HST-3000

E1 Testing

User's Guide

JDSU

HST-3000

E1 Testing

User's Guide

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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-057001. The catalog number for a CD-ROM 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 xi

Purpose and scope xii
Assumptions xii
Terminology xii
HST-3000 E1 testing user's guide xiii
HST-3000 base unit user's guide xiii
Safety and compliance information xiii
Technical assistance xiv
Conventions xv

Chapter 1 Getting started 1

Overview and options 2
E1 connectors 3
E1 interface cables 4
Launching an application 5
Accessing the test configuration menus 7
Instrument settings and user preferences 9

Chapter 2 E1 testing 11

About testing 12
Test modes 13
Status LEDs 16
Monitoring a channel 18
Measuring timing slips 25
Terminate testing 27
Pulse shape analysis 34
Drop and insert testing 35
Line loopback testing 38
Viewing test results 39
Troubleshooting 40

Chapter 3 ISDN PRA testing 43

About ISDN PRA testing 44
Status LEDs 45
About PRA interfaces and the HST emulation modes . 47
U2 interface 47
TE-U2/G.704 simulation mode 47
LT-U2/G.704 simulation mode 47
U2/G.704 Monitor 47
S_2/T_2 interface 48
TE-S_2/T_2 simulation mode 48
NT-S_2/T_2 simulation mode 48
S2/T2 Monitor 48
PMP Monitor 48
DASS2 modes 48
PBX-U2 emulation 48
ET-U2 emulation 49
Headset connector 49
Selecting a test function 50
Specifying test settings 52
Specifying ISDN settings 52
Specifying E1 settings 54

Specifying call settings 55
Specifying BERT settings 58
Specifying Supplementary Services settings 60
Specifying UUS/IE settings 62
Specifying Tracer settings 64
Managing test profiles 66
Storing test profiles 66
Loading a profile 67
Overwriting a profile 67
Deleting a profile 68
Connecting to the line 68
PRA Simulation connections 68
S2/T2 68
LT-S2/T2 69
TE-U2 69
LT-U2 70
DASS2 PBX-U2 71
ET-U2 71
PRA Monitor connections 72
S_2/T_2 Monitor 72
U2/G.704 Monitor 73
PMP Monitor 74
Emulating an ISDN phone 75
Placing calls 76
Running the 30 call macro 78
Receiving and disconnecting a call 78
Accepting a call 78
Rejecting a call 79
Ignoring a call 79
Disconnecting a call 79
Viewing all active calls 79
Viewing the call status for all channels 80
Viewing layer 2 status 80
Viewing physical layer statistics 80
Viewing LED statistics 81
Running a BER test 81
Transmitting DTMF tones 82

Managing speed dial numbers 83
Adding or editing speed dial entries. 83
Deleting a speed dial entry 84
Physical layer BERT 85
Running the BERT macro 87
Performing a capabilities services test 88
Performing a supplementary services test 90
Performing a B channel test 92
Tracing D channel messages 95
Capturing messages 95
Navigating decode messages 97
Retrieving saved tracer messages. 97
Clearing the message buffer 98
Automatically responding to calls 99
Monitoring the D channel. 100
Running a HIZBERT 101
Monitoring all of the channels. 102

Chapter 4 Troubleshooting 105

Interpreting D channel decode messages 106
LAPD messages 108
LAPD Unnumbered frame messages 109
LAPD Supervisory frame messages 111
Q.931 messages 112
Q.931 decodes. 112
Cause Codes 114
Resolving problems 116

Appendix A E1 BERT and Pulse Shape Test Results 119

About test results 120
Summary results. 120
LED results 122
Signal results 123
Interface results 125

Frame Data results **127**
Timeslot results **127**
BERT results **128**
Pulse shape results **129**
Performance results **130**
G.821 results 131
G.826 ISM results 132
G.826 OOS results 135
M.2100 ISM results 137
M.2100 OOS results 140
Time results **141**
Event Log results **142**
Saving and printing results **142**

Appendix B PRA Test Results **143**

About test results **144**
Phone status **144**
Layer 2 results **146**
BERT results **146**
Interface results **147**
LED results **149**
Services or Supplementary services test results **150**
B channel test results **150**
Tracer results **151**
Monitor Summary results **151**
E1 Physical results **151**
2M View results **152**
ISDN View results **152**
Saving and printing results **153**

Appendix C BERT Patterns, Defects, Anomalies, and Messages **155**

BERT patterns **156**
Defects **158**

Anomalies 158
Q.931 Cause Codes 159

Appendix D Call acceptance rules 163

1TR6 and TN-1R6 protocol. 164
Other protocols. 164

Appendix E Protocol Services 167

Q.931, EDSS-1, Q.SIG, TPH1962, Telenokia, Televerket, NTT, and CorNet 168
VN3. 169
VN4. 169
VN6. 170
SwissNet-3. 171
1TR6 and TN-1R6 172
1TR67. 173

Appendix F Specifications 175

Physical interface specifications 176
E1 Transmitters 176
E1 Receivers 176
PRA pin-outs 177
TE mode 177
NT mode 178
Monitor mode. 178
E1 circuit testing specifications 179
Pulse shape specifications 180

Glossary 183

Index 187

About This Guide

Topics discussed in this chapter include the following:

– “Purpose and scope” on page xii
– “Assumptions” on page xii
– “Terminology” on page xii
– “HST-3000 E1 testing user’s guide” on page xiii
– “HST-3000 base unit user’s guide” on page xiii
– “Safety and compliance information” on page xiii
– “Technical assistance” on page xiv
– “Conventions” on page xv

Purpose and scope

The purpose of this guide is to help you successfully use the features and capabilities of the HST-3000 with the E1 testing capability. This guide includes task-based instructions that describe how to configure, use, and troubleshoot the HST-3000 for E1 physical transmission testing.

This guide also includes information about the following optional testing features:

– Pulse Shape Analysis

Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the HST-3000 E1 testing option efficiently and effectively. We assume that you have basic computer experience and are familiar with basic telecommunications safety, concepts, and terminology.

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" is used to refer to the HST-3000 family of products or to the combination of a base unit and attached SIM. "HST" is also 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 183.

HST-3000 E1 testing user's guide

This guide is an application-oriented user's guide containing information about using the HST-3000 E1 testing option to perform test operations on E1 and n x 64k lines. For information about purchasing an optional test feature, contact your JDSU sales representative.

This guide includes an overview of testing features, instructions for using the HST-3000 in monitor, terminate, drop and insert, and line loopback test operations, and test result descriptions. This guide also contains specifications 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 relating to device and general functions such as using the unit with a keyboard, peripheral support, battery charging, saving and printing results, and managing files. This guide also contains technical specifications for the base unit and a description of JDSU's warranty, services, and repair information, including terms and conditions of the licensing agreement.

Safety and compliance information

Safety instructions and compliance information are contained in the booklet included with the HST-3000 user documentation CD-ROM jewel case. The safety/compliance booklet is also available in electronic form on the HST-3000 user documentation CD-ROM.

Technical assistance

If you need assistance or have questions related to the use of this product, use the information in Table 1 to contact JDSU's Technical Assistance Center (TAC) for customer support.

Before you contact JDSU for technical assistance, please have the serial numbers for the service interface module (SIM) and the base unit handy (see "Locating the serial number" in the *HST-3000 Base Unit User's 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 message at the TAC for your region; email the North American TAC (tac@jdsu.com); 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 appear in this **typeface**.	On the Status bar, click **Start**.Use the Direction character tag for this convention.
Buttons or switches that you press on a unit appear in this **TYPEFACE**.	Press the **ON** switch.Use the Switch character tag for this convention.
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. the CodeDirection character tag for this convention.
Variables appear in this ***typeface***.	Type the new ***hostname***.Use the Emphasis character tag for this convention.
Book references appear in this *typeface*.	Refer to *Newton's Telecom Dictionary*.
A vertical bar | means "or": only one option can appear in a single command.	`platform [a|b|e]`
Square brackets [ ] indicate an optional argument.	`login [platform name]`
Slanted brackets < > group required arguments.	<`password`>

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**.

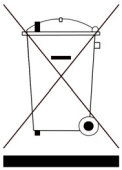
Table 4 Symbol conventions

This symbol represents a caution.

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 E1 testing option. Topics discussed in this chapter include the following:

– “Overview and options” on page 2
– “E1 connectors” on page 3
– “E1 interface cables” on page 4
– “Launching an application” on page 5
– “Accessing the test configuration menus” on page 7
– “Instrument settings and user preferences” on page 9

Overview and options

An HST-3000, with E1 testing capability, allows you to perform the test operations necessary to install, maintain, and troubleshoot E1 and n x 64 k E1 circuits. Test operations include in-service monitoring, bit error rate testing (BERT), loopback testing, and drop and insert testing.

You can expand your testing capability by purchasing additional E1 testing options. All test operations using the E1 options are performed from an E1 access point. The options available for purchase are as follows:.

Table 6 E1 testing options

Option	Description	Order Number
Pulse Shape Analysis	With this option, you can measure the peak voltage, width, rise time, fall time, overshoot, undershoot, and signal level of an E1 pulse. The HST displays the measurements and a graph of the pulse shape. You can also measure the pulse for conformance to the G.703 pulse mask.	HST3000-PS
Frame Relay	Allows you to test frame relay services. Available for E1, T1, Datacom, and DDS local loop SIMs.	HST3000-FR
Primary Rate ISDN	Allows you to test Primary Rate ISDN (ETSI).	HST3000-PRI

E1 connectors

A SIM with E1 testing capability contains the physical interfaces needed to perform E1 testing. The transmit (Tx) and receive (Rx) connectors for line1 and line 2 are located on the side of the SIM (see Figure 1). Table 7 on page 4 describes the connectors on the E1 SIM.

CAUTION: INSTRUMENT DAMAGE

The HST-3000 must be turned off before you remove a SIM. For information about powering the HST and attaching and detaching SIMs, see the *HST-3000 Base Unit User's Guide*.

Your SIM may have additional connectors depending on its testing features.

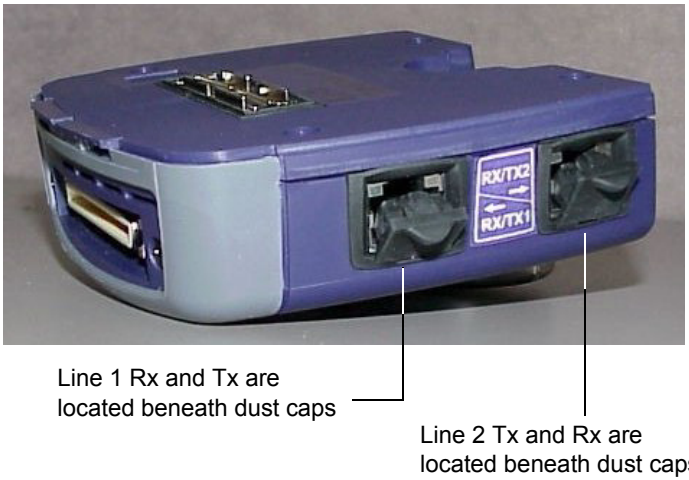


Figure 1 E1 interface connectors

NOTE:

The E1 interface connectors are protected by flexible dust caps. The dust caps are permanent fixtures and should not be removed.

Table 7 describes the connectors on the E1 SIM. For additional input and output specifications, see Appendix F.

Table 7 E1 SIM connectors

Connector	Type	Description
Rx/TX1	RJ-48	E1 connection to line 1.
Rx/TX2	RJ-48	E1 connection to line 2.

NOTE:

The External 2M reference clock signals are included in the RX/TX2 connector. To connect to the External 2M reference clock, you need the 2M Reference Clock cable (part no. CB-0045402).

CAUTION: INSTRUMENT DAMAGE

Using a cable that is not specified for the port can damage the port. For example, using a RJ-11 connector in a RJ-45 or RJ-48 port will damage the port. Use only appropriate cables.

E1 interface cables

Table 8 describes the optional E1 interface cables.

Table 8 E1 interface cables

JDSU part number	Description
K1599	Balanced RJ-48 (M) and RJ-48 (F) cable

Table 8 E1 interface cables (Continued)

JDSU part number	Description
K1597	Balanced RJ-48 to balanced CF- Y-cable
K1598	Balanced RJ-48 (M) cable
CB-44995	RJ-48 (bal.) to dual BNC (unbal.) cable
CB-0045402	External 2M Reference Clock cable
K2508 (4)	RJ-45 (M) to 2 Banana
LB-68	Test-Um 8-position mod test adapter

Launching an application

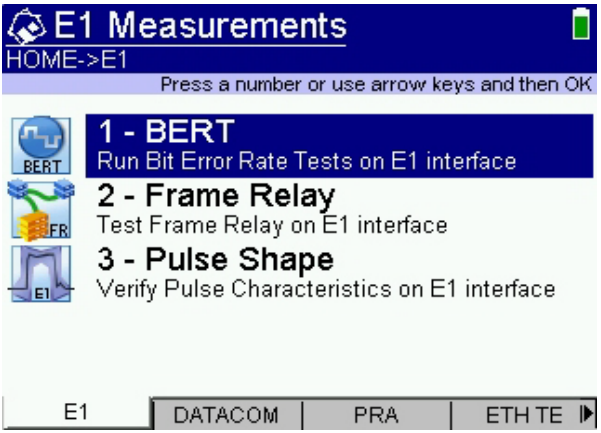
Before you can launch an E1 application, you must have a SIM with E1 testing capability. Also, make sure the SIM is properly connected to the HST base unit before you power on the unit. For information about connecting a SIM and powering the HST, see the *HST-3000 Base Unit User's Guide*.

The following procedure describes how to launch an application.

To launch an E1 application

1. Power on the HST-3000.
2. Press the **E1** soft key.

The E1 Measurements menu appears.



This menu lists the E1 test applications. Menu items vary depending on the options you purchased.

3 Select the application you want to launch.

You can press a number key that corresponds to the application you want to launch. For example, press the 1 key to launch the BERT application. You can also use the up and down arrow keys to highlight your selection, and the press the OK key. The following table lists all currently available E1 applications.

Application	Select...
E1 full rate and n x 64k bit error rate analysis	**BERT**
Frame relay testing	**Frame Relay**
E1 pulse shape analysis	**Pulse Shape**

The HST launches the application.

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.

Accessing the test configuration menus

When you configure a test, you configure the test settings through menu options on the HST-3000 interface. The following procedure describes how to access the test configuration menus.

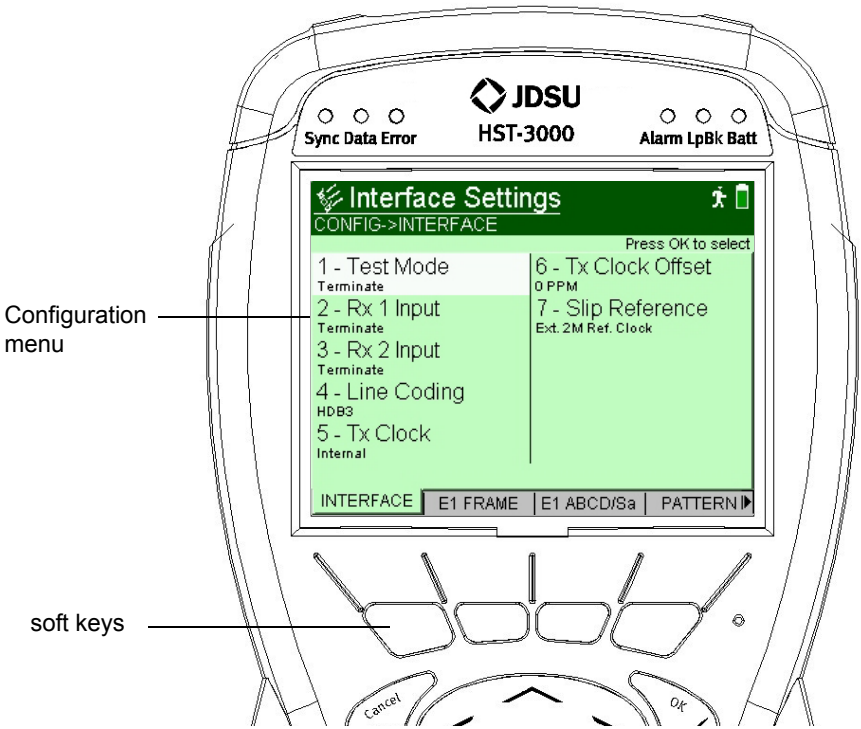
To access the test configuration menus

1. Launch an application. See "Launching an application" on page 5.

   The HST launches the application and a test result screen appears.

2. Press the **Configure**  navigation key.

The configuration menus appear. The menus contain the settings you configure to perform test operations. The menus will vary depending on the application you selected.



3 To view a menu, press the corresponding soft key. For example, to view the Pattern Settings menu, press the PATTERN soft key.

Instrument settings and user preferences

For information about the following HST-3000 features, see the *HST-3000 Base Unit User's Guide*:

- Powering the HST-3000
- Changing instrument and preference settings, such as date and time format, port settings, sound, and screen settings
- International settings
- Remote operation
- Web browser
- VT100 emulation
- Transferring files using FTP
- Managing files
- Printing

E1 testing

2

This chapter provides information on performing turn-up and maintenance testing using the HST-3000 E1 testing feature. Topics discussed in this chapter include the following:

– “About testing” on page 12
– “Test modes” on page 13
– “Status LEDs” on page 16
– “Monitoring a channel” on page 18
– “Measuring timing slips” on page 25
– “Terminate testing” on page 27
– “Pulse shape analysis” on page 34
– “Drop and insert testing” on page 35
– “Line loopback testing” on page 38
– “Viewing test results” on page 39
– “Troubleshooting” on page 40

About testing

The HST-3000, with an E1-capable SIM, is intended to be used to commission and maintain E1 circuits. Typically this 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 in the following ways:

– To terminate a circuit, and then loop back to another HST-3000 unit or piece of network equipment to perform BER testing.
– To perform BER analysis 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.
– To passively monitor one or two E1 circuits (in-service testing) by examining transmission layer metrics such as CRC and frame errors or timing slips.
– To perform drop-and-insert (D&I) BER testing on individual timeslots within an E1 circuit.
– To perform line loopback testing to monitor the circuit.

HST-3000 E1 testing applications include the following features:

– Standard E1 transmit (Tx) and receive (Rx) interfaces.
– Analysis for contiguous and non-contiguous timeslots in 64 kbit/s format.
– Supported framing formats: PCM30C, PCM30, PCM31C, PCM31, and unframed.
– Insertion of code errors, bit errors, frame errors, TSE (bit errors), CRC, E-bit errors, CRC, and MFAS errors.
– “All Summary Results 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 defects (alarms), anomalies (errors), and statistics are collected during the test.
– Programmable timers allow a delayed test at a specific date and time for a selected duration.
– Auto configure to automatically select the interface, framing, and pattern.

Test modes

The HST-3000 with an E1-capable SIM can operate in the following test modes:

– **Terminate Mode**: This mode separates the Transmit and Receive side of an E1 path, as shown in Figure 2. The received E1 signal is terminated and a completely independent signal is transmitted.

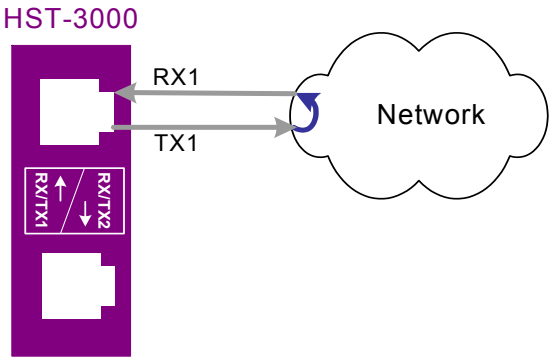


Figure 2 Terminate mode

This mode tests out-of-service lines using RX/TX1. You can generate and send test patterns on TX 1 and receive patterns on RX 1. RX/TX2 is not used in this mode.

– **Monitor Mode**: This mode measures signal parameters, monitors traffic from an E1 access point, or bridges onto the line. Both of the receivers are monitored simultaneously, as shown in Figure 3.

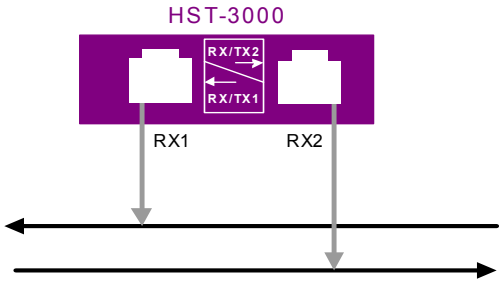


Figure 3 Monitor mode

This permits simultaneous non-intrusive monitoring of both lines. The transmitters are not used in this mode.

– **Drop and Insert Mode (D&I)**: This mode assumes the use of 2 RX/TX pairs and recovered timing. The input signal is passed through the instrument to the transmitter, as shown in Figure 4.

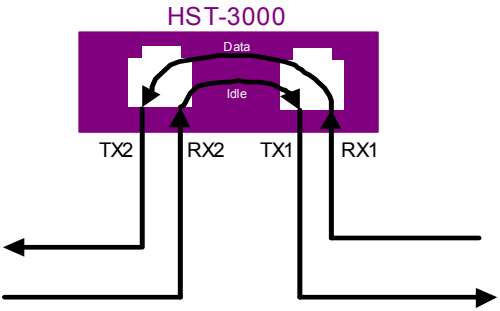


Figure 4 Drop and Insert mode

D&I allows you to perform bit error rate testing (BERT) on user-selected channels within an E1 circuit. Line code errors are corrected, the signal is regenerated, de-jittered,

and new data can be inserted onto specified channel(s) before the signal is transmitted out again. Non-selected channels remain in-service and pass through unchanged.

– **Line Loopback**: This mode loops the entire E1 circuit. This configuration will loop the incoming data back out the transmitter yet still allow the receiver to monitor the incoming signal, as shown in Figure 5.

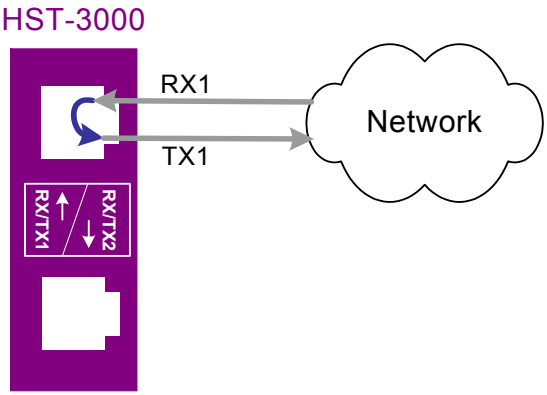


Figure 5 Loopback mode

Line code errors will not be corrected, jitter will not be cleaned up, and the signal will be regenerated but data will not be inserted on the line. While in this mode, the HST-3000 will present minimal delay. Only RX/TX1 is applicable in Line Loopback mode.

Status LEDs

There are six status LEDs located on the front of the HST-3000, above the LCD screen. Table 9 describes how the LEDs operate.

Table 9 Status LEDs

LED	Description
Sync	A two-color LED that reports the signal status. – 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 that 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.
Error	An LED that reports error conditions (anomalies). – If the Error LED is not illuminated it means all Summary results are OK. – Solid red indicates an error. In Monitor mode, the Error LED indicates that only one receiver is connected.

Table 9 Status LEDs (Continued)

LED	Description
Alarm	An LED that reports alarm (defect) status. – If the Alarm LED is not illuminated, then no alarm was detected. – Solid red indicates an alarm was detected.
LpBk	This LED indicates the local loopback state of the HST unit. – Solid green indicates the HST has been placed in line loopback mode. – If the LpBk LED is not illuminated, there is no line 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 *Acterna HST-3000 Base Unit User’s Guide*.

Monitoring a channel

The HST-3000 allows you to monitor both E1 receivers simultaneously. You can analyze full E1 and n x 64k circuits and examine transmission layer results, such as CRC and frame errors, or code errors for a single side of the traffic or in both directions.

The following procedure describes how to monitor a circuit.

NOTE:

The transmitters (Tx) are turned off in Monitor mode.

To monitor a channel

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

2 To set the test configuration, do one of the following:

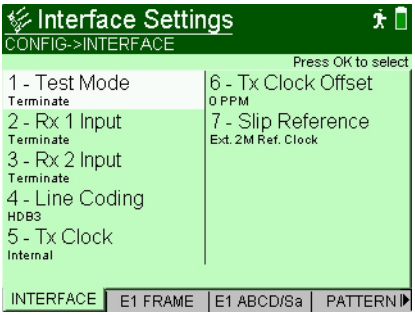
– Press the **Actions** soft key, then select **Auto Configure**.

The unit will attempt to automatically configure the interface, framing, and pattern. Go to step 9.

– Access the test configuration menus. See "Accessing the test configuration menus" on page 7 then proceed with step 3.

3 Press the **INTERFACE** soft key.

The Interface Settings menu appears.



4 Select **Test Mode** and then select **Monitor**.

5 Configure the remaining settings by pressing a number on the key pad that corresponds to the setting you want to configure. For example, press the 2 key to select the Rx 1 Input.

You can also use the arrow keys to highlight the setting you want to change, and then press the **OK** key. Press the **Cancel** key to exit a menu.

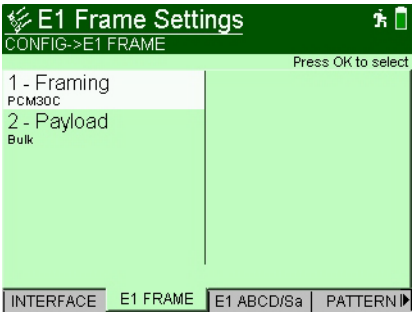
The following table describes the settings.

Setting	Parameters
Rx 1 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: – **Bridge (HI-Z)**: High impedance setting used to connect to the line in a bridged arrangement, resistive termination >1k Ω. – **Terminate**: Used to terminate a line with 120 Ω. – **PMP** (default): Used to connect to a Protected Monitor Point (PMP) on the network equipment under test; provides a resistive termination of 120 Ω with 20 —- 31dB gain applied to the input signal to compensate for the reduced PMP amplitude.
Rx 2 Input	Set the secondary receiver (Rx) to one of the following: – **Bridge (HI-Z)** – **Terminate** – **PMP** For descriptions, see Rx 1 Input.

Setting	Parameters
Line Coding	Select one of the following line coding options: – **HDB3**: High Density Bipolar 3 – **AMI**: Alternate mark inversion

6 Press the **E1 FRAME** soft key.

The E1 Frame Settings menu appears.



7 Configure Framing settings by pressing a number on the key pad that corresponds to the setting you want to configure. For example, press the 1 key to configure the payload.

You can also use the arrow keys to highlight the setting you want to change, and then press the **OK** key. Press the **Cancel** key to exit a menu.

The following table describes the settings.

Setting	Parameters
Framing	Select the framing format for the signal: – **PCM30C** – **PCM30** – **PCM31C** – **PCM31** – **Unframed**

Setting	Parameters
Payload	Select the type of channel you want to monitor: – **Bulk**: full E1 circuit – **n x 64k**: individual timeslot(s) from an E1 circuit
Timeslots (n x 64k payload only)	Use the arrow keys to highlight any of the timeslots, then press the **OK** key to select the channel. You can select multiple channels. When you have finished selecting timeslots, press the **Commit** soft key. At least one timeslot must be selected.
Speaker Drop	Select one of the following: – **None** – **Rx 1** – **Rx 1 and Rx 2** – **Rx 2**
VF Timeslot	Use the arrow keys to highlight any of the timeslots, then press the **OK** key to select the channel. You can select only one channel. After you have selected the timeslot, press the **Commit** soft key.

8 Press the **PATTERN** soft key then specify a BERT pattern by performing the following:

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

For a description of available patterns, see "BERT patterns" on page 156.

NOTE:

If you select the All Zeros BERT pattern, the line coding should be set to HDB3. Using AMI is not recommended because the network will lose timing and signal. To change the line coding, press the **INTERFACE** soft key, and then select **Line Coding**. See "Line Coding" on page 20.

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

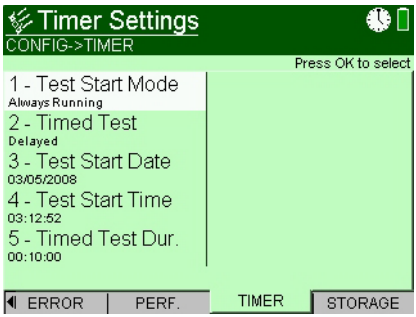
If you selected User Bit Pattern or User Byte Pattern, you must enter additional information. The following table describes the settings.

Setting	Parameter
User Bit Patt.	Enter a binary number from 3 to 32 bits long.
User Byte Patt.	Enter a hexadecimal number from 1 to 64 bytes long.

9 To perform a timed test, do the following:

a Press the **TIMER** soft key.

The Timer Settings menu appears.



a Select **Test Start Mode**, and then select either **Always Running** or **Start/Stop**.

b Select **Timed Test**, and then select either **Enabled** or **Delayed**.

A clock icon appears in the upper right corner of the screen.

If you selected Enabled, proceed to step e.

If you selected Delayed, proceed to step c.

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

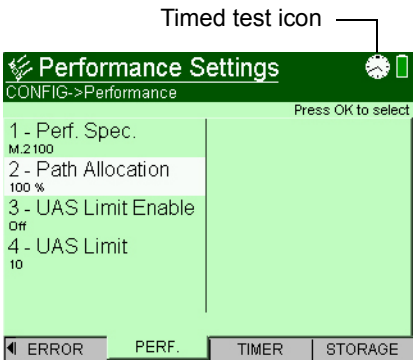
d Select **Test Start Time** and then enter the hour, minute, and second at which you want to begin the test.

e 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 ITU performance analysis, do the following:

a Press the **PERF.** soft key.

The Performance Settings menu appears.



b Select a setting, and then specify the parameter. The parameters that are available depend on the Perf. Spec setting. You can configure settings for all three specs (one at a time). The following table describes the settings.

Setting	Parameter
Perf. Spec	Select the performance specification: – **G.821** – **G.826** – **M.2100**
Path Allocation	Enter a value, **from 0.0% to 100%**, to indicate the percentage of the end-to-end target values that must be met for the test path to be acceptable. The end-to-end target values are based on the “Hypothetical Reference Configuration” (HRX) of length 27 500 km.
UAS Limit Enable (G.826 and M.2100 only)	Select whether the Unavailable Seconds limit is Enabled (**On**) or not (**Off**).
UAS Limit (G.826 and M.2100 only)	If UAS Limit Enable is On, specify the **number of seconds**.

11 Connect the HST-3000 to the test access point (Figure 6 shows a PMP connection):

- Connect the HST E1 RX/TX1 jack to the access point
- Connect the HST E1 RX/TX2 jack to the access point

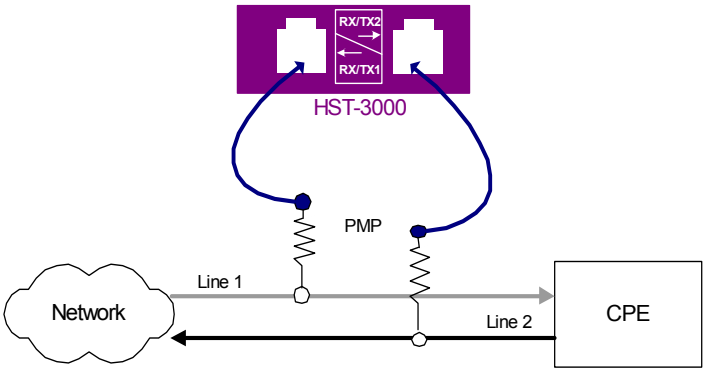


Figure 6 Monitor connections

12 Press the **Home** navigation key, and then restart the test.

13 To view other results, see "Viewing test results" on page 39.

You have finished monitoring the circuit.

Measuring timing slips

The HST-3000 allows you to monitor the timing between two E1 signals for timing slips. For example, you can check customer premises equipment against a master clock at the central office, or you can compare two lines of network equipment. The HST-3000 measures the difference, in bits per second (bit/s), between the opposite receiver (Rx) or the external 2M Reference clock.

The following procedure describes how to measure timing slips.

To measure timing slips

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

2 Access the test configuration menus. See "Accessing the test configuration menus" on page 7.

3 Press the **INTERFACE** soft key.

The Interface Settings menu appears.

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

5 Select **Slip Reference** and then select the clock reference for timing slips.

6 Connect the HST-3000 to a reference signal and to the test signal (see Figure 7):

- Connect the 2M Reference Clock cable from the HST RX/TX2 jack to an E1 BITS clock or a known good reference signal.
- Connect a cable from the HST RX/TX1 jack to the signal to be tested.

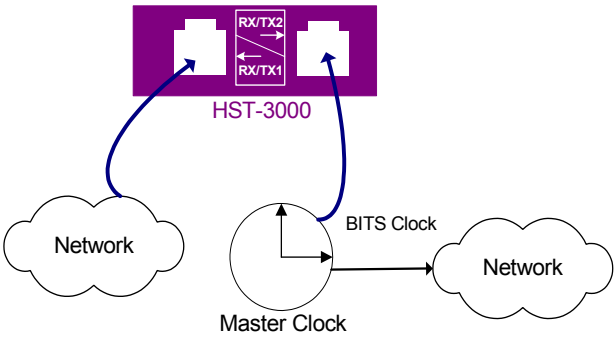


Figure 7 Timing slips connections

7 Press the **Home** navigation key, and then restart the test.

This will clear all alarms and begin a new test.

8 Press the **Display** soft key, and then select **Signal**.

The Signal Results window appears.

9 Check the timing slips result.

For a description of the result, see "Timing Slips" on page 124.

You have finished measuring timing slips.

Terminate testing

In Terminate mode, you can use the HST-3000 to perform bit error rate testing (BERT or BER testing) on E1 circuits, and timeslots within the E1 circuit. You can test for bit errors, code errors, frame errors, and CRC errors (if applicable).

In Terminate mode, it is assumed that there is either a far-end loopback or another test set terminating the far end. This allows you to qualify E1 circuit error performance by testing for bit errors, code errors, CRC errors, FAS errors, MFAS errors, and E-BIT errors (if applicable) on E1 lines.

The following procedure describes how to perform a BER test.

To perform a BER test

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

2 To set the test configuration, do one of the following:

   – Press the **Actions** soft key, then select **Auto Configure**.

     The unit will attempt to automatically configure the interface, framing, and pattern. Go to step 7.

   – Access the test configuration menus. See "Accessing the test configuration menus" on page 7 then proceed with step 3.

3 Press the **INTERFACE** soft key.

   The Interface Settings menu appears.

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

5 Configure the remaining settings by pressing a number on the key pad that corresponds to the setting you want to configure. For example, press the 2 key to select the Rx 1 Input.

   You can also use the arrow keys to highlight the setting you want to change, and then press the **OK** key. Press the **Cancel** key to exit a menu.

The following table describes the settings.

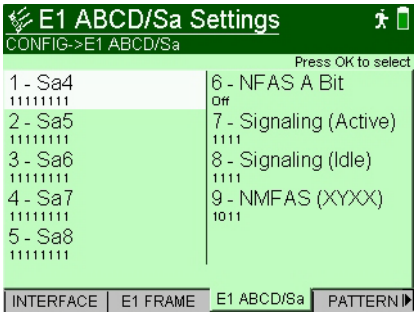
Setting	Parameters
Rx 1 Input	The primary input setting becomes effective immediately and should be set before the HST is connected to the line. Set the primary receiver (Rx) to one of the following: – **Bridge (HI-Z)**: High impedance setting used to connect to the line in a bridged arrangement, resistive termination >1k Ω. – **Terminate**: Used to terminate a line with 120 Ω. – **PMP** (default): Used to connect to a Protected Monitor Point (PMP) on the network equipment under test; provides a resistive termination of 120 Ω with 20 —- 31dB gain applied to the input signal to compensate for the reduced PMP amplitude.
Rx 2 Input	Set the secondary receiver (Rx) to one of the following: – **Bridge (HI-Z)** – **Terminate** – **PMP** For descriptions, see Rx 1 Input.
Line Coding	Select one of the following line coding options: – **HDB3**: High Density Bipolar 3 – **AMI**: Alternate mark inversion
TX Clock	Select one of the following: – **Internal** – **Recovered Rx 1** – **Recovered Rx 2** – **Ext. 2M Ref. Clock** **NOTE:** If timing is lost, the HST-3000 reverts to internal timing.

Setting	Parameters
TX Clock Offset (internal timing only)	Enter a value, from **-100** through **100** ppm, to indicate the offset frequency generated by the 2048 kbit/s internal clock. To specify negative or positive numbers, press the **+/-** soft key. To clear the entire field, press the **Clear** soft key. To delete a single character, press the **Delete** soft key.

6 Configure the Framing, Pattern, Run Mode, and Performance settings for the test (see step 6 through step 10 beginning on page 20).

7 Press the **E1 ABCD/Sa** soft key.

The E1 ABCD/Sa Settings menu appears.



8 Configure Signaling settings by pressing a number on the key pad that corresponds to the setting you want to configure. For example, press the 1 key to configure the Sa4 bit sequence.

You can also use the arrow keys to highlight the setting you want to change, and then press the **OK** key. Press the **Cancel** key to exit a menu.

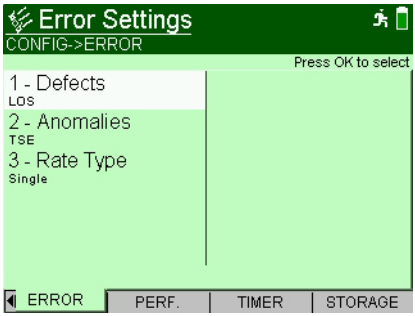
The following table describes the settings.

Setting	Parameters
Sa4	Set the 8-digit Sa4 bit sequence.
Sa5	Set the 8-digit Sa5 bit sequence.
Sa6	Set the 8-digit Sa6 bit sequence.
Sa7	Set the 8-digit Sa7 bit sequence.
Sa8	Set the 8-digit Sa8 bit sequence.
NFAS A Bit	Select whether the NFAS A Bit is **On** or **Off**.
Signaling (Active)	Set the 4-digit active signaling word.
Signaling (Idle)	Set the 4-digit idle signaling word.
NMFAS (XYXX)	Set the 4-digit NMFAS word.

9 To specify errors (anomalies) or alarms (defects) to insert, do the following:

a Press the **ERROR** soft key.

The Error Settings menu appears.



b Press the number key that corresponds to the setting you want to configure. For example, to configure a defect (alarm), press the **1** key.

The following table shows the available settings.

Setting	Parameter
Defects	Select **Defects**, and then specify the type of defect to be inserted. For a list of available alarms, see "Defects" on page 158.
Anomalies	Select **Anomalies**, and then specify the type of error to be inserted. For a list of available errors, see "Anomalies" on page 158.
Rate Type	This setting is only available if the anomaly type is TSE. Select **Rate Type**, and then indicate how errors will be inserted: – **Single** – **Rate** – **Multiple**
Rate	This setting is only available if the rate type is Rate. Select **Rate**, and then indicate the insertion rate for logic errors.
Anomaly Count	This setting is only available if the Rate Type is Multiple. Enter the number of anomalies to be inserted. The range is **1** though **50**.

NOTE:

The HST-3000 will attempt to insert a clean code error (only a code error and not a bit error). If, after a time-out period of 256 bits, this is not possible, the HST will insert a code plus a bit error (a line error). This timeout would occur if an unframed all zeros pattern is currently being output.

10 If you are performing an end-to-end test, connect the HST-3000 to the test access point (see Figure 8):

– Connect the HST RX/TX1 jack to the access point.

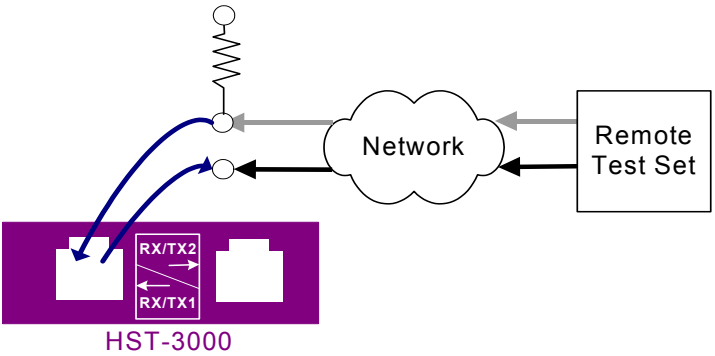


Figure 8 End-to-end connection

11 For end-to-end testing, you can use two test sets, as above, or set up a physical loop at the far end device.

12 Press the **Home** navigation key, and then restart the test.

This will clear all alarms and begin a new test.

13 To insert anomalies or enable defects, press the **Action** soft key, and then select the anomaly or defect. The selections depend on your selection in the Error Settings menu.

14 If the circuit is physically looped back, check to see that the inserted errors are received in the Summary test result category (For instructions on viewing results, see "Viewing test results" on page 39). If you are performing an end-to-end test, verify that the HST units at each end of the circuit received the inserted errors.

BER testing is complete.

Pulse shape analysis

With the Pulse Shape option, you can use the HST-3000 to measure the height, width, rise time, fall time, overshoot and undershoot, and signal level of an E1 pulse. The HST displays the measurements and a graph of the pulse shape. You can also measure the pulse for conformance to ITU G.703 specifications.

To perform pulse shape analysis

1. Launch the **Pulse Shape** application. See "Launching an application" on page 5.)
2. To set the test configuration, do one of the following:
   - Press the **Actions** soft key, then select **Auto Configure**.

     The unit will attempt to automatically configure the interface, framing, and pattern. Go to step 5.
   - Access the test configuration menus. See "Accessing the test configuration menus" on page 7 then proceed with step 3.
3. Press the **INTERFACE** soft key.

   The Interface Settings menu appears.
4. Configure the Interface, Framing, ABCD/Sa, and Pattern settings for the test (see step 5 through step 8 beginning on page 19).
5. After you have configured the settings, press the **Home** navigation key.
6. Connect the HST to the test access point. See Figure 8 on page 33.
7. To start the test, press the **Restart** soft key.
8. To initiate a pulse shape capture, press the **Action** soft key then select **Capture Pulse**.

9 To view pulse shape results, press the **Display** soft key, and then select **Pulse Shape**.

A graphical representation of the pulse appears. For information about pulse shape results, see "Pulse shape results" on page 129.

10 To measure conformance to G.703 specifications, do the following:

a Press the **Action** soft key, and then select **Enable Mask**.

The HST applies the selected mask and displays the results as a graph.

b To disable a mask, press the **Action** soft key, and then select **Disable Mask**.

You have completed pulse shape analysis.

Drop and insert testing

Drop and insert (D&I) testing allows you to "drop" timeslots (n x 64k) from an E1 circuit to perform bit error rate testing (BERT) on the selected channels. The remaining channels are not affected and remain in-service. You can also monitor a channel in D&I mode by not inserting data into the transmission.

When a signal enters the HST-3000 on RX 2, the HST inserts a user-specified pattern into the selected timeslots, and then transmits those channels on TX 1. Non-selected channels pass through the TX 1 unchanged. When a signal enters the HST on RX 1, the HST inserts the user-defined idle byte pattern into selected timeslots, and then transmits those chan-

nels on TX 2. Non-selected channels pass through TX 2 unchanged. Figure 9 illustrates how the HST-3000 inserts patterns in D&I mode.

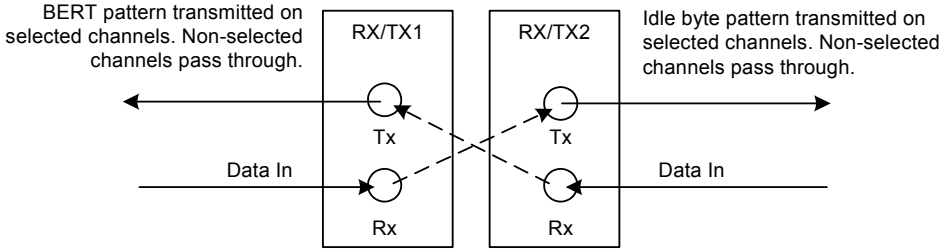


Figure 9 Drop and insert data flow

Before operating in D&I mode, JDSU recommends using the power adaptor to plug the HST into an outlet, and keeping the unit plugged in throughout D&I testing. This ensures that testing will not be interrupted due to loss of battery power.

NOTE:

If the HST-3000 loses power while connected to a live circuit in D&I mode, the circuit will go down.

The following procedure describes how to perform a drop and insert test.

To perform a drop and insert test

1. Launch the **BERT** application. See "Launching an application" on page 5.
2. Access the test configuration menus. See "Accessing the test configuration menus" on page 7.
3. Press the **INTERFACE** soft key.
4. Select Test Mode and then select **Drop and Insert**.

5 Configure the remaining Interface settings and the Framing, Pattern, Run Mode, and Performance settings for the test (see step 5 through step 10 beginning on page 19) as well as the signaling settings (see step 7 on page 30).

6 Connect the HST-3000 to the test access point (Figure 10 shows a PMP connection):

- Connect a Y-cable to the HST RX/TX2 jack and to the access point.
- Connect a Y-cable to the HST RX/TX1 jack and to the access point.

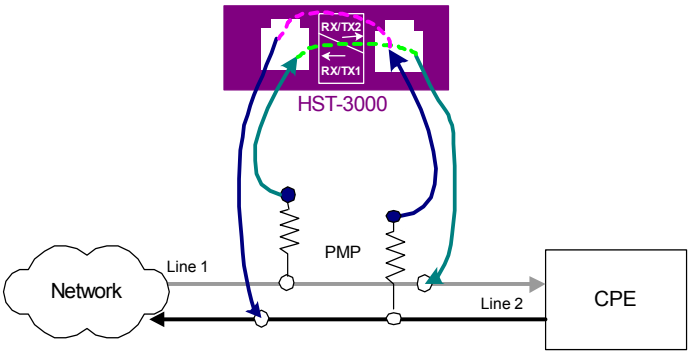


Figure 10 Drop and insert mode connection

7 Press the **Home** navigation key, and then restart the test.

This will clear all alarms and begin a new test.

8 To begin inserting data into the specified channels, press the **Actions** soft key, and then select **Enable D&I**.

9 To insert anomalies, press the **Action** soft key, and then select the error to be inserted.

10 To enable TSEs, do the following:

a Press the **Configure** soft key.

b Press the **ERROR** soft key. You may need to use the left or right arrow buttons to find the Error soft key.

The Error Settings menu appears. For more information, see step 9 on page 31.

11 To view results, see "Viewing test results" on page 39.

Drop and insert testing is complete.

Line loopback testing

Line loopback testing allows you to loop the entire E1 circuit. This configuration will loop the incoming data back out the transmitter yet still allow the receiver to monitor the incoming signal. Line code errors will not be corrected, jitter will not be cleaned up, and the signal will be regenerated but data will not be inserted on the line. While in this mode, the HST-3000 will present minimal delay. Only RX/TX1 is applicable in Line Loopback mode.

The following procedure describes how to perform a line loopback test.

To perform a line loopback test

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

2 Access the test configuration menus. See "Accessing the test configuration menus" on page 7.

3 Press the **INTERFACE** soft key.

4 Select Test Mode and then select **Line Loopback**.

5 Press the **Home** navigation key, and then restart the test.

This will clear all alarms and begin a new test.

6 To view results, see "Viewing test results" on page 39.

Line loopback testing is complete.

Viewing test results

The following procedure describes how to view test results.

To view test results

1. Configure and run a test:
   - See “Monitoring a channel” on page 18
   - See “Terminate testing” on page 27
   - See “Pulse shape analysis” on page 34
   - See “Drop and insert testing” on page 35
   - See “Line loopback testing” on page 38
2. Press the **Home** navigation key.
3. Press the **Display** soft key.

   The test categories appear.
4. Select a category.

   Test results for the selected category appear. For descriptions of test results, see Appendix A beginning on page 119.

NOTE:

Ending a test (by either stopping or upon completion of a timed test) freezes all results.

The Sync and Data LEDs are still real-time.

Troubleshooting

Table 10 describes situations that you may encounter when using the HST-3000.

Table 10 Problems and resolutions

Issue	Description	Resolution
Auto failed	Attempted to auto configure, but didn't work.	Check that you are connected to the line under test. If still not working, set the configuration manually.
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 an unframed "all ones" pattern is received. This is usually generated by network equipment to indicate 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 E1 setup accordingly.
Code errors detected	This error occurs when the polarity of a received pulse does not match the rules of the line code. It is normally seen when AMI is expected but HDB3 is in use on the line.	Check that the line code parameter is set correctly.

Table 10 Problems and resolutions (Continued)

Issue	Description	Resolution
In Monitor mode, the Sync and Data LEDs are red even though frame synchronization and pattern synchronization are present on the primary interface.	The HST monitors RX/TX1 and RX/TX2 interfaces simultaneously. The Sync and Data LEDs will be green only if both receivers have frame and pattern synchronization, respectively.	To monitor only one E1 interface, select Terminate mode, and then configure the RX 1 input to desired input termination. Make sure you do not connect TX 1.

ISDN PRA testing

3

This chapter provides information on testing ISDN PRA service using the HST-3000 ISDN PRA testing option. Topics discussed in this chapter include the following:

– “About ISDN PRA testing” on page 44
– “Status LEDs” on page 45
– “About PRA interfaces and the HST emulation modes” on page 47
– “Headset connector” on page 49
– “Selecting a test function” on page 50
– “Specifying test settings” on page 52
– “Managing test profiles” on page 66
– “Connecting to the line” on page 68
– “Emulating an ISDN phone” on page 75
– “Physical layer BERT” on page 85
– “Running the BERT macro” on page 87
– “Performing a capabilities services test” on page 88
– “Performing a supplementary services test” on page 90
– “Performing a B channel test” on page 92
– “Tracing D channel messages” on page 95

– "Automatically responding to calls" on page 99
– "Monitoring the D channel" on page 100
– "Running a HIZBERT" on page 101
– "Monitoring all of the channels" on page 102

About ISDN PRA testing

The HST-3000 ISDN PRA testing option enables you to install and maintain ISDN PRA services over E1 interfaces. Using the option, you can place, receive, and analyze calls, test data services using BERT analysis, test voice services using a microphone/speaker audio headset, and monitor physical (layer 1), LAPD (layer 2), and Q.931 (layer 3) results.

Using the ISDN PRA testing option, you can:

– Place and receive calls using the standard transmit-receive 2M interfaces. After a call is established, you can insert voice traffic into the associated B Channel, place the channel in loopback, or perform BERT analysis on the B Channel.
– Emulate a network termination device such as a PBX or terminal equipment device (for example, an ISDN phone) using Terminal equipment (TE) mode.
– Emulate a switch or network termination device using Network termination (NT) mode.
– Process calls for switches using the following call control protocols:

1TR6	Q.931
1TR67	TN-1R6
EDSS-1	SwissNet-3
VN3	CorNet-N
VN4	CorNet-NQ

VN6	DREX
TPH1856	Alcatel QSIG
Q.SIG	DASS2

– Passively monitor and analyze ISDN PRA service while the network is in-service (at the S_2/T_2, U_2, or PMP).

– Isolate and locate problems by viewing D channel decode text for all captured transmitted and received frames when you monitor or terminate ISDN PRA service. After viewing the decode text, you can save the text to a file on the HST-3000.

Status LEDs

There are six status LEDs located on the front of the HST-3000, above the LCD screen.

Table 11 describes the LEDs.

Table 11 Status LEDs

LED	Description
Sync	**Blinking green** — Attempting to sync on layer 1. **Solid green** — HST-3000 is synchronized with the incoming signal. **Not illuminated** — HST-3000 not synchronized.
Data	**Solid green** — Layer 2 established. **Solid red** — Layer 2 has not been established. **Not illuminated** — No layer 2 messages have been exchanged.

Table 11 Status LEDs (Continued)

LED	Description
Error	Used only when running a BER test. **Not illuminated** — All results OK. **Red** — Lights for one second to indicate a received error. Causes of the error appear on the Interface Results page. **Blinking amber** — Lost pattern synchronization.
Alarm	Not used for Primary Rate testing.
LpBk	**Solid green** — One or more channels have been looped up on the HST-3000. **Not illuminated** — No payload channels are currently looped.
Batt	**Not illuminated** — Battery has a useful charge. **Solid green** — AC adapter is plugged in. **Solid red** — Battery is approximately 20 percent or below of full charge. **Flashing red** — Approximately five minutes of use remains. Immediately attach AC adapter or replace battery. **Solid amber** — Battery capacity indicator (“gas gauge”) needs to be reset (see the *HST-3000 Base Unit User’s Guide*).

About PRA interfaces and the HST emulation modes

The HST ISDN PRA option offers seven emulation modes for testing the U_2 and S_2/T_2 interfaces. Each mode allows the HST to emulate a specific network device or devices when testing ISDN PRA service. Figure 11 illustrates the PRA interfaces.

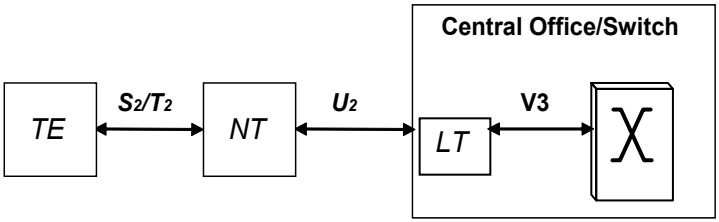


Figure 11 PRA interfaces

For details on testing ISDN PRA service using the HST, refer to "About ISDN PRA testing" on page 44.

U_2 interface

The U_2 interface is the physical 4-wire interface spanning from the central office, to the local loop, and finally, to the customer premises. Each of the modes available for testing the U_2 interface are described below.

TE-U_2/G.704 simulation mode The tester replaces the terminal equipment (TE) and operates on a U_2/G.704 interface. In this case, the tester can operate with a max. attenuation of 33dB.

LT-U_2/G.704 simulation mode The tester is used to replace the Line Termination (LT) device, and emulates the switch. In this case, the tester can operate with a max. attenuation of 33dB.

U_2/G.704 Monitor The tester is used to monitor a TE on the U_2/G.704 interface.

S_2/T_2 interface The S_2/T_2 interface is the standard 4-wire (2 RX, 2 TX) interface used by ISDN terminals on the terminal side of a NT1. Each of the modes available for testing the S_2/T_2 interface are described below.

TE-S_2/T_2 simulation mode The tester is used to replace terminal equipment connected to the S_2/T_2 interface. In this case, the tester can operate with a maximum attenuation of 20dB.

NT-S_2/T_2 simulation mode The tester replaces the network device and operates on the S_2/T_2 interface. In this case, the tester can operate with a maximum attenuation of 20dB.

S_2/T_2 Monitor The tester is used to monitor a TE on the S_2/T_2 interface.

PMP Monitor The tester is used to monitor a device at the Protected Monitor Point (PMP).

DASS2 modes If you are using Digital Access Signalling System No. 2 (DASS2) protocol, the following modes are available.

PBX-U_2 emulation The module can emulate a PBX and perform out-of-service testing before the PBX is connected (Figure 12).

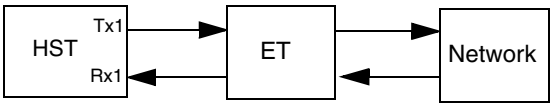


Figure 12 PBX emulation

ET-U2 emulation The module can emulate an Exchange Termination device with a single PBX connected (Figure 13). This mode is used to test the network interface of a PBX system during out-of-service testing.

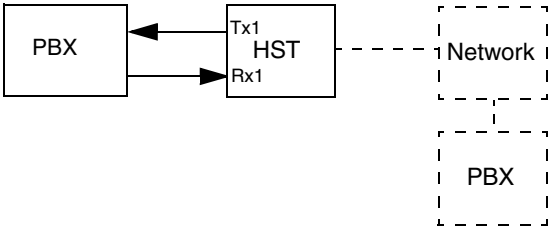


Figure 13 ET emulation

Headset connector

When you place and receive voice calls from the HST-3000, you can use a 2.54mm microphone/speaker audio headset to insert voice data into the associated B channels. The headset connects to the HST-3000 through the headset connector located on the top panel (see Figure 14).

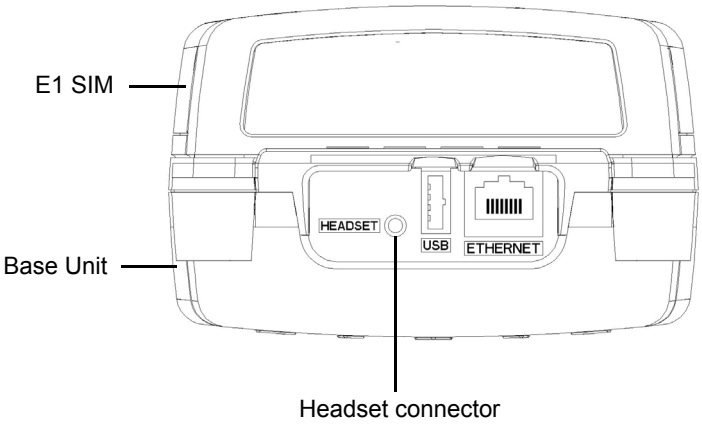


Figure 14 Headset connector located on the top panel

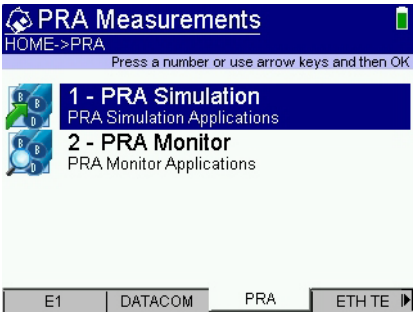
Selecting a test function

To navigate to the test functions, you must first select the application, then the interface. The test functions that are available vary depending on which application you choose.

To select a test function

1 If the HST is off, press the green power button to power on the unit.

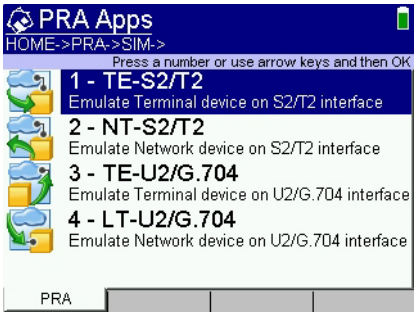
The PRA Measurements menu may take several seconds to appear.



2 Select a measurement application.

To select an item, either scroll to it and then press **OK**, or press the number for the selection.

The Apps menu appears. For example, if you selected **PRA Simulation**, the following screen appears.



If you selected **PRA Monitor**, the display will have three selections:

- S_2/T_2 Monitor
- U_2/G.704 Monitor
- PMP Monitor

If **DASS** was the last protocol selected, the display will have two selections:

- PBX-U_2
- ET-U_2

3 Select an application, for example **TE-S_2/T_2**.

The test function menu appears.

4 Select a test function.

- Phone (See “Emulating an ISDN phone” on page 75)
- BERT (See “Running the BERT macro” on page 87)
- Services (See “Performing a capabilities services test” on page 88)
- Supplementary Services (See “Performing a supplementary services test” on page 90)
- B Channel (See “Performing a B channel test” on page 92)

– Tracer (See "Tracing D channel messages" on page 95)
– Responder (See "Automatically responding to calls" on page 99)

The test function launches.

Specifying test settings

Before you begin testing, make sure the test settings on the HST-3000 match the settings of the line you are testing. The settings that are available vary depending on the application.

Specifying ISDN settings

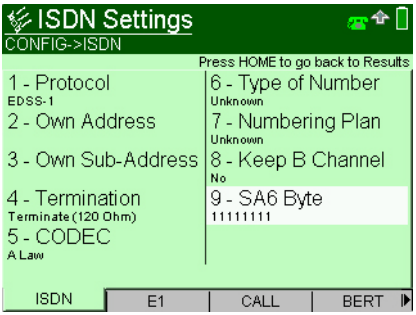
When you configure the HST to place a call, you specify the settings required to activate the physical layer and initialize ISDN service over the D channel (ISDN Settings).

To specify ISDN settings

1 Access the test configuration menus. See "Accessing the test configuration menus" on page 7 then proceed with step 2.

2 Press the **ISDN** soft key. You may need to use the left or right arrow button to find the ISDN soft key.

The ISDN Settings menu appears.



The available selections vary depending on the protocol you choose.

3 Select **Protocol** and then choose a protocol (sometimes called Call Control).

NOTE:

To select DASS2 protocol, you must first select UK as the country on the System>Instrument>International Settings menu.

4 Select **Own Address** and then enter your phone number.

5 Select **Own Sub Address** and then enter your sub-address, if required.

A sub-address is typically used when multiple devices are on the same line, such as a telephone and fax machine.

This selection is not available in TN-1R6 or DASS2 protocols.

6 Select **Termination** and then specify a termination:

- **Bridge (HI-Z)**: High impedance. Used to connect to the line in a bridged arrangement, resistive termination >1k Ω.
- **Terminate**: Used to terminate a line with 120 Ω.
- **PMP**: Used to connect to a Protected Monitor Point (PMP) on the network equipment under test; provides a resistive termination of 75 Ω.

7 Select **CODEC** and then select the type of codec: mu law or A law.

8 Select **Type of Number** and then specify the type of number for your address, if required.

This selection is not available in DASS2 protocol.

9 Select **Numbering Plan** and then specify the numbering plan for your address, if required.

This selection is not available in DASS2 protocol.

10 Select **Keep B channel** then choose whether to keep the channel open if the call is terminated at the other end.

This selection is not available in DASS2 protocol.

11 Select **SA6 Byte** and then specify the 8-digit SA6 Byte.

You are finished specifying ISDN settings.

Specifying E1 settings

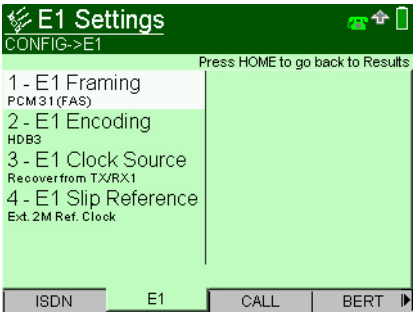
The following procedure describes how to specify the E1 settings.

To specify the E1 settings

1 Access the test configuration menus. See "Accessing the test configuration menus" on page 7 then proceed with step 2.

2 Press the **E1** soft key. You may need to use the left or right arrow button to find the E1 soft key.

The E1 Settings menu appears.



3 Select **E1 Framing** and then specify the framing format for the E1 signal:

- **PCM31 (FAS)**
- **PCM31 (FAS+CRC)**

4 Select **E1 Encoding** and then specify the encoding:

- **HDB3**: High Density Bipolar 3
- **AMI**: Alternate Mark Inversion

5 Select **E1 Clock Source** and then specify the clock source:

- **Generate Clock**
- **Recover from RX/TX1**
- **Recover from RX/TX2**
- **Recover from External**

6 Select **E1 Slip Reference** and then select the clock reference for timing slips.

You are finished specifying E1 settings.

Specifying call settings

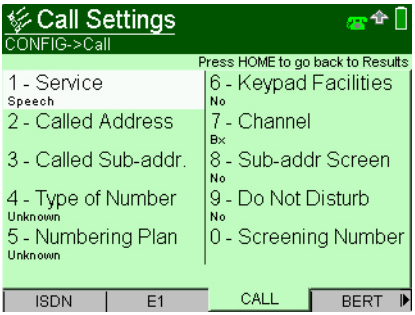
The following procedure describes how to specify the call settings.

To specify the call settings

1 Access the test configuration menus. See "Accessing the test configuration menus" on page 7 then proceed with step 2.

2 Press the **CALL** soft key. You may need to use the left or right arrow button to find the CALL soft key.

The Call Settings menu appears.



NOTE:

The call settings you specify apply to the next outgoing call you make using the HST. The settings do not impact currently active calls or incoming calls.

The available selections vary depending on the protocol you chose on the ISDN settings screen.

There may be more selections than can be displayed. Press the down arrow after the last selection to view any additional selections.

3 Select **Service** and then choose the type of service. If you selected DASS2 protocol, this selection is **Call Type**.

4 Select **Called Address** and then enter the number you are calling.

5 Select **Called Sub-Address** and then enter the sub-address, if required.

If the number you are calling requires an additional sub-address, such as a telephone and fax machine on the same line, enter the sub-address.

This selection is not available in the DASS2 protocol.

6 Select **Type of Number** and then specify the called party type of number, if required.

This selection is not available in the DASS2 protocol.

7 Select **Numbering Plan** and then specify the called party numbering plan.

This selection is not available in the DASS2 protocol.

8 Select **Keypad Facilities** and then specify whether keypad facilities are supported.

If supported, key presses are sent as KEYPAD information elements, in addition to DTMF tones.

This selection is not available in the DASS2 protocol.

9 Select **Channel** and then choose a B channel.

If you want the call to be placed on a specific channel, choose that channel, otherwise use Bx (meaning any B channel).

10 Select **Sub-addr Screen** and specify whether calls will be screened based on the sub-address.

This selection is not available in 1TR6 or DASS2 protocols.

11 Select **Extension (EAZ)** and enter the extension, if required.

This selection is only available in 1TR6 protocol.

12 Select **Reject Global Call** and specify whether to globally reject all calls.

This selection is only available in 1TR6 protocol.

13 Select **Master/Slave** and select whether the HST is the Layer 2 Master or Slave.

This selection is only available in Q.SIG, Cornet-N, Cornet-NQ, and Alcatel Q.SIG protocols.

14 Select **Establish** and specify whether the layer 2 establish mode is permanent or non-permanent.

This selection is only available in Q.SIG, Cornet-N, Cornet-NQ, and Alcatel Q.SIG protocols.

15 Select **Do Not Disturb** and specify whether the HST will ignore incoming call setup messages.

16 Select **B channel test** and then specify which B channel test to run.

This selection is not available in DASS2 protocol.

17 Select **Screening Number** and specify the number to screen for. If you enter a number, the HST will only allow incoming calls from that number.

18 Select **CUG** and then select whether to make outgoing calls with the HST from a Closed User Group.

This is only available in DASS2 protocol.

19 If you selected a specific CUG, enter the value of the closed user group.

This is only available in DASS2 protocol.

You are finished specifying Call settings.

Specifying BERT settings

The BERT settings menu varies depending on the application. For example, if you are running the BERT macro, the settings are different than the HIZBERT application. The following procedure describes how to specify the BERT settings.

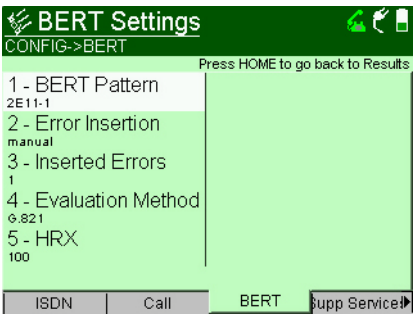
To specify the BERT settings

1 Press the **Configure** navigation key.

The test configuration soft keys appear.

2 Press the **BERT** soft key. You may need to use the left or right arrow button to find the BERT soft key.

The BERT Settings menu appears.



3 Select **BERT Pattern** and then choose a pattern.

The BERT patterns are described in Appendix C "BERT Patterns, Defects, Anomalies, and Messages".

4 Select **Error Insertion** and then select how frequently errors are inserted.

This selection is not available in HIZBERT.

5 If you selected manual Error Insertion, select **Inserted Errors** and then enter the number of errors to be inserted.

This selection is not available in HIZBERT.

6 Select **Evaluation Method** and then choose which method to evaluate the results: per G.821 or against a threshold.

7 Perform one of the following:

- If you selected the G.821 as the Evaluation Method, select **HRX** and enter the hypothetical reference connection.
- If you selected the Threshold Evaluation Method, select **Threshold Value** and choose the threshold value.

If you are in the Phone application, you are finished.

If you are using the BERT macro, additional settings should be specified.

8 Select **Duration** and then specify the test duration.

9 If you selected **User** as the Duration, select **hh:mm:ss** and then enter the hours, minutes, and seconds for the test.

10 Select **Repetition Factor** and then specify how many times to repeat the test when using the BERT macro.

NOTE:

This selection only applies to the BERT macro. You can repeat a BERT from the phone screen by selecting Start BERT or Stop BERT.

11 If you are running a HIZBERT, you must specify a few more settings.

a Select **Channel** and then specify the number of channels to BERT.

1x64 K — BERT on one channel

31x64K PMC31(C) — BERT on all channels of a PMC31(C) framed circuit.

b If you set Channel to 1x64K (BERT on one channel), specify the **Time Slot value** of that channel.

c Select the direction to **Monitor** for the HIZBERT.

NT->TE is from the CO toward the customer.

TE->NT is from the customer toward the CO.

You are finished specifying BERT settings.

Specifying Supplementary Services settings

The following procedure describes how to specify the Supplementary Services settings. These settings are not available when using DASS2 protocol.

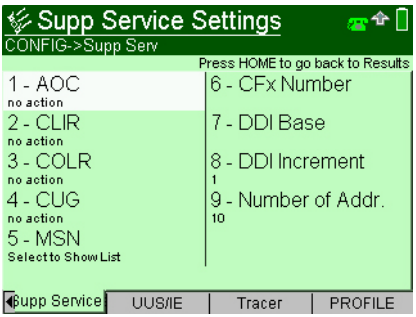
To specify the Supplementary Services settings

1 Press the **Configure** navigation key.

The test configuration soft keys appear.

2 Press the **Supp Service** soft key. You may need to use the left or right arrow button to find the Supp Service soft key.

The Supp Service Settings menu appears.



3 Select **AOC** (advice of charge) and then choose the charge type.
   – no action
   – AOC-S: charge at setup
   – AOC-D: charge during call
   – AOC-E: charge at end of call
   – all (includes AOC-S, AOC-D, and AOC-E)

4 Select **CLIR** and then choose whether calling line ID is restricted.
   – No action: encoding of the calling line ID is not implemented
   – Not allowed: calling line ID is encoded in the setup message, but will be hidden from the called party.
   – Allowed: calling line ID is encoded in the setup message and presented to the called party.

5 Select **COLR** and then choose whether connecting line ID is restricted.
   – No action: encoding of the connected address and connected sub-address are not implemented.
   – Not allowed: connected line ID is encoded in the setup message, but will be hidden from the calling party.
   – Allowed: connected line ID is encoded in the setup message and presented to the calling party.

6 Select **CUG** and then select whether to make outgoing calls with the HST from a Closed User Group.

7 If you selected a specific CUG, enter the value of the closed user group.

8 Select **MSN** and then enter the multiple subscriber number (MSN) values, if needed.

9 Select **CFx Number** and then enter the call forward number.

10 Select **DDI Base** and then enter the Direct Dial In Base number.

Some networks may be setup to have Direct Dial In service. Usually this is a group of phone numbers, starting with a base number, and then using incrementing numbers.

11 If DDI service is being used, two additional settings must be selected.

- Select **DDI Increment** and then enter the number delta for each phone number (the amount to increment). For example, if the DDI Base number is 555-1000 and the increment is set to 50, the next phone number would be 555-1050.
- Select **Number of Addr.** and then enter the number of addresses within the DDI group. Using the same example as above, if the number of addresses is 4, the final number in the group would be 555-1150.

You are finished specifying Supplementary Services settings.

Specifying UUS/IE settings

The following procedure describes how to specify the User to User Signal (UUS) and Information Element (IE) settings.

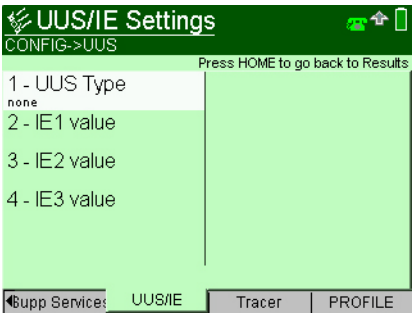
To specify the UUS and IE settings

1 Press the **Configure**  navigation key.

The test configuration soft keys appear.

2 Press the **UUS/IE** soft key. You may need to use the left or right arrow button to find the UUS/IE soft key.

The UUS/IE Settings menu appears.



3 Select **UUS Type** and then specify a UUS type.

If you selected a UUS type, the UUS Info setting appears.

4 Select **UUS Info** and then select a test.

5 If you selected **Other** as the **UUS Info** test, you must specify more settings.

a Select **UUS pattern** and then enter the user defined pattern.

b Select **UUS Repetition** and then enter the number of times to repeat the test.

6 Select **IE1 value** and enter the value of information element number 1.

This is typically a string of up to 40 characters.

7 Select **IE2 value** and enter the value of information element number 2.

This is typically a string of up to 40 characters.

8 Select **IE3 value** and enter the value of information element number 3.

This is typically a string of up to 40 characters.

You are finished specifying the UUS/IE settings.

Specifying Tracer settings

The following procedure describes how to specify the Tracer settings.

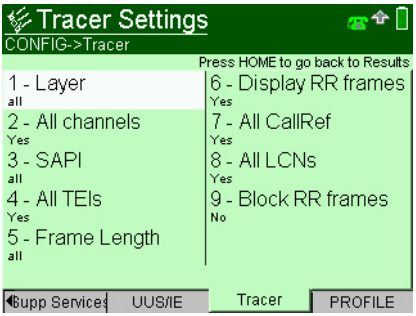
To specify the Tracer settings

1. Press the **Configure** navigation key.

   The test configuration soft keys appear.

2. Press the **Tracer** soft key. You may need to use the left or right arrow button to find the Tracer soft key.

   The Tracer Settings menu appears.



   This screen varies, depending on the application (Simulation/Monitor) and which protocol you are using.

3. If you are in the Monitor application, the first item is **Monitor Protocol**. Specify whether the monitor protocol is Euro ISDN or DASS2.

4. Select **Layer** and then choose whether to filter on a specific layer.

5. Select **All channels** and then choose whether to include all channels or filter on a specific channel.

6. If you selected No for All channels, select **Channel value** and specify the channel to filter.

7. Select **SAPI** and then choose whether to filter on a specific SAPI.

8 Select **All TEIs** and then choose whether to include all TEIs or filter on a specific TEI.

9 If you selected No for All TEIs, select **TEI value** and specify the TEI to filter.

10 Select **Frame Length** and then choose whether to filter on a specific frame length.

11 Select **Display RR frames** and then choose whether to display Receiver Ready frames.

12 Select **All CallRef** and then choose whether to filter on a specific call reference number. Selecting **Yes** means all call references are included (in other words, the filter is disabled).

13 If filtering on a specific call reference (you selected No for All CallRef), select **CallRef value** and specify the call reference number.

14 Select **All LCNs** and then choose whether to filter on a specific logical channel number. Selecting **Yes** means all LCNs are included (in other words, the filter is disabled).

15 If filtering on a specific LCN, select **LCN VALUE** and specify the LCN.

16 Select **Block RR frames** and then choose whether to block Receiver Ready frames.

17 Select **DASS2 Abbreviated** and then choose whether DASS2 message decodes will be abbreviated.

You are finished specifying the Tracer settings.

Managing test profiles

The profile manager feature allows you to save test profiles, load saved profiles, overwrite saved profiles, and delete saved profiles.

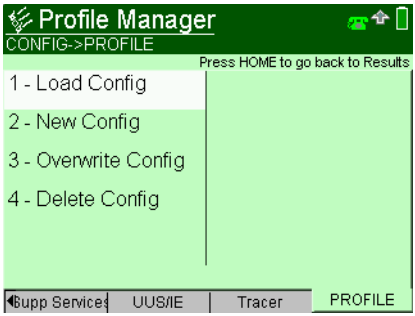
NOTE:

Profile changes are not automatically saved to the Profile Manager. You must overwrite the profile (or create a new one) to make the change permanent.

To view the Profile Manager feature

1. Press the **Configure** navigation key.
2. Press the **Profile** soft key.

   The Profile Manager menu appears.



Storing test profiles

After you have finished specifying the HST-3000's settings for a particular test, you can store the test profile for future use.

To store a test profile

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

5 Enter the file name.

6 Press the **OK** key.

The test configuration is stored.

Loading a profile

After a profile 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 profile

1 Press the **Configure** navigation key.

2 Press the **Profile** soft key.

3 Press the **1** key.

4 Select the file name to load.

5 Press the **OK** key.

The test profile is loaded.

Overwriting a profile

You can change a saved profile and then overwrite the old version.

To overwrite a profile

1 Press the **Configure** navigation key.

2 Press the **Profile** soft key.

3 Press the **3** key.

4 Select the file name to overwrite.

5 Press the **OK** key.

The test profile is overwritten.

Deleting a profile

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

To delete a test profile

1. Press the **Configure** navigation key.
2. Press the **Profile** soft key.
3. Press the **4** key.
4. Select the file name to delete.
5. Press the **OK** key.

The test profile is deleted.

Connecting to the line

After specifying the test settings, you can connect to the line.

Your connection method will change, depending on the test application.

For additional detail on the connections, see "PRA pin-outs" on page 177.

PRA Simulation connections

If you are testing using a PRA Simulation function, the following paragraphs describe how to connect to the line.

S2/T2

If you are testing using the TE-S2/T2 application, Figure 15 shows how to connect to the line.

To connect to the line

1. Connect one end of the test cable to the **RX/TX1** jack on the left side of the module.

2 Connect the other end of the cable to the NT.

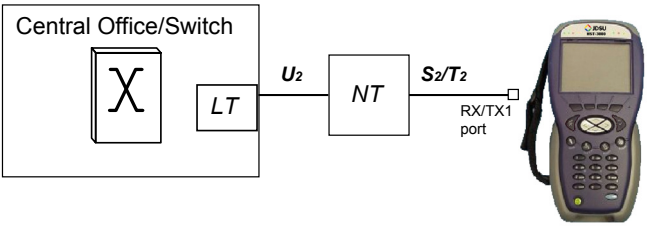


Figure 15 Connecting as a TE-S2/T2

The cables are connected.

LT-S2/T2 If you are testing using the LT-S2/T2 application, Figure 16 shows how to connect to the line.

To connect to the line

1 Connect one end of the test cable to the **RX/TX1** jack on the left side of the module.

2 Connect the other end of the cable to the TE.

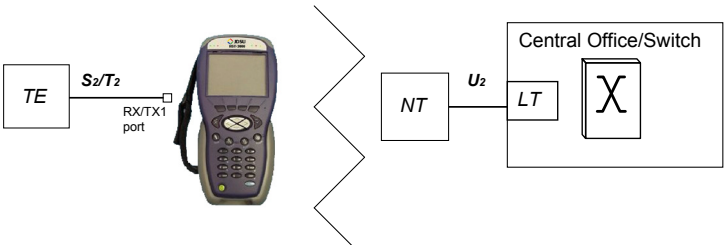


Figure 16 Connecting as a LT-S2/T2

The cables are connected.

TE-U2 If you are testing using the TE-U2 application, Figure 17 shows how to connect to the line.

To connect to the line

1 Connect one end of the test cable to the **RX/TX1** jack on the left side of the module.

2 Connect the other end of the cable into the network interface.

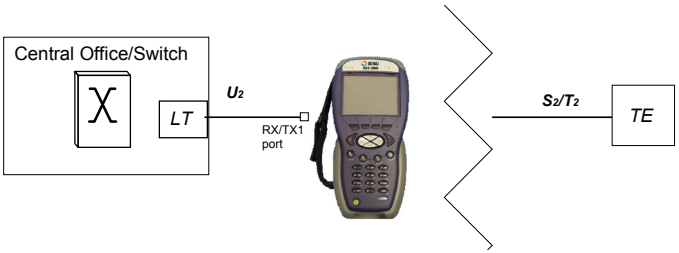


Figure 17 Connecting as a TE-U2

The cables are connected.

LT-U2 If you are testing using the LT-U2 application, Figure 18 shows how to connect to the line.

To connect to the line

1 Connect one end of the test cable to the **RX/TX1** jack on the left side of the module.

2 Connect the other end of the cable to the NT.

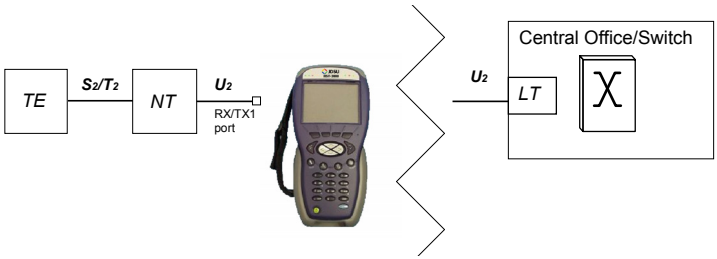


Figure 18 Connecting as a LT-U2

The cables are connected.

DASS2 PBX-U2 If you are testing using the PBX-U2 application, Figure 19 shows how to connect to the line.

To connect to the line

1. Connect one end of the test cable to the **RX/TX1** jack on the left side of the module.
2. Connect the other end of the cable to the ET.

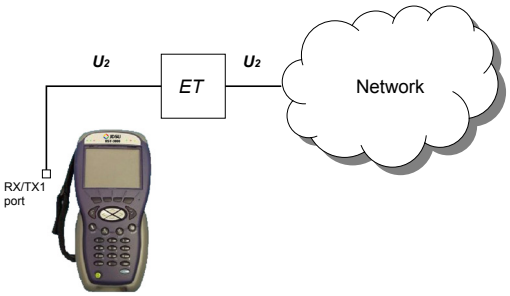


Figure 19 Connecting as a DASS2 PBX

The cables are connected.

ET-U2 If you are testing using the ET-U2 application, Figure 20 shows how to connect to the line.

To connect to the line

1. Connect one end of the test cable to the **RX/TX1** jack on the left side of the module.

2 Connect the other end of the cable into the PBX.

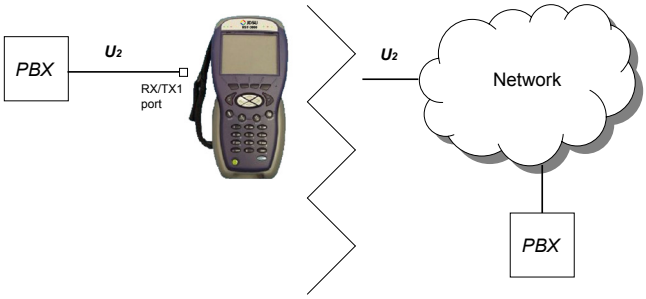


Figure 20 Connecting as a DASS2 ET

The cables are connected.

PRA Monitor connections

If you are testing using a PRA Monitor function, the following paragraphs describe how to connect to the line.

S2/T2 Monitor

If you are testing using the S2/T2 Monitor application, Figure 21 shows how to connect to the line.

To connect to the line

1 With the first cable, connect one end of the test cable to the **RX/TX1** jack on the left side of the module.

2 Connect the other end of the cable to the TE.

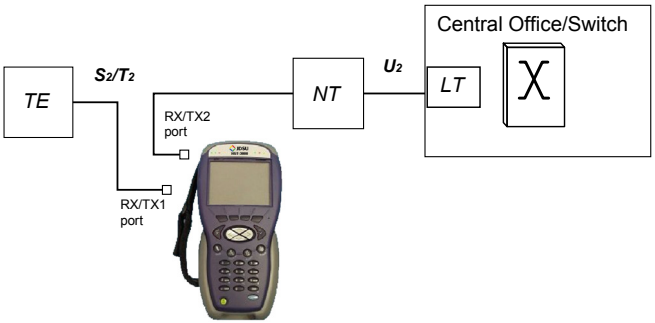


Figure 21 Connecting as a S2/T2 Monitor

3 With the second cable, connect one end of the test cable to the **RX/TX2** jack on the left side of the module.

4 Connect the other end of the cable to the NT.

The cables are connected.

U2/G.704 Monitor If you are testing using the U2/G.704 Monitor application, Figure 22 shows how to connect to the line.

To connect to the line

1 With the first cable, connect one end of the test cable to the **RX/TX1** jack on the left side of the module.

2 Connect the other end of the cable to the network interface.

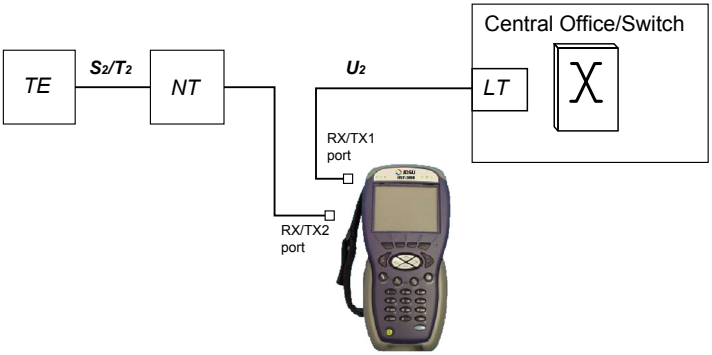


Figure 22 Connecting as a U_2 Monitor

3 With the second cable, connect one end of the test cable to the **RX/TX2** jack on the left side of the module.

4 Connect the other end of the cable to the NT.

The cables are connected.

PMP Monitor If you are monitoring a device at the PMP (Protected Monitor Point), Figure 23 shows how to connect to the line.

To connect to the line

1 Using a special “Y” cable (one RJ-45 to two RJ-45s), connect the single end of the test cable to the **RX/TX1** jack on the left side of the module.

2 With the dual ends of the cable, connect to the PMP.

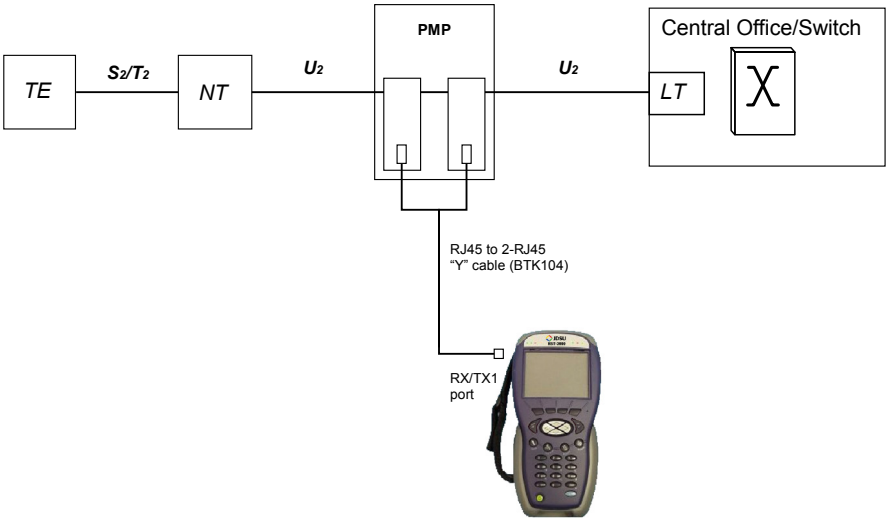


Figure 23 Connecting at a PMP

The cables are connected.

Emulating an ISDN phone

The ISDN phone emulation function allows you to do the following:

- place or receive up to 30 calls
- transmit DTMF tones
- perform a BER test
- view D channel messages
- view layer 1 statistics
- view E1 LED results

Placing calls

After you specify the test settings and connect to the line, the HST establishes a data link. After it is synchronized, it is ready to place or receive calls.

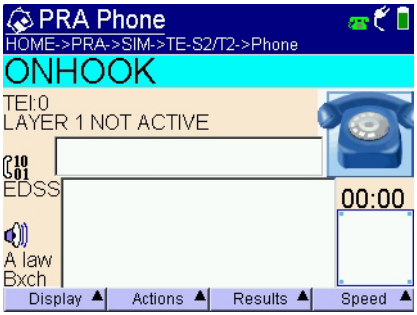
NOTE:

You will not hear a dial tone when you place voice calls from the HST using enbloc dialing. This is normal for devices placing ISDN calls.

To place a call

1 Select the **Phone** emulate test function.

The Phone screen appears.



2 Verify your test settings. (See “Specifying test settings” on page 52)

3 Connect to the line. (See “Connecting to the line” on page 68)

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

5 Verify the link is up by doing the following:

a Press the **Home** navigation key.

b Press the **Display** soft key, and then select **LED**.

c Verify the **Sync** LED is on.

6 Dial the number using one of the following methods:

To dial using...	do this...
Speed dial numbers	Press the **Speed** soft key and select a number by either: – pressing the number key for the entry you want to speed dial. – using the arrow keys to highlight the entry, and then press **OK** to select it. Press the **OK** key to go off hook and dial. (For more information on speed dial numbers, see "Managing speed dial numbers" on page 83.),
Enblock dialing	Enter the phone number using the keypad, and then press the **OK** key to go off hook and dial.
Overlap dialing	Press the **OK** key to go off hook, wait for dial tone, and then enter the phone number using the keypad. **NOTE:** You may have to clear the previous phone number by pressing the **Actions** soft key and then selecting **Clear phone number**.

7 Verify that the call status is `CONNECTED`.

NOTE:

If the call status is not `CONNECTED`, a cause code (indicating the reason the call was not connected) displays on the Phone screen. You can also check the Interface results screen to view the layer 1 (L1) state, or check the D channel tracer for cause codes and Q.931 messages.

8 If you want to place a second call, press the **NEW CALL** soft key and then repeat step 6 and step 7.

Use the up and down arrow keys to move among calls.

You have placed a call.

Running the 30 call macro

The 30 call macro places 30 outbound calls. This verifies that all channels are provisioned for placing calls.

To run the 30 call macro

1. Press the **Actions** soft key and then select **30 Call Macro**.

   The HST-3000 places 30 individual outbound calls, one on each channel.

2. To end the calls, press the **Actions** soft key and then select **Hang Up All Calls**.

3. If you wish to cancel the macro before it finishes, press the **Actions** soft key and then select **Cancel Macro**.

Receiving and disconnecting a call

When a call comes in, the soft keys change to allow you to accept, reject, or ignore each incoming call.

Accepting a call

You can accept up to thirty calls on the HST. When you accept a call, the call automatically connects to the microphone, and the payload is dropped to the speaker. If you are using a headset, the call connects to the headset, and the payload is dropped to the headset speaker. To move between calls, press the up or down arrow.

You can insert voice traffic into the B channel associated with the call by speaking into the microphone or headset or you can insert BER test patterns (see “Running a BER test” on page 81).

To accept a call when prompted

– Press the **OK** key or press the **Answer** soft key.

The HST-3000 accepts the call.

Rejecting a call

When you reject a call, the HST-3000 disconnects the call.

To reject a call when prompted

– Press the **Reject** soft key.

The HST-3000 rejects the call and sends a “Call Rejected” cause message.

Ignoring a call

When you ignore a call, the HST-3000 disconnects the call.

To ignore a call when prompted

– Press the **Ignore** soft key.

The HST-3000 disconnects the call and sends a “Normal Clearing” message.

Disconnecting a call

To disconnect a call

1 Press the **OK** key to go on hook.

NOTE:

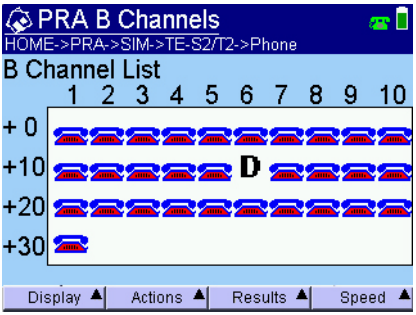
If the call status is not `ON HOOK`, the cause code (indicating the reason the call was not disconnected) appears on the Phone screen. See “Q.931 Cause Codes” on page 159 for descriptions of each code.

Viewing all active calls

If you wish to view all active calls, from the Phone menu, press the right arrow. The PRA Calls menu appears. This menu lists all currently active calls, their associated B channel, and the elapsed time for each call.

Viewing the call status for all channels

If you wish to view the call status for all channels, from the PRA Calls menu, press the right arrow. The Call List appears, which lists the active calls. Press the right arrow again. The PRA B Channels menu appears.



This menu provides an icon to report the status of each B channel. If a call is active, the phone icon will be off hook.

Viewing layer 2 status

If you are using DASS2 protocol, the Layer 2 results reports the status of layer 2 for each channel.

To view the layer 2 results

– Press the **Display** soft key and then select **Layer 2**.

For more information on these results, see “Layer 2 results” on page 146.

Viewing physical layer statistics

The Interface result category lists results related to the physical interface.

To view the Interface results

– Press the **Display** soft key and then select **Interface**.

For more information on these results, see “Interface results” on page 147.

Viewing LED statistics

The LED result category shows the current and historical status for alarms.

To view the LED results

– Press the **Display** soft key and then select **LED**.

For more information on these results, see "LED results" on page 149.

Running a BER test

After you place or receive calls, you can perform BER analysis of the associated B channels. In addition to providing general ISDN results, the HST provides results based on the BER analysis of the B channels.

To run a BER test

1 With a call active, press the **Display** soft key and then select BERT.

The BERT screen appears.

2 Press the **Start BERT** soft key.

The timer will begin counting and results begin to increment.

3 *Optional.* To change the BERT pattern, press the up or down arrow.

4 *Optional.* If you have multiple calls active, you can BERT on a single channel or multiple channels. Press the **Actions** soft key and then select a BERT function.

Selection	Description
BERT Single Channel	BERT on a single channel (only one channel)
BERT Multiple Channels	BERT on the multiple channels. The channel map appears. Choose the channels using the arrow keys and the OK key. When finished selecting channels, press the **Commit** soft key.

5 *Optional.* You can loop the channel or the entire circuit if another technician is performing the BERT, by pressing the **Actions** soft key, and then select **Change Loop Map**.

Choose the channels using the arrow keys and the OK key. When finished selecting channels, press the **Commit** soft key.

6 To inject errors, press the **Actions** soft key and then select **Inject Error**.

The HST will inject the number of errors that were specified in the BERT Settings menu.

7 To end a BERT, press the **Stop BERT** soft key

NOTE:

If you end the call while the BER test is running, the HST will lose pattern sync (and you will get errors).

8 To save your results, press the **Results** soft key and then select **Save Results**.

For more information on these results, see "BERT results" on page 146.

You are finished performing a BERT test.

Transmitting DTMF tones

After a call is connected, use the keypad to insert and transmit DTMF tones. When you transmit DTMF tones, the HST temporarily disables the microphone.

To transmit DTMF tones

1 Verify that Keypad Facilities is set to NO (on the Call Settings screen).

2 Place a call (see "Placing calls" on page 76).

3 Enter the DTMF tones using the keypad.

4 If you have multiple calls connected, press the up or down arrow to move to another call.

5 Enter the DTMF tones using the keypad.

The HST transmits the tones.

NOTE:

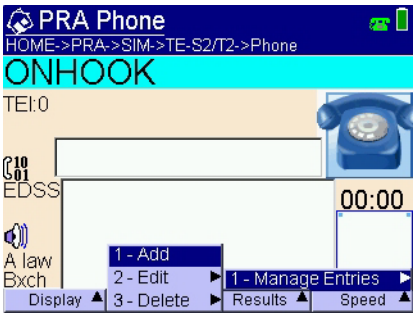
DTMF tones are not available when tracing D channel messages.

Managing speed dial numbers

You can define and store up to nine (9) frequently used phone numbers on the HST, and then speed dial a number when placing a call.

To access the HST speed dial manager

1. Press the **Home** navigation key to return to the main Phone screen.
2. Press the **Speed** soft key and then select **Manage Entries**.



3. Select one of the following:
   - Add (see “Adding or editing speed dial entries” on page 83)
   - Edit (see “Adding or editing speed dial entries” on page 83)
   - Delete (see “Deleting a speed dial entry” on page 84)

Adding or editing speed dial entries

The following procedure describes how to add or edit speed dial entries.

To add or edit speed dial entries

1 From the Speed>Manage Entries menu, select **Add** or **Edit**.

If you selected **Edit**, select the entry to edit.

The Enter Name dialog opens.

2 Enter the name and then press **OK**.

The Enter Number dialog opens.

3 Enter the phone number and then press **OK**.

The new or edited entry appears in the speed dial list.

Deleting a speed dial entry

The speed dial function allows you to delete a stored entry. The following procedure describes how to delete speed dial entries.

To delete a speed dial entry

1 From the Speed>Manage Entries menu, select **Delete**.

2 Select the entry to delete and then press **OK**.

The entry is deleted.

Physical layer BERT

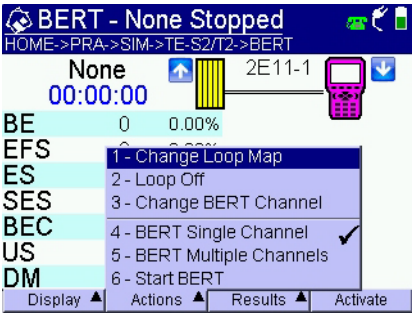
The HST allows you to test the physical layer without placing a call, by performing bit error rate tests (BERT or BER testing).

To test the physical layer using a BERT

1. Enter the **Phone** emulate test function.
2. Press the **Display** soft key and select **BERT**.

   The BERT screen appears.
3. If layer 1 is not up, press the **Activate** soft key to activate layer 1 communication.

   The **Sync** LED lights when communication is established and the Activate soft key changes to Start BERT.
4. To start the BERT, either press the Start BERT soft key or press the **Actions** soft key and then select **Start BERT**.



5. To change the channel or channels to BERT, press the **Actions** soft key and then select a BERT function.

Selection	Description
BERT Single Channel	BERT on a single channel (only one channel)
BERT Multiple Channels	BERT on the multiple channels. The channel map appears. Choose the channels using the arrow keys and the OK key. When finished selecting channels, press the **Commit** soft key.

6 *Optional.* You can loop the channel or the entire circuit if another technician is performing the BERT, by pressing the **Actions** soft key, and then select **Change Loop Map**.

   Choose the channels using the arrow keys and the OK key. When finished selecting channels, press the **Commit** soft key.

7 To change the pattern, press the up or down arrow.

8 To insert errors, press the **Actions** soft key and select **Inject Errors**.

9 To end the BERT, press the **Actions** soft key and then select **Stop BERT**.

10 *Optional.* Press the **Results** soft key and then select **Save Results**.

NOTE:

In BERT mode, you can save results only after the BERT ends.

For more information on these results, see “BERT results” on page 146.

Running the BERT macro

The BERT macro test function places a call and then performs a BER test. The call that is placed depends on the called address in the Call Settings configuration menu. For example, you may call a loopback device, another user (who would answer the call manually), or call yourself.

To execute the BERT macro

1 Select **BERT** from the test function screen (see "Selecting a test function" on page 50).

The BERT Macro screen appears.

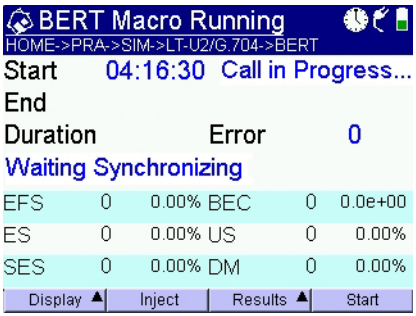
2 Verify your test settings. (See "Specifying BERT settings" on page 58)

3 Connect to the line. (See "Connecting to the line" on page 68)

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

5 Press the **Start** soft key.

The HST places a call and then begins a BERT. Results appear on the screen.



The test will run for the duration set in the BERT configuration menu.

6 *Optional.* To clear any history results, press the **Results** soft key and then select **Clear Results**.

7 To change the way the results are displayed, press the **Display** soft key and then select one of the following:
   – Display Graphical Results (same as above)
   – Display Text Results (displays the results in text format)

8 To save your results, press the **Results** soft key and then select **Save Results**.

For more information on these results, see "BERT results" on page 146.

You are finished running the BERT macro.

Performing a capabilities services test

The Services test function allows you to test the availability of services (teleservices) using an automatic test.

To run the Services test

1 Select **Services** from the test function screen (see "Selecting a test function" on page 50).

   The Services screen appears.

2 Verify your test settings. (See "Specifying test settings" on page 52)

3 Connect to the line. (See "Connecting to the line" on page 68)

4 Select which services to test by performing the following:

   a Press the **Select** soft key.

   b Scroll to highlight the desired services.

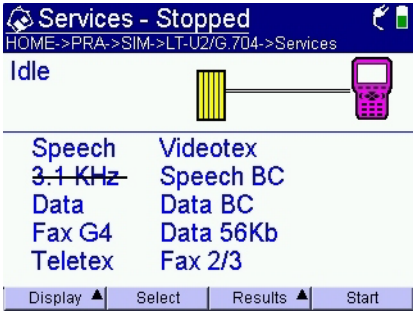
c Press the **OK** key to toggle the check mark.

The check mark indicates that the test will be included.

NOTE:

The services available will vary depending on the protocol selection in the ISDN configuration.

d After selecting the desired tests, press the **Accept** soft key to return to the Services screen.



If a selection has a line through it, that service will not be tested.

5 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

6 *Optional.* To clear any history results, press the **Results** soft key and then select **Clear Results**.

7 Press the **Start** soft key.

The HST places successive calls using all the selected services. A “Running” message appears in the upper left of the screen and an arrow appears next to the service currently being tested.

8 To change the way results are displayed, press the **Display** soft key and then select one of the following:

Selection	Description
Display graphical results	Results are indicated with either a check mark for pass or an “X” for fail.
Display text results	A full description of the test is displayed as text. For example, the test start and stop times are included as well as a cause code if the test failed.

9 To save your results, press the **Results** soft key and then select **Save Results**.

For more information on these results, see “Services or Supplementary services test results” on page 150.

You have finished the Services test.

Performing a supplementary services test

The Supplementary Services test function allows you to test the availability of supplementary services using an automatic test.

This function is not available in DASS2 protocol.

To run the supplementary services test

1 Select **Supplementary Services** from the test function screen (see “Selecting a test function” on page 50).

The Supp Services screen appears.

2 Verify your test settings. (See “Specifying test settings” on page 52)

3 Connect to the line. (See “Connecting to the line” on page 68)

4 Select which services to test by performing the following:

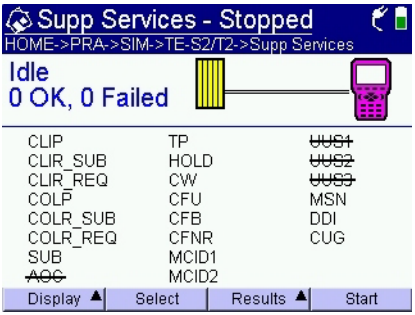
a Press the **Select** soft key.

b Scroll to highlight the desired service.

c Press the **OK** key to toggle the check mark.

The check mark indicates that the test will be included.

d After selecting the desired tests, press the **Accept** soft key to return to the Supp Services screen.



If a selection has a line through it, that service will not be tested.

5 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

6 *Optional.* To clear any history results, press the **Results** soft key and then select **Clear Results**.

7 Press the **Start** soft key.

The HST places successive calls using all the selected services. A “Running” message appears in the upper left of the screen and an arrow appears next to the service currently being tested.

8 To change the way results are displayed, press the **Display** soft key and then select one of the following:

Selection	Description
Display graphical results	Results are indicated with either a check mark for pass or an “X” for fail.
Display text results	A full description of the test is displayed as text. For example, the test start and stop times are included as well as a cause code if the test failed.

9 To save your results, press the **Results** soft key and then select **Save Results**.

For more information on these results, see “Services or Supplementary services test results” on page 150.

You have finished the Supplementary Services test.

Performing a B channel test

The B Channel test function allows you to test the provisioning of the B channels.

To perform a B channel test

1 Select **B Channel** from the test function screen (see “Selecting a test function” on page 50).

The B Chan Test screen appears.

2 Verify your test settings, including the Call Settings selection for B channel test. (See “Specifying test settings” on page 52)

3 Connect to the line. (See “Connecting to the line” on page 68)

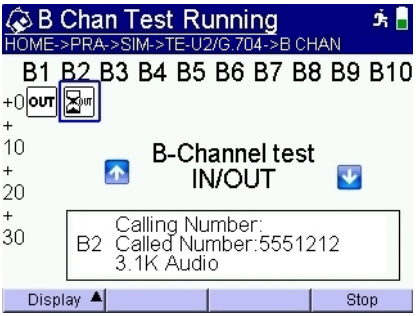
4 Select a test mode by pressing the Test Type soft key and selecting a test.

Test	Description
Sequence	Determines whether the channel is available for outgoing calls. This mode places a sequence of single-channel calls, and clears any existing calls.
Multiple Call	Determines whether the channel is available for outgoing calls. This mode places a multi-channel call. Calls are placed on open channels but any existing calls are maintained.
In/Out	Determines whether the B channels are available for incoming (IN) and outgoing (OUT) calls. This test is based on the ETSI recommendations and is performed in Selfcall mode. This test runs continuously until both an outgoing and incoming call are placed. (This test is not available in DASS2 protocol.)
Auto BERT Release	This test places an outbound call on each channel and upon connect, runs a BERT using the current pattern, duration, and error insertion selections, and releases the call. This test runs until calls have been placed on all channels.
Auto BERT Hold	This test places an outbound call on each channel and upon connect, runs a BERT using the current pattern, duration, and error insertion selections, and holds the channel open until all channels are tested. This test runs until calls have been placed on all channels.

5 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

6 Press the **Start** soft key.

The HST places the calls.



7 To change the way results are displayed, press the **Display** soft key and then select one of the following:

Selection	Description
Display graphical results	Results are indicated with icons for pass/fail or In/Out, depending on which test was run.
Display text results	A full description of the test is displayed as text. For example, the test start and stop times are included as well as a cause code if the test failed.

8 To save your results, press the **Results** soft key and then select **Save Results**.

For more information on these results, see “B channel test results” on page 150.

You have finished the B Channel test.

Tracing D channel messages

The Tracer test function allows you to trace D channel messages to troubleshoot problems with call establishment. You can view current messages or retrieve previously saved messages. For information on interpreting the messages, see "Interpreting D channel decode messages" on page 106.

NOTE:

DTMF tones are not available when tracing D channel messages.

Capturing messages

The following procedure describes how to capture D channel messages.

To capture D channel messages

1. Select **Tracer** from the test function screen (see "Selecting a test function" on page 50).

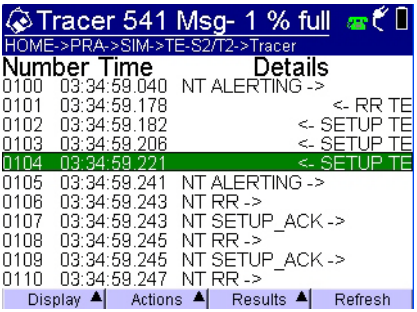
   The Tracer screen appears.

2. Verify your test settings. (See "Specifying test settings" on page 52)

3. Connect to the line. (See "Connecting to the line" on page 68

4. Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

The messages appear on the screen.



Different protocols may use different messaging, so your display will vary, depending on the protocol.

5 Press **Refresh** to update the list.

The messages will be filtered, based on the settings specified on the Tracer Settings menu.

6 To stop or restart the decode, press the **Actions** soft key and select **Stop Decode** or **Start Decode**.

7 Press the **OK** key to change the display mode:

Display mode	Description
Summary	A brief description of the message, if applicable.
Detailed	Full text decode, if applicable.
Hexadecimal	Only the HEX code

8 To spool tracer message to the file system, press the **Actions** soft key and then select **Start Decode Spool to File** or **Stop Decode Spool to File**.

If you enable this feature, the HST saves the decode to a file each time the buffer is full. This is useful if you are running a long term monitor test.

The file name will be `HST.[date].[time].cap`, where “date” and “time” are the current system clock results (this file name cannot be changed).

9 To save your results, press the **Results** soft key and then select one of the following:

Selection	Description
Save as Trace file	Saves in binary format. You can later retrieve and view the file in Tracer. See "Retrieving saved tracer messages" on page 97.
Save as Text file	Saves as decoded ASCII text file. You can save the results and then import it into a word processor or view the text file at a later time using the File Manager. For details on viewing text files on the HST, refer to the *HST-3000 Base Unit User's Guide*.

You have finished capturing D Channel messages.

Navigating decode messages

The D Chan Decode Results screen displays decode text messages in the order they are received on the HST.

To navigate through the messages

– Use the up and down arrows to scroll through the text of a message.

– In the Summary view, use the keypad to enter the line number for the desired message or use the arrow keys to navigate to the desired message and then press OK.

– You can easily determine how many messages have been captured by looking at the Message count at the top of the screen.

Retrieving saved tracer messages

The following procedure describes how to retrieve previously saved tracer messages.

To retrieve saved trace files

1 Select **Tracer** from the test function screen (see "Selecting a test function" on page 50).

The Tracer screen appears.

2 Press the **Results** soft key.

3 Select **Load Trace file**.

A list of Trace files (files saved as binary Trace files) appears.

4 Select the trace file, and then press **OK**.

The messages appear on the screen.

Clearing the message buffer

The HST decode message buffer can store up to 5,000 messages. The HST captures D Channel frames and displays the associated decode text messages until the buffer becomes full. You can easily determine how full the buffer is by looking at the % Full indicator at the top of the screen. When the buffer is full, the HST stops capturing frames. You can clear the message buffer, enabling the HST to continue capturing frames.

To clear the HST message buffer

– On any results screen (for example, the D-Chan Decode Results screen), press the **Results** soft key, and then select **Clear All**.

The message buffer is cleared.

Automatically responding to calls

The Responder test function allows you to automatically accept up to thirty simultaneous calls.

To automatically respond to calls

1 Select **Responder** from the test function screen (see "Selecting a test function" on page 50).

2 Verify your test settings. (See "Specifying test settings" on page 52)

3 Connect to the line. (See "Connecting to the line" on page 68

4 Verify that the **Sync** LED is illuminated to ensure that the HST is synchronized with a valid signal.

5 If you want to simply connect to the call, rather than loop it back, press the **Loop Off** soft key.

Change this only if it is required.

NOTE:

This applies to the next call received.

6 Press the **Run** soft key.

The call status appears on the screen.

7 Press the **Break** soft key to stop the responder.

Monitoring the D channel

The HST-3000 allows you to monitor and analyze the D Channel from the U_2/G.704 and S_2/T_2 interface while the network is in-service.

To monitor the D Channel

1. If the HST is off, press the green power button to power on the unit.

   The PRA Measurements menu may take several seconds to appear.

2. Select **PRA Monitor**, and then select an interface, for example **S2/T2 Monitor**.

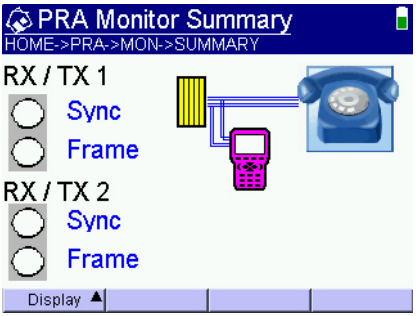
   The test function screen appears

3. Select **D Monitor**.

4. Verify your test settings. (See "Specifying test settings" on page 52)

5. Connect to the line. (See "Connecting to the line" on page 68

   After the HST achieves synchronization, the **Sync** LED on the unit will light and the Synced and Frame LEDs will light on the summary screen.



6 Press the **Display** soft key, and then select **Interface** to display interface results for the network side (the U interface, on the RX1/TX1 port) and the customer side (the S2/T2 interface, on the RX2/TX2 port) of the PRA interface.

You have finished monitoring the D Channel.

Running a HIZBERT

The HST-3000 allows you to perform a BERT on the received signals with HIZ impedance. The HIZBERT is receive only and shows RX results from either direction.

To run a HIZBERT

1 If the HST is off, press the green power button to power on the unit.

The PRA Measurements menu may take several seconds to appear.

2 Select **PRA Monitor**, and then select an interface, for example **S2/T2 Monitor**.

The test function screen appears

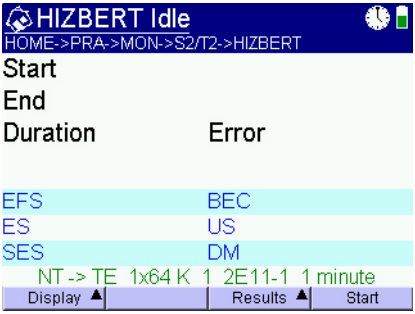
3 Select **HIZBERT**.

4 Verify your ISDN test settings. (See “Specifying ISDN settings” on page 52.)

5 Specify the **BERT** Settings. (See “Specifying BERT settings” on page 58.)

6 Connect to the line. (See “Connecting to the line” on page 68

After the HST achieves synchronization, the **Sync** LED on the unit will light.



The direction, channel(s), pattern, and duration are displayed on the bottom line of the results.

7 To change the way results are displayed, press the **Display** soft key and then select one of the following:

Selection	Description
Display graphical results	Results are indicated with either a check mark for pass or an “X” for fail.
Display text results	A full description of the test is displayed as text. For example, the test start and stop times are included as well as a cause code if the test failed.

8 To save your results, press the **Results** soft key and then select **Save Results**.

You have finished running a HIZBERT.

Monitoring all of the channels

The HST-3000 allows you to monitor an active PRA line and show statistics about the E1 circuit.

To monitor all channels

1 If the HST is off, press the green power button to power on the unit.

The PRA Measurements menu may take several seconds to appear.

2 Select **PRA Monitor**, and then select an interface, for example **S2/T2 Monitor**.

The test function screen appears

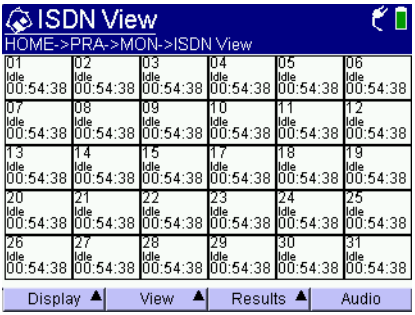
3 Select **ISDN View**.

If you are using DASS2 protocol, this is called **DASS View**.

4 Verify your test settings. (See "Specifying test settings" on page 52)

5 Connect to the line. (See "Connecting to the line" on page 68).

After the HST achieves synchronization, the **Sync** LED on the unit will light and the ISDN View menu appears.



6 To monitor the audio of a call, press the **Audio** soft key and then enter the channel number you wish to monitor.

NOTE:

Both sides must be synced to listen to the channel.

7 To view other statistics, do the following.

a Use the up and down keys to change the display:

– Call timers, all channels

– Channels 1-16 call timers

– Channels 17-31 call timers

– Per-channel stats (use the keypad to jump to a specific channel)

– B channel usage, all channels

b Use the **Display** soft key to view the D Channel trace.

8 To save your results, press the **Results** soft key and then select **Save Results**.

For more information on these results, see "ISDN View results" on page 152.

You have finished monitoring all channels.

Troubleshooting

4

This chapter describes how to identify and correct problems related to Primary Rate testing with the HST-3000. Topics discussed in this chapter include the following:

– “Interpreting D channel decode messages” on page 106
– “Resolving problems” on page 116

Interpreting D channel decode messages

When you monitor or terminate ISDN PRA service, you can isolate and locate problems by viewing D channel decode messages for all captured transmitted and received frames.

The decode messages fall into three categories:

– Messages related to layer 1 events and errors.
– Messages concerning the establishment and maintenance of the D channel link (layer 2 messages). These are often referred to as LAPD (Link Access Procedure D Channel) messages.
– Messages concerning the ISDN calls, such as the reason a call is rejected, who is disconnecting a call, and the call's bearer capability (layer 3 messages). These are often referred to as Q.931 messages.

Figure 24 on page 107 illustrates a sample Q.931 message indicating that a call is being setup.

```
TE->NT:C SAPI:000 TEI:0  TIME: 12:29:45.407
I   Ns =   0  Nr=  0   P=0
Call Reference 66
Protocol Discriminator.. 08
SETUP
BEARER CAPABIL. Lg =      3
 Hex. value   : 90 90 A3
 Coding stand.: CCITT coding
 Info tr.capab: 3.1 kHz audio
 Transfer mode: circuit mode
 Info tr.rate : 64 kbit/s
 Layer 1 ident.
 User info l.1: Rec.G.711 Alaw
FACILITY                      Lg =     18
 Hex. value   : 91 A1 0F 02 02 5C FF 02 01 02
 30 06 81 01 00 82 01 08
 Service discr: suppl.applica.
 COMPONENT    : Invoke
 Component LI =    15
 InvokeID(hex): 5C FF
 operation    : CUGCall
 OARequested  : FALSE
 CUGIndex(hex): 08
CALLING PTY NB. Lg =      2
 Hex. value   : 00 A0
 Type of numb.: unknown
 Number. plan : unknown
 Present.indic: restricted
 Screening ind: U.prov.nt.scre
CALLED PARTY NB Lg =      9
 Hex. value   : 80 38 36 37 35 33 30 39 31
 Type of numb.: unknown
 Number. plan : unknown
 No.digit/IA-5: 86753091
USER-USER       Lg =     21
 Hex. value   : 04 57 26 47 2D 49 42 54 3A 4C
 4F 4F 50 3B 56 30 36 2E 30 38 43
 Prot. discr. : IA5 characters
 (IA5)        : W&G-IBT:LOOP;V06.08C
```

Figure 24 Sample Q.931 message

You can easily determine the source of each message by looking at the message prefix on the first line. Messages originating from a TE device begin with `TE->NT`; messages originating from a NT device begin with `NT->TE`. The message in Figure 24 originated from a TE device.

Each call processed by the D channel is assigned a unique call reference number, which is reported on the third line of each decode message. The message in Figure 24 has a call reference number of `66`. All messages exchanged in reference to the call have the same call reference number. When viewing decode messages on a D channel processing a number of calls, it is important to verify the call reference number for each message because messages for each call are not presented as a group. A message indicating one call has been connected may be followed immediately by a message indicating a different call has been disconnected.

For details on viewing and navigating through D channel decode messages, see "Navigating decode messages" on page 97.

For descriptions of each individual decode message, see "Services or Supplementary services test results" on page 150.

LAPD messages

LAPD messages are useful when verifying the status of the D channel link. Complaints prompting you to look at LAPD messages include:

- The D channel does not go in service.
- D channel communications are lost for no known reason.
- Callers are experiencing excessive delays or timeouts when trying to place calls.

Using the LAPD messages, you can determine why a D channel link is not established, if a link is being terminated, and why a link is being terminated. Three types of frames are transmitted in LAPD: Information frames, which carry detailed

call information, Unnumbered frames, which are used to establish or terminate D channel communications, and Supervisory frames, which are used to maintain link communications after a link has been established.

LAPD Unnumbered frame messages

Table 12 lists each of the LAPD unnumbered frame decode messages.

Table 12 LAPD unnumbered frame decodes

Message…	Sent to…
SABME (Set Asynchronous Balanced Mode with Extended Sequence Numbering)	Establish initial D channel communications. – An affirmative response from the link partner is a UA message. – A negative response (indicating the link partner is not ready to establish a link) is a DM message.
UA (Unnumbered Acknowledgement)	Acknowledge one of the following: – A `SABME` message from the device initiating D channel communications. – A `DISC` message from the device terminating the D channel link.
DISC (Disconnect)	Disconnect or terminate the D channel link. This message should not be confused with the Q.931 `DISCONNECT` message which is used to disconnect a call.

Table 12 LAPD unnumbered frame decodes (Continued)

Message…	Sent to…
DM (Disconnect Mode)	Indicate one of the following: – The link partner is not ready to establish a D channel link with the device sending a `SABME` message. – The link partner cannot terminate the link (in response to a `DISC` message), typically because communications have already been disconnected.
FRMR (Frame Reject)	Indicate that an unrecoverable link-level problem has occurred. This message is transmitted when retransmitting a frame will not correct the problem, and indicates a potential high level protocol issue between the link partners.
UI (Unnumbered Information)	Request an exchange of information between the link partners.

LAPD Supervisory frame messages

Table 13 lists each of the LAPD supervisory frame decode messages. For an overview of LAPD messages, see "LAPD messages" on page 108.

Table 13 LAPD supervisory frame decodes

Message…	Sent to…
RR (Receiver Ready)	Keep the signal alive between the link partners, and acknowledge receipt of frames. RR messages are the most common messages observed in D channel decodes. When there are no call-related messages to send, the link partners transmit RR frames to make sure the link stays in service. **NOTE:** When you are viewing a large number of decode messages to troubleshoot call processing, you can typically ignore the RR messages since they are simply used to keep the D channel signal alive.
RNR (Receiver Not Ready)	Indicate that a link partner is experiencing difficulty (such as buffer depletion), and cannot accept any additional information frames (call related messages) at this time. RNR messages should occur rarely, and should be investigated immediately when they occur.
REJ (Reject)	Force re-transmission of bad frames. Frequent REJ frames indicate miscommunication on the D channel, typically due to errored frames during transmission.

Q.931 messages

Q.931 messages are useful for observing the call setup process, and identifying key information about each call, such as the called party number, transfer capability (which indicates whether the call is a voice or data call), and the channel selection (the B channel carrying the call).

Each Q.931 message begins with a message prefix on the first line which indicates where the message originated. Messages originating from a TE device begin with `TE->NT`; messages originating from a NT device begin with `NT->TE`. The call reference number for the message appears on the fourth line. The fifth line indicates the type of message being sent (for example, `SETUP` or `CONNECT`).

Finally, information elements pertaining to the call are listed. For `SETUP` messages, the elements roughly correspond to the settings required to place a call from the HST, such as the ISDN and Call settings listed in "Placing calls" on page 76. Additional call settings are also listed in the `SETUP` messages.

For `DISCONNECT` messages, the cause or reason for the call being disconnected is reported. For example, if the call is disconnected simply because one of the users hangs up the phone, the cause is reported as a `Normal Clearing`.

If a call cannot be connected, and as a result a `RELEASE` message is issued in response to a `SETUP` request, the `RELEASE` message reports the cause for the disconnection.

Q.931 decodes

Table 14 lists each of the Q.931 decode messages. For an overview of Q.931 messages, see "Q.931 messages" on page 112.

Table 14 Q.931 decodes

Message…	Sent to…
SETUP	Originate a call.

Table 14 Q.931 decodes (Continued)

Message…	Sent to…
ALERTING	Indicate that a SETUP message has been received, and that the device is attempting to process the call.
CONNECT	Indicate that the call has been completed and that the calling party is connected with the called party.
CONNECT ACK	Acknowledge that the CONNECT message has been received.
DISCONNECT	Disconnect the call. Can be sent from the calling device or the called device. **NOTE:** DISCONNECT messages report the cause for the disconnection.
RELEASE	Release the call in response to a DISCONNECT message, or because a call cannot be connected. **NOTE:** If a call cannot be connected, and as a result a RELEASE message is issued in response to a SETUP request, the RELEASE message will report the cause for the disconnection.
RELEASE COMPLETE	Acknowledge that a RELEASE message has been received, and disconnect the call. **NOTE:** A call is not disconnected until the RELEASE COMPLETE message is observed.

Cause Codes

Table 15 lists and explains the most commonly encountered cause codes for ISDN PRA calls.

Table 15 Common Q.931 Cause Codes

Cause Code	D Channel Decode Description	Typically Indicates
16	`Normal clearing`	No fault is detected; the call is finished.
18	`No user responding`	The receiving equipment did not respond to the call attempt within the allowed time.
28	`Invalid number format`	The receiving equipment considers the number to be incomplete or in an incorrect format. For example, numbers sent as a subscriber plan are expected to be 7 digits or less; numbers sent as national dialing plans are expected to be more than 7 digits.
31	`Normal unspecified`	Any number of unspecified conditions, but may indicate the call is terminating into a “fast busy” (all trunks are busy).

Table 15 Common Q.931 Cause Codes (Continued)

Cause Code	D Channel Decode Description	Typically Indicates
57	`Bearer capability not authorized`	The calling party has requested a call type (bearer capability) or service that is not implemented on the receiving equipment for the line. Often seen when trying to place voice calls on data only lines or data calls on voice only lines.
88	`Incompatible destination`	The destination device is not capable of supporting the type of call requested. Usually seen when trying to place data calls to a voice phone.
100	`Invalid information element contents`	A protocol problem where the receiving equipment does not understand one of the fields inside of the call setup message. If you receive this message, do the following: – Verify that the call control is correct for the call. – Contact a Tier 2 or Tier 3 technician or switch vendor to isolate and resolve the problem.
102	`Recovery on timer expiry`	No response received to generated messages. Often seen when B channels are not active.

Resolving problems

Table 16 describes situations that you may encounter when using the HST-3000 to test ISDN PRA service, and then helps you resolve the situation.

Table 16 Issues and resolutions

Issue	Description	Resolution
No dial tone detected on HST	You will not hear a dial tone when you place voice calls from the HST using enbloc dialing or if you place data calls. This is normal for devices placing ISDN calls.	N/A.
Is my call connected?	When placing or receiving a call on the HST, you want to verify that the call is connected.	Check the call status on the Phone screen or the Interface screen.
Call will not connect	Calls may not connect because the HST is not configured properly for the outgoing call, or for a variety of other reasons, such as an invalid bearer capability ("Call Service" on the Call settings page).	Verify the following: – Make sure you specified the number you want to call as the **Called address** (under Call Settings); not your Own Address (under ISDN settings). – Make sure you specified the correct call control protocol (under ISDN Settings). – If the HST is configured correctly for the call, check the cause code on the Phone screen.

Table 16 Issues and resolutions (Continued)

Issue	Description	Resolution
Decode messages are not captured.	The HST stops capturing decode messages when the message buffer is full.	Clear the message buffer (see "Clearing the message buffer" on page 98).
	The HST is filtering messages.	Check the Tracer settings to verify that the desired filters are being used.
HST-3000 does not synchronize to ISDN line.	Sync LED does not illuminate solid green when attached to the ISDN line.	– Verify the correct mode is selected for what the HST-3000 is trying to emulate (NT/LT, TE). – Verify the test cord is plugged into the jack on the PRA SIM corresponding to the selected mode. Most CPE turn-up testing is performed with the HST-3000 configured as a TE-U2/G.704 with the test cord in the RX/TX1 jack.

E1 BERT and Pulse Shape Test Results

A

This appendix describes the test result categories and the results within each category that are available when performing E1 tests. Topics discussed in this appendix include the following:

– “Summary results” on page 120
– “LED results” on page 122
– “Signal results” on page 123
– “Interface results” on page 125
– “Frame Data results” on page 127
– “Timeslot results” on page 127
– “BERT results” on page 128
– “Pulse shape results” on page 129
– “Performance results” on page 130
– “Time results” on page 141
– “Event Log results” on page 142
– “Saving and printing results” on page 142

About test results

After a test is started, the HST-3000 begins gathering results.

Ending a test (either upon completion of a timed test or by stopping the test) freezes all results.

NOTE:

The Sync and Data LEDs are still real-time.

Test results are sorted into several categories. To view results in other categories, press the **Display** soft key, and then select a category.

The following sections describe the test results for each of the categories.

Summary results

The Summary result category displays a large “All Summary Results OK” message if no anomalies or defects have been detected. If anomalies are detected, results are displayed.

Error results that are non-zero, key results that are out-of-specification, or key informational results are displayed After you start a test, the Summary result category automatically displays a large “All Summary Results OK” message if no errors or alarms have been detected. If errors are detected, the results are displayed. This allows quick access to the results without having to search each category.

Table 17 describes the results that appear in the Summary category.

Table 17 Summary results

Result	Definition
LOS Seconds	Total number of test seconds in which loss of signal was detected.
Pulse Shape Measurement	Only appears if the Pulse Shape capture failed.
Code Errors	Number of detected violations of the selected encoding method.
LOF Seconds	Seconds in which loss of framing occurred.
FAS Word Errors	Number of errored FAS words received since initial frame sync.
LSS Seconds	Seconds in which Loss of Sequence Synchronization was detected
TSE	Test Sequence Error (bit error)
Timing Loss Seconds	Count of the seconds during which the selected timing signal was not present. Applicable to all timing modes except Internal. **NOTE:** When timing source is not available, HST-3000 reverts to internal timing.
Rx Freq Max Dev	Receive Frequency Maximum Deviation. This result appears when the deviation from the nominal E1 frequency of 2048 kbit/s is greater than 50 ppm.
AIS Seconds	Number of test seconds during which the AIS condition has been detected
MF-AIS Seconds	Seconds in which Multiframe AIS was detected
RDI Seconds	Number of test seconds during which the RDI condition has been detected
MF-RDI Seconds	Number of test seconds during which the MF-RDI condition has been detected

Table 17 Summary results (Continued)

Result	Definition
MFAS Word Errors	Number of errored MFAS words received since initial frame sync
CRC Errors	Number of CRC errors detected
E-bit Errors	Number of remote CRC errors
Pattern Slips	Number of pattern slips detected since start of test

LED results

Results in the LED category are designated as “History” or real time (current). An “x” in the History column indicates the condition was detected since the last test restart. Restarting the test will clear the History column. A checkmark in the other column indicates the condition is currently being detected.

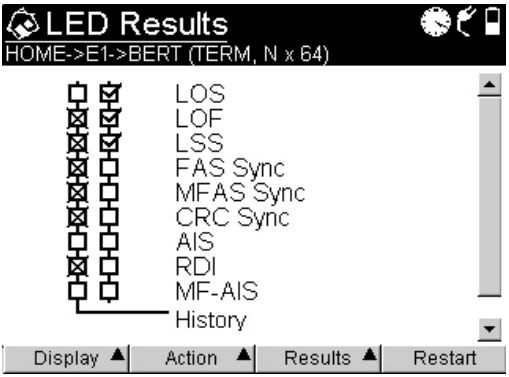


Table 18 describes the LED results.

Table 18 LED results

Result	Description
LOS	Loss of Signal
LOF	Loss of Framing detected
LSS	Loss of Sequence Synchronization
FAS Sync	Frame Alignment Signal synchronized
MFAS Sync	Multiframe Alignment Signal synchronized
CRC Sync	Cyclic Redundancy Check synchronized
AIS	Alarm Indication Signal detected
RDI	Remote Defect Indicator detected
MF-AIS	Multiframe AIS detected
MF-RDI	Multiframe RDI detected

Signal results

The Signal category shows signal level, frequency, and loss seconds results. Results in this category accumulate after test restart. Table 19 describes the results that appear in the Signal category.

Table 19 Signal test results

Result	Description
LOS Alarms	Number of Loss of Signal alarms
LOS Seconds	Number of seconds in which LOS was detected
Rx Frequency	Frequency of the clock recovered from the received E1 circuit

Table 19 Signal test results (Continued)

Result	Description
Rx Freq Dev PPM	Current received frequency deviation, ± 200 ppm
Rx Freq Max Dev	Maximum received frequency deviation, ± 200 ppm
Tx Frequency	Current transmitter clock frequency
Tx Freq Dev PPM	Current transmitted frequency deviation, ± 200 ppm
Rx Level Vpp	Current receive level, in volts peak-to-peak
Rx Level dBnom	Current receive level, in dB nominal
Frame Slips	Number of frame slips (absolute value) counted when the E1 test signal slips from the E1 reference signal after both signals are present simultaneously.
Timing Slips	Number of bit slips (±) counted when the E1 test signal slips from the E1 reference signal after both signals are present simultaneously. Counts from 0 to + or - 255, and then rolls over to 0. Resets to 0 if signal present is lost on the analyzed E1 circuit or on the reference E1 circuit. A positive results indicates that the analyzed E1 circuit is faster than the reference E1 circuit.
Ref Clk Frequency	Frequency of the reference clock
Ref Clk Dev PPM	Reference clock deviation, ± 200 ppm
Ref Clk Max Dev	Reference clock maximum deviation, ± 200 ppm

Interface results

The Interface category lists results related to the physical interface. Table 20 describes the results that appear in the Interface category.

Table 20 Interface test results

Result	Description
Code Errors	Number of detected violations of the selected encoding method.
Code Error Rate	Ratio of code errors received to the total number of bits received
LOF Alarms	Number of times the LOF condition was detected
LOF Seconds	Seconds in which loss of framing was detected
AIS Alarms	Number of alarm indication signals detected
AIS Seconds	Number of seconds in which AIS was detected
RDI Alarms	Number of Remote Defect Indication alarms
RDI Seconds	Number of seconds in which RDI was detected
MF-AIS Alarms	Number of Multi Frame Alarm Indication Signals detected
MF-AIS Seconds	Number of seconds in which MF-AIS was detected
MF-RDI Alarms	Number of Multi Frame Remote Defect Indication alarms detected
MF-RDI Seconds	Number of seconds in which MF-RDI was detected
FAS BIT Errors	Number of errored Frame Alignment Signal bits detected

Table 20 Interface test results (Continued)

Result	Description
FAS BIT Error Rate	Ratio of errored FAS bits to the total number of FAS bits received
FAS Word Errors	Number of errored FAS words detected
FAS Word Error Rate	Ratio of errored FAS words to the total number of frames received
MFAS Word Errors	Number of Multi Frame Alignment Signal Word Errors detected.
MFAS Word Error Rate	Ratio of errored MFAS words to the total number of multi-frames received
CRC Errors	Number of CRC Errors detected
CRC Error Rate	Ratio of errored CRC blocks to the total number of blocks received
FAS Sync Losses	Number of times FAS Sync was lost
MFAS Sync Losses	Number of times MFAS Sync was lost
CRC Sync Losses	Number of times CRC Sync was lost
E-bit Errors	Number of remote CRC errors
E-bit Error Rate	Ratio of E-bit Error blocks received to the total number of blocks received

Frame Data results

The Frame Data category lists results related to framing. Table 21 describes the results that appear in the Frame Data category.

Table 21 Frame Data results

Result	Description
FAS Word	The current Frame Alignment Signal word
NFAS Word	The current Non Frame Alignment Signal word
MFAS Word	The current Multi Frame Alignment Signal word
NMFAS Word	The current Non Multi Frame Alignment Signal word
A Bit	The current A Bit setting
Sa 4	The value of the Sa 4 bit over the previous 8 received frames
Sa 5	The value of the Sa 5 bit over the previous 8 received frames
Sa 6	The value of the Sa 6 bit over the previous 8 received frames
Sa 7	The value of the Sa 7 bit over the previous 8 received frames
Sa 8	The value of the Sa 8 bit over the previous 8 received frames

Timeslot results

The timeslot category lists the current bits, and signaling bits where applicable, for each timeslot.

BERT results

The BERT category lists results related to the bit error rate test pattern. Table 22 describes the results that appear in the BERT category.

Table 22 Test (BERT) results

Result	Description
LSS	Loss of Sequence Synchronization
Pattern Losses	Number of times synchronization is lost after pattern sync.
Pattern Slips	Number of pattern slips detected since start of test (PRBS patterns only)
LSS Seconds	Seconds in which LSS was detected
TSE	Test Sequence Error (bit error)
Bit Error Rate	Ratio of bit errors (TSEs) to received pattern data bits
Error Seconds	Number of seconds during which one or more pattern TSEs occurred since initial pattern synchronization
Error Free Seconds	Number of seconds during which no pattern TSEs are detected while pattern synchronization is present
% Error Free Seconds	Ratio of seconds during which no pattern bit errors were detected, to the total number of seconds while pattern synchronization is present

Pulse shape results

When you select the Pulse Shape result, the HST displays a graphical representation of the E1 pulse.

NOTE:

The Pulse Shape results will only be available if you purchased the HST3000-PS Pulse Shape option.

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.

Using the **Action** soft key, you can apply masks to measure conformance to G.703 specifications. Results are described in Table 23.

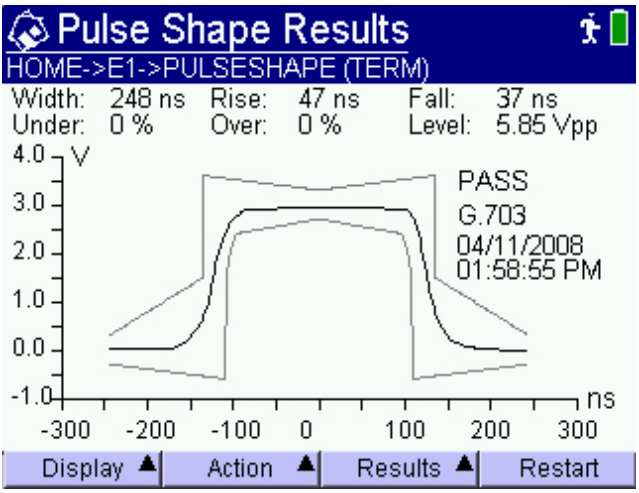


Figure 25 Pulse shape graph with mask

Table 23 describes the pulse shape results.

Table 23 Pulse shape results

Result	Description
Width	Pulse Width. This indicates the pulse width at the 50% point of the waveform.
Rise	Rise Time. This indicates the rise time of the leading edge between the 10% and 90% points of the waveform.
Fall	Fall Time. This indicates the fall time of the trailing edge between the 90% and 10% points of the waveform.
Under	Undershoot. The undershoot is the amount of the trailing edge that falls below the zero point of the waveform.
Over	Overshoot. The overshoot is the amount of the leading edge that rises above the 100% point of the waveform.
Level	Signal level measured in volts peak-peak (Vpp)
Pass/Fail	This result is only available when a mask is enabled. A “Pass” result indicates the pulse shape conforms to the mask specifications. A “Fail” result indicates the pulse shape does not conform to the mask specifications.

Performance results

The HST-3000 provides performance analysis results in accordance with the ITU-T G.821, G.826, and M.2100 standards. The following sections describe the results for each standard.

G.821 results

Table 24 describes the G.821 performance results.

Table 24 G.821 performance results

Result	Description
Verdict	"Accepted" indicates that the test results have met the ITU-T Rec. G.821 performance objectives. "Rejected" indicates that the test results did not meet the performance objectives.
AS	Available Seconds. A count of the number of Test Seconds which met the ITU-T Rec. G.821 definition of available time.
ASR	Available Seconds Ratio. The ratio of available seconds to the number of test seconds.
EFS	Error Free Seconds. The number of available seconds during which no relevant anomalies or defects are present.
EFSR	Error Free Seconds Ratio. The ratio of error free seconds, to the number of available seconds.
ES	Errored Seconds. The number of available seconds during which one or more relevant anomalies or defects were present.
ESR	Errored Seconds Ratio. The ratio of errored seconds to the number of available seconds.
SES	Severely Errored Seconds. Seconds during which one or more defects were present or the anomaly rate exceeded the ITU-T Rec. G.821 threshold.
SESR	Severely Errored Seconds Ratio. The ratio of severely errored seconds to the number of available seconds.
TS	Test Seconds. Total number of elapsed seconds since the start of the test.

Table 24 G.821 performance results (Continued)

Result	Description
UAS	Unavailable Seconds. A count of the number of test seconds which met the ITU-T Rec. G.821 definition of unavailable time.
UASR	Unavailable Seconds Ratio. The ratio of unavailable seconds to the number of test seconds.

G.826 ISM results

Table 24 describes the G.826 ISM (in service measurement) performance results.

Table 25 G.826 ISM performance results

Result	Description
NE Verdict	Near End Verdict. Test status for the receive direction. "Accepted" indicates that the test results have met the ITU-T Rec. G.826 performance objectives. "Rejected" indicates that the test results did not meet the performance objectives.
NE ES	Near End Errored Seconds. The number of available seconds during which one or more relevant anomalies or defects were present.
NE ESR	Near End Errored Seconds Ratio. The ratio errored seconds to the number of available seconds.
NE EFS	Near End Error Free Seconds. The number of available seconds during which no relevant anomalies or defects were present.
NE EFSR	Near End Error Free Seconds Ratio. The ratio of error free seconds to the number of available seconds.

Table 25 G.826 ISM performance results (Continued)

Result	Description
NE SES	Near End Severely Errored Seconds. Available seconds during which one or more defects were present or the anomaly block error rate exceeded the ITU-T Rec. G.826 threshold.
NE SESR	Near End Severely Errored Seconds Ratio. The ratio of Severely Errored Seconds to the number of Available Seconds.
NE UAS	Near End Unavailable Seconds. A count of the number of test seconds which met the ITU-T Rec. G.826 definition of unavailable time.
NE UASR	Near End Unavailable Seconds Ratio. The ratio of unavailable seconds to the number of test seconds.
NE FAS EB	Near End Frame Alignment Signal Errored Blocks. Number of FAS frames containing one or more FAS word errors.
NE FAS BBE	Near End FAS Background Block Errors. Number of errored blocks that did not result in a SES.
NE FAS BBER	Near End FAS Background Block Error Ratio. The ratio of FAS background block errors to the number of blocks received.
NE CRC EB	Near End CRC Errored Blocks. Number of blocks containing one or more errored bits as determined by evaluating the CRC-6 of the corresponding block.
NE CRC BBE	Near End CRC Background Block Error. Number of errored blocks that did not result in a SES.
NE CRC BBER	Near End CRC Background Block Error Ratio. The ratio of CRC background block errors to the number of blocks received.

Table 25 G.826 ISM performance results (Continued)

Result	Description
FE Verdict	Far End Verdict. Test status for the send direction. "Accepted" indicates that the test results have met the ITU-T Rec. G.826 performance objectives. "Rejected" indicates that the test results did not meet the performance objectives.
FE ES	Far End Errored Seconds. The number of available seconds during which one or more relevant anomalies or defects were present.
FE ESR	Far End Errored Seconds Ratio. The ratio of errored seconds to the number of available seconds.
FE EFS	Far End Error Free Seconds. The number of available seconds during which no relevant anomalies or defects were present.
FE EFSR	Far End Error Free Seconds Ratio. The ratio of error free seconds to the number of available seconds.
FE SES	Far End Severely Errored Seconds. Available seconds during which one or more defects were present or the anomaly block error rate exceeded the ITU-T Rec. G.826 threshold.
FE SESR	Near End Severely Errored Seconds Ratio. The ratio of severely errored seconds to the number of available seconds.
FE UAS	Far End Unavailable Seconds. A count of the number of Test Seconds which met the ITU-T Rec. G.826 definition of unavailable time.
FE UASR	Far End Unavailable Seconds Ratio. The ratio of unavailable seconds to the number of test seconds.

Table 25 G.826 ISM performance results (Continued)

Result	Description
FE CRC EB	Far End CRC Errored Blocks. Number of blocks containing one or more errored bits as determined by evaluating the E-BIT field of the corresponding block.
FE CRC BBE	Far End CRC Background Block Error. Number of errored blocks that are not SES.
FE CRC BBER	Far End CRC Background Block Error Ratio. The ratio of available blocks to the number of errored blocks.

G.826 OOS results

Table 24 describes the G.826 OOS (out of service) performance results in alphabetical order.

Table 26 G.826 OOS performance results

Result	Description
Verdict	“Accepted” indicates that the test results have met the ITU-T Rec. G.826 performance objectives. “Rejected” indicates that the test results did not meet the performance objectives.
ES	Errored Seconds. The number of available seconds during which one or more relevant anomalies or defects were present.
ESR	Errored Seconds Ratio. The ratio errored seconds to the number of available seconds.
EFS	Error Free Seconds. The number of available seconds during which no relevant anomalies or defects were present.
EFSR	Error Free Seconds Ratio. The ratio of error free seconds to the number of available seconds.

Table 26 G.826 OOS performance results (Continued)

Result	Description
SES	Severely Errored Seconds. Available seconds during which one or more defects were present or the anomaly block error rate exceeded the ITU-T Rec. G.826 threshold.
SESR	Severely Errored Seconds Ratio. The ratio of severely errored seconds to the number of available seconds.
UAS	Unavailable Seconds. A count of the number of test seconds which met the ITU-T Rec. G.826 definition of unavailable time.
UASR	Unavailable Seconds Ratio. The ratio of unavailable seconds to the number of test seconds.
FAS EB	Frame Alignment Signal Errored Blocks. Number of FAS frames containing one or more FAS word errors.
FAS BBE	FAS Background Block Errors. Number of errored blocks that did not result in a SES.
FAS BBER	FAS Background Block Error Ratio. The ratio of FAS background block errors to the number of blocks received.
CRC EB	CRC Errored Blocks. Number of blocks containing one or more errored bits as determined by evaluating the CRC-6 of the corresponding block.
CRC BBE	CRC Background Block Error. Number of errored blocks that did not result in a SES.
CRC BBER	CRC Background Block Error Ratio. The ratio of CRC background block errors to the number of blocks received.
BERT EB	BERT Errored Blocks. Number of blocks containing one or more errored bits.

Table 26 G.826 OOS performance results (Continued)

Result	Description
BERT BBE	BERT Background Block Error. Number of errored blocks that did not result in a SES.
BERT BBER	BERT Background Block Error Ratio. The ratio of available blocks to the number of blocks received.

M.2100 ISM results

Table 24 describes the M.2100 ISM (in service monitoring) performance results in alphabetical order.

Table 27 M.2100 ISM performance results

Result	Description
NE Verdict	Near End Verdict. Test status for the receive direction. “Accepted” indicates that the test results have met the M.2100 performance objectives. “Uncertain” indicates that the SES and ES counts fall within the S1 <= n <= S2 range. “Rejected” indicates that the test results did not meet the performance objectives.
NE ES	Near End Errored Seconds. The number of available seconds during which one or more relevant anomalies or defects were present.
NE ESR	Near End Errored Seconds Ratio. The ratio errored seconds to the number of available seconds.
NE EFS	Near End Error Free Seconds. The number of available seconds during which no relevant anomalies or defects were present.
NE EFSR	Near End Error Free Seconds Ratio. The ratio of error free seconds to the number of available seconds.

Table 27 M.2100 ISM performance results (Continued)

Result	Description
NE SES	Near End Severely Errored Seconds. Available seconds during which one or more defects were present or the anomaly block error rate exceeded the ITU-T Rec. M.2100 threshold.
NE SESR	Near End Severely Errored Seconds Ratio. The ratio of severely errored seconds to the number of available seconds.
NE UAS	Near End Unavailable Seconds. A count of the number of test seconds which met the ITU-T Rec. M.2100 definition of unavailable time.
NE UASR	Near End Unavailable Seconds Ratio. The ratio of unavailable seconds to the number of test seconds.
ES BISO	Bringing into Service Objective for Errored Seconds
ES S1	The S1 limit for Errored Seconds
ES S2	The S2 limit for Errored Seconds
SES BISO	Bringing into Service Objective for Severely Errored Seconds
SES S1	The S1 limit for Severely Errored Seconds.
SES S2	The S2 limit for Severely Errored Seconds.
FE Verdict	Far End Verdict. Test status for the send direction. “Accepted” indicates that the test results have met the M.2100 performance objectives. “Uncertain” indicates that the SES and ES counts fall within the S1 <= n <= S2 range. “Rejected” indicates that the test results did not meet the performance objectives.
FE ES	Far End Errored Seconds. The number of available seconds during which one or more relevant anomalies or defects were present.

Table 27 M.2100 ISM performance results (Continued)

Result	Description
FE ESR	Far End Errored Seconds Ratio. The ratio errored seconds to the number of available seconds.
FE EFS	Far End Error Free Seconds. The number of available seconds during which no relevant anomalies or defects were present.
FE EFSR	Far End Error Free Seconds Ratio. The ratio of error free seconds to the number of available seconds.
FE SES	Far End Severely Errored Seconds. Available seconds during which one or more defects were present or the anomaly block error rate exceeded the ITU-T Rec. M.2100 threshold.
FE SESR	Far End Severely Errored Seconds Ratio. The ratio of severely errored seconds to the number of available seconds.
FE UAS	Far End Unavailable Seconds. A count of the number of test seconds which met the ITU-T Rec. M.2100 definition of unavailable time.
FE UASR	Far End Unavailable Seconds Ratio. The ratio of unavailable seconds to the number of test seconds.

M.2100 OOS results

Table 24 describes the M.2100 OOS (out of service) performance results in alphabetical order.

Table 28 M.2100 OOS performance results

Result	Description
Verdict	“Accepted” indicates that the test results have met the M.2100 performance objectives. “Uncertain” indicates that the SES and ES counts fall within the S1 <= n <= S2 range. “Rejected” indicates that the test results did not meet the performance objectives.
ES	Errored Seconds. The number of available seconds during which one or more relevant anomalies or defects were present.
ESR	Errored Seconds Ratio. The ratio errored seconds to the number of available seconds.
EFS	Error Free Seconds. The number of available seconds during which no relevant anomalies or defects were present.
EFSR	Error Free Seconds Ratio. The ratio of error free seconds to the number of available seconds.
SES	Severely Errored Seconds. Available seconds during which one or more defects were present or the anomaly block error rate exceeded the ITU-T Rec. M.2100 threshold.
SESR	Severely Errored Seconds Ratio. The ratio of severely errored seconds to the number of available seconds.
UAS	Unavailable Seconds. A count of the number of test seconds which met the ITU-T Rec. M.2100 definition of unavailable time.
UASR	Unavailable Seconds Ratio. The ratio of unavailable seconds to the number of test seconds.

Table 28 M.2100 OOS performance results (Continued)

Result	Description
ES BISO	Bringing into Service Objective for Errored Seconds
ES S1	The S1 limit for Errored Seconds
ES S2	The S2 limit for Errored Seconds
SES BISO	Bringing into Service Objective for Severely Errored Seconds
SES S1	The S1 limit for Severely Errored Seconds.
SES S2	The S2 limit for Severely Errored Seconds.

Time results

The Time category lists the current date, time, and the amount of elapsed time since test restart.

NOTE:

You must have a test running for the Time results to update.

Table 29 describes the results that appear in the Time category.

Table 29 Time test results

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

Table 29 Time test results (Continued)

Result	Description
Time Remaining	Amount of time remaining until the test is complete.
% Complete	When timed testing is enabled, this result indicates test progress as a percentage.

Event Log results

This category provides a running log of significant events and errors. You can view the results in table form or histogram.

Saving and printing results

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

PRA Test Results

B

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

– “About test results” on page 144
– “Phone status” on page 144
– “Layer 2 results” on page 146
– “BERT results” on page 146
– “Interface results” on page 147
– “LED results” on page 149
– “Services or Supplementary services test results” on page 150
– “Monitor Summary results” on page 151
– “E1 Physical results” on page 151
– “2M View results” on page 152
– “Saving and printing results” on page 153

About test results

After you start a test, test results begin counting. Test results are separated into several categories. To view test results in other categories, press the **Display** soft key then select a category. The categories available vary depending on the application.

The following sections describe the test results for each of the categories.

Phone status

The Phone status displays information related to placing and receiving calls. This category is available when using the PRA Simulate test functions. Figure 26 provides an example of the Phone status screen.

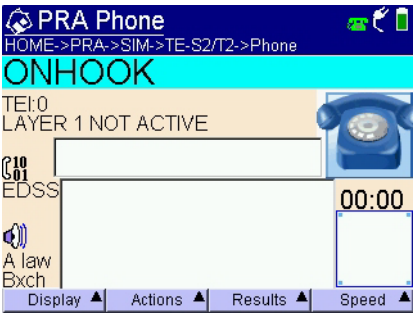


Figure 26 Phone status screen

Table 30 describes the information that appears on the Phone status screen.

Table 30 Phone status

Result	Description
Hook status	Indicates on hook or off hook, both in text and with the phone icon.
TEI	If on hook, provides the TEI of the last call. If off hook, provides the current TEI.
Cause Message	Provides a cause for call failure (for example, “NORMAL CLEARING”.)
Phone number	Indicates the phone number to be dialed.
Call Control	Indicates the current call control (for example, EDSS)
Codec	Indicates the current Codec (for example, A law)
Channel	Indicates the current channel (for example, B1 CH)
Mini monitor	Displays D channel messages
Elapsed time	Appears under the phone icon, indicates the elapsed time of the call. If the call duration continues beyond 59:59 (meaning, is more than an hour), the display changes from mm:ss to hh::mm (note the change from : to ::).
BERT status	Box in the lower right that indicates BERT status (empty in the example)

Layer 2 results

If you are using DASS2 protocol, the layer 2 category reports the status of layer 2 communication, per channel. The LED for the channel will light when the SABME, UA sequence has completed successfully.

BERT results

The BERT category lists results related to bit error rate tests. This category is available when using the PRA Simulate test functions, and is the only result category for the BERT macro and HIZBERT. Table 30 describes the results that appear in the BERT category.

Table 31 BERT results

Result	Description
BE	Bit Errors. Number of received bits that have a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
EFS	Error Free Seconds. Seconds during which pattern synchronization was maintained through the entire second and no bit error occurred.
ES	Errored Seconds. Counts test seconds where one or more bit errors occurred.
SES	Severely Errored Seconds.
BEC	Block Error Count.
US	Unavailable Seconds.
DM	Degraded Minutes.

Interface results

The Interface category lists results related to the physical interface. Table 32 describes the results that appear in the Interface category.

NOTE:

When you display the category in the D Channel Monitor application, results for the network side of the PRA interface appear in the Rx1/Tx1 column; results for the customer side of the PRA interface appear in the Rx2/Tx2 column.

Table 32 Interface test results

Result	Description
E1 Signal/Frame	Displays the current physical layer state.
LOS/LOF Alarms	Count of the times loss of signal or loss of framing occurred.
LOS/LOF Seconds	Total number of test seconds in which loss of signal was detected or loss of framing occurred.
RDI/AIS/E-Bit Alarms	Value of the activation, deactivation, and alarm indication overhead bits.
E-Bit Count	Number of remote CRC errors.
RDI/AIS Alarm Seconds	Number of test seconds during which the RDI or AIS condition has been detected.
CRC Alarms/Alarm Seconds	Count of the CRC alarms and the total number of test seconds in which a CRC occurred.
Rx Frequency	The signal frequency of the received signal.
Rx Delta ppm	Rx frequency deviation, displayed in ppm
Rx Freq Max ppm	The maximum Rx signal frequency that has been received since the beginning of the test.

Table 32 Interface test results (Continued)

Result	Description
Bit Slips	The number of bit slips (±) counted when the test signal slips from the reference signal after both signals are present simultaneously. Counts from 0 to + or - 255, and then rolls over to 0. Resets to 0 if signal present is lost on the analyzed circuit or on the reference circuit. A positive results indicates that the analyzed circuit is faster than the reference circuit.
Max Pos Wander	The maximum wander in the positive direction, from the test signal to the reference signal.
Max Neg Wander	The maximum wander in the positive direction, from the test signal to the reference signal.
FAS Word	The current Frame Alignment Signal word.
MFAS Word	The current Multi Frame Alignment Signal word
Sa6 Sequence	The value of the Sa 6 bit over the previous 8 received frames.
Frame Slips	Number of framing slips detected since start of test.
L2	Layer 2 status message.

LED results

The LED category shows the current and historical status for alarms. The current LEDs are on the right and history LEDs are on the left. This category is available in the Phone emulate test function.

Table 33 describes the results that appear in the LED category.

Table 33 LED results

Result	Description
L1	Indicates layer 1 signal detection.
L2	Indicates layer 2 signal detection (a correct response to a SABME message on TEI 0).
LOS	Loss of Signal alarm indication.
CRC	Indicates a CRC error.
LOF	Indicates a Loss of Frame alarm
RDI	Indicates a Remote Defect Indication alarm.
AIS	Indicates an Alarm Indication Signal has been detected.
E-Bit	Indicated the correct presence of E-bit in the frame.
Loop	Indicates a loopback is present.
LSIG	Indicates the Layer 1 signal is above 31dB in strength.

Services or Supplementary services test results

The Services and Supplementary services tests allows you to test the availability of services by placing a call with each call type. Results will be indicated by a check mark (pass) or a “x” (fail) next to each type. The test is considered as passed if a SETUP_ACK, ALERTING or CONNECT message is received.

B channel test results

Table 34 describes the results for the B channel tests.

Table 34 B channel test results

Result	Description
	Call in progress
IN	Configuration of the channel is IN.
OUT	Configuration of the channel is OUT.
IN OUT	Configuration of the channel is IN/OUT.
	Calls barred.
---	Channel not in use.
Pass/Fail	Reports the result of the BER test. The test fails if the result is any number except zero (0).

Tracer results

The Tracer category displays D Channel Decode messages. You can scroll through the messages using the arrow keypad. For an overview on interpreting decode messages, see "Interpreting D channel decode messages" on page 106.

Monitor Summary results

The Summary results provides a graphical indication of the Sync and Frame LEDs in each direction: Rx1/Tx1 (to CO) and Rx2/Tx2 (to CPE). This category is available in the D Monitor and D Monitor with PC test functions.

E1 Physical results

The E1 Physical results provide statistics related to the physical layer. Table 35 describes the results that appear in the E1 physical category.

Table 35 E1 Physical results

Result	Description
Signal Level	The signal level for each side of the circuit (Tx/Rx1 is network side and Tx/Rx2 is the customer side).
Bit Slips	Number of bit slips (±) counted when the E1 test signal slips from the E1 reference signal after both signals are present simultaneously.
Frame Slips	Number of frame slips (absolute value) counted when the E1 test signal slips from the E1 reference signal after both signals are present simultaneously.
Input Frequency	The frequency of the received signal input.

Table 35 E1 Physical results (Continued)

Result	Description
Input Deviation	The frequency deviation of the input signal.
Input Level dB	The input signal level, in dB.

2M View results

The 2M View results provide layer 1 data for all time slots on the 2M circuit. It shows the RX data byte of each channel as well as whether a channel is receiving the IDLE byte. To change the view from Rx1/Tx1 to Rx2/Tx2, press the second soft key (View T2/T2 or VIew T1/R1).

ISDN View results

The ISDN View results provide a view of all time slots on the PRA circuit. It shows the call status and elapsed time for each channel. (This category is called DASS View if using DASS2 protocol.)

Use the **View** soft key to view show different statistics.

– **All channels** shows the call status and elapsed time per channel for all channels
– **Channels 1-16** shows the call status and elapsed time per channel for channels 1-16.
– **Channels 17-31**shows the call status and elapsed time per channel for channels 17-31

- **Single channel** shows the following:
  - Channel State and elapsed time of current call, if applicable
  - Calls Attempted
  - Calls Completed
  - Calls not completed
  - Calls connected %
  - Calls not connected %
  - Min call duration
  - Max call duration
  - Avg Call duration
- **Usage** shows the channel usage percentages.

Saving and printing results

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

BERT Patterns, Defects, Anomalies, and Messages

C

This appendix describes the available BERT patterns, errors, and alarms you can use when performing a test. Topics discussed in this appendix include the following:

– “BERT patterns” on page 156
– “Defects” on page 158
– “Anomalies” on page 158
– “Q.931 Cause Codes” on page 159

BERT patterns

Table 36 describes the available BERT patterns.

Table 36 E1 BERT patterns

Pattern	Description
All Ones	Provides a fixed test pattern of all ones (AMI pulses). It can be used as an AIS in unframed circuits, a keep alive signal, or an idle code. This pattern is required to accurately measure the E1 signal power in dBnom.
All Zeros	Provides a fixed test pattern of all ones. The Line Code should be set for HDB3 when sending the All Zeros pattern or the network will lose timing. This pattern can be transmitted framed or unframed.
1:1	A one followed by a zero, the minimum stress on clock recovery circuits.
1:3	A one followed by 3 zeros.
1:4	A one followed by 4 zeros.
1:7	A one followed by 7 zeroes. Stresses the minimum ones density requirement for E1 circuits using AMI coding. This pattern is used to test timing clock recovery and can be transmitted framed and unframed.
QRSS	Simulates live E1 data. E1 QRSS is a modified 2^{20}-1 pseudorandom pattern that allows a maximum of 15 sequential zeros and 20 sequential ones. 2^{20}-1 pseudorandom pattern with 14-zero suppression.
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
63	Selects the 2^{6} -1 pseudorandom pattern, which generates a maximum of 5 sequential 0s and 6 sequential 1s.

Table 36 E1 BERT patterns (Continued)

Pattern	Description
511	Selects the 2^9 -1 pseudorandom pattern, which generates a maximum of 8 sequential 0s and 9 sequential 1s.
2047	Simulates live E1 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 0s and 11 sequential 1s.
Live	Used in monitor mode to avoid false “errors” when the monitored circuit contains live traffic rather than BERT patterns.
2^15-1 ITU	Selects the 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential 0s and 15 sequential 1s. Simulates live data for 56 kbit/s to 2 Mbit/s circuits. This is the default pattern for E1.
2^15-1 INV ITU	Selects the inverted 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential 1s and 15 sequential 0s.
2^20-1	Selects the 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential 0s and 20 sequential 1s.
2^20-1INV	Selects the inverted 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential 1s and 20 sequential 0s.
2^23-1 ITU	Selects the 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential 0s and 23 sequential 1s.
2^23-1 INV ITU	Selects the inverted 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential 1s and 23 sequential 0s.
QBF	The Quick Brown Fox message.
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 bytes long.

Defects

Table 37 lists the defects you can insert.

Table 37 Defects

Defect	Description
LOS	Loss of signal
LOF	Loss of framing
AIS	Alarm indication signal
RDI	Remote defect indication
MF-AIS	Multi frame AIS
MF-RDI	Multi frame RDI

Anomalies

Table 38 lists the anomalies you can insert.

Table 38 Anomalies

Anomaly	Description
TSE	Test Sequence Errors (bit error)
Pattern Slip	One or more bits of the test pattern are deleted or repeated
Code Error	Violation of the selected encoding method
CRC Error	Cyclical redundancy check error
FAS Errors	Frame alignment signal error
MFAS Error	Multi frame alignment signal error
E-bit Error	Remote CRC errors

Q.931 Cause Codes

Cause codes indicating the reason a call is disconnected are displayed on the phone screen.

For each disconnected call, the D Channel Decode Results screen displays the following cause value information in either the `DISCONNECT` or `RELEASE` message:

- A location code, indicating where the disconnect originated (for example, on a private network or a transit network).
- A class code, indicating the type of disconnect (for example, due to a protocol error).
- The cause value issued by the ISDN Network. This value corresponds to a Q.931 cause code (see the cause codes listed in Table 39 on page 160).
- An abbreviated description indicating the reason the call was disconnected.

The Phone screen simply provides the cause value and an abbreviated description of the cause of the disconnect.

NOTE:

The cause codes listed in Table 39 on page 160 do not appear on the D Channel Decode Results or Phone screens. The codes correspond to those listed in the International Telecommunications Union (ITU) Q.931 standards.

Table 39 lists the cause codes for ISDN PRA calls.

Table 39 Cause Codes

Cause Code	Cause Message	Description
0	UNKNOWN CAUSE VALUE	
1	UNASSIGNED NUM	Unassigned Number
2	NO ROUTE TO NETWORK	No route to specified network
3	NO ROUTE TO DESTINATION	No route to destination
6	CHAN UNACCEPTABLE	Channel unacceptable
7	CALL AWARDED	Call awarded delivered in est. ch.
16	NORMAL CLEARING	Normal Clearing
17	USER BUSY	User busy
18	NO USER RESPONSE	No User Response
19	ALERTING NO ANSWER	User alerting no answer
21	CALL REJECTED	Call Rejected
22	NUMBER CHANGED	Number changed
26	NON SELECTED CLR	Non-selected user clearing
27	DEST OUT OF ORDER	Destination out of order
28	INVALID NUMBER FORMAT	Invalid Number Format
29	REQ FACILITY REJ	Requested facility rejected
30	RSP TO STAT ENQ	Response to STATUS ENQuiry
31	NORM UNSPECIFIED	Normal Unspecified
34	NO CHAN AVAILABLE	No channel available
35	QUEUED	Queued
38	NETWORK OUT OF ORDER	Network out of order
41	TEMPORARY FAILURE	Temporary failure

Table 39 Cause Codes (Continued)

Cause Code	Cause Message	Description
42	NETWORK CONGESTED	Network congested
43	INFO DISCARDED	Access information discarded
44	CHAN NOT AVAILABLE	Requested channel not available
47	RESOURCE UNAVAILABLE	Resources unavailable/unspecified
49	QUAL SVC UNAVAILABLE	Quality of service unavailable
50	FAC NOT SUBSCRIBED	Requested facility not subscribed
52	OUT CALLS BARRED	Outgoing calls barred
54	IN CALLS BARRED	Incoming calls barred
57	BEARCAP NOT AUTHORIZED	Bearer capability not authorized
58	BEARCAP NOT AVAILABLE	Bearer capability not presently available
63	SERVC NOT AVAILABLE	Service or option not available
65	BEARSVC NOT IMPLEMENTED	Bearer service not implemented
66	CHNTYPE NOT IMPLEMENTED	Channel type not implemented
69	REQ FAC NOT IMPLEMENTED	Requested facility not implemented
70	RES DIGITAL ONLY	Only restricted dig. info. bearer
79	SERVICE NOT IMPLEMENTED	Service/option not implemented unspecified
81	INVALID CALL REF	Invalid Call Reference value
82	CHAN NOT EXIST	Identified channel does not exist
83	NO CALL ID	No call ID
84	CALL ID IN USE	Call ID in use
85	NO CALL SUSPEND	No call suspend
86	CALL CLEARED	Call cleared

Table 39 Cause Codes (Continued)

Cause Code	Cause Message	Description
88	INCOMPAT DEST	Incompatible destination
91	NET NOT EXIST	Transit network does not exist
95	INVALID MSG	Invalid message unspecified
96	INFOELEMENT MISS	Mandatory information element missing
97	MSG TYPE NON-EXIST	Message type nonexistent or not implemented
98	MSG NOT COMPAT	Message not compatible with call state
99	ELEMENT NONEXIST	Info element nonexistent or not implemented
100	INVAL INFO	Info element not valid
101	MSG NOT COMPAT	Message not compatible with call state
102	RECOV ON TMR EXP	Recover on timer expire
111	PROTOCOL ERROR	Protocol error unspecified
127	INTERWORKING	Interworking unspecified
200	LAYER 1 NOT ACTIVE	Layer 1 not active
201	TEI ERROR	TEI Error
202	LAYER 2 NOT ACTIVE	Layer 2 not active
203	NO RESP SABME	No response to SABME
204	DM RECEIVED	Received a DM
205	DISC RECEIVED	Disconnect received
206	NO RESPONSE TO SETUP	No response to setup

Call acceptance rules

D

This appendix lists the call acceptance or call rejection rules according to the protocol selected. Topics listed in this appendix include the following:

– “1TR6 and TN-1R6 protocol” on page 164
– “Other protocols” on page 164

1TR6 and TN-1R6 protocol

Table 40 provides the call acceptance rules for the 1TR6 and TN-1R6 protocols.

If the last number is compatible with the installed EAZ (extension) and the condition for global call rejection (see the following section), the incoming call is accepted. It is assumed that the address of the incoming call is compatible with the installed address. (The validity of the received address is not checked.)

Table 40 Call acceptance rules for 1TR6 and TN-1R6 protocols

RejGlob	EAZ	Last number of the received address	Call management
Don't care	Don't care	= EAZ	Call accepted
Don't care	# 0	# EAZ and # 0	Call rejected
No	# 0	= 0	Call accepted
Yes	# 0	= 0	Call rejected
No	= 0	# 0	Call accepted
Yes	= 0	# 0	Call rejected

Other protocols

The following tables provide examples of accepted and rejected call scenarios for protocols other than 1TR6 and TN-1R6.

The field “Sub-add call screening” (on the Call Settings configuration menu) allows the user to test the called address and sub-address on incoming calls. If this field is set to “Yes,” the called address and sub-address are tested before accepting the call.

Table 41 lists examples of accepted calls.

Table 41 Accepted call examples

Sub-add call screening	Own address	Received address	Own sub-address	Received sub-address	Call management
No	Indifferent	Indifferent	Indifferent	Indifferent	Call accepted
Yes	Empty	Indifferent	Empty	Indifferent	Call accepted
Yes	X	X	A	A	Call accepted
Yes	X	X	Empty	Indifferent	Call accepted
Yes	Empty	Indifferent	A	A	Call accepted

Table 42 lists examples of rejected calls due to the address.

Table 42 Call rejection due to the address

Sub-add call screening	Own address	Received address	Own sub-address	Received sub-address	Call management
Yes	X	Empty	Indifferent	Indifferent	Call rejected
Yes	X	Y (not equal to X)	Indifferent	Indifferent	Call rejected

Table 43 lists examples of rejected calls due to the sub-address.

Table 43 Call rejection due to the sub-address

Sub-add call screening	Own address	Received address	Own sub-address	Received sub-address	Call management
Yes	Indifferent	Indifferent	A	B (not equal to A)	Call rejected
Yes	Indifferent	Indifferent	A	Empty	Call rejected

Protocol Services

E

This appendix lists the services offered according to the protocol selected. Services listed in this appendix include the following:

– “Q.931, EDSS-1, Q.SIG, TPH1962, Telenokia, Televerket, NTT, and CorNet” on page 168
– “VN3” on page 169
– “VN4” on page 169
– “VN6” on page 170
– “SwissNet-3” on page 171
– “1TR6 and TN-1R6” on page 172
– “1TR67” on page 173

Q.931, EDSS-1, Q.SIG, TPH1962, Telenokia, Televerket, NTT, and CorNet

Table 44 lists the services available for the Q.931, EDSS-1, Q.SIG, CorNet-T®, and CorNet-NQ® protocols.

Table 44 Q.931, EDSS-1, Q.SIG, and CorNet services

Service	Bearer Capability (BC)	Low Layer Compatibility (LLC)	High Layer Compatibility (HLC)
Speech	0x80, 0x90, 0xA3	-	0x91, 0x81
3.1 KHz	0x90, 0x90; 0xA3	-	0x91, 0x81
Data	0x88, 0x90	-	0x91, 0xC1
Fax G4	0x88, 0X90	-	0x91, 0xA1
Teletex	0x88, 0X90	-	0x91, 0xB1
Videotex	0x88, 0X90	-	0x91, 0xB2
Speech BC	0x80, 0x90, 0xA3	-	-
Data BC	0x88, 0x90	-	-
Data 56Kb	0x88, 0x90; 0x21; 0x8F	-	-
Fax 2/3	0x90, 0X90, 0xA3	-	0x91, 0x84

VN3

Table 45 lists the services available for the VN3 protocol.

Table 45 VN3 services

Service	BC	LLC	HLC
Speech	0x80, 0x90, 0xA3	-	0x91, 0x81
3.1 kHz	0x90, 0x90; 0xA3	-	0x91, 0x81
Data	0x88, 0x90	-	0xC1, 0xFF
Fax G4	0x88, 0X90	-	0x91, 0xA1
Teletex	0x88, 0X90	-	0x91, 0xB1
Videotex	0x88, 0X90	-	0x91, 0xB2
Speech BC	0x80, 0x90, 0xA3	-	-
Data BC	0x88, 0x90	-	-
Data 56Kb	0x88, 0x90; 0x21; 0x8F	-	-

VN4

Table 46 lists the services available for the VN4 protocol.

Table 46 VN4 services

Service	BC	LLC	HLC
Speech	0x80, 0x90, 0xA3	-	0x91, 0x81
3.1 KHz	0x90, 0x90; 0xA3	-	0x91, 0x81
Data	0x88, 0x90	-	
Fax G4	0x88, 0X90	-	0x91, 0xA1
Teletex	0x88, 0X90	-	0x91, 0xB1
Videotex	0x88, 0X90	-	0x91, 0xB2

Table 46 VN4 services (Continued)

Service	BC	LLC	HLC
Speech BC	0x80, 0x90, 0xA3	-	-
Data 56Kb	0x88, 0x90; 0x21; 0x8F	-	-

VN6

Table 47 lists the services available for the VN6 protocol.

Table 47 VN6 services

Service	BC	LLC	HLC
Speech BC	0x80 0x90 0xA3	-	-
3.1 KHz BC	0x90 0x90 0xA3	-	-
7 K Audio	0x91 0x90 0xA5 (H.221, H.242)	-	-
Data BC	0x88 0x90	-	-
Speech	0x80 0x90 0xA3	-	0x91 0x81
Fax G3	0x90 0x90 0xA3	-	0x91 0x84
Fax G4	0x88 0x90	-	0x91 0xA1
Teletex	0x88 0x90	-	0x91 0xB1
Videotex	0x88 0x90	-	0x91 0xB2
Video conference	0x88 0x90	-	0x91 0xE1

SwissNet-3

Table 48 lists the services available for the SwissNet-3 protocol.

Table 48 SwissNet-3 services

Service	BC	LLC	HLC
Speech	0x80, 0x90, 0xA3	-	0x91, 0x81
3.1 KHz	0x90, 0x90; 0xA3	-	0x91, 0x81
Data	0x88, 0x90	-	0x91, 0xC1
Fax G3	0x90, 0x90; 0xA3	-	0x91, 0x84
Fax G4	0x88, 0x90	-	0x91, 0xA1
Teletex	0x88, 0X90	-	0x91, 0xB1
Videotex	0x88, 0X90	-	0x91, 0xB2
Speech BC	0x80, 0x90, 0xA3	-	-
Data BC	0x88, 0x90	-	-
Data 56Kb	0x88, 0x90; 0x21; 0x8F	-	-
7 kHz NFB	0x91, 0x90, 0xA5	-	0x91, 0x81
Vtel NFB	0x91, 0x90, 0xA5	-	0x91, 0x60, 0x81
3.1 KHz PI	0x90, 0x90; 0xA3	-	-

1TR6 and TN-1R6

Table 49 lists the services available for the 1TR6 and TN-1R6 protocols.

Table 49 1TR6 and TN-1R6 services

Service	Service byte (hex)[1]	Additional info byte (hex)[1]
Speech	01	02
3.1 KHz	01	01
Data	07	00
Ton 3.1 KHz	10	01
Fax G3	02	02
Fax G4	04	00
Teletex	09	00
Btx	05	00
X21 Uc 19	03	0C
X25 Uc 13	08	05
Mixed	0A	00
Remote	0D	00
Graph	E0	00
Bild	10	03

1. The service byte and additional info byte combine to form the service indicator (SIN)

1TR67

Table 50 lists the services available for the 1TR67 protocol.

Table 50 1TR67 services

Service	BC	LLC	HLC
3.1 K tel	0x80, 0x90; 0xA3	-	0x91, 0x81
Speech	0x80, 0x90, 0xA3	-	-
D 64K	0x88, 0x90;	-	-
3.1k aud	0x90, 0x90, 0xA3	-	-
7k audio	0x91, 0x90; 0xA5	-	-
X.25B-K	0x88, 0xC0; 0xC6, 0xE6	-	-
7k tele	0x91, 0x90; 0xA5	-	0x91, 0x81
Fax 2/3	0x90, 0x90; 0xA3	-	0x91, 0x84
Fax 4	0x88, 0x90	0x88, 0x90; 0xD1, 0xE7	0x91, 0xA1
Btx 64k	0x88, 0x90	0x88, 0x90; 0xD1, 0xEA	-
Btx neu	0x88, 0x90	0x88, 0x90; 0xD1, 0xE7	91, B2
X.21 Uc19	0x88, 0x90	0x88, 0x90; 0x21, 0x90	0x91, 0xB1
Tele 64	0x88, 0x90	0x88, 0x90; 0xD1, 0xE7	0x91, 0xB1
Bild 3.1	0x91, 0x90, 0xA5	-	0x91, 0x60, 0x81
Bild	0x88, 0x90, 0xA5		0x91, 0x60, 0x82

Specifications

F

This appendix contains specifications for the E1 testing option. Topics discussed in this appendix include the following:

– “Physical interface specifications” on page 176
– “E1 circuit testing specifications” on page 179
– “Pulse shape specifications” on page 180

Physical interface specifications

E1 Transmitters

The transmitters operate as per ITU-G.703. Table 51 describes the transmitter specifications.

Table 51 Transmitter specifications

Parameter	Specification
Outputs	2 x balanced RJ-48 jacks Impedance 120 ohms Unbalanced/ 75 ohms via adapter cables
Bit Rate	Range: 2048 MHz ± 512 Hz Accuracy: ±3 ppm, +1 ppm per year aging Resolution: 1 Hz
Line Code	HDB3 or AMI
Frequency Offset	+/-100 ppm in 1 ppm intervals
Clock Source[1]	Internal, Recovered from RX 1 or RX 2, External 2M Reference Clock (via optional cable)

1. Internal 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.

E1 Receivers

The receivers operate as per ITU-G.703. Table 52 describes the receiver specifications.

Table 52 Receiver specifications

Parameter	Specification
Inputs	2 x balanced RJ-48 jacks Impedance 120 ohms or bridged (HI-Z) Unbalanced/ 75 ohms via adapter cables

Table 52 Receiver specifications (Continued)

Parameter	Specification
PMP Compensation	-20 to -31 dbB resistive gain
Bit Rate	Range: 2048 MHz ± 512 Hz Accuracy: ±3 ppm, +1 ppm per year aging Resolution: 1 Hz
Level Measure-ment	Range: +3 to -37 dBnom Accuracy (assumes All Ones pattern): +3 to -15 dBnom ± 1 dB -15 to -30 ± 2 dB -30 to -37 ± 3 dB Resolution: 0.01 dBnom
Slip Reference	Opposite RX, External 2M Reference Clock
External 2M Reference Clock	0.5 to 3 V square or sine wave, 2 MHz, unbalanced/ 75 ohms (at adapter cable input)

PRA pin-outs

Figure 27 through Figure 29 provide the pin-outs used when running the PRA application.

TE mode

In TE mode, the connector is wired as shown in Figure 27.

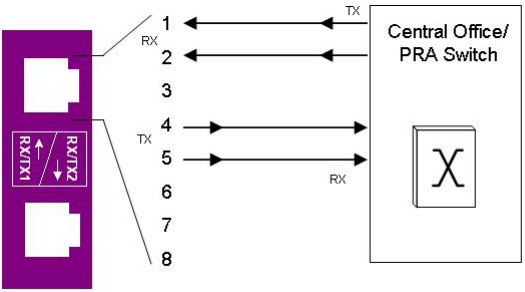


Figure 27 TE mode pin-outs

NT mode In NT mode, the connector is wired as shown in Figure 28.

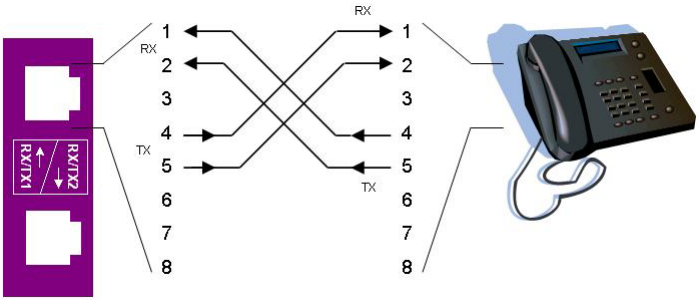


Figure 28 NT mode pin-outs

Monitor mode In Monitor mode, the connectors are wired as shown in Figure 29.

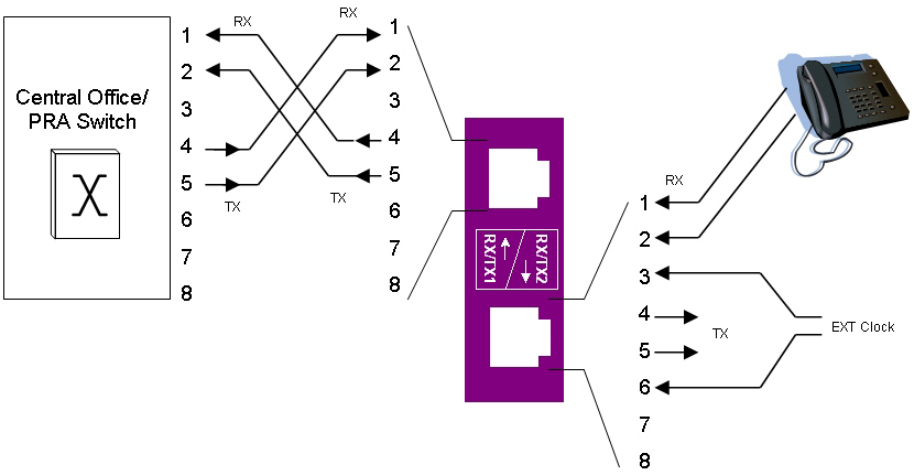


Figure 29 Monitor mode pin-outs

E1 circuit testing specifications

Table 53 describes the E1 circuit testing specifications.

Table 53 E1 circuit testing specifications

Parameter	Specification
General	Framed and unframed test signal generation Bulk, n x 64 kbit/s BERT G.821, G.826, M.2100 analysis Error and alarm and generation and analysis Round Trip Delay Signal Level and Frequency Audio Monitor Si, Sa, A-bit, and E-Bit (REBE) monitoring and generation
Test Modes	Terminate, Monitor, Drop and Insert, Line Loopback
Performance Measurement	G.821, G.826, M.2100
Test Patterns	2^6-1 (ITU), 2^9-1 (ITU), 2^11-1 (ITU), 2^15-1 (ITU & ITU INV), 2^20-1 (ITU & ITU INV), 2^23-1 (ITU & ITU INV), QRSS, QBF 1:1, 1:3, 1:4, 1:7 User Bit Patterns 3 to 32 bits User Byte Patterns 1 to 64 bytes Live Delay Auto (via Auto Configure)
Anomaly (Error) Injection	Bit (TSE): Single, rate, multiple Code, CRC, Pattern Slip, E-Bit (REBE): Single FAS: Single, 2, 3, 4 MFAS: Single, 2
Defect (Alarm) Generation	LOS, LOF, AIS, TS-16, AIS, RDI/FAS distant, MF AIS, MF RDI/MFAS distant

Table 53 E1 circuit testing specifications (Continued)

Parameter	Specification
Anomaly (Error) Counts	Bit (TSE), Code, FAS, MFAS, CRC, E-Bit
Frame Data	FAS, NFAS, MFAS words, A-Bit, Sa4, Sa5, Sa6, Sa7, Sa8
Signal Results	Signal loss (seconds), bit slips, RX level, TX and RX bit rate
BERT Results	Bit errors (TSE), bit error rate, errored seconds, error-free seconds, percentage error-free seconds, pattern slip, round trip delay, pattern loss second
Audio Monitor	From RX 1, RX 2, or RX 1 and RX 2
Round Trip Delay	Range: 0-10 s Resolution: 0.1 ms Accuracy: 125 µs
Result Categories	Summary, LED, Signal, Interface, Frame Data, Timeslots, BERT, Performance (G.821, G.826 ISM, G.826 OOS, M.2100 ISM, M.2100 OOS), Time, Event Log (Event Table, Event Histogram)

Pulse shape specifications

Table 54 describes the pulse shape specifications.

Table 54 Pulse shape specifications

Parameter	Specification
Results	Pulse Shape Graph G.703 mask: Pass/Fail
Pulse Width	Resolution: 2.75 ns
Rise Time	Resolution: 1 ns

Table 54 Pulse shape specifications (Continued)

Parameter	Specification
Fall Time	Resolution: 1 ns
Undershoot	Resolution: 1% of nominal level
Overshoot	Resolution: 1% of nominal level
Signal Level	In [V] peak-peak
Result Categories	Summary, LED, Signal, Interface, Frame Data, BERT, Pulse Shape, Time

Glossary

A

A bit — Remote (or distant) alarm indication.

AIS — Alarm Indication Signal. A continuous stream of unframed 1's 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 1s.

AS — Available Seconds.

ASR — Available Seconds Ratio.

B

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.

BBE — Background Block Error.

BBER — Background Block Error Ratio.

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.

Bridge — A high impedance tap into an E1 circuit (at a bridge point where no monitor point access is provided) that does not disrupt the existing communication line.

C

CAS — Channel Associated Signalling.

CRC — Cyclic Redundancy Check. A code word used to confirm that a bit stream contains valid data.

E

E-Bit error — Remote CRC (REBE).

EB — Errored Blocks.

EFS — Error Free Seconds.

EFSR — Error Free Seconds Ratio.

ES — Errored Seconds. A second during which at least one anomaly or defect occurred.

ESR — Errored Seconds Ratio.

F

FAS — Frame Alignment Signal. Fixed seven-bit sequence transmitted in timeslot 0 of alternating E1 frames.

G

G.703 — ITU-T specification for 2048 kbit/s (Europe) and 1544 kbit/s (US) transmissions.

G.704 — ITU-T specification describing framing structures for 2 Mbit/s multiplexer equipment.

G.821 — ITU-T specification that defines performance criteria for ISDN circuits.

H

HDB3 — High Density Bipolar 3. A bipolar coding method that does not allow more than two consecutive zeros.

HI-Z — High Impedance termination (>2.5kΩ) which may be used with the G.703 interface.

Hz — Hertz (cycles per second).

I

ITU-T — International Telecommunication Union - Telecommunication Standardization Sector. Formerly CCITT.

L

LCN — Logical Channel Number.

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 128 (AMI) or 10 (HDB3) pulse counts.

LSS — Loss of Sequence Synchronization.

N

NFAS — Non Frame Alignment Signal. Bit sequence transmitted in timeslot 0 of alternating E1 frames. The NFAS word contains the Si, Sa, and A bits.

NMFAS — Non Multiframe Alignment Signal. Four-bit XYXX sequence transmitted in timeslot 16 of PCM30 framed E1 signals. The NMFAS “Y” bit indicates MFAS-RDI when set to 1. The “X” bits are reserved and normally set to 1.

M

MFAS — Multiframe Alignment Signal. Four-bit zero sequence transmitted in timeslot 16 of PCM30 framed E1 signals. The MFAS marks the start of the signaling multiframe.

P

PCM — Pulse Code Modulation.

PCM30 — Framing format with 30 channels where CAS signalling is used in timeslot 16.

PCM30C — Framing format with 30 channels where CAS signalling is used in timeslot 16 and CRC error checking is enabled.

PCM31 — Framing format with 31 channels.

PCM31C — Framing format with 31 channels and CRC error checking is enabled.

PDH — Plesiosynchronous Digital Hierarchy.

PMP — Protected Monitor Point. A PMP provides a digital interface at which it is possible to monitor the transmitted digital signal without impairing it.

PRBS — Pseudo Random Binary Sequence.

Q

QRSS — Quasi-Random Signal Sequence.

R

RDI — Remote defect indication. A terminal will transmit an RDI when it loses its incoming signal.

Rx — Receiver or Received. Also used to specify input.

S

SES — Severely Errored Seconds.

SESR — Severely Errored Seconds Ratio.

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

T

TS — Total Seconds.

Tx — Transmitter or Transmitted. Also used to specify output.

TSE — Test Sequence Error. Same as a bit error.

U

UAS — Unavailable Seconds.

UASR — Unavailable Seconds Ratio.

Index

A

About testing
  E1 12
  ISDN PRA 44

Accepting calls 78

Alarm
  available alarms 158
  LED 17, 46

Assistance, technical xiv

Audio headset connector 49

Auto configure 13, 18, 28, 34, 40

B

B channel
  select for calling 56
  test 92–94

Base unit
  defined 183
  user's guide xiii

Batt LED 17, 46

BERT
  E1 27–33
  macro 87–88
  patterns 156
  results 146
  specifying settings 58–60
  test, during call 81
  testing the physical layer 85–86

C

Cabling diagrams
  end-to-end testing 33
  monitor 25
  timing slips 26

Calls
  accepting 78, 164–166
  call reference numbers 108
  disconnecting 79
  ignoring 79
  interpreting D channel decode text 106
  placing 76–77
  receiving 78
  rejecting 79, 164–166
  transmitting DTMF tones 82

Cause codes, described 159

Clearing the decode buffer 98

Compliance information xiii

Configuration menus 52–63

Configure, automatic 13, 18, 28, 34, 40

D

D channel decode messages
call reference numbers 108
capturing to text file 97
clearing the message buffer 98
determining source of 108
interpreting 106
LAPD supervisory frames 111
LAPD unnumbered frames 109
Q.931 frames 112
sample message 107
viewing and navigating 97

D&I *See* Drop and insert

DASS
ET emulation 49
PBX emulation 48

Data LED 16, 45

Decode text
call reference numbers 108
capturing messages to text file 97
clearing the message buffer 98
determining source of 108
interpreting 106
LAPD supervisory frame decodes 111
LAPD unnumbered frame decodes 109
Q.931 decodes 112
sample message 107
viewing and navigating 97

Deleting a speed dial entry 84

Deleting a test configuration 68

Disconnecting calls 79

Documentation
base unit user's guide xiii
E1 testing option user's guide xiii

Drop and insert
mode description 14
testing 35–38

DTMF tones, transmitting 82

E

E1 features 12

Emulation modes, illustrated 47–49

Error LED 16, 46

Errors 158
BERT analysis, physical layer 85
inserting CRC and FEBE 85

ET emulation 49

F

Features
E1 12
ISDN PRA 44

Frame relay software option 2

H

Headset connector 49

Help, technical xiv

HST emulation modes 47–49

I

Ignoring calls 79

Interface connectors 3

Interface results 147

Interpreting D channel decode messages 106

ISDN PRA
D channel decode messages 106
features 44
status LEDs 45

L

LAPD frames
about decode messages 108
interpreting decodes 106
supervisory messages 111
unnumbered messages 109

LED 16
alarm 46
batt 46
data 45
error 46
ISDN PRA 45

lpbk 46
results 149
sync 45

Line 1 Rx 3

Line 1 Tx 3

Line 2 Rx 3

Line 2 Tx 3

Line loopback
mode description 15
testing 38

Loading a test configuration 67

Loopbacks 82, 86

LpBk LED 17, 46

M

Managing test configurations
deleting 68
loading 67
overwriting 67
storing 66

Messages, D channel decode
call reference numbers 108
capturing to text file 97
clearing the buffer 98
determining source of 108
interpreting 106
LAPD supervisory frames 111
LAPD unnumbered frames 109
Q.931 messages 112
sample 107
viewing and navigating 97

Monitor 18–25
mode description 14
test access 25

Monitoring at the U interface 101–102

Multi-channel BERT 81

N

Navigating decode text 97

O

Operating modes 13

Overwriting test configuration 67

P

PBX emulation, DASS 48

Phone status results 144

Placing calls 76–77

Pulse shape analysis 34–35

Pulse shape software option 2

Q

Q.931 frames
about decode messages 112
cause codes 159
decode message descriptions 112
information elements 112
interpreting decodes 106
sample message 107

R

Receiving calls 78

Rejecting calls 79

Results
BERT 128, 146
event log 142
frame data 127
Interface 147
interface 125
LED 122, 149
performance
G.821 131
G.826 ISM 132
G.826 OOS 135
M2100 ISM 137
M2100 OOS 140
Phone status 144
pulse shape 129
saving and printing 142, 153

signal 123
summary 120, 151
time 141
timeslot 127

S

Safety information xiii

Speed dials, managing 83–84

Status LEDs 16, 45

Storing test configurations 66

Summary results 151

Supervisory frames
decode message descriptions 111
interpreting decodes 106

Support, technical xiv

Sync LED 16, 45

T

Technical assistance xiv

Terminate
mode description 13
testing 27–33

Test configurations 66–68
deleting 68
loading 67
overwriting 67
storing 66

Test settings, specifying 52–63

Testing
about E1 12
about ISDN PRA 44
drop and insert 35–38
ISDN PRA 43
line loopback 38
line loopback mode 15
managing configurations 66–68
modes 13
monitor mode 14
monitoring a channel 18–25
monitoring at U interface 101–102
physical layer 85–86
placing calls 76–77
specifying test settings 52–63
test results 143–153
timing slips 25

Text file, capturing decodes to 97

Timed testing, monitor mode 22

Timing slips
cabling diagrams 26
testing 25

Transmitting DTMF tones 82

Troubleshooting 40, 105–117

U

Unnumbered frames
decode message descriptions 109
interpreting decodes 106

User documentation
base unit user's guide xiii
E1 testing option user's guide xiii

V

Viewing decode messages 97

Viewing test results 39

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