SmartClass

E1 and E1/Datacom Testers

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 SmartClass E1 and E1/Datacom Testers. The catalog number for a printed guide is ML-21107607. The catalog number for a CD-ROM containing all user documentation and utilities is CML-21104331.

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This product was 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 when the equipment is operated in a commercial or residential environment. This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

The authority to operate this product is conditioned by the requirements that no modifications be made to the equipment unless the changes or modifications are expressly approved by JDSU.

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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.

EMC Directive Compliance

This product was tested and conforms to the EMC Directive, 89/336/EEC as amended by 92/31/EEC and 93/68/EEC for electromagnetic compatibility.

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This product was tested and conforms to the Low Voltage Directive, 73/23/EEC as amended by 93/68/EEC. Conformity with this directive is based upon compliance with the harmonized safety standard, UL61010-1.

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.

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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.

Table of Contents

About this Guide

This chapter describes how to use 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 SmartClass E1Tester.

This guide includes task-based instructions that describe how to configure, use, and troubleshoot the general functions of the SmartClass E1Tester. Additionally, this guide provides a description of JDSU's warranty.

Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the SmartClass E1Tester effectively and efficiently. We are assuming that you have basic computer experience and are familiar with basic telecommunication concepts, terminology, and safety.

Safety and compliance information

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

Conventions

This symbols and safety terms used in this guide are described in the following tables.

Table 1 Symbol conventions

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

Table 2 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 a general description of the SmartClass E1 Tester. Topics discussed in this chapter include the following:

Ship list

The E1 Tester typically ships in anti-static packing material to stabilize the unit inside the box. The following items ship standard with the SmartClass E1 Tester:

- SmartClass E1 Tester unit.
- AC Power Adapter with Plug Kit (USA, UK, Australia, Europe) — A power adapter designed specifically for the SmartClass Tester is included. When supplying power to the SmartClass Tester using an adapter, you must use the adapter *supplied with your unit*. (catalog no. SC1WALLCHARGER)
- Small Carrying Bag (catalog no. 7522/90.03)
- 4 AA Rechargeable NiMH Batteries (catalog no. BATTAA25AHNIMH4PCK)
- RJ-48 (M) to RJ-48 (M/F) Cable (catalog no. K1599)
- USB Cable (catalog no. CB-50759)
- Documentation CD. The *SmartClass E1 Tester User's Guide* and the *Download Manager and Upgrade Instructions* are included on the CD. (catalog no. CML-21104331)

  The latest version of the Download Manager utility is available on JDSU's Communications Test & Measurement Customer Care site at http://www.jdsu.com/test_and_measurement/products/descriptions/SmartClass_E1/index.html.

  Safety and compliance information is provided separately, in printed format.

When unpacking the unit, verify that each of the standard items, and any optional items you ordered, are included in the package.

Features and capabilities

Features and capabilities of the SmartClass E1 Tester include the following:

- General features
  - Color display
  - Supported languages: Simplified Chinese, Deutsche, English, French, Italian, Japanese, Korean, Portuguese, Russian, and Spanish.
  - Field replaceable batteries
  - Remote control (optional)
  - VT-100 terminal emulation (option)
- E1 Testing features
  - Dual E1 RJ-48 interfaces (Port 1 Rx/Tx, Port 2 Rx only).
  - 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, TSE (bit errors), pattern slips, CRCs, E-bit errors, FAS, and MFAS errors.

  - Physical layer defects (alarms), anomalies (errors), and statistics are collected during the test.
  - Auto configure to automatically select the interface, framing, and pattern.
  - Line rate throughput testing
  - Line loopback testing
  - Round trip delay measurement
  - Terminate, Monitor, Bridge, and Loopback testing
  - Pulse shape (option)
  - MFC-R2 Signaling (option)
- Datacom Testing features
  - DTE emulate, DCE emulate and monitor mode
  - X.21, V.24 (RS-232), V.35, V.36 (RS-449), EIA-530
  - V. delay
  - Frame Relay
  - G.703 Co-directional, Contra-directional and Centralized interface testing

Options

The SmartClass E1 Tester has factory-configurable options as well as options available for field upgrade. You can expand your testing capability by purchasing optional software or accessories.

Configurations

The SmartClass E1 Tester is factory configurable with or without Datacomm. Table 3 describes the available configurations.

Table 3 SmartClass E1 Tester configurations

Catalog Number	Option
CSC-E1-P1	SmartClass E1 Tester. Allows you to test E1 services.
CSC-E1-P2	SmartClass E1 Tester with the PS option. Allows you to test E1 services, including Pulse Shape.
CSC-E1-P3	SmartClass E1 Tester with the JIT option. Allows you to test E1 services, including Jitter.
CSC-E1-P4	SmartClass E1 Tester complete package. Allows you to test E1 services, including Pulse Shape and Jitter.
CSC-E1DC-P1	SmartClass E1 Datacomm Tester. Allows you to test E1 and Data communication services.
CSC-E1DC-P2	SmartClass E1 Datacomm Tester with PS and FR options. Allows you to test E1 services, including Pulse Shape, and Data communication services, including Frame Relay.
CSC-E1DC-P3	SmartClass E1 Datacomm Tester with PS, SIG, and VT100 options. Allows you to test E1 services including Pulse Shape, MFC-R2 signaling, and VT100, as well as Data communication services, including Frame Relay.

Table 3 SmartClass E1 Tester configurations (Continued)

Catalog Number	Option
CSC-E1DC-P4	SmartClass E1 Datacomm Tester with PS and JIT options. Allows you to test E1 services, including Pulse Shape and Jitter, and Data communication services.
CSC-E1DC-P5	SmartClass E1 Datacomm Tester complete package. Allows you to test E1 services including Pulse Shape, Jitter, MFC-R2 signaling, and VT100, as well as Data communication services, including Frame Relay.

Software options

Table 5 lists the software options offered for the E1 Tester.

Table 4 SmartClass E1 Tester software options

Catalog Number	Option
CSC-E1-PS	SmartClass Pulse Shape SW Option. Allows measuring of and displaying a graphical representation of the E1 pulse. (Applicable to CSC-E1 and CSC-E1DC)
CSC-E1-FR	SmartClass Frame Relay option. Allows you to test frame relay services over Datacomm interfaces. (Applicable to CSC-E1DC only)
CSC-E1-SIG	SmartClass Signaling option. Allows you to test MFC-R2 signaling. (Applicable to CSC-E1DC only)
CSC-E1-VT100	SmartClass VT100 option. Allows emulation of a VT100 terminal. (Applicable to CSC-E1DC only)
CSC-E1-JIT	SmartClass Jitter option. Allows measurement of jitter. (Applicable to CSC-E1DC only)
CSC-E1-RC	SmartClass Remote Control Option. Allows remote access and control of the instrument using specific commands. A command guide is available with this option. (Applicable to CSC-E1 and CSC-E1DC)

Optional accessories

Table 5 lists the optional accessories offered for the E1 Tester.

Table 5 SmartClass E1 Tester optional accessories

Catalog Number	Accessory
General	
CC-120101	Large Carrying Bag
AC-009801	Large Strand Hook
SCACARCHARGER	SmartClass 12V car adapter
ML-21107607	Printed *SmartClass E1 Tester User's Guide* (English)
ML-21121114	Printed *SmartClass E1 Tester Remote Control Reference Guide* (English)
E1 testing	
K1597	Balanced RJ-48 to balanced CF Y-cable
CB-44995	RJ-48 (balanced) to dual BNC (unbalanced) cable

Table 5 SmartClass E1 Tester optional accessories (Continued)

Catalog Number	Accessory
CB-0045402	External 2M Reference Clock cable
Datacom testing	
CB-44391	X.21 10 MHz DTE/DCE Emulate
CB-44346	X.21 Monitor
CB-44385	V.24 DTE/DCE Emulate
CB-44348	V.24 Monitor
CB-44389	V.35 DTE/DCE Emulate
CB-44341	V.35 Monitor
CB-44388	V.36 DTE/DCE Emulate
CB-44347	V.36 Monitor
CB-21128081	68-pin MDR to DB-15 cable (DTE emulation, for interface to network)
CB-21118474	68-pin MDR to Bananas (for Co-directional, Contra-directional and Centralized testing)

To order accessories for your E1 Tester, contact JDSU Customer Care, your JDSU TAC representative, or your local JDSU sales office. You can also contact JDSU through the company web site, www.jdsu.com.

Preparation for use

This section explains how to start using your E1 Tester.

General preparation

When you unpack the E1 Tester, do the following:

– Inspect the tester for damage.
– If undamaged, save the box and packing materials in case you need to ship the tester in the future.

Before using the E1 Tester for the first time, do the following:

– If you are using alkaline batteries, verify that your unit is OFF, and then install fresh batteries in the tester.
– If you are using rechargeable batteries, verify that your unit is OFF, and then install the batteries in the tester. Before testing, make sure the batteries have been fully charged (see “Recharging the batteries” on page 104).
– Turn the unit ON (see “Powering ON your unit” on page 10).
– When prompted, specify the type of battery you installed.
– Verify that your unit is operating properly by navigating through a few menus.

– If the Batt LED is red, replace the batteries (see “Replacing the batteries” on page 105). If you suspect that the batteries are fine, and the batteries are fully charged, it’s possible the charger has detected a fault condition. See “Resolving problems” on page 108 for details.

Charging the batteries

The SmartClass Tester uses an AC adapter or four (4) AA batteries (alkaline or rechargeable NiMH batteries). The first time you use the SmartClass Tester, or after prolonged storage, use the AC adapter to power the unit and charge NiMH batteries only. For details on charging and maintaining batteries, see Chapter 8 “Maintaining the Batteries”.

Exploring the front panel

The controls and LEDs on the SmartClass front panel, shown in Figure 1, are used to operate the unit, set up tests, and view data.

Figure 1 SmartClass front panel

The label near the top will say “SmartClass E1/Data”, if you have the E1/Datacomm configuration.

The following paragraphs describe each of the controls and LEDs on the front panel.

Status LEDs

These indicators report the status of the unit. The function of the LEDs change depending on the application. Table 6 describes each of the Status LEDs.

Table 6 Status LEDs

Status LED	Description
Sync	*For E1 testing:* Green – Solid—A signal is present and synchronization is established on all active receivers. – Flashing—Auto-framing is running on at least one active receiver. Red – At least one of the active receivers does not have frame synchronization. Off – No signal has been detected on any receiver. *For Datacom testing:* Green – Solid—A receive clock is present. Red – Solid—A receive clock was present at some point in the past, but was lost. Off – No receive clock has been detected on any receiver.
Data/LpBK	Green – Solid—Synchronization is established with BERT pattern for all active receivers. – Flashing—Auto-pattern is running on at least one active receiver. Red – At least one of the active receivers does not have pattern synchronization. Amber – *For E1 testing:* The E1 Tester has been placed in a line loopback mode. Off – The E1 Tester is not in a line loopback mode, which means the selected traffic pattern is live on all active receivers, or no pattern synchronization has been detected on the receiver.
Err/Alm	Red – Flashing—The LED flashes for one second when an error or alarm occurs. Or, for E1 testing, flashes when the unit is searching for framing or a pattern during Auto Config. Amber – At least one error or alarm has occurred since that last reset. Off – All Summary results are OK. No error or alarm has been received.

Table 6 Status LEDs

Status LED	Description
Batt	Green – Solid—An external source is powering the unit. Red – Low battery, or the charger has detected a fault condition. Amber – The battery is charging. Off – A battery is powering the unit.

LCD The LCD is a 320 x 240 pixel color display with contrast control and backlight.

Cancel key Use the Cancel key to exit a data entry screen without changing your settings, or to return to the previous menu.

OK key Use OK to accept a changed setting or to proceed to the next menu.

Arrow keys Use the arrow keys to navigate through menu selections. For E1 testing, when viewing the test results, use the left or right arrow key to switch between Rx1 and Rx2 result screens. For Datacom testing, in monitor mode use the left or right arrow to switch between DCE and DTE.

Keypad Use the keypad to enter numbers, make menu selections, enter alphabetic characters, and so on. Throughout the menus, the numbers associated with each function provide a quick way to perform tests with simple number sequences.

***Action key** Use the *Action key to insert errors or alarms during testing.

#Start key Use the #Start key to *restart your test and transmit traffic* immediately after you configure your test. After starting the test, the unit automatically displays test results associated with your application.

Backlight key Use the backlight key to adjust the brightness level on your LCD. The SmartClass E1 provides four brightness levels on the LCD. Pressing the backlight key once increases the brightness by one level. The brightness level returns to the original level when you press the backlight key the fourth time.

Power key Use the power key to turn power ON (see “Powering ON your unit” on page 10), put the unit into sleep mode, or turn power OFF (see “Powering OFF your unit” on page 10).

Exploring the side panels

The connectors located on the side panels are used to connect the E1 Tester to the circuit for testing.

Left side panel

Figure 2 shows the left side panel.

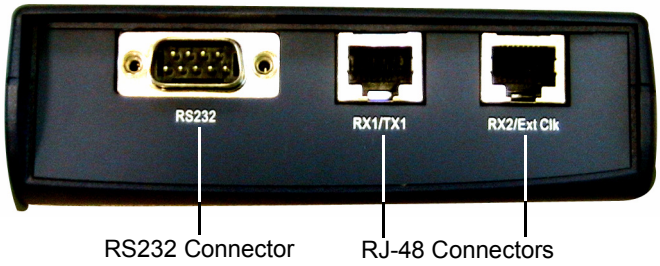

Figure 2 SmartClass E1 Tester left side panel

Use the RJ-48 jacks (labeled **RX1/TX1** and **RX2/Ext Clk**) to connect to E1 circuits. See Table 5 on page 4 for cables that are available for the SmartClass E1 Tester.

The RS232 connector is only used on the SmartClass E1/Datacomm configuration. It is used to connect to network elements when using the optional VT-100 emulation feature.

Right side panel

The right side panel has a universal connector, shown in Figure 3, that is used to connect to Datacom circuits

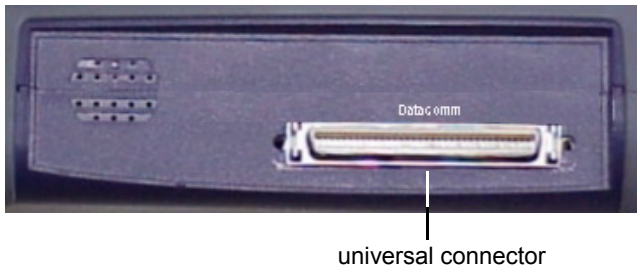

Figure 3 SmartClass E1 Tester right side panel

The universal connector supports several interface standards. Use the connector and adaptor cables (see Table 5 on page 4) to connect to the appropriate test interface. For pin assignments for the supported interface standards, see Appendix A on page 111.

Exploring the bottom panel

The SmartClass AC adapter and USB device ports are located on the bottom panel. The USB device port is used to establish connections that allow you to run reports from a remote device (typically a PC or laptop) or update the software using the Download Manager utility.

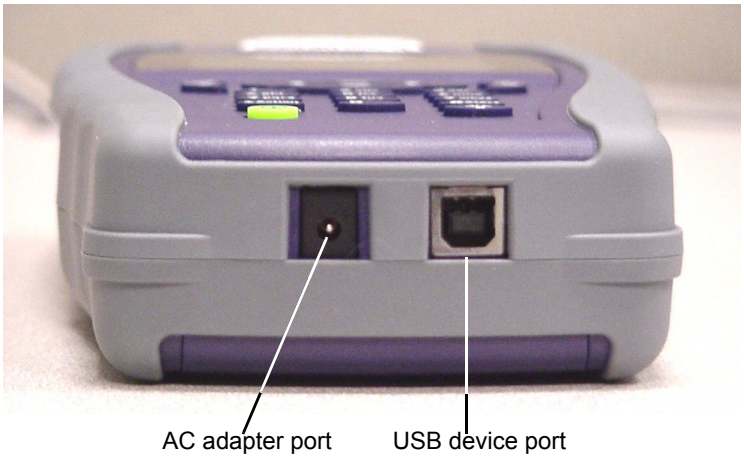

Figure 4 SmartClass bottom panel

Powering ON your unit

The following procedure describes how to power ON the E1 Tester.

To power ON your unit

– Press and hold the Power key for a few seconds.

The SmartClass E1 splash screen appears for a few seconds, and then the Main Menu appears.

Powering OFF your unit

The following procedure describes how to power OFF the E1 Tester.

To power OFF your unit

1 Press and hold the Power key for a few seconds.

The Power Control menu appears.

2 Do one of the following:

– If you want to be able to restart the unit quickly, select **Enter Sleep Mode**. The test stops, and then the user interface disappears. If the backlight is ON, the unit automatically turns it OFF. When you are ready to resume testing, press the Power key for a few seconds to redisplay the user interface.

NOTE: If your unit is in sleep mode for more than two hours, it will automatically turn itself OFF.

– To conserve power and completely power OFF your unit, select **Shut Down**. A message briefly appears informing you that the unit is shutting down.

Power is OFF.

Navigating the user interface

The user interface of the SmartClass is designed to be intuitive and easy to use. Using the LCD and keypad, you can set up the unit, configure test parameters, and view test results. This section describes the user interface, and explains how to navigate through the menus and screens.

When you power up the SmartClass E1 Tester, the Main Menu of the user interface appears. Figure 5 illustrates the Main menu for the SmartClass E1/Datacom tester.

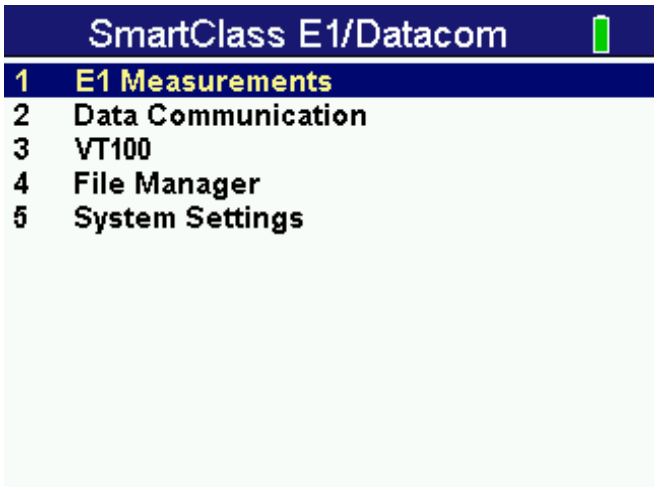

Figure 5 SmartClass E1/Datacom Tester Main Menu

There are 3 types of screens on the user interface:

– Menus
– Data entry screens
– Results screens

Menu screens

Figure 6 illustrates the Configuration menu screen for the SmartClass E1 tester.

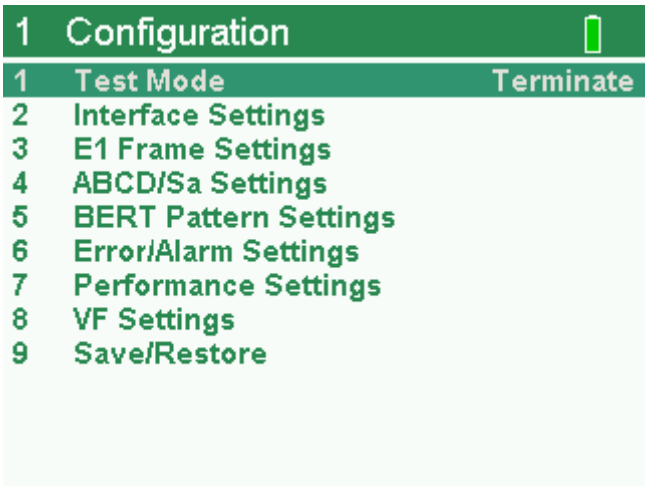

Figure 6 SmartClass E1 Tester Configuration menu screen

Menu screens provide a series of selections that take you to another menu screen, a data entry screen, or a results screen.

Figure 7 illustrates the Error/Alarm settings menu screen listing each of the available error or alarm settings.

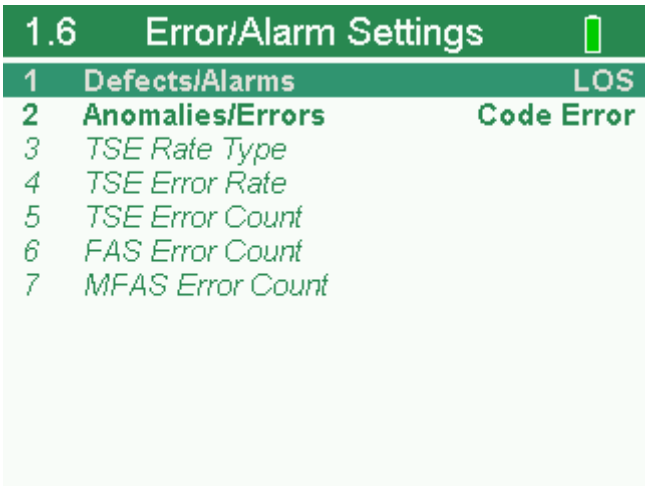

Figure 7 SmartClass E1 Tester Error/Alarm Settings menu screen

Data entry screens

Data entry screens provide a list of selectable options, or allow you to enter data or specify settings using the keypad. Figure 8 illustrates the Timeslots screen, used to specify the timeslots you want to use to transmit traffic in.

Figure 8 SmartClass E1 Tester Data Entry screen

Result screens

Figure 9 illustrates a Result screen.

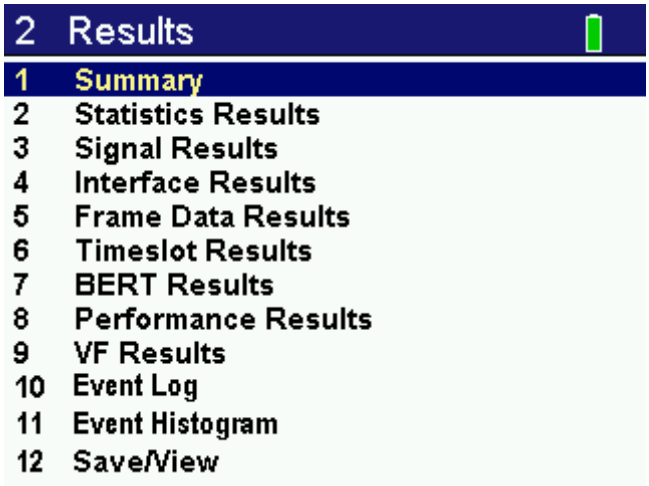

Figure 9 SmartClass E1 Tester Result screen

These screens display test results. The results are split into categories. Press the arrow keys to navigate through the result categories (screens).

Using the keypad

Use the keypad to enter alpha-numeric values, or to navigate to different screens by specifying the menu number corresponding to the screen. When entering alpha-numeric values for a test setting:

- The left arrow positions the cursor one position to the left.
- The down arrow operates as a Backspace key, and typically clears the character one position to the left of the cursor. If the cursor is on the *first character* of a text entry field, the down arrow deletes the first character.
- If you are entering text, the up arrow serves as a Caps Lock key.

Selecting a menu option or a configuration setting

There are three ways to select a menu option or configuration setting.

- Use the arrow keys to scroll to the desired option then press the **OK** key.
- Press the number associated with the menu option.
- Change on/off or enable/disable values using the left and right arrow keys on your keypad. For example, if the current value is ON, pressing the left arrow a single time changes the value to OFF. Pressing it a second time changes it back to ON.

Returning to a previous menu

Use the **Cancel** key to return to the previous menu.

Entering numeric values

To enter numeric values

1. Use the arrow keys to scroll to and highlight the setting you want to specify.
2. Press **OK**.
3. Use the keypad to type the numeric value.
4. If you want to move to the next field, use the right arrow key.
5. If you want to enter a minus sign (-), and the setting accepts negative values, press the # key.
6. If you want to enter a decimal point, and the setting accepts floating decimal values, press the asterisk (*) key.

Typing text

To type text

1. Use the arrow keys to scroll to and highlight the setting you want to specify.
2. Press **OK**.

3 Use the keypad to type the text.

- Repeatedly pressing a key scrolls through the selections for that key. For example, repeatedly pressing the 2 key will scroll through A, B, C and 2.
- To toggle between upper and lower case, press the up arrow.
- To delete the previous character, press the down arrow.
- Use the left and right arrow to navigate through typed text.
- To enter a space between characters, press the 0 (zero) key once.
- To scroll through and select a special character such as:

  `. @ / , ' - ? ! _ 1`

  press the 1 (one) key.

NOTE

You can not enter a space when specifying a filename.

Instrument Settings

2

This chapter describes how to configure the basic settings of the instrument. Topics discussed in this chapter include the following:

Setting the language

The following instructions explain how to specify the language for your SmartClass E1Tester.

To specify the language for the SmartClass E1 tester

1 Power ON your tester by pressing and holding the ⏻ key for a few seconds.

The SmartClass E1 splash screen appears briefly, and then the SmartClass E1 main menu appears.

2 Select **System Settings**. A menu appears listing each of the system settings.

3 Select **Language**. A menu appears listing the available languages.

4 Select the language. After a brief moment, the main menu appears, and options appear in the language you selected.

The language for the E1 Tester is specified.

NOTE:

If you select the wrong language by mistake, you can return to the language selection menu by selecting the last item on the Main Menu, and then the last menu on the System Settings menu.

Viewing the software and hardware information

The Version Info screen displays the current version of the software loaded on your unit, whether your hardware is jitter capable, and the factory-assigned SCE ID number.

To view the software and hardware information

1 Select **System Settings** from the Main Menu.

2 Select **Version Info**.

The software version and SCE ID Number appear. The screen may also display “Jitter-capable hardware”.

NOTE:

The jitter option requires both newer hardware *and* an option code. Thus, having hardware that is jitter capable does not guarantee that the option is enabled. To verify whether your unit includes the jitter option, view the E1 Measurement menu. If it includes a selection for **E1 Jitter**, the option is enabled.

Setting the date and time

The E1 Tester has an internal clock that you can set to provide accurate time stamps for test results. By default, the clock uses a 12-hour format and presents dates in a MM/DD/YYYY format. You can optionally configure your unit to use a 24-hour time format or a DD/MM/YYYY date format. For example, you can configure the E1 Tester to display midnight, January 15th in the following manner:

Time format	Time displayed	Date format	Date displayed
12-hour	12:00:00 AM	MM/DD/YYYY	01/15/2007
24-hour	00:00:00	DD/MM/YYYY	15/01/2007

Changing the date or time format

The following procedure describes how to change the date or time format on your unit.

To change the date or time format

1. Select **System Settings** from the Main Menu.
2. Select **Set Time/Date Format**.
3. Do one of the following:
   - To change the format used to display the time, select **Time Format**, and then select the new format.
   - To change the format used to display the date, select **Date Format**, and then select the new format.

The format is changed.

Setting the date or time

The following procedure describes how to set the date or time.

To set the date or time

1. Select **System Settings** from the Main Menu.
2. Select **Set Time/Date**.
3. Do one of the following:
   - To set the time, select **Set Time**, and then enter the time.
   - To set the date, select **Set Date**, and then enter the date.

The date or time is set.

Adjusting the contrast and brightness

The following procedure describes how to adjust the contrast and brightness.

To adjust the contrast and brightness

1. Select **System Settings** from the Main Menu.
2. Select **Contrast/Brightness**.
3. Change the contrast level using the left or right arrow key.
4. Change the brightness using the up or down arrow key.
5. Press the **Cancel** key to return to the previous Menu.

The contrast and brightness are set. You can also press and hold the Backlight key, and then press the right and left arrows to adjust contrast of the display.

Determining the specified battery type

The following procedure describes how to determine the type of battery you specified when you installed batteries in your unit (see "Replacing the batteries" on page 105).

To determine the specified battery type

1. Select **System Settings** from the Main Menu.
2. Select **Battery Selection**.

A screen briefly appears indicating the type of battery you specified, and then the System Settings menu appears.

Managing files

The following procedure describes how to view or delete test configuration or test result files.

To view or delete files

1. Select **File Manager** from the Main Menu.

   The File Manager menu appears.
2. Select **Config Files** or **Result Files**.

   A list of files appears.
3. Use the down arrow to scroll to the desired file, and then do one of the following:
   - If you want to view the file, press the OK key.
   - If you want to delete the file, press the left arrow key.

     A menu appears asking you to verify whether or not you want to delete the file.

     To delete the file, select **Yes**.

The file is deleted.

Specifying DB9 port usage

The E1 Tester has one DB9 RS232 serial port but both the VT100 and remote control options use this port. This menu specifies which option will use the port. This menu only appears if your unit has both options.

To specify the DB9 port usage

1. Select **System Settings** from the Main Menu.
2. Select **RS232 DB9 port usage**.
3. Choose which option will use the DB9 port.

   The default is VT100.

The port usage is specified.

Setting options

The **Set Options** item on the System Settings menu allows you to add optional functionality to your SmartClass E1 Tester. If the options were ordered at the same time the unit was ordered, they will be installed at the factory. If you order a field upgrade, you will receive a package with an option code to enter here, along with additional instructions.

Restoring factory defaults

The following procedure describes how to restore the E1 Tester to use factory default test application and system settings.

To restore factory default settings

1. Select **System Settings** from the Main Menu.
2. Select **Restore Defaults**.
3. Select **Yes** to restore the settings, or **No** to keep the current settings.

Factory defaults are restored.

Basic Testing

3

This chapter provides instructions for basic tests or procedures that are common among testing applications. Topics discussed in this chapter include the following:

Managing test configurations

After specifying test settings, you can save the configuration, and then restore it at a later time when you want to run a test using the same settings. You can also view a stored test configuration to verify it matches the desired settings before using it. If you no longer need the configuration, you can delete it.

Saving a configuration

To save a test configuration

1. If you haven't already done so, launch your test application (see "Launching an E1 test application" on page 28), and configure the test (see "Specifying test application settings" on page 29).
2. On the Configuration menu, select **Save/Restore-View**.

   A menu appears.
3. Select **Save Config**.

   A screen appears prompting you for a filename for the configuration file.
4. Enter a filename, and then press **OK**.

The configuration file is saved.

Restoring a configuration

To restore a saved test configuration

1. On the Configuration menu, select **Save/Restore-View**.

   A menu appears.
2. Select **Restore/View**.

   A menu appears listing all saved configurations.
3. Use the up and down arrows to highlight the configuration you want to restore, and then the right arrow.

The configuration is restored.

Viewing a configuration

To view a saved test configuration

1. On the Configuration menu, select **Save/Restore-View**.

   A menu appears.
2. Select **Restore/View**.

   A menu appears listing all saved configurations.
3. Use the up and down arrows to highlight the configuration you want to restore, and then press **OK**.

The configuration is displayed on the screen.

Starting or restarting a test

After you configure your test, you are ready to start or restart the test.

To start or restart the test

1 If you haven't already done so, launch your test application (see "Launching an E1 test application" on page 28 or "Launching the datacom application" on page 52), and configure the test (see "Specifying test application settings" on page 29 or page 53).

2 Press the **# Start** key.

The unit clears your test results, the test restarts, and the unit transmits the traffic you configured.

The test starts or restarts.

NOTE

You can also start or restart a test by pressing the Cancel key until you get to the BERT menu, and then select Action, and then selecting the corresponding option on the Action menu.

Stopping a test

You can stop a test any time.

To stop a test

1 Press **Cancel** until you get to the main test menu, and then select **Action**.

A menu of actions applicable to you test appears.

2 Select **Stop Test**.

A message appears indicating the tester is stopping the test.

The test stops.

Timed testing

If you wish to run a test for a specific amount of time, you can do a timed test.

To do a timed test

1 If you haven't already done so, launch your test application (see "Launching an E1 test application" on page 28 or "Launching the datacom application" on page 52), and configure the test (see "Specifying test application settings" on page 29 or page 53).

2 On the Configuration menu, select **Timed Test**.

3 Select **Enabled**, and then select either **On** or **Off**.

4 Select **Duration**, and then enter the number of seconds to run the test.

The test runs for the specified duration.

Viewing test results

After the E1 tester is connected to the circuit and test is started, the unit immediately accumulates and displays results in the Summary and Signal result categories. After you start a test and transmit traffic, additional test results populate the remaining categories.

To view test results

1. If you haven't already done so, launch a test application (see "Launching an E1 test application" on page 28 or "Launching the datacom application" on page 52).
2. Start the test.
3. On the Main menu for the test, select **Results**.

   A menu of result categories applicable to you test appears.
4. Select a result category.
5. If necessary, use the up / down arrow keys or the OK key to select Rx1 or Rx2 results.

Test results appear for the category you selected. After the test is complete and all results have accumulated, the status bar at the bottom of the results display blinks and indicates that the results are complete.

You can clear existing result values and then accumulate new values using the **Restart** action.

The test results for the category appear. For descriptions of test results, see Chapter 7 "Test Results".

Remote Control

With the remote control option, you can connect to a E1 Tester in order to control it remotely using command lines via the serial interface. A command guide is available with the option.

E1 Testing

4

This chapter provides task-based instructions for turning up and trouble-shooting E1 service using the SmartClass E1 Tester. Topics discussed in this chapter include the following:

About E1 testing

The SmartClass E1 tester 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 SmartClass E1 in the following ways:

– To terminate a circuit, and then loop back to another SmartClass unit or piece of network equipment to perform BER testing.
– To perform BER analysis end-to-end between two SmartClass 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 BER testing on individual timeslots within an E1 circuit.
– To perform line loopback testing to monitor the circuit.
– To measure an E1 pulse and display a graph of the pulse shape

Launching an E1 test application

The following procedure describes how to launch an E1 test.

To launch an E1 test

1 Power ON your tester by pressing and holding the ⏻ key for a few seconds.

The SmartClass E1 splash screen appears for a few seconds, and then the SmartClass E1 main menu appears.

2 Select **E1 Measurements**. The E1 Measurements menu appears.

3 Select an application; for example, **E1 BERT**.

A message briefly appears stating that the unit is launching the test application.

A test menu appears for the application, listing the following options:

– Configuration. Select this option to configure your test.
– Results. Select this option to observe test results associated with your test.
– Error/Alarm. Select this option to insert errors or alarms as you test. This is only available in the E1 BERT application.
– Action. Select this option to perform key actions required for your test, such as starting or restarting a test, starting traffic or looping up a unit. You can also press the Action button at any time to view a menu of actions applicable to your test.

The E1 test application is launched.

Specifying test application settings

Before transmitting traffic over a link, you can specify interfaces and settings that filter received traffic for analysis.

Specifying a test mode

The SmartClass E1 can operate in the following test modes:

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

  Use this mode to test out of service lines using the RX1/TX1 port. You can generate and send test patterns on TX1 and receive patterns on RX1. RX2/Ext Clk is not used in this mode.

– **Monitor Mode (PMP Monitor)**: This mode measures signal parameters and monitors traffic at an E1 access point (the PMP – Protected Monitor Point). The PMP typically has a resistive loss of -26dB. The tester applies gain to the input signal to compensate for the reduced PMP amplitude. Both of the receivers are monitored simultaneously. However, the E1 tester does not transmit any traffic in this mode. This permits simultaneous non-intrusive monitoring of the E1 line.

– **Bridge Mode (HI-Z Monitor)**: This mode allows you to bridge onto a terminated E1 line with a high impedance (Hi-Z). This permits simultaneous non-intrusive monitoring on the E1 line. The transmitter on the E1 line is not used in this mode.

– **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.

Table 7 lists the transmitter/receiver used in the test modes supported by the SmartClass E1 tester:

Table 7 SmartClass E1 Tester Test Modes

Test Mode	Rx1	Tx1	Rx2	Rx1 VF
Terminate	X	X		X
Monitor	X		X	X
Bridge	X		X	X
Line Loopback	X	X		X

To specify a test mode

1 If you haven't already done so, launch an E1 application (see "Launching an E1 test application" on page 28).

2 On the Configuration menu, select **Test Mode**, and then use the up or down arrow to specify one of the following:

  – Terminate
  – Monitor
  – Bridge
  – Line Loopback

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The test mode is specified.

Configuring test settings automatically

You can use the Auto Configure feature to configure the interface, framing, and pattern settings automatically.

To configure the interface, framing, and pattern settings automatically

1 If you haven't already done so, launch your test application (see "Launching an E1 test application" on page 28).

2 Connect the E1Tester to the circuit.

3 On the test menu, select **Action**.

The Action menu appears.

4 On the Action menu, select **Auto Configure**.

The SmartClass E1 will attempt to automatically configure the interface, framing, and pattern. If this attempt fails, the E1 tester will set the framing to Unframed and the pattern to Live. You can also configure the framing and pattern settings manually. See "Specifying E1 framing settings" on page 31 and "Specifying a BERT pattern" on page 33.

The interface, framing, and pattern settings are automatically configured. Proceed to configure the following settings for the test:

– VF settings, see "Specifying VF settings" on page 37.
– E1 signaling settings, see "Specifying E1 signaling (ABCD/Sa) settings" on page 32.
– Defect and anomaly settings, see "Specifying Error/Alarm settings" on page 35.
– Performance settings, see "Specifying performance settings" on page 36.

Specifying interface settings

Before you transmit E1 traffic, you can specify the characteristics of the interface you want to transmit the traffic on, such as the line coding for the signal you want to transmit, the transmit clock, and the slip reference for the receiver.

To specify interface settings

1 If you haven't already done so, launch an E1 BERT application (see "Launching an E1 test application" on page 28).

2 On the Configuration menu, select **Interface Settings**, and then specify values for the following settings:

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

Setting	Parameter
Tx Clock	Select one of the following: – **Internal** – **Rx1** – **Rx2** – **Ext. BNC** **NOTE:** If timing is lost, the SmartClass reverts to internal timing.
Tx Clk Offset (ppm)	Enter a value, from **-100** through **100** ppm, to indicate the offset frequency generated by the 2048 kbit/s internal clock. To specify negative numbers, press the **#** key. To delete a single character, press the down arrow key.
Slip Reference	Select one of the following slip reference options: – **Rx2** – **Ext. BNC**

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The interface settings are configured.

Specifying E1 framing settings

Before transmitting E1 traffic, you can specify the framing format and payload of the traffic you want to transmit.

To specify E1 framing settings

1 If you haven't already done so, launch an E1 application (see "Launching an E1 test application" on page 28).

2 On the Configuration menu, select **E1 Frame Settings**, and then specify values for the settings listed below:

Setting	Parameter
Framing	Select the framing format for the signal: – **PCM31C** – **PCM31** – **PCM30C** – **PCM30** – **Unframed**
Payload	Select the payload: – **Bulk**: full E1 circuit – **n x 64k**: individual timeslot(s) from an E1 circuit

Setting	Parameter
Timeslots (n x 64k payload only)	Do one of the following: – To turn all the available channels on, press **1**. – To turn all the available channels off, press **0**. – To turn on only the selected channels, use the arrow keys to point at the channels you want to turn on, and then press the **#** key to select the channel. You can select multiple channels. When you have finished selecting timeslots, press **OK**. At least one timeslot must be selected.
Idle Byte (n x 64k payload only)	Specify the idle byte pattern you want to insert into the selected timeslots. For example, (MSB) `10101010` (LSB), the MSB is sent first.

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The framing settings are configured.

Specifying E1 signaling (ABCD/Sa) settings

Before transmitting E1 traffic, you can specify settings for E1 signaling.

To specify E1 signaling settings

1 If you haven't already done so, launch an E1 test application (see "Launching an E1 test application" on page 28).

2 On the Configuration menu, select **ABCD/Sa Settings**, and then specify values for the following 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.
A Bit (Remote Alarm)	Select whether the NFAS A Bit is **On** or **Off**.
Si Bit	Select whether the Si Bit is **ITU-T** (default) or **USER**.
Signaling Bits (BERT)	Set the 4-digit active signaling word.
Signaling Bits (Idle)	Set the 4-digit idle signaling word.
NMFAS (XYXX)	Set the 4-digit NMFAS word.

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The E1 signaling settings are configured.

Specifying a BERT pattern

You can specify a BERT pattern for your test.

To specify a BERT pattern

1 If you haven't already done so, launch an E1 test application (see "Launching an E1 test application" on page 28).

2 On the Configuration menu, select **BERT Pattern Settings**, and then select **Pattern**.

3 Select one of the following BERT patterns:

Pattern	Description
63 (2^6-1)	Selects the 2^6 -1 pseudorandom pattern, which generates a maximum of 5 sequential 0s and 6 sequential 1s.
511 (2^9-1)	Selects the 2^9 -1 pseudorandom pattern, which generates a maximum of 8 sequential 0s and 9 sequential 1s.
2047 (2^11-1)	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.
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.
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
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.

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.
QBF	The Quick Brown Fox message (all uppercase: THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789). **NOTE**: For Datacom testing, this pattern is only available when testing in synchronous mode.
QBF1	The Quick Brown Fox message (see “QBF”) followed by CR LF. **NOTE**: This pattern is only available for Datacom testing and when testing in asynchronous mode. The QBF message is encoded according to the number of data bits you specified in the character format.
QBF2	The Quick Brown Fox message (see “QBF”) followed by LF CR LF CR. **NOTE**: This pattern is only available for Datacom testing and when testing in asynchronous mode. The QBF message is encoded according to the number of data bits you specified in the character format.
QBF3	The Quick Brown Fox message (see “QBF”) followed by LF CR. **NOTE**: This pattern is only available for Datacom testing and when testing in asynchronous mode. The QBF message is encoded according to the number of data bits you specified in the character format.
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.
Live	Used in monitor mode to avoid false “errors” when the monitored circuit contains live traffic rather than BERT patterns.
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.

If you selected User Bit Pattern or User Byte Pattern, proceed to step 4. Otherwise, proceed to step 5.

4 Do one of the following:
   – If you selected User Bit Pattern, in the BERT Pattern Settings menu, select **User Bit Pattern**, and then specify the bit pattern you want to use.
   – If you selected User Byte Pattern, in the BERT Pattern Settings menu, select **User Byte Pattern**, and then specify the byte pattern you want to use.

5 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The BERT pattern is specified.

Specifying Error/Alarm settings

You can specify the error or alarm to be inserted into the traffic you are transmitting.This is only available in the E1 BERT application.

To specify defects or anomalies

1 If you haven't already done so, launch the E1 BERT application (see "Launching an E1 test application" on page 28).

2 On the Error/Alarm menu, select **Error/Alarm Settings**, and then do one of the following:
   – To specify defects or alarms, select **Defects/Alarms**, and then proceed to step 3.
   – To specify anomalies or errors, select **Anomalies/Errors**, and then proceed to step 4.

3 On the Defects/Alarms menu, select one of the following defects or alarms:

Defect/Alarm	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

Proceed to step 5.

4 On the Anomalies/Errors menu, select one of the following anomalies or errors:

Anomalies/Errors	Description/Additional Settings
TSE	Test Sequence Errors (bit error). If you selected TSE, on the Error/Alarm Settings menu, select **TSE Rate Type**, and then select one of the following: **Single.** **Multiple.** Select **TSE Error Count**, and then specify the number of TSE error count (1~50). **Rate.** Select **TSE Error Rate**, and then specify one of the following: – **1e-2** – **1e-3** – **1e-4** – **1e-5** – **1e-6** – **1e-7**
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. On the Error/Alarm Settings menu, select **FAS Error Count**, and then specify the number of FAS error count (1~4).
MFAS Error	Multi frame alignment signal error. On the Error/Alarm Settings menu, select **MFAS Error Count**, and then specify the number of MFAS error count (1~2).
E-bit Error	Remote CRC errors

5 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The defect or anomaly settings are configured.

Specifying performance settings

You can configure settings for ITU performance analysis. This is only available in the E1 BERT application.

To configure performance settings

1 If you haven't already done so, launch an E1 BERT test application (see "Launching an E1 test application" on page 28).

2 On the Configuration menu, select **Perf. Settings**, and then specify values for the settings listed below:

Setting	Parameters
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, between 10 and 100000**.

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The performance settings are configured.

Specifying VF settings

You can specify the VF tone pattern as the signal you want to transmit, and the VF timeslot for the receiver. You can also turn the speaker on or off and adjust the speaker volume. This is only available in the E1 BERT application.

To specify VF settings

1 If you haven't already done so, launch the E1 BERT test application (see "Launching an E1 test application" on page 28).

2 On the Configuration menu, select **VF Settings**, and then specify values for the following settings:

Setting	Parameters
VF Timeslot	Do the following: **a** To select a timeslot, use the arrow keys to point at the timeslot, and then press the **#** key. **b** After you finish selecting the timeslot, press **OK** to return to the VF Settings menu.
VF Tones	Specify the VF tones pattern for the signal you want to transmit.
Speaker State	Specify whether the speaker is turned on or off.
Volume Control	Use the right or left arrow keys to increase or decrease the speaker volume.

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The VF settings are configured.

Monitoring a circuit

The SmartClass E1 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 transmitter (Tx) is turned off in Monitor mode.

To monitor a circuit

1 Launch the **BERT** application. See “Launching an E1 test application” on page 28.

2 Connect the E1 Tester to the test access point:
   – Connect the 2M Reference Clock cable from the SmartClass E1 RX2/ Ext Clk jack to an E1 BITS clock or a known good reference signal.
   – Connect a cable from the SmartClass E1 RX1/TX1 jack to the signal to be tested.

3 To set the test configuration, do one of the following:
   – On the test menu, select **Action**, and then select **Auto Configure**.

     The unit will attempt to automatically configure the interface, framing, and pattern. Go to step 9.
   – On the test menu, select **Configuration**, and then proceed with step 4.

4 On the Configuration menu, select **Test Mode**.

   A list of test modes appears.

5 Select **Monitor**.

6 Configure the interface settings. See “Specifying interface settings” on page 30.

7 Configure the Framing settings. If you selected the n x 64k payload, you can select specific timeslots to monitor. See “Specifying E1 framing settings” on page 31.

8 Specify a BERT pattern. See “Specifying a BERT pattern” on page 33.

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 see “Line Coding” on page 30.

9 To monitor VF channel, configure the VF settings. See “Specifying VF settings” on page 37.

10 To configure settings for ITU performance analysis, configure the performance settings. See “Specifying performance settings” on page 36.

11 Restart the test.

12 To view other results, see "E1 Results" on page 78.

You have finished monitoring the circuit.

Measuring timing slips

The SmartClass E1 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 SmartClass 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 E1 **BERT** application. See "Launching an E1 test application" on page 28.

2 On the Configuration menu, select **Test Mode**.

A list of test modes appears.

3 Select **Monitor**.

4 Connect the E1 Tester to a reference signal and to the test signal:

- Connect the 2M Reference Clock cable from the E1 Tester's RX2/ Ext Clk jack to an E1 BITS clock or a known good reference signal.
- Connect a cable from the E1 Tester RX1/TX1 jack to the signal to be tested.

5 On the Configuration menu, select **Interface Settings**.

6 Select **Slip Reference** and then select the clock reference for timing slips. See "Slip Reference" on page 31.

7 Restart the test.

This will clear all alarms and begin a new test.

8 On the test menu, select **Results**, and then select **Signal Results**.

The Signal Results window appears.

9 Check the timing slips result.

For a description of the result, see "Timing Slips" on page 80.

You have finished measuring timing slips.

Terminate testing

In Terminate mode, you can use the SmartClass E1 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 E1 test application" on page 28.

2 On the Configuration menu, select **Test Mode**.

A list of test modes appears.

3 Select **Terminate**.

4 If you are performing an end-to-end test, you can connect a test set at each end, or you can connect a single test set at the near end and establish a physical loop on the far end device.

For this test, use only the RX/TX1 connector.

5 To configure the test, do one of the following:

– If you want the E1 Tester to configure the interface, framing, and pattern settings automatically, on the test menu, select **Action**, and then select **Auto Configure**.

The unit will attempt to automatically configure the interface, framing, and pattern. If the Auto Configure succeeds, proceed to step 8.

If this attempt fails, the E1 Tester will continue it's attempt to configure the framing settings, and the pattern will default to Live. You can also configure the setting manually by selecting **Configuration**, and then proceed with step 6.

– If you want to configure the interface, framing, and pattern settings manually, on the test menu, select **Configuration**, and then proceed with step 6.

6 Configure the interface settings. See "Specifying interface settings" on page 30.

7 Specify the following settings for the test:

– Framing, see "Specifying E1 framing settings" on page 31.

– Pattern, see "Specifying a BERT pattern" on page 33.

– Performance settings, see "Specifying performance settings" on page 36.

8 Configure the E1 ABCD/Sa settings. See "Specifying E1 signaling (ABCD/Sa) settings" on page 32.

9 Configure the defect or anomaly settings. See "Specifying Error/Alarm settings" on page 35.

10 Restart the test.

This will clear all alarms/defects and begin a new test.

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

NOTE:

The SmartClass E1 Tester will first attempt to insert a clean code error (without a bit error). If, after a time-out period of 256 bits, this is not possible, the unit will insert a code plus a bit error (a line error). This timeout would occur if an unframed all zeros pattern is currently being transmitted.

12 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 "E1 Results" on page 78). If you are performing an end-to-end test, verify that the SmartClass E1 units at each end of the circuit received the inserted errors.

BER 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 E1 Tester will present minimal delay. You must use the RX1/TX1 port for Line Loopback testing.

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

To perform a line loopback test

1 Launch the **E1 BERT** application. See "Launching an E1 test application" on page 28.

2 On the test menu, select Configuration.

The Configuration menu appears.

3 On the Configuration menu, select **Test Modes**.

A list of test modes appears.

4 Select **Line Loopback**.

5 Connect the E1 Tester to the test access point, using the RX/TX1 connector.

6 Restart the test.

This will clear all alarms and begin a new test.

7 To view results, see "E1 Results" on page 78.

Line loopback testing is complete.

Pulse shape analysis

You can use the Pulse Shape feature to measure the height, width, rise time, fall time, overshoot and undershoot, and signal level of an E1 pulse. The results are displayed as text or as a graph of the pulse shape. You can also measure the pulse for conformance to ITU G.703 specifications.

NOTE:

Pulse Shape is an optional feature. It only appears if you have purchased the pulse shape software option.

To perform pulse shape analysis

1. If you haven't already done so, launch the E1 Pulse Shape test application (see "Launching an E1 test application" on page 28).
2. From the E1 Pulse Shape menu, select **Configuration**.

   The Configuration menu appears.
3. Connect the E1 Tester to the test access point, using the RX/TX1 connector.
4. To configure the test, do one of the following:
   - If you want the E1 Tester tester to configure the interface, framing, and pattern settings automatically, on the test menu, select **Action**, and then select **Auto Configure**.

     The unit will attempt to automatically configure the interface, framing, and pattern. If the Auto Configure succeeds, proceed to step 7.

     If this attempt fails, the E1 Tester will continue it's attempt to configure the framing settings, and the pattern will default to Live. You can also configure the setting manually by selecting **Configuration**, and then proceed with step 5.
   - If you want to configure the interface, framing, and pattern settings manually, on the test menu, select **Configuration**, and then proceed with step 5.
5. Configure the interface settings. See "Specifying interface settings" on page 30.
6. Configure the E1 framing settings. See "Specifying E1 framing settings" on page 31.
7. Configure the E1 ABCD/Sa settings. See "Specifying E1 signaling (ABCD/Sa) settings" on page 32.
8. From the E1 Pulse Shape menu, select **Results** and then select one of the following:
   - **Summary** displays a large "All Summary Results OK" message if no anomalies or defects have been detected. If anomalies are detected, results are displayed.
   - **Pulse Shape** displays a graphical representation of the pulse.

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

   a Press the asterisk [*] key to go to the **Action** menu.

   b Select **View Mask**.

   The pulse should fall between the maximum and minimum mask.

   c To hide the mask, press the asterisk [*] key to go to the **Action** menu, and then select **Hide Mask**.

10 To restart the test, press the asterisk [*] key to go to the **Action** menu, and then do one of the following:

   – **Restart Capture**. This captures the pulse in the current configuration. If the configuration is Capture Positive Pulses, it will capture a positive pulse; if the configuration is Capture Negative Pulses, it will capture negative pulses.

   – **Capture Positive Pulses**

   – **Capture Negative Pulses**

For more information about pulse shape results, see "Pulse shape results" on page 86.

You have completed pulse shape analysis.

Measuring Jitter

The jitter test is used to verify the integrity of circuits by qualifying the jitter characteristics. The jitter option allows you to measure jitter manually or using automatic sequences to measure Maximum Tolerable Jitter (MTJ), Fast MTJ, and the Jitter Transfer Function (JTF).

NOTE:
Jitter is an optional feature. It only appears if you have purchased the Jitter option. In addition, jitter requires newer hardware. To verify whether your hardware is jitter capable, see "Viewing the software and hardware information" on page 18.

This test involves three basic steps:

– Configuring test settings
– Connecting to the circuit
– Running the test

Configuring test settings

Before running any tests, you should configure the E1 Tester with the appropriate settings for the line under test.

To configure test settings

1 From the E1 Measurement menu, launch the **E1 Jitter** application.

2 From the E1 Jitter menu, select **Configuration**.

The Configuration menu appears.

3 Specify the test settings. The following table describes the settings.

Setting	Parameter
Test Mode	Select one of the following: – **Terminate** – **Monitor** – **Bridge (HI-Z)**
AMS Jitter Mode	Select one of the following: – **MTJ** - maximum tolerable jitter – **FMTJ** - fast maximum tolerable jitter – **JTF**- jitter transfer function
AMS Jitter Settings	Specify the following automated measurement sequences (AMS) settings: – **Settling Time** - The amount of time a DUT is allowed to settle and adjust to a change in the frequency or amplitude of a received signal. The E1 Tester resumes error measurement after the specified time elapses. – **Gate Time** - Time duration for error measurement. During this period the error source is accumulated if it is an error or recorded if it is an alarm. (not selectable if Jitter Mode is “JTF”.) – **Sensor Threshold** - The number of alarms or errors allowed by the MTJ/Fast MTJ sensor that will result in a pass status for a particular transmit amplitude and frequency point. (not selectable if Jitter Mode is “JTF”.) – **Sensor** - The alarm or error source used to determine the jitter tolerance at a particular transmit amplitude and frequency point. (not selectable if Jitter Mode is “JTF”.)
Manual Jitter Settings (only selectable if the Test Mode is “Terminate”.)	Specify the following: – Modulation: On or Off – Jitter Tx Frequency (Hz) – Jitter Tx Amplitude (UI) **NOTE:** Manual jitter is the default jitter mode. It begins running when you enter the jitter application.
Interface Settings	Specify the Tx Clock Source, TX Line Code, and Rx Line Code as described in “Specifying interface settings” on page 30.
Frame Settings	Specify the Framing, Payload, Time Slots, and Sa bits as described in “Specifying E1 framing settings” on page 31.
Pattern Settings	Specify the pattern as described in “Specifying a BERT pattern” on page 33.
Error/Alarm Settings	Specify the settings as described in “Specifying Error/Alarm settings” on page 35.
Performance Settings	Specify the settings as described in “Specifying performance settings” on page 36.

Setting	Parameter
Timed Test Settings	Specify whether timed test is enabled and if On, specify the duration.

The settings are configured.

Connecting to the circuit

After specifying test settings, connect the E1 Tester to the line under test at the test access point.

To connect to the line

1 Connect the E1 Tester to the test access point:
   – Connect the 2M Reference Clock cable from the SmartClass E1 RX2/ Ext Clk jack to an E1 BITS clock or a known good reference signal.
   – Connect a cable from the SmartClass E1 RX1/TX1 jack to the signal to be tested.

Running the test

After specifying test settings and connecting to the line, you can run the test and view the results.

To run the test

1 From the E1 Jitter menu, select **Action**, and then select one of the following:

If using Jitter mode...	select...
Manual	Restart
MTJ	MTJ Start
FMTJ	FMTJ Start
JTF	JTF Calibration Start then after it completes, JTF Start

NOTE:

Manual jitter is the default jitter mode. It begins running when you enter the jitter application. Selecting an MTJ, FMTJ, or JTF start will close the manual jitter application, and selecting stop will restart manual jitter.

2 From the E1 Jitter menu, select **Results** and then select a result category.

For more information about Jitter results, see “MFC-R2 results” on page 90.

You have completed the test.

Testing MFC-R2 Signaling

The SmartClass E1's MFC-R2 signaling option allows testing of line signaling (supervisory signals) and inter-register signaling (call control signals).

NOTE:

MFC-R2 Signaling is an optional feature. It only appears if you have purchased the MFC-R2 software option.

This test involves three basic steps:

– Configuring test settings
– Connecting to the circuit
– Running the test

Configuring test settings

Before running any tests, you should configure the E1 Tester with the appropriate settings for the line under test.

To configure test settings

1 From the E1 Measurement menu, launch the **E1 R2** application.

2 From the E1 R2 menu, select **Configuration**.

The Configuration menu appears.

3 Specify values for the **Test Mode** and **Country**, as described below:

Setting	Parameter
Test Mode	Select one of the following: – **Simulate** – **Monitor** – **Bridge (HI-Z)**
Country	Select one of the following: – **ITU-T** – **Mexico** – **Brazil** – **Brazil (San Paolo)** – **India** – **Philippines** – **China** – **User Defined**

4 Select **Interface**, and then specify the values as described below:

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

Setting	Parameter
Clock Source (selectable only in Simulate test mode)	Select one of the following: – **Internal** – **Rx1** – **Rx2** – **Ext. BNC** **NOTE:** If timing is lost, the SmartClass reverts to internal timing.
Framing	Select one of the following: – **PCM30C** – **PCM30**
MF Channel	Select the MF channel or channels. – To turn on the selected channels, use the arrow keys to point at the channels/ timeslots you want to turn on, and then press the **#** key to select it. – If in Monitor/Bridge mode, you can select multiple channels. – If in Simulate mode, select only one channel. When you have finished selecting channels, press **OK**.
Idle Code (selectable only in Simulate test mode)	Enter an 8-bit binary string

5 From the Configuration menu, select **Simulate Settings**, and then specify the values as described below:

Setting	Parameter
Sequence Generation	Select one of the following: – **Express** – **Advanced**
Direction	Select one of the following: – **Forward** – **Backward**
DID Number (selectable only for Forward Direction and Express Sequence Generation)	Enter the Direct Inward Dial (DID) number. This is the phone number to be called.
ANI Number (selectable only for Forward Direction and Express Sequence Generation)	Enter the Automatic Number Identification (ANI) number. This is the caller's number, typically the E1Tester’s own number.
Category (selectable only for Forward Direction and Express Sequence Generation)	Select a category. This is the E1Tester’s own category, from II-1 to II-15.
Number of DIDs (selectable only for Backward Direction and Express Sequence Generation)	Specify the number of DIDs on the circuit.

Setting	Parameter
Number of ANIs (selectable only for Backward Direction and Express Sequence Generation)	Specify the number of ANIs on the circuit.
Final Status (selectable only for Backward Direction and Express Sequence Generation)	Select the Final Status signal, between and B-1 and B-15.
Clear First	Select which end should be cleared first: – **Home** – **Opposite End**
User Defined Signalings (selectable only with Advanced Sequence Generation)	Enter a signal between 1 and 30.
Delay Btwn. Signals	Specify the time to wait (delay) between signals.
Pause Before Dial/Answer	Specify whether to pause before dialing or answering.

6 Select **User Defined Settings**, and then specify the values as described below. These settings are only definable if the Country is set to “User Defined”.

Setting	Parameter
ANI Calling Party Category	Select a category. This is the E1Tester’s own category, from II-1 to II-15.
ANI Category	Select a category. This is the E1Tester’s own category, from II-1 to II-15.
ANI Category Req. Tone	Select a tone, from A1 to A15
ANI Request Type	Select one of the following: – Do not request ANI – After first DNIS Digit (default) – After second DNIS Digit – After complete DNIS
ANI Tone Request	Select a tone, from A1 to A15
Answer Tone	Select a tone, from A1 to A15
DNIS Tone Request	Select a tone, from A1 to A15
CD Bits	Specify the CD bits.
GroupB Rcv Busy Tone	Select a timeslot between 0 and 15.
GroupB Rcv Idle Tone	Select a timeslot between 0 and 15.

7 *Optional.* To save the test configuration, **Save/Restore-View**. For more information on saving test configurations, see “Managing test configurations” on page 24.

The settings are specified

Connecting to the line

After specifying test settings, connect the E1 Tester to the line under test at the test access point.

To connect to the line

1. If using Simulate mode, connect to the RX/TX1 connector.

   If using Simulate mode, the backward end should be ready first.

   This means that if the E1 Tester acts as the forward end, the opposite end should act as the backward end and run before the E1 Tester starts simulating.

   If the E1 Tester acts as the backward end, after it starts simulating, the opposite end starts running.

2. If using any other mode, connect the network side to RX/TX1 connector and then the customer side to the RX2 connector.

You are connected to the line.

Running the test

After specifying test settings and connecting to the line, you can run the test and view the results.

To run the test

1. From the E1 R2 menu, select **Action** and then select **Start Simulation**.
2. From the E1 R2 menu, select **Results** and then select one of the following:
   - **Survey Display** displays the forward and backward signaling bits decoded to line state labels (for example, seize, clear forward, etc.).
   - **Call States** displays call statistics for each channel.
   - **Line Display** displays the current line signaling and/or register signaling for each receive channel with its associated time stamp.

For more information about R2 results, see “MFC-R2 results” on page 90.

You have completed the test.

Datacom Testing

5

This chapter provides information about using the E1/Datacom Tester for data communications testing. Topics discussed in this chapter include the following:

About data communications testing

The SmartClass E1/Datacom Tester 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 E1/Datacom Tester, 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 E1/Datacom Tester, 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 E1/Datacom Tester to use asynchronous timing when testing the RS-232/V.24 standard.
- Synchronous timing—You can set up the E1/Datacom Tester to use synchronous timing, and then specify a valid clock source for the interface.
- Flow control—You can set up the E1/Datacom Tester to use out of band flow control by interpreting signals from selected leads on the E1/Datacom Tester and its link partner. You can also specify inband flow control by transmitting XON/XOFF characters.
- Round trip delay measurement—Using the E1/Datacom Tester, 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 E1/Datacom Tester.
- User specified test intervals—You can set up the E1/Datacom Tester to run a test continuously, or to run a test for a specific timed interval lasting up to seven days.

Launching the datacom application

The following procedure describes how to launch the datacom application.

To launch the datacom application

1 Power ON your tester by pressing and holding the ⏻ key for a few seconds.

The SmartClass E1/Datacom splash screen appears for a few seconds, and then the SmartClass E1/Datacom main menu appears.

2 Select **Data Communication**. The Data Communication menu appears.

3 Select **DataCom BERT**.

NOTE:

Datacom is a factory-installed option. It only appears if you have purchased the E1/Datacom configuration (see “Configurations” on page 3).

A message briefly appears stating that the unit is launching the test application.

A test menu appears for the application, listing the following options:

- Configuration. Select this option to configure your test.
- Results. Select this option to observe test results associated with your test.
- Error (*). Select this option to specify errors to insert or to begin inserting errors.
- Action. Select this option to perform key actions required for your test, such as starting or restarting a test, starting traffic or looping up a unit. You can also press the Action button at any time to view a menu of actions applicable to your test.

The datacom application is launched.

Specifying test settings

Before you begin testing with the SmartClass E1/Datacom Tester, you should specify the characteristics of the circuit that you will connect to the tester.

Specifying the test mode

You can operate the SmartClass E1/Datacom Tester 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 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **Test Mode**, and then select one of the following:

- **DTE –** If the E1/Datacom Tester is establishing a link directly to a DCE you should configure the E1/Datacom Tester to emulate a DTE.
- **DCE –** If the E1/Datacom Tester is establishing a link directly to a DTE you should configure the E1/Datacom Tester to emulate a DCE.

If your network is secured using an encrypting device (located in between the E1/Datacom Tester 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 E1/Datacom Tester to emulate the opposite type of device.

- **Monitor** – To non-intrusively monitor performance in both directions on a circuit, select Monitor. A Y-cable is needed.

You have finished specifying the test mode.

Specifying the interface standard

The Datacom application supports the following interface standards: RS-232/V.24, X.21, EIA-530, V.35, RS-449/V.36, Codirectional Timing, Contradirectional Timing, and Centralized Timing. The following procedure describes how to select an interface standard for the test.

To specify the interface standard

1 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **Interface**, and then select one of the following:
   – RS-232/V.24
   – X.21
   – EIA-530
   – V.35
   – RS-449/V.36
   – Codirectional Timing
   – Contradirectional Timing
   – Centralized Timing

3 Also determine what cables you will need to connect the E1/Datacom Tester to the test circuit. See Table 5 on page 4.

You have finished specifying the interface standard.

Specifying 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 E1/Datacom Tester to use either synchronous or asynchronous timing.

To specify the timing mode

1 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **Timing Settings**.

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 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **Timing Settings**.

3 Select the appropriate transmit and receive options:
   – **Tx Timing** (only available in DTE or DCE emulation modes)
   – **DTE Rx Timing** (only available in DTE emulation or monitor mode)
   – **DCE Rx Timing** (only available in DCE emulation or monitor mode)

   A menu of timing options appears.

4 Select the appropriate timing.

You have finished specifying the clock source for transmit and receive timing.

Specifying polarity settings

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

To specify polarity settings

1 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **Polarity**, and then specify values for the following settings:

Setting	Parameter
RxClock Polarity	Specify the polarity for the Rx Clock: – **Normal**. Uses the phasing specified by the interface standard. – **Inverted**. Uses the inverse of the phasing specified by the interface standard.
TxClock Polarity	Specify the polarity for the Tx Clock: – **Normal**. Uses the phasing specified by the interface standard. – **Inverted**. Uses the inverse of the phasing specified by the interface standard.
RxData Polarity	Specify the polarity for the received data: – **Normal**. Uses the phasing specified by the interface standard. – **Inverted**. Uses the inverse of the phasing specified by the interface standard.
TxData Polarity	Specify the polarity for the transmitted data: – **Normal**. Uses the phasing specified by the interface standard. – **Inverted**. Uses the inverse of the phasing specified by the interface standard.

You have finished specifying the polarity settings.

Specifying a BERT pattern

You can specify a specific BERT pattern for your test.

To specify a BERT pattern

1 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **BERT Pattern Settings**, and then choose a pattern:

Pattern	Description
PRBS 63	Selects the 2^6 -1 pseudorandom pattern, which generates a maximum of 5 sequential 0s and 6 sequential 1s.
PRBS 511	Selects the 2^9 -1 pseudorandom pattern, which generates a maximum of 8 sequential 0s and 9 sequential 1s.

Pattern	Description
PRBS 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.
PRBS 2 15 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.
PRBS 2 15 INV ITU	Selects the inverted 2^{15}-1 pseudorandom pattern, which generates a maximum of 14 sequential 1s and 15 sequential 0s.
PRBS 2 20	Selects the 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential 0s and 20 sequential 1s.
PRBS 2 20 INV	Selects the inverted 2^{20} -1 pseudorandom pattern, which generates a maximum of 19 sequential 1s and 20 sequential 0s.
PRBS 2 23 ITU	Selects the 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential 0s and 23 sequential 1s.
PRBS 2 23 INV ITU	Selects the inverted 2^{23} -1 pseudorandom pattern, which generates a maximum of 22 sequential 1s and 23 sequential 0s.
PRBS 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
PRBS 2 20 QRSS	Simulates live data. 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.
LUP 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.
LUP 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.
LUP QBF	The Quick Brown Fox message.
LUP 1TO1	A one followed by a zero, the minimum stress on clock recovery circuits.
LUP 1TO3	A one followed by 3 zeros.
LUP 1TO4	A one followed by 4 zeros.

Pattern	Description
LUP 1TO7	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.
BIT PROGRAMMABLE	Selects a user-defined pattern from 3 to 32 bits long.
BYTE PROGRAMMABLE	Selects a user-defined pattern from 1 to 64 bytes long.

If you selected Bit Programmable or Byte Programmable, proceed to step 3. Otherwise, proceed to step 4.

3 Do one of the following:
   – If you selected Bit Programmable, specify the bit pattern you want to use.
   – If you selected Byte Programmable, specify the byte pattern you want to use.

4 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

You have finished specifying the BERT pattern.

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 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **Data Rate (bps)**.

3 Enter a value, in Hz, for the data rate (see Table 8 for a list of supported data rates for each interface).

Table 8 Data rates by interface

Interface		Synchronous	Asynchronous
X.21	Balanced	50 Hz to 2.048 Hz[1]	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

1. Can be up to 10 MHz, depending on the cable. See Table 5 on page 4 for more information.

You have finished specifying the data rate.

Enabling/disabling data loss detection

Enabling (or disabling) data loss detection criteria affects Rx data loss counts and alarms. Enabling the criteria causes the E1/Datacom Tester 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. If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).
2. On the Configuration menu, select **Data Loss Enable**.
3. Select **On** to enable data loss detection or **Off** to disable.

You have finished specifying data loss detection.

Specifying the Rx input

The following procedure describes how to specify the Rx input.

To specify the Rx input

1. If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).
2. On the Configuration menu, select **Rx Input**.
3. Select the receive input termination for the balanced Data interfaces.

You have finished specifying the Rx input.

Specifying the clock loss threshold

Clock loss threshold refers to the number of milliseconds, without transitions on the clock signal lead, needed for the E1/Datacom Tester to declare clock loss. The following procedure describes how to configure the clock loss threshold.

To specify the clock loss threshold

1. If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).
2. On the Configuration menu, select **Clock Loss Thres (ms)**.
3. Enter a value for the clock loss threshold.

   The default value is 50 ms.

You have finished specifying the clock loss threshold.

Specifying async settings

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

To specify async settings

1. If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **Async Settings**, and then specify values for the following settings:

Setting	Parameter
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**

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

You have finished specifying the async settings.

Specifying flow control settings

Determine whether the device you will connect the E1/Datacom Tester to uses flow control. If so, you can configure the E1/Datacom Tester 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.

To specify flow control settings

1 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **Flow Ctrl Settings**, and then specify values for the following settings:

Setting	Parameter
Oob Flow Control	Select On to set out-of-band flow control; Off uses in-band flow control.
DTR	Out-of-band flow control based on the Data Terminal Ready (DTR) signal.
DSR	Out-of-band flow control based on the Data Signal Ready (DSR) signal.
RTS/C	Out-of-band flow control based on the Request To Send (RTS) signal.
CTS/I	Out-of-band flow control based on the Clear To Send (CTS) signal.
RLSD	Out-of-band flow control based on the Receiver Line Signal Detect (DCD) signal.

Setting	Parameter
In-band Flow Control	If you are testing in asynchronous timing mode, you can enable in-band flow control. Select On to set in-band flow control; Off uses out-of-band flow control.
In-band Xon	Specify the in-band flow control Xon character. Enter a value using a decimal format. The default value is 17.
In-band Xoff	Specify the in-band flow control Xoff character. Enter a value using a decimal format. The default value is 19.

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

You have finished specifying the flow control settings.

Specifying G.821 performance settings

The following procedure describes how to configure bit error insertion.

To specify the G.821 performance settings

1 If you haven't already done so, launch the Data Communication application (see "Launching the datacom application" on page 52).

2 On the Configuration menu, select **G.821 Performance Settings**, and then specify the path allocation percentage.

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 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 specifying the G.821 performance settings.

Specifying error settings

You can specify the number of bit errors to insert or the rate at which bit errors are inserted.

To specify error settings

1 From the BERT menu, select **Error**.

2 Select **Error Settings**.

3 Select **Rate Type**, and then indicate how errors will be inserted:

- Single
- Multiple
- Rate

4 If you selected Multiple, select **Error Count** and then enter the number of errors to be inserted, between 1 and 50.

5 If you selected Rate, select **Error Rate** and then select the insertion rate.

You have finished specifying the error settings.

Performing a self test

Before you begin testing, you should perform a self test on the E1/Datacom Tester to make sure it is operating properly on the selected interface standard. You can test the E1/Datacom Tester and the test cable.

To perform a self test on the E1/Datacom Tester

1 Configure a test.

2 On the test menu, select **Action**.

3 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 5.
- **Enable Cable Test** — This option tests the amplifiers along with one of the emulation cables. When you select this option, the E1/Datacom Tester 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 4.

4 If you selected Enable Cable Test, connect the cable's DCE connector to the DTE connector.

5 After you have connected the emulation cables (if applicable), select **Restart** from the Action menu.

6 On the test menu, select **Results**.

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

  If errors appear in the Summary result category, there is a problem with the E1/Datacom Tester or the cables.

You have completed the self test.

Connecting the E1/Datacom Tester to the circuit

To connect the E1/Datacom Tester 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 Table 6 on page 7. 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 E1/Datacom Tester 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 E1/Datacom Tester for monitor or DTE/DCE emulation tests.

Connecting for X.21 testing

To connect the E1/Datacom Tester **to a X.21 circuit**

1 Identify the correct cable for the test operation and interface standard:
   – If the emulation 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 emulation 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 E1/Datacom Tester'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 emulation mode is DTE or DCE Emulation, use the RS-232/EIA-530 DTE/DCE Emulation cable (part number CB-44385).
   – If the emulation 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 E1/Datacom Tester'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 emulation mode is DTE or DCE Emulation, use the V.35 DTE/DCE Emulation cable (part number CB-44389).
   – If the emulation mode is Monitor, use the V.35 Y-Monitor cable (part number CB-44341).

2 Connect one end of the adaptor cable to the E1/Datacom Tester'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 emulation mode is DTE or DCE Emulation, use the V.36 DTE/DCE Emulation cable (part number CB-44388).
   – If the emulation mode is Monitor, use the V.36 Y-Monitor (part number CB-44347).

2 Connect one end of the adaptor cable to the E1/Datacom Tester'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.

BER Testing

Performing a bit error rate test (BERT) involves configuring the test settings, including logic error insertion; connecting the E1/Datacom Tester to the a circuit; starting the test and inserting logic errors; and observing the results.

To do a bit error rate test

1 Set the test mode to DTE or DCE Emulation. See "Specifying the test mode" on page 53.

2 Select a pattern. See "Specifying a BERT pattern" on page 55.

3 Specify the other settings on the Configuration menu, as needed.

See "Specifying the interface standard" on page 53.

See "Specifying timing parameters" on page 54.

See "Specifying polarity settings" on page 55.

See "Specifying data parameters" on page 57.

See "Specifying async settings" on page 58.

See "Specifying flow control settings" on page 59.

See "Specifying G.821 performance settings" on page 60

4 Specify how errors will be inserted. See "Specifying error settings" on page 60.

5 If you want to run the test for a specific amount of time, configure the timed test settings. See "Timed testing" on page 25.

6 If this is your first test of the day, perform a self test on the E1/Datacom Tester. See "Performing a self test" on page 61.

7 Connect the E1/Datacom Tester to the circuit. See "Connecting the E1/Datacom Tester to the circuit" on page 61.

8 From the Action menu, select **Restart**.

9 Verify that the **Sync** LED illuminates green.

10 To insert errors, press the *** Action** key to view the Error menu, and then select press **1**.

This will do one of the following:

- **Enable** or **Disable Bit Error Rate Insertion** — begin inserting bit errors at the rate specified on the Error Settings menu (appears only if the Rate Type is set to "Rate").
- **Bit Error Multi Insert** — inserts multiple bit errors with each press (appears only if the Rate Type is set to "Multiple").
- **Bit Error Insert** — inserts one bit error with each press (appears only if the Rate Type is set to "Single").

11 From the BERT menu, select **Results** and then the BERT category.

12 To check other result categories, press **Cancel** to return to the BERT menu, and then select a result category.

You have finished the test.

Monitoring a Datacom interface

In monitor mode you can use the E1/Datacom Tester to non-intrusively monitor traffic in both directions on a specified interface standard.

1 From the BERT menu, select **Configuration**.

2 Set the test mode to Monitor. See "Specifying the test mode" on page 53.

3 Specify the other settings on the Configuration menu, as needed.

See "Specifying the interface standard" on page 53.

See "Specifying timing parameters" on page 54.

See "Specifying polarity settings" on page 55.

See "Specifying data parameters" on page 57.

See "Specifying async settings" on page 58.

See "Specifying flow control settings" on page 59.

See "Specifying G.821 performance settings" on page 60

4 Connect the E1/Datacom Tester to the circuit. See "Connecting the E1/Datacom Tester to the circuit" on page 61.

5 Press **Cancel** to return to the BERT menu, and then select **Restart**.

6 Verify that the Sync LED illuminates green.

7 From the BERT menu, select **Results** soft key, and then select **BERT**.

8 To check other result categories, press **Cancel** to return to the BERT menu, and then select a result category.

You have finished the test.

Frame Relay testing

After the physical interface has been verified, you can use the E1/Datacom Tester's Frame Relay option to monitor frame relay traffic, and to transmit and receive frame relay frames to commission and maintain frame relay services.

With the Frame Relay testing feature, results such as LMI message stats, error results, DCLI status, and link trace results are available.

Launching the Frame Relay application

The following procedure describes how to launch the datacom application.

To launch the Frame Relay application

– From the Data Communication menu, select **Datacom Frame Relay**.

NOTE:

Frame Relay is an optional feature. It only appears if you have purchased the frame relay option with the SmartClass E1/Datacom configuration, and is only available over the Datacom interface.

A message briefly appears stating that the unit is launching the test application.

A test menu appears for the application, including the following options: Configuration, Results, and Action.

Configuring the test mode

The following procedure describes how to set the test mode.

To specify the test mode

1 From the Frame Relay menu, select **Configuration**.

2 Select **Test Mode**, and then select a mode for the test operation: DTE Emulation, DCE Emulation, or Monitor.

3 To return to the Frame Relay menu, press the **Cancel** key.

You have specified the test mode.

Specifying datacom settings

Before you transmit traffic, you can specify the characteristics of the datacom circuit you want to transmit the traffic on, such as the interface standard, timing mode, and data rate.

To specify datacom settings

1 If you haven't already done so, launch the Frame Relay application (see "Launching the Frame Relay application" on page 64).

2 On the Configuration menu, select **Datacom Settings**, and then specify values for the following settings:

Setting	Parameter
Standard	The E1/Datacom Tester allows you to test the following interface standards: – RS-232/V.24 – X.21 – EIA-530 – V.35 – RS-449/V.36 – Codirectional Timing – Contradirectional Timing – Centralized Timing Also determine what cables you will need to connect the E1/Datacom Tester to the test circuit. See Table 5 on page 4
Timing Mode	Set to synchronous timing.

Setting	Parameter
Data Rate	Determine the data rate of the device you will be connecting to, between 50 and 10,000,000 Hz. In asynchronous mode, you must configure the E1/Datacom Tester to use the same rate.
DTE Rx Timing	The receive timing for data applications.
DCE Rx Timing	The receive timing for data applications.
Tx Timing	The transmit timing for the data applications.
Rx Input	Receive input termination settings, in Ohms, for the balanced Data interfaces.
Clk Loss Thres.	The number of milliseconds, between 0 and 1000, without transitions on the clock signal lead needed to declare clock loss.
Data Loss Enable	Enabling (or disabling) data loss detection criteria affects Rx data loss counts and alarms. Enabling the criteria causes the E1/Datacom Tester to register data loss when no data transitions have occurred for 63 clock transitions in synchronous timing modes.

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The datacom settings are specified.

Configuring the frame load settings

You can configure frame characteristics such as the traffic load type and rate, frame length, and payload data. The following procedure describes how to specify these characteristics.

To configure frame load settings

1 If you haven't already done so, launch the Frame Relay application (see "Launching the Frame Relay application" on page 64).

2 On the Configuration menu, select **FR Load Settings**, and then specify the following settings:

Setting	Parameters
Load Type	Select a traffic load type: – **None**: No traffic load is generated. – **Fixed**: Causes the E1/Datacom Tester to transmit frames constantly at a specified rate. – **Burst**: Causes the E1/Datacom Tester to transmit a burst of traffic followed by a specified period of no frame transmissions (burst idle time). – **Ping**: Causes the E1/Datacom Tester to transmit one ping per second.
Load Rate (Fixed loads only)	Enter a value, from **1** to **10000** kbps, for the data load rate. **Note:** It is possible to enter a load rate that exceeds the data rate for the interface.

Setting	Parameters
Burst Tx Time (Burst loads only)	Time, ranging from 0.1 to 99.9 seconds, during which the E1/Datacom Tester transmits a burst of traffic between idle time. **Note:** To type a decimal point, use the asterisk (*) key on the E1/Datacom Tester keypad.
Burst Idle Time (Burst loads only)	Time, ranging from 0.1 to 99.9 seconds, during which the E1/Datacom Tester is idle and does not transmit traffic between bursts.
Min Frm.Len Tx (Fixed and Burst loads only)	Enter a value, from **5** to **9999** bytes, for the minimum frame length to be transmitted. **Note**: Assigning the same value to the Min Frame Len Tx and Max Frame Len Tx will cause a fixed-length frame to be transmitted.
Max Frm.Len Tx (Fixed and Burst loads only)	Enter a value, from **5** to **9999** bytes, for the maximum frame length to be transmitted.
Payload (Fixed and Burst loads only)	Select the type of payload: – **Seq Test**: Transmits a sequential count from 0 to 65,535. The remainder of the data is a fixed pattern. Generated frames that are not of a length sufficient to conform to RFC 2427 will not have a TTC Test Frame Header. The E1/Datacom Tester analyzes received TTC test frames sequence numbers to check for lost frames. – **User 1 Data**: Transmits a user-defined hexidecimal payload from 1 to 64 bytes long. – **User 2 Data**: Transmits a user-defined hexidecimal payload from 1 to 64 bytes long. – **Seq + User 1**: Transmits the sequential count (0 to 65,535), and then the user-defined hexidecimal payload. **Note:** If you select the User 1 Data, User 2 Data, or Seq + User 1 payload, be certain to define the data.
User 1 Data (User 1 Data or Seq + User 1 payloads only)	Enter a hexidecimal value from **1** to **64** bytes long.
User 2 Data (User 2 Data payload only)	Enter a hexidecimal value from **1** to **64** bytes long.
Src.IP Address (Ping loads only)	Enter the IP address of the device the echo reply packets will be transmitted to. **NOTE:** The E1/Datacom Tester only receives echo messages if the source address of the incoming echo message matches the destination address configured on the E1/Datacom Tester.
Inverse ARP (Ping loads only)	Select one of the following: – **On**. If you want the HST to use Inverse ARP to determine the IP address of the equipment at the other end of the Frame Relay link, select On. – **Off**. If you specified a destination address for the device you are pinging, select Off. Off is the default.

Setting	Parameters
Dest IP Address (Ping loads only)	Enter the IP address of the device the echo request packets will be transmitted to.
Ping Length	Enter a value, from **34** to **2000** octets, to indicate the length of the packets.
Encapsulation	Select the type of encapsulation for the packets: – **NLPID** – **ETHER**

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The frame load settings are configured.

Configuring the frame header settings

You can specify characteristics for the frame header such as transmit (Terminate mode only) and receive DLCIs, and whether the transmit control bits (DE, FECN, BECN, and C/R) are active.

To specify frame header settings

1 If you haven't already done so, launch the Frame Relay application (see "Launching the Frame Relay application" on page 64).

2 On the Configuration menu, select **FR Header Settings**, and then specify the following settings:

Setting	Parameters
DLCI Tx	Enter a value, from **0** to **1023**, for the transmitted data link connection identifier (DLCI).
DE Bit Tx	Enter one of the following values for the discard eligibility indicator: – **1**: Indicates the field is checked. – **0**: Indicates the field is blank.
FECN Bit Tx	Enter one of the following values for the forward explicit congestion notification bit: – **1**: Indicates the field is checked. – **0**: Indicates the field is blank.
BECN Bit Tx	Enter one of the following values for the backward explicit congestion notification: – **1**: Indicates the field is checked. – **0**: Indicates the field is blank.
C/R Bit Tx	Enter one of the following values for the command/response field bit: – **1**: Indicates the field is checked. – **0**: Indicates the field is blank.
DLCI Rx	Enter a value, from **0** to **1023**, for the received data link connection identifier (DLCI). The E1/Datacom Tester will display test results for the traffic on this DLCI in the DLCI result category; results for the entire link appear in the Link result category.

Setting	Parameters
Lng Frm Rx Thresh	Enter a value, from **5** to **9999** bytes, to indicate the long frame receive threshold. The E1/Datacom Tester will maintain a count of received frames that exceed the specified threshold.

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The frame header settings are configured.

Configuring the LMI Settings

Local Management Interface (LMI) is a signaling mechanism often used on frame relay networks to communicate information about the status of a network connection. With the Frame Relay testing option, the E1/Datacom Tester can monitor and emulate LMI signals on UNI-user, UNI-network, and NNI interfaces for the following LMI types:

– Annex D (ANSI T1.617)
– Annex A (ITU-T Q.933)
– LMI Rev 1

The E1/Datacom Tester can capture LMI messages, decode them, and then display them in the Trace result category. Other LMI link results include the LMI type, message count, errors, and timeouts. For more information about LMI results, see “LMI results” on page 100.

To specify LMI settings

1 If you haven’t already done so, launch the Frame Relay application (see “Launching the Frame Relay application” on page 64).

2 On the Configuration menu, select **FR LMI Settings**, and then specify the following settings:

Setting	Parameters
Type	Select the type of local management interface (LMI): – **Off** – **T1.617 Annex D** – **Q.933 Annex A** – **LMI Rev 1** – **Auto**
Status Poll Time	Enter a value, from **5** to **30**, to indicate the status poll time in seconds.
Full Poll Time	Enter a value (*n*), from **1** to **255**, to indicate that the E1/Datacom Tester should perform a full status poll time every *nth* poll cycle. For example, if you enter 4, the E1/Datacom Tester will perform a full status poll every 4th time.
Interface	Select one of the following interfaces: – **UNI-U** (user) – **UNI-N** (network) – **NNI**

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The frame relay LMI settings are configured.

Configuring the trace settings

You can use the E1/Datacom Tester to capture and decode LMI messages. Captured messages can be displayed as link trace results in text, hexidecimal, or text and hexidecimal format. The following procedure describes how to set the trace settings.

To specify trace settings

1 If you haven't already done so, launch the Frame Relay application (see "Launching the Frame Relay application" on page 64).

2 On the Configuration menu, select **FR Trace Settings**, and then specify the following settings:

Setting	Parameters
Decode Level	Select one of the following decode levels: – **Simple**: Displays basic decode information for each trace message. – **Verbose**: Displays detailed decode information for each trace message.
Display Type	Select how trace messages will be displayed: – **Text**: Displays the trace messages as text. – **Hex**: Displays the trace messages in a hexidecimal format. – **Text & Hex**: Displays the trace messages in both text and hexidecimal formats.

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The trace settings are configured.

Specifying flow control settings

Determine whether the device you will connect the E1/Datacom Tester to uses flow control. If so, you can configure the E1/Datacom Tester for out-of-band flow control.

To specify flow control settings

1 If you haven't already done so, launch the Frame Relay application (see "Launching the Frame Relay application" on page 64).

2 On the Configuration menu, select **Flow Control Settings**.

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

4 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

The flow control settings are specified.

Specifying polarity settings

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

To specify polarity settings

1 If you haven't already done so, launch the Frame Relay application (see "Launching the Frame Relay application" on page 64).

2 On the Configuration menu, select **Data/Clock Polarity Settings**, and then specify **Normal** (uses the phasing specified by the interface standard) or **Inverted** (uses the inverse of the phasing specified by the interface standard) for the following settings:

Setting	Parameter
TxClock Polarity	Specify the polarity for the Tx Clock
RxClock Polarity	Specify the polarity for the Rx Clock
TxData Polarity	Specify the polarity for the transmitted data
RxData Polarity	Specify the polarity for the received data

3 If you need to specify other settings for the test, press **Cancel** to return to the Configuration menu.

You have specified the polarity settings.

Monitoring traffic on Datacom interfaces

The E1/Datacom Tester can monitor frame relay traffic on Datacom interfaces.

To monitor traffic on a Datacom interface

1 If you haven't already done so, launch the Frame Relay application (see "Launching the Frame Relay application" on page 64).

2 On the Configuration menu, select **Datacom Settings**, and then specify the settings.

3 Specify the frame header settings:

   a On the Configuration menu, select **FR Header Settings**.

   b Select **DLCI Rx**, and then enter a value, from **0** to **1023**, for the received data link connection identifier (DLCI).

   The E1/Datacom Tester will display test results for the traffic on this DLCI in the DLCI result category; results for the entire link appear in the Link result category.

   c Select **Lng Frm Thresh**, and then enter a value, from **5** to **9999** bytes, to indicate the threshold for long frames on the receiver.

   The E1/Datacom Tester will maintain a count of received frames that exceed the specified threshold.

4 Specify the local management interface settings. See "Configuring the LMI Settings" on page 69.

5 Specify how link trace results should be displayed. See "Configuring the trace settings" on page 70.

6 Specify the polarity settings. See "Specifying polarity settings" on page 55.

7 After you finish configuring the test settings, press **Cancel** to return to the Test menu.

8 Connect the E1/Datacom Tester to the circuit. For more information, see "Connecting the E1/Datacom Tester to the circuit" on page 61.

9 On the Test menu, select **Restart** to begin the test.

You are monitoring frame relay traffic on a datacom interface.

Transmitting traffic over a Datacom interface

The E1/Datacom Tester can also transmit frame relay traffic over a Datacom interface.

To transmit frame relay traffic over a Datacom interface

1 f you haven't already done so, launch the Frame Relay application (see "Launching the Frame Relay application" on page 64).

2 On the Configuration menu, select **Data Comm.**, and then specify the settings.

3 Specify the frame load settings. See "Configuring the frame load settings" on page 66.

4 Specify the frame header settings. See "Configuring the frame header settings" on page 68.

5 Specify the local management interface settings. See "Configuring the LMI Settings" on page 69.

6 Specify how link trace results should be displayed. See "Configuring the trace settings" on page 70.

7 Configure flow control settings. See "Specifying flow control settings" on page 70.

8 After you finish configuring the test settings, press **Cancel** to return to the Test menu.

9 Connect the E1/Datacom Tester to the circuit. For more information, see "Connecting the E1/Datacom Tester to the circuit" on page 61.

10 On the Test menu, select **Restart** soft key to begin the test.

The E1/Datacom Tester transmits frame relay traffic over the Datacom interface.

VT100 Terminal Emulation

6

This chapter contains information about using the E1/Datacom Tester to emulate a VT100 terminal. Topics discussed in this chapter include the following:

About VT100

The optional VT100 feature lets you use the E1/Datacom Tester to emulate a VT100 terminal, allowing local access to network elements. During a VT100 session, you can retrieve circuit and service performance information, such as loss, margin, synchronization, performance (such as SES, ES, and UAS), and alarm information from network elements such as HTU-R, HTU-C, HRE, and SmartJack (NIU). Data from the network element appears on the E1/Datacom Tester's screen. You can save this information to an ASCII file, print it, or export it. During a VT100 session, you can also configure and provision the accessed network element from the E1/Datacom Tester.

For information about emulating a VT100 session using the E1/Datacom Tester, see "Emulating a VT100 terminal" on page 74.

NOTE:

For more information about the VT100 option and E1/Datacom Tester training, contact your JDSU sales representative.

VT100 cabling

The optional VT100 emulation feature allows you to attach the E1/Datacom Tester to a network element.

To connect, you need the following:

– DB-9 RS-232 cable.
– DB-9 male to male null modem adapter for connecting to network elements

To ensure an uninterrupted supply of power during the session, attach the standard AC Adapter or optional Cigarette Lighter Adapter.

Emulating a VT100 terminal

The following procedure describes how to run a VT100 session on the E1/Datacom Tester.

To emulate a VT100 terminal

1 If the E1/Datacom Tester is off, press the green power button to power on the E1/Datacom Tester.

It may take several seconds for the E1/Datacom Tester to fully power on. When a menu appears, you can begin using the E1/Datacom Tester.

2 Connect the E1/Datacom Tester to the network element:

a Connect one end of the DB-9 cable to the E1/Datacom Tester's RS-232 connector located on the left panel.

b If necessary, connect the other end of the cable to the null modem adapter (DB-9 male to male).

c Connect the cable to a network element.

3 Verify that VT100 is selected for the RS232 DB9 port, if needed. See "Specifying DB9 port usage" on page 21.

4 From the main menu, select **VT100**.

The VT100 menu appears.

The main menu displays help for using the menus: Press and hold the *Action key and then press the appropriate key to view a menu.

5 Press and hold the *Action key and then press the 4 key to view the Settings menu. Specify the following settings.

Parameter	Option
Serial Speed	Select a baud rate: – **1200** – **2400** – **9600** – **19200** – **38400** (default) – **57600** – **115200**
Data Bits	Select a data bit setting: – **7** – **8** (default)
Flow Control	Specify the flow control: – **Xon/Xoff** – **None** (default)
Stop Bits	Select a stop bits setting: – **1** (default) – **2**
Parity	Select the parity: – **None** (default) – **Odd** – **Even**

6 Press and hold the *Action key and then press the 5 key to view the File menu and then select **Connect**.

7 If the VT100 session does not start after a few seconds, view the File menu and then select **10 Spaces**.

A VT100 session screen appears. The menu for the network element appears after a few seconds.

8 To view different parts of the screen, use the arrow keys.

9 To send commands using the E1/Datacom Tester keypad, press and hold the *Action key and then select Spcl Keys (the 7 key) or Keypad (the 2 key).

Menu item	Function
Spcl Keys	To send commands, such as backspace, delete, tab, and return, select **Spcl Keys**. A list of special key functions appears, including an option for function keys (F-keys). To send commands, such as home, end, break, insert, and page up/page down, select **Spcl Keys**, then select **Operator**, and then select a command.
Keypad:ABC Keypad:abc Keypad:123	Changes the behavior of repeated key presses: alphanumeric (ABC or abc) or numeric (123).
Keys 0 through 9, *, and #	Press a key on the keypad to send a character. Press the key several times to view all the characters you can send with that key. The characters appear in the upper right corner of the E1/Datacom Tester display. For example, the 1 key lets you send the following characters: **#**, space, **_**, **&**, **$**, **%**, **<**, **>**, **+**, and **-**.

10 If you want to transmit a single space, or multiple space characters, view the File menu and then select the number of spaces.

11 *Optional.* To save on-screen information to a file, do the following:

a Press and hold the *Action key and then press the 5 key to view the File menu.

b Select Capture.

c Enter a file name, and then press the OK key.

You can view the saved file using the File Manager.

12 To exit, press and hold the *Action key, press the 5 key to view the File menu, and then select Exit.

Test Results

7

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

E1 Results

E1 Summary results

The E1 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, key results that are out-of-specification, or key informational results are displayed. This allows quick access to the results without having to search each category.

Table 9 describes the results that appear in the E1 Summary category.

Table 9 E1 Summary results

Result	Definition
LOS Seconds	Total number of test seconds in which loss of signal was detected.
TSE	Number of Test Sequence Errors (bit errors).
Code Errors	Number of detected violations of the selected encoding method.
LOF Seconds	Seconds in which loss of framing occurred.
AIS Seconds	Number of test seconds during which the AIS condition has been detected.
RDI Seconds	Number of test seconds during which the RDI condition has been detected.
MF-AIS Seconds	Seconds in which Multiframe AIS was detected.
MF-RDI Seconds	Number of test seconds during which the MF-RDI condition has been detected.
FAS Word Errors	Number of errored FAS words received since initial frame sync
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.
Block Errors	Number of blocks containing one or more errored bits.
Pattern Slips	Number of pattern slips detected since start of test.
Pattern Sync Losses	Number of times synchronization is lost after pattern sync.
Rx Freq Max Dev	Receive Frequency Maximum Deviation. This result appears when the deviation from the nominal E1 frequency of 2048 kBps is greater than 50 ppm.

Statistics results

Results in the Statistics results category are designated as “History” or real time (current). Restarting the test will clear the History Statistics results.

Table 10 describes the Statistics results.

Table 10 Statistics results

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

Signal results

The Signal category shows signal level, frequency, and loss seconds results. Results in this category accumulate after test restart. Table 11 describes the results that appear in the Signal category.

Table 11 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
Rx Freq Dev PPM	Current received frequency deviation, ± 200 ppm
Rx Freq Max Dev	Maximum received frequency deviation, ± 200 ppm

Table 11 Signal test results (Continued)

Result	Description
Ref Clk Frequency	Frequency of the reference clock
Rx Level Vpp	Current receive level, in volts peak-to-peak
Rx Level dBnom	Current receive level, in dB nominal
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
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.
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.

Interface results

The Interface category lists results related to the physical interface. Table 12 describes the results that appear in the Interface category.

Table 12 Interface test results

Result	Description
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
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
MFAS Word Errors	Number of errored MFAS words received since initial frame sync

Table 12 Interface test results (Continued)

Result	Description
MFAS Word Error Rate	Ratio of errored MFAS words to the total number of frames received
MFAS Sync Losses	Number of times MFAS Sync was lost

Frame Data results

The Frame Data category lists results related to framing. Table 13 describes the results that appear in the Frame Data category.

Table 13 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
Si Bit	The current Si Bit setting
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 14 describes the results that appear in the BERT category.

Table 14 Test (BERT) results

Result	Description
TSE	Test Sequence Error (bit error)
Bit Error Rate	Ratio of bit errors (TSEs) to received pattern data bits
Block Errors	Number of blocks containing one or more errored bits.
Pattern Slips	Number of pattern slips detected since start of test (PRBS patterns only)
Pattern Slip Seconds	Number of seconds during which one or more pattern slips occurred after initial pattern synchronization.

Table 14 Test (BERT) results (Continued)

Result	Description
Pattern Sync Losses	Number of times pattern synchronization is lost since the last test start or restart.
Pattern Sync Loss Seconds	Number of seconds during which the receiver has lost pattern synchronization, even momentarily, since initial pattern synchronization.
Round Trip Delay (ms)	The round trip delay for the last delay pattern sent and successfully received by the SmartClass E1. Calculated in milliseconds.

Performance results

The SmartClass E1 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 15 describes the G.821 performance results.

Table 15 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.
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.
UAS	Unavailable Seconds. A count of the number of test seconds which met the ITU-T Rec. G.821 definition of unavailable time.

G.826 ISM results

Table 16 describes the G.826 ISM (in service measurement) performance results.

Table 16 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 AS	Near End Available Seconds. A count of the number of Test Seconds which met the ITU-T Rec. G.821 definition of available time.
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 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.
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 AS	Far End Available Seconds. A count of the number of Test Seconds which met the ITU-T Rec. G.821 definition of available time.
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 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	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. G.826 definition of unavailable time.
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 17 describes the G.826 OOS (out of service) performance results in alphabetical order.

Table 17 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.
AS	Available Seconds. A count of the number of Test Seconds which met the ITU-T Rec. G.821 definition of available time.
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.
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.
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.

M.2100 ISM results

Table 18 describes the M.2100 ISM (in service monitoring) performance results in alphabetical order.

Table 18 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 AS	Near End Available Seconds. A count of the number of Test Seconds which met the ITU-T Rec. G.821 definition of available time.
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 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.

Table 18 M.2100 ISM performance results (Continued)

Result	Description
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.
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 AS	Far End Available Seconds. A count of the number of Test Seconds which met the ITU-T Rec. G.821 definition of available time.
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 errored 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.

M.2100 OOS results

Table 19 describes the M.2100 OOS (out of service) performance results in alphabetical order.

Table 19 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.
AS	Available Seconds. A count of the number of Test Seconds which met the ITU-T Rec. G.821 definition of available time.
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.
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.

Table 19 M.2100 OOS performance results (Continued)

Result	Description
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.

VF results

The VF category lists the level and frequency of the current VF tones pattern you selected for the signal you are transmitting.

Freezing test results

You can freeze the E1 test results display at any time during the course of your test.

To freeze test results

1 Press the **Cancel** key until you get to the E1 BERT menu.

2 Select **Action**.

A menu of actions applicable to you test appears.

3 Select **Freeze Results**.

A message appears indicating the tester is freezing results.

The results display freezes, and the status bar at the bottom of the result display blinks and indicates that results are frozen. Results continue to accumulate in the background.

To unfreeze results, return to the Action menu and select **Unfreeze Results**.

Pulse shape results

There are two result categories in the pulse shape application:

– Summary
– Pulse Shape

NOTE:

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

For information about purchasing options for the SmartClass E1 Tester, contact your JDSU representative or your local JDSU sales office. You can also contact JDSU through the company web site, www.jdsu.com.

Summary

The Pulse Shape 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, key results that are out-of-specification, or key informational results are displayed. This allows quick access to the results without having to search each category

Table 20 describes the results that appear in the Pulse Shape Summary category.

Table 20 Pulse Shape Summary results

Result	Definition
LOS Seconds	Total number of test seconds in which loss of signal was detected.
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.
Pattern Sync Loss Seconds	Total number of test seconds in which loss of pattern sync was detected.
Pattern Slip Seconds	Total number of test seconds in which pattern slips were detected.
TSE	Number of Test Sequence Errors (bit errors).
Level	Signal level measured in volts base-peak (Vb-p).
Measured Pulse Width	This indicates the pulse width at the 50% point of the waveform.
Rise Time	This indicates the rise time of the leading edge between the 10% and 90% points of the waveform.
Fall Time	This indicates the fall time of the trailing edge between the 90% and 10% points of the waveform.
Overshoot	This is the amount of the leading edge that rises above the 100% point of the waveform.
Undershoot	This is the amount of the trailing edge that falls below the zero point of the waveform.

Pulse Shape

The Pulse Shape category displays a graphical representation of the E1 pulse. Figure 10 shows an example of the Pulse Shape results.

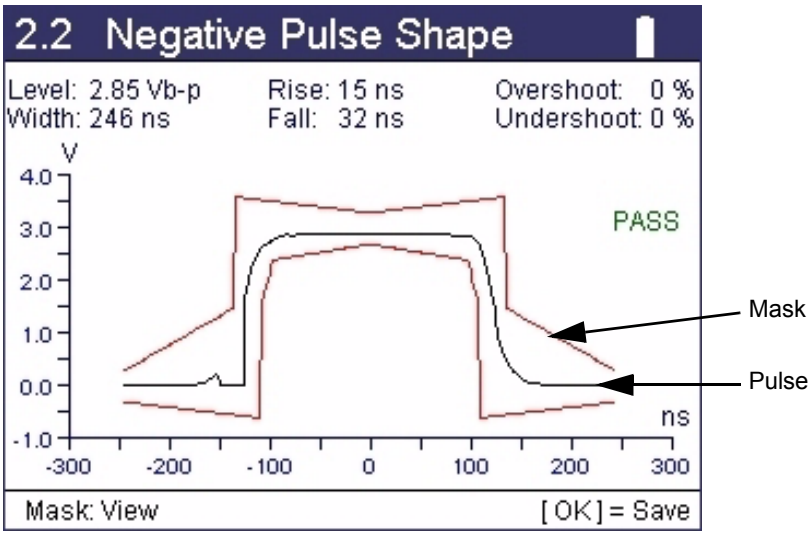

Figure 10 Pulse shape graph with mask

Use the mask to measure conformance to G.703 specifications. To view or hide the mask, press the asterisk [*] key to go to the **Action** menu, and then select **View Mask** or **Hide Mask**.

When the mask is enabled, a status indication appears to the right. Table 21 describes the status messages.

Table 21 Pulse Shape status messages

Result	Description
PASS	Indicates the pulse shape conforms to the mask specifications.
FAIL	Indicates the pulse shape does not conform to the mask specifications.
NO DATA	Indicates the unit was unable to capture or measure the pulse.
NO SIG	Indicates the E1 input signal level is below -42dB.
LOW SIG	Indicates the E1 input signal level is below -6dB.

Jitter results

When configured for jitter tests, the E1 Tester provides jitter results in several result groups. The module also allows you to view the jitter results in a graphical or tabular format.

Summary results

The Summary results report the same results as the other E1 tests. See "E1 Summary results" on page 78.

Jitter results

Table 22 lists and describes each of the test results in the Jitter category.

Table 22 Jitter test results

Test Result	Description
Rx Jitter (UIpp)	The maximum peak-to-peak jitter measured since starting or restarting the test, expressed in UIpp.
Max Rx Jitter (UIpp)	The maximum peak-to-peak jitter measured since starting or restarting the test, expressed in UIpp.
Rx 18-100 KHz (UIpp)	The peak-to-peak jitter outputted from the 18-100 k filter since starting or restarting the test, expressed in UIpp.
Max Rx 18-100 KHz (UIpp)	The maximum peak-to-peak jitter outputted from the 18-100 k filter since starting or restarting the test, expressed in UIpp.

Graphical and Tabular jitter results

When testing jitter, you can view results in a graphical or tabular format by selecting the corresponding result categories in the Interface group.

Jitter Graph

The jitter graph is available when manually testing jitter, and when measuring MTJ and Fast MTJ.

MTJ Graph and Table

The MTJ graph and table are available when measuring MTJ and Fast MTJ.

JTF Graph

The JTF graph is available when measuring JTF.

Signal results

The Signal results report the same results as the other E1 tests. See “Signal results” on page 79.

Interface results

The Interface results report the same results as the other E1 tests. See “Interface results” on page 80.

BERT results

The BERT results report the same results as the other E1 tests. See “BERT results” on page 81.

Event Log

The Event Log results report the same results as the other E1 tests. See “Event Log” on page 89.

Event Histogram

The Event Histogram results report the same results as the other E1 tests. See “Event Histogram” on page 94.

MFC-R2 results

There are three result categories in the MFC-R2 Signaling application:

- **Survey Display** displays the forward and backward signaling bits decoded to line state labels (for example, seize, clear forward, etc.).
- **Call States** displays call statistics for each channel.
- **Line Display** displays the current line signaling and/or register signaling for each receive channel with its associated time stamp.

Datacom results

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

Summary results

Table 23 describes the Datacom Summary results.

Table 23 Datacom Summary results

Result	Definition
Signal Present	Indicates whether an active signal is present (yes/no).
Pattern Sync Present	Indicates whether pattern synchronization was detected. (yes/no).
Pattern Sync History	Pattern synchronization detected since last test restart.
Bit Errors	Number of received bits with a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
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).
Block Errors	Number of blocks that contained an errored bit.
Rx Clock Present	Number of seconds where the receive clock was detected. Only appears if using synchronous timing.
Rx Clock History	Receive clock detected since last restart. Only appears if using synchronous timing.
Rx Data Loss History	Receiver synchronization loss detected since start of test. Only valid when the Data Loss setting is enabled and only appears if using synchronous timing.
Rx Data Loss	Number of receiver synchronization losses resulting from a loss of data. Only valid when the Data Loss setting is enabled and only appears if using synchronous timing.
Rx Async Data Present	Receiver synchronization loss currently detected. Only valid when the Data Loss setting is enabled and only appears if using asynchronous timing.
Rx Async Data Loss	Number of receiver synchronization losses resulting from a loss of data. Only valid when the Data Loss setting is enabled and only appears if using asynchronous timing.

Table 23 Datacom Summary results (Continued)

Result	Definition
Rx Async Data Loss History	Receiver synchronization loss detected since start of test. Only valid when the Data Loss setting is enabled and only appears if using asynchronous timing.
Rx Char Errors	Count of characters containing one or more bit errors. Only appears if using asynchronous timing.
Flow Control	Indicates whether flow control is on or off, for out-of-band (Oob) and In-band (Ib).
Rx Frame Errors	Count of frames containing one or more bit errors. Only appears if using asynchronous timing.

Clock results

Table 24 describes the Clock results.

Table 24 Clock results

Result	Definition
Signal Present	Indicates whether an active signal is present (yes/no).
Signal Loss Count	Number of times loss of signal occurred.
Rx Frequency	Frequency derived from the receiver clock. Only appears if using synchronous timing.
Tx Frequency	Frequency derived from the transmitter clock. Only appears if using synchronous timing.
Rx Clock Loss Count	Count of how many times the receive clock is lost. Only available in synchronous timing mode.
Tx Clock Loss Count	Count of how many times the transmit clock is lost. Only available in synchronous timing mode.
Rx Clock Present	Receiver clock detected. Only appears if using synchronous timing.
Tx Clock Present	Transmitter clock detected. Only appears if using synchronous timing.
Rx Clock History	Receiver clock detected since start of test. Only appears if using synchronous timing.
Tx Clock History	Transmitter clock detected since start of test. Only appears if using synchronous timing.

Control Signal results

Table 25 describes results in the Control Signal category.

Table 25 Control Signal results

Result	Definition
Rx CTS/I	Receiver Clear To Send.
Rx DSR	Receiver Data Set Ready
Rx DCD	Receiver Line Signal Detect
Rx TM	Receiver Test Mode

Table 25 Control Signal results (Continued)

Result	Definition
Tx RTS/C	Transmitter Request To Send
Tx DTR	Transmitter Data Terminal Ready
Tx LL	Transmitter Local Loopback
Tx RL	Transmitter Remote Loopback

Data results

In the Data result category, a “mark” indicates the all ones pattern is being detected; a “space” indicates the all zeros pattern is being detected. The results change depending on the test mode.

Table 26 describes the Data results.

Table 26 Data results

Result	Definition
RX Data Loss Count	Number of receiver synchronization losses resulting from a loss of data. Only valid when the Data Loss setting is enabled.
RX Data Loss	Lost receiver synchronization detected.
RX Data Loss History	Lost receiver synchronization detected since start of test.
Rx RD Space	Receiver Receive Data Space (Yes or No
Rx RT Space	Receiver Receive Timing Space (Yes or No)
Rx ST Space	Receiver Signal Timing Space (Yes or No)
Rx RD Mark	Receiver Receive Data Mark (Yes or No)
Rx RT Mark	Receiver Receive Timing Mark (Yes or No)
Rx ST Mark	Receiver Signal Timing Mark (Yes or No)
Tx TD Space	Transmitter Transmit Data Space (Yes or No)
Tx TT Space	Transmitter Signal Timing Space (Yes or No)
Tx TD Mark	Transmitter Transmit Data Mark (Yes or No)
Tx TT Mark	Transmitter Signal Timing Mark (Yes or No)
Rx Async Data Present	Receiver synchronization loss currently detected. Only valid when the Data Loss setting is enabled and only appears if using asynchronous timing.
Rx Async Data Loss Count	Number of receiver synchronization losses resulting from a loss of data. Only valid when the Data Loss setting is enabled and only appears if using asynchronous timing.
Rx Frame Errors	Count of frames containing one or more bit errors.
Rx Frame Error Rate	Ratio of frame errors to received frames.
Rx Char Errors	Count of characters containing one or more bit errors.
Rx Chars	Count of the number of received characters since the last test restart.

Table 26 Data results (Continued)

Result	Definition
Tx Chars	Count of the number of transmitted characters since the last test restart.

BERT results

The BERT results change, depending on the timing selection and the pattern. Table 27 describes the results that can appear in the BERT test result category.

Table 27 BERT results

Result	Definition
Bit Errors	Number of received bits with a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved. Does not appear if using the Delay pattern.
Bit Count	Does not appear if using the Delay pattern.
Bit Error Rate	Ratio of bit errors to received pattern data bits. Does not appear if using the Delay pattern.
Pattern Loss Seconds	Number of seconds that the received pattern is lost relative to the expected (therefore, internally generated) test pattern.
Pattern Slip Seconds	Number of seconds in which a pattern slip was detected since start of test (PRBS patterns only). Appears if using synchronous timing and *not* using the Delay pattern.
Block Count	Does not appear if using the Delay pattern.
Block Error Rate	Does not appear if using the Delay pattern.
Block Errors	Appears if using synchronous timing and *not* using the Delay pattern.
Error Free Seconds	Number of seconds during which no pattern bit errors are detected while pattern synchronization is present. Does not appear if using the Delay pattern.
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. Does not appear if using the Delay pattern.
Error Seconds	Number of seconds during which one or more pattern bit errors occurred since initial pattern synchronization. Does not appear if using the Delay pattern.
Elapsed Seconds	Total number of test seconds. Does not appear if using the Delay pattern.
Sequence Sync Loss Count	Number of times the receiver lost pattern synchronization, even momentarily, since initial pattern synchronization.
Sequence Sync Loss Secs	Number of seconds during which the receiver lost pattern synchronization, even momentarily, since initial pattern synchronization.
Round Trip Delay	The current time between transmission and reception of the Delay pattern. The result is given in milliseconds. Only applicable when the BERT pattern is set to Delay.

Table 27 BERT results (Continued)

Result	Definition
Round Trip Delay Max	The maximum round trip delay since the start of the test. Only applicable when the BERT pattern is set to Delay.
Round Trip Delay Min	The minimum round trip delay since the start of the test. Only appears if using the BERT pattern is set to Delay.

G.821 performance results

Table 28 describes the G.821 performance results.

Table 28 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.
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.
UAS	Unavailable Seconds. A count of the number of test seconds which met the ITU-T Rec. G.821 definition of unavailable time.

Event Log

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

Event Histogram

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

Frame relay results

The Frame Relay result category is divided into the following subcategories: Summary, Clock, Control Signal, Data, DLCI, Link, Ping, LMI, DLCI List, Trace, Event Log, Event Histogram. The results available in each subcategory are listed in the following sections.

Summary results

The Frame Relay 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, key results that are out-of-specification, or key informational results are displayed. This allows quick access to the results without having to search each category.

Table 29 describes the results that can appear in the Summary result category.

Table 29 Summary results

Result	Definition
Signal Present	Indicates whether an active signal is present (yes/no).
Signal Loss Count	Number of times loss of signal occurred.
Rx Data Loss	Number of receiver synchronization losses resulting from a loss of data. Only valid when the Data Loss setting is enabled and only appears if using synchronous timing.
Rx Data Loss History	Receiver synchronization loss detected since start of test. Only valid when the Data Loss setting is enabled and only appears if using synchronous timing.
FCS Err Frm	Count of frame relay frames with FCS errors.
Long Frm	Count of frame relay frames exceeding the length specified as the long frame threshold.
Test Frm Lost	Count of frame relay frames lost by the network based on gaps in sequence numbers.
Lost Pings	Count of Echo messages that were not replied to. This result also includes out of order Echo Reply messages and corrupted order Echo Reply messages.
Message Err	Indicates the wrong message type was received, for example: – A status enquiry was received in UNI-N mode, – A small status message was received when expecting a full status message, – A status response was received, but no request was sent, – A message with incorrect information elements was received
Seq Err	Count of all the LMI frames received which have an incorrect or unexpected sequence number since the last test restart.
Time Outs	Count of LMI Status Enquiry messages sent that yielded no response from the network before the next poll cycle.
AIS Present	Alarm Indication Signal detected. (G703 interface only)
AIS History	Alarm Indication Signal detected since the last test restart. (G703 interface only)
Rx Code Error Present	Violations of the selected encoding method have been detected. (G703 interface only)
Rx Code Error Count	Number of detected violations of the selected encoding method. (G703 interface only)
Rx Error Bipolar Data Count	Number of detected bipolar data errors. (G703 interface only)
Rx Error Bipolar Data Present	Bipolar data errors have been detected. (G703 interface only)

Table 29 Summary results (Continued)

Result	Definition
Rx Error Bipolar Timing Count	Number of detected bipolar timing errors. (G703 interface only)
Rx Error Bipolar Timing Present	Bipolar timing errors have been detected. (G703 interface only)
Rx Clock Present	Receiver clock detected. Only appears if using synchronous timing.
Rx Clock History	Receiver clock detected since last test restart.
Tx Clock Present	Transmitter clock detected. Only appears if using synchronous timing.
Tx Clock History	Transmitter clock detected since last test restart.
Ex Clock Present	External clock detected. Only appears if using synchronous timing. (G703 interface only)
Ex Clock History	External clock detected since last test restart. (G703 interface only)
Rx Overrun	Receiver overflow.
Oob Flow Ctrl Status	Indicates whether out-of-band (Oob) flow control is on or off.

Clock results

See “Clock results” on page 91.

Control Signal

See “Control Signal results” on page 91.

Data Results

See “Data results” on page 92.

DLCI results

Table 30 lists results in the DLCI (Data Link Connection Identifier) category. These results apply to the DLCI you specified as a frame header setting when you configured your test.

Table 30 DLCI results

Result	Definition
Frm Cnt Rx	Count of the total number of frame relay frames detected.
Frm Octets Rx	Count of the total number of frame relay octets detected.
Avg Frm Size Rx	Calculates the average size of received frames (frame octets ÷ frame count).
Avg Frm Rate Rx	The average number of frame relay frames received per second, since the start of the test (frame count ÷ total seconds).
Max Frm Rate Rx	The maximum number of frame relay frames received per second, since the start of the test.

Table 30 DLCI results (Continued)

Result	Definition
% Util	Current link utilization during the last second.
Avg % Util	The average percentage of link utilization on the received channel since the start of the test. Calculated as total frame relay octets in frames (excluding flags, including overhead) ÷ total octets (idle and frame data) received.
Max % Util	The max percentage of link utilization on the received channel since the start of the test. Calculated as total frame relay octets in frames (excluding flags, including overhead) ÷ total octets (idle and frame data) received.
Thrput(bps)Rx	Current received throughput during the last second.
Avg Thruput (bps) Rx	The average received throughput since the start of the test, calculated as frame octets ÷ total seconds.
Max Thruput (bps) Rx	The maximum received throughput since the start of the test.
Long Frm DLCI	Count of frame relay frames exceeding the length specified as the long frame threshold.
FECN Frms Rx	Count of the frame relay frames with the FECN bit set.
% FECN Frms Rx	Percentage of total frame relay frames with the FECN bit set.
BECN Frm Rx	Count of frame relay frames with the BECN bit set.
% BECN Frm Rx	Percentage of total frame relay frames with the BECN bit set.
DE Frm Rx	Count of frame relay frames with the DE bit set.
% DE Frm Rx	Percentage of total frame relay frames with the DE bit set.
CR Frm Rx	Count of frame relay frames received with the C/R bit.
% CR Frm Rx	Percentage of total frame relay frames received with the C/R bit.
Test Frm Rx DLCI	Count of the total number of frame relay frames detected for the DLCI.
Test Frm Lost	Count of frame relay frames lost by the network based on gaps in sequence numbers.
% Test Frm Lost	Percentage of total frame relay frames lost by the network based on gaps in sequence numbers.

Link results

Table 31 lists results in the Link category. These results apply to the entire link.

Table 31 Link results

Result	Definition
Link Status	Indicates whether the link is up or down.
Frm Cnt Rx	Count of the total number of frame relay frames detected.

Table 31 Link results (Continued)

Result	Definition
Frm Octets Rx	Count of the total number of frame octets detected. The frame octets include all octets between the flags of the frame relay frame (for example, the address field, the information field, and the FCS field).
Avg Frm Size Rx	Calculates the average size of received frames (frame octets ÷ frame count).
Avg Frm Rate Rx	The average number of frame relay frames received per second, since the start of the test (frame count ÷ total seconds).
Max Frm Rate Rx	The maximum number of frame relay frames received since the start of the test.
% Util	Current link utilization during the last second.
Avg % Util	The average percentage of link utilization on the received channel since the start of the test. Calculated as total frame relay octets in frames (excluding flags, including overhead) ÷ total octets (idle and frame data) received.
Max % Util	The maximum percentage of link utilization on the received channel since the start of the test.
Thrput(bps) Rx	The current received throughput, in bits per second, measured over the last second.
Avg Thrput(bps)Rx	The average received throughput since the start of the test, calculated as frame octets ÷ total seconds.
Max Thrput(bps)Rx	The maximum received throughput since the start of the test.
FECN Frms Rx	Count of the frame relay frames with the FECN bit set.
% FECN Frm Rx	Percentage of total frame relay frames with the FECN bit set.
BECN Frm Rx	Count of the frame relay frames received with the BECN bit set.
% BECN Frm Rx	Percentage of total frame relay frames with the BECN bit set.
DE Frm Rx	Count of frame relay frames with the DE bit set.
% DE Frm Rx	Percentage of total frame relay frames with the DE bit set.
CR Frm Rx	Count of the frame relay frames received with the C/R bit set.
% CR Frm Rx	Percentage of total frame relay frames received with the C/R bit.
FCS Err Frm	Count of frame relay frames with FCS errors.
Short Frm	Count of frame relay frames containing less than four octets between frame flags.
Long Frm	Count of frame relay frames exceeding the length specified as the long frame threshold.
Test Frm Rx	Count of the total number of frame relay frames detected for the link.

Table 31 Link results (Continued)

Result	Definition
Test Frm Lost	Count of frame relay frames lost by the network based on gaps in sequence numbers.
% Lost Frm	Percentage of total TTC test frames lost by the network based on gaps in sequence numbers.

Ping results

Table 32 lists results in the Ping category. These results only appear if you configure the E1 Tester to transmit a Ping load.

Table 32 Ping results

Result	Definition
Tx Pings	Count of transmitted ping packets since the last test restart.
Echoed Pings	Count of echo frames transmitted since the start of the test.
Lost Pings	Count of Echo messages that were not replied to. This result also includes out of order Echo Reply messages and corrupted order Echo Reply messages.
Min Delay (ms)	Minimum round trip delay, measured in milliseconds, since the start of the test.
Avg Delay (ms)	Average round trip delay, measured in milliseconds, since the start of the test.
Max Delay (ms)	Maximum round trip delay, measured in milliseconds, since the start of the test.
Ping State	Displays the ping status: – Idle – Inverse ARP Active – OK – Host Unreachable – Network Unreachable – Protocol Unreachable – Port Unreachable – Fragmentation Needed but DF Bit Set – Unknown Network – Unknown Host – TTL Failed During Transit – TTL Failed During Reassembly – Network Prohibited – Host Prohibited – Network TOS – Host TOS – Unknown Error

LMI results

Table 33 lists results in the LMI category.

Table 33 LMI results

Result	Definition
Message Type	Indicates the type of LMI available on the frame relay circuit: None, LMI Rev 1, T1.617 Annex D, or ITU-T Q.933 Annex A.
Message Count Rx	Count of LMI messages received since the start of the test (an incrementing count indicates a “heartbeat”).
Status Enq Message Rx	Count of LMI Status Enquiry messages received since the last test restart.
Status Message	Indicates whether the LMI is Up or Down.
Message Err	Indicates the wrong message type was received, for example: – A status enquiry was received in UNI-N mode, – A small status message was received when expecting a full status message, – A status response was received, but no request was sent, – A message with incorrect information elements was received
Seq Err	Count of all the LMI frames received which have an incorrect or unexpected sequence number since the last test restart.
Time Outs	Count of LMI Status Enquiry messages sent that yielded no response from the network before the next poll cycle.

DLCI list results

The DLCI list result shows the status of up to 150 data link connection identifiers in the test.

The status (active, new, inactive, or deleted), provided by a LMI full status poll, is displayed for each DLCI. If a DLCI is inactive, a count of the number of times that the specified DLCI was inactive, and the duration during which it was inactive is provided.

NOTE:

Deleted DLCIs only apply to LMI Rev 1.

Trace results

The Trace Results category displays decoded LMI text for STATUS, STATUS ENQUIRY, and STATUS UPDATE (LMI revision 1 only) messages. When you configure the HST for testing, you can specify whether you want to display detailed (Verbose) or summarized (Simple) decode text in this category (see “Configuring the trace settings” on page 70).

Event Log

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

Event Histogram

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

Saving results

After running a test, you can save the results, and then view or import them into Excel at a later time.

To save test results

1. After your test is finished, display the Results menu, and then select **Save/View**.
2. Select **Save Results**.

   A screen appears prompting you for a filename for the results file.
3. Enter a filename, and then press **OK**.

   The result file is saved.

The test results are stored.

For more information on printing or downloading the results to Excel, see the instructions provided with the Download Manager utility.

Viewing saved results

After saving test results, you can retrieve them for review.

To view saved results

1. Display the Results menu, and then select **Save/View** or display the File Manager menu, select **Result Files**, and then select **View Results**.
2. Select which results to view, and then press OK.

   The results appear on the screen.

You can also view the results in Excel, using the Download Manager utility. For more information on viewing or printing results with Excel, see the instructions provided with the Download Manager.

Maintaining the Batteries

8

This chapter describes how to maintain the E1 Tester‘s batteries. Topics discussed in this chapter include the following:

WARNING: EXPLOSION HAZARD

Only charge nickel metal hydride (NiMH) batteries. Do not charge alkaline batteries. Charging any other type of rechargeable or non-rechargeable (disposable) batteries may cause them to leak, rupture, or explode, causing injuries.

Prolonging battery life

The SmartClass Tester uses four (4) AA batteries. Either alkaline or rechargeable NiMH batteries can be used.

To prolong the life span of any batteries, follow the guidelines below:

- Do not mix battery types (do not use Alkaline and rechargeable at the same time).
- Do not mix old batteries and new batteries.
- When not connected to the unit, store the batteries in a cool, dry, and clean environment. Do not leave the batteries in a car or truck, particularly during extremely hot or cold weather.
- The first time you use the SmartClass Tester, or after prolonged storage, use the AC adapter to power the unit and charge NiMH batteries only.
- If the battery capacity is depleted or if the batteries have been stored for a prolonged period, charge the batteries before use.
- If charging the batteries while they are in the unit, use the JDSU AC adapter to power the unit.
- The charger will not charge the batteries when it is extremely hot or cold.
- Always carry fully charged spare batteries.
- If the unit will be stored (and unused) for more than 4 weeks, and the AC adapter is not plugged in to an AC power supply, remove the batteries from the unit.
- Always dispose of batteries properly.

  The following section describes how to recharge and replace the batteries.

Recharging the batteries

When the Battery LED lights red, the batteries should be charged or replaced.

NOTE:

You can test a circuit and recharge the batteries at the same time. If you do not want to interrupt the current test, you may leave the power on and connect the AC power adapter.

If you have an external battery charger, follow the instructions for that charger. If charging the batteries in the unit, follow the procedure outlined below.

To charge the batteries

1. Connect one end of the AC adapter to the connector on the bottom of the E1 Tester.
2. Connect the other end of the AC adapter to an AC power supply.

NOTE: If the AC adapter is connected to the unit and to an AC power supply, and the Battery LED is red, the charger has detected a fault condition, or the battery has less than ten minutes of power remaining. For details on correcting this condition, see "Resolving problems" on page 108.

WARNING: ELECTRICAL SHOCK

Electrical shock may result in serious injury or death. Be sure the AC Adapter is connected to the correct voltage mains. Do not use outdoors or in wet locations. Use only the AC Adapter supplied with the test set.

3 Let the SmartClass charge for 2 to 4 hours depending on the voltage level.

The **Batt** LED is amber when the unit is charging the battery.

Charging the batteries is complete when the Batt LED is green.

Replacing the batteries

The battery compartment is located on the back of the unit, as shown in Figure 11.

Figure 11 Back of SmartClass

The following procedure describes how to replace the batteries.

To replace the batteries

1 Turn the power off.

CAUTION: INSTRUMENT DAMAGE

Failure to turn the power off before removing the batteries from the E1 Tester could damage internal components and/or corrupt the software. Always power down the unit before removing the batteries.

2 Disconnect the AC adapter.

3 Using a slotted screwdriver, remove the screw from the battery compartment door, and then press down and push the panel toward the bottom end.

4 Replace the batteries, with polarities oriented as shown in Figure 12.

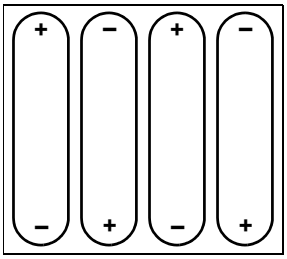

Figure 12 Battery orientation

We recommend *Energizer*® 2500 mAh rechargeable batteries.

5 Replace the battery compartment door, and secure the door by tightening the screw.

6 Reconnect the AC adapter to the unit and to an AC power supply.

7 Turn the unit ON, and then specify the type of battery you inserted.

The batteries are replaced.

Troubleshooting

9

This chapter describes how to identify and correct problems related to the SmartClass E1 Tester. Topics discussed in this chapter include the following:

Getting Technical Assistance

For the latest TAC (Technical Assistance Center) contact information, go to www.jdsu.com or contact your local sales office for assistance. 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 Germany Technical Assistance Center, hotline.europe@jdsu.com, or submit your question using our online Technical Assistance Request form at www.jdsu.com.

Resolving problems

If you are having trouble with the E1 Tester, the following sections describe common problems and solutions. You should verify whether your problem is listed here before contacting technical assistance.

The following section addresses questions that may be asked about completing tests with the SmartClass. There are three sections included:

– General
– E1 testing
– Datacom testing

General testing

The following section addresses questions about testing in general using SmartClass E1 or E1/Datacom Testers.

Issue

Batteries are fully charged, and the external power adapter is attached, but the Batt LED on the unit is red.

Resolution

The charger has detected a fault condition. Turn the unit OFF, and then disconnect the external power adapter. Verify that the batteries installed in your unit are NiMH batteries, and that they are installed in the proper orientation (see Figure 12 on page 106). Always use JDSU recommended batteries in your unit.

Issue

Batteries are not detected by the tester.

Resolution

The battery charge is depleted to such a degree that the tester can no longer detect or charge them. Replace the batteries (see “Recharging the batteries” on page 104.

E1 testing

Table 34 describes situations that you may encounter when using the SmartClass E1 tester.

Table 34 Problems and resolutions

Issue	Description	Resolution
No signal present	This occurs when there is no valid input connected to the SmartClass.	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 SmartClass 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.
In Monitor mode, the Sync and Data LEDs are red even though frame synchronization and pattern synchronization are present on the Rx1 interface.	The SmartClass E1 monitors the RX1/TX1 and RX2/Ext Clk interfaces simultaneously. The Sync and Data LEDs will be green only if both receivers have frame and pattern synchronization, respectively.	To monitor a single E1 interface, select Monitor mode, and then configure the settings for the monitored interface. Be certain to use the RX1 connector; the RX2/Ext Clk connector should not be used when monitoring a single interface.
Received NOSIG DATA alarm	This happens in the Pulse Shape application when the captured pulse does not fall between the maximum and minimum mask.	Run the test again.

Datacom testing

Table 34 describes situations that you may encounter when performing Datacom testing with the E1 Tester.

Table 35 Issues and resolutions

Issue	Resolution
No receive clock	Check the Datacom settings. Specifically, 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 E1 Tester.
The receive clock is inverted	Check the Datacom settings. Specifically, 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.
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 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 to 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.
No pattern synchronization	– Perform a self test. See “Performing a self test” on page 61. – 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. If flow control is on, a generator hold may be preventing the pattern from being transmitted.

Signal Lead Names

A

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 36 on page 112 provides a cross reference of signal lead names, including signal direction.

Table 36 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
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

Specifications

B

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

E1 interface connector specifications

Table 37 provides the connector specifications.

Table 37 Connector specifications

Connector	Specification
RJ-48	Standard telecom RJ-48/RJ-48C
USB	USB 1.1/2.0 compliant
DC power	12 VDC, 1.25A Maximum

Physical interface specifications

Transmitter

The transmitter operates as per ITU-G.703. Table 38 describes the transmitter specifications.

Table 38 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: ±5 ppm, +1 ppm per year aging Resolution: 1 Hz
Line Code	HDB3 or AMI
Frequency Offset	+/-100 ppm in 1 ppm intervals
Clock Source[a]	Internal, Recovered from Rx1 or Rx2, External 2M Reference Clock (via optional cable)

a. 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.

Receivers

The receivers operate as per ITU-G.703. Table 39 describes the receiver specifications.

Table 39 Receiver specifications

Parameter	Specification
Inputs	2 balanced RJ-48 jacks Impedance 120 ohms or bridge (HI-Z) Unbalanced/ 75 ohms via adapter cables
PMP Compensation	-16 to -26 dbB resistive loss

Table 39 Receiver specifications (Continued)

Parameter	Specification
Bit Rate	Range: 2.048 MHz ± 512 Hz Accuracy: ±5 ppm, +1 ppm per year aging Resolution: 1 Hz
Level Measurement	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 – 2.048 MHz – Unbalanced/ 75 ohms (at adapter cable input)

E1 circuit testing specifications

Table 40 describes the E1 circuit testing specifications.

Table 40 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, Bridge, 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

Table 40 E1 circuit testing specifications (Continued)

Parameter	Specification
Defect (Alarm) Generation	LOS, LOF, AIS, TS-16, AIS, RDI/FAS distant, MF AIS, MF RDI/MFAS distant
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 RX1 or RX2
Round Trip Delay	Range: 0-10 s Resolution: 0.1 ms
Result Categories	Summary, Statistics, Signal, Interface, Frame Data, Timeslots, BERT, Performance (G.821, G.826 ISM, G.826 OOS, M.2100 ISM, M.2100 OOS), VF

Pulse shape specifications

Table 41 describes the pulse shape specifications.

Table 41 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
Fall Time	Resolution: 1 ns
Undershoot	Resolution: 1% of nominal level
Overshoot	Resolution: 1% of nominal level
Signal Level	In [V] base-peak
Result Categories	Summary, LED, Signal, Interface, Frame Data, BERT, Pulse Shape, Time

Jitter specifications

This section provides jitter specifications for the E1 Tester.

Standards

Jitter is generated and analyzed in accordance with the standards *ITU-T Recommendations G.823, O.171.*

Manual Jitter Measurement

Table 42 provides the specifications for the manual jitter measurement.

Table 42 Manual jitter measurement specifications

Item	Description
Rx accuracy	0.05 UI or 3%, whichever is greater
Rx resolution	1/128 UI
Rx frequency range	20 Hz to100 kHz
Range of Rx jitter amplitude (UIpp)	16 UI
Rx clock source	Recovered clock
Tx accuracy	0.03 UI or 3%, whichever is greater
Tx resolution	1/64 UI
Tx frequency range (nominal)	20 Hz to100 kHz
Range of Tx jitter amplitude (UIpp)	0.1 UI to 10 UI
Tx clock source	Internal clock

MTJ and FMTJ Measurements

Table 43 provides the specifications for the maximum tolerable jitter (MTJ) and fast maximum tolerable jitter (FMTJ) measurements.

Table 43 MTJ and FMTJ measurement specifications

Item	Description
Tx accuracy	0.03 UI or 3%, whichever is greater
Tx resolution	1/64 UI
Tx frequency range (nominal)	20 Hz to100 kHz
Range of Tx jitter amplitude (UIpp)	0.1 UI to 10 UI

Jitter Transfer Measurement

Table 44 provides the specifications for the jitter transfer measurement.

Table 44 Jitter transfer measurement specifications

Item	Description
Rx accuracy	0.05 UI or 3%, whichever is greater
Rx resolution	1/128 UI
Rx frequency range	20 Hz to100 kHz
Tx accuracy	0.03 UI or 3%, whichever is greater
Tx resolution	1/64 UI
Tx frequency range (nominal)	20 Hz to100 kHz
Range of Tx jitter amplitude (UIpp)	0.1 UI to 5 UI
Intrinsic jitter of instrument	<0.07 UI

Datacom specifications

The following sections contain specifications related to the Datacom testing option.

Supported interface standards

Table 45 lists the supported Datacom test interfaces and circuits.

Table 45 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]
Co-directional Timing	AMI with block violation for Octet timing
Contra-directional Timing and Centralized Timing	Data - AMI with 100% duty cycle Clock - AMI with 50% duty cycle

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 universal Datacom connector. The following sections describe the pin assignments for the supported interfaces.

RS-232/V.24 pin assignments

Table 46 lists pin assignments for the RS-232/V.24 interface.

Table 46 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

Table 46 RS-232/V.24 pin assignments (Continued)

Pin	Signal Description	Signal Source	CCITT Circuit
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 48 lists pin assignments for the X.21 interface.

Table 47 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 48 lists the pin assignments for the EIA-530 interface.

Table 48 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
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 49 lists the pin assignments for the V.35 interface.

Table 49 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
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 50 lists pin assignments for the RS-232/V.36 interface.

Table 50 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

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 51 provides a cross reference of signal lead names, including signal direction.

Table 51 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
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

Physical specifications

Table 52 provides the physical specifications for the SmartClass E1 tester with batteries.

Table 52 Physical specifications

Parameter	Specification
Size (H x W x D)	230 x 120 x 50 mm
Weight	<2 lbs (1 kg)
Display	320 x 240 pixel color display

Environmental specifications

Table 53 provides the environmental specifications without batteries.

Table 53 Environmental specifications

Parameter	Specification
Operating Temperature	0° to +50° C (32° to +120° F)
Storage Temperature[a]	-10° to 60° C (-50° to 140° F)
Humidity	10% to 80% RHNC

a. Without Batteries

Power specifications

Although battery life varies, depending on the type of battery and the type of test, Table 54 provides specifications for the battery life of the recommended *Energizer*® 2500 mAh NiMH rechargeable batteries, and the specifications for the AC adapter.

Table 54 Power specifications

Parameter	Specification
Operating time (at 25° C)	Under typical conditions: – if running in E1 mode: should provide 5 hours continuous use – if running in Datacom mode: should provide 2 hours continuous use
Charging time (at 25° C)	Under typical conditions for empty to full charge: – With unit OFF: Up to 5 hours – With unit ON: Up to 7 hours
Charging temperature	15° to +35° C (59° to +95° F)
Power supply input	100 to 240 VAC, 50/60 Hz, autosensing
Power supply output	12 V, 1.25 Amp

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