

To configure the E1 or T1 interface, complete these steps:

1. If you are configuring an E1 interface, use unshielded twisted pair (UTP) cabling with RJ-48C connectors to connect the E1 port on the ProCurve Secure Router to the external CSU provided by your public carrier. If you are configuring a T1 interface, use UTP cabling with RJ-48C connectors to connect the T1 port to the wall jack provided by your public carrier.

2. Establish a terminal session with the ProCurve Secure Router. You are automatically at the basic mode context.

ProCurve>

3. Move to the enable mode context. If you have configured a password for the enable mode context, enter the password.

ProCurve> enable
Password:

4. Move to the global configuration mode context.

ProCurve# configure terminal

5. Move to the E1 or T1 interface configuration mode context.

Syntax: interface <interface> <slot>/<port>

For example, if you are configuring a one-port E1 or T1 module that is installed in slot one, enter:

```
ProCurve(config)# interface e1 1/1
```

or

```
ProCurve(config)# interface t1 1/1
```

You can also specify a range of interfaces to configure.

Syntax: interface range [e1 | t1] [<slot/port-port> | <slot/port>, <slot/port>]

For example, to specify several E1 ports for configuration, enter:

```
ProCurve(config)# interface range e1 3/1-2, 3/4-6, 3/8
```

6. Create a TDM group and assign it the number of channels used for this connection.

Syntax: tdm-group <number> timeslots <range of numbers>

For example, to assign the E1 or T1 interface all the available channels, enter:

```
ProCurve(config-e1 1/1)# tdm-group 1 timeslots 1-31
```

or

```
ProCurve(config-t1 1/1)# tdm-group 1 timeslots 1-24
```

7. Configure the line coding. For E1 interfaces, use the following syntax:

Syntax: coding [ami | hdb3]

```
ProCurve(config-e1 1/1)# coding ami
```

HDB3 is the default setting for E1 interfaces.

For T1 interfaces, use the following syntax:

Syntax: coding [ami | b8zs]

```
ProCurve(config-t1 1/1)# coding ami
```

B8ZS is the default setting for T1 interfaces.

8. Configure the frame format for the E1- or T1-carrier line. For E1-carrier lines, use the following syntax:

Syntax: framing crc4

If your public carrier is using E1 framing format, do *not* enter a **framing** command. E1 framing is the default setting for E1 interfaces. If your PTT is using CRC4, change the frame format.

ProCurve(config-e1 1/1)# framing crc4

If you need to change the frame format back to E1, enter:

ProCurve(config-e1 1/1)# no framing crc4

For T1 interfaces, use the following syntax to configure the framing:

Syntax: framing [d4 | esf]

ProCurve(config-t1 1/1)# framing d4

The default setting for T1 framing is ESF.

9. Configure the clock source setting.

Syntax: clock source [internal | line | through]

ProCurve(config-e1 1/1)# clock source line

or

ProCurve(config-t1 1/1)# clock source line

Table 4-9 shows the default settings for the clock source on each type of E1 or T1 module.

Table 4-9. Default clock source settings for E1 and T1 modules

Module	Port	Default Clock Source
One-port E1 or T1 module	1	line
Two-port E1 or T1 module	1 2	line through
E1 + G.703 module	1	line
T1 + DSX-1 module	2	through
Eight-port module	1–8	line

10. For T1 interfaces only, configure the line build out (lbo). If the cable connecting the T1 interface to the wall jack is longer than 655 feet, use the following **lbo** command:

Syntax: lbo long <value>

Replace <value> with one of the following numbers, which are in decibels (db):

- -22.5
- -15
- -7.5
- 0

If the cable connecting the T1 interface to the wall jack is shorter than 655 feet, use the following **lbo** command:

Syntax: lbo short <value>

Replace <value> with the actual number of feet. For example, if the cable is 100 feet, enter:

```
ProCurve(config-t1 1/1)# lbo short 100
```

11. Activate the interface.

```
ProCurve(config-e1 1/1)# no shutdown
```

or

```
ProCurve(config-t1 1/1)# no shutdown
```

12. View the status of the E1 or T1 interface.

```
ProCurve(config-e1 1/1)# do show interface e1 1/1
```

or

```
ProCurve(config-t1 1/1)# do show interface t1 1/1
```

Note

The **do** command enables you to enter enable mode commands (such as **show** commands) from any context.

By default, the ProCurve Secure Router immediately notifies you that the interface is administratively up. It will take a few moments to establish the E1 or T1 connection, however. When the connection goes up, the ProCurve Secure Router displays another message at the command line interface (CLI), reporting that the line is up. If you want to disable this reporting function, enter **no events** from the enable mode context.

You must now configure the Data Link Layer protocol for the E1 or T1 interface. For information about configuring this protocol, see *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.