HST-3000

DS3 Testing

User's Guide

JDSU

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Ordering information

This guide is a product of JDSU's Technical Information Development Department, issued as part of the HST-3000. The catalog number for a printed user's guide is ML-060901. The catalog number for a USB containing all HST-3000 user documentation is ML-060301.

Federal Communications Commission (FCC) Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.
– Increase the separation between the equipment and receiver.
– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
– Consult the dealer or an experienced radio/TV technician for help.

In order to maintain compliance with the limits of a Class B digital device JDSU requires that quality interface cables be used when connecting to this equipment. Any changes or modifications not expressly approved by JDSU could void the user's authority to operate the equipment.

Industry Canada Requirements

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

WEEE and Battery Directive Compliance

JDSU has established processes in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive, 2002/96/EC, and the Battery Directive, 2006/66/EC.

This product, and the batteries used to power the product, should not be disposed of as unsorted municipal waste and should be collected separately and disposed of according to your national regulations. In the European Union, all equipment and batteries purchased from JDSU after 2005-08-13 can be returned for disposal at the end of its useful life. JDSU will ensure that all waste equipment and batteries returned are reused, recycled, or disposed of in an environmentally friendly manner, and in compliance with all applicable national and international waste legislation.

It is the responsibility of the equipment owner to return equipment and batteries to JDSU for appropriate disposal. If the equipment or battery was imported by a reseller whose name or logo is marked on the equipment or battery, then the owner should return the equipment or battery directly to the reseller.

Instructions for returning waste equipment and batteries to JDSU can be found in the Environmental section of JDSU's web site at www.jdsu.com. If you have questions concerning disposal of your equipment or batteries, contact JDSU's WEEE Program Management team at WEEE.EMEA@jdsu.com.

Contents

About This Guide

Topics discussed in this chapter include the following:

Purpose and scope

The purpose of this guide is to help you successfully use the features and capabilities of the HST-3000 DS3 testing option. This guide includes task-based instructions that describe how to configure, use, and troubleshoot the HST-3000 for DS3 physical transmission testing.

Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the HST-3000 DS3 testing option efficiently and effectively. We assume that you have basic computer experience and are familiar with basic telecommunications safety, concepts, and terminology.

Screen shots are provided for reference only; depending on a number of variables they might not reflect what appears on your test instrument.

Terminology

The following terms have a specific meaning when they are used in this guide:

- **HST-3000** — Handheld Services Tester 3000. In this user's guide, "HST-3000" can be used to refer to the HST-3000 family of products or the combination of a base unit and attached SIM. "HST" is sometimes used to refer to the base unit/SIM combination.
- **SIM** — Service Interface Module. Sometimes referred to generically as the module. The SIM provides test application functionality.

For definitions of other terms used in this guide, see "Glossary" on page 107.

Application-oriented user guide

The *HST-3000 DS3 Testing User's Guide* is an application-oriented user's guide containing information about using the HST-3000 DS3 testing option in monitor and terminate test operations, and test result descriptions. This guide also contains specifications for the HST unit and contact information for JDSU's Technical Assistance Center (TAC).

This user's guide should be used in conjunction with the *HST-3000 Base Unit User's Guide*.

HST-3000 base unit user's guide

The *HST-3000 Base Unit User's Guide* contains overall information about the base unit and general functions such as instructions for charging the battery, managing files, information on peripheral support, and technical specifications for the base unit. The base unit user's guide also contains a description of JDSU's warranty, services, and repair information, including terms and conditions of the licensing agreement.

Safety and compliance information

Safety and compliance information are contained in a separate guide and are provided in printed format with the product.

Technical assistance

If you need assistance or have questions related to the use of this product, call or e-mail JDSU's Technical Assistance Center (TAC) for customer support. Before contacting TAC, you should have the serial numbers for your HST-3000 unit. See "Locating the serial number" in the HST-3000 Base Unit User's Guide for more information.

Table 1 lists TAC information. For the latest TAC contact information, go to www.jdsu.com, or contact your local sales office for assistance. For contact information for regional sales offices, see the back cover of this guide.

Table 1 Technical assistance centers

Region	Phone Number	
Americas	1-866-ACTERNA 301-353-1550	(1-866-228-3762) tac@jdsu.com
Europe, Africa, and Mid-East	+49 (0) 7121 86 1345 (JDSU Germany)	hotline.europe@jdsu.com
Asia and the Pacific	+852 2892 0990 (Hong Kong) +8610 6833 7477 (Beijing-China)	

During off-hours, you can request assistance by doing one of the following: leave a voice mail message at the Technical Assistance number, e-mail the North American Technical Assistance Center, tac@jdsu.com, or submit your question using our online Technical Assistance Request form at www.jdsu.com.

Conventions

When applicable, this guide uses the typographical conventions and symbols described in the following tables.

Table 2 Typographical conventions

Description	Example
User interface actions and buttons or switches you have to press appear in this **typeface**.	Press the **OK** key.
Code and output messages appear in this `typeface`.	`All results okay`
Text you must type exactly as shown appears in this **`typeface`**.	Type: **`a:\set.exe`** in the dialog box.
Variables appear in this **typeface**.	Type the new **hostname**.
Book references appear in this *typeface*.	Refer to *Newton's Telecom Dictionary*

Table 3 Keyboard and menu conventions

Description	Example
A plus sign + indicates simultaneous keystrokes.	Press **Ctrl+s**
A comma indicates consecutive key strokes.	Press **Alt+f,s**
A slanted bracket (>) indicates choosing a submenu from menu.	On the menu bar, click **Start > Program Files**.

Table 4 Symbol conventions

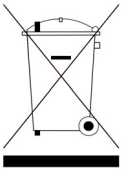
	This symbol represents a general hazard.
	This symbol represents a risk of electrical shock.
	This symbol represents a risk of explosion
	This symbol represents a Note indicating related information or tip.
	This symbol, located on the equipment, battery, or packaging indicates that the equipment or battery must not be disposed of in a land-fill site or as municipal waste, and should be disposed of according to your national regulations.

Table 5 Safety definitions

DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Getting started

1

This chapter provides basic information about the HST-3000 with a DS3 SIM. Topics discussed in this chapter include the following:

Overview of features

The HST-3000 DS3 testing option allows you to perform the test operations necessary to install, maintain, and trouble-shoot DS3 circuits and DS1 channels within DS3 circuits. Test operations include in-service monitoring, bit error rate testing (BERT), and loopback testing.

The HST-3000 DS3 testing option includes the following features:

- Standard dual DS3 receive (Primary and Secondary Rx) and single DS3 transmit (Primary Tx) capability.
- Out-of-service testing by generating and transmitting user selected test patterns in Terminate mode.
- Passive (non-intrusive) monitoring of one or two DS3 lines in Monitor mode.
- DS1 channel testing from a DS3 interface for contiguous and non-contiguous timeslots in 64 kbps format.
- Supported framing types: DS3 Unframed, M13, and C-bit.
- Insertion of BPV, bit errors, CRC errors, parity errors, and DS3/DS1 frame errors.
- Insertion of the following alarms: DS3/DS1 AIS, DS3/DS1 Yellow Alarm, DS1 LOF, DS1 LOS.
- Generation of the following DS1 loop codes: NIU, CSU, FT1 CSU V.54, HDSL, MSS, user defined, and repeater.
- Generation of the following FEAC loop codes: NIU, DS3 line, DS1 line.
- “OK” message is displayed if no errors or alarms have occurred during the test. This provides a quick and easy way of determining that the line is free from errors.
- Physical layer alarms, errors, and statistics are collected at all times.

What's new This release of the DS3 testing option supports the following new features:

– Simplified user interface. The menu structure, tab structure, and setup screens have been simplified and streamlined to allow you to configure and run your tests quickly and efficiently. Before testing, we strongly recommend that you read "Configuring your test" on page 5 to become comfortable with the new interface.

– Excess zero insertion and detection. An alarm is now declared if 8 or more consecutive excess zeros were detected in B8ZS line coding, and 16 or more in AMI line coding.

DS3 interface connectors

The DS3 interface connectors are located on top of the DS3 service interface module (SIM). There are three interface connectors: Primary Tx, Primary Rx, and Secondary Rx.

Figure 1 shows the top view of a SIM with DS3 interface connectors. Your SIM may have additional interface connectors depending on its test features.

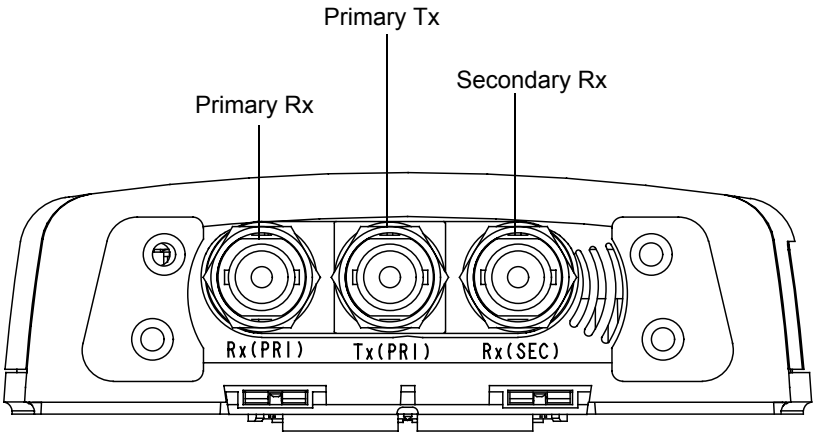


Figure 1 DS3 interface connectors

Table 1 describes the connectors on the DS3 SIM. For additional input and output specifications, see Appendix C.

WARNING: ELECTRICAL SHOCK

Electrical shock may result in serious injury or death. Use care when connecting to telecommunications circuits, to be sure that you do not come in contact with exposed conductors or power mains. Connect telephone-network voltage (TNV) signals only to TNV ports.

For instructions on attaching and detaching a SIM, see the *HST-3000 Base Unit User's Guide*.

Table 1 DS3 interface connectors

Connector	Type	Description
Primary Rx	BNC	DS3 connection to the primary receiver. Used in Monitor and Terminate modes.

Table 1 DS3 interface connectors (Continued)

Connector	Type	Description
Primary Tx	BNC	DS3 connection to the primary transmitter. Used in Terminate mode.
Secondary Rx	BNC	DS3 connection to the secondary receiver. Used in Monitor mode.

Configuring your test

Configuring your tests involves launching an application, selecting a test mode, and then specifying settings on the configuration menus.

Launching an application

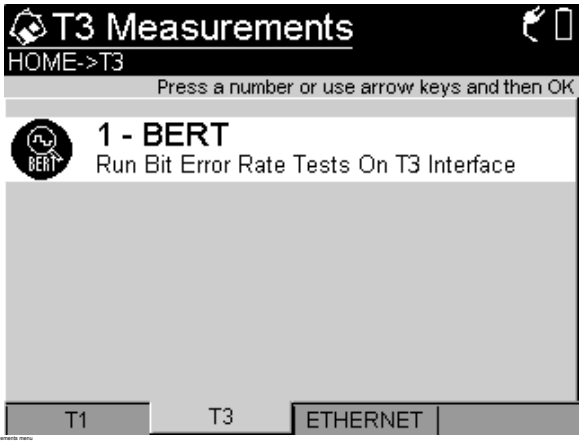
Before you can launch an application, you must have a SIM with DS3 testing capability. Make sure the SIM is properly connected to the HST base unit before you power on the unit. For information about connecting a SIM and powering the HST, see the *HST-3000 Base Unit User's Guide*.

The following procedure describes how to launch an application.

To launch a DS3 application

1. Power on the HST-3000.
2. Press the **T3** soft key.

The T3 Measurements menu appears.



T1 Measurements menu

3 Select **BERT** to run bit error rate and monitor tests.

A "*Please Wait... Launching Test Application*" message appears briefly. The message disappears, the HST launches the application, and a menu listing each of the test modes for the application appears.

4 Select a test mode for the application.

A "*Please Wait... Reconfiguring Test*" message appears briefly.

The message disappears, the HST configures the test, and the Summary Results screen appears.

5 To review or change the current test settings, press the **Configure** button.

The Summary Settings menu appears, listing each of the key settings required to run your test.

– If the settings meet your test requirements, and if you do not need to change any of the settings on the other configuration menus, press **Home** to return to the

Results display, and then press the **Restart** soft key to clear statistical and historical results and restart the test.

– If you need to change the settings, proceed to "Specifying basic test settings" on page 7.

For information about purchasing options for the HST-3000, contact your JDSU representative or your local JDSU sales office. You can also contact JDSU through the company web site, www.jdsu.com.

You have launched the DS3 test application.

Specifying basic test settings

After you launch an application, you verify and specify test settings using the configuration menus. The following procedure describes how to access the test configuration menus and specify basic settings.

NOTE:

If you change settings while transmitting traffic, results will not reflect the true state of the circuit. Always stop traffic before changing settings.

To specify basic test settings

1 Launch an application and specify the test mode (see "Launching an application" on page 5).

The HST launches the application in the mode you specified, and the Summary Results screen appears.

2 Press the **Configure** button.

The Summary Settings menu appears, listing the key settings for the application you launched. The settings and the values for the settings vary depending on the current application and test mode.

3 To change a setting, do the following:

a If the setting you need to change appears on the Summary Settings menu, proceed to step c.

b If the setting you need to change does not appear on the Summary Settings menu, use the left and right arrow keys on your keypad to scroll through the available configuration menus. For example, if you want to specify the type of alarm to transmit, scroll to the Error Settings configuration menu.

c Press the number corresponding to the setting you want to change, and then select or type the value for the setting as appropriate.

If you type the value for a setting (such as the Tx Clock Offset), **OK** stores the new value. **Cancel** returns you to the previous configuration menu without storing the new value.

Basic test settings are specified. For detailed instructions on configuring the remaining settings, refer to Chapter 2 “DS3 BER and Monitor Testing”.

Saving test configurations

After you have finished configuring the HST-3000 for a particular test, you can store the test configuration for future use. The configurations are stored on power down.

To store a test configuration

1. Set up the HST-3000 for the test you are performing.
2. Press the **Configure** navigation key.
3. Press the **Storage** soft key.
4. **Select Save Config**.

5 Enter the file name.

6 Press the **OK** key.

The test configuration is stored.

Loading a configuration

After a configuration is saved, you can load it. This could save you some time in cases where the majority of settings are the same.

To load a test configuration

1 Press the **Configure** navigation key.

2 Press the **Storage** soft key.

3 Select **Load Config**.

4 Select the file to load.

5 Press the **OK** key.

The test configuration is loaded.

Overwriting a configuration

You can change a saved configuration then overwrite the old version.

To overwrite a configuration

1 Press the **Configure** navigation key.

2 Press the **Storage** soft key.

3 Press the **3** key.

4 Select the file to overwrite.

5 Press the **OK** key.

The test configuration is overwritten.

Deleting a configuration

If a configuration is no longer needed, you can delete it.

To delete a test configuration

1. Press the **Configure** navigation key.
2. Press the **Storage** soft key.
3. **Select Delete Config.**
4. Select the file to delete.
5. Press the **OK** key.

The test configuration is deleted.

Restarting tests

Pressing the **Restart** soft key (at the bottom of the Results display) clears statistical and historical results and restarts your test.

Viewing test results

After you start a test, the Summary category appears showing an overview of the test results. You can view other results by selecting a different test result category.

To view test results

1. Configure and run a test.
2. Press the **Display** soft key, and then do one of the following:
   – Use the arrow keys to highlight a result category, and then press **OK**.

– Press the number corresponding to the category.

  If a leading zero appears in front of a number, you must also enter the leading zero. For example, if you want to display the third category listed on a menu with more than ten categories, press “0”, and then “3”. If you want to display the eleventh category on the menu, press “1” twice.

The test results for the category appear.

For descriptions of test results, see Appendix A.

Clearing history results

The following procedure describes how to clear history results in the LED and Summary categories.

To clear history results

1. Configure and run a test.
2. Press the **Home** button.
3. Press the **Results** soft key.
4. Select **Clear History**.

The HST-3000 clears any history results in the LED and Summary categories. Statistical results are not cleared and continue to accumulate.

Instrument settings and user preferences

For information about attaching SIMs; powering the unit; and changing instrument and preference settings, such as date and time format, port settings, sound, and screen settings, see the *HST-3000 Base Unit User’s Guide*.

DS3 BER and Monitor Testing

2

This chapter provides information on performing turn-up and maintenance testing using the HST-3000 with a DS3 SIM. Topics discussed in this chapter include the following:

About testing

You can use the HST-3000 with a DS3 SIM to commission and maintain DS3 transmission circuits DS1 channels within a DS3. This typically involves out-of-service testing to ensure that the physical layer is clean and there are no problems with network equipment or improper provisioning. You can use the HST-3000 to do the following:

- Terminate a circuit, and then looped back to another HST-3000 unit or piece of network equipment (such as a CSU, repeater) to perform bit error rate testing (BERT or BER testing).
- Qualify DS3 circuits with BERT patterns for both M13 and C-bit framing and insert patterns on a DS1 channel.
- Emulate a piece of network equipment (such as an NIU or CSU).
- Send DS3 FEAC loop codes to equipment at the far end.
- Perform bit error rate tests (BERT) end-to-end between two HST-3000 units (typically requires two technicians) with analysis performed in both directions. This allows you to easily isolate faults on the circuit.
- Passively monitor circuits (in-service testing) by examining transmission layer metrics such as frame errors or timing slips.

Test modes

You can use the HST-3000 DS3 testing feature in the following modes:

Terminate Mode — This mode is for testing out-of-service lines using the Primary DS3 transmitter (Tx) and the Primary DS3 receiver (Rx). You can generate and send test patterns on the Tx and receive patterns on the Rx.

Monitor Mode — This mode measures signal parameters, monitors traffic from a resistor-isolated monitor point. You can use either the Primary or Secondary DS3 receiver, or you can use both simultaneously.

Status LEDs

Six status LEDs located on the front of the HST-3000, above the LCD screen. Table 2 describes the LEDs.

Table 2 Status LEDs

LED	Description
Sync	A two-color LED that reports the presence of a signal on the selected application. – Solid green indicates a signal is present and there is frame synchronization on all active receivers. – Flashing green indicates auto-framing is running on at least one active receiver. – Solid red indicates at least one of the active receivers does not have signal or frame synchronization. – If the Sync LED is not illuminated, no signal has been detected on any active receiver.
Data	A two-color LED that reports pattern synchronization status. – Solid green indicates pattern synchronization has been achieved on all active receivers. – Flashing green means auto pattern is running on at least one active receiver. – Solid red indicates that at least one of the active receivers does not have pattern synchronization. – If the Data LED is not illuminated, it means the selected traffic pattern is live, or no pattern synchronization has been detected on any active receiver.

Table 2 Status LEDs (Continued)

LED	Description
Error	An LED that reports error conditions. – Solid red indicates an error. – If the Error LED is not illuminated it means all results are OK.
Alarm	An LED that reports alarm status (Yellow Alarm, AIS). – Solid red indicates an alarm was detected. – If the Alarm LED is not illuminated, then no alarm was detected.
LpBk	This LED indicates the local loopback state of the HST unit. – Solid green indicates the HST has been placed in loopback by the remote end. – If the LpBk LED is not illuminated, there is no local loopback.
Batt	A three-color LED that indicates the battery status. – The LED is off when the battery has a useful charge. – Solid green indicates the AC adapter is plugged in. – Solid red indicates the battery is at 20 percent or below of full charge. – Flashing red indicates about five minutes of use remain. When this happens, the battery should be charged or replaced immediately. – Solid amber or flashing amber indicates the battery capacity indicator (“gas gauge”) needs to be reset. **NOTE:** For information about charging the battery, changing batteries, and resetting the battery capacity indicator, see the *HST-3000 Base Unit User’s Guide*.

BER testing

In Terminate mode, you can use the HST-3000 to perform bit error rate (BER) testing on DS3 circuits and DS1 channels within a DS3. You can test for bit errors, BPVs, frame errors, and CRC errors (if applicable).

You can also use the HST-3000 to perform loopback testing. The HST can generate the following loop codes: NIU, CSU, MSS, repeater, HDSL, and user-defined. This allows you to set up a loop at an NIU, CSU, or any repeater between the DSX-3 and the customer premises.

The following sections describe how to perform terminate mode testing.

DS3 BER testing

The following procedure describes how to perform a bit error rate test on a DS3 channel.

To perform a BER test on a DS3 channel

1. Launch the **BERT** application. See "Launching an application" on page 5.
2. Press the **Configure** button.

   The Summary Settings menu appears, listing the key settings for the application you launched.
3. Review the Summary Settings.

   If the settings are appropriate for your test, press the **Home** key and proceed to step 11.

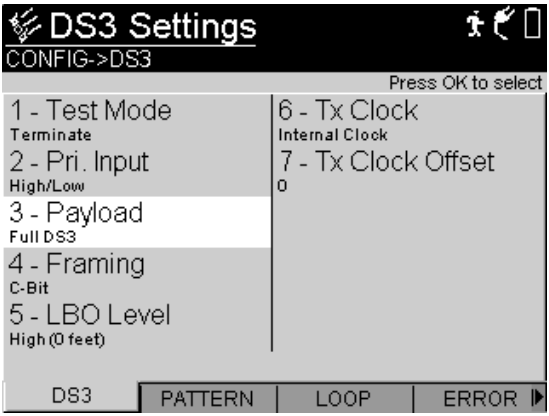
   To change the settings, do one of the following:

   – Navigate to the desired item by selecting the item number using the keypad

   – Use the arrow keys to highlight the item and then press OK.

   If you want to configure additional settings, proceed to step 4.

4 Go to the DS3 Settings menu.



5 Configure settings by pressing the number key that corresponds to the setting you want to configure. For example, press the **4** key to specify the type of framing on the line.

The following table describes the settings.

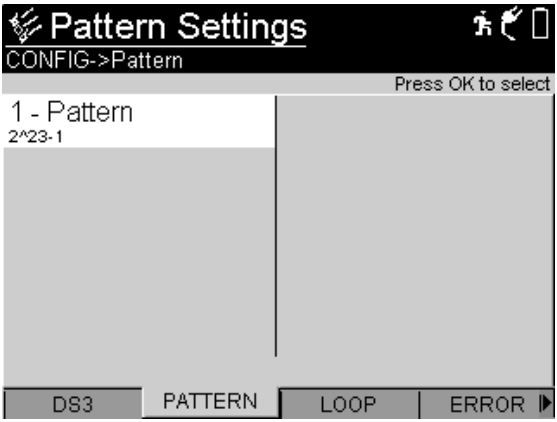
Setting	Options
Test Mode	Select **Terminate**.
Pri. Input	The primary input setting becomes effective immediately and should be set before the HST is connected to the line. Set the primary receiver (Rx) to one of the following: – **High/Low** — Accept a nominal signal level of 1.2 Vp (HIGH source) with 0 to 12 dB of cable attenuation at 22 MHz. – **DSX/Monitor** (default) — Accept a nominal signal level of 1.2 Vp (HIGH source) with 20 dB of resistive attenuation, and with 0 to 9 dB of cable attenuation at 22 MHz.
Payload	Select **Full DS3**.

Setting	Options
Framing	Select one of the following framing formats: – **Auto** — Causes the HST to automatically detect the framing format on the line. – **Unframed** — The DS3 signal will be analyzed and generated (if applicable) as a single 44.736 Mbps serial bit stream. This option is not applicable in DS1 test modes. – **M13** — If this option is selected, and the HST is originating the DS3 signal, the transmitter will transmit DS3 C-Bits as if generated from a stuffed DS2. That is they will go between ones and zeros. Also, the receiver will be put into the framed mode and will sync to C-Bit or M13 regardless of the framing selection. C-Bit related results are not applicable. – **C-bit** — If this option is selected, and the HST is originating the DS3 signal, the Tx will transmit DS3 C-Bits. NOTE: If you want to configure a far end alarm control (FEAC) loop code, the framing format must be C-bit.
LBO Level (Line Build Out)	Specify the level of cable loss for the output signal. Options are as follows: – **High (0 feet)** – **DSX (450 feet)** – **Low (900 feet)**

Setting	Options
Tx Clock	Select one of the following timing sources: – **Internal Clock —** Timing is derived using the internal clock/frequency synthesizer. – **Recovered from Primary —** Timing is derived from the network signal by the receiver and used as the transmit timing source. This option requires that signal be present on the receiver.
Tx Clock Offset	Enter a values, from **-50** to **50** ppm, for the offset frequency generated by the 44.736 MHz internal clock. To specify negative or positive numbers, press the **+/-** soft key. To clear the entire field, press the **Clear** key. To delete a single character, press the **Delete** soft key.

6 To specify a test pattern, do the following:

Go to the Pattern Settings menu.



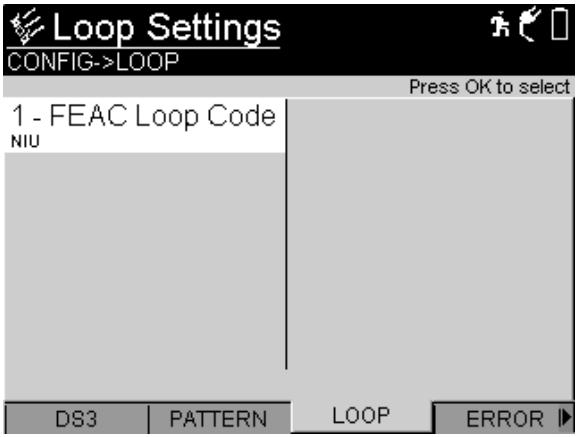
a Select **Pattern**, and then use the arrow keys to highlight a pattern from the list.

b Press the **OK** key to select the pattern.

For descriptions of available BERT patterns, see "DS3 BERT patterns" on page 98.

7 To specify a far end alarm control (FEAC) loop code, do the following:

a Go to the Loop Settings menu. The menu is only visible when the DS3 framing format is set to C-bit.

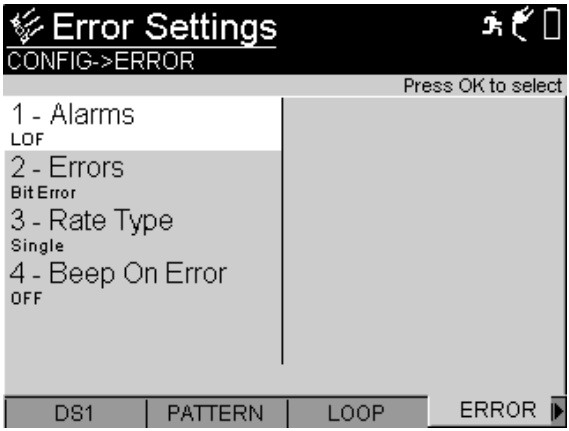


b Select **FEAC Loop Code**.

c Select either **NIU** (network interface unit) or **DS3 Line**.

8 To configure errors and alarms, do the following:

Go to the Error Settings menu.



a Press a keypad number that corresponds to the setting you want to configure.

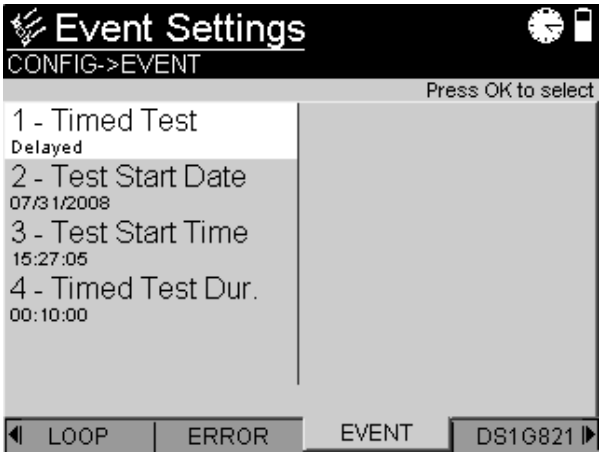
The following table describes the remaining options.

Setting	Options
Alarms	Select **Alarms**, and then specify the type of alarm to be inserted. For a list of available alarms, see "Alarms" on page 99.
Errors	Select **Errors**, and then specify the type of error to be inserted. The list of available errors will vary depending on the selected framing format. For a list of available errors, see "Errors" on page 99.
Rate Type	Select **Rate Type**, and then indicate how errors will be inserted. Select one of the following: – **Single**, **Rate** (frame rate) – **Multiple** Rate Type is only visible if the error type is Bit Error.

Setting	Options
Frame Errors	Select **Frame Errors**, and then indicate how many errors will be inserted on a single key press. Options are as follows: – **1** – **2** – **3** Frame Errors is only visible if the error type is DS3 Frame Errors.
Error Rate	Select **Error Rate**, and then indicate the insertion rate for logic errors. **NOTE:** This option is only visible if the rate type is set to Rate.
Error Count	Select **Error Count**, and then **NOTE:** This setting is only visible if the Rate Type is set to Multiple.
Beep On Error	Select whether an audible beep will sound when an error is detected.

9 To specify a time limit for the test, do the following:

Go to the Event Settings menu.



a Select **Timed Test**, and then select one of the following.

– **Enabled** – turns on timed testing

– **Disabled** – turns off timed testing

– **Delayed** – sets timed testing to run at a specific date and time.

If enabled or delayed is selected, a clock icon appears in the upper right corner of the display.

If you selected Enabled, proceed to step d.

If you selected Delayed, proceed to step b.

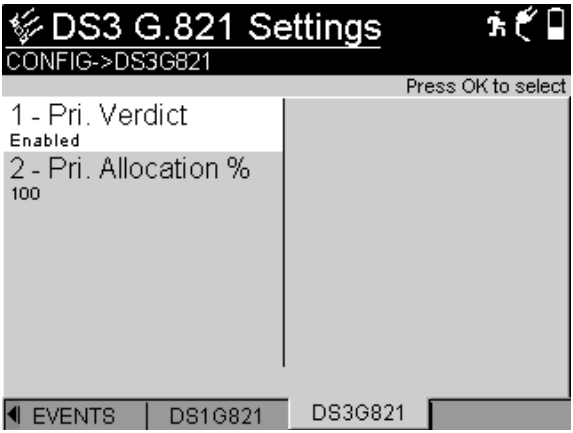
b Select **Test Start Date** and then enter the month, day, and year that you want to run the test.

c Select **Test Start Time** and then enter the hour, minute, and second at which you want to begin the test.

d Select **Timed Test Dur** and then enter the number of hours, minutes, and seconds you want the test to run.

10 To configure G.821 settings, do the following:

Go to the DS1 or DS3 G.821 Settings menu.



a Select a setting, and then specify the parameters. The following table describes the G.821 settings.

Setting	Parameter
Pri. Verdict	Indicates the primary channel will be analyzed for conformance to G.821 specifications. The HST will return either a "Pass" or "Fail" result. The only option for this setting is Enabled.
Pri. Allocation %	Enter a value, from **0.1**% to **100**%, to indicate the percentage of the end-to-end target values for ESR (Errored Seconds Ratio) and SESR (Severely Errored Seconds Ratio) that must be met for the primary test path to be acceptable. The end-to-end target values are based on the "Hypothetical Reference Configuration" (HRX) of length 27 500 km.
Sec. Verdict	Indicates the secondary channel will be analyzed for conformance to G.821 specifications. The HST will return either a "Pass" or "Fail" result. The only option for this setting is Enabled.

Setting	Parameter
Sec. Allocation %	Enter a value, from **0.1**% to **100**%, to indicate the percentage of the end-to-end target values for ESR (Errored Seconds Ratio) and SESR (Severely Errored Seconds Ratio) that must be met for the secondary test path to be acceptable. The end-to-end target values are based on the “Hypothetical Reference Configuration” (HRX) of length 27 500 km.

11 Connect the HST-3000 to the test access point (see Figure 2).

– Connect the HST's Primary DS3 Tx to the DSX-3 In (Tx) In jack.

– Connect the HST's Primary DS3 Rx to the DSX-3 Out (Rx) jack.

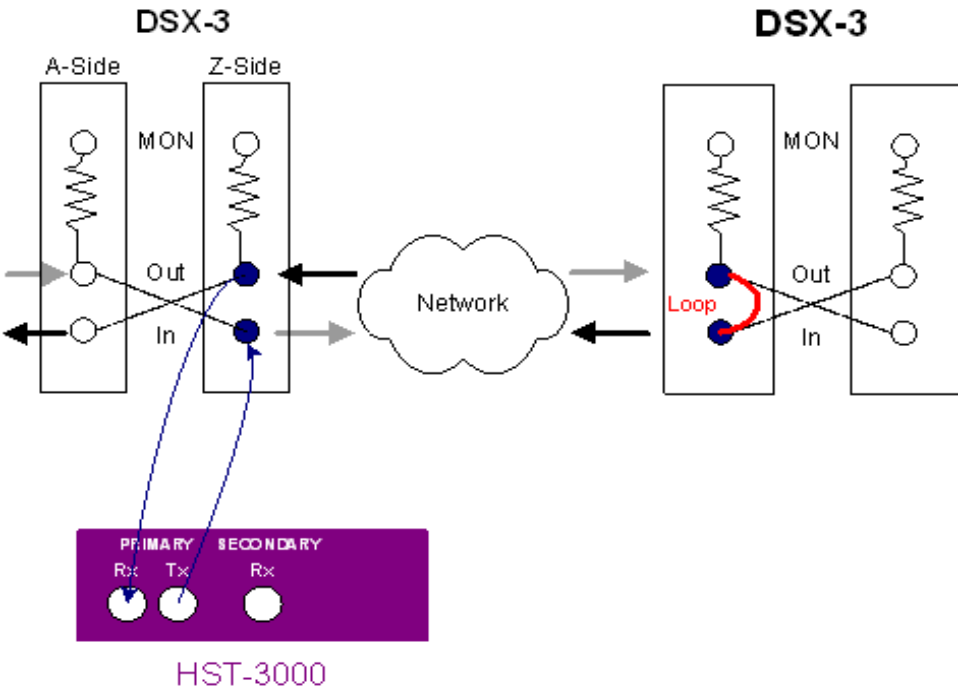


Figure 2 Terminate mode connection

If you are performing a straightaway (end-to-end) test at the customer premises, you will likely be accessing the circuit at the NIU or DSX-3 patch panel.

12 Press the **Home** navigation key.

13 Press the **Restart** soft key to clear all alarms and begin the test.

14 To insert errors, do one of the following:

– Press the **1** key.

– Press the **Action** soft key and then press the **1** key.

This inserts the number and type of error that you specified on the Error Settings menu.

The error is inserted into the Primary Tx (transmit) path.

15 To enable or disable alarms, do one of the following:

– Press the **3** key.

– Press the **Action** soft key and then press the **2** key.

This enables or disables the type of alarm that you specified on the Error Settings menu.

The alarm is inserted into the Primary Tx (transmit) path.

16 To send a far end action control (FEAC) command to the far end DSX-3, press the **Actions** soft key, select **FEAC Action**, and then select either **Loop Up** or **Loop Down**. This selection is only available if using C-BIt framing.

17 To send HDSL loop commands, press the **Actions** soft key, select **HDSL Loop Action**, and then select either **Loop Up** or **Loop Down**.

18 If the circuit is looped back, check to see that the inserted errors are received in the Summary test result category (see "Viewing test results" on page 59). If you are performing an end-to-end test, verify that the HST unit at each end of the circuit received the inserted errors.

19 To stop a running test, press the **Cancel** key.

DS3 BER testing is complete.

DS1 BER testing

The following procedure describes how to perform a bit error rate test on a DS1 channel within a DS3.

To perform a BER test on a DS1 channel

1 Launch the **BERT** application. See "Launching an application" on page 5.

2 Press the **Configure** button.

The Summary Settings menu appears, listing the key settings for the application you launched.

3 Review the Summary Settings.

If the settings are appropriate for your test, press the **Home** key and proceed to step 13.

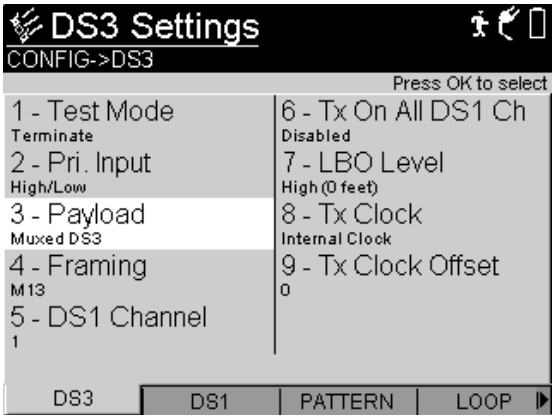
To change the settings, do one of the following:

– Navigate to the desired item by selecting the item number using the keypad

– Use the arrow keys to highlight the item and then press OK.

If you want to configure additional settings, proceed to step 4.

4 Go to the DS3 Settings menu.



5 Configure the settings by pressing the number key that corresponds to the setting you want to configure. For example, press the **4** key to specify the framing format.

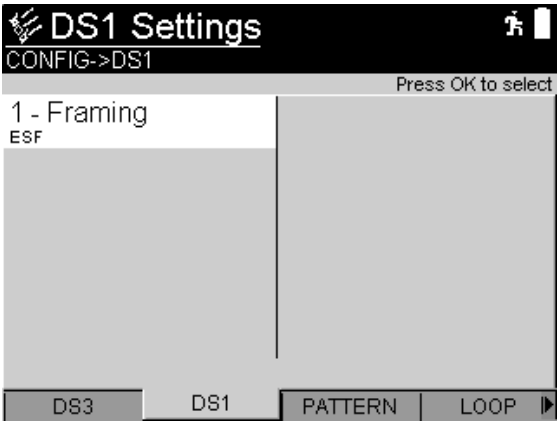
The following table describes the settings.

Setting	Options
Test Mode	Select **Terminate**.
Pri. Input	The primary input setting becomes effective immediately and should be set before the HST is connected to the line. Set the Primary Rx input to one of the following: – **High/Low** — Accept a nominal signal level of 1.2 Vp (HIGH source) with 0 to 12 dB of cable attenuation at 22 MHz. – **DSX/Monitor** (default) — Accept a nominal signal level of 1.2 Vp (HIGH source) with 20 dB of resistive attenuation and with 0 to 9 dB of cable attenuation at 22 MHz.
Payload	Select **Muxed DS3**. For information about DS3 BER testing, see "DS3 BER testing" on page 17.

Setting	Options
Framing	Select the framing format of the signal: – **Auto —** This option enables the HST to automatically detect the framing format on the line. – **M13** — If this option is selected, and HST-3000 is originating the DS3 signal, the Tx will transmit DS3 C-Bits as if generated from a stuffed DS2. That is they will go between ones and zeros. Also, the receiver will be put into the framed mode and will sync to C-Bit or M13 regardless of the framing selection. C-Bit related results are not applicable. – **C-Bit** — If this option is selected, and HST is originating the DS3 signal, the Tx will transmit DS3 C-Bits in accordance with the C-Bit overhead specification (with CP bits, Datalink bits, and AIC bit =1).
DS1 Channel	To specify a DS1 channel, use the key pad to enter a number from **1** to **28**, and then press the **OK** key. To clear an entry, press the **Clear** soft key. To cancel, press the **Cancel** key.
Tx on All DS1 Chan	Select one of the following: – **Enable** – **Disable**
LBO Level (Line Build Out)	Specify the level of cable loss for the output signal: – **High (0 feet**) – **DSX (450 feet)** – **Lows (900 feet)**

Setting	Options
Tx Clock	Specify the signal timing source for the Primary Tx output: – **Internal** – **Recovered from Primary**
Tx Clock Offset	Enter the offset frequency generated by the 44.736 MHz internal clock. The frequency can be changed with the following range: **-50** through **50 ppm**. To specify negative or positive numbers, press the **+/-** soft key. To clear the entire field, press the **Clear** key. To delete a single character, press the **Delete** soft key.

Go to the DS1 Settings menu.

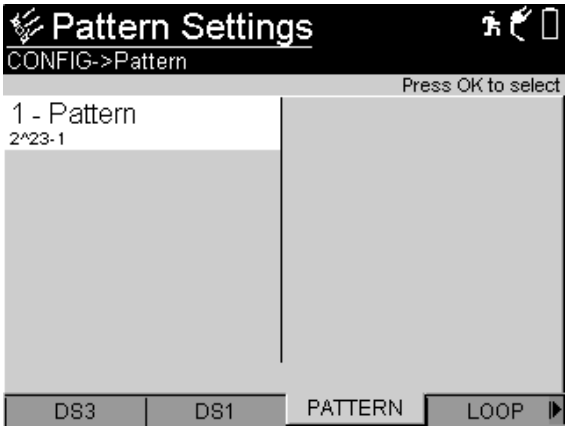


6 Select **Framing**, and then select one of the following formats:

- **Auto**
- **Unframed**
- **ESF** — Extended SuperFrame format
- **D4/SF** — D4 SuperFrame format
- **SLC-96**

7 To specify a BERT pattern, do the following:

Go to the Pattern Settings menu.



a Select **Pattern**, and then use the arrow keys to highlight a pattern.

For descriptions of available BERT patterns, see "DS1 BERT patterns" on page 94.

b Press the **OK** key to select the pattern.

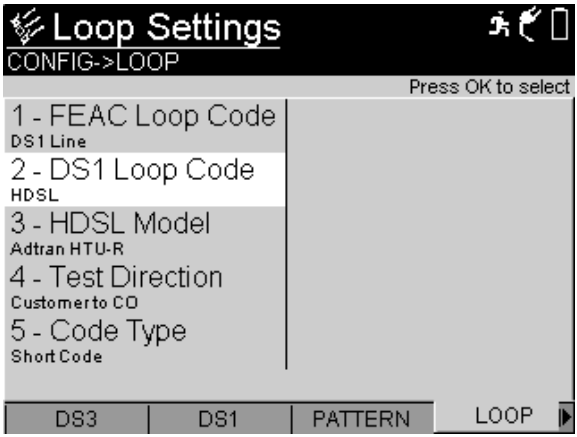
If you selected Multipat, User Bit Pattern, or User Byte Pattern, you must enter additional information. The following table describes the settings.

Setting	Option
User Bit Patt.	Enter a binary number from 3 to 32 bits long.

Setting	Option
User Byte Patt.	Enter a hexadecimal number from 1 to 64 bytes long.
Multipat (Ones)	If you select Multipat as the pattern, select how long each pattern should be transmitted: – **N/A** — Indicates a pattern will not be run. – **15 sec** – **30 sec** – **45 sec** – **1 min** – **3 min** – **5 min** – **10 min** – **15 min** For a description of the Multipat patter, see "MULTIPAT" on page 94.
Multipat (1:7)	Same as Multipat (Ones)
Multipat (2in8)	
Multipat (3in24)	
Multipat (QRSS)	

Go to the Loop Settings menu.

If the DS3 framing is set to C-bit (See Framing on page 31), the FEAC Loop Code setting is visible. The only option for this setting is **DS1 Line**.



8 Select **DS1 Loop Code**, and then select a loop code:

- **NIU**
- **CSU**
- **HDSL**
- **Repeater**
- **MSS**
- **User-Defined**

The menu settings change according to the DS1 loop code you select.

9 Configure the settings for the selected loop code.

The following table shows the options for all the DS1 loop codes.

Setting	Options
NIU	
NIU Loop Code	Specify one of the following: – **Facility 1** – **Facility 2** – **Facility 3** – **ESF Net** [a]
Auto Response	Select one of the following – **Respond Off** – **Respond On**
CSU	
CSU Loop Code	Specify one of the following: – **Basic CSU** – **ESF Line**[a] – **ESF Payload**[a]
Auto Response	Select one of the following: – **Respond Off** – **Respond On**
HDSL	
HDSL Model	Select one of the following units: – **Adtran HRE** (Standard & Abbreviated) – **Adtran HTU-C** (Standard & Abbreviated) – **Adtran HTU-R** (Standard & Abbreviated) – **ADC/Pair Gain HDU** (A2LB & Generic) – **ADC/Pair HLU** (A2LB & Generic) – **ADC/Pair HRU** (A2LB & Generic)

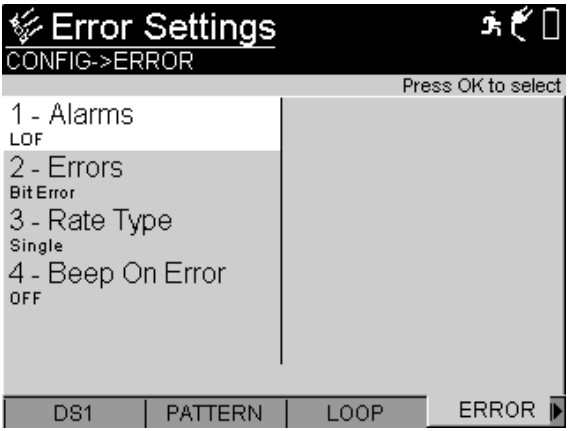
Setting	Options
Test Direction	Specify the test direction: – **CO to Customer** – **Customer to CO**
Code Type	Select one of the following: – **Long Code** – **Short Code**
Address	Select one of the following – **1** – **2**
Repeater	
Repeater Model	Select one of the following repeaters: – **Teltrend 7231LW IOR** – **Teltrend 7231 LP IOR** – **Teltrend 9132 LW IHR** – **Teltrend 9132 LP IHR** – **Teltrend 7239 LW ILR** – **Teltrend 7239 LP ILR** – **Teltrend 7239 LBE ILR** – **Westell 3130-50 IOR A/B** – **Westell 3130-50 IOR C** – **Westell 3130-80 IOR** – **Westell 3150-56 ILR A/B** – **Westell 3150-56 ILR C** – **Westell 3151-56 ILR** – **Westell 3150-80 ILR** – **Westell 3150-81 ILR** – **Xel 7853-200 ILR**
Address	Depending on the repeater model you select, you may need specify an address. Select either **1** or **2**.
MSS (maintenance switch system)	
MSS Model	The **Westell 3171 60 series** is the only supported switch.

Setting	Options
Card Number	Enter a card number. Valid card numbers range from **1** to **28**.
User-Defined	
Loop Code Name	Default names appear as User1, User2, User3, and so on. To change a pattern name, use the arrow keys to highlight a name, and then press the **Edit** soft key. Use the keypad to enter a new name.
Bit Pattern	Enter a pattern. The pattern can be 1 to 16 digits long. Press the **OK** key to accept the change.
Type	Specify the type of loop code: – **Loop Up** – **Loop Down** – **Other**
Delivery	Select either **In Band** or **Out of Band**.

a. Available if the framing format is ESF.

10 To specify errors and alarms, do the following:

Go to the Error Settings menu.



a Specify the error and alarm types to be inserted. The table below shows the setting options.

Setting	Options
Alarms	Select **Alarms**, and then specify the type of alarm to be inserted. For a list of available alarms, see "Alarms" on page 99.
Errors	Select **Errors**, and then specify the type of error to be inserted. For a list of available errors, see "Errors" on page 99.
Rate Type	Select **Rate Type**, and then indicate how errors will be inserted: **Single**, **Rate** (frame rate), or **Multiple**. Rate Type is only visible if the error type is Bit Error.
Frame Errors	Select **Frame Errors**, and then indicate how many errors will be inserted on a single key press: **1**, **2**, or **3**. Frame Errors is only visible if the error type is Frame Errors.

Setting	Options
Error Rate	Select **Error Rate**, and then indicate the insertion rate for logic errors. This option is only visible if the rate type is set to Rate.
Error Count	Select **Error Count**, and then enter a value, from **1** to **50**, to indicate the number of errors to be inserted. This option is only visible if the rate type is set to Multiple.
Beep On Error	Select whether an audible beep will sound when an error is detected.

11 To specify a time limit for the test, do the following:

Go to the Event Settings menu.

a Select **Timed Test**, and then select one of the following.

– **Enabled** – turns on timed testing.

– **Disabled** – turns off timed testing.

– **Delayed** – sets timed testing to run at a specific date and time.

If enabled or delayed is selected, a clock icon appears in the upper right corner of the display.

If you selected Enabled, proceed to step d.

If you selected Delayed, proceed to step b.

b Select **Test Start Date** and then enter the month, day, and year that you want to run the test.

c Select **Test Start Time** and then enter the hour, minute, and second at which you want to begin the test.

d Select **Timed Test Dur** and then enter the number of hours, minutes, and seconds you want the test to run.

12 To configure G.821 settings, see step 10 on page 24.

13 Connect the HST-3000 to the test access point (see Figure 3):

- Connect the HST's Primary DS3 Tx to the DSX-3 In (Tx) jack.
- Connect the HST's Primary DS3 Rx to the DSX-3 Out (Rx) jack.

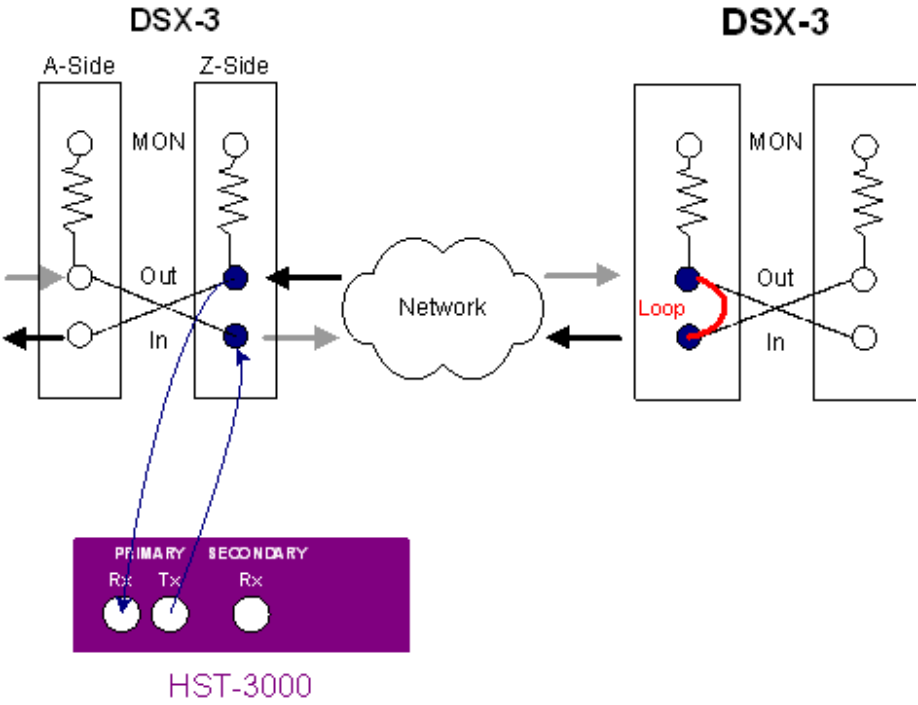


Figure 3 Terminate mode connection

If you are performing a straightaway (end-to-end) test at the customer premises, you will likely be accessing the circuit at the network interface unit (NIU) or DSX-3 patch panel.

14 Press the **Home** navigation key.

15 Press the **Restart** soft key to clear all alarms and begin the test.

16 To insert errors, do one of the following:

– Press the **1** key.

– Press the **Action** soft key and then press the **1** key.

This inserts the number and type of error that you specified on the Error Settings menu.

The error is inserted into the Primary Tx (transmit) path.

17 To enable or disable alarms, do one of the following:

– Press the **3** key.

– Press the **Action** soft key and then press the **2** key.

This enables or disables the type of alarm that you specified on the Error Settings menu.

The alarm is inserted into the Primary Tx (transmit) path.

18 To send a far end action control (FEAC) command to the far end DSX-3, press the **Actions** soft key, press the **3** key, and then select either **Loop Up** or **Loop Down**.

The FEAC option is only available when the DS3 framing format is set to C-bit.

19 To send a DS1 loop command, press the **Actions** soft key, press the **3** key, and then select a loop command such as **Arm**, **Disarm**, **Loop Up**, **Loop Down**, or another available command.

The loop commands will vary depending on the selected DS1 loop code.

20 If the circuit is looped back, check to see that the inserted errors are received in the Summary test result category (see “Viewing test results” on page 59). If you are performing an end-to-end test, verify that the HST unit at each end of the circuit received the inserted errors.

21 To stop a running test, press the **Cancel** key.

You have completed bet error rate testing.

Configuring user-defined loop codes

You can define and store up to ten loop codes on the HST-3000. Stored loop codes are available each time you configure a loopback test.

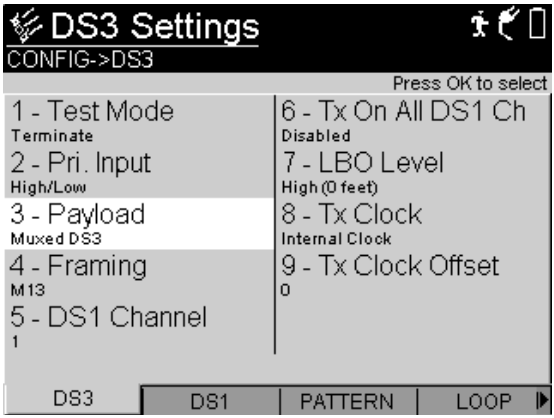
To define a loop code

1 Launch the **BERT** application. See "Launching an application" on page 5.

2 Press the **Configure** button.

The Summary Settings menu appears, listing the key settings for the application you launched.

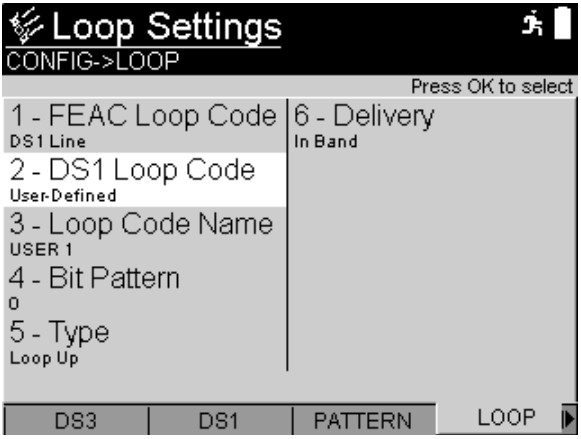
3 Go to the DS3 Settings menu.



4 Select **Test Mode**, and then select **TERMINATE**.

5 Select **Payload**, and then select **Muxed DS3**.

6 Go to the Loop Settings menu.



7 Select **DS1 Loop Code**, and then select **User-Defined**.

The settings for user-defined loop code appear.

8 Select the setting you want to configure. For example, to specify the name of your loop code, select **Loop Code Name**, and then enter a name.

The following table describes the options.

Setting	Options
Loop Code Name	The default names appear as USER 1, USER 2, USER 3, and so on. To change the loop code name: – Select a name, and then press the **Edit** soft key. – Use the keypad to enter a new name. – To erase a single letter, press the **Delete** soft key. To erase the entire name, press the **Clear** soft key. To switch between upper and lower-case, press the **Keypad:ABC** soft key. – When you are done entering the name, press **OK** key.

Setting	Options
Bit Pattern	To enter a user pattern: – Use the 1 key and the 0 key to enter a bit pattern. The pattern can be 1 to 16 digits long. – When you are done entering the pattern, press the **OK** key.
Type	Select one of the following pattern types: – **Loop Up** – **Loop Down** – **Other**
Delivery	Select either In **Band** or **Out of Band**.

You have finished defining a loop code.

Monitoring a channel

You can use the HST-3000 to monitor performance on DS3, DS1, and DS1 channels. This includes single-receiver monitoring and simultaneous, dual-receiver monitoring. You can examine transmission layer results, such as frame errors or BPVs for a single side of the traffic or in both directions.

The following sections describe how to monitor a DS3 channel or a DS1 channel.

Monitoring a DS3 channel

The following procedure describes how to monitor a DS3 channel using the HST-3000.

To monitor a DS3 channel

1 Launch the **BERT** application. See “Launching an application” on page 5.

2 Press the **Configure** button.

The Summary Settings menu appears, listing the key settings for the application you launched.

3 Review the Summary Settings.

If the settings are appropriate for your test, press the **Home** key and proceed to step 9.

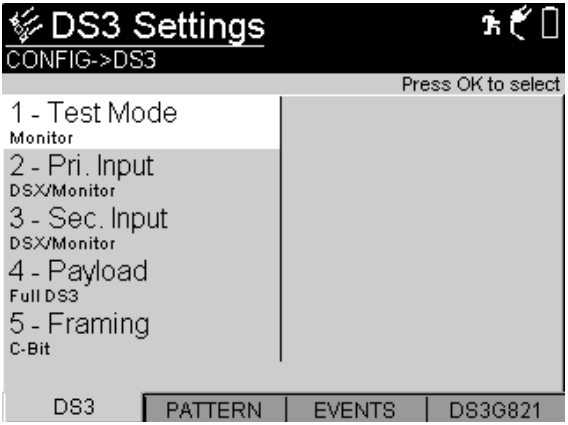
To change the settings, do one of the following:

– Navigate to the desired item by selecting the item number using the keypad

– Use the arrow keys to highlight the item and then press OK.

If you want to configure additional settings, proceed to step 4.

4 Go to the DS3 Settings menu.



5 Configure the settings by pressing the number key that corresponds to the setting you want to configure. For example, press the **5** key to specify the framing format.

You can also use the arrow keys to highlight the setting you want configure, and then press the **OK** key.

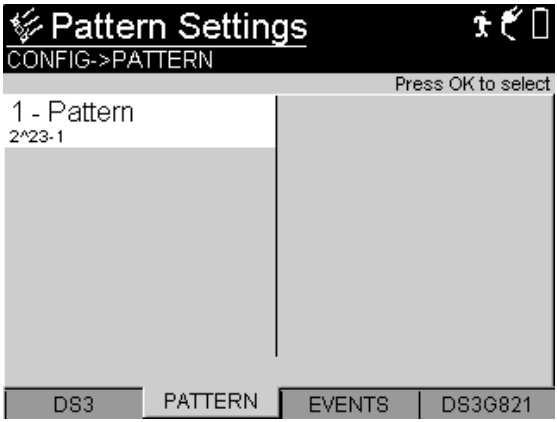
The following table describes the remaining options.

Setting	Option
Test Mode	Select **Monitor**. The HST's transmitters are turned off in Monitor mode.
Pri. Input	The primary receiver becomes effective immediately and should be set before the HST is connected to the line. Set the primary receiver (Rx) to one of the following: – **High/Low** — Accept a nominal signal level of 1.2 Vp (HIGH source) with 0 to 12 dB of cable attenuation at 22 MHz. – **DSX/Monitor** (default) — Accept a nominal signal level of 1.2 Vp (HIGH source) with 20 dB of resistive attenuation and with 0 to 9 dB of cable attenuation at 22 MHz.
Sec. Input	The secondary receiver becomes effective immediately and should be set before the HST is connected to the line. Set the secondary receiver (Rx) to one of the following: – **High/Low** – **DSX/Monitor** (default) See the descriptions for Pri. Input.
Payload	Select **Full DS3**. For information about monitoring a DS1 channel from a DS3, see "Monitoring a DS1 channel" on page 54.

Setting	Option
Framing	Select one of the framing formats for the signal: – **Auto —** This option enables the HST to automatically detect the framing format on the line. – **Unframed** — The DS3 signal will be analyzed and generated (if applicable) as a single 44.736 Mbps serial bit stream. This option is not applicable in DS1 test modes. – **M13** — If this option is selected, and HST-3000 is originating the DS3 signal, the Tx will transmit DS3 C-Bits as if generated from a stuffed DS2. That is they will go between ones and zeros. Also, the receiver will be put into the framed mode and will sync to C-Bit or M13 regardless of the framing selection. C-Bit related results are not applicable. – **C-Bit** — If this option is selected, and HST is originating the DS3 signal, the Tx will transmit DS3 C-Bits in accordance with the C-Bit overhead specification (with CP bits, Datalink bits, and AIC bit =1).

6 To specify a test pattern, do the following:

Go to the Pattern Settings menu.



a Select **Pattern**, and then use the arrow keys to highlight a BERT pattern from the list.

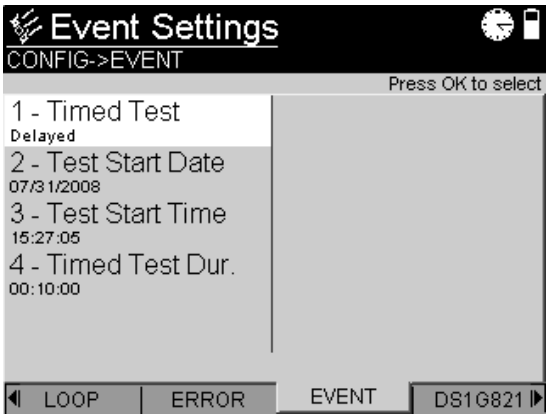
For descriptions of available BERT patterns, see "DS3 BERT patterns" on page 98.

b Press the **OK** key to select the pattern.

If you selected User Bit Pattern, you must enter a binary number from 3 to 32 bits long.

7 To specify a time limit for the test, do the following:

Go to the Event Settings menu.



a Select **Timed Test**, and then select one of the following.

– **Enabled** – turns on timed testing

– **Disabled** – turns off timed testing

– **Delayed** – sets timed testing to run at a specific date and time.

If enabled or delayed is selected, a clock icon appears in the upper right corner of the display.

If you selected Enabled, proceed to step d.

If you selected Delayed, proceed to step b.

b Select **Test Start Date** and then enter the month, day, and year that you want to run the test.

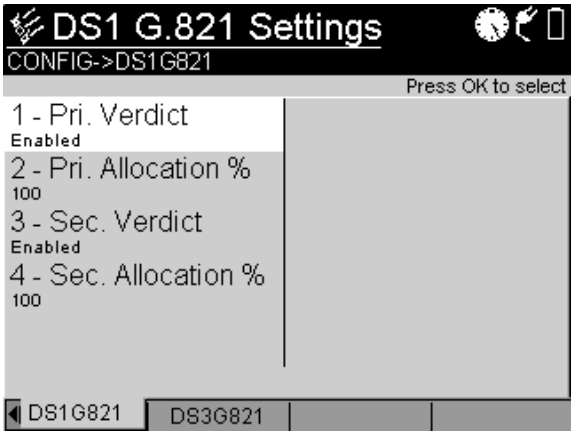
c Select **Test Start Time** and then enter the hour, minute, and second at which you want to begin the test.

d Select **Timed Test Dur** and then enter the number of hours, minutes, and seconds you want the test to run.

8 To configure G.821 settings, do the following:

a Go to the DS1 or DS3 G.821 Settings menu.

The DS1G821 menu is only available when the payload is configured to Muxed DS3. See "Monitoring a DS1 channel" on page 54.



b Select a setting, and then specify the parameters. The following table describes the G.821 settings.

Setting	Parameter
Pri. Verdict	Indicates the primary channel will be analyzed for conformance to G.821 specifications. The HST will return either a “Pass” or “Fail” result. The only option for this setting is Enabled.
Pri. Allocation %	Enter a value, from 0.1% to 100%, to indicate the percentage of the end-to-end target values for ESR (Errored Seconds Ratio) and SESR (Severely Errored Seconds Ratio) that must be met for the primary test path to be acceptable. The end-to-end target values are based on the “Hypothetical Reference Configuration” (HRX) of length 27 500 km.

Setting	Parameter
Sec. Verdict	Indicates the secondary channel will be analyzed for conformance to G.821 specifications. The HST will return either a “Pass” or “Fail” result. The only option for this setting is Enabled.
Sec. Allocation %	Enter a value, from 0.1% to 100%, to indicate the percentage of the end-to-end target values for ESR (Errored Seconds Ratio) and SESR (Severely Errored Seconds Ratio) that must be met for the secondary test path to be acceptable. The end-to-end target values are based on the “Hypothetical Reference Configuration” (HRX) of length 27 500 km.

9 Connect the HST-3000 to the test access point (see Figure 4):

– Connect the HST's Primary DS3 Rx to the DSX-3 A-side MON jack.

– Connect the HST's Secondary DS3 Rx to the DSX-3 Z-Side MON jack.

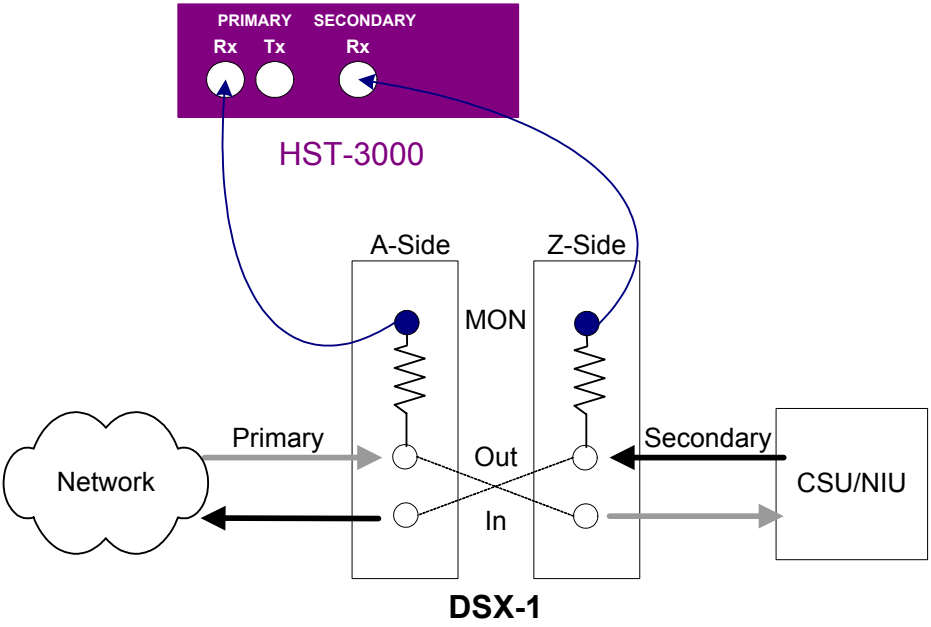


Figure 4 Monitor connections

10 Press the **Home** navigation key, and then press the **Restart** soft key to clear all alarms and begin the test.

Test results appear in the Summary category. For information about viewing results, see "Viewing test results" on page 59.

11 To stop a running test, press the **Cancel** key.

You have finished monitoring the circuit.

Monitoring a DS1 channel

The following procedure describes how to monitor a DS1 channel.

To monitor a DS1 channel

1 Launch the **BERT** application. See "Launching an application" on page 5.

2 Press the **Configure** button.

The Summary Settings menu appears, listing the key settings for the application you launched.

3 Review the Summary Settings.

If the settings are appropriate for your test, press the **Home** key and proceed to step 11.

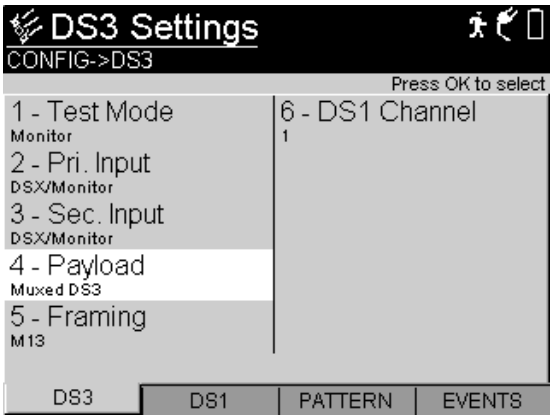
To change the settings, do one of the following:

– Navigate to the desired item by selecting the item number using the keypad

– Use the arrow keys to highlight the item and then press OK.

If you want to configure additional settings, proceed to step 4.

4 Go to the DS3 Settings menu.



5 Configure the settings by pressing the number key that corresponds to the setting you want to configure. For example, press the **5** key to specify the framing format.

The following table describes the settings.

Setting	Option
Test Mode	Select **Monitor**. The HST's transmitters are turned off in Monitor mode.
Pri. Input	The primary input becomes effective immediately and should be set before the HST is connected to the line. Set the primary receiver (Rx) to one of the following: – **High/Low** — Accept a nominal signal level of 1.2 Vp (HIGH source) with 0 to 12 dB of cable attenuation at 22 MHz. – **DSX/Monitor** (default) — Accept a nominal signal level of 1.2 Vp (HIGH source) with 20 dB of resistive attenuation and with 0 to 9 dB of cable attenuation at 22 MHz.
Sec. Input	The secondary input becomes effective immediately and should be set before the HST is connected to the line. Set the secondary receiver (Rx) to one of the following: – **High/Low** — Accept a nominal signal level of 1.2 Vp (HIGH source) with 0 to 12 dB of cable attenuation at 22 MHz. – **DSX/Monitor** (default) — Accept a nominal signal level of 1.2 Vp (HIGH source) with 20 dB of resistive attenuation and with 0 to 9 dB of cable attenuation at 22 MHz.

Setting	Option
Payload	Select **Muxed DS3**.
Framing	Select one of the following framing formats for the signal: – **Auto —** This option enables the HST to automatically detect the framing format on the line. – **M13** — If this option is selected, and HST-3000 is originating the DS3 signal, the transmitter will transmit DS3 C-Bits as if generated from a stuffed DS2. That is they will go between ones and zeros. Also, the receiver will be put into the framed mode and will sync to C-Bit or M13 regardless of the framing selection. C-Bit related results are not applicable. – **C-Bit** — If this option is selected, and HST is originating the DS3 signal, the Tx will transmit DS3 C-bits in accordance with the C-bit overhead specification (with CP bits, datalink bits, and AIC bit =1).
DS1 Channel	To specify a DS1 channel, use the key pad to enter a number from **1** to **28**, and then press the **OK** key. To clear an entry, press the **Clear** soft key. To cancel, press the **Cancel** key.

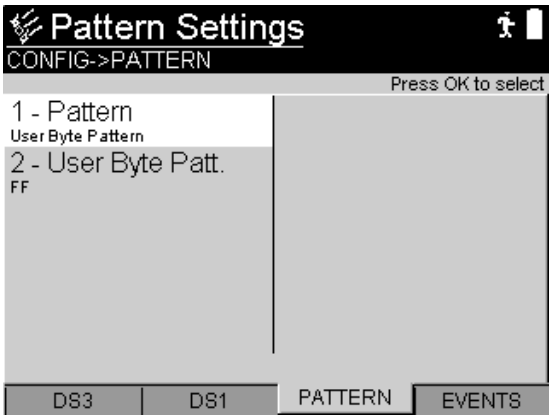
6 Go to the DS1 Settings menu.

7 Select **Framing**, and then select a framing format from the list:

- **Auto —** This option enables the HST to automatically detect the framing format on the line.
- **Unframed** — This option is not applicable in DS1 test modes.
- **ESF** — Extended superframe
- **D4/SF** — Superframe
- **SLC-96**

8 To specify a BERT pattern, do the following:

Go to the Pattern Settings menu.



a Select **Pattern**, and then use the arrow keys to highlight a BERT pattern from the list.

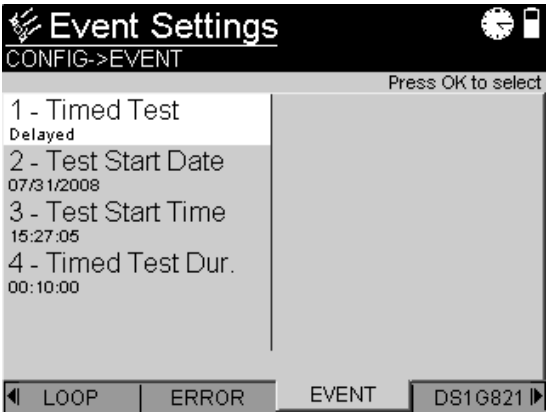
For descriptions of available BERT patterns, see "DS1 BERT patterns" on page 94.

b Press the **OK** key to select the pattern.

If you selected User Bit Pattern or User Byte Pattern, you must enter a pattern.

9 To specify a time limit for a test, do the following:

Go to the Events Settings menu.



a Select **Timed Test**, and then select one of the following.

– **Enabled** – turns on timed testing

– **Disabled** – turns off timed testing

– **Delayed** – sets timed testing to run at a specific date and time.

If enabled or delayed is selected, a clock icon appears in the upper right corner of the display.

If you selected Enabled, proceed to step d.

If you selected Delayed, proceed to step b.

b Select **Test Start Date** and then enter the month, day, and year that you want to run the test.

c Select **Test Start Time** and then enter the hour, minute, and second at which you want to begin the test.

d Select **Timed Test Dur** and then enter the number of hours, minutes, and seconds you want the test to run.

10 To configure settings for G.821 analysis, see step 8 on page 50.

11 Connect the HST-3000 to the test access point. See Figure 4 on page 53.

12 Press the **Home** navigation key, and then press the **Restart** soft key to clear all alarms and begin the test.

Test results appear in the Summary category. For information about viewing results, see "Viewing test results" on page 59.

13 To stop a running test, press the **Cancel** key.

You have finished monitoring the circuit.

Viewing test results

The following procedure describes how to view test results.

To view test results

1 Configure and run a test.

2 Press the **Display** soft key, and then select a result category.

Results for the selected category appear. For descriptions of test results, see "Test Results" on page 61.

Troubleshooting

Table 3 describes situations that you may encounter when using the HST-3000.

Table 3 Problems and resolutions

Problem	Description	Resolution
No signal present	This occurs when there is no valid input connected to the HST-3000.	Make sure the cables are connected to the receiver and that the signal consists of valid data.
Alarm Indication Signal (AIS) detected	This alarm is displayed when the network equipment indicates a fault or lack of data on the line.	Clear the fault and restart the test.
Pattern synchronization is not achieved	The error is displayed when an input signal is detected but the incoming data pattern is different to the test pattern selected in the BERT setup.	Check the test pattern. make sure the correct one is selected.
Frame synchronization is not achieved	The HST-3000 cannot recognize a frame within the received signal.	Check the framing type used on the line and change the DS1 or DS3 settings accordingly.
Bipolar violations (BPVs) detected	This error occurs when the DS3 signal is very noisy or there is no DS3 signal at all.	Check the signal level and the connection.

Test Results

A

This appendix describes the test result categories and the results within each category that are available when performing DS3 and fractional T3 tests. Topics in this appendix include the following:

About test results

After you start a test, the Summary result category automatically displays the message, “All Summary Results OK” if no errors or alarms have been detected (see Figure 5).

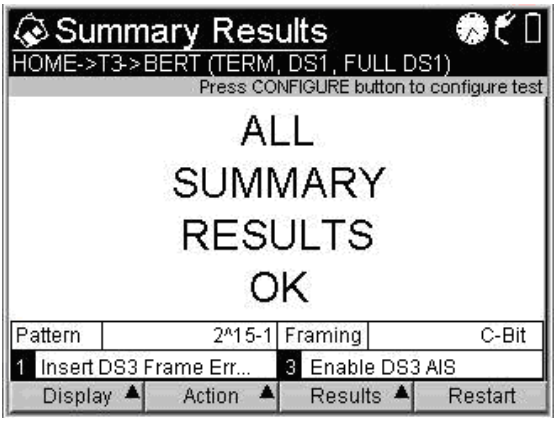


Figure 5 T3 Summary Results

If errors are detected, errors, alarms, and statistics are displayed. To view test results in other categories, see “Viewing test results” on page 59.

The following sections describe the test results for each of the categories. The test results for each category are listed alphabetically.

Summary results

The Summary Results window displays any detected errors and alarms, including far-end alarm and control (FEAC) messages. Table 4 describes the results that can appear in the Summary category.

Table 4 Summary results

Result	Definition
Bit Errors	Number of received bits that have a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
C-Bit Framing Mismatch	Indicates whether where a C-Bit framing mismatch was detected.
Com EF NSA	Indicates a Common Equipment Failure, Non-service Affecting (Type 2 equipment failure), message is detected.
Com EF NSA Hist	Indicates a Common Equipment Failure, Non-service Affecting (Type 2 equipment failure) message was detected, but no longer exists.
DS1 B8ZS Detect	Indicates whether B8ZS clear channel coding is detected in the received DS1 signal.
DS1 BPVs	Number of bipolar violations (BPVs) detected in the received signal (that are not BPVs embedded in valid B8ZS sequences) since the test start.
DS1 CRC Errors	Number of Cyclical Redundancy Check-6 errors detected since the beginning of the test. A CRC algorithm is performed on an ESF frame on the transmitting end. It is then recalculated at the receiving end. If the measurements are not equal, it indicates an error occurred in the packet.

Table 4 Summary results (Continued)

Result	Definition
DS1 EF NSA	Indicates a DS1 Equipment Failure, Non-Service Affecting (Type 2 Equipment Failure) message is detected.
DS1 EF NSA Hist	Indicates a DS1 Equipment Failure, Non-Service Affecting (Type 2 Equipment Failure), message alarm was detected, but no longer exists.
DS1 EF SA	Indicates a DS1 Equipment Failure, Service Affecting (Type 1 Equipment Failure) message is detected.
DS1 EF SA Hist	Indicates a DS1 Equipment Failure, Service Affecting (Type 1 Equipment Failure) message was detected, but no longer exists.
DS1 Exc Zeros Cnt	Number of excess zeros in the received DS1 signal.
DS1 Excess Zeros	Indicates 16 or more consecutive excess zeros were detected.
DS1 Max Consecutive Zeros	Indicates a maximum number of consecutive zeros is detected.
DS1 Ones Density	Indicates the T1 signal violates the ones density criteria (when there is at least n ones in 8(n+1) bits).
DS1 Ones Density History	Indicates the Ones Density condition was detected, but no longer exists.
DS3 AIS Rx	Indicates whether a DS3 alarm indication signal was received.
DS3 AIS Rx Hist	Indicates a DS3 alarm indication signal was received, but no longer exists.
DS3 BPVs	Number of bipolar violations (BPVs) detected in the received signal (that are not BPVs embedded in valid B3ZS sequences) since start of test.

Table 4 Summary results (Continued)

Result	Definition
DS3 C-bit Errors	Number of M-frames that contain a mismatch between the majority rule of the C-bit path parity bits (CP-bits) and the parity calculated from the information bits in the previous M-frame.
DS3 EF NSA	Indicates a DS3 Equipment Failure, Non-Service Affecting (type 2 equipment failure) message is detected.
DS3 EF NSA Hist	Indicates a DS3 Equipment Failure, Non-Service Affecting (type 2 equipment failure) message was detected, but no longer exists.
DS3 EF SA	Indicates a DS3 Equipment Failure, Service Affecting (type 1 equipment failure) message is detected.
DS3 EF SA Hist	Indicates a DS3 Equipment Failure, Non-Service Affecting (type 1 equipment failure) message was detected, but no longer exists.
DS3 FEBEs	Number of far-end block errors (FEBEs) detected since initial DS3 C-bit frame synchronization caused by an M-Frame in which any of the three FEBE bits is a zero.
DS3 Idle Rx	Indicates whether a DS3 idle signal is detected.
DS3 Idle Rx Hist	Indicates a DS3 idle signal was detected, but no longer exists.
DS3 L/H	Indicates whether a DS3 loss of signal/high bit ratio message is detected.
DS3 L/H Hist	Indicates a DS3 loss of signal/high bit ratio message was detected, but no longer exists.

Table 4 Summary results (Continued)

Result	Definition
DS3 OOF	Indicates whether a DS3 out of frame, loss of DS3 frame synchronization condition is detected.
DS3 OOF Hist	Indicates where a DS3 out of frame condition was detected, but no longer exists.
DS3 Parity Errors	Number of M-frame that contain a mismatch between either parity bit (P-bits) and the parity calculated from the information bits in the previous M-frame.
DS3/DS1 AIS	Indicates whether an alarm indication signal is detected. The AIS tells downstream equipment that a piece of upstream equipment has detected loss of signal or loss of framing.
DS3/DS1 AIS Alarms	Number of alarm indication signals detected.
DS3/DS1 Rx Frequency Hist	Receive frequency history. Receive frequency was previously out of range and this result indicates the worst value.
DS3/DS1 Signal Losses	Number of times the signal was lost or absent (limited to 1 loss in every 100 milliseconds).
DS3/DS1 Signal Present	Indicates the presence of a valid signal.
DS3/DS1 Yellow Alarm	Remote alarm indication signal is detected.
DS3/DS1 Yellow Alarms	Number of yellow alarms, or remote alarm signals (RAIs), detected.
DS3/DS2/DS1 Frame Errors	Number of frame errors received since start of test.
DS3/DS2/DS1 Frame Sync	Indicates whether DS3/DS2/DS1 frame synchronization is detected.

Table 4 Summary results (Continued)

Result	Definition
DS3/DS2/DS1 Frame Sync Losses	Number of times frame synchronization was lost.
MULT DS1 L/H	Indicates whether a Multiple DS1 Loss of Signal/High Bit Ratio message is detected.
MULT DS1 L/H Hist	Indicates a Multiple Loss of Signal/high Bit Ratio message was detected, but no longer exists.
Pattern Losses	Number of times pattern synchronization was lost.
Pattern Slips	Number of pattern slips detected since start of test (PRBS patterns only).
Pattern Sync	Indicates whether pattern synchroniza-tion is detected.
SING DS1 L/H	Indicates whether a Single DS1 Loss of Signal/High Bit Ratio message is detected.
SING DS1 L/H Hist	Indicates a single DS1 Loss of Signal/ High Bit Ratio message was detected, but no longer exists.
DS3/DS1 Idle	DS1 idle condition is detected.
DS3/DS1 Idle Hist	Indicates an idle condition was detected, and then later lost.
Idle	No FEAC message received.

Signal results

The Signal category shows signal level, frequency, and loss seconds results. Results in this category accumulate after test restart. Table 5 describes the DS3 signal results. Table 6 on page 69 describes the DS1 signal results.

Table 5 DS3 signal results

Result	Definition
Rx Freq	Frequency of the clock recovered from the received DS1 in Hz.
Rx Level dBdsx	DS1 power of signal received in a DS3 test. The value is displayed as xx.x dBdsx in a range from +10.5 dBdsx to -34.0 dBdsx.
Rx Level dBm	DS1 power of signal received in a DS3 test. The value is displayed as + xx.x dBm in a range from +12.3 dBdsx to -31.7 dBdm.
Rx Level Vbp	The value is displayed as + x.xx V in a range from +1.6 V to 0.01 V.
Signal Loss Secs	Number of test seconds in which the signal was not present for any part of the second.
Signal Present	Indicates the presence of a DS3 signal.
Signal Losses	Number of times the DS3 signal was lost. or absent.
Tx Freq	Current transmitter clock frequency in Hertz (1 Hz resolution from 0 to 9999999 Hz).

Table 6 describes the DS1 signal results that appear in the results category

Table 6 DS1 signal results

Result	Definition
ESF Sync Message	Indicates extended superframe synchronization is detected.
Frame Slips	Number of frame slips (absolute value) counted when the DS1 test signal slips from the DS1 reference signal after both signals are present simultaneously.
Rx Frequency	Frequency of the clock recovered from the received DS1 in Hz.
Signal Loss Seconds	Number of test seconds in which the signal was not present for any part of the second.
Simplex Current mA	The simplex current (in milliamps) between the Rx and Tx connectors. The measurement range is ±180 mA with an accuracy of ±4% ±4 mA. NOTE: Only available on Primary Tx/Rx pair side when in Terminate mode
Signal Losses	Number of times the DS1 signal was lost or absent (equal to 1 loss in every 100 milliseconds).
Signal Present	Indicates the presence of a DS1 signal.
Timing Slips	Number of bit slips (±) and frame slips (absolute value) counted when the DS1 test signal slips from the DS1 reference signal after both signals are present simultaneously. Counts from 0 to + or - 192 and then rolls over to 0. Resets to 0 if signal present is lost on the analyzed DS3 or on the reference DS3. A positive results indicates that the analyzed DS3 is faster than the reference DS3.

Table 6 DS1 signal results (Continued)

Result	Definition
Tx Frequency	Current transmitter clock frequency in Hertz (1 Hz resolution).

Interface results

The Interface category lists results related to framing. Table 7 describes DS3 interface results. Table 8 on page 72 describes DS1 interface results.

Table 7 DS3 interface results

Result	**Definition**
BPV Rate	Ratio of bipolar violations received over total bits received.
BPV Secs	The number of seconds during which one or more bipolar violations occurred since the beginning of the test.
BPVs	Number of bipolar violations detected in the received signal.
DS2 Frame Error Rate	The ratio of detected DS2 frame errors to the total DS2 framing bits received.
DS2 Frame Errored Secs	Number of seconds during which one or more frame errors occurred since initial DS3 frame synchronization
DS2 Frame Errors	The number of DS2 frame errors detected since initial DS2 frame synchronization.
DS2 Frame Sync	Indicates whether frame synchronization is detected.

Table 7 DS3 interface results (Continued)

Result	**Definition**
DS2 Frame Sync Loss Secs	Number of seconds during which one or more frame synchronization losses occurred or during which frame synchronization could not be achieved, since initial DS3 frame synchronization.
DS2 Frame Sync Losses	Number of times frame synchronization was lost.
DS3 Frame Error Rate	Ratio of frame errors to received framing bits since initial frame synchronization.
DS3 Frame Errored Secs	Number of seconds during which one or more frame errors occurred since initial DS3 frame synchronization
DS3 Frame Errors	Number of frame errors detected since initial frame synchronization.
DS3 Frame Sync	Indicates whether frame synchronization is detected.
DS3 Frame Sync Loss Secs	Number of seconds during which one or more frame synchronization losses occurred or during which frame synchronization could not be achieved, since initial DS2 frame synchronization.
DS3 Frame Sync Losses	Number of times frame synchronization was lost.
Far End OOF Secs	Far end out of frame seconds. The number of seconds during which the received X-bits are zero within the 1 second interval.
FEAC Msg	Indicates a far-end alarm control message is detected.
Near End OOF Secs	Near end out of frame seconds. The number of seconds during which an out-of-frame condition or an AIS is detected.

Table 7 DS3 interface results (Continued)

Result	**Definition**
Rx X-Bits	The current status of the received X-bits when in a framed mode. The result is available after receiving DS3 frame synchronization.
Tx X-Bits	The current setting of the transmitted X-bits when in a framed mode.

Table 8 lists DS1 interface results.

Table 8 DS1 interface results

Result	Definition
CRC Error Rate	Ratio of CRC errors to the number of extended superframes received.
CRC Errored Secs	Number of test seconds in which one or more CRC-6 errors occurred.
CRC Errors	Number of Cyclical Redundancy Check-6 errors detected since the beginning of the test. A CRC algorithm is performed on an ESF frame on the transmitting end. It is then recalculated at the receiving end. If the measurements are not equal, it indicates an error occurred in the packet.
CRC SES	Number of seconds during which the total number of CRC errors and frame synchronization losses equaled 320 or more.
Excess Zeros	Alarm that indicates 16 or more consecutive excess zeros were detected.
Frame Error Rate	Ratio of frame errors to received framing bits since initial frame synchronization.

Table 8 DS1 interface results (Continued)

Result	Definition
Frame Errored Secs	Number of seconds during which one or more frame errors occurred since initial DS1 frame synchronization.
Frame Errors	Number of frame errors detected since initial frame synchronization.
Frame Loss Secs	Number of seconds during which one or more frame synchronization losses occurred or during which frame synchronization could not be achieved, since initial DS1 frame synchronization.
Frame Losses	Number of times frame synchronization was lost.
Frame SES	Severely errored seconds. Number of seconds during which the total number of frame errors equals 12 or more (D4 framing only).
Frame Sync	Indicates whether frame synchronization was detected.
Max Consec Zeros	Number of consecutive zeros on the T1 receiver since initial signal present (counts 0 to 250 with overflow indication).
T1 Alarm Sec	Number of test seconds where at least one of the following results was present for a portion of the test: Yellow Alarm, AIS, or Insufficient Pulse Density.

BERT results

Table 9 describes the results that appear in the BERT category.

Table 9 BERT results

Result	Definition
% Error Free Seconds	Ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while pattern synchronization is present.
Bit Error Rate	Ratio of bit errors to received pattern data bits.
Bit Errors	Number of received bits with a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
Error Free Seconds	Number of seconds during which no pattern bit errors are detected while DS1 pattern synchronization is present.
Error Seconds	Number of seconds during which one or more pattern bit errors occurred since initial pattern synchronization.
Pattern Losses	Number of times the received pattern is lost relative to the expected (therefore, internally generated) test pattern.
Pattern Slips	Number of pattern slips detected since start of test (PRBS patterns only).
Pattern Sync	Pattern synchronization is not detected.
Round Trip Delay (ms)	Calculates round trip delay for DS3 applications. The result is given in milliseconds. This result is only applicable if the Delay BERT pattern is selected during test set up.

Table 9 BERT results (Continued)

Result	Definition
Sync Loss Seconds	Number of seconds during which the receiver lost pattern synchronization, even momentarily, since initial pattern synchronization.

LED results

The LED category shows the current and historical status for the signal, framing, pattern, and alarms. A checkmark (✓) indicates the condition is currently detected. An x indicates the condition was detected previously, but is not currently detected. Table 10 describes the DS3 results that appear in the LED category. Table 11 on page 76 describes the DS1 LED results.

Table 10 DS3 LED results

LED Result	Definition
AIS Alarm	Indicates an alarm indication signal is detected.
AIS History	Indicates an alarm indication signal was detected, and then later lost.
C-Bit Sync	C-bit frame synchronization is detected.
DS2 Frame Sync	Indicates frame synchronization is detected.
DS2 Frame Sync History	Indicates frame synchronization was detected, and then later lost.
DS3 Frame Sync	Indicates frame synchronization was detected.
DS3 Frame Sync History	Indicates frame synchronization was detected, and then later lost.

Table 10 DS3 LED results (Continued)

LED Result	Definition
FEAC	Far-end alarm control (FEAC) messages in the C-bit parity framing format (third C-bit in the M1 subframe) are detected.
FEAC History	Far-end alarm control (FEAC) messages in the C-bit parity framing format (third C-bit in the M1 subframe) were detected, and then later lost.
Pattern Sync	Indicates pattern synchronization is detected.
Pattern Sync History	Indicates pattern synchronization was detected, and then later lost.
Signal Present	Indicates the presence of a signal on the line.
Signal Present History	Indicates a signal was detected, and then later lost.
T3 Idle	DS3 idle condition is detected.
T3 Idle History	DS3 idle condition was detected, and then later lost.
Yellow Alarm	Indicates a remote alarm indication signal is detected.
Yellow Alarm Hist	Indicates a remote alarm indication signal was detected, and then lost.

Table 11 describes the DS1 LED results.

Table 11 DS1 LED results

Result	**Definition**
AIS	Alarm indication signal. This signal tells downstream equipment that a piece of upstream equipment has detected loss of signal or loss of framing.

Table 11 DS1 LED results (Continued)

Result	Definition
B8ZS	Indicates bipolar 8 zero substitution line coding is detected.
B8ZS Hist	Indicates bipolar 8 zero substitution was detected, but is no longer present.
AIS Hist	Alarm indication signal history. Alarm indication signal was previously detected.
DS1 Idle	DS1 idle condition is detected.
DS1 Idle Hist	Idle history. DS1 idle condition was detected, and then later lost.
Excess Zeros	Alarm that indicates 16 or more consecutive excess zeros were detected.
Excess Zeros Hist	Excess zeros history. Indicates the Excess Zeros alarm occurred previously.
Frame Sync	DS3 frame synchronization was not detected.
Frame History	Frame synchronization history. Frame synchronization was lost and later detected.
Ones Density	Alarm that indicates the DS3 signal violates the ones density criteria (when there is at least n ones in 8(n+1) bits).
Ones Density Hist	Ones density history. Ones Density alarm was previously detected.
Pattern Sync	Pattern synchronization was not lost
Pattern History	Pattern synchronization was previously detected.
Signal Present	Indicates the presence of a signal on the line.
Signal History	Signal history. Signal was previously detected.

Table 11 DS1 LED results (Continued)

Result	Definition
Yellow Alarm	Remote alarm indication signal is detected.
Yellow Alarm Hist	Remote alarm indication signal was previously detected.

Parity results

Table 12 describes the DS3 parity results.

Table 12 DS3 Parity results

Result	Definition
C-Bit Error Rate	The ratio of C-bit parity errors to the number of bits over which C-bit parity was calculated.
C-Bit Errored Secs	The number of seconds during which one or more C-bit parity error occurred since initial DS3 C-bit frame synchronization.
C-Bit Errors	An M-Frame that contains a mismatch between the majority rule of the C-bit path parity bits (CP-bits) and the parity calculated from the information bits in the previous M-frame.
FEBE Errored Secs	The number of seconds during which at least one FEBE occurred since initial DS3 C-bit frame synchronization.
FEBE Rate	The ratio of FEBEs to the number of bits over which C-bit parity was calculated.
FEBEs	Far-end block errors (FEBEs) detected since initial DS3 C-bit frame synchronization caused by an M-Frame in which any of the three FEBE bits is a zero.

Table 12 DS3 Parity results (Continued)

Result	Definition
Parity Errored Secs	The number of seconds during which one or more parity errors occurred since initial DS3 frame synchronization.
Parity Errors	An M-Frame that contains a mismatch between either parity bit (P-bits) and the parity calculated from the information bits in the previous M-frame.
Parity Error Rate	The ratio of parity errors to the number of bits over which parity was calculated.

DS1 Bridge tap results

The Bridge Tap category is available when you select the Bridge Tap BERT pattern during test setup. The DS1 Bridge Tap Results category lists error counts for the following patterns:

All Ones	2:9	3 in 19
1:1	2:10	3 in 20
1:3	2:11	3 in 21
1:5	2:12	3 in 22
1:6	2:13	3 in 23
1:7	2:14	3 in 24
2:8	3 in 18	QRSS

Figure 6, below, shows a sample DS1 Bridge Tap Results screen. Table 13 on page 80 describes the bridge tap results.

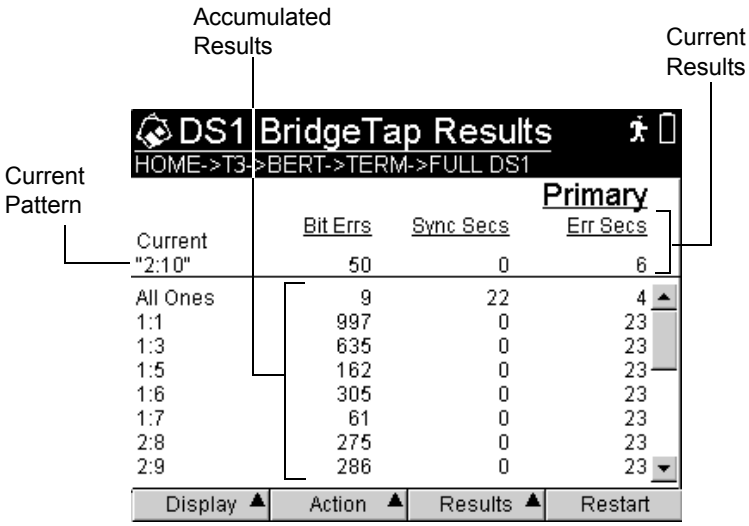


Figure 6 DS1 Bridge Tap Results

Table 13 describes the bridge tap results.

Table 13 Bridge tap results

Result	Definition
Bit Errs	The number of received pattern bits that have a value opposite that of the corresponding transmitted bit pattern since initial pattern synchronization.
Current "*Pattern*"	Indicates the BERT pattern currently being sent. The pattern name appears inside the quotation marks.
Current Bit Errs	A present count of received pattern bits that have a value opposite that of the corresponding transmitted bit pattern since initial pattern synchronization.

Table 13 Bridge tap results (Continued)

Result	Definition
Current Err Secs	A present count of seconds in which one or more pattern bit errors occurred.
Current Sync Secs	A present count of seconds during which the receiver detects pattern synchronization since initial pattern synchronization.
Err Secs	The number of seconds during which one or more pattern bit errors occurred since initial pattern synchronization.
Sync Secs	The number of seconds during which the receiver has pattern synchronization since initial pattern synchronization.

Multiple pattern results

The DS1 MultiPat results are available when you select the MultiPat BERT pattern during test setup. This result automatically sends the five most commonly used test patterns:

All Ones	3 In 24
1:7	QRSS
2 In 8	

Table 14 describes the results that appear on the multi pat category.

Table 14 Multi pat results

Result	Definition
Bit Errs	Number of received bits with a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.

Table 14 Multi pat results (Continued)

Result	Definition
Err Secs	Number of seconds during which one or more pattern bit errors occurred since initial pattern synchronization.
Sync Secs	The number of seconds during which the receiver has pattern synchronization since initial pattern synchronization.

T1.231 performance results

The HST-3000 can provide performance results in accordance with the ANSI T1.231 standard. Results are available for tests performed on a DS3 and on a DS1 from a DS3. Table 15 lists the DS3 T1.231 performance results. Table 16 lists the DS1 T1.231 performance results.

DS3 T1.231 results

Table 15 lists the DS3 T1.231 performance results.

Table 15 DS3 T1.231 results

Result	Definition
AISS-P	Alarm Indication Signal Second - Path. Count of one-second intervals containing one or more AIS defects.
CVCP-P	Code Violations - Path, C-bit based. Count of C-bit parity errors.
CV-L	Code Violation - Line. Count of excess zeroes occurring over the accumulation period.
CVP-P	Code Violation P-bit - Path. Count of P-bit parity errors.

Table 15 DS3 T1.231 results (Continued)

Result	Definition
ESACP-P	Errored seconds - Path type A, C-bit based. Count of one-second intervals containing one C-bit parity error and no severely errored frame (SEF) or AIS defects.
ESA-L	Errored Second - Line type A. Count of one-second intervals containing one BPV or excess zero and no LOS defects. BPVs that are part of the zero substitution code, as defined in ANSI T1.102 are excluded.
ESAP-P	Errored Seconds - Path type A, P-bit based. Count of one-second intervals containing exactly one P-bit parity error and no other severely errored frame (SEF) or AIS defects.
ESBCP-P	Errored seconds - path type B, C-bit based. Count of one-second intervals containing more than one but less than x CVCP-Ps, and no severely errored frame (SEF) or AIS defects.
ESB-L	Errored Second - Line type B. Count of one-second intervals containing more than one but less than x BPVs plus excess zeros, and no LOS defects. BPVs that are part of the zero substitution code, as defined in ANSI T1.102 are excluded.
ESBP-P	Errored Seconds - Path type B, P-bit based. Count of one-second intervals containing more than one but less than x P-bit parity errors, and no severely errored frame (SEF) or AIS defects.

Table 15 DS3 T1.231 results (Continued)

Result	Definition
ESCP-P	Errored seconds - Path, C-bit based. Count of one-second intervals containing one or more C-bit parity errors, one or more severely errored frame (SEF) defects, or one or more AIS defects.
ES-L	Errored Second - Line. Count of one-second intervals with one or more BPVs, or one or more excess zeroes, or one or more LOS defects.
ESP-P	Errored Seconds - Path, P-bit based. Count of one-second intervals containing one or more P-bit parity errors, one or more severely errored frame (SEF) defects, or one or more AIS defects.
LOSS-L	Loss of Signal Seconds - Line. Count of one-second intervals containing one or more LOS defects.
SAS-P	Severely Errored Frame/Alarm Indication Signal Second - Path. Count of one-second intervals containing one or more severely errored frame (SEF) defects or one or more AIS defects.
SESCP-P	Severely Errored Seconds - Path, C-bit based. Count of one-second intervals containing x or more C-bit parity errors, one or more severely errored frame (SEF) defects, or one or more AIS defects.
SES-L	Severely errored second - Line. Count of one-second intervals with 1544 or more BPVs plus excess zeros, or one or more LOS defects.

Table 15 DS3 T1.231 results (Continued)

Result	Definition
SESP-P	Severely Errored Seconds - Path, P-bit based. Count of one-second intervals containing more than one, but less than x, P-bit parity errors, and no severely errored frame (SEF) or AIS defects.
UASCP-P	Unavailable Seconds - Path, C-bit based. Count of one-second intervals for which the DS3 path is not available. The DS3 path becomes unavailable with at the onset of 10 contiguous SESCP-Ps. The 10 SESCP-Ps are included in the unavailable time. Once unavailable, the DS3 path becomes available when the at the onset of 10 contiguous seconds with no SESCP-Ps. The 10 seconds with no SESCP-Ps are excluded from unavailable time.
UASP-P	Unavailable Seconds - Path, P-bit based. Count of one-second intervals for which the DS3 path is not available. The DS3 path becomes unavailable with at the onset of 10 contiguous SESP-Ps. The 10 SESP-Ps are included in the unavailable time. Once unavailable, the DS3 path becomes available at the onset of 10 contiguous seconds with no SESP-Ps. The 10 seconds with no SESP-Ps are excluded from unavailable time.

DS1 T1.231 results

Table 16 lists the DS1 T1.231 performance results. These results are available when you test a DS1 from a DS3.

Table 16 DS1 T1.231 performance results

Result	Definition
AISS-P	Alarm Indication Signal Second - Path Count of one-second intervals containing one or more AIS defects.
CV-L	Code Violation - Line. Count of both BPVs and excess zeroes occurring over the accumulation period.
CV-P	Code Violation - Path. Count of frame synchronization bit errors (FE) in the D4/SF format[a], or a count of CRC-6[b] errors in the extended super-frame (ESF) format occurring during the accumulation period.
ESA-P	Errored Second Type A - Path. This result applies to DS1 ESF paths only. Count of one-second intervals with exactly one CRC-6 error, and no severely errored frame (SEF) or AIS defects.
ESB-P	Errored Second Type B - Path. This result applies to DS1 ESF paths only. Count of one-second intervals with no less than 2, and not more than 319 CRC-6 errors, no severely errored frame (SEF) defects, and no AIS defects.
ES-L	Errored Second - Line. Count of one-second intervals with one or more BPVs, or one or more excess zeroes, or one or more LOS defects.

Table 16 DS1 T1.231 performance results (Continued)

Result	Definition
ES-P	Errored Second - Path. In DS1 ESF, this result is a count of one-second intervals containing any of the following: – CRC-6 errors – SEF (severely errored frame) defects – AIS defects In DS1 D4/SF, this result is a count of one-second intervals containing any of the following: – FE errors – SEF (severely errored frame) defects – AIS defects
LOSS-L	Loss of Signal Second - Line. Count of one-second intervals containing one or more LOS defects
SAS-P	Severely errored frame/Alarm indication signal second - Path. Count of one-second intervals containing one or more severely errored frame (SEF) defects or one or more AIS defects.
SES-L	Severely Errored Second - Line. Count of one-second intervals with 1544 or more BPVs plus excess zeros, or one or more LOS defects.

Table 16 DS1 T1.231 performance results (Continued)

Result	Definition
SES-P	Severely Errored Second - Path. This parameter applies to both D4/SF and ESF frame formats of DS1. In the case of ESF, this result is a count of one-second intervals with 320 or more CRC-6 errors, or one or more SEF or AIS defects. In the case of D4/SF, this result is a count of one-second intervals with 8 or more FE events or an severely errored frame (SEF) or AIS defect.
UAS-P	Unavailable Second - Path. Count of one-second intervals for which the DS1 path is unavailable. The DS1 path becomes unavailable at the onset of 10 contiguous SESs. The 10 SESs are included in unavailable time. Once unavailable, the DS1 path becomes available at the onset of 10 contiguous seconds with no SESs. The 10 seconds with no SESs are excluded from unavailable time

a. Because there is no redundancy check mechanism in the DS1 D4/SF format to verify the correctness of frame payload bits, the FE primitive is substituted as a code violation primitive.
b. Some implementations may include other detectable errors, for example, FE.

G.821 performance results

The HST-3000 allows you to measure conformance to the ITU-T G.821 standard. Table 17 lists the results available for DS3 and DS1 tests.

Table 17 G.821 performance results

Result	Description
AS	Available seconds. A count of the number seconds a circuit is available as specified in G.821, calculated as total test time minus unavailable seconds.
ASR	Available seconds ratio. The ratio, expressed as a percentage, of available seconds to the number of test seconds.
CSES	Consecutive severely errored seconds. A count of the number of groups of three or more contiguous seconds in which an error rate greater than 10^{-3} was found in each second.
EFS	Error free seconds. The number of seconds during which no pattern bit errors are detected while DS1 pattern synchronization is present. This count is inhibited during unavailable seconds.
EFSR	Error free seconds ratio. The ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while pattern synchronization is present
ES	Errored seconds. The number of seconds during which one or more pattern bit errors occurred since initial pattern synchronization. This count is inhibited during unavailable seconds.

Table 17 G.821 performance results (Continued)

Result	Description
ESR	Errored seconds ratio. The ratio, expressed as a percentage, of seconds during which one or more pattern bit errors are detected, to the total number of seconds while pattern synchronization is present.
SES	Severely errored seconds. Seconds during which the bit error ratio was greater than 10^{-3} within available time.
SESR	Severely errored seconds ratio. The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.
TS	Total seconds. Total number of seconds during which pattern synchronization is present.
UAS	Unavailable seconds. A count of unavailable time per the ITU-T G.821 standard.
UASR	Unavailable seconds ratio. The ratio, expressed as a percentage, of available seconds to the number of test seconds.
Verdict	“Pass” indicates conformance to the G.821 standard. “Fail” indicates the circuit did not conform to the G.821 standard.

Event Table results

The Event Table category displays the date and time that significant events, errors, or alarms occurred during the course of your test.

Event Histogram results

A histogram is a display or print output of test results in a bar graph format. Histograms enable you to quickly identify spikes and patterns of errors over a specific interval of time (seconds, minutes, or hours).

Use the up and down arrow keys to scroll through each of the events reported in the histogram.

NOTE:

When viewing a histogram, the left and right arrow keys can not be used to navigate through the other result categories. Use the Display softkey to select and then view another category.

Time results

The time category lists the current date, time, and the amount of elapsed time since test restart. Table 18 describes the results that appear in the Time category.

Table 18 Time test results

Result	Definition
Date	Current day and month.
Elapsed Time	Amount time in hours, minutes, and seconds (hh:mm:ss) since the last test restart.
Time	Current time of day in hours, minutes, and seconds (hh:mm:ss).
Time Remaining	Amount of time remaining until the test is complete.

Saving and printing results

For information about saving and printing test results, see the *HST-3000 Base Unit User's Guide*.

BERT Patterns, Errors, and Alarms

B

This appendix describes the patterns available for BER testing. Topics discussed in this appendix include the following:

DS1 BERT patterns

Table 19 shows the BERT patterns available for DS1 testing.

Table 19 DS1 BERT patterns

Pattern	Description
All Ones	Provides a fixed test pattern of all ones (AMI pulses). Generally this pattern is used to stress span repeater current regulator circuits. It can also be used as an AIS in unframed circuits, a keep alive signal, or an idle code. This pattern is required to accurately measure the T3 signal power in dBm (n42 RX LVL result).
All Zeros	Used to test T3 circuits for B8ZS clear channel capability (CCC). The Line Code should be set for B8ZS when sending the All Zeros pattern. This pattern can be transmitted framed or unframed.
1:7	Stresses the minimum ones density requirement (12.5%) for T3 circuits using AMI coding. This pattern is used to test timing clock recovery and can be transmitted framed and unframed.
2 in 8	Generally used to test mis-optioned equipment for B8ZS encoding.
3 in 24	Stresses the minimum ones density (12.5%) and the maximum zeros requirement (15) of T3 circuits. When the pattern is framed, at least n ones must appear in 8(n+1) bits where n = 1 to 23. This pattern is used to test timing clock recovery and can be transmitted framed and unframed.
MULTIPAT	**NOTE:** MULTIPAT is only available in the Full T1 channel format. Transmits five consecutive test patterns: ALL ONES, 1:7, 2 IN 8, 3 IN 24, and QRSS. When MULTIPAT is selected, a test restart occurs and the pattern is transmitted. As each pattern is transmitted, it is identified in the display in lowercase letters. The MULTIPAT test takes approximately15 minutes with each pattern transmitted for three minutes. This automated test pattern sequence is used during the acceptance testing of a new T3 span or while troubleshooting an existing T3 span.

Table 19 DS1 BERT patterns (Continued)

Pattern	Description
BRIDGETAP	**NOTE:** BRIDGETAP is only available in the Full T1 channel format. Transmits 21 consecutive test patterns: ALL ONES, 1:1, 1:3, 1:5, 1:6, 1:7, 2:8, 2:9, 2:10, 2:11, 2:12, 2:13, 2:14, 3 IN 18, 3 IN 19, 3 IN 20, 3 IN 21, 3 IN 22, 3 IN 23, 3 IN 24, and QRSS. When BRIDGETAP is selected a test restart occurs and the pattern is transmitted. As each pattern is transmitted, it is identified in the display in lowercase letters. The BRIDGETAP test takes approximately ten minutes. This automated test pattern sequence is used during initial installation to identify bridge taps or stress the T3 span during routine maintenance. When a bridge tap exists on the line, reflections occur during the transmission of data which interfere with the performance of the T3 span.
Delay	Used for measuring round trip delay. Delay pattern measurement requires a transmitter/receiver loopback, with the transmit rate equal to the receive rate. This test measures round trip delay once per second (or until the previous delay measurement is complete) for the length of the test, provided pattern sync is present. Normal BER test results (such as bit errors and pattern sync) are not available during delay testing.
T1-1 (MIN/MAX)	Minimum/Maximum Density Stress Pattern - Generates rapid transitions from low ones density octets to high ones density octets. This pattern is used to test the ability of repeaters to adjust to rapid changes in ones density.
T1DALY	Provides a fixed framed 55-octet HEX pattern used with framed T3 circuits without causing excess zeros (excess zeros is more than 15 consecutive zeros). This pattern is a variant of T3-6.
T1-2/96	Selects the 96 octet fixed stress pattern (transmitted right to left). Stresses repeater preamplifier and Automatic Line Build Out (ALBO) circuitry. Detects marginal equipment using rapid transitions between low and high ones density.
T1-3/54	Provides a fixed 54-octet HEX pattern used to stress test T3 circuits and equipment.

Table 19 DS1 BERT patterns (Continued)

Pattern	Description
T1-4/120	Selects the 120 octet fixed stress pattern (transmitted right to left). Stresses circuits and equipment. Should not be used on ESF circuits because it contains false ESF framing bits.
T1-5/53	Provides a fixed 53-octet HEX pattern used to stress test T3 circuits and equipment.
T1-6/55 (55 Octet)	Provides a fixed unframed 55-octet HEX pattern and a variant of the MIN/MAX repeater stress pattern used to test the repeaters' ability to lock onto the incoming clock when the data changes from high ones density to low ones density.
Live	Used in monitor mode to avoid false "errors" when the monitored circuit contains live traffic rather than BERT patterns.
QRSS	Simulates live T3 data. T3 QRSS is a modified 2-1 pseudorandom pattern that allows a maximum of 15 sequential zeros and 20 sequential ones. The Ones Density alarm is disabled when this pattern is transmitted. This is the most popular pattern for T3 installation and maintenance. 2^{20}-1 pseudorandom pattern with 14-zero suppression.
63	(fractional T3 only) Selects the 2^6 -1 Pseudorandom pattern, which generates a maximum of 5 sequential zeros and 6 sequential ones. Simulates live data for circuits less than 9.6 kbps.
511	(fractional T3 only) Selects the 2^9 -1 Pseudorandom pattern, which generates a maximum of 8 sequential zeros and 9 sequential ones. Simulates live data for circuits less than 9.6 kbps.
511QRS	(fractional T3 only) Selects the 2^9 -1 Pseudorandom pattern, which generates a maximum of 7 sequential zeros and 9 sequential ones.
2047	Simulates live T3 data. A pseudorandom pattern based on an 11-bit shift register. Selects the 2^{11} -1 Pseudorandom pattern, which generates a maximum of 10 sequential zeros and 11 sequential ones. Simulates live data for circuits 56 kbps and lower. (Used for DDS and ISDN.)

Table 19 DS1 BERT patterns (Continued)

Pattern	Description
2047QRS	(fractional T3 only) Selects the 2^{11} -1 Pseudorandom pattern, which generates a maximum of 7 sequential zeros and 11 sequential ones.
2^15-1	Selects the 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential zeros and 15 sequential ones. Simulates live data for 56 kbps to 2Mbps circuits.
2^20-1	Selects the 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential zeros and 20 sequential ones. Simulates live data for DS2 circuits.
2^23-1	Selects the 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential zeros and 23 sequential ones. Usually used to simulate live data for DS1 and SONET circuits.
2^15-1 INV	Selects the inverted 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential ones and 15 sequential zeros. Simulates live data for 56 kbps to 2Mbps circuits.
2^20-1 INV	Selects the inverted 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential ones and 20 sequential zeros. Simulates live data for DS2 circuits.
2^23-1 INV	Selects the inverted 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential ones and 23 sequential zeros. Usually used to simulate live data for DS1 and SONET circuits.
User Bit Pattern	Selects a user-defined pattern from 3 to 32 bits long.
User Byte Pattern	Selects a user-defined pattern from 1 to 64 bits long.

DS3 BERT patterns

Table 20 describes the BERT patterns available for DS3 and DS1 testing.

Table 20 DS3 BERT patterns

Pattern	Description
Auto	Automatically configures the receiver to the pattern on the line. When the pattern is 1100 or 1010, the HST will not declare idle or blue, just the raw bit patterns.
Live	Used in monitor mode to avoid false “errors” when the monitored circuit contains live traffic rather than BERT patterns.
2^15-1	Selects the 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential zeros and 15 sequential ones. Simulates live data for 56 kbps to 2Mbps circuits.
2^15-1 INV	Selects the inverted 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential ones and 15 sequential zeros. Simulates live data for 56 kbps to 2Mbps circuits.
Live	Used in monitor mode to avoid false “errors” when the monitored circuit contains live traffic rather than BERT patterns.
2^20-1	Selects the 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential zeros and 20 sequential ones. Simulates live data for DS2 circuits.
2^23-1	Selects the 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential zeros and 23 sequential ones. Usually used to simulate live data for DS1 and SONET circuits.
2^20-1 INV	Selects the inverted 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential ones and 20 sequential zeros. Simulates live data for DS2 circuits.
2^23-1 INV	Selects the inverted 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential ones and 23 sequential zeros. Usually used to simulate live data for DS1 and SONET circuits.
100	Generates a repeating of one 1 and two zeros.

Table 20 DS3 BERT patterns (Continued)

Pattern	Description
1010	Generates a pattern of alternating ones and zeroes.
1010 (BLUE)	Generates a pattern of alternating ones and zeroes.
1100	Generates a repeating of 2 ones and 2 zeroes.
1100 (IDLE)	Generates a repeating of 2 ones and 2 zeroes.
1111	Provides a fixed test pattern of all ones. This pattern is required to accurately measure the T3 signal power in dBm (n42 RX LVL result).
User Bit Pattern	Selects a user-defined pattern from 3 to 32 bits long.

Alarms

Table 21 lists the alarms you can insert.

Table 21 Alarms

Alarm	Description
AIS	Alarm indication signal.
LOF	Loss of framing
Yellow Alarm	Remote alarm indication signal.

Errors

Table 22 lists the available errors you can insert.

Table 22 Errors

Error	Description
Bit Error	Payload bit error

Table 22 Errors (Continued)

Error	Description
DS1 CRC Error	Cyclic redundancy check error
DS3 Frame Error	Frame error or frame alignment signal (FAS)
DS3 BPV	Bipolar violation
DS3 C-Bit Error	Number of M-frames that contain a mismatch between the majority rule of the C-bit path parity bits (CP-bits) and the parity calculated from the information bits in the previous M-frame.
DS3 Parity Error	Number of M-frames that contain a mismatch between either parity bit (P-bits) and the parity calculated from the information bits in the previous M-frame.

Error/alarm criteria

Table 23 shows the criteria that will cause an error or alarm to register on the HST-3000.

Table 23 Error/alarm criteria

Error/Alarm	Criteria
AIS	Alarm indication signal. Stuck C-bit All stuffing indicator C-Bits are equal to zero (0). 1010 30ms of 1010 pattern with framing
Excess Zero	An alarm is now declared if 8 or more consecutive excess zeros were detected in B8ZS line coding, and 16 or more in AMI line coding
Far End Alarm	Receipt of valid far-end alarm message

Table 23 Error/alarm criteria (Continued)

Error/Alarm	Criteria
Frame Loss	3 out of 15: 3 out of 15 F-bits or 2 out of 3 M-Bit sequence. 6 out of 15: 6 out of 15 F-bits in error
Signal Loss	0.02 ms without input pulses after signal detected
Yellow Alarm	Both X-bits equal zero

Specifications

C

This appendix contains specifications for the T3 testing option. Topics in this appendix include the following:

Inputs

Table 24 lists specifications for the Primary and Secondary DS3 receivers (Rx).

Table 24 Rx specifications

Parameter	Specification
Connector type	BNC
Frequency	44,736 Mbps ±300 ppm
Impedance	Nominal 75 Ohms at 22 MHz unbalanced to ground
Range	– High/Low: 0 to 12 dB of cable loss at 22 MHz – DSX/Monitor: -20 dB of resistive loss plus 0 to 9 dB of cable loss from a high signal at 22MHz
Jitter tolerance	As defined in T1.102 - 1993 Table 9 and T1.404 - 1994 section 5.10.

Outputs

Table 25 lists specifications for the Primary DS3 transmitter (Tx).

Table 25 Tx specifications

Parameter	Specification
Connector type	BNC
Frequency	44,736 Mbps ±50 ppm maximum
Line coding	B3ZS

Table 25 Tx specifications (Continued)

Parameter	Specification
Tx Clock[a] (Timing)	Internal reference clock with accuracy ±3 ppm, ±1 ppm/year Recovered from Primary Rx Internal with offset of ±50 ppm
Pulse (high)	Nominal 1.2 Vp. Complies with ANSI T1.102-1993 and ITU-T G.703 after passing through 450 feet of RG59B/U cable.
Pulse (DSX)	Nominal 0.6 Vp. Complies with ANSI T1.102 1993 and ITU-T G.703.
Pulse (low)	Nominal 0.3 Vp with 75 Ohms
Pulse shape	With output terminated in 100Ω resistive load and DSX selected, the HST-3000 meets ITU-T Recommendation G.703 and ANSI T1.102-1993
Impedance	Nominal 75 unbalanced to ground
Output jitter	Complies with ANSI specification T1.102-1993 Table 9

a. Timing can drift approximately 1ppm per year from the unit's date of manufacture. If you need keep the drift from going beyond ± 3 ppm, JDSU recommends that you establish a calibration schedule.

Test configurations

Table 26 lists specifications for DS3 testing option configurations.

Table 26 DS3 configuration specifications

Parameter	Specification
Operating modes	Terminate, Monitor

Table 26 DS3 configuration specifications (Continued)

Parameter	Specification
Tests	Bit error rate test (BERT), Monitor, Loopback
Framing	Auto, Unframed, M13, C-bit
Line Coding	B3ZS
Error/Alarm types	Bit, BPV, Parity, Frame, AIS, RA, Excess Zero
Loopback codes	NIU, CSU, HDSL, MSS, user defined, and repeater
FEAC Loop Codes	NIU, DS3 line, DS1 line

Frequency and level measurements

Table 27 lists frequency and level measurement specifications.

Table 27 DS3 measurement specifications

Parameter	Specification
Tx and Rx Frequency (Hz)	Range: 44.736 ±350 ppm Accuracy: ±3 ppm, ±1 ppm per year Resolution: 1 Hz
Level V b-p	Range: 1.6 V to 0.01 V Resolution: 0.01 V Accuracy: ±0.02 V ±10%

Glossary

A

AIS — Alarm Indication Signal (Red Alarm). A continuous stream of unframed ones sent to indicate that the terminal equipment has failed, has lost its signal source or has been temporarily removed from service.

AMI — Alternate Mark Inversion. A line code which inverts the polarity of alternate ones.

B

B3ZS — Bipolar 3 Zero Substitution. A T-carrier line code in which bipolar violations are deliberately inserted if user data contain a string of 3 or more consecutive zeros. B3ZS is used to ensure a sufficient number of transitions to maintain system synchronization when the user data stream contains an insufficient number of "ones" to do so. B3ZS is used in the North American hierarchy at the T3 rate.

B8ZS — Bipolar 8 Zeros Substitution. A bipolar line code which suppresses consecutive patterns of 8 zeros.

Base Unit — The HST-3000 base unit houses the keypad, display screen, battery, and some connectors. Service interface modules (SIMs) connect to the base unit to provide testing functionality.

BERT — Bit Error Rate Test. A known pattern of bits is transmitted, and errors received are counted to figure the BER. The Bit Error Rate test is used to measure transmission quality.

BPV — Bipolar Violation. A BPV is a violation that occurs when two consecutive non-zero elements of the same polarity occur in a bipolar signal.

Bridge — A high impedance tap into an T1 circuit (at a bridge point where no monitor point access is provided) that does not disrupt the existing communication line.

Bridgetap — Automated test that transmits 21 consecutive test patterns.

C

CO — Central Office.

CPE — Customer Premise Equipment.

CRC — Cyclic Redundancy Check. A code word used to confirm that a bit stream contains valid data. In ESF framing mode this is 6 bits long and is based on the polynomial (x^6+x+1).

CSU — Channel Service Unit. A device to terminate a digital channel on a customer's premises. A CSU is needed to connect to a T1 network. A CSU also provides network termination, keep alive, electrical protection, regeneration of signal, stores performance reports, and supports loop-backs.

D

D4/SF — Type D4 Superframe.

DS1 — Digital Signal 1. An interface providing a framed or unframed 1.544 Mb/s bit stream. DS1 corresponds to the North American and Japanese T1 designator.

DS2 — Digital Signal 2. A digital signaling rate of 6.312 Mbps, corresponding to the North American T2 designator

DS3 — Digital Signal 3. A digital signal rate of 44.736 Mbps, corresponding to the North American T3 designator.

DSX — Digital System Cross-connect frame.

E

ES — Errored Second. A second during which at least one error or alarm occurred.

ESF — Extended Superframe. The F bits from 24 consecutive frames are used to provide frame alignment, frame CRC and out-of-band signalling.

F

FEAC — Far End Alarm and Control. This function allows the user to send loop up and down codes as well as performance information to a far end device.

Frame Loss — Criteria is as follows: D4D - 2 out of 5 Ft bits in error; ESF - 2 out of 5 frame bits in error.

FT1 — Fractional T1.

L

LBO — Line Build Out. An optional attenuation which can be applied to the output signal to simulate long lengths of cable.

LOF — Loss of Frame. A condition indicating that the receiving equipment has lost frame delineation.

LOS — Loss Of Signal. A condition when no pulses of positive or negative polarity are received for more than 175 pulse counts.

M

Multipat — Automated test that transmits 5 consecutive test patterns: ALL ONES, 1:7, 2:8, 3 in 24, and QRSS.

N

NIU — Network Interface Unit. Electronic device at the point of interconnection between the service provider communications facilities and terminal equipment at a subscriber's premises.

P

Pattern sync — The condition when the received test pattern matches the transmitted test pattern. In order to detect pattern sync the instrument must be transmitting a known test pattern in at least one channel (if framed) or continuously (if unframed).

Q

QRSS — Quasi-Random Signal Sequence.

R

RAI — See Yellow Alarm.

Red alarm — See AIS.

Rx — Receiver or input.

S

SES — Severely Errored Seconds.

SF — Super Frame.

SIM — Service Interface Module. SIMs connect to the HST-3000 base unit to provide testing functionality.

T

T1 — T-carrier Level 1. Digitally multiplexed telecommunications carrier system. Carries a Level 1 digital signal (DS1) that consists of 24 multiplexed voice-frequency channels (DS0).

TNV — Telephone-network voltage.

Tx — Transmitter or output.

Y

Yellow Alarm — A Remote Alarm Indication. A terminal will transmit an RAI when it loses its incoming signal.

In the D4/S4 framing format, the RAI is formed by setting bit 2 in every channel to zero for at least one second.

In the ESF framing format, the RAI is formed by repeatedly sending 8 ones followed by 8 zeros in the ESF data link.

Index

F

H

I

L

M

O

P

R

S

T

U

V

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21128666-002
Revision 000, 10/2009
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