HST-3000

Data Communications Testing

User's Guide

JDSU

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Ordering information

This guide is a product of JDSU's Technical Information Development Department, issued as part of the HST-3000. The catalog number for a printed user's guide is ML-059101. The catalog number for a CD-ROM containing all HST-3000 user documentation is CML-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 Directive Compliance

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

This 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 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 returned is 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 the equipment to JDSU for appropriate disposal. If the equipment was imported by a reseller whose name or logo is marked on the equipment, then the owner should return the equipment directly to the reseller.

Instructions for returning waste equipment 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, contact JDSU's WEEE Program Management team at WEEE.EMEA@jdsu.com.

Contents

About This Guide

Topics discussed in this chapter include the following:

Purpose and scope

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

Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the HST-3000 Data Communications 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" can be used to refer to the HST-3000 family of products or 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.
- **Datacom** — Data Communications.

Datacom testing user's guide

The *HST-3000 Data Communications Testing User's Guide* is an application-oriented guide intended to help you use the HST to verify network connectivity and performance for a variety of data communication interfaces. The user's guide contains step-by-step instructions for performing data communications tests; Troubleshooting information; and descriptions of test results

The *HST-3000 Data Communications Testing User's Guide* should be used in conjunction with the *HST-3000 Base Unit User's Guide*.

Base unit user's guide

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

Safety and compliance information

Safety and compliance information are provided in the *HST Safety and Compliance Information* booklet included with the HST-3000 user documentation CD-ROM.

Technical assistance

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

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

Table 1 Technical assistance centers

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

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

Conventions

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

Table 2 Typographical conventions

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

Table 3 Keyboard and menu conventions

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

Table 4 Symbol conventions

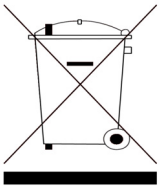
	This symbol represents a general hazard.
	This symbol represents a risk of electrical shock.
	This symbol represents a risk of explosion
	This symbol represents a Note indicating related information or tip.
	This symbol, located on the equipment or its packaging indicates that the equipment must not 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 Data Communications testing option. Topics discussed in this chapter include the following:

Overview of features

The HST-3000 with a Data Communications SIM provides the tools you need to turn up and maintain data services. The Data Communications option offers the following features and capabilities:

- End-to-End Testing—Using the HST-3000, you can analyze the performance of an entire digital link in both directions, allowing you to isolate problems to a specific direction.
- BER testing—Using the HST-3000, you can BER test a variety of data communication interfaces to verify error free performance and transmission by transmitting ANSI, ITU, and user programmable test patterns.
- Asynchronous timing— You can set up the HST-3000 to use asynchronous timing when testing the RS-232/V.24 standard.
- Synchronous timing—You can set up the HST-3000 to use synchronous timing, and then specify a valid clock source for the interface.
- Flow control—You can set up the HST-3000 to use out of band flow control by interpreting signals from selected leads on the HST-3000 and its link partner. You can also specify inband flow control by transmitting XON/XOFF characters.
- Round trip delay measurement—Using the HST-3000, you can transmit and loop back a Delay pattern, and then measure the time it takes to receive the pattern.
- Self Loop—Before you start testing, you can perform a self loop to validate the unit and the selected test interface on the HST-3000.
- User specified test intervals—You can set up the HST-3000 to run a test continuously, or to run a test for a specific timed interval lasting up to seven days.

Status LEDs

The six status LEDs are located on the front of the HST-3000, above the screen. Table 1 describes the status LEDs.

Table 1 Status LEDs

LED	Description
Sync	A two-color LED that reports the presence of a receive clock. – Solid green indicates a receive clock is present. – Solid red indicates a receive clock was present at some point in the past, but was lost. – If the Sync LED is not illuminated, no receive clock has been detected. The Sync LED does not illuminate when the HST is configured for asynchronous testing.
Data	A two-color LED that reports pattern synchronization status. – Solid green indicates pattern synchronization has been achieved. – Flashing green means Auto pattern is running. – Solid red indicates that the HST does not have pattern synchronization. – If the Data LED is not illuminated, no pattern synchronization has been detected. The Data LED does not illuminate when the HST is configured for asynchronous testing.
Error	An LED that reports error conditions. – Solid red indicates an error. – If the Error LED is not illuminated it means all summary results are OK.
Alarm	– This LED is not used in Datacom testing.
LpBk	– This LED is not used in Datacom testing.

Table 1 Status LEDs (Continued)

LED	Description
Batt	A three-color LED that indicates the battery status. – The LED is off when the battery has a useful charge. – Solid green indicates the AC adapter is plugged in. – Solid red indicates the battery is at 20 percent or below of full charge. – Flashing red indicates about five minutes of use remain. When this happens, the battery should be charged or replaced immediately. – Solid amber or flashing amber indicates the battery capacity indicator ("gas gauge") needs to be reset. **NOTE:** For information about charging the battery, changing batteries, and resetting the battery capacity indicator, see the *HST-3000 Base Unit User's Guide*.

Datacom connector

The HST-3000 Datacom SIM supports several interface standards using a universal connector. When the Datacom SIM is attached to the base unit, the connector is located on the unit's top panel. Use the connector and adaptor cables (see "Adaptor cables" on page 6) to connect the HST to the appropriate test interface. For pin assignments for the supported interface standards, see Appendix C on page 61.

WARNING:

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*.

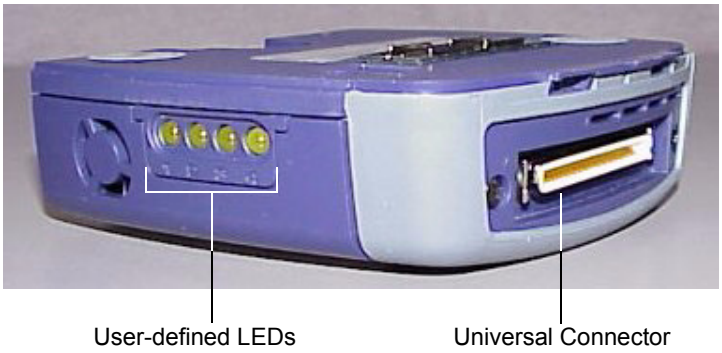


Figure 1 Datacom SIM

Adaptor cables

JDSU offers adaptor cables to connect the HST-3000 to the supported test interfaces. Different cables are available depending on the test mode (DTE/DCE emulation or monitor) and the interface you want to test. Emulation cables have yellow bands and monitor cables have blue bands. All adaptor cables are six feet long.

Table 2 on page 6 lists the available cables and part numbers.

NOTE:

To obtain adaptor cables, contact your local JDSU sales office or contact JDSU through the company web site, www.jdsu.com.

The adaptor cables listed in Table 2 are the same cables used with JDSU's FST-2230 product.

Table 2 Datacom adaptor cables

Interface Adaptor Cable	Acterna Part Number
DCE/DTE Emulation	
X.21 up to 2.048 MHz X.21 up to 10 MHz	CB-44390 CB-44391
RS-232/V.24 and EIA-530	CB-44385
V.35	CB-44389
RS-449/V.36	CB-44388
Monitor (Y-cables)	
X.21 up to 2.048 MHz X.21 up to 10 MHz	CB-44346 CB-44345
RS-232/V.24 and EIA-530	CB-44348
V.35	CB-44341
RS-449/V.36	CB-44347

User-defined LEDs

LEDs are located on the side of the Datacom SIM and are labelled 1, 2, 3, and 4. These LEDs illuminate yellow when a user-assigned signal is detected. You can assign any of the signals described in Table 3 to any of the four LEDs. You can also define up to 10 groups of four LEDs for later use.

Table 3 Available LED signal assignments

Signal	Description
LED Off	Turns the LED off
RD Mark	Receive data mark
RD Space	Receive data space
RT Mark	Receive timing mark
RT Space	Receive timing space
ST Mark	Send timing mark
ST Space	Send timing space
DSR	Data set ready
CTS/I	Clear to send
RLSD	Receiver line signal detect
TM	Test mode
TD Mark	Transmit data mark
TD Space	Transmit data space
DTR	Data terminal ready
RTS/C	Request to send
RL	Remote loopback received
LL	Local loopback
LED On	Turns the LED on

Test modes

You can operate HST-3000 Datacom test option in the following test modes:

– DTE Emulation: In this mode, the HST terminates a Datacom interface and emulates data termination equipment (DTE) to perform test operations. Adaptor cables are available to connect the HST to the test interface.

– DCE Emulation: In this mode, the HST terminates a Datacom interface and emulates data communications equipment (DCE) to perform test operations. Adaptor cables are available to connect the HST to the test interface.

– Monitor: In this mode, the HST non-intrusively monitors performance in both directions on a circuit. A Y-cable is needed when performing monitor operations.

Options

You can order software options to add functionality to the HST-3000. For Datacom, the following option is available:

– Frame Relay — Allows you to test frame relay services. Available for E1, T1, Datacom, and DDS local loop SIMs. (Ordering number: HST3000-FR)

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.

Launching an application

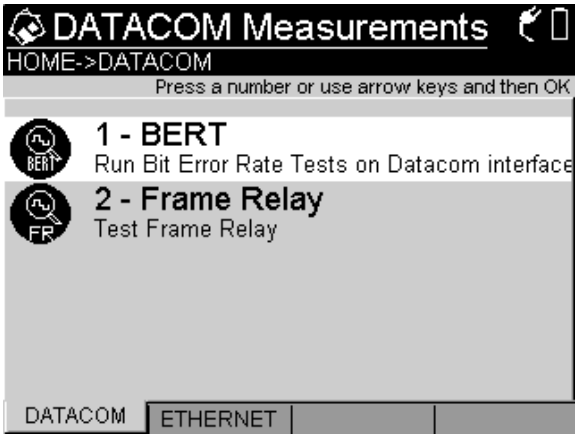
Before you can launch an application, you must have a Datacom SIM. Make sure the SIM is properly connected to the HST base unit before you power on the unit. For information about connecting a SIM and powering the HST, see the *HST-3000 Base Unit User's Guide*.

The following procedure describes how to launch an application.

To launch an application

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

   The Datacom Measurements menu appears. This menu lists the available test applications. Menu items vary depending on the options you purchased.



3. Press the number key that corresponds to the application you want to launch. For example press the 1 key to launch the BERT application.

The following table lists the currently available applications.

Application	Select...
Bit error rate testing (BERT) on Datacom interfaces	**BERT**
Frame relay testing	**Frame Relay** For information about frame relay testing, see the *HST-3000 Frame Relay Testing User's Guide*.

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 test settings menus

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

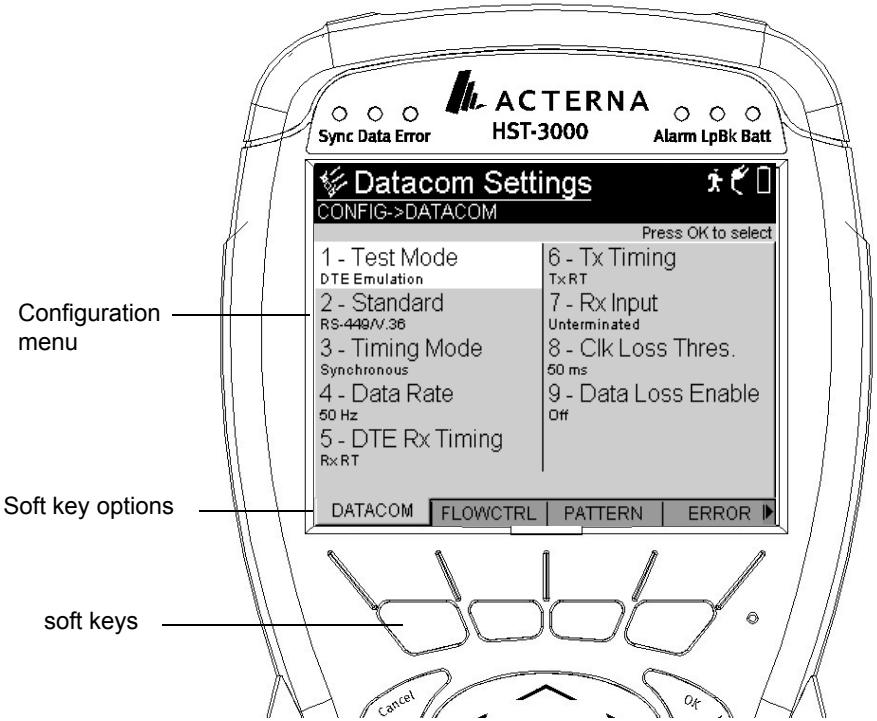
Accessing the test settings menus

1 Launch the Datacom **BERT** application. See "Launching an application" on page 9.

A test result screen appears.

2 Press the **Configure** navigation key.

A settings menu and soft key options appear. You will use the menus and soft keys to specify the settings for the test operation you want to perform.



3 To view settings for test mode, interface standard, timing mode, and other Datacom settings, press the **DATACOM** soft key.

4 To view different settings, press a different soft key. For example, to view flow control settings, press the FLOWCTRL soft key.

Available soft keys are as follows: DATACOM, FLOWCTRL, PATTERN, ERROR, LED, POLARITY, G.821, RUN MODE, and STORAGE.

5 To return to the test result page, press the **Home** navigation key.

You have accessed the test settings menus. For information about test operations, see Chapter 2 “Datacom Testing” beginning on page 13.

Instrument settings and user preferences

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

Datacom Testing

2

This chapter provides information about using the HST for data communications testing. Topics discussed in this chapter include the following:

About data communications testing

Using the HST-3000 Data communications SIM involves specifying test parameters, connecting the HST to the test circuit, starting the test, and then observing test results. You can monitor and perform bit error rate tests (BERT) on a variety of data communications interface standards.

Identifying test requirements

Before you begin testing with the HST-3000, you should identify the test requirements that you will need to configure on the HST. Consider the following items before you begin testing:

– **Test mode**: Determine whether you want to monitor a Datacom circuit or emulate DTE or DCE (see "Test modes" on page 8). Use the following guidelines for determining what emulation mode to use:
  – If the HST-3000 is establishing a link directly to a DCE you should configure the HST-3000 to emulate a DTE.
  – If the HST-3000 is establishing a link directly to a DTE you should configure the HST-3000 to emulate a DCE.

  If your network is secured using an encrypting device (located in between the HST-3000 and the device on the far end), the encrypting device represents a DTE to a DCE, and a DCE to a DTE. Therefore, you should determine the emulation mode for the encrypting device, and then configure the HST-3000 to emulate the opposite type of device.

- **Interface standard**: Determine the interface you want to test. The HST allows you to test the following interface standards: RS-232/V.24, X.21, EIA-530, V.35, and RS-449/V.36. Also determine what cables you will need to connect the HST to the test circuit. See "Adaptor cables" on page 6.
- **Timing modes**: Determine whether the device you will connect the HST-3000 to uses asynchronous or synchronous timing. When you configure your test, specify the same mode for the HST-3000.
- **Timing source**: Determine the timing sources for transmitted and received data.
- **Data rate**: When operating in DTE or DCE Emulation modes, if you are using the internal synthesizer as your timing source, determine the data rate of the device you will be connecting to. In asynchronous mode, you must configure the HST-3000 to use the same rate.
- **Flow control**: Determine whether the device you will connect the HST-3000 to uses flow control. If so, you can configure the HST-3000 for out-of-band flow control. If you are testing in asynchronous mode, you can also use in-band flow control. When you enable out-of-band flow control, you can specify whether data is transmitted based on specific signal lead conditions.
- **Test pattern**: Determine which pattern will effectively stress the circuit during a bit error rate test (BERT). For a list of available BERT patterns, see "Test Patterns" on page 57.

Enabling and disabling timed testing

Enabling timed testing allows you to run a test for a specified length of time. The following sections describe how to turn the timed testing feature on or off.

Enabling timed testing

To enable timed testing

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Press the **Event** soft key.

The Event Settings menu appears.

NOTE:

Depending on the options purchased, your soft key and menu may be labeled "RUN MODE."

3 If you have a **Test Start Mode** selection, set it to **Start/Stop**.

4 If the Timed Test setting is disabled, select **Timed Test**, and then select **Enable**.

The Timed Test Dur setting appears and the timed test icon appears in the upper right corner of the display screen.

5 To specify how long the test should run, select **Timed Test Dur**, and then enter the test duration in hours, minutes, and seconds.

6 Do one of the following:

- To configure other test settings, press a different soft key.
- To return to the test result display area, press the **Home** navigation key.

You have enabled timed testing.

Enabling delayed timed testing

You may want to set up a test to run at a certain time on a certain date. You can do this with the delayed timed testing feature.

To enable timed testing

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Press the **Event** soft key.

The Event Settings menu appears.

NOTE:

Depending on the options purchased, your soft key and menu may be labeled “RUN MODE.”

3 If you have a **Test Start Mode** selection, set it to **Start/Stop**.

4 Select **Timed Test**, and then select **Delayed**.

Additional parameters appear and the timed test icon appears in the upper right corner of the display screen.

5 Select **Test Start Date**, and then enter the date that you want the test to run.

6 Select **Test Start Time**, and then enter the time that you want the test to run.

7 Select **Timed Test Dur**, and then enter the test duration in hours, minutes, and seconds.

8 Do one of the following:

– To configure other test settings, press a different soft key.

– To return to the test result display area, press the **Home** navigation key.

You have enabled delayed timed testing.

Disabling timed testing

To disable timed testing

1 Access the test configuration menus. See “Accessing test settings menus” on page 10.

2 Press the **Event** soft key.

The Event Settings menu appears.

3 If the Timed Test setting is enabled, select **Timed Test**, and then select **Disable**.

4 Do one of the following:

- To configure other test settings, press a different soft key.
- To return to the test result display area, press the **Home** navigation key.

You have disabled the timed testing setting.

Configuring the test mode

You can operate the HST-3000 in three different test modes: Monitor, DTE Emulation, or DCE Emulation. The following procedure describes how to set the test mode.

To specify the test mode

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Press the **DATACOM** soft key.

The Datacom Settings menu appears.

3 Select **Test Mode**, and then select one of the following:

- **DTE Emulation**
- **DCE Emulation**
- **Monitor**

The options on the Datacom Settings menu change depending on what test mode you select. For more information, see "Test modes" on page 8.

You have finished specifying the test mode.

Configuring the interface standard

The HST-3000 with a Datacom SIM supports the following interface standards: RS-232/V.24, X.21, EIA-530, V.35, and RS-449/V.36. The following procedure describes how to select an interface standard for the test.

To specify the interface standard

1. Access the test configuration menus. See "Accessing test settings menus" on page 10.
2. Select the **DATACOM** soft key.

   The Datacom Settings menu appears.
3. Select **Standard**.

   A list of interface standards appears.
4. Press the number key that corresponds to the interface standard you want to test. For example, press the 2 key to select the X.21 interface.

You have specified the interface standard.

Configuring timing parameters

The following sections describe how to configure the timing mode and the timing source for transmitted and received data.

Specifying the timing mode

If you are testing an RS-232 interface, you can configure the HST-3000 to use either synchronous or asynchronous timing.

To specify the timing mode

1. Access the test configuration menus. See "Accessing test settings menus" on page 10.
2. Select the **DATACOM** soft key.

The Datacom Settings menu appears.

3 Select **Timing Mode**, and then select either **Asynchronous** or **Synchronous**.

After you specify the timing mode, you should specify the transmit and receive timing.

You have completed specifying the timing mode.

Specifying transmit and receive timing

The following procedure describes how to specify the clock source for received and transmitted data.

To specify the clock source for received and transmitted data

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Select the **DATACOM** soft key.

The Datacom Settings menu appears. Timing options on the Datacom settings menu vary depending on the selected test mode and interface standard.

3 Select the appropriate transmit and receive options:

- **Tx Timing** (only available in DTE or DCE emulation modes)
- **DTE Rx Timing**
- **DCE Rx Timing**

A menu of timing options appears.

4 Select the appropriate timing.

The clock source for transmit and receive timing is specified.

Specifying data parameters

The following sections describe how to specify the data rate, enable/disable data loss detection, and specify the polarity for transmitted and received signal.

Specifying the data rate

The following procedure describes how to specify the data rate.

To specify the data rate

1. Access the test configuration menus. See "Accessing test settings menus" on page 10.
2. Press the **DATACOM** soft key.

   The Datacom Settings menu appears.
3. Select **Data Rate**.
4. Enter a value, in Hz, for the data rate (see Table 4 for a list of supported data rates for each interface).

You have specified the data rate.

Table 4 Data rates by interface

Interface		Synchronous	Asynchronous
X.21	Balanced	50 Hz to 2.048 Hz[a]	N/A
RS-232/V.24	Unbalanced	50 Hz to 128,000 Hz	50 Hz to 128,000 Hz
EIA-530	Balanced	50 Hz to 10 MHz	N/A
V.35	Balanced	50 Hz to 2.048 Hz	N/A
RS-449/V.36	Balanced	50 Hz to 10 MHz	N/A

a. Can be up to 10 MHz, depending on the cable. See "Datacom adaptor cables" on page 6 for more information.

Enabling/disabling data loss detection

Enabling (or disabling) data loss detection criteria affects Rx data loss counts and alarms. Enabling the criteria causes the HST to register data loss when no data transitions have occurred for 63 clock transitions in synchronous timing modes, or 10 seconds in asynchronous timing modes.

To enable or disable data loss detection

1. Access the test configuration menus. See "Accessing test settings menus" on page 10.
2. Press the **DATACOM** soft key.

   The Datacom Settings menu appears.
3. Select **Data Loss Enable**.
4. Select **On** to enable data loss detection or **Off** to disable.

You have specified data loss detection.

Configuring data polarity settings

For instructions on configuring data polarity, see "Configuring Tx/Rx clock and data polarity" on page 31.

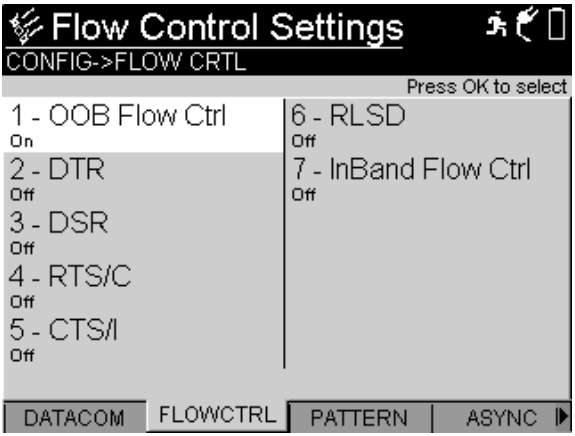
Enabling/disabling flow control

When you enable out-of-band flow control, you can specify whether data is transmitted based on specific signal lead conditions. When the user-defined settings for the signal leads are detected, data is transmitted. If you are testing in asynchronous timing mode, you can enable in-band flow control to control the flow of data whenever the HST receives the user-specified control characters.

To enable flow control

1. Access the test configuration menus. See "Accessing test settings menus" on page 10.
2. Press the **FLOWCTRL** soft key.

The Flow Control Settings menu appears.



3 Select **OOB Flow Ctrl**, and then select **On** to enable out of band flow control.

A list of test leads appears. The available leads vary depending on the selected interface standard.

4 Select a lead, and then select **On** to enable flow control on the transmitter, or **Off** to disable flow control based on the status of the lead.

5 If you are testing in asynchronous timing mode, you can enable in-band flow control:

a To enable inband flow control, select **Inband Flow Ctrl**, and then select **On**.

b Select **XON Value**, and then enter a value using a decimal format. The default value is 17.

c Select **XOFF Value**, and then enter a value using a decimal format. The default value is 19.

Configuring a test pattern

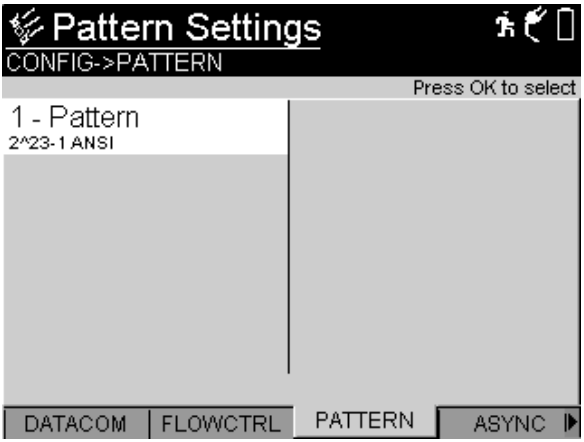
You can select from a number of supported test patterns or you can specify a user-defined pattern.

To specify a pattern

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Select the **PATTERN** soft key.

The Pattern Settings menu appears.



3 Select **Pattern**, and then use the up and down arrow keys to view the available patterns.

For descriptions of the available patterns, see "Test Patterns" on page 57. For information about user-defined patterns, see "Defining test patterns" on page 24.

4 Press the **OK** key to select the pattern you want.

Defining test patterns

You can define two types of test patterns: user bit pattern and a user byte pattern. The following procedure describes how to define these patterns.

To define a user pattern

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Select the **PATTERN** soft key.

The Pattern Settings menu appears.

3 Select **Pattern**.

4 Use the up and down arrow keys to select either **User Bit Pattern** or **User Byte Pattern**.

5 Select either **User Bit Patt**. or **User Byte Patt**.

6 For the user bit pattern, enter a pattern of ones and zeros from 3 to 32 digits long. For the user byte pattern, enter a hexidecimal pattern from 1 to 64 bytes long.

7 Press the **OK** key.

You have finished defining a user-defined test pattern.

Configuring asynchronous settings

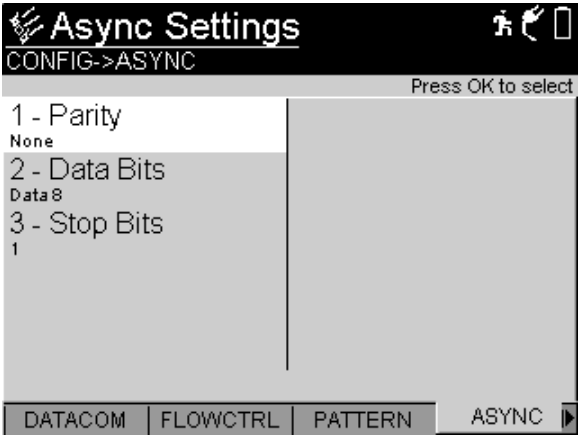
If you selected Asynchronous as the timing mode, you must specify the character format for the data.

To specify asynchronous settings

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Press the **ASYNC** soft key.

The Async Settings menu appears.



3 Select a setting, and then enter a value. The following table describes the available parameters for each setting.

Setting	Parameters
Parity	– **None** – **Even** – **Odd** Note: Selecting Odd or Even adds one bit to each character to accommodate the parity bit. For example, 7 data bits with even parity encoding generates 8 bit characters.
Data Bits	– **Data 5** for baudot encoding – **Data 6** for BCDIC encoding – **Data 7** for ASCII encoding – **Data 8** for EBCDIC encoding
Stop Bits	– **1** – **1.5** – **2**

You have finished specifying settings for asynchronous testing.

Configuring logic error insertion

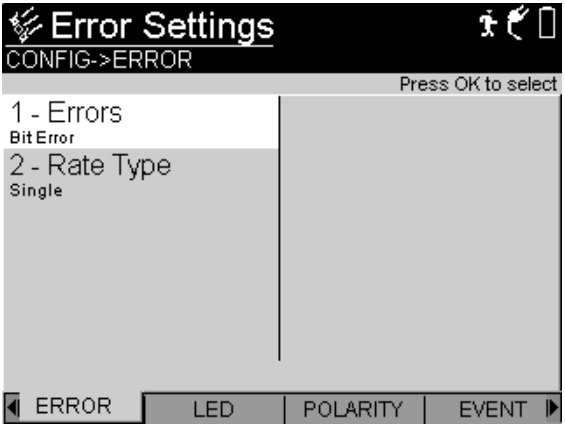
The following procedure describes how to configure bit error insertion.

To specify the error settings

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Press the **ERROR** soft key.

The Error Settings menu appears. The only available error type is Bit Error.



3 Select **Rate Type**, and then select one of the following:

- **Single** — Allows you to insert a single bit error at a key press.
- **Rate** — Causes the HST to insert bit errors at a user-specified rate. Available rates are from **1e-2** to **1e-7**.
- **Multiple** — Allows you to insert a specific number of bit errors at a key press. You can insert from **1** to **50** errors.

4 Select one of the following options:

- If you chose to insert bit errors at a specified rate, select **Rate**, and then select a rate.
- If you selected Multiple as the rate type, select **Error Count**, and then enter the number of errors to be inserted at a key press.

You have finished specifying the error settings.

Configuring user LED behavior

User LEDs are located on the side of the Datacom SIM and are labeled 1, 2, 3, and 4. These LEDs illuminate yellow when a user-defined signal is detected.

You can assign a group name to a group of four user-defined LEDs. This group name and it's associated LED assignments are saved for later use. You can name and define up to 10 groups.

NOTE:

There is also an LED result category where soft LED indicators display data, pattern sync, and clock results. See "LED results" on page 51.

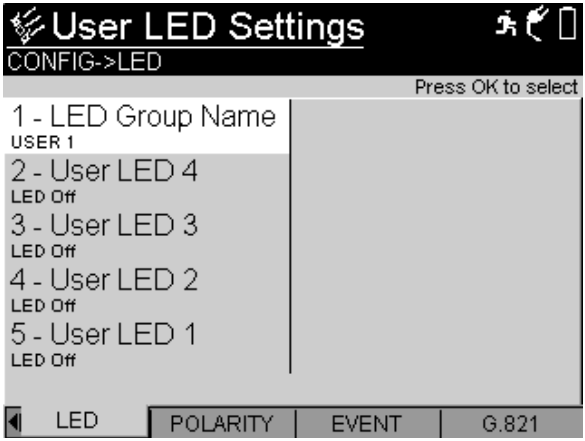
Defining an LED group

You can name and define up to 10 four-group sets of user LEDs. The groups are saved under an LED group name.

To specify a group of LEDs

1. Access the test settings menus. See "Accessing test settings menus" on page 10.
2. Press the **LED** soft key.

The User LED Settings menu appears.



3 Select **LED Group Name**.

4 Use the up and down arrow keys to highlight a group name.

5 To change a group name, do the following:

   a Highlight a name from the list, and then press the **Edit** soft key.

   b Use the HST key pad to enter a new name, and then press **OK**.

   Use a meaningful name so that you can identify the group name in the future.

6 Press the **OK** key to select a name from the list.

7 Assign signals to the four LEDs. See “Defining individual user LEDs” on page 30.

The assignments you make are saved to the LED group name you specified. To use these same assignments at a later time, select the LED Group Name, and then the name.

Defining individual user LEDs

The following procedure describes how to assign signal types to the four user LEDs.

To specify the User-defined LED behavior

1. Access the test settings menus. See "Accessing test settings menus" on page 10.
2. Press the **LED** soft key.

   The User LED Settings menu appears. The four individual LED options are labeled User LED 1, User LED 2, User LED 3, and User LED 4. These options correspond to the four LEDs located on the side of the Datacom SIM. For example, User LED 1 corresponds the User-defined LED labeled 1, User LED 2 corresponds with the User-defined LED labeled 2, and so on.
3. Select one of the four LED options such as **User LED 1**.
4. Use the up and down arrow keys to view the signals you can assign to the LED. For descriptions of the signals, see "User-defined LEDs" on page 7.
5. Press the **OK** key to select the signal and assign it to the selected LED.
6. Repeat step 3 through step 5 for each LED you want to define.

You have finished defining the User-defined LEDs.

Configuring clock settings

The following sections describe how to configure the polarity for the transmit and receive clocks and data, and how to configure the clock loss threshold.

Configuring Tx/Rx clock and data polarity

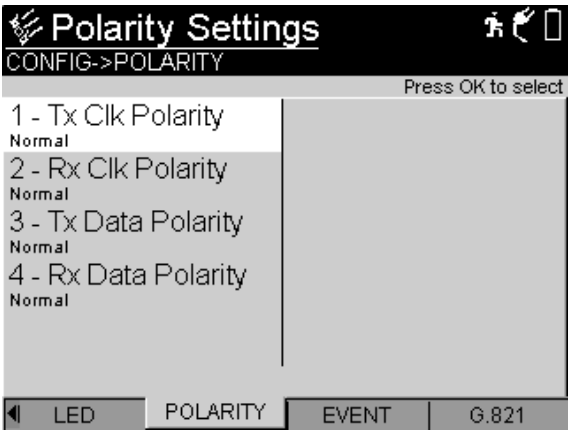
The following procedure describes how to configure clock and data polarity settings.

To configure polarity settings

1 Access the test configuration menus. See "Accessing test settings menus" on page 10.

2 Press the **POLARITY** soft key. You may need to press the left or right arrow keys to find the Polarity soft key.

The Polarity Settings menu appears.



3 Select one of the following:

- **Tx Clk Polarity** for the transmit clock
- **Rx Clk Polarity** for receive clock.
- **Tx Data Polarity** for the transmitted data
- **Rx Data Polarity** for received data.

4 Select one of the following:

- **Normal**. Uses the phasing specified by the interface standard.
- **Inverted**. Uses the inverse of the phasing specified by the interface standard.

You have specified the polarity.

Configuring the clock loss threshold

Clock loss threshold refers to the number of milliseconds, without transitions on the clock signal lead, needed for the HST to declare clock loss. The following procedure describes how to configure the clock loss threshold.

To configure the clock loss threshold

1. Access the test configuration menus. See "Accessing test settings menus" on page 10.
2. Press the **DATACOM** soft key.

   The Datacom Settings menu appears.
3. Select **Clk Loss Thres**.
4. Enter a value for the clock loss threshold.

   The default value is 50 ms.
5. Press the **OK** key.

You have finished configuring the clock loss threshold.

Configuring G.821 result settings

The following procedure describes how to configure settings for the G.821 performance results.

To configure G.821 settings

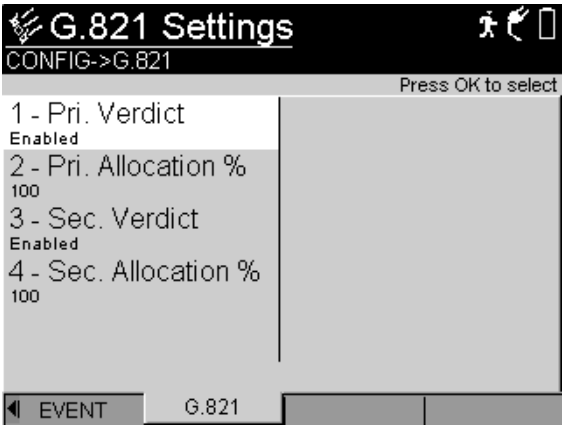
1. Access the test configuration menus. See "Accessing test settings menus" on page 10.
2. Press the **G.821** soft key. You may need to use the left or right arrow keys to locate the G.821 soft key.

The G.821 Settings menu appears. The available settings vary depending on the test mode:

– Monitor: both primary (Pri.) and secondary (Sec.) channel settings are available.

– DTE Emulation: only Pri. settings are available.

– DCE Emulation: only Sec. channel settings are available.



3 For the primary channel, select a setting, and then specify the parameter. The following table describes the settings.

Setting	Parameter
Pri. Verdict	Select one of the following: – **Enabled**: Indicates the primary channel will be analyzed for conformance to G.821 specifications. The HST will return either a “Pass” or “Fail” result. – **Disabled**: Indicates the primary channel will not be analyzed for conformance to G.821 specifications.

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

4 If secondary channel settings are available, select a setting, and then specify the parameter. The following table describes the settings.

Setting	Parameter
Sec. Verdict	Select one of the following: – **Enabled**: Indicates the secondary channel will be analyzed for conformance to G.821 specifications. The HST will return either a "Pass" or "Fail" result. – **Disabled**: Indicates the secondary channel will not be analyzed for conformance to G.821 specifications.

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

You have finished configuring the G.821 settings.

Connecting the HST-3000 to the circuit

To connect the HST-3000 to the circuit, you must have the correct adaptor cable for the test operation and the interface standard you want to test. For a list of available cables, see “Adaptor cables” on page 6. For information on ordering cables, contact your local JDSU sales office.

NOTE:

All DTE and DCE emulation cables have yellow bands. All monitor cables have blue bands.

When you connect a cable to the HST and the Signal result screen is currently visible, the unit will display the cable type in the lower right corner of the screen.

The following sections describe how to connect the HST for monitor or DTE/DCE emulation tests.

Connecting for X.21 testing

To connect the HST to a X.21 circuit

1. Identify the correct cable for the test operation and interface standard:
   - If the test mode is DTE or DCE Emulation, use one of the X.21 DTE/DCE Emulation cables (part number CB-44390 for up to 2.048 MHz or CB-44391 for up to 10 MHz).
   - If the test mode is Monitor, use one of the X.21 Y-Monitor cables (part number CB-44346 for up to 2.048 MHz or CB-44345 for up to 10 MHz)).
2. Connect one end of the adaptor cable to the HST's universal Datacom connector located on the top panel of the unit.
3. Connect the other end(s) of the adaptor cable to the test access point.

You have finished connecting the cables.

Connecting for RS-232/V.24 and EIA-530 testing

To connect for RS-232/V.24 or EIA-530 testing

1. Identify the correct cable for the test operation and interface standard:
   - If the test mode is DTE or DCE Emulation, use the RS-232/EIA-530 DTE/DCE Emulation cable (part number CB-44385).
   - If the test mode is Monitor, use the RS-232/EIA-530 Y-Monitor cable (part number CB-44348).
2. Connect one end of the adaptor cable to the HST's universal Datacom connector located on the top panel of the unit.
3. Connect the other end(s) of the adaptor cable to the test access point.

You have finished connecting the cables.

Connecting for V.35 testing

To connect for V.35 testing

1. Identify the correct cable for the test operation and interface standard:
   - If the test mode is DTE or DCE Emulation, use the V.35 DTE/DCE Emulation cable (part number CB-44389).
   - If the test mode is Monitor, use the V.35 Y-Monitor cable (part number CB-44341).
2. Connect one end of the adaptor cable to the HST's universal Datacom connector located on the top panel of the unit.
3. Connect the other end(s) of the adaptor cable to the test access point.

You have finished connecting the cables.

Connecting for RS-449/V.36 testing

To connect for RS-449/V.36 testing

1. Identify the correct cable for the test operation and interface standard:
   - If the test mode is DTE or DCE Emulation, use the V.36 DTE/DCE Emulation cable (part number CB-44388).
   - If the test mode is Monitor, use the V.36 Y-Monitor (part number CB-44347).
2. Connect one end of the adaptor cable to the HST's universal Datacom connector located on the top panel of the unit.
3. Connect the other end(s) of the adaptor cable to the test access point.

You have finished connecting the cables.

Performing a self test

Before you begin testing, you should perform a self test on the HST to make sure it is operating properly on the selected interface standard. You can test the HST and the test cable.

To perform a self test on the HST-3000

1. Configure a test.
2. Press the **Home** navigation key
3. Press the **Action** soft key.
4. Select **Self Loop**, and then select one of the following options:
   - **Enable Internal Loop** — This option connects the transmitter to the receiver without involving amplifiers or cables. Skip to step 6.
   - **Enable Cable Test** — This option tests the amplifiers along with one of the emulation cables. When you select this option, the HST automatically sets the Rx Input setting to unterminated and the Tx Timing setting to Tx SYNTH. The maximum data rate supported for this option is 1 MHz.

     Proceed to step 5.
5. If you selected Enable Cable Test, connect the cable's DCE connector to the DTE connector.
6. After you have connected the emulation cables (if applicable), press the **Restart** soft key.
7. Select the **Display** soft key, and then select **Summary**.

   If an “All Results OK” message should appears, the unit and interface are operating properly.

   If errors appear in the Summary result category, there is a problem with the HST-3000 or the cables.

You have completed the self test.

Performing BERT analysis

Performing a bit error rate test (BERT) involves configuring the test settings, including logic error insertion; connecting the HST to the a circuit; starting the test and inserting logic errors; and observing the results.

To perform a bit error rate test

1. Configure the test mode to DTE or DCE Emulation. See "Configuring the test mode" on page 18.
2. Configure the other parameters on the Datacom Settings menu:
   - Standard (see "Configuring the interface standard" on page 19)
   - Timing Mode (see "Specifying the timing mode" on page 19)
   - Data Rate (see "Specifying data parameters" on page 20)
   - Tx/Rx Timing (see "Specifying transmit and receive timing" on page 20)
   - Clk Loss Threshold (see "Configuring the clock loss threshold" on page 32)
   - Data Loss Enable (see "Enabling/disabling data loss detection" on page 21)
3. Specify the flow control parameters. See "Enabling/disabling flow control" on page 22.
4. Specify a test pattern. See "Configuring a test pattern" on page 23.
5. If you are testing in asynchronous timing mode, specify the asynchronous parameters. See "Configuring asynchronous settings" on page 25.
6. Configure the logic error insertion settings. See "Configuring logic error insertion" on page 26.

7 Configure the User-defined LED settings. See “Configuring user LED behavior” on page 28.

8 Configure the Tx/Rx data polarity settings. “Configuring Tx/Rx clock and data polarity” on page 31

9 If you want to run the test for a specific amount of time, configure the timed test settings. See “Enabling and disabling timed testing” on page 15.

10 If you want to test performance to G.821 specifications, configure the G.821 settings. See “Configuring G.821 result settings” on page 32

11 If this is your first test of the day, perform a self test on the HST. See “Performing a self test” on page 38.

12 Connect the HST to the circuit. See “Connecting the HST-3000 to the circuit” on page 35.

13 Press the **Home** navigation key.

14 Press the **Restart** soft key to begin the test.

15 Verify that the Sync LED illuminates green.

16 To insert errors, press the **Actions** soft key, and then select the option to insert errors.

17 Press the **Display** soft key, and then select **Summary**.

Results appear in the Summary category.

18 To check other result categories, select the **Display** soft key, and then select a result category.

Monitoring a Datacom interface

In monitor mode you can use the HST-3000 to non-intrusively monitor traffic in both directions on a specified interface standard.

1 Display the test settings menus (see “Accessing test settings menus” on page 10).

2 Configure the test mode to Monitor. See "Configuring the test mode" on page 18.

3 Configure the other settings on the Datacom Settings menu:

- Standard (see "Configuring the interface standard" on page 19)
- Timing Mode (see "Specifying the timing mode" on page 19)
- Data Rate (see "Specifying data parameters" on page 20)
- Tx/Rx Timing (see "Specifying transmit and receive timing" on page 20)
- Clk Loss Threshold (see "Configuring the clock loss threshold" on page 32)
- Data Loss Enable (see "Enabling/disabling data loss detection" on page 21

4 Connect the HST to the circuit. See "Connecting the HST-3000 to the circuit" on page 35.

5 Press the **Home** navigation key.

6 Press the **Restart** soft key to begin the test.

7 Verify that the Sync LED illuminates green.

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

Results appear in the Summary category.

9 To check other result categories, select the **Display** soft key, and then select a result category.

Viewing test results

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

To view test results

1. Configure and run a test.
2. Press the **Display** soft key, and then select a result category.

   The test results for the category appear. For descriptions of test results, see “Test Results” on page 47.

Troubleshooting

3

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

Resolving issues

Table 5 describes situations that you may encounter when performing Datacom testing with the HST-3000.

Table 5 Issues and resolutions

Issue	Resolution
No receive clock	Check the Datacom Settings: – Press the **Configure** navigation key, and then press the **DATACOM** soft key. – Make sure the following settings are correct: Test Mode, Standard, Timing Mode, and DTE/DCE Rx Timing.
	Check the adaptor cable: – Make sure you are using the correct adaptor cable for the interface standard and test mode. – Make sure the adaptor cable is securely attached to the HST.
The receive clock is inverted	Check the Datacom settings: – Press the **Configure** navigation key, and then press the **DATACOM** soft key. – Make sure the RX Timing setting is correct. For higher speed DCE emulation, terminal timing normally has to be used in order to avoid clock/data phase issues.

Table 5 Issues and resolutions (Continued)

Issue	Resolution
The receive clock is inverted	Check the frequency of the circuit under test: – The frequency should not exceed the specified maximum rate supported by the currently selected interface standard. – The maximum rate that can be supported will vary depending on the selected standard and the timing mode.
	If additional cabling has been added to extend the length of the test cable: – Make sure the cable uses the proper shielding. – Make sure the length is not too long for the speed of the circuit under test.
No pattern synchronization	Check the test pattern selection: – Press the **Configure** navigation key, and then press the **PATTERN** soft key. – Check the Pattern setting to ensure the correct test pattern has been selected. For patterns with both ANSI (North American) and ITU (European) versions, ensure that the proper version has been selected.
	Check the Tx and Rx Data Polarity settings: – Press the **Configure** navigation key, and then press the **POLARITY** soft key. – Make sure the proper TX and RX Data Polarity settings are selected. Most applications use the default “Normal” setting for both Tx and Rx Data Polarity.

Table 5 Issues and resolutions (Continued)

Issue	Resolution
No pattern synchronization	Perform a self test: – Configure a test. – Press the **Home** navigation key. – Press the **Action** soft key, and then select > **Self Loop** > **Enable Internal Loop**. – Check the Rx Data Mark and Rx Data Space status to ensure that data transitions are being received. – If a solid mark is being received, check the state of all signaling leads to make sure the proper signaling leads are being asserted. Frequently a DCE will not allow data to proceed when it does not detect the expected state on the DTE's signaling leads (DTR, RTS).
	Check the out of band flow control setting: – Press the **Configure** navigation key, and then press the **FLOWCTRL** soft key. – Check the OOB Flow Ctrl setting. If flow control is on, a generator hold may be preventing the pattern from being transmitted.

Test Results

A

This appendix describes the test result categories, and the results within each category, that are available when testing data communications circuits. Topics in this appendix include the following:

About test results

After you start a test, the Summary result category automatically displays the message, “All Summary Results OK” if no errors or alarms have been detected. If errors are detected, key results are displayed in the Summary category.

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

Summary results

The Summary category automatically displays error results that are non-zero, key results that are out-of-specification, or key informational results. This allows you to view key results quickly without having to search through each category. If no errors or anomalies are detected, the HST will display an “All Results OK” message in the summary category.

Signal results

Table 6 describes results in the Signal category.

Table 6 Signal results

Result	Definition
Rx Clock Losses	Count of how many times the receive clock is lost. Only available in synchronous timing mode.
Rx Frequency Hz	Frequency derived from the receiver clock.
Tx Clock Losses	Count of how many times the transmit clock is lost. Only available in synchronous timing mode.

Table 6 Signal results (Continued)

Result	Definition
Tx Frequency Hz	Frequency derived from the transmitter clock.

BERT results

Table 7 describes the results that can appear in the BERT test result category.

Table 7 BERT results

Result	Definition
% Error Free Seconds	Ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while pattern synchronization is present.
Bit Error Rate	Ratio of bit errors to received pattern data bits.
Bit Errors	Number of received bits with a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
Error Free Seconds	Number of seconds during which no pattern bit errors are detected while pattern synchronization is present.
Error Seconds	Number of seconds during which one or more pattern bit errors occurred since initial pattern synchronization.
Pattern Losses	Number of times the received pattern is lost relative to the expected (therefore, internally generated) test pattern.
Pattern Slips	Number of pattern slips detected since start of test (PRBS patterns only).

Table 7 BERT results (Continued)

Result	Definition
Pattern Sync	Pattern synchronization is not detected.
Round Trip Delay	Time between transmission and reception of the Delay pattern. The result is given in milliseconds. Only applicable when the Delay pattern is selected during test set up.
Sync Loss Seconds	Number of seconds during which the receiver lost pattern synchronization, even momentarily, since initial pattern synchronization.

Data results

Table 8 describes the results that can appear in the Data result category.

Table 8 Data results

Result	Definition
Char Errors	Count of characters containing one or more bit errors in asynchronous timing mode.
Chars Received	Count of the number of received characters since the last test restart in asynchronous timing mode.
Chars Sent	Count of the number of transmitted characters since the last test restart in asynchronous timing mode.
Frame Error Rate	Ratio of the number of errored framing bits detected to the number of framing bits received in asynchronous timing mode.

Table 8 Data results (Continued)

Result	Definition
Frame Errors	Count of errored framing bits detected since the last test restart in asynchronous timing mode.
Parity Error Rate	Ratio of the number of parity errors detected to the number of parity bits received in asynchronous timing mode.
Parity Errors	Count of parity errors since the last test restart in asynchronous timing mode.
Rx Data Losses	Number of receiver synchronization losses resulting from a loss of data. Only valid when the Data Loss setting is enabled.

LED results

A sample of the LED results is shown in Figure 2.

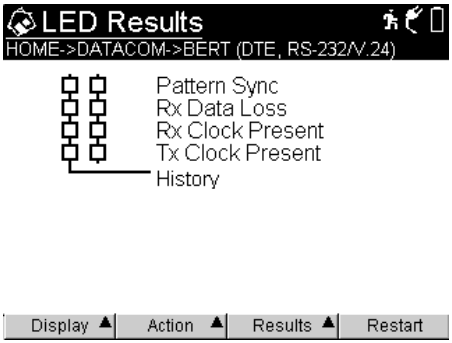


Figure 2 LED Results

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 9 describes the results.

Table 9 LED results

Result	Definition
Pattern Sync	Pattern synchronization detected
Pattern Sync History	Pattern synchronization detected since last test restart.
Rx Data Loss	Data loss detected. Only valid when the Data Loss setting is enabled.
Rx Data Loss History	Data loss detected since last test restart.
Rx Clock Present	Receiver clock detected.
Rx Clock Present History	Receiver clock detected since last test restart.
Tx Clock Present	Transmitter clock detected.
Tx Clock Present History	Transmitter clock detected since last test restart.

Data LED

In the Data LED category, a checkmark indicates the LED is on and the signal for the selected interface standard is currently being detected. You can also see the mark and space state of each signal, and whether the signal is detected on the transmit or receive side. Signal names vary based on the selected interface standard. For a list of signal names, see “Signal Lead Names” on page 69.

Figure 3 shows a sample Data LED result screen.

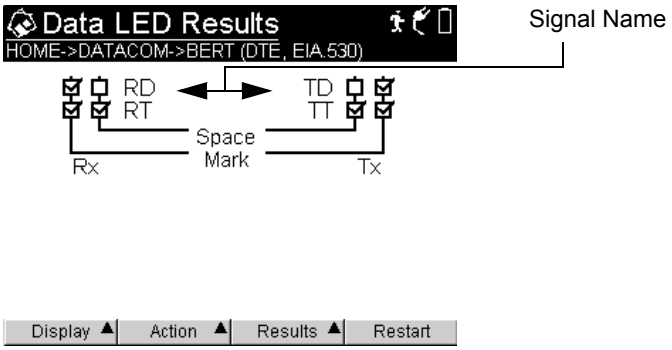


Figure 3 Sample Data LED results

Control LED

In the Control LED category, a checkmark indicates the LED is on and the signal for the selected interface standard is currently being detected. You can also see where the signal is detected, either the transmit or receive side. For a list of signal names, see “Signal Lead Names” on page 69.

Figure 4 on page 54 shows a sample Control LED screen.

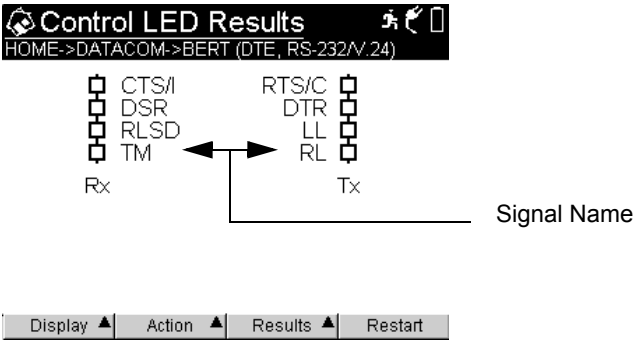


Figure 4 Sample Control LED results

G.821 performance results

Table 10 lists results related to ITU-T G.821 performance standards.

Table 10 G.821 performance results

Result	Description
AS	Available seconds. A count of the number of seconds a circuit is available as specified in G.821, calculated as total test time minus unavailable seconds.
ASR	Available seconds ratio. The ratio, expressed as a percentage, of available seconds to the number of test seconds.
CSES	Consecutive severely errored seconds. A count of the number of groups of three or more contiguous seconds in which an error rate greater than 10^{-3} was found in each second.

Table 10 G.821 performance results (Continued)

Result	Description
EFS	Error free seconds. The number of seconds during which no pattern bit errors are detected. This count is inhibited during unavailable seconds.
EFSR	Error free seconds ratio. The ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while pattern synchronization is present
ES	Errored seconds. The number of seconds during which one or more pattern bit errors occurred since initial pattern synchronization. This count is inhibited during unavailable seconds.
ESR	Errored seconds ratio. The ratio, expressed as a percentage, of seconds during which one or more pattern bit errors are detected, to the total number of seconds while pattern synchronization is present.
SES	Severely errored seconds. Seconds during which the bit error ratio was greater than 10^{-3} within available time.
SESR	Severely errored seconds ratio. The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.
TS	Total seconds. Total number of seconds during which pattern synchronization is present.
UAS	Unavailable seconds. A count of unavailable time per the ITU-T G.821 standard.
UASR	Unavailable seconds ratio. The ratio, expressed as a percentage, of available seconds to the number of test seconds.

Table 10 G.821 performance results (Continued)

Result	Description
Verdict	“Pass” indicates conformance to the G.821 standard. “Fail” indicates the circuit did not conform to the G.821 standard.

Time results

Table 11 lists results in the Time category.

Table 11 Time results

Result	Definition
Date	Indicates the current date in mm/dd/yyyy format.
Time	Indicates the current time in hh:mm:ss format.
Elapsed Time	Indicates how long the test has been running in hh:mm:ss format.
Remaining Time	Available only during timed testing. Indicates how much longer the test will run in hh:mm:ss format.
% Complete	Available only during timed testing. Indicates how much of the test in complete as a percentage.

Event Log results

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

Test Patterns

B

Table 12 shows the patterns available for Datacom testing.

Table 12 BERT patterns

Pattern	Description
Mark	Selects an all ones pattern, the logic one (idle condition) datacom signal. Intended to test transmission circuits for maximum ones condition.
Space	Selects an all zeros pattern, the logic zero datacom signal. Intended to test transmission circuits for maximum zeroes condition.
1:1	Selects a one followed by a zero, the minimum stress on clock recovery circuits.
1:3	Selects a one followed by 3 zeros (1000, 1000...)
1:4	Selects a one followed by 4 zeros (10000, 10000...).
1:7	Selects a 1 followed by 7 zeros (10000000, 10000000...). Stresses the minimum ones density requirement (12.5%) for T1 circuits.
3:1	Selects 3 ones followed by 1 zero (1110) pattern.
7:1	Selects 7 ones followed by 1 zero (11111110) pattern.

Table 12 BERT patterns (Continued)

Pattern	Description
63	Selects the 2^6 -1 Pseudorandom pattern, which generates a maximum of 5 sequential zeros and 6 sequential ones. Simulates live data for circuits less than 9.6 kbps.
511	Selects the 2^9 -1 Pseudorandom pattern, which generates a maximum of 8 sequential zeros and 9 sequential ones. Simulates live data for circuits less than 9.6 kbps.
2047	Selects the 2^{11} -1 Pseudorandom pattern, which generates a maximum of 10 sequential zeros and 11 sequential ones. Simulates live traffic for data rates between 9.6 and 56 Kbps. Compatible with DDS and ISDN.
2047R	Reverse of the 2047 pattern.
2047 INV	Inverse of the 2047 pattern.
2047R INV	Reverse and inverse of the 2047 pattern.
2^15-1 ANSI	Selects the 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential zeros and 15 sequential ones. Simulates live data for 56 kbps to 2Mbps circuits.
2^15-1 ITU	Selects the 2^{15}-1 pseudorandom pattern, which generates a maximum of 15 sequential zeros and 14 sequential ones. Simulates live data for 56 kbps to 2Mbps circuits.
2^20-1 ANSI	Selects the 2^{20} -1 pseudorandom pattern, which generates a maximum of 20 sequential zeros and 19 sequential ones. Simulates live data for DS2 circuits.
2^20-1 ITU	Selects the 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential zeros and 20 sequential ones. Simulates live data for DS2 circuits.
2^23-1 ANSI	Selects the 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential zeros and 23 sequential ones.
2^23-1 ITU	Selects the 2^{23} -1 pseudorandom pattern, which generates a maximum of 23 sequential zeros and 22 sequential ones.
QRSS	Selects the quasi random signal source pattern which allows a maximum of 15 sequential zeros and 20 sequential ones.

Table 12 BERT patterns (Continued)

Pattern	Description
QBF	Selects the quick brown fox message in all uppercase letters: THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789. **NOTE:** This pattern is only available when testing in synchronous mode.
QBF1	Selects the quick brown fox message (see "QBF") followed by CR LF. **NOTE:** This pattern is only available when testing in asynchronous mode. The QBF message is encoded according to the number of data bits you specified in the character format.
QBF2	Selects the quick brown fox message (see "QBF") followed by LF CR LF CR. **NOTE:** This pattern is only available when testing in asynchronous mode. The QBF message is encoded according to the number of data bits you specified in the character format.
QBF3	Selects the quick brown fox message (see "QBF") followed by LF CR. **NOTE:** This pattern is only available when testing in asynchronous mode. The QBF message is encoded according to the number of data bits you specified in the character format.
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.
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.

Specifications

C

This appendix contains specifications related to the HST-3000 Datacom testing option. Topics in this appendix include the following:

Supported interface standards

Table 13 lists the test interfaces and circuits supported by the HST-3000 Datacom SIM.

Table 13 Datacom interface specifications

Interface Standard	Supported Circuits
RS-232/V.24	BA, BB, CA, CB, DD, CF, DB, DD, LL, RL, CD, DA, and TM
EIA-530	EIA-422-B: BA, BB, CA, CB, CC, CD, CF, DA, DB, and DD EIA-423-B: LL, RL, and TM.
RS-449/V.36	EIA-422-B: SD, RD, RS, CS, DM, TR, RR, RT, ST, and TT EIA-423-B: LL, RL, and TM.
V.35	Balanced clock and data circuits EIA-232/V.24 control circuits 306: SCT, SCTE, SCR, SD, and RD V.35: 103, 104, 114, and 115 V.28: 105, 106, 107, and 109
X.21	V.11: R, I, S, T, C[a], and X[b]

a. With cable CB-44390 or CB-44346
b. With cable CB-44391 or CB-44345

About pin assignments

All of the signals necessary for the supported interfaces are mapped to pins on the HST's universal Datacom connector. The following sections describe the pin assignments for the supported interfaces.

RS-232/V.24 pin assignments

Table 14 lists pin assignments for the RS-232/V.24 interface.

Table 14 RS-232/V.24 pin assignments

Pin	Signal Description	Signal Source	CCITT Circuit
1	Signal Ground	N/A	102
2	Transmitted Data	DTE	103
3	Received Data	DCE	104
4	Request to Send	DTE	105
5	Clear to send	DCE	106
6	Data Set Ready	DCE	107
7	Signal Ground	N/A	102
8	Data Channel Received Line Signal Detector	DCE	109
15	Transmitter Signal Element Timing	DCE	114
17	Receiver Signal Element Timing	DCE	115
18	Local Loopback	DTE	141
20	Data Terminal Ready	DTE	108
21	Loopback / Maintenance	DTE	140
24	Transmitter Signal Element Timing	DTE	114
25	Test Indicator	DCE	142

X.21 pin assignments

Table 16 lists pin assignments for the X.21 interface.

Table 15 X.21 pin assignments

Pin	Signal Description	Lead	Signal Source	Circuit
1	Protective Ground	N/A	N/A	G
2	Transmit Data	A	DTE	T
3	Control	A	DTE	C
4	Receive Data	A	DCE	R
5	Indication	A	DCE	I
6	Signal Element Timing	A	DCE	S
7[a]	Transmitter SIgnal Element Timing	A	DTE	X
8	Signal Ground	N/A	N/A	SG
9	Transmit Data	B	DTE	T
10	Control	B	DTE	C
11	Receive Data	B	DCE	R
12	Indication	B	DCE	I
13	Signal Element Timing	B	DCE	S
14[a]	Transmitter Signal Element Timing	B	DTE	X

a. Only used with cables CB-44391 and CB-44345

EIA-530 pin assignments

Table 16 lists the pin assignments for the EIA-530 interface.

Table 16 EIA-530 pin assignments

Pin	Signal Description	Lead	Signal Source	Circuit	Category (422 or 423)
1	Shield	N/A	Ground	N/A	N/A
2	Transmitted Data	A	DTE	BA	422
3	Received Data	A	DCE	BB	422
4	Request to Send	A	DTE	CA	422
5	Clear to Send	A	DCE	CB	422
6	DCE Ready	A	DCE	CC	422
7	Signal Ground	N/A		AB	N/A
8	Received Line Signal Detector	A	DCE	CF	422
9	Receiver Signal Element Timing	B	DCE	DD	422
10	Received Line Signal Detector	B	DCE	CF	422
11	Transmit Signal Element Timing	B	DTE	DA	422
12	Transmit Signal Element Timing	B	DCE	DB	422
13	Clear to Send	B	DCE	CB	422
14	Transmitted Data	B	DTE	BA	422
15	Transmit Signal Element Timing	A	DCE	DB	422
16	Received Data	B	DCE	BB	422
17	Receiver Signal Element Timing	A	DCE	DD	422

Table 16 EIA-530 pin assignments (Continued)

Pin	Signal Description	Lead	Signal Source	Circuit	Category (422 or 423)
18	Local Loopback	N/A	DTE	LL	423
19	Request to Send	B	DTE	CA	422
20	DTE Ready	A	DTE	CD	422
21	Remote Loopback	N/A	DTE	RL	423
22	DCE Ready	B	DCE	CC	422
23	DTE Ready	B	DTE	CD	422
24	Transmit Signal Element Timing	A	DTE	DA	422
25	Test Mode	N/A	DCE	TM	423

V.35 pin assignments

Table 17 lists the pin assignments for the V.35 interface.

Table 17 V.35 pin assignments

Pin Position	Signal Description	Signal Source	Circuit	Electrical Characteristics
A	Shield	DTE, DCE	N/A	N/A
B	Signal Ground	DTE, DCE	102	
C	Request to Send	DTE	105	V.28
D	Ready for Sending	DCE	106	V.28
E	Data Set Ready	DCE	107	V.28
F	Data Channel Received Line Signal Detector	DCE	109	V.28

Table 17 V.35 pin assignments (Continued)

Pin Position	Signal Description	Signal Source	Circuit	Electrical Characteristics
H	Data Terminal Ready	DTE	108	V.28
L	Local Loop	DTE	141	V.28
N	Remote Loop	DTE	140	V.28
n	Test Mode	DCE	142	V.28
P	Transmitted Data (B Lead)	DTE	103	V.35
R	Received Data (A Lead)	DCE	104	V.35
S	Transmitted Data (B Lead)	DTE	103	V.35
T	Received Data (B Lead)	DCE	104	V.35
V	Receiver Signal Element Timing (B Lead)	DCE	115	V.35
Y	Transmitter Signal Element Timing (A Lead)	DCE	114	V.35
a	Transmitter Signal Element Timing (B Lead)	DCE	114	V.35

RS-449/V.36 pin assignments

Table 18 lists pin assignments for the RS-232/V.36 interface.

Table 18 RS-449/V.36 Pin Assignments

Pin Position A	Pin Position B	Signal Description	Signal Source	Circuit Indicator	Category
1		Protective Ground	Shield	Shield	
4	22	Send Data	DTE	SD	422
6	24	Receive Data	DCE	RD	422
7	25	Receive Data	DTE	RS	422
9	27	Clear to Send	DCE	CS	422
11	29	Data Mode	DCE	DM	422
12	30	Terminal Ready	DTE	TR	422
13	31	Receiver Ready	DCE	RR	422
17	35	Terminal Timing	DTE	TT	422
19		Signal Ground	N/A	SG	422
5	23	Send Timing	DCE	ST	422
8	26	Receive Timing	DCE	RT	422
10		Local Loopback	DTE	LL	423
14		Remote Loop-back	DTE	RL	423
18		Test Mode	DCE	TM	423

Signal Lead Names

D

The signal leads for the supported interfaces use a variety of names. The names describe the circuits between DTE and DCE, for example TXD is the transmit data circuit, an output at the DTE and an input at the DCE. As the role of the test instrument changes, the direction of this signal in the connector changes. Table 1 provides a cross reference of signal lead names, including signal direction.

Table 19 Signal lead cross reference

Signal Lead (Direction)	Unified Name	CCITT	RS-232 V.24	X.21	EIA-530	V.35	RS-449 V.36
Receive Data (From DCE)	RXD	104	RD	R	RD	RD	RD
Transmit Data (To DCE)	TXD	103	TD	T	TD	SD	SD
Clear To Send (From DCE)	CTS	106	CTS	I	CTS	CTS	CS
Request To Send (To DCE)	RTS	107	RTS	C	RTS	RTS	RS

Table 19 Signal lead cross reference (Continued)

Signal Lead (Direction)	Unified Name	CCITT	RS-232 V.24	X.21	EIA-530	V.35	RS-449 V.36
Data Terminal (DTE) Ready (To DCE)	DTR	108.2	DTR	-	DTR	DTR	TR
Data Set (DCE) Ready (From DCE)	DSR	107	DSR	-	DSR	DSR	DM
Receiver Line Signal Detect (From DCE)	DCD	109	RLSD	-	RLSD	RLSD	RR
Ring Indicator (From DCE)	RNG (not supported)	125	RI	-	RI	CI	IC
Local Loopback (To DCE)	LLB	141	LL	-	LL	LL	LL
Remote Loopback (To DCE)	RLB	140	RL	-	RL	RL	RL
Test Mode (From DCE)	TMA	142	TM	-	TM	TM	TM
Transmitter Signal Element Timing (From DCE)	STC	114	ST	-	TC	SCT	ST
Transmitter Signal Element Timing (To DCE)	TXC	113	TT	X	XTC	SCTE	TT
Receiver Signal Element Timing (From DCE)	RXC	115	RT	S	RC	SCR	RT

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Test and Measurement Regional Sales

North America
Toll Free: 1 800 638 2049
Tel: +1 240 404 2999
Fax:+1 240 404 2195

Latin America
Tel: +55 11 5503 3800
Fax:+55 11 5505 1598

Asia Pacific
Tel: +852 2892 0990
Fax:+852 2892 0770

EMEA
Tel: +49 7121 86 2222
Fax:+49 7121 86 1222

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HST-000-592-01
Revision 500, 08-06
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