T-BERD® 950
User's Guide

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Getting Technical Assistance

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Chapter 1 Introduction

This chapter is an overview of the contents of this guide and describes the typographical conventions used. Additionally, you will find a brief description of T-BERD 950 testing features and capabilities.

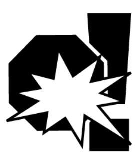
About this Guide

This guide describes the T-BERD 950, including features, accessories, warnings, and complete installation instructions; maintenance information and troubleshooting techniques; system specifications; warranty, service, and repair information; and terms and conditions of the licensing agreement.

Typographical Conventions

The following format conventions clarify content throughout this guide.

- Key names, menu options, and screen prompts appear in boldface. Example: **Tab**, **Start**, **Enter**.
- Consecutive or simultaneous keystrokes are indicated with the plus (+) symbol. Example: **Ctrl+Alt+Delete**.
- Special messages or warnings are indicated with the following symbols:



Warning

Caution

Note/Tip

Using This Guide

The T-BERD 950 User's Guide provides basic operating information for the T-BERD 950 Communications Analyzer.

To help you best use this guide, it is organized as follows:

- **Chapter 1 — Introduction:** Describes the guide conventions and outline of the User's Guide.
- **Chapter 2 — Instrument Setup and Description:** Describes the T-BERD 950 Communications Analyzer, instrument setup, modes of operation, preventative maintenance, and battery replacement procedures.
- **Chapter 3 — Large Graphical Display Operation:** Describes the operation of the Large Graphical Display.
- **Chapter 4 — Specifications:** Describes the physical specifications of the Communications Analyzer.
- **Chapter 5 — T1 Task Navigated Testing (TNT) Overview:** Describes the Task Navigated Testing (TNT) feature.
- **Chapter 6 — T1 Manual Test Setup:** Describes the setup for T1 BER Testing and includes Smart Repeater test setups and commands.
- **Chapter 7 — T1 Test Results:** Describes the available test results, the category of the test results, and the test type with which it is associated.
- **Chapter 8 — Printer Operation:** Describes the printer functions of the T-BERD 950.
- **Chapter 9 — Options:** Contains subsections for each of the following options:
  - **DDS-LL Option**: Describes the DDS LL option, specifications, TNT and manual test setups, plus results.
  - **Frame Relay Option:** Describes the Frame Relay option, specifications, TNT and manual test setups, plus results.
  - **ISDN PRI Option:** Describes the ISDN Primary Rate Interface (PRI) option, specifications, TNT and manual test setups, plus results.

- **Signaling Option:** Describes the Signaling option, specifications, TNT and manual test setups, plus results.
- **PCM TIMS Option:** Describes the Pulse Code Modulation Transmission Impairment Measurement Set (PCM TIMS) option, specifications, TNT and manual test setups, plus results.
- **ISDN BRI Option:** Describes the ISDN Basic Rate Interface (BRI) option, specifications, TNT and manual test setups, plus results.
- **10BaseT/Ethernet Option:** Describes the 10BaseT Ethernet option, specifications, TNT and manual test setups, plus results.

- **Chapter 10 — Acterna Customer Services:** Contains information on Acterna customer services, general warranty information, and service and repair information.
- **Appendix A — Repeater Loop Codes**
- **Appendix B — Glossary**
- **Index**

Features and Capabilities

Designed to make routine test setup simple and intuitive, Task Navigated Testing (TNT) guides field service technicians through typical testing scenarios quickly, easily, and accurately. TNT is designed around the tasks and terminology employed by the technician. Basic T1 TNT configurations are described in “Testing with the T-BERD 950” on page 48.

TNT is for the technician who performs typical field service turnup and troubleshooting procedures. However, for those who encounter non-traditional testing scenarios, the T-BERD 950 is still entirely custom configurable using Manual Setup mode. Either way, the T-BERD 950 can provide full featured testing capabilities based on your needs.

Chapter 2 Instrument Setup and Description

This section describes the T-BERD 950 Communications Analyzer instrument setup; modes of operation; front, side, and rear panel connectors and indicators; battery operation; and preventative maintenance.

Instrument Setup

This section provides you with instructions for how to get your T-BERD 950 up and running.

1. Remove the T-BERD 950 from the shipping container.

   Save the container. If the T-BERD 950 requires servicing, use this container to return it to Acterna.

2. Temporarily remove the cover of the T-BERD 950.

   Place the T-BERD 950 upright so that it stands on its rubber feet and the handle is at the top. Use both thumbs to push the lid clips inward and to the right simultaneously (to unhinge them from the connector). Pull the lid towards you. Be sure to save the cover.

The cover is not hinged at the bottom of the T-BERD 950, so to remove the bottom of the cover, simply raise it up from the slots on the bottom.

3. Connect the yellow AC power cord to the T-BERD 950.

   The power cable is included with the T-BERD 950 in the shipping container. The AC power connector is on the bottom right side of it.

4. Apply power to the T-BERD 950.

   The switch is on the right side of the T-BERD 950.

5. Adjust the contrast of the graphical display to suit you.

   The control is located on front panel, to the left of the display. The display appears blank until the contrast is adjusted.

6. Press the SELF LOOP control.

   The SELF LOOP control is on lower left corner of the front panel. The SELF LOOP LED illuminates to indicate the T-BERD 950 is receiving its transmitted signal.

7. Check the Status/Alarm LEDs.

Status/Alarm LEDs are located in the upper right corner of the front panel. Verify SIGNAL, FRAME SYNC, PATTERN SYNC and B8ZS LEDs are illuminated green.

Once you complete these procedures, it is safe set up the T-BERD 950 for testing purposes. For additional help, please call Acterna's Technical Assistance Center (TAC) at 1-800-638-2049.

Modes of Operation

The baseline T-BERD 950 Communications Analyzer is a T1/FT1 Bit Error Rate (BER) test set that offers several options that enable it to become a full-featured, multi-service test instrument. It has two T1 interfaces: T1-LINE and T1-EQUIPMENT. Each interface consists of an independent receiver and transmitter. The interfaces can be configured for various applications.

The T-BERD 950 can operate in four modes:

- Terminate Mode
- Drop and Insert (D&I) Mode
- Dual Monitor (Mon) Mode
- Line Loop Back (LLB) Mode

Terminate Mode

This mode separates the transmit and receive sides of a T1 path. The input signal is terminated at the receive side, and a totally independent signal is generated for the output. You can use either the LINE Tx/Rx pair or the EQUIPMENT Tx/Rx pair.

In the event of power loss (i.e., no AC power and no batteries) to the T-BERD 950, the LINE and EQUIPMENT pairs are automatically cross connected to prevent loss of service.

Drop and Insert (D&I) Mode

This mode enables the T-BERD 950 to access specific channels from the T1 line while leaving the other channels unaffected. The transmit and receive side of the T1 path are paired. As shown in Figure 1, the input signal is received, Bipolar Violations (BPVs) are corrected, the signal is regenerated, and new data can be inserted onto specific bandwidths before the signal is sent to the output. No data is inserted on the transmit path unless the associated receiver has frame synchronization. The D&I mode signal paths are illustrated in Figure 1.

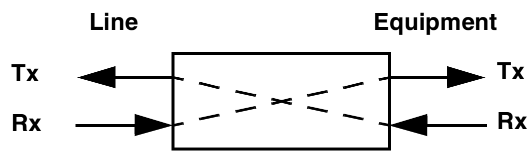


Figure 1 • D&I Mode Paths

Dual Monitor (Mon) Mode

This mode measures signal parameters, monitors traffic from a resistor-isolated DS1 monitor point, or bridges onto the line. One (1) or two (2) receivers may be used. If two (2) receivers are used, the LINE and EQUIPMENT receivers are monitored simultaneously.

Line Loop Back (LLB) Mode

This mode places the T1 path into Full Loop Back configuration, which loops the incoming data back out the transmitter while enabling the receiver to monitor the incoming signal (BPV errors are not corrected). The LLB mode signal paths are illustrated in Figure 2.

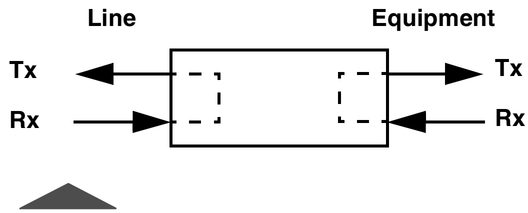


Figure 2 • LLB Mode Paths

Self Loop Mode

When the T-BERD 950 is placed in Self Loop mode (press **SELF LOOP** key), a set of relays is activated. These relays are designed to pass the incoming signal through the T-BERD 950. The signal path is from Rx LINE to Tx EQUIPMENT, and from Rx EQUIPMENT to Tx LINE. This is the same configuration as for D&I Mode.

If a D&I test is being performed, and the T-BERD 950 is placed in Self Loop mode; the incoming signal still passes through it without interruption. If it is in Terminate Mode, where the configuration is Tx LINE to Rx LINE, the relays have no effect. The relays remain active when the unit loses power or is powered off.

Front Panel Controls, Indicators, and Connectors

The front panel of the T-BERD 950 mainframe is shown in Figure 3 with each control (or control group), indicator, and connector marked with a numbered callout. Table 1 provides a brief description of each control, indicator, and connector referenced to the numbered callouts in Figure 3.

Figure 3 • Front Panel

Table 1 • Front Panel Controls, Indicators, and Connectors

No	Control Indicator	Description
1	Large Graphical Display	Shows four unique views: **Home** — Configures the interface, task, and test to be performed. **Setup** — Configures the specifics of the selected test. **Results** — Shows results for the selected test. **System** — Configures general mainframe and auxiliary settings.
2	T1 LINE Tx and Rx Connectors	Consists of one set of WECO 310 female connectors, one set of Bantam female connectors, and one 15-pin D connector for LINE Tx and Rx. This is also referred to as Primary Side.
3	Large Graphical Display LED	Illuminates to indicate which view is active.
4	**RESTART** Key	Generates a manual test restart and clears all results, including any flashing messages on the Two-Line Display.
5	Microphone	Used for Voice testing, activated by the PUSH-TO-TALK key on the keypad.
6	Two-Line Display	Shows LINE and EQUIPMENT receiver results. Line receiver results appear unless the **EQUIPMENT** Key is used to show EQUIPMENT receiver results (see Callout #8). Also shows status and alarm messages.
7	T1 EQUIPMENT Tx and Rx Connectors	Connects one set of Bantam female connectors for the EQUIPMENT Tx and Rx. This is also referred to as Secondary Side.
8	RESULTS I and II Display Area Controls & Indicators	**Up/Down Arrow** Keys — Selects the results category. **Left/Right Arrow** Keys — Selects the individual result within the selected category. **Category Light Emitting Diodes (LEDs)** — Illuminates to indicate the selected category. **EQUIPMENT** Key — Selects EQUIPMENT channel results for the RESULTS I and II display areas. The LEDs under RESULTS I and II light to indicate that EQUIPMENT channel results are shown. If the LED is off, LINE side results appear.

Table 1 • Front Panel Controls, Indicators, and Connectors (Continued)

No	Control Indicator	Description
9	DDS Local Loop Connector	Connects RJ45 connector for four wire Digital Data Service (DDS) Local Loop Option.
10	Status/Alarm Group	**Status/Alarm LEDs** — (inside LEDs) Illuminates green to indicate Signal Present, Frame Sync, Pattern Sync, and B8ZS detection. Illuminates red for AIS and Yellow Alarm for LINE and EQUIPMENT channels. **History LEDs** — (outside LEDs) Illuminates red to indicate that a status/alarm condition has changed state for Signal Present, Frame Sync, Pattern Sync, B8ZS detection, AIS, and Yellow Alarm, for both LINE and EQUIPMENT channels. Press **RESTART** or **HISTORY RESET** to clear. **HISTORY RESET** Key — Clears all history LEDs. It does not clear an active alarm LED. **Low Battery LED** — Illuminates to indicate that the batteries have less than 15 minutes of charge remaining. **NOTE:** This LED also illuminates when the T-BERD 950 is powered on and remains on (for approximately 30 seconds) until the internal battery test circuitry determines the amount of charge remaining in the battery. **Charge LED** — Steady illumination indicates that the battery(ies) is being charged at the maximum rate. It blinks to indicate that the battery is being trickle charged.
11	**SOFTKEYS** Control Group	**FUNCTION** — Shows the current available softkey groups. **MORE** — Shows additional softkeys. Softkeys — Use to make selections for the currently highlighted field.
12	**SELF LOOP** Key	Loops the selected interface transmitter to its receiver. The LED illuminates indicating self loop is active. When in self loop mode, the T-BERD 950 is isolated from the LINE and EQUIPMENT connectors. When SELF LOOP operation is turned On, the T-BERD 950 operating mode is automatically set to TERMINATE, the transmit timing is set to INTERNAL and Line Build Out (LBO) is set to 0 db. When the SELF LOOP operation is turned Off, the T-BERD 950 returns to its previous configuration.

Table 1 • Front Panel Controls, Indicators, and Connectors (Continued)

No	Control Indicator	Description
13	Large Graphical Display Controls Group	**VIEWS** Control Keys (**HOME**, **SETUP**, **RESULTS** and **SYSTEM)** — Provide access to the Home, Setup, Results, and System views. **SCROLL** Keys — Move one item at a time up or down the list on the current view. **PAGE** Keys — Scroll up or down a full screen at a time when PGUP or PGDN appear on the right side of the prompting area.
14	**ERROR INSERT** Key	Inserts a single error or errors at a specified rate. If the key is pressed for more than two (2) seconds, the LED illuminates to indicate that error rates are being inserted.
15	**HELP** Key	Accesses help for the active selection line.
16	**VOLUME** Keys	Controls the volume of the speaker. The left key reduces the volume and the right key increases the volume.
17	Speaker	Allows you to hear audible VF tones present (i.e., voice, TIMS tones).
18	Alphanumeric Keypad	Consists of a telephone keypad. See Table 2, on page 14, for detailed functions of the special keys.
19	**PUSH-TO-TALK** Key	Activates the microphone feature.
20	**LOOP UP** Key	Activates loop up code transmission. The LED illuminates to indicate loop up code is being transmitted.
21	**LOOP DOWN** Key	Activates loop down code transmission. The LED illuminates to indicate loop down code is being transmitted.
22	Interface Module Slot	Provides slot for optional interface module use, such as the Analog 2W/4W or Datacom (DTE/DCE) interface modules.

Keypad

The keypad consists of a telephone keypad and has additional keys for signaling entry and HEX-based input. Special keys are described in Table 2.

Table 2 • Keypad Special Function s

Key	Description
A, B, C, D	Adds DTMF signaling when setting the Program Dial feature for some options. The STP, ST2P, and ST3P markings above the keys are for MF signaling. Also used for entering HEX information.
***/E**	Adds DTMF signaling and KP for MF signaling. Also used for entering HEX information and a decimal point (.)
#/F	Adds DTMF signaling and ST for MF signaling. Also used for entering HEX information.
D/±	Toggles a level value from positive (+) to negative (-).
DEL	Deletes the selected character.
(← →)	Moves the cursor left or right.
Push-to-Talk	Provides Push-to-Talk microphone activation.

Left Side Panel Controls and Connectors

The left side panel of the T-BERD 950 mainframe is shown in Figure 4. Each control and connector is marked with a numbered callout. Table 3 describes each control and connector labeled in Figure 4.

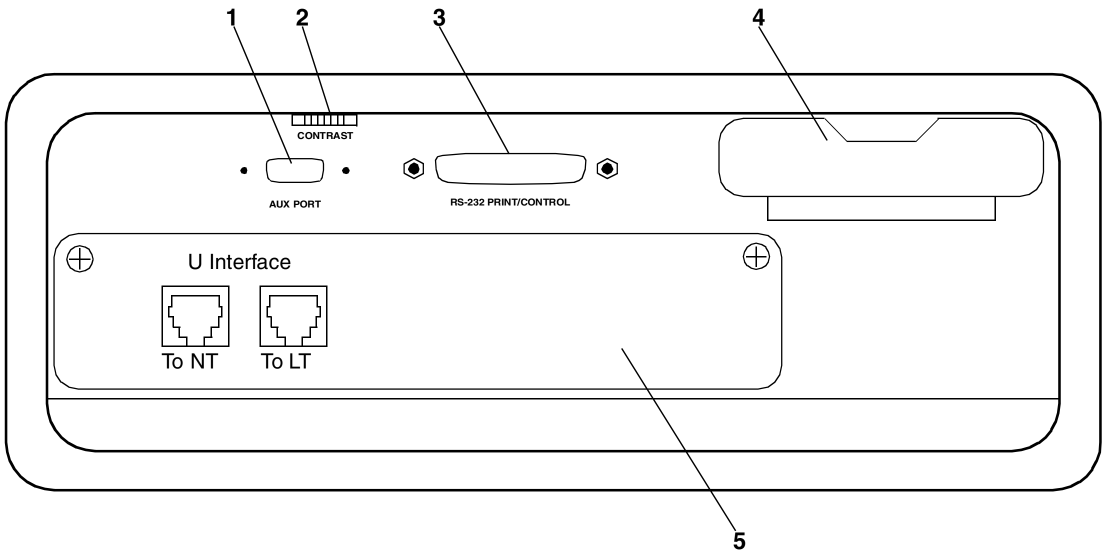


Figure 4 • Left Side Panel

Table 3 • Left Side Panel Description

No.	Control Indicator	Description
1	AUX PORT	Future use.
2	CONTRAST	Adjusts the backlight on the Large Graphical Display. Note: If the contrast is not set properly, the display appears blank.
3	RS-232 PRINT/ CONTROL	Connects to the RS-232 side of the printer cable.
4	PCMCIA Card Slot	Used for the T-BERD 950 software card.
5	Option Slot	Used for the Protocol Services Board (Acterna Part # TB950-PSB). U interface connectors are present, but the ISDN BRI software option (Acterna# TB950-BRI) must be installed to perform ISDN BRI testing. For details see “External Interface Requirements” on page 223.

Using the PCMCIA Card Slot

Insert the T-BERD 950 software card.

1. Turn power off.
2. Open the PCMCIA access door, the hinged cover over the port on the right side.

   The inside of the door is marked "OPTION - Top Eject" on the left and "SOFTWARE - Bottom Eject" on the right.
3. Insert your software in the bottom slot.

   The top slot is for future use.

To remove the PCMCIA software card, press the small release button on the right side of the software slot. Do not try to pull it out.

Right Side Panel Controls and Connectors

The right side panel of the T-BERD 950 mainframe is shown in Figure 5. Each control and connector is marked with a numbered callout. Table 4 describes each control and connector referenced to the numbered callouts in Figure 5.

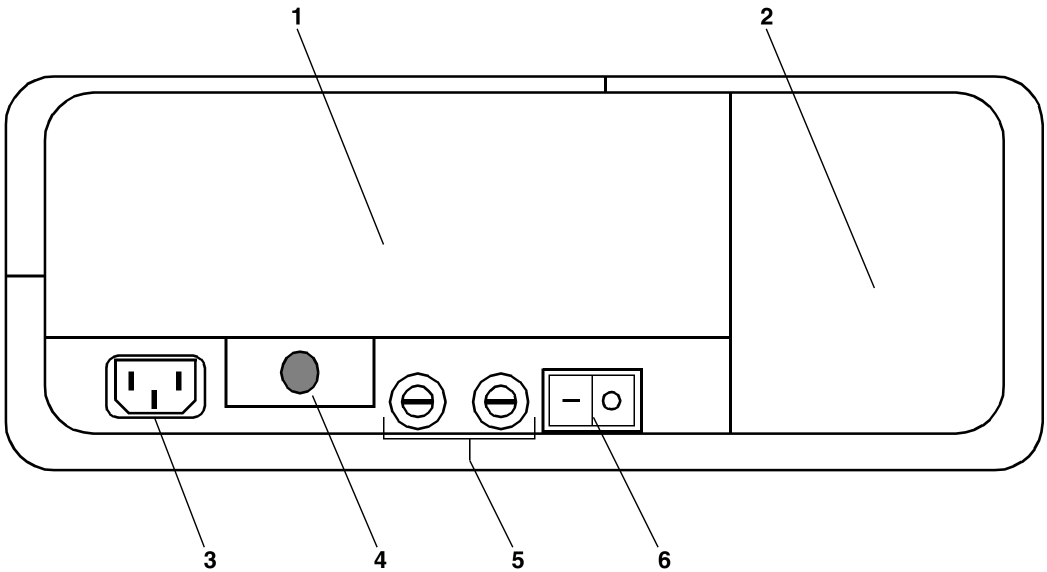


Figure 5 • Right Side Panel View

Table 4 • Right Side Panel Controls and Connectors

No.	Control Indicator	Description
1	Interface Module Slot	Contains optional interfaces, such as the Analog 2W/4W or Datacom (DTC/DCE) Interface Modules.
2	Fan	Cools the T-BERD 950 when connected to AC power and when the batteries are being charged. During test operations, the fan is controlled by its internal temperature.
3	AC Power Receptacle	Connects the AC power cord to the T-BERD 950.

Table 4 • Right Side Panel Controls and Connectors (Continued)

No.	Control Indicator	Description
4	Interface Module Release Button or Lever	Releases an interface module for removal. To release the installed interface module, press the button or pull the lever.
5	AC Line Fuses	Contains two 250Volt, 1 Amp Slo-Blo fuses (LittleFuse p/n 218 001).
6	Power Switch	Powers the T-BERD 950 **On** or **Off** (**I** or **O**).

Rear Panel

The rear panel of the T-BERD 950 mainframe is shown in Figure 6. As shown in Figure 6, access to the rechargeable batteries is through the battery compartment door. The tilt stand can be adjusted to stand the T-BERD 950 at an angle for easier viewing of the display screens.

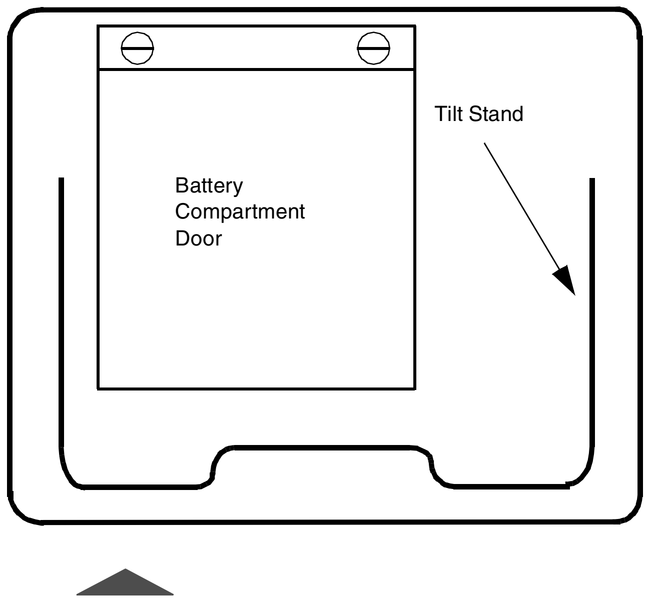


Figure 6 • Rear Panel View

Battery Operation

The T-BERD 950 uses battery power when AC power is not available. It does so by automatically switching over to battery power when AC power is lost. The rechargeable batteries provide between 2 and 4 hours of operating time. Depending on the tests performed and the configuration, the operating time can vary.

Charging Batteries

The batteries are charged whenever the T-BERD 950 is connected to AC power. When **Off**, the charging time is approximately 3 hours. When the T-BERD 950 is powered **On**, the number of batteries charged and the time required to reach full power is determined by the installed options and configuration of the T-BERD 950. To reach full power, recharging may require up to 8 hours.

Battery charging is not supported in some configurations (i.e., Frame Relay and ISDN PRI). To start charging, either power off the T-BERD 950 or select a configuration that supports charging.

Two LEDs are located on the front panel of the T-BERD 950 to indicate the status of the batteries: **Charge LED** and **Low Battery LED**.

- **Charge LED** — Illuminates steady to indicate that the batteries are being charged at the maximum charge rate. Blinks to indicate that the batteries are fully charged and the charger is producing a trickle charge to maintain the batteries at a full charge, while the T-BERD 950 is turned Off.
- **Low Battery LED** — Illuminates to indicate that the batteries have less than 15 minutes of charge remaining.

The* BATT CHG *result (Time Results Category) becomes invalid when the batteries are removed. The batteries must be conditioned to obtain a valid Battery Charge result.

Battery Replacement Procedure

To replace the batteries follow these instructions:

1. Power off the T-BERD 950 and disconnect the AC power cord.

If the current configuration supports battery charging, the batteries can be changed one at a time while the test is in progress without interrupting T-BERD 950 performance. The batteries can be "hot swapped" (i.e., one at a time when T-BERD 950 is powered* ON*). If you do so, remember that the* BATT CHG *result (Time Results Category) becomes invalid until the batteries are conditioned.

2. Open the battery compartment door, located on the rear panel of T-BERD 950, by turning the two fasteners ¼ turn counterclockwise.
3. Remove each of the batteries individually. Using the cloth strap, lift the end of the battery away from the contacts.
4. Allow one (1) minute between removal and installation of the batteries to enable the battery capacity measurement to reset.
5. Install the new battery by inserting the contact end first and firmly press down on the end away from the contacts.

Battery contacts are offset to prevent incorrect installation.

6. Close the battery compartment door and secure it by turning the two fasteners ¼ turn clockwise.

Condition the batteries to obtain accurate battery capacity readings. (Refer to pag e37 in Chapter 3 for additional information.) Allow the batteries to charge to full capacity prior to operating T-BERD 950 on battery power. The batteries will charge when the unit has AC power.

Preventive Maintenance

Preventive maintenance on the T-BERD 950 involves two steps: **visually inspecting** it and **cleaning** it. The T-BERD 950 should be visually inspected and cleaned as often as operating conditions require.

The accumulation of dirt on the T-BERD 950 can cause overheating and component failure.

Exterior Inspection

Inspect the external portions of the instrument for damage, wear, and loose or missing parts. Check all parts thoroughly to verify correct operation and performance.

Any deficiencies found that could cause personal injury or lead to further damage indicate that the unit should not be used.

Exterior Cleaning

Loose dust on the outside of the instrument can be removed with a soft cloth. Remove any dirt that remains with a soft cloth dampened in a mild detergent and water solution (e.g., Miller Stephenson Cleaner MS-260).

Do not use abrasive cleaners on the Large Graphical Display or Two-Line Display screen as the screens could be scratched. Do not get moisture inside the instrument.

Use only enough water to dampen the cloth. Any accumulated dust and dirt in the fan input area can be removed with a vacuum.

Replacing the Fuse

The procedure to replace the AC power fuse(s) in the T-BERD 950 is presented below.

1. Power off the T-BERD 950 and disconnect the AC power cord.
2. Remove the fuse holder(s) by turning it ¼ turn counterclockwise while pulling the fuse out of the holder.

The fuse holders are located on the right side panel of T-BERD 950, immediately to the left of the Power switch. See item 4 of Figur e5 on page 17.

3. Insert the replacement fuse (Replace with a fuse of the proper rating and voltage (i.e., T1A/250V). See the label on the bottom of the T-BERD 950 for fuse type.) into the holder and reinstall the fuse holder by turning it ¼ turn counterclockwise.

4. Reconnect the AC power cord.

Chapter 3 Large Graphical Display Operation

This chapter describes the operation of the Large Graphical Display and the Home, Setup, Results, and System views.

Main Display Controls

The following paragraphs describe the operation of the front panel controls associated with the Large Graphical Display. Figure 7 shows the controls and LEDs for the Large Graphical Display.

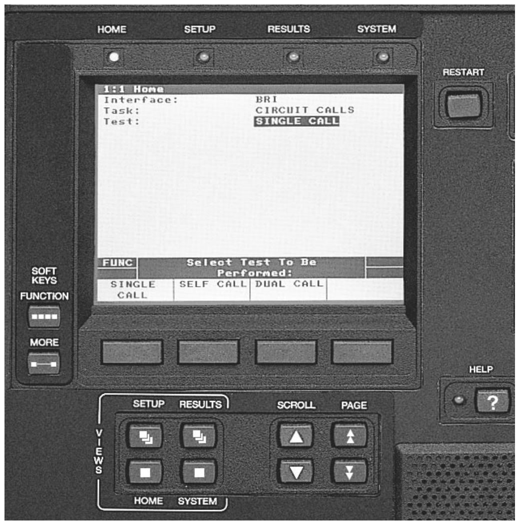


Figure 7 • Main Display and Controls

Large Graphical Display LEDs

The LEDs above the Large Graphical Display correspond to the view that is active on the display. For example, when the Setup view is active, the **SETUP** LED illuminates.

Views Keys

The Views keys **HOME**, **SETUP**, **RESULTS**, and **SYSTEM** provide access to various views on the Large Graphical Display as follows:

HOME — Allows you to choose the Test Interface, the Task (TNT or Manual), or the Test Type.

SETUP — Allows you to set the test parameters for the selected Test Interface, Task, and Test Type. Press the **SETUP** key to access the TNT view, or to change the view to Interface or Test Type.

RESULTS — Allows you to view the test results for these Test Result views: TNT, Summary, Interface, Test Type, Signal, Time, Performance, and Alarms. Press the **RESULTS** key to view each page.

SYSTEM — Allows you to set general mainframe and auxiliary settings.

Scroll and Page Keys

The **SCROLL** keys (up and down arrow) are used to scroll through the menu items. The **PAGE** keys (up and down arrows) are used to page through the display when the PGUP or PGDN indicators appear in the prompting area. If you only have one page, the up arrow **PAGE** key moves the active selection line to the top of the display. The down arrow **PAGE** key moves the active selection line to the bottom of the display.

Help Key

The **HELP** key accesses the available help for the active selection line (shown in reverse video) on the Large Graphical Display. Pressing the key once activates the help function (the LED to the left of the key illuminates) and the available help for the selected menu item will appear. Pressing the **HELP** key a second time turns off the help function (LED turns off).

If the active selection line is a data entry type field, instructions are provided that explain how to edit the field data. Help must be turned off to edit the field.

Softkeys Controls

The SOFTKEYS Control keys, located to the left of the Large Graphical Display, operate the softkey groups.

The **FUNCTION** key shows all available softkey groups for the current test and when available, “FUNC” appears on the left side o the Prompting area.

The **MORE** key shows additional softkeys available within the current softkey group. If there are more than four selections available, “MORE” appears on the left side of the Prompting area.

Softkeys

The softkeys (located immediately below the Large Graphical Display) are used to make selections and activate the functions that appear at the bottom of the Large Graphical Display. The function may be related to a single selection line or to a group of items. The SOFTKEYS Controls (**FUNC** and **MORE**) allow you to navigate the softkeys.

In addition to selecting the parameter for your test, the softkeys provide additional functionality based on the type of information you may need to set up your test. Some selections require a numeric or alphanumeric input. Depending on the type of information, softkeys appear allowing you to add or change the information in the field. For example, the **Edit** softkey appears for you to change numeric information. When selected, the Edit Channels Map popup screen appears.

Edit Softkey

When a channel needs to be selected, the **Edit** softkey appears. Follow these steps to make your selection.

1. Press **Edit** to access the Edit Channels screen and the **Select/Deselect**, **Clear All**, **Abort Changes**, and **Save & Exit** softkeys.

   The Edit Channels screen enables configuration of the active channels for both the T1 LINE and T1 EQUIPMENT interfaces (the selected channels are the same for both interfaces).

2. Use the **SCROLL** keys to move from channel to channel.

   The **Select/Deselect** softkey toggles the channel between active and inactive.

   The **Clear All** softkey deselects all channels.

   The **Abort Changes** softkey exits the Edit Channels screen without making any changes to the existing channel selections and returns you to the previous screen.

3. Press **Save & Exit** to enter all changes and return to the Setup view.

Increase or Decrease Value Softkeys

The **INCREASE VALUE**, **DECREASE VALUE**, and **OK** softkeys appear when selection lines require a numeric input.

1. Press **Increase Value** or **Decrease Value** to increase or decrease the value.

   You may also use the keypad to change the value in the field.

2. Press **OK** to set the value.

Clear, Home, and End Softkeys

These softkeys appear when you need to edit a user-programmable field such as **Long User Pattern.**

1. Press **EDIT** softkey and a popup window and additional softkeys appear.

   Clear — Clears the field.

Home — Places the cursor at the beginning of the string.

End — Places the cursor at the end of the string.

2. Press the **1** through **9**, or **0** key on keypad to select a character set. The assigned values for that key will appear in the popup window.
3. Press the corresponding number for the character you want to place into the user data information. Press **0** to add spaces if needed.
4. Repeat steps 2 and 3 until your loop code label is complete.
5. Press **SCROLL** when finished to move to the next selection line.

Large Graphical Display

The four views available on the Large Graphical Display provide easy access to TNT and manual test setups, test configurations, results, and mainframe configurations.

Home View

The Home view (see Figure 8) allows you to select the interface, task, and test you want to perform. The display is divided into four areas: title bar, selection area, prompting area, and softkey descriptions. The following paragraphs describe the function of each area of the Home view.

Title Bar

The top line of the display, called the title bar (see Figure 8), indicates the current view and view type of the Large Graphical Display.

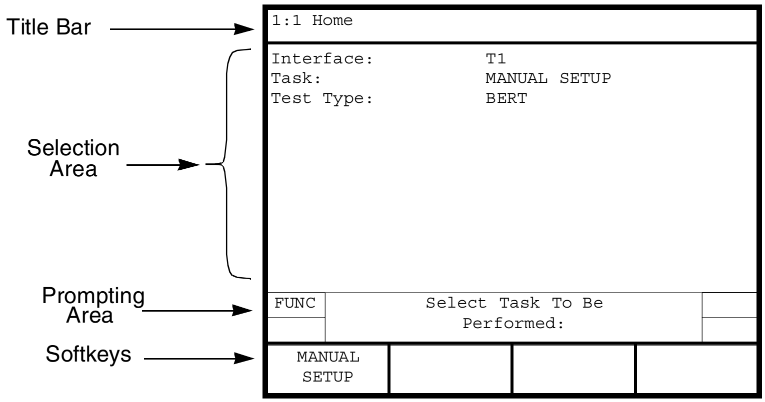


Figure 8 • Home View

Selection Area

The selection area enables you to control all of the analyzer configuration selections (see Figure 8). Use the **SCROLL** keys to navigate the selection area and make the required changes.

The change takes effect after one second, after exiting the active selection line, or changing the active display screen.

Prompting Area

The area on the Large Graphical Display above the softkeys is the prompting area. This area prompts you to perform a specific action based on the current softkey group.

Softkeys

Softkeys show the available choices for each selection line to configure the unit for your test.

Setup View

The Setup view, shown in Figure 9, is used to set the parameters for the interface, task, or test type selected on the Home view. The display is divided into four areas: title bar, selection area, prompting area, and softkey descriptions. The following paragraphs describe the function of each area of the Setup view.

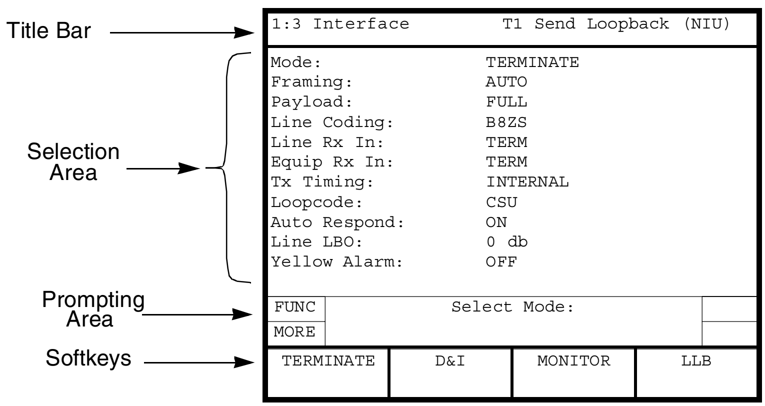


Figure 9 • Interface Setup View

Title Bar

The title bar (see Figure 9) indicates the interface in use and the test type to be performed. Press **SETUP** to toggle between TNT, Interface, and Test Type configurations. The active view is also indicated by the illuminated LED above the Large Graphical Display.

Selection Area

The selection area enables you to control all of the analyzer configuration selections (see Figure 9)). Use the **SCROLL** and **PAGE** keys to navigate the selection area and make the required change.

The change takes effect after one second, after exiting the active selection line or changing the active display screen.

Prompting Area

The prompting area prompts you to perform a specific action based on the current softkey group (see Figure 9). The PGUP and PGDN indicators appear in this area of the display when the view has more than one page of parameters. Press the **PAGE** keys to view additional results.

Softkeys

Softkeys show the available choices of each selection line to configure your test (Figure 9). These softkeys appear as choices, or as functions of the selected option.

Results View

The Results view is used to display data for each of the Results categories (i.e., TNT, Summary, Interface, Test Type, Signal, Time, and Performance). In addition, the Results view also lists the date and time the alarm occurred, as well as where the alarm occurred, i.e., the LINE (Primary) or EQUIPMENT (Secondary) side. A sample Interface Results view is shown in Figure 10.

In the event that one Results view is not sufficient to show all of the results for a given category, the PGUP or PGDN indicator will appear on the right side of the prompting area. Use the **PAGE** keys to scroll the results up and down.

If all results are within specification for the LINE (Primary) and EQUIPMENT (Secondary) receivers, the message " `All Results OK` ***" will appear on the Results view.***

The display is divided into four areas: title bar, selection area, prompting area, and softkey descriptions. The following paragraphs describe the function of each area of the Results view.

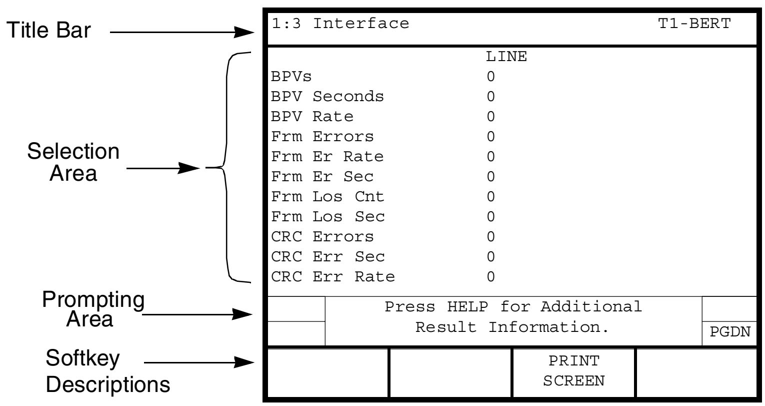


Figure 10 • Interface Results View

Title Bar

The title bar displays the view number 1:8 (one of eight) and the current Results view (TNT, Summary, Interface, Test Type, Signal, Time, Performance, or Alarm). Press the **RESULTS** key to display the next result view.

Display Area

The display area shows the list of results for the selected view. The **SCROLL** keys can be used to scroll up and down through the list of results. The left column lists LINE (Primary) results and the right column lists EQUIPMENT (Secondary) results.

Prompting Area

The prompting area prompts you to perform a specific action based on the current softkey group (see Figure 10 on page 34). The PGUP and PGDN indicators appear in this area of the display when the view has more than one page of results. Press the **PAGE** keys to view additional results.

Softkeys

Softkeys appear to show the functions available in the Results view.

System View

The System view, shown in Figure 11, provides access to system parameters for the mainframe and other auxiliary functions. The display is divided into four areas: title bar, selection area, prompting area, and softkey descriptions. The following paragraphs describe the function of each area of the System view.

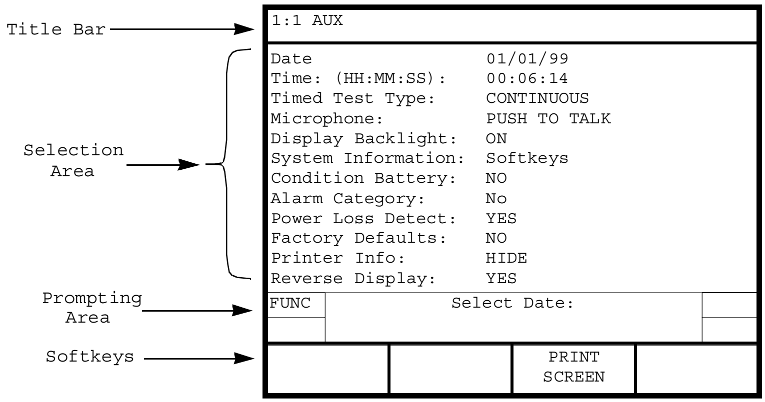


Figure 11 • System View

Title Bar

The title bar shows the current usage for the System view (Auxiliary).

Selection Area

The selection area is used to configure System functions. Use the **SCROLL** keys to select the active selection line. Softkeys become available to choose the appropriate configuration. Data entry fields are edited using the keypad.

The following paragraphs provide a description of each System parameter, the choices available, and how to select or edit the parameter. Use the available softkeys in combination with the keypad to edit these parameters.

Date — Displays the date in MM/DD/YY (Month/Day/Year) format.

Time — Displays the time in HH:MM:SS (Hours:Minutes:Seconds) format.

Timed Test Type — Selects the type of test to be run. The choices are **TIMED** or **CONTINUOUS**. If **TIMED** is selected the following selection line will appear and must be configured.

Length — Used to enter the amount of time, in HHH:MM (Hours:Minutes) format, that a timed test is to run. A time of zero (0) causes continuous testing.

When* CONTINUOUS *is selected the test runs continuously until the* RESTART *key is pressed or the analyzer is powered off.

Microphone — Displays the default microphone operating mode **PUSH-TO-TALK.**

Display Backlight — Used to vary the length of time the display backlight remains on. Turning off the backlight will extend operating time when operating on battery power. The choices include the following:

AUTO 5 MIN — Turns the backlight on for 5 minutes when a front panel key is pressed. If no front panel key is pressed for a period of 5 minutes, the backlight is turned off.

ON — Turns the backlight on.

OFF — Turns the backlight off.

System Information — Used to show system option and version information. The following softkeys are will appear when **System Information** is selected:

SOFTWARE VERSIONS — Displays the versions of all software on the system PCMCIA card.

INSTALLED OPTIONS — Displays the hardware and software options currently installed.

UPGRADE CARD INFO — Displays the uninstalled options available on a system PCMCIA card.

Condition Battery — Used to reset the internal fuel gauge maximum capacity to the actual available capacity of the batteries when fully charged. This function should be used whenever the batteries are changed, the Battery Performance Index (BPI) or Battery Capacity result is “Invalid,” or the reported capacity of the batteries does not correlate to the actual operating time available.

The battery conditioning cycle can take as long as 12 hours if it is started with fully discharged batteries. During the cycle, the analyzer should be left **On** and not disturbed. At the end of conditioning, the BPI result is updated to reflect the total capacity of the batteries when fully charged. This capacity will diminish over time as the batteries wear (this is normal). If the BPI is below 50%, you should contact Acterna to obtain new batteries.

Alarm Category — Controls whether a notification message appears on the Two-Line Display when an alarm is detected.

> **ALERT ON UPDATES —** Alerts you to verify the alarm logged in the Alarm Result view.
>
> **DON'T ALERT** — Disables the notification message but alarms are still logged.

Power Loss Detect — Setting this function to **Yes** enables detection and incrementing of the **Power Loss** result on the Time view.

> **YES** — The **Power Loss** result increments each time the analyzer is powered on. The **Power Loss** result is cleared when the **RESTART** key is pressed.
>
> **NO —** The **Power Loss** result is not shown.

Factory Defaults — Used to clear the nonvolatile random access memory (NOVRAM). The choices are **NO** or **YES**.

> **YES** — Opens confirmation popup window. This window states that the NOVRAM will be reset to the factory defaults and the analyzer will reboot.

Printer Info — Select one of the following choices. Default is **HIDE**.

> **HIDE** — Hides the options for printer operation.
>
> **DISPLAY** — Shows other options to set up the print configuration. See “Printer Configuration” on page 106 for more details.

Reverse Display — Used to reverse the display from white letters on blue background to blue letters on white background. Default is white on blue. Choices are **YES** and **NO**.

Prompting Area

The area on the large graphical display above the softkeys is the prompting area. This area prompts you to perform a specific action based on the current softkey group.

Softkeys

Softkeys appear to show the available choices of each selection line for you to configure the unit for your test.

Chapter 4 Specifications

This section describes the physical and test specifications of the T-BERD 950.

Physical Specifications

The physical specifications for the T-BERD 950 are presented in Table 5.

Table 5 • Physical Specifications

Specification	Value
Physical:	
Height:	10.5" (26.68 cm)
Width:	13.25" (33.66 cm)
Depth:	4" (10.17 cm)
Weight:	10 lb. (4.55 kg.) without batteries, 13 lb. (5.9 kg.) with batteries
Environmental:	
Temperature:	
Operating:	32°F to 122°F (0°C to +50°C)
Non-Operating:	-4°F to 140°F (-20°C to +60°C)
Humidity:	10% to 90% Relative Humidity, non-condensing
Vibration:	Per BellCore NEBS TR-EOP-000063
Shock:	Per IEEE-743-1985
Altitude:	
Operating:	200 ft. (61 m) below sea level to 16,400 ft. (5000 m)
Non-operating storage or transportation:	49,210 ft, (15,000 m)
Electrical:	
AC Power:	
Input Voltage:	90 to 240VAC, 47 to 63 Hz, autodetected.
Power Dissipation:	30 watts (typical), 68 watts (peak - two batteries receiving initial charge)
Fuse Type:	250 Volt, 1 Amp Slo-Blo (LittleFuse p/n 218 001)
DC Power:	
Battery Type:	Panasonic LCS-2012DP (2 required)
Operating Time:	Depends on configuration, up to 4 hours.

T1 Specifications

The T1 specifications for the T-BERD 950 are presented in Table 6.

Table 6 • T1 Specifications

Item	Specification
Operating Modes:	Terminate (TERM) Drop & Insert (D&I) Monitor (MON) Line Loopback (LLB)
Framing:	ESF SF SLC Unframed Auto
T1 Input:	
Frequency:	1.544 MHz ±5000 Hz
Input Impedance:	TERM:100 ohms ±5% BRIDGE:1000 ohms minimum DSX-MON:100 ohms ±5%
Operating Range:	TERM: +6 dBdsx to -35.0 dBdsx cable attenuation DSX-MON: +6 dBdsx to -35.0 dBdsx cable attenuation
T1 Output:	
Frequency:	1.544 MHz ±7 Hz
Clock Sources:	Internal Oscillator Recovered (from associated path receiver)
Line Build Out (LBO) Options:	0, -7.5, -15, -22.5 dB ± 1 dB at 772kHz
Operating Range:	DSX MON: -10 dBdsx to -30 dBdsx resistive attenuation
Line Coding:	AMI B8ZS
Error Insert Types:	BPV L&BPV (Logic and BPV errors) Logic Frame

Table 6 • T1 Specifications (Continued)

Item	Specification
Error Insertion Rates:	
BPV, L&BPV, Logic:	Single, 1E-3, 1E-6
Frame:	1 through 6 and continuous
Loopcodes[a]:	CSU (Loop-up code: 10000; Loop-down code: 100) FAC1 (Loop-up code: 1100; Loop-down code: 11100) FAC2 (Loop-up code: 11000; Loop-down code: 11100) FAC3 (Loop-up code: 100000; Loop-down code: 100) DL-LLB (Data Link - Line Loopback): per ANSI T1.403-1989 DL-PLB (Data Link - Payload Loopback): per ANSI T1.403-1989 DL-Net (Data Link - Network Loopback): ANSI T1.403-1989 V.54 (Fractional T1 only) - PN127 Programmable Loop Codes: 3 to 8 bit repeating loop-up and loop-down codes. Latching Loopcodes (DDS only): *N signifies a "do not care" value.* OCU: N1010101 CSU: N0110001 DS0-DP: N0000101 LSI: N1000111 NEI: N1000001 DSU: N1110111 Alternating Loopcodes (DDS only): *N signifies a "do care" value.* *S signifies: "1" when transmitting or receiving an idle code of a 56 kbps DS0-A signal; "0" when transmitting a DSU loopback of a 56 kbps DS0-A signal; or "do not care" value when transmitting and receiving all other DS0-A signals.* OCU: S0101010 OCU+HL96: S0101010 HL96NY: S0101010 DSU: S0101100 CSU: S0101000 CSU+R: S0101000 CSU+2R: S0101000 1ST RPTR: S0101000 2ND RPTR: S0101000
Indicators:	Signal Present, Frame Sync, Pattern Sync, B8ZS Detect, AIS (Alarm Indication Signal) and Yellow Alarm.

Table 6 • T1 Specifications (Continued)

Item	Specification
Frequency Measurements:	
Accuracy:	± 10 ppm
Resolution:	1Hz
Level:	
Peak to Peak:	20mV to 12.0 V
Positive and Negative Base to peak:	10 mV to 6.0 V
Positive and Negative Base to peak:	-48.0 dBdsx to +6.7 dBdsx
Resolution[b]:	±1 dB
Simplex Current:	
Range:	10 to 207 mA, and under 10 mA
Accuracy:	±10% or 2mA (whichever is greater)
Wander:	
Resolution:	1 UI
Accuracy:	1 UI

a. See Appendix B for additional Loopcodes.
b. All level measurement results are based on the peak voltage level of the input signal.

Table 7 lists the Originating Messages that are only available when payload is set to DDS for T1. Similar messages are also set for T1 non-DDS Payload.

Table 7 • T1 Loop Code Originating Messages

Type	Message
Loop Up Status:	Transmitting Loop Up: <Loopcode> Loop Up: Aborted <Loopcode> Loop Up: Success <Loopcode> Loop Up: Failed <Loopcode> Loop Up: Sent <Loopcode>
Loop Down Status:	Transmitting Loop Down: <Loopcode> Loop Down: Aborted <Loopcode> Loop Down: Success <Loopcode> Loop Down: Failed <Loopcode> Loop Down: Sent <Loopcode>

Chapter 5 T1 Task Navigated Testing (TNT)

This chapter describes the TNT functionality for the T1 interface of the T-BERD 950. The T-BERD 950 user interface includes two modes of test operation: TNT and Manual Setup. An explanation of how TNT works, the differences between Manual Setup and TNT modes and how to setup a test using both TNT and Manual Setup modes is discussed in this chapter.

Testing with the T-BERD 950

1. From the Home view on the T-BERD 950, select the interface (i.e., T1, DDS-LL, and Analog).
2. Define your task.

   There are two types of selections: MANUAL SETUP and TNT. Manual Setup is always available. The TNT selections vary depending on the selected interface. Use Manual Setup when you need to perform a non-standard configuration test. TNT tasks primarily address turnup and troubleshooting procedures.
3. Select the specific type of test for the selected procedure.
4. Select **SETUP** to configure the T-BERD 950 for the chosen application.
5. During the test, press **RESULTS** to view valuable result information.

Comparing Manual Setup to TNT

In TNT mode, after you press **SETUP**, the TNT setup view appears. During Manual Setup, after you press **SETUP** the Interface Setup view appears. While in TNT mode, the TNT Results view is initially shown after you press the Results view key. In manual mode, the Test Type Results view is shown when the Results view is initially pressed.

TNT Task Mode, Setup, and Results

The TNT Setup view provides a condensed number of setup configurations for the chosen tests and tasks selected on the Home view. This enables you to quickly configure the unit because there is a limited number of configurations. The TNT Results view lists only the most common results to allow you to quickly verify or troubleshoot the circuit.

All Setup and Results views can be shown while in TNT mode, by pressing the associated VIEWS control keys (i.e., **SETUP** ***and*** **RESULTS*****). However, TNT Setup and TNT Results view are only available in TNT mode.***

Table 8 through Table 11 list the available setups and results for each TNT test. Items in parenthesis ( ) are default settings and can be changed using the softkeys to select the appropriate settings for your test. For descriptions of the test setup parameters, see “Setting Up Manual T1 Test” on page 62. For descriptions of all results see “T1 Test Results” on page 92.

Performing T1 BERT Turn-up in CSU Emulation

The objective of a T1 BER test is to perform T1 qualification, such as a QRSS BER test. In the passive loopback mode, you can view various test results while the test is running. This provides a method of isolating the problem to a specific piece of equipment or section of the loop. This is performed as an out-of-service test in TERMINATE mode. Table 8 provides detailed test scenarios, TNT setup items, and test results.

Table 8 • T1 BERT Turn-up

Test	TNT Setup Items	TNT Results
SEND LOOPBACK (NIU Access) In this scenario, the T-BERD 950 is being used to generate a loopback code to a device located at either the customer premise (e.g., a CSU) or within the network. The unit sends an HDSL loop code to a doubler or HTU-C, or sends a loop code to an NIU or smart repeater. The technician is typically in control of the test.	Framing (AUTO) Line Coding (ESF) Tx Timing (INTERNAL) Loopcode (CSU) Bert Pattern (QRSS)	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx
RECEIVE LOOPBACK (NIU Access) In this scenario, the T-BERD 950 is being used as a loopback device. Ideally, you are waiting for a loopback code (e.g., a CSU loop) to be sent from a centralized tester or from a test set located in the Central Office (CO). The remote tester is typically in control of the test.	Framing (AUTO) Line Coding (B8ZS) Tx Timing (RECOVERED) Loopcode (CSU) Bert Pattern (AUTO)	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx
STRAIGHTAWAY (NIU/DSX access) In this scenario, the T-BERD 950 is being used at the customer premise, while another test set is located at the far end, typically the CO at a DSX patch panel. Testing and analysis is performed in both directions.	Framing (AUTO) Line Coding (B8ZS) TX Timing (INTERNAL) Bert Pattern (QRSS)	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx

Performing T1 DDS Turn-up Test in CSU Emulation

The objective of this test is to perform DDS qualification such as a 2047 BER test from a T1 access point. This mode lets you view various test results while the test is running. Because you are in D&I

mode, the DDS channel under test is out-of-service, while the remaining DS0s (on the T1) are in-service. Table 9 provides detailed test scenarios, TNT setup items, and test results.

Table 9 • T1 DDS Turn-up

Test	TNT Setup Items	TNT Results
STRAIGHT-AWAY-DSX In this scenario, the T-BERD 950 is being used at the CO, while another test set is located at the far end, typically the customer premises NID. Testing and analysis is performed in both directions. This is the best method to sectionalize and verify a trouble during a turnup than loopback testing.	Framing (ESF) Channel (1) Rate (DS0A56) Line Coding (B8ZS) Insert Side (LINE TX) Insert Payload (OFF) * Bert Pattern (2047) * User prompted to turn this ON.	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx
SEND LOOPBACK-DSX In this scenario, theT-BERD 950 is used to generate a loop code to a device located at either: (1) the customer premises (such as the CSU/ DSU), (2) the local loop (such as a repeater), or (3) within the network (such as an OCU-DP or DS0-DP card).	Framing (ESF) Channel (1) Rate (DS0A56) Line Coding (B8ZS) Insert Side (LINE TX) Insert Payload (OFF) * Loopcode Type (ALTERNATING) Loopcode (DSU) Bert Pattern (2047) * User prompted to turn this ON.	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx

Performing Fractional T1 Turn-up Test in CSU Emulation

The purpose of these tests is to perform Fractional T1 qualification such as QRSS BER tests. This mode lets you view various test results while the test is running.Table 10 provides detailed test scenarios, TNT setup items, and test results.

Table 10 • Fractional T1 BERT Turnup Task

Test	TNT Setup Items	TNT Results
SEND LOOPBACK-NIU (Out-of-Service) In this scenario, the T-BERD 950 is used to generate a V.54 loopback code to the CSU/DSU located at the customer premise. This will loopback the fractional bandwidth configured for BER analysis. The technician is typically in control of the test. In D&I mode, the fractional DS0s under test are out-of-service, while the remaining DS0s are in-service. This test isolates the problem to a specific piece of equipment or portion of the loop.	Framing (AUTO) Payload (Nx56) Channels (Edit Screen) Line Coding (B8ZS) Bert Pattern (QRSS)	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx
RCV LOOPBACK-NIU (Out-of-Service) In this scenario, theT-BERD 950 is being used as a loopback device. Ideally, you are waiting for a loop code to be sent from a centralized tester or from a test set located in the CO. The remote tester is typically in control of the test. In D&I mode, the fractional DS0s under test are out-of-service, while the remaining DS0s are in-service. This test isolates the problem to a specific piece of equipment or portion of the loop.	Framing (AUTO) Payload (Nx56) Channels (Edit Screen) Line Coding (B8ZS) Bert Pattern (QRSS)	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx
STRAIGHTAWAY DSX (In-Service) In this scenario, theT-BERD 950 is being used at the CO, while another test set is located at the far end, typically the customer premises NID. Testing and analysis is performed in both directions. In D&I mode, the fractional DS0s under test are out-of-service, while the remaining DS0s are in-service. This is a better method to sectionalize and verify a trouble during a turnup than loopback testing.	Framing (ESF) Payload (Nx56) Channels (Edit Screen) Line Coding (B8ZS) Insert Side (LINE TX) Bert Pattern (QRSS) Insert Payload (OFF) * * User is prompted to turn this ON.	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx

Table 10 • Fractional T1 BERT Turnup Task (Continued)

Test	TNT Setup Items	TNT Results
STRAIGHTAWAY NIU (Out-of-Service) In this scenario, the T-BERD 950 is being used at the customer premises (NIU access), while another test set is located at the far end, typically the CO at a DSX patch panel. Testing and analysis is performed in both directions. This test is performed as an out-of-service BER test in TERMINATE mode and provides a better method to sectionalize and verify a trouble during a turnup than loopback testing.	Framing (AUTO) Payload (Nx56) Channels (Edit Screen) Line Coding (B8ZS) Bert Pattern (QRSS) Loopcode (CSU) Tx Timing (RECOVERED)	BPVs Bit Errors Pat Slips Frm Errors Errored Sec CRC Errors Rcv Freq, Hz R Lvl, dBdsx

Performing T1 Monitor Tests

The purpose of T1 Monitor Tests is to passively monitor the timing between two T1 signals for timing slips and gather results, including ABCD signaling bits. Table 11 provides detailed test scenarios, TNT setup items, and TNT test results.

Table 11 • T1 Monitor Tests

Test	TNT Setup Items	TNT Results
BERT In this scenario, you can connect to the monitor point and review the results.	Payload (FULL)	CRC Errors Frm Errors Timing Slips BPVs Rcv Lvl Frm Los Sec Frm Los Cnt Sig Los Sec

Table 11 • T1 Monitor Tests (Continued)

Test	TNT Setup Items	TNT Results
TIMING SLIPS In this scenario, you can connect to the monitor point and review the results.	Payload (FULL)	CRC Errors Frm Errors Timing Slips BPVs Rcv Lvl Frm Los Sec Frm Los Cnt Sig Los Sec

Manual Setup and Results

The TNT tasks identified for a specific interface are only the most common tasks. Therefore, there are numerous tests not covered by TNT. You can perform these tasks using Manual Setup mode. In this mode, you are automatically given access to every configuration and result that is applicable for the physical interface chosen. Pressing **SETUP** allows you to configure the Interface Setup view. Pressing **SETUP** again allows you to configure the Test Type Setup view. After both of these are completed, pressing **RESULTS** shows Test Type results in the Results view. Pressing **RESULTS** again allows you to view other categories in the Results view.

Test Configuration Examples

When you power on the unit, the Home view appears on the Large Graphical Display (see Figure 12). Use the **SCROLL** keys to move to each selection line and the **SOFTKEYS** to make your choice.

This section gives examples of how to use both TNT and Manual Setup test configuration.

TNT Example

In this scenario, your customer has ordered T1 service, and you will need to perform the final acceptance turnup procedures. After you install the smart jack (NIU) at the customer premises, you must run a straightaway (end-to-end) BER test with a CO technician to verify service. This common test scenario requires two testers.

Because this is a common test application, you can use the TNT mode.

1. From the Home view, select **T1** as the interface.

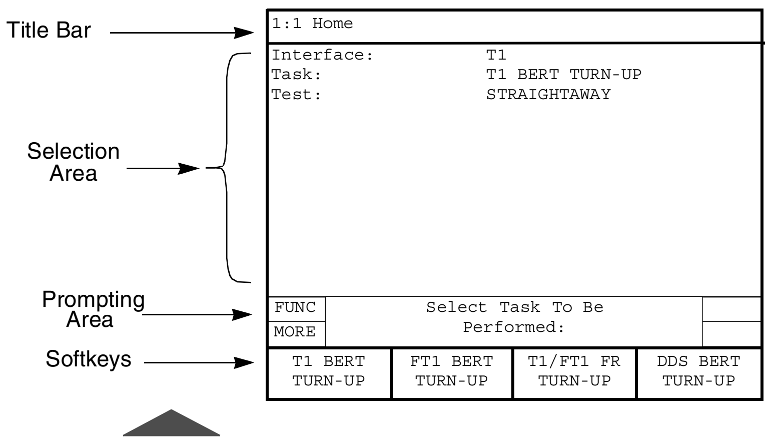


Figure 12 • Home View

2. Select **T1 BERT TURN-UP** as the task.

Pressing the* MORE *key shows additional choices. One of those choices is* MANUAL SETUP*. Manual Setup allows you to set up your test using the Interface and Test Type views. See “Setting Up Manual T1 Test” on page 62 for Manual Setup instructions.

3. Select **STRAIGHTAWAY** as the test.
4. Press **SETUP** to access the TNT Setup view.

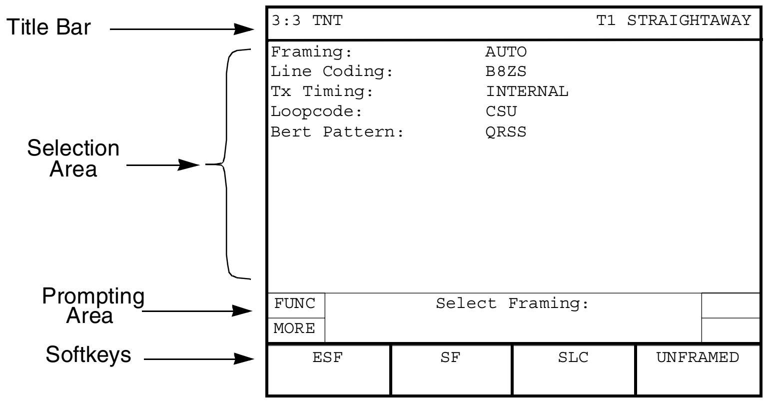


Figure 13 • TNT Setup View

5. Select the framing.

The default setting is **AUTO** framing, which will detect the framing on the line. Set the framing after the T-BERD 950 has made a determination.

6. Select the appropriate line coding (**B8ZS** is the default).

7. Select the appropriate transmit timing (**INTERNAL** is the default).

8. Select the appropriate BERT pattern (**QRSS** is the default).

If you need to change any pre-set configurations, press* SETUP *once to access the Manual Setup mode Interface view and again to access the Manual Setup mode Test Type view. If you press* SETUP *a third time, the display returns to the TNT Setup view.

9. Connect to the Circuit. If you are performing a straightaway BER test at the customer premises, you will most likely be accessing the circuit at the 66 block, NIU, or DSX-1 patch panel.

10. Verify you have a T1 Signal, Frame Sync, and Pattern Sync (the SIGNAL, FRAME SYNC and PATTERN SYNC LEDs illuminate green). Both you and your test partner need to send errors back and forth to validate your connection. Press **RESTART** to begin a new test.

11. Press **RESULTS** to view TNT specific results (see Figure 14). As with the Setup views, press **RESULTS** to cycle through all eight categories in the Results view.

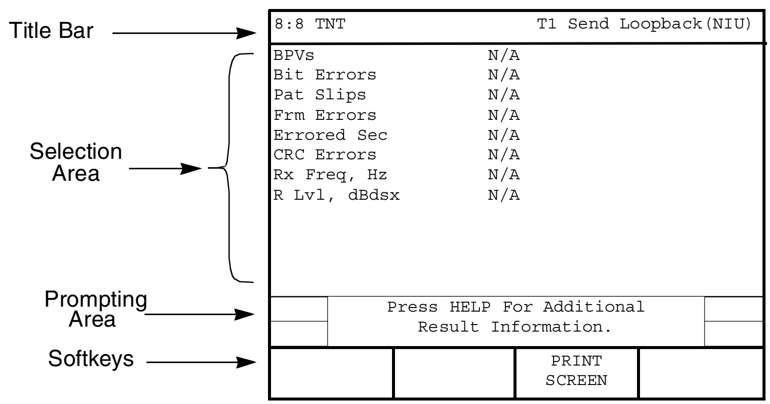


Figure 14 • TNT Results View

Manual Setup Example

Similar to the TNT scenario, you will need to perform a T1 turnup with the additional requirements of performing an end-to-end BER test, and sending an idle code and a Yellow Alarm. This is not the typical testing scenario. Therefore, use Manual Setup mode.

1. From the Home view, select **T1** as the **Interface**.
2. Select **MANUAL SETUP** as the **Task**.
3. Select **BERT** as the **Test**.
4. Press the **SETUP** key to access the Manual Setup Interface view.

5. Select **TERMINATE** as the **Mode**.
6. Select the appropriate **Framing** (default is **ESF**).
7. Select **FULL** as the **Payload**.
8. Select the appropriate **Line Coding** (default is **B8ZS**).
9. Select **TERM** as the **Line Rx In**.
10. Select **TERM** as the **Equip Rx In**.
11. Select **LINE** as the **Tx/Rx Pair**.
12. Select the appropriate **Tx Timing** (default is **RECOVERED**). In this testing scenario, set one test set to **RECOVERED** and the other to **INTERNAL**.

    A loopcode selection is not required because this is an end-to-end test and you are not looping components.
13. Set **Auto-Respond** to **OFF.**
14. Select the appropriate **Line LBO** if required.
15. Use the keypad to enter the **Idle Byte** value (default is **11111111**).
16. Select **ON** as the **Yellow Alarm** to transmit a yellow alarm.
17. Select **DS1 Idle Tx** to **ON** to transmit a DS1 idle code.
18. Press **SETUP** again to access the Manual Setup Test Type view.
19. Select the appropriate **Bert Pattern**.
20. Select the appropriate **Error Insert Type** (default is **LOGIC**).
21. Select the appropriate **Error Insert Rate**.
22. Connect to the Circuit. If you are performing a straightaway BER test at the customer premises, you will most likely be accessing the circuit at the 66 block, NIU, or DSX-1 patch panel.

Verify you have a T1 Signal, Frame Sync and Pattern Sync (the SIGNAL, FRAME SYNC and PATTERN SYNC LEDs illuminate green), and exchange errors with your test partner to validate your connection.

23. Press **RESTART** to begin a new test.
24. Press **RESULTS** to show the Results Test Type Category view.
25. Press **RESULTS** to cycle through the all seven result category views, and check the results for which you are concerned (i.e., BPVs, bit errors, CRC errors, simplex current, and signal level).

Using the Manual to Setup Configurations

The remaining chapters are organized by interface and option. Each chapter provides both TNT and Manual Setup information. Unless it is related to a specific option (i.e., Frame Relay), the configuration is described in the appropriate interface section. For example, even though you can test the frame relay option with the T1 or DDS-LL interface, it is only available if you have the option (regardless of the interface). Therefore, all frame relay TNT scenarios are described in the Frame Relay Option section. This same principle applies to the Primary Rate ISDN Option as well.

In each option/interface chapter, the TNT tasks are described and the tests within each task are presented in a table. This table explains the specific test as is pertains to the associated task. Also provided in these tables are the configurable parameters in the TNT Setup view and the results in the TNT Results view. The TNT Setup parameter defaults are listed in parentheses () beside the TNT Setup parameter.

Following the TNT descriptions are the Manual Setup parameter descriptions for the Interface and Test Type views, in addition to detailed results information by category. Because the setup parameters and results for TNT are a subset of those for Manual Setup, refer to the Manual Setup section for definitions of these items.

Chapter 6 T1 Manual Test Setup

This section describes the basic test setup for the T1 interface on the T-BERD 950.

Setting Up Manual T1 Test

This section provides descriptions of the test setup parameters to perform a variety of tests using the manual setups for the T1 interface.

Setting Up the Home View

Start with the Home view as shown in Figure 15.

1. Select the **T1 Interface**.
2. Select the **MANUAL SETUP Task**.
3. Select the **BERT Test**.
4. Press the **SETUP** key.

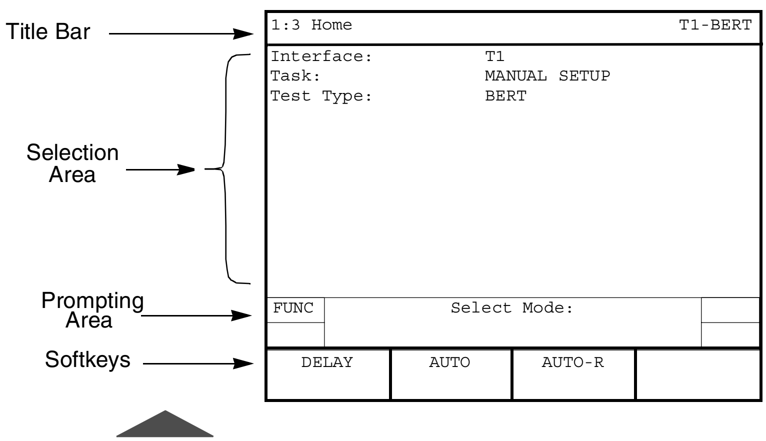


Figure 15 • Home View

Setting Up the T1 Interface View

The Setup Interface view is used to configure the T1 interface (see Figure 16). Use the **SCROLL** and **PAGE** keys to control this selection area.

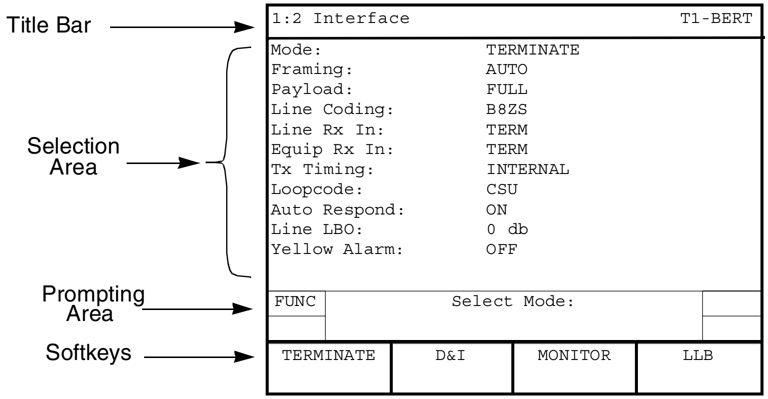


Figure 16 • T1 Setup Interface View

Using the Setup Interface view, select the parameters for your test:

Mode — Enables selection of the operating mode (default is **TERMINATE**). The choices include the following:

TERMINATE — Selects Terminate mode, both sides of a T1 path are separated, the input signal is terminated at the receive side, and a totally independent signal is generated for the output. Use this mode when the T-BERD 950 terminates the line.

D&I — Selects Drop and Insert mode, which enables the analyzer to insert data onto specific channels from the T1 line while leaving the other channels unaffected. Typically used at a DSX-1 patch panel or similar T1 access point.

MONITOR — Selects Monitor mode, which enables the analyzer to measure signal parameters or monitor traffic from a resistor-isolated DS1 monitor point, or bridge on to the line. Use this mode to analyze live traffic without disrupting the circuit. You can monitor one or two circuits at a time. BER testing cannot be performed in Monitor mode.

LLB — Selects Line Loop Back mode, which causes the analyzer to loopback the received signal to the transmitter without changing the signal. Not available when **VOICE** is the selected test type.

Not all of the following selection lines are available in all operating modes.

Framing — (*all operating modes*) Selects the framing format for the T1 signal (default is **ESF**). Choices include:

ESF — Enables transmission and analysis of T1 signals with Extended SuperFrame (ESF) framing format.

SF — Enables transmission and analysis of T1 signals with SuperFrame (SF) framing format.

SLC — Enables transmission and analysis of T1 signals with SLC-96 framing.

UNFRAMED — Enables data analysis on the full 1.544 Mbps bandwidth of the T1 line. No framing bits are added during transmission, and no data bits are stripped when received. Not available in **D&I** mode or when **VOICE** is the selected test type.

AUTO — Performs automatic Frame Search. The unit automatically configures the receivers and transmitters to the incoming framed and unframed T1 signals. `AUTO Framing Searching` appears on the RESULTS I and II display while the unit attempts to identify the received framing mode. If frame synchronization is received, the detected mode will be printed in lowercase letters on the Setup view, as indicated in Table 12.

Table 12 • AUTO Framing

T1 Signal Format	AUTO Mode Selection
D1D	*sf
D2	*sf
D4	*sf

Table 12 • AUTO Framing (Continued)

T1 Signal Format	AUTO Mode Selection
ESF	*esf
SLC	*slc
Unframed	unframed

AUTO mode is performed concurrently on the LINE and EQUIPMENT receivers. The T-BERD 950 tries to synchronize to the LINE input. If framing synchronization is achieved, the green LINE Frame Sync LED illuminates; the detected mode appears in lowercase letters; and the T-BERD 950 tries to synchronize to the same frame format with EQUIPMENT. If EQUIPMENT frame format is not the same as LINE, then the green EQUIPMENT Frame Sync does not illuminate. Neither the LINE nor the EQUIPMENT frame sync LEDs will be illuminated in this scenario.

AUTO-R — Performs Automatic Restart Frame Search. The unit operates in the manner described in AUTO; however, it automatically searches for frame synchronization upon the loss of frame synchronization or when signal is lost and reacquired (i.e., when the Frame Sync LED is no longer illuminated).

Auto-R this mode should not be selected when performing long-term, unattended testing, because valid testing results will be cleared each time frame sync is reacquired.

Payload — *(not available for VOICE testing)* Enables selection of the circuit type to be tested (default is **FULL**). Choices include:

FULL — (*not available in D&I operating mode)* Configures the analyzer to transmit and receive data at the full T1 rate.

Nx56 — Selects the channel bandwidth for Nx56 kbps data analysis. This selection line shows only the number of channels currently selected. Selecting Nx56 accesses the **Channels** selection line.

Nx64 — Selects the channel bandwidth for Nx64 kbps data analysis. This selection line shows only the number of channels currently selected. Selecting Nx64 accesses the **Channels** selection line.

> **Channels** — *(Nx54 and Nx64)* Selects the channel to test. Use the softkeys to select the channel.

DDS — Selects DDS over T1 analysis and enables the selection of an individual T1 (DS0) channel to be tested.

> **Channel** — Selects a specific DS0 channel to be tested. Use the **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the channel.
>
> **Rate** — Selects the unframed channel format and data transmission subrate over the DS0 64 kbps channel (default is **CLEAR CHANNEL**). Choices include:
>
> > **CLEAR CHANNEL** — Select to test DS0-A formatted DDS data at 64 kbps. Uses entire DS0 bandwidth.
> >
> > **DS0A56** — Select to test DS0-A formatted DDS data at 56 kbps. Uses the entire DS0 bandwidth, except bit 8, which is controlled by the analyzer and distinguishes customer data from network control information.
> >
> > **DS0A9.6** — Select to test DS0A formatted DDS data at 9.6 kbps. Copies all eight bits of the DS0A9.6 bandwidth five times into the selected 64 kbps channel.
> >
> > **DS0A4.8** — Select to test DS0A formatted DDS data at 4.8 kbps. Copies all eight bits of the DS04.8 bandwidth 10 times into the selected 64 kbps channel.
> >
> > **DS0A2.4** — Select to test DS0A formatted DDS data at 2.4 kbps. Copies all eight bits of the DS02.4 bandwidth 20 times into the selected 64 kbps channel.

Line Coding — (*all operating modes*) Enables selection of the line coding for the transmitted data (default is **B8ZS**). Choices include:

> **AMI** — Selects Alternate Mark Inversion (AMI) coding.
>
> **B8ZS** — Selects Bipolar with 8 Zero Substitution (B8ZS) coding.

Line Rx In — (*all operating modes*) Enables selection of the LINE receiver input impedance and signal conditioning (default is **TERM**). Choices include:

> **TERM** — Select when the T-BERD 950 terminates the line. Provides 100 Ω ± 5% resistive termination.
>
> **DSX MON** — Select when the T-BERD 950 connects to the circuit via the DSX-1 patch panel or similar access point. Provides resistive compensation for signals with +6.0 dBdsx to -35 dBdsx of cable loss at 772 kHz, and can accommodate signals resistively attenuated from +0.0 dBdsx through -26.0 dBdsx.
>
> **BRIDGE** — Select when the T-BERD 950 bridges onto the circuit. Provides greater than 1000 Ω resistive termination.

Equip Rx In — (*all operating modes*) Enables selection of the EQUIPMENT receiver input impedance and signal conditioning (default is **DSX-MON**). Choices include:

> **TERM** — Select when the T-BERD 950 terminates the line. Provides 100Ω ±5% resistive termination.
>
> **DSX MON** — Select when the T-BERD 950 connects to the circuit via the DSX-1 patch panel or similar access point. Provides resistive compensation for signals with +6.0 dBdsx to -35 dBdsx of cable loss at 772 kHz, and can accommodate signals resistively attenuated from +0.0 dBdsx through -26.0 dBdsx.
>
> **BRIDGE** — Select when the T-BERD 950 bridges onto the circuit. Provides greater than 1000 Ω resistive termination.

Insert Side — *(D&I operating mode only)* Enables selection of the T1 interface that data is inserted on (default is **LINE Tx**). Choices include:

> **LINE Tx** or **EQUIPMENT Tx**— Selects the T1 LINE or EQUIPMENT transmitter.

Insert Payload — *(D&I operating mode only)* Turns payload insertion on or off (default is **OFF**).

***Whenever any of the following parameters are changed,* Insert Payload *is reset to* OFF*:* Mode, Framing, Line Coding, Line Rx In, Equip Rx In, Payload, Insert Side, Line LBO, Equip LBO, Channels, Tx Timing, *and* Test Type. *In addition, each time* D&I *mode is selected,* Insert Payload *is reset to* OFF.**

Tx/Rx Pair — *(TERMINATE operating mode only)* Enables selection of the receiver and transmitter pair (default is **LINE**). Choices include:

> **LINE** or **EQUIPMENT**— Selects the LINE or EQUIPMENT receiver and transmitter pair.

Tx Timing — *(TERMINATE operating mode only)* Enables selection of the signal timing source for each of the T1 transmit channels, LINE and EQUIPMENT (default is **RECOVERED**). Choices include:

> **RECOVERED** — Selects the receiver channel clock as the timing source for the transmitter. Timing is derived from the incoming (Rx) signal.
>
> **INTERNAL** — Selects the internal crystal oscillator as the timing source for the transmitter.

Setting DDS Loop Codes

Loop Code Type — (*DDS payload only*) Enables the selection of either latching or alternating loop codes (default is **LATCHING**). Choices include:

> **LATCHING** — Enables selection of a latching loop code where all eight bits of a DS0 are used to transmit network control codes. The success or failure of latching loop code operation will be reported at the end of each latching loop up or loop down operation on the Two-Line Display.
>
> **ALTERNATING** — Enables selection of an alternating (non-latching) loop code where the payload data is intermixed every other byte with the loop code. The success or failure of an alternating loop code operation shall be reported at the end of each loop up or loop down.

An "n" signifies a "don't care" value an "S" signifies the subrate framing bit; "1" when transmitting/receiving an idle code of a 56 kbps DS0A signal; "0" when transmitting/receiving a DSU loopback of a 56 kbps DS0A signal; or "don't care" for all other transmitted/received DS0A signals.

Loop Code — *(TERMINATE operating mode only)* Enables selection of the loop code sequence transmitted through the active channels or through the ESF Data Link when the **LOOP UP** and **LOOP DOWN** keys are pressed (default is **CSU**). Choices for DDS include:

CSU — *(DDS ALTERNATING or LATCHING loop code type only*) Selects the loop code for a Channel Service Unit. Alternating loop code: S0101000. Latching loop code: N0110001.

CSU+R — (*ALTERNATING loop code type only*) Selects the alternating loop code for a Channel Service Unit with one repeater between the CSU and the analyzer. Alternating loop code: S0101000.

When a repeater is on the span, the **CSU+R** loops up the repeater with the CSU loop up sequence. The analyzer loops down the repeater, allowing the following transmission to pass through. The CSU then loops up with the standard alternating loop back activation.

CSU+2R — (*ALTERNATING loop code type only*) Selects alternating loop code for a Channel Service Unit with two repeaters between the CSU and the analyzer. Alternating loop code: S0101000.

When two repeaters are on the span, the sequence for the (**CSU+2R**) loop code is the same as the CSU+R, except, after the second loop up sequence is transmitted, a second loop down sequence is transmitted, followed by a third loopback activation sequence.

1ST RPTR — (*ALTERNATING loop code type only*) Selects First 56 kbps repeater. Alternating loop code: S0101000.

2ND RPTR — (*ALTERNATING loop code type only*) Selects Second 56 kbps repeater. Alternating loop code: S0101000.

OCU — (*ALTERNATING or LATCHING loop code type only*) Selects Office Channel Unit loop code. Alternating loop code: S0101010. Latching loop code: N1010101.

The **OCU+HL96** code loops up with the OCU sequence. The analyzer loops down the HL96NY, allowing the following transmissions to pass through. The OCU is then looped up with the standard alternating loopback activation sequence.

OCU+HL96 — (*ALTERNATING loop code type only*) Selects Office Channel Unit behind a HL96NY. Alternating loop code: S0101010.

HL96NY — (*ALTERNATING loop code type only*) Selects HL96NY Office Channel Unit. Alternating loop code: S0101010.

LSI — (*LATCHING loop code type only*) Selects LIN Side Interface. Latching loop code: N1000111.

NEI — (*LATCHING loop code type only*) Selects Network Element Interface. Latching loop code: N1000001.

The DS0-DP loop code loops up or down any DS0 data port within a series of eight DS0 data ports. At the completion of the loop, feedback is read from the looped DS0 data port that determines if the DS0 data port is configured from the LINE side or drop side.

DS0-DP — (*LATCHING loop code type only*) Selects DS0-Data Port latching loop code: N0000101.

Location — Selects the data port location. Choices include: **1**, **2**, **3**, **4**, **5**, **6**, **7**, or **8**.

DSU — (*ALTERNATING or LATCHING loop code type only*) Selects Data Service Unit loop code. Alternating loop code: S0101100. Latching loop code: N1110111.

Setting T1 Loop Codes

Loop Code — *(TERMINATE operating mode only)* Enables selection of the loop code sequence transmitted through the active channels or through the ESF Data Link when the **LOOP UP** and **LOOP DOWN** keys are pressed (default is **CSU**). Choices include:

CSU — *(not available for DDS)* Selects repeating inband Channel Service Unit (CSU) loop codes: loop up = 10000 and loop down = 100. These loop codes are valid in Full T1, Fractional T1, and all framing modes.

NIU — *(not available for DDS)* Enables selection of network interface (or smart jack) inband repeating codes.

NIU Type — Selection line appears, allowing selection of the Facility Type codes listed below.

FAC1 — Selects Facility Type 1 network interface (or smart jack) inband repeating 4-bit loop codes: loop up = 1100 and loop down = 1110. These loop codes are valid in Full T1, Fractional T1, and all framing modes.

FAC2 — Selects Facility Type 2 network interface (or smart jack) inband repeating 5-bit loop codes: loop up = 11000 and loop down = 11100. These loop codes are valid in Full T1, Fractional T1, and all framing modes.

FAC3 — Selects Facility Type 3 network interface (or smart jack) inband repeating 6-bit loop codes: loop up = 100000 and loop down = 100. These loop codes are valid in Full T1, Fractional T1, and all framing modes.

REPEATER — *(FULL payload only)* Selects repeater loop codes sent over the T1 interface.

Repeater Type — Selects Repeater type (see Table 13).

Table 13 • RepeaterTyp e

Central Office Repeaters	Line Repeaters
Teltrend 7231LP/LW IOR	Teltrend 7239LP/LW ILR
Teltrend 9132LP/LW IHR	WSTL 315056 ILR A/B
WSTL 313056 IOR A/B	WSTL 315056 ILR C..
WSTL 313056 IOR C..	WSTL 315156 ILR
WSTL 313080 IOR	WSTL 313080 ILR

Table 13 • Repeater Type (Continued)

Central Office Repeaters	Line Repeaters
	WSTL315080 ILR
	WSTL 315081 ILR
	XEL 7853-200 ILR

CMD — *(REPEATER loop code only)* Selects commands to configure the repeater for testing see "Setting T1 Loop Codes" on page 70. Based on the repeater selected, the choices dynamically appear for selection using the softkeys.

TIMEOUT DISABLE — Disables the loopback, time-out function of the repeater.

LOOPBACK QUERY — Returns address of the repeater that is in loopback.

POWER QUERY — Returns address of the repeater that is currently looping back the power.

ISSUES QUERY — Returns the issue (revision) of the repeater.

POWER DOWN/POWER UP — The Teltrend IHR and the IOR accept **POWER DOWN** commands because both are capable of supplying power to the span. When **POWER DOWN** command is set, the command is received and turns the power off the span. As long as the repeater is receiving this Power Down sequence command, it will continue to power down. However, when the command is no longer being received (using **POWER UP**), the power is then restored. This can take up to 5 seconds. This function is typically used to reset the line, particularly if a repeater in loopback cannot be looped down via commands.

SEQ LOOPBACK — *(REPEATER COMMANDS only)* Loops up or down, T1 line repeaters on the span in sequence, starting with the repeater nearest the T-BERD 950, and proceeds down the span, regardless of the repeater's address. Pressing **SEQ**

LOOPBACK transmits the sequential loopback code. The first repeater on the span will loop up, return its address, then loop down. This loopback procedure continues for each repeater on the span.

Table 14 lists the command sets and addresses for the repeater type.

Table 14 • Commands and Addresses for Repeater s

Command Set	Address	Repeater Type
1	—	Teltrend 7231LP/LW IOR
	—	Teltrend 9132LP/LW IHR
2	up to 20	Teltrend 7239LP/LW ILR
3	up to 1999	Westell 3130-80 IOR
	up to 2	Westell 3130-56 IOR
4	up to 1999	Westell 3150-80 ILR
	up to 1999	Westell 3150-81 ILR
5	up to 20	Westell 3150-56 ILR
	up to 20	Westell 3151-56 ILR

Table 15 shows the commands available for each command set.

Table 15 • Command Se ts

Command	Set 1	Set 2	Set 3	Set 4	Set 5
Timeout Disable	✔	✔	✔	✔	✔
Loopback Query	✔	✔	✔	✔	✔
Power Query	✔	✔			✔
Issues Query	✔	✔			

Table 15 • Command Sets (Continued)

Command	Set 1	Set 2	Set 3	Set 4	Set 5
Power Up	✔		✔		
Power Down	✔		✔		
Sequential Loopback	✔	✔			

HDSL — *(FULL payload only)* High bit-rate Digital Subscriber Line. Selects HDSL loop code transmitted over the HDSL circuit.

HDSL Type — Selects HDSL type (see Table 16).

Table 16 • HDSL Equipment

HDSL Central Office Cards	Repeaters/Doublers	Customer Premises Cards
Adtran HTU-C	Adtran HRE	Adtran HTU-R
PairGain HLU	PairGain HDU	PairGain HRU

Adtran Codes — *(HDSL loop code only)* Choices include: **STANDARD** and **ABBREVIATED**. Default is **ABBREVIATED** *(no softkeys available)*. If **STANDARD** is selected, the **REPEATER CMDS** softkey becomes available. See "Using HDSL and Repeater Commands Softkeys" on page 75.

PairGain Codes — *(HDSL loop code only)* Choices include: **A2LB** and **GENERIC**. Default is **GENERIC** *(no softkeys available)*. If **A2LB** is selected, the **REPEATER CMDS** softkey becomes available. See "Using HDSL and Repeater Commands Softkeys" on page 75.

Origin of Test — *(REPEATER and select HDSL loop codes only)* Selects point of origin of the test. Choices include: **CENTRAL OFFICE** or **CUSTOMER PREM**. The default is **CENTRAL OFFICE**.

Address — *(HDSL loop codes only)* Set the address of the HDSL equipment.

Using HDSL and Repeater Commands Softkeys

To access the **REPEATER CMDS** softkey, press **FUNCTION** softkey control. Press the **REPEATER CMDS** softkey to access to **ARM, NEAR END ARM, DISARM, ADDR UP,** and **ADDR DWN** softkeys.

ARM — Transmits an arming code on the span when testing from the Central Office toward the NIU to prepare the span for receipt of loop up or loop down codes.

NEAR END ARM — Transmits a near-end arming code on the span when testing from the NIU toward the Central Office (CO) to prepare the span for receipt of loop up or loop down codes.

DISARM — Transmits a disarming code on the span to disarm the span when testing is completed.

ADDR UP / ADDR DOWN — Increments or decrements (by one) the repeater address from the current address.

PROGRAMMABLE — Selects user-programmable inband loop codes (3 to 16 bit loop up and loop down codes), the left-most bit of each code string is transmitted first. These loop codes are valid in Full T1, Fractional T1, and all framing modes. When selected, the following selection lines are available:

Prog Set # — Allows you to program and access up to 10 user-programmable loop up and loop down codes. Each set contains its own 16 bit loop up code and loop down code. You can label each of the user-programmable codes **Loop Up Code (n)** and **Loop Down Code (n)** with alphanumeric characters. See “Editing User-Programmable Fields” on page 77 for details on editing this field.

Loop Up Code (n) — Enables setting the binary value of the loop up code (default is **10000**). The left and right arrow keys on the keypad are used to select the individual bit to be set, and the zero (**0**) or one (**1**) key on the keypad is used to set the bit value.

Loop Down Code (n) — Enables setting the binary value of the loop down code (default is **100**). The left and right arrow keys on the keypad are used to select the individual bit to be set, and the zero (**0**) or one (**1**) key on the keypad is used to set the bit value.

V.54 — *(not available when DDS loop code type is ALTERNATING)* Selects inband loop code transmitted over a Fractional T1 bandwidth.

In* D&I *mode, the only loop code responded to is V.54.

DATALINK — (*ESF framing only*) A communications connection used to transmit data. These loop codes comply with the ANSI T1.403 (‘95) specifications Datalink Type.

DL-LLB — Selects out-of-band ESF Data Link Line Loopback codes. The loop codes include: loop up = 1111 1111 0111 0000 and loop down = 1111 1111 0001 1100; the left-most bit of each code string is transmitted first. These loop codes are valid in Full T1 or Fractional T1 when ESF framing is selected.

DL-PLB — Selects out-of-band ESF Data Link Payload Loopback codes. The loop codes include: loop up = 1111 1111 0010 1000 and loop down = 1111 1111 0100 1100; the left-most bit of each code string is transmitted first. These loop codes are valid in Full T1 or Fractional T1 when ESF framing is selected.

DL-NET — Selects out-of-band ESF Data Link Network Loopback codes. The loop codes include: loop up = 0000 0000 0100 1000 and loop down = 0000 0000 0010 0100; the left-most bit of each code string is transmitted first. The loop codes are valid in Full T1 or Fractional T1 when ESF framing is selected.

Auto-Respond — (*TERMINATE and D&I operating modes only*) Enables Auto-Respond (to loop codes) to be turned **ON** or **OFF** (default is **OFF**). When Auto-Respond is set to **ON,** the analyzer is configured for automatic loop code response and the response status will appear on the Two-Line Display. The applicability of the loop code and the mode (Fractional T1 or Full T1) determine what is actually looped back (Line, Payload or Fractional Payload).

ON — Turns Auto-Respond to selected loop codes on.

OFF — Turns Auto-Respond to selected loop codes off.

Editing User-Programmable Fields

This feature allows you to enter any combination of alphanumeric characters to label your programmable loop codes for testing.

1. Select the **Loop Up Code (n)** or **Loop Down Code (n)** field. The **EDIT** softkey appears.
2. Press the **EDIT** softkey and a popup window appears. Additional softkeys appear.

   Clear — Clears the field.

   Home — Places the cursor at the beginning of the string.

   End — Places the cursor at the end of the string.
3. Press the **1** through **9**, or **0** key on keypad to select a character set. The assigned values for that key are shown in the popup window.
4. Press the corresponding number for the character you want to place into the user data information. Press **0** to add spaces if needed.
5. Repeat steps 3 and 4 until your loop code label is complete.
6. Press **SCROLL** when finished to move to the next selection line.

Line LBO — *(TERMINATE [with Tx/Rx Pair=LINE] and D&I operating modes only)* Enables emulation of four different cable losses for the T1 LINE output signal level (default is **0 dB**). The selected cable loss affects the transmit data only at the connectors. Choices include:

0 dB — Sets the output (Tx) to the DSX level with no line build-out (0 dB attenuation).

-7.5 dB — Provides -7.5 dB line build-out, attenuating the output with 7.5 dB of simulated cable loss.

-15 dB — Provides -15 dB line build-out, attenuating the output with 15 dB of simulated cable loss.

-22.5 dB — Provides -22.5 dB line build-out, attenuating the output with 22.5 dB of simulated cable loss.

Equip LBO — *(TERMINATE [with Tx/Rx Pair=EQUIP] and D&I operating modes only)* Enables emulation of four different cable losses for the T1 EQUIPMENT output signal level (default is **0 dB**). The selected cable loss affects the transmit data only at the connectors. Choices include:

0 dB — Sets the output (Tx) to the DSX level with no line build-out (0 dB attenuation).

-7.5 dB — Provides -7.5 dB line build-out, attenuating the output with 7.5 dB of simulated cable loss.

-15 dB — Provides -15 dB line build-out, attenuating the output with 15 dB of simulated cable loss.

-22.5 dB — Provides -22.5 dB line build-out, attenuating the output with 22.5 dB of simulated cable loss.

Idle Byte — (*TERMINATE and D&I operating modes only*) Enables setting the binary value of the idle byte to be inserted on inactive channels (default is **11111111**). The left and right arrow keys on the keypad are used to select the individual bit to be set, and the zero (**0**) or one (**1**) key on the keypad is used to set the bit value. The idle byte is inserted in the opposite direction of the inserted payload in D&I mode to block looped test patterns.

Yellow Alarm — (*TERMINATE and D&I operating modes only*) Enables selection of yellow alarm (default is **OFF**). Choices include:

Auto — Automatically transmits yellow alarm upon Loss of Signal.

ON — Turns on transmission of yellow alarm.

OFF — Turns off transmission of yellow alarm.

DS1 Idle Tx — Enables selection of a DS1 idle code transmission (default is **OFF**). Choices include:

> **OFF** — Turns off transmission of the DS1 idle code.
>
> **ON** — Transmits a DS1 idle code.

Setting Up a Voice Test

Voice testing enables you to communicate over a single DS0 utilizing the built-in microphone and speaker. Begin with the Home view as described in “Setting Up the Home View” on page 62. The following additional menu choices are available on the Setup Interface view (see Figure 17) when **VOICE** is the test type selected.

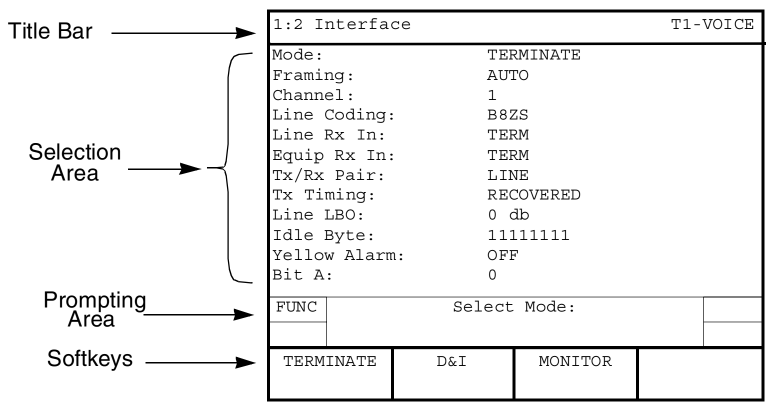


Figure 17 • Voice Interface Setup View

Channel Format — *(SF framing only)* Enables selection of the desired channel format: **D1D**, **D2**, or **D3/D4** (default is **D3/D4**).

Channel — Enables selection of the DS0 channel (**1** to **24** may be selected) to be used for voice testing (default is **1**). Use the **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the channel.

Bit A — *(VOICE testing only)* Enables setting signaling bit **A** to **0** or **1** (default is **0**).

Bit B — *(VOICE testing only)* Enables setting signaling bit **B** to **0** or **1** (default is **1**).

Bit C — *(VOICE testing only — ESF framing only)* Enables setting signaling bit **C** to **0** or **1** (default is **1**).

Bit D — *(VOICE testing only — ESF framing only)* Enables setting signaling bit **D** to **0** or **1** (default is **1**).

Setting Up the T1 Test Type View

The T1 Test Type view is used to configure the BER Test to be performed. The **SCROLL** and **PAGE** keys are used to control this selection area.

Press the **SETUP** view key for the Test Type view.

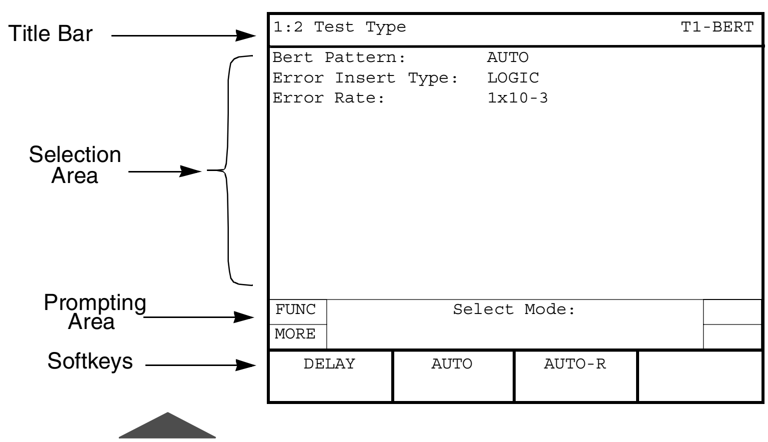


Figure 18 • T1 Test Type View

T1 BERT Patterns

Bert Pattern — *(TERMINATE, D&I, and MONITOR only)* Enables the selection of the required test pattern (default is **2047**). Unless otherwise stated, all patterns are transmitted from left to right and are available for use in full T1 and fractional T1 testing. Choices include:

All Ones — Selects a fixed pattern of AMI pulses. Used to stress repeaters or as a keep alive idle (AIS) code in a T1 signal. In DDS its an idle or keep alive signal.

All Zeros — *(FULL T1 only)* Selects the B8ZS Clear Channel Compatibility Test Pattern. Helps isolate mis-optioned AMI equipment.

1:7 — *(FULL T1 only)* Selects a fixed pattern — F01000000... where F is the frame bit. Tests the minimal ones density for AMI circuits.

2 in 8 — *(FULL T1 only)* Selects a fixed pattern — F01000010... where F is the frame bit. Used to stress B8ZS circuits.

3 in 24 — *(FULL T1 only)* Selects a fixed pattern — F01000100000000000000100... where F is the frame bit. Stresses maximum zeroes and minimum ones density at the same time.

QRSS — Selects the 2^{20}-1 Pseudorandom pattern with a maximum of 15 sequential 0s and 20 sequential 1s. Simulates live T1 traffic.

2^23-1 — Selects the 2^{23}-1 Pseudorandom pattern, which generates a maximum of 22 sequential 0s and 23 sequential 1s. Simulates live data for DS3 and SONET circuits.

2^20-1 — Selects the 2^{20}-1 Pseudorandom pattern, which generates a maximum of 19 sequential 0s and 20 sequential 1s. Simulates live data for DS2 circuits.

2^15-1 — Selects the 2^{15-1} Pseudorandom pattern, which generates a maximum of 14 sequential 0s and 15 sequential 1s. Simulates live data for 56 kbps to 2Mbps circuits.

2^15-1 INV — Selects the inverted 2^{15-1} Pseudorandom pattern, which generates a maximum of 15 sequential 0s and 14 sequential 1s. Provides the maximum number of zeroes allowed for framed, non-B8ZS testing.

2047 — Selects the 2^{11}-1 Pseudorandom pattern, which generates a maximum of 10 sequential 0s and 11 sequential 1s. Simulates live data for circuits 56 kbps and lower. (Used for DDS and ISDN.)

T1-1 (MIN/MAX) — *(FULL T1 only)* Selects a fixed pattern that generates rapid changes in ones density. Tests the repeaters ability to readjust to rapid changes in ones density.

T1-2/96 — *(FULL T1 only)* Selects the 96 octet fixed stress pattern (transmitted right to left). Stresses repeater preamplifier and Automatic Line Build Out (ALBO) circuitry. Detects marginal equipment using rapid transitions between low and high ones density.

T1-3/54 — *(FULL T1 only)* Selects the 54 octet fixed stress pattern (transmitted right to left). Stresses circuits and equipment.

T1-4/120 — *(FULL T1 only)* Selects the 120 octet fixed stress pattern (transmitted right to left). Stresses circuits and equipment. Should not be used on ESF circuits because it contains false ESF framing bits.

T1-5/53 — *(FULL T1 only)* Selects the 53 octet fixed stress pattern (transmitted right to left). Stresses circuits and equipment.

T1-6/55 — *(FULL T1 only)* Selects an unframed 55 octet fixed stress pattern (transmitted right to left). Tests the ability of the repeater to lock onto the incoming clock when data changes between high and low ones density.

T1 DALY — *(FULL T1 only)* Selects a framed 55 octet fixed stress pattern (transmitted right to left). This is the same as T1-6/55, except that byte 7 is 80 instead of 00. Use with framed T1 circuits without causing excess zeroes.

BRIDGETAP — *(FULL T1 only)* Selects an automated test that transmits 21 consecutive test patterns: ALL ONES, 1:1, 1:3, 1:5, 1:6, 1:7, 2:8, 2:9, 2:10, 2:11, 2:12, 2:13, 2:14, 3 in 18, 3 in 19, 3 in 20, 3 in 21, 3 in 22, 3 in 23, 3 in 24, and QRSS. Bridgetaps are faults that, depending on the location and length of the bridgetap, affect different frequencies in the T1 spectrum. Typically, a bridgetap is identified if more than one consecutive pattern fails. Multiple series of failures can indicate more than one bridgetap.

MULTIPAT — *(FULL T1 only)* Selects an automated test that transmits 5 consecutive test patterns: ALL ONES, 1:7, 2:8, 3 in 24, and QRSS. Use the keypad to change the time for each pattern.

A pattern set to 0 minutes is not transmitted. At least one pattern must be set to a non-zero value.

MULTIPAT 2 — *(FULL T1 only)* Selects an automated test that transmits 5 consecutive test patterns: 3 in 24, 1:7, ALL ONES, QRSS, ALL ZERO. Use the keypad to change the time for each pattern.

Programmable — Selects a user-programmable pattern from 3 to 32 bits long (transmitted left to right). The default is **01010101**. When selected, the following selection line is available:

> **Program Pattern** — (*available only when* **PROG** *is the selected pattern*) Enables programming of a user-programmable pattern (transmitted left to right) using the softkeys and keypad. The pattern must be at least 3 binary characters and no more than 32 binary characters in length. If an invalid pattern is entered, a Validation Error appears on the display. The following softkeys are available:
>
> > **Home** — Places the cursor at the beginning of the binary data string.
> >
> > **End** — Places the cursor at the end of the binary data string.
> >
> > **Clear** — Deletes the current binary data string.

LONG USER n — Selects Long User Pattern n (where n = 1 or 2), programmable from 3 to 2048 bytes long (transmitted right to left). The default is **T1-6**. When selected, the following selection line is available:

> **User Pattern n** — *(available only when LONG USER n is the selected pattern, where n = 1 or 2)* Accesses Long User Pattern n for editing. See “Editing the User Pattern n Field” on page 87.

DELAY — Used to measure 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 previous delay measurement is complete) for the length of the test, provided pattern sync is present. Normal BER test results (i.e., bit errors and pattern sync) are not available during the DELAY testing.

AUTO — Automatic Pattern Search. Enables the T-BERD 950 to automatically search for and identify a known test pattern on the LINE or EQUIPMENT interfaces. `Auto Pattern Searching` will appear on the Two-Line Display. If a pattern match occurs, the pattern name will be listed in the Pattern configuration field in lowercase letters, along with an asterisk. If the unit cannot achieve pattern synchronization, it defaults to a “live” condition, indicating that live customer traffic is most likely being received on the circuit. An “All Ones” BERT will be transmitted by the T-BERD 950 in this scenario. The test set remains in this Auto Pattern mode until a BERT pattern is selected (Table 17).

Table 17 • AUTO Pattern Example

Received BERT Pattern	AUTO Mode Selection
QRSS	*qrss
2047	*2047

Press* RESTART *key to start the auto search process again.

AUTO-R — Automatic Restart Pattern Search. The unit operates similarly to **AUTO** pattern; however, it automatically begins to search for pattern synchronization upon the loss of pattern sync. Upon re-sync, the BERT results will be cleared and begin counting from zero.

AUTO-R should not be used when performing long-term, unattended testing. The test set remains in this mode until a BERT pattern is selected.

63 — *(fractional T1 only)* Selects the 2^6-1 Pseudorandom pattern, which generates a maximum of 5 sequential 0s and 6 sequential 1s. Simulates live data for circuits less than 9.6 kbps.

511 — *(fractional T1 only)* Selects the 2^9-1 Pseudorandom pattern, which generates a maximum of 8 sequential 0s and 9 sequential 1s. Simulates live data for circuits less than 9.6 kbps.

511 QRS — *(fractional T1 only)* Selects the 2^9-1 Pseudorandom pattern, which generates a maximum of 7 sequential 0s and 9 sequential 1s.

2047 QRS — *(fractional T1 only)* Selects the 2^{11}-1 Pseudorandom pattern, which generates a maximum of 7 sequential 0s and 11 sequential 1s.

DDS1 — Selects a pattern consisting of 100 octets of 0xFF, followed by 100 octets of 0x00, transmitted right to left. Stresses a DDS circuit's minimum and maximum power recovery.

DDS2 — Selects a pattern consisting of 100 octets of 0x7E, followed by 100 octets of 0x00, transmitted right to left. Ensures a DDS circuit can properly pass the signal. Provides a minimum ones density and simulates bit-oriented protocol flags.

DDS3 — Selects a fixed pattern consisting of 0xF0011 0010 [0x32], transmitted right to left, where F is the frame bit. Used to simulate a signal transmitted over the DDS circuit. Medium stress for a DDS circuit.

DDS3R — Selects a fixed pattern the reverse of DDS3.

DDS4 — Selects a fixed pattern consisting of 0xF0100 0000 [0x40], transmitted right to left, where F is the frame bit. Moderately stresses the DDS clock recovery circuitry.

DDS5 — Selects a pattern consisting of DDS patterns 1-4.

DDS6 — Selects a fixed pattern consisting of seven octets of 0x7F, followed by one octet of 0xFF, transmitted right to left. Simulates a DDS signal transition from idle mode to data mode. Detects marginal equipment in multipoint applications.

Error Insert Type — *(TERMINATE and D&I operating modes only)* Enables selection of the type of error to be inserted in the data stream when the **ERROR INSERT** key is pressed (default is **LOGIC**). Choices include:

LOGIC — Enables insertion of bit (logic) errors. Single errors or an error rate can be selected by using the **ERROR INSERT** key.

BPV — Enables insertion of bipolar violation errors. Single errors or an error rate can be selected by using the **ERROR INSERT** key.

L&BPV — Enables insertion of logic and bipolar violation errors. Single errors or an error rate can be selected by using the **ERROR INSERT** key.

The logic and BPV errors are generated independently and are not guaranteed to coincide (e.g., the logic and BPV errors may not be generated on the same bit).

FRAME — Enables insertion of frame errors. One through 6 consecutive errors or Continuous can be selected.

Error Rate — *(TERMINATE and D&I operating modes only)* Enables selection of the error rate to be applied to the data stream that is inserted in the active channel when the **ERROR INSERT** key is pressed and held for approximately 2 seconds (pressing the **ERROR INSERT** key a second time cancels error rate insertion). Choices include:

1x10-3 — Inserts errors at a rate of 1x10-3.

If signal loss occurs while inserting errors at a rate of 1x10-3, frame sync and pattern sync can only be regained by turning off **ERROR INSERT** ***or changing the error rate.***

1x10-6 — Inserts errors at a rate of 1x10-6.

Editing the User Pattern n Field

Press the **EDIT** softkey to access the User Pattern n Edit Screen. The pattern can now be edited using the softkeys and the keypad. The display shows the cursor position within the byte and nibble, along with the total number of bytes in the pattern string. The following softkeys are will appear:

CLEAR STRING — Deletes the entire pattern.

ABORT CHANGES — Deletes all edits made to the pattern and returns the display to the Test Type Setup view.

SAVE & EDIT — Saves the current pattern and exits the editing function. This softkey appears constant in edit mode.

Pressing the **MORE** key accesses additional softkeys:

CURSOR HOME — Places the cursor at the beginning of the pattern.

CURSOR END — Places the cursor at the end of the pattern.

SAVE & EDIT — Saves the current pattern and exits the popup User Pattern Edit Screen. This softkey appears constant in edit mode.

Pressing the **MORE** key again accesses the following additional softkeys:

PREV PAGE — Places the cursor at the beginning of the previous page.

NEXT PAGE — Places the cursor at the beginning of the next page.

SAVE & EDIT — Saves the current pattern and exits the User Pattern n Edit Screen. This softkey appears constant in edit mode.

The left and right arrow keys on the keypad are used to move the cursor to an individual bit in the pattern. The **DEL** (delete) key on the keypad is used to delete individual program bits, and the zero (**0**) and one (**1**) keys on the keypad are used to enter new bit values into the pattern.

Chapter 7

T1 Test Results

This section provides information on the test results available for the T-BERD 950 T1 interface and BER testing.

Test Results Display

Test results for the T-BERD 950 appear on a Liquid Crystal Display (LCD) referred to as the Two-Line Display. The Two-Line Display and associated controls and indicators, located on the front panel above the keypad, are shown in Figure 19. The following paragraphs describe the display and the use of the controls and indicators associated with it.

Test results can also appear on the Large Graphical Display by pressing the* RESULTS *key. (See "Results View" on page 33 for more information).

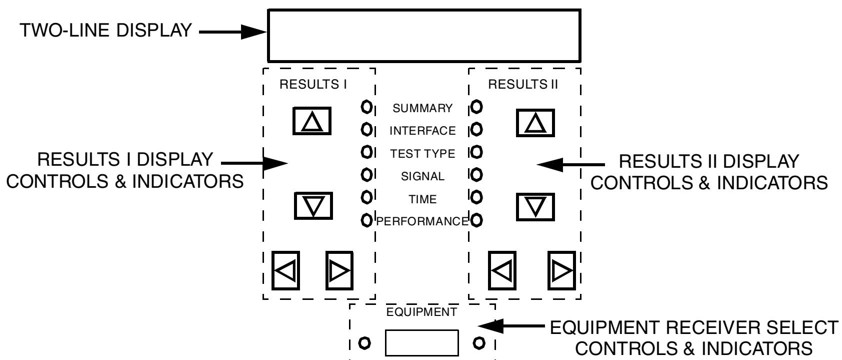


Figure 19 • Two-Line Display Area

LCD

The Two-Line Display is a two line by 24 character LCD. The display is divided vertically into two sections: RESULTS I (left side) and RESULTS II (right side). The top line on each side of the LCD lists the result name. The bottom line on each side of the LCD lists the result value.

RESULTS I and II Display Controls and Indicators

The RESULTS I and II display controls and indicators consist of the **Results** Category keys (up↑ and down ↓ arrows), the **Results** Select keys (left ← and right → arrows), and the category LED indicators. The controls and indicators are used as follows:

Results Category keys (↑ ↓) — Scrolls up or down to select the required result category, which illuminates the associated LED indicator. The available results categories include: Summary, Interface, Test Type, Signal, Time, and Performance.

Results Select keys (← →) — Displays the available results in the selected category.

The Alarm category, which is available on the Large Graphical Display Results view, is not available on the RESULTS I and II displays.

Equipment Receiver Results Controls and Indicators

The **EQUIPMENT** key is used to show EQUIPMENT Receiver results on the Two-Line Display. Press the **EQUIPMENT** key until the EQUIPMENT Receiver results are shown on the **RESULTS I** and/or **RESULTS II** side of the Two-Line Display (see Table 18 for the required settings). The LED illuminates to show which Results (I or II) is listing EQUIPMENT results.

Table 18 • EQUIPMENT Key/LEDs Settings

Left LED	Right LED	RESULTS I Display	RESULTS II Display
Off	Off	LINE Receiver results	LINE Receiver results
Off	On	LINE Receiver results	EQUIPMENT Receiver results

Table 18 • EQUIPMENT Key/LEDs Settings (Continued)

Left LED	Right LED	RESULTS I Display	RESULTS II Display
On	Off	EQUIPMENT Receiver results	LINE Receiver results
On	On	EQUIPMENT Receiver results	EQUIPMENT Receiver results

T1 Test Results

The T-BERD 950 test results categories: Summary, Interface, Test Type, Signal, Time, Performance, and Alarms are described in the following subsections as they pertain to the T1 interface.

TNT results are listed in the TNT configuration setups, however, this section and each option section provides definitions for all test results.

Summary Category

The Summary category results, view 1:7, automatically shows key results that are non-zero or out-of-specification.

If all results are within specification for the LINE and EQUIPMENT receivers, the message `All Results OK` ***appears on both sides of the Two-Line Display.***

Alarm/Status LEDs

Table 19 defines the T-BERD 950 front panel Alarm/Status LEDs as they pertain to the T1 Interface.

Table 19 • Status/Alarm LEDs for T1 Interface

Status/Alarm LED	Description
SIGNAL	Illuminates green when the T-BERD 950 detects a T1 signal with frequency equal to 1,544,000 Hz ± 50 Hz and a level greater than -35 dBdsx. The LED indicates at which RECEIVE input (LINE or EQUIPMENT) the signal is detected. The red **History** LED illuminates when no signal is detected for a period of 150 ns.
FRAME SYNC	Illuminates green when the T-BERD 950 achieves frame synchronization with the received T1 data stream. The LED indicates which RECEIVE input (LINE or EQUIPMENT) the signal is detected. The red **History** LED illuminates when two out of four received frame bits are in error.
PATTERN SYNC	Illuminates green when the received test pattern is recognized by the T-BERD 950 and pattern synchronization is achieved. The LED indicates if pattern sync is detected on the LINE or EQUIPMENT side. Pattern synchronization depends on receiving a given number of consecutive error-free bits for the specific test pattern.

Table 19 • Status/Alarm LEDs for T1 Interface (Continued)

Status/Alarm LED	Description
B8ZS	Illuminates green when the T-BERD 950 detects Bipolar 8-Zero Substitution clear-channel coding. The LED indicates which RECEIVE input (LINE or EQUIPMENT) detected the B8ZS coding. The red **History** LED illuminates when the B8ZS code is no longer detected at the corresponding input.
AIS	Illuminates red when the T-BERD 950 detects an Alarm Indication Signal. The LED indicates which RECEIVE input (LINE or EQUIPMENT) the AIS is detected. The red **History** LED illuminates when the AIS is no longer detected.
YELLOW ALARM	Illuminates red when the T-BERD 950 detects a yellow alarm. The LED indicates which RECEIVE input (LINE or EQUIPMENT) the yellow alarm is detected. The red History LED illuminates when a yellow alarm is no longer detected. Neither the Status nor the **History** LED illuminates if T1 frame sync has not been achieved.

Interface Category Results

The Interface category results, view 2:7, lists all results as described in Table 20.

Table 20 • Interface Category Results

Result Name	Description
BPVs (Bipolar Violations)	Counts BPVs detected in the received signal (that are not embedded in valid B8ZS sequences) since start of test.
BPV Seconds (BPV Error Seconds)	Counts test seconds in which a BPV was received.
BPV Rate	Calculates ratio of BPVs received over total bits received.

Table 20 • Interface Category Results (Continued)

Result Name	Description
Frm Errors (Frame Errors)	Counts frame errors received since start of test
Frm Er Rate (Frame Error Rate)	Displays percentage of frame errors received divided by the number of framing bits received.
Frm Er Sec (Frame Error Seconds)	Counts number of test seconds in which a frame error occurred.
Frm Los Cnt (Frame Loss Count)	Counts the times frame synchronization has been lost during the test.
Frm Los Sec (Frame Loss Seconds)	Counts test seconds in which frame synchronization was not present for any part of the second.
CRC Errors (CRC-6 Errors)	Counts Cyclical Redundancy Check 6 errors detected since the beginning of the test. An algorithm is performed on a packet on the transmitting end. It is then recalculated at the receiving end. If the measurements are not equal, it indicates an error occurred in the packet.
CRC Err Sec (CRC-6 Error Seconds)	Counts test seconds in which a CRC-6 error occurred.
CRC Er Rate (CRC-6 Error Rate)	Counts CRC-6 errors received divided by the total number of CRC-6s received.
COFA Count (Change of Frame Alignment Count)	Counts Change of Frame Alignment occurrences during the test.
Ex Zero Cnt (Excess Zeros Count)	Counts the strings of eight or more consecutive zeros in B8ZS or 16 or more zeros in AMI. Does not count if pattern sync present.
T1Alarm Sec	Count of test seconds when at least one of these status results (**Yellow Alarm**, **AIS**, or **Insufficient Pulse Density**) were present for a portion of the test.

Table 20 • Interface Category Results (Continued)

Result Name	Description
Rcv Byte (Receive Byte)	Displays the receive data bytes for all channels in binary format.
DDS Rx Byte (DDS Receive Byte)	Displays the receive data byte for the current DSO under test in binary format. Valid only with DDS payload.
DDS Rx Code (DDS Receive Code)	Displays the received control code, by name when one is detected. When no control codes are detected, the message `Non Ctrl` appears. Table 21 lists the Receive Codes by name and binary. (Codes are transmitted left to right.)

Table 21 • DDS Control Code s

Control Code	Binary
ASC (Abnormal Station)	N001 1110
BLOCK (Block Code)	S000 1010
CHAN LPBK (Channel Loopback)	S010 1000
CTRL IDLE (Idle)	S111 1110
DATA IDLE (Data Idle)	S111 1111
DSU LPBK (DSU Loopback)	S010 1100
FEV (Far End Voice)	S101 1010
LBE (Loopback Enable)	S101 0110
LD ACK	S011 0010
LPBK ID (Loopback ID)	S101 0001
LSC DSU (Data Service Unit Loopback Select)	S011 0001
LSC NEI (Network Element Indicator Loopback Select)	S100 0001
MA (MJU Alert)	S111 0010
MAP0 (MAP0 Confirmation)	S001 0011

Table 21 • DDS Control Codes (Continued)

Control Code	Binary
MAP1 (MAP1 Confirmation)	S110 1101
MOS (Mux Out Of Sync)	N001 1010
OCU LPBK (OCU Loopback)	S010 1010
RELEASE (Release Code)	S111 1000
TEST (Test Code)	S001 1100
TA (Test Alert)	S110 1100
TIP (Transition in Progress)	S011 1010
UMC (Unassigned Mux Channel)	N001 1000

Test Type Category

The Test Type category results are described in Table 22.

Table 22 • Test Type Category Results

Result	Description
Bit Errors	Counts the received bits that have a value opposite that of the corresponding transmitted bits, after pattern synchronization has been achieved.
Pat Slips (Pattern Slips)	Counts the total number of pattern slips detected since start of test.
BER (Bit Error Rate)	Displays ratio of bit errors to received pattern data bits.
Errored Sec (Errored Seconds)	Counts test seconds where one or more bit errors occurred.

Table 22 • Test Type Category Results (Continued)

Result	Description
EFS (Error Free Seconds)	Counts the seconds during which pattern synchronization was maintained through the entire second and no bit error occurred.
%EFS (Percent Error Free Seconds)	Displays ratio, expressed as a percentage of error free seconds to the total number of seconds during which pattern synchronization was maintained through any part of the second.
Pat Los Sec (Pattern Loss Seconds)	Counts the total number of seconds, after initial pattern synchronization, where pattern synchronization was not present for any length of time.
RT Delay, ms (Round Trip Delay in milliseconds)	Calculates round trip delay in milliseconds for T1 applications (Resolution is 20 µs). **NOTE:** Only applicable when a Delay pattern is selected.
PatSyncLoss (Pattern Synchronization Loss)	Displays pattern synchronization loss count.
Inv Pattern	Displays the pattern received. This inverted pattern is the opposite of the expected pattern.
Synctest ID (Current SyncTest ID)	Displays the current SyncTest pattern.
Synctest (Synchronous Test LINE or EQUIPMENT)	Displays the following test results for each pattern used in Bridgetap or Multipat testing: Bit Errors, Sync Seconds, and Errored Seconds.

Signal Category Results

The Signal category results are described in Table 23.

Table 23 • Signal Category Results

Result Name	Description
Spx Cur, mA (Simplex Current in milliamps)	Measures the simplex current, in milliamps, on the T1 LINE or T1 EQUIPMENT pair. Measurement range is 0 - 250 mA with accuracy of ±10% or 2mA, whichever is greater, with over range indication. **NOTE:** Only available on Tx/Rx pair side when in **TERMINATE** mode.
Rx Freq, Hz (Receive Frequency in Hertz)	Measures the current receiver clock frequency in Hertz (1 Hz resolution from 0 to 9999999 Hz).
Tx Freq, Hz (Transmit Frequency in Hertz)	Measures the current transmitter clock frequency in Hertz (1 Hz resolution from 0 to 9999999 Hz).
Rcv Lvl, dBm (Receive Level in dBm)	Displays power level of an all-ones signal. Measurement range is +23.0 dBm to -23.5 dBm (with over and under value indication).
R Lvl, dBdsx (Receive Level in dBdsx)	Displays level of received signal in dB relative to a standard 6 volt base-to-peak signal (DSX level). Measurement range is +6.0 dBdsx to -40.0 dBdsx with over and under value indication.
Rcv Lvl, Vpp (Receive Signal Level in Volts peak-to-peak)	Displays level of the received signal in peak-to-peak volts. Measurement range is 12 V to 1 V if under 1 V the range is 0.99 V to 0.05 V.
- Rcv Lvl, V (Negative Receive Level in Volts)	Displays level of the received signal in volts, measured on negative T1 pulses.
+ Rcv Lvl, V (Positive Receive Level in Volts)	Displays level of the received signal in volts, measured on positive T1 pulses.
Sig Los Sec (Signal Loss Seconds)	Counts test seconds in which the signal was not present for any part of the second.

Table 23 • Signal Category Results (Continued)

Result Name	Description
Sig Los Cnt (Signal Loss Count)	Counts number of times the signal has been lost.
Max Zeros (Maximum Consecutive Zeros)	Counts the maximum number of consecutive zeros on the T1 receiver since initial signal present (counts 0 to 250 with overflow indication).
ABCD Bits	Displays the status bits for all 24 channels. When framing is set to **SF** the AB bits are shown and results could be 0, 1, or T (toggling between 0 and 1 only when QRSS is selected). When framing is set to **ESF** the ABCD bits are shown. Only appears on the Results view.

Time Category Results

The Time category results are described in Table 24.

Table 24 • Time Category Test Results

Result Name	Description
Time	Displays time of day in 24 hour format in hours, minutes, and seconds.
Date	Displays the date in MM:DD:YY format.
Elapse Time	Displays the number of hours, minutes, and seconds since a test start or a test restart.
Test Length (Timed Test)	Displays the time selected for the test to run.
Test End In (Timed Test)	Displays the time remaining until the test is complete.

Table 24 • Time Category Test Results (Continued)

Result Name	Description
Power Loss	Displays the number of times the unit has powered on since the **RESTART** key was pressed.
Batt Charge	Displays amount of battery charge remaining.
Batt Index (Battery Performance Index)	Indicates the amount of total charge capacity available when the batteries are fully charged.

Performance Category Results

The Performance category results are described in Table 25.

Table 25 • Performance Category Results

Result	Description
G.821 EFS (Error Free Seconds, G.821)	Counts number of available seconds in which no bit errors occurred.
G.821 %EFS (Percent Error Free Seconds, G.821)	Calculates ratio of available seconds in which no errors were detected to total number of available seconds.
SES (Severely Errored Seconds, G.821)	Counts the seconds in which the bit error ratio was greater than 10^{-3} within available time.
%SES (Percent Severely Errored Seconds, G.821)	Displays percentage of severely errored seconds to the number of available seconds.
Deg Min (Degraded Minutes)	Counts the blocks of 60 non-severely errored, available seconds in which the average BER was worse than 10^{-6}.

Table 25 • Performance Category Results (Continued)

Result	Description
%Deg Min (Percent Degraded Minutes)	Displays percentage of degraded minutes to the number of minutes derived from available, non-severely errored seconds.
Avail Sec (Available Seconds)	Counts available seconds per CCITT G.821.
% Avail Sec (Percent Available Seconds)	Displays percentage of available seconds to the number of test seconds.
Unavail Sec (Unavailable Seconds, G.821)	Counts unavailable seconds per CCITT G.821.
Consec SES (Consecutively Severely Errored Seconds)	Counts the number of groups of three or more contiguous seconds in which an error rate greater than 10^{-3} was detected in each second.

Alarm Category Results

Table 26 provides a list of results, which appear in the Alarm Category results along with a description of the alarm.

Table 26 • Alarm Category Results

Result	Description
Not B8ZS Seq Det (Not B8ZS Sequence Detected)	Indicates B8ZS line coding is not present.
Pulse Den Violatn (Pulse Density Violation)	Indicates a T1 pulse density violation, which is triggered when 12.5% of the incoming pulses are spaces.
DS1 Idle Present	Indicates the receiver has detected a DS1 idle code as defined by ANSI T1.403. This condition will also illuminate the YELLOW ALARM LED (ESF framing) or a blinking YELLOW ALARM LED (D4 framing).
Excess Zeros Det (Excess Zeros Detected)	Indicates more than 15 consecutive zeros have been detected.
Inv Pattern Sync (Inverted Pattern Sync)	Indicates pattern synchronization was achieved by inverting the received pattern.

When no alarms are present, `No Alarms Detected` ***appears on the T-BERD 950 display.***

Chapter 8 Printer Operation

This chapter describes how to print information from theT-BERD 950 manually and at user-specified intervals.

Printer Configuration

The T-BERD 950 printer function supports common data rates up to 9600 bps (300, 1200, 2400, and 9600) of even, odd, or no parity. It supports the line terminator (CR, or CR/LF, LF, NONE) for the printer output. Standard RS-232 out-of-band flow control, stop bits, and data length are also supported. It supports the Acterna PR-40A (DPU-411) and compatible printers.

Printing

The T-BERD 950 printer performs manual prints by pressing the **PRINT SCREEN** softkey. This generates a print of the current view on the Large Graphical Display ("Home," "Setup," "Results," or "System").

The T-BERD 950 uses the 39 column print format. Prints contain headers that show the product identifier, print type, site ID, and the date and time of the print. The site and ID fields can be configured from the System view. The time stamp is captured when screen capture is obtained for the print.

Manual Print Screen

With the T-BERD 950 printer, you can print the contents of the currently-active graphical display. Press the **PRINT SCREEN** softkey. Except for the screen borders and softkeys, the contents print as shown on the display. Figure 20 is an example of the T-BERD 950 Print Screen.

```
T-BERD 950  Print Screen
13:44:24  07/17/1998 SITE:       ID:
---------------------------------------
Test Type                T1-BERT
LINE
Bit Errors                 3
Pat Slips                  0
BER                  5. E-08
Errored Sec                2
EFS                       36
%EFS                  94.74%
Pat Los Sec                0
RT Delay,ms              N/A
PatSyncLoss                0
Inv Pattern            FALSE
Synctest ID              N/A
Synctest - Line          N/A
```

Figure 20 • T-BERD 950 Print Screen

Timed Print Screen

The T-BERD 950 prints the current view at a specified interval. Select this option as described in “User Interface Configuration Requirements” on page 108. Specify the time interval up to 999 hours and 99 minutes.

Non-Volatile Storage of Prints

When a print is initiated, data is stored in non-volatile RAM (NOVRAM). This allows you to turn off the T-BERD 950 and retain the print buffers that have not been printed.

With the T-BERD 950 printer option, you can store screen information when you are out in the field. When you connect the analyzer to a printer at a later time, the T-BERD 950 will resume printing until the buffers are empty.

The T-BERD 950 printer has a fixed amount of NOVRAM reserved for storing print data. It can store at least 10 prints. These prints can be one or more manual or timed prints. If a print request is received and there is not enough memory to store the print data, the T-BERD 950 does not store the print data. Instead, it alerts you to this condition by flashing the `Print Buffer Full` message on the Two-Line display.

To temporarily clear the `Print Buffer Full` message, you can disable automatic printing in the System view or press the **RESTART** key. The message will reappear when another print request generates and the buffer is full, which requires you to clear the condition again. The Two-Line message is removed when the buffer becomes available.

You can use a configuration from the System view to clear the print buffer stored in NOVRAM. After setting the configuration to **YES**, you are prompted to confirm the operation using the softkeys. You can **Confirm** to clear the buffer or **Cancel** the operation. The print buffer is cleared when you change the software version.

User Interface Configuration Requirements

The System view is used to configure the Printer option for the T-BERD 950. The **SCROLL** keys are used to control this selection area.

Printer Info — Select one of the following choices (default is **HIDE**):

- **HIDE** — Hides the options for the printer port (default).
- **DISPLAY** — Shows other options to set up the print configuration.

If Printer Info DISPLAY is selected, the remainder of the options are shown on the System view.

Site — Identifies the Site on the Print Header. Enter six characters of hex digit or leave blank (default is blank).

Id — Identifies other characteristics of the site on the Print Header. Enter two characters of 0-9 or leave blank (default is blank).

Timed Prints — Prints the current views test results at a specified interval. Select **ON** or **OFF.**

When **ON** is selected, the following line appears to set the print time.

Timed Prints (HHH:MM) — Set the print time using the keypad. (Default is 1:00 (one hour)).

Clear Print Buffer — Use the Softkeys to select **YES** or **NO.** The default is **NO.** A dialog screen pops up to confirm your selection.

Printer Port Info — Provides Printer Port options. Set the options based on your printer configuration. The default is **HIDE**.

HIDE — Hides the options.

DISPLAY — Shows other options to set up the printer port.

If Printer Port Info DISPLAY is selected, the remainder of the options are shown on the System view.

Data Rate — Select the Baud Rate of **1200, 2400, 4800, 9600** (default is **9600**).

Stop Bits — Select the Stop Bits **1, 1.5,** or **2** (default is **1).**

Data Length — Select the Data length **7** or **8** (default is **8**).

Parity — Select Parity of **EVEN, ODD,** or **NONE (**default is **NONE**).

Terminator — Select the termination of the print (default is **CRLF**).

CRLF — Carriage Return and Line Feed

CR — Carriage Return only

LF — Line Feed only

NONE — None

Chapter 9 Options

This chapter provides operating information for the T-BERD 950 Communications Analyzer options.

Available Options

The available options are described in separate subsections.

- Digital Data System Local Loop Option
- Frame Relay Option
- ISDN Primary Rate Interface Option
- Signaling Option
- PCM TIMS Option
- ISDN Basic Rate Interface Option
- 10BaseT/Ethernet Option

DDS LL Option

This section provides step-by-step instructions for the Digital Data System Local Loop (DDS LL) Option for the T-BERD 950 and discusses the following topics:

- Option Description
- TNT Setups
- Manual Test Setups
- Test Results

Option Description

The DDS Local Loop option allows you to test from and analyze the DDS four-wire local loop. The electrical interface for the option is the eight position RJ-45 connector. This connector is compatible with both the RJ-45 (keyed, 8 position, 8 conductor) and RJ-48 (non-keyed) modular plugs. Only four conductors are used on the connector; Table 27 explains the RJ-45 connector pin assignments in the various operating modes of the DDS Local Loop option.

Table 27 • RJ-45 Pin Assignments

Pin No.	Function	Pin No.	Function
	OCU-DP Emulation Mode		
1	R (Receive Data, Ring Lead)	5	Not Used
2	T (Receive Data, Tip Lead)	6	Not Used
3	Not Used	7	T1 (Transmit Data, Tip Lead)
4	Not Used	8	R1 (Transmit Data, Ring Lead)
	DSU/CSU Emulation Mode		
1	R (Transmit Data, Ring Lead)	5	Not Used
2	T (Transmit Data, Tip Lead)	6	Not Used
3	Not Used	7	T1 (Receive Data, Tip Lead)
4	Not Used	8	R1 (Receive Data, Ring Lead)
	Monitor Mode		
1	R (Receive Data, Ring Lead)	5	Not Used
2	T (Receive Data, Tip Lead)	6	Not Used
3	Not Used	7	T1 (Receive Data, Tip Lead)
4	Not Used	8	R1 (Receive Data, Ring Lead)

Option Specifications

Table 28 describes the specifications for the DDS Local Loop option.

Table 28 • Option Specification s

Item	Specification
Data Formats	Standard DDS — Two information bands are used: the primary data channel, and out of band control codes (transmitted as BPV sequences). DDS with Secondary Channel — Three information bands are used: the primary data channel, the secondary channel, and inband control codes.
Primary Channel Data Rates	2.4, 4.8, 9.6, 19.2, 38.4, 56, and 64 kbps.
Secondary Channel Data	Only the Idle, 511, and 2047 BER testing patterns are available — inband flow control is not available.
Clock Source	Recovered timing from received signal or internal synthesizer (menu selectable).
Receive Signal Connection: Termination Impedance Bridging Impedance Operating Range	 OCU-DP mode: RJ-45 pins 1 & 2. DSU/CSU mode: RJ-45 pins 7 & 8. MONITOR mode: RJ-45 pins 1 & 2 and 7 & 8. Balanced, 135 Ω ±5%. Greater than 1900 Ω. +6.0 dB to -45 dB minimum (56 kbps and 64 kbps) -OR- +6.0 dB to -40 dB minimum (all other data rates).
Transmit Signal Connection: Termination Impedance Output Levels	 OCU-DP mode: RJ-45: pins 7 & 8. DSU/CSU mode: RJ-45: pins 1& 2. Balanced, 135 Ω, ±5%. 0, -3, -6, and -9 dB of simulated cable attenuation.
Test Modes	TERMINATE, MONITOR or LLB (Line Loop Back)
Emulation Modes	DSU/CSU, OCU-DP or Metallic

Table 28 • Option Specifications (Continued)

Item	Specification
Simplex Current	
Input Level	±30 mA maximum
Measurement range	±26 mA with an accuracy of ±10% or 2mA
OCU-DP mode current output	4 mA to 20 mA depending on the length of the span
Error Insertion	
Operation	Single or continuous
Error rate	1E-3
Error insert type	Logic, BPV, L&BPV, or Frame. Available on Primary or Secondary Channel
Loop Response	V.54 DSU/CSU Disabled

Option Messages

The messages that may appear on the analyzer front panel during testing are provided in Table 29.

Table 29 • Option Messages

Message Category	Message
Receive Messages	Preexisting Loop Present In Loopback Sealing Current Loss (Alarm message)
Originating Messages	Transmitting Loop Up Transmitting Loop Down

Setting Up TNT

This section describes the TNT test setups for the DDS LL option. A sample TNT Setup view is shown in Figure 21.

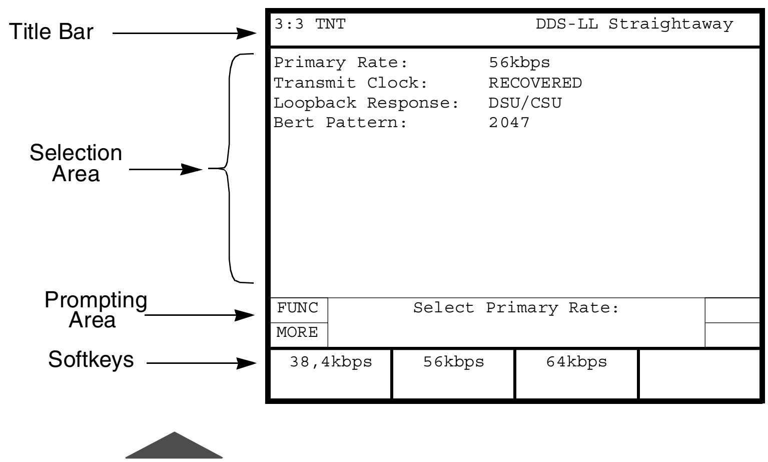


Figure 21 • DDS LL TNT Setup View

Performing DDS Service Turn-up

Table 30 describes the TNT test setups for DDS LL BER tests. For descriptions of the test setup parameters, see “Setting Up Manual DDS LL Test” on page 120. For descriptions of all results see“Test Results” on page 125.

The objective of this test is to perform DDS qualification such as a 2047 BERT test. While in this passive mode, you can view signal level, signal frequency, BPVs, bit errors, sealing current and others, while the test is being run.

Table 30 • DDS LL BERT Turnup

Test	TNT Setup	TNT Results
RESPOND TO LOOPBACK (CSU/DSU Emulation) In this scenario, the T-BERD 950 is being used as a loopback device. Ideally, you are waiting for a loopback code to be sent from a centralized tester or from a test set located in the CO.	Primary Rate (56K) Loopback Response (DSU/CSU) Bert Pattern (AUTO)	Bit Errors Pat Slips BPVs DDS Frm Errs Seal Cur, mA Rcv Freq, Hz Rcv Lvl, dB
STRAIGHTAWAY (Emulate CSU/DSU) In this scenario, theT-BERD 950 is being used as one test set at customer premise, while another test set is located at the far end, typically the CO at a DSX panel. Testing and analysis is performed in both directions. This is a better method of sectionalizing a trouble and service verification during turnup.	Primary Rate (56K) Transmit Clock (Recovered) Loopback Response (DSU/CSU) Bert Pattern (2047)	Bit Errors Pat Slips BPVs DDS Frm Errs Seal Cur, mA Rcv Freq, Hz Rcv Lvl, dB

Troubleshooting DDS Service

Table 31 describes the TNT test setup to troubleshoot DDS service. For descriptions of the test setup parameters, see “Setting Up Manual DDS LL Test” on page 120. For descriptions of all results see“Test Results” on page 125.

The objective of this test is to perform DDS qualification such as a 2047 BERT test. In this mode, you can view signal level, signal frequency, BPVs, bit errors, sealing current, and others, while the test is running.

Table 31 • DDS LL Interface DDS Troubleshooting

Test	TNT Setup	TNT Results
SEND CSU LOOPBACK (OCU-DP or Office Card emulation) This scenario assumes that the DDS physical layer has already been tested. This is to be used as a method of troubleshooting the customer's CSU/DSU to isolate the provider's network as a source of the problem. The technician can use a CSU/DSU loop code to loop up the CSU/DSU and perform BER testing. This is a one-person test.	Primary Rate (56K) Loopcode (Tx) (CSU/DSU) Bert Pattern (2047)	Bit Errors BPVs Pat Slips DDS Frm Errs Seal Cur, mA Rcv Freq, Hz Rcv Lvl, dB

Monitoring DDS Service

Table 32 describes the TNT test setup to monitor at the DDS interface. For descriptions of the test setup parameters, see "Setting Up Manual DDS LL Test" on page 120. For descriptions of all results see"Test Results" on page 125.

The purpose of the DDS LL monitor test is to passively monitor various DDS LL results while the test is being run. Monitor the timing between two DDS signals for timing slips and other results.

Table 32 • DDS LL Monitor

Test	TNT Setup	TNT Results
BERT In this scenario, you can connect to the monitor point and review the results.	Primary Rate (56K) Bert Pattern (AUTO)	BPVs DDS Frm Errs Seal Cur, mA Rcv Freq, Hz Rcv Lvl, dB Timing Slips

Setting Up Manual DDS LL Test

This section provides descriptions of the Test setup parameters for the Interface and Test Type views for the DDS LL option. Figure 22 shows a sample Interface Setup view.

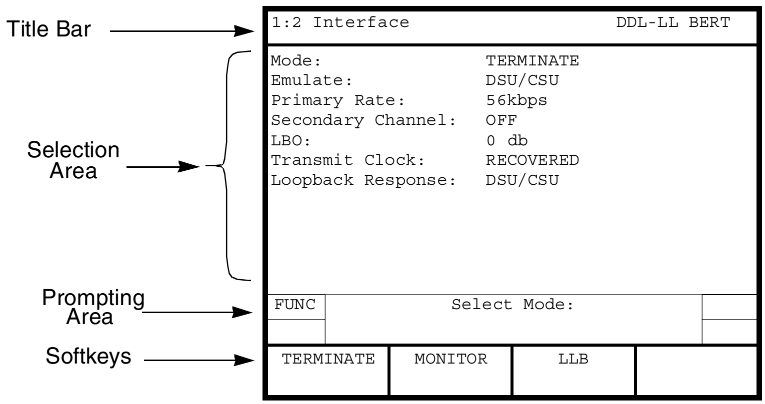


Figure 22 • DDS LL Setup Interface View

Setting Up the DDS LL Interface View

The DDS Local Loop Interface Setup view is used to configure the DDS LL interface. The DDS LL interface parameters and the available choices for those parameters are discussed in the following paragraphs. The **SCROLL** and **PAGE** keys are used to control this selection area.

Mode — Enables selection of the operating mode (default is **TERMINATE**). Choices include: **TERMINATE**, **MONITOR**, and **LLB**. See ‘Setting Up the T1 Interface View’ on page 62. for definitions for these modes.

Emulate — *(TERMINATE and LLB modes only)* Enables selection of the emulation used by the analyzer (default is **DSU/CSU**). Choices include:

DSU/CSU — In DSU/CSU emulation, the analyzer receives on the T1/R1 pair and transmits on the T/R pair. In this emulation type, choices include:

Transmit Clock — Enables selection of the transmit timing source (default is **RECOVERED)**. Choices include:

RECOVERED — Selects the LINE receiver clock as the transmit timing source.

INTERNAL — Selects the internal frequency synthesizer as the transmit timing source.

Loopback Response — Selects the type of loop code response performed by the analyzer (default is **DISABLED**). The choice is:

V.54 — Enables the T-BERD 950 to loop back when it receives a V.54 loop code.

When the T-BERD 950 is in DSU/CSU emulation, the V.54 loop code is sent when the* LOOP UP *key is pressed.

DSU/CSU — *(not available in OCU-DP emulation)* Enables the T-BERD 950 to loop back when it receives a DSU/CSU loop code.

DISABLED — The T-BERD 950 will not respond to received loop codes.

In the DSU/CSU emulation, DSU/CSU Loop Resp responds to both alternating and latching CSU loop back requests and alternating and latching DSU loopback requests. Latching DSU is valid in framed formats (secondary channel and 64kbps) only.

OCU-DP — In OCU-DP emulation, the analyzer receives on the T/R pair and transmits on the T1/R1 pair. TheT-BERD 950 automatically sets the transmit clock to internal. In this emulation type, choices include:

The T-BERD 950, when configured for OCU-DP mode, can drive a non-repeatered span up to 18,000 feet. The OCU-DP mode sealing current conforms to 4-20mA, 7-28V which will not power a repeater located on the span.

Loopback Response — Selects the type of loop code response performed by the analyzer (default is **DISABLED**). Choices include:

V.54 — Enables the T-BERD 950 to loop back when it receives a V.54 loop code.

DISABLED — The T-BERD 950 will not respond to received loop codes.

Loopcode (Tx) — Selects the type of loop code transmitted by the analyzer (default is **V.54**). Choices include:

V.54 — V.54 loop codes are transmitted by the analyzer.

LATCHING CSU — Selects latching CSU (sealing current reversal).

METALLIC — Enables metallic loop testing and tip-ring short metallic testing. Choices include:

Shorts — Enables selection of the type of cable test to be performed (default is **TX-to-RX**). Choices include:

TX-to-RX — Connects the transmit tip (T) to the receive tip (T1) and the transmit ring (R) to the receive ring (R1), via a metallic short.

TIPS-to-RINGS — Connects the transmit tip (T) to the transmit ring (R) and the receive tip (T1) to the receive ring (R1), via a metallic short.

In Metallic emulation, no DDS LL results are gathered and BER testing is not performed.

Primary Rate — *(TERMINATE and LLB modes)* Enables selection of the data rate for transmission and analysis (default is **56kbps**). Choices include: **2.4**, **4.8**, **9.6**, **19.2**, **38.4**, **56**, or **64kbps**.

When **Primary Rate** is set to any rate except 64kbps, the secondary channel choices include:

Secondary Channel — Turns the secondary channel **ON** or **OFF** (default is **OFF**). When set to **ON**, the following choice appears:

Analysis Channel — Selects the channel on which analysis is performed (default is **PRIMARY**). Choices include:

PRIMARY — Performs analysis on the Primary channel.

SECONDARY — Performs analysis on the Secondary channel.

LBO — *(TERMINATE mode only)* Enables emulation of the different cable losses for the output signal level (default is **0dB**). The selected cable loss affects the transmit data only at the connectors. Choices include:

0 dB — Sets the primary output (TX) to zero or no line build-out (0 dB attenuation).

-3 dB — Provides -3 dB line build-out, attenuating the output with 3 dB of simulated cable loss.

-6 dB — Provides -6 dB line build-out, attenuating the output with 6 dB of simulated cable loss.

-9 dB — Provides -9 dB line build-out, attenuating the output with 9 dB of simulated cable loss.

Setting Up the DDS LL Test Type View

The Test Type view allows you to configure the type of test to be performed.

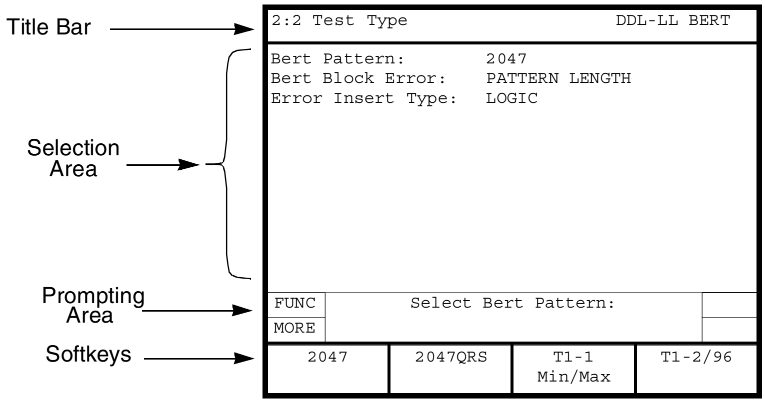


Figure 23 • DDS LL Setup Test Type View

Bert Pattern — Select the appropriate BERT pattern. For descriptions of all BERT patterns see “Setting Up the T1 Test Type View” on page 80.

Sec Channel Pattern — Selects the type of data inserted on the secondary channel (default is **511**). Choices include:

- **IDLE** — Inserts idle code on the secondary channel.
- **511** — Inserts the 511 BER test pattern on the secondary channel.
- **2047** — Inserts the 2047 BER test pattern on the secondary channel.

Bert Block Type — Enables selection of the block length for the currently selected pattern (default is **PATTERN LENGTH**). Choices include:

- **PATTERN LENGTH** — Sets the block length to the length of the currently selected pattern.
- **USER DEFINED** — Enables the user to set a specific block length for the selected pattern. Choices include:
  - **Bert Block Length** — Enables setting the block length to any value between 50 and 100000 (default is **1000**). The keypad is used to enter the desired value.

Error Insert Type — *(TERMINATE mode only)* Enables selection of the type of error to be inserted in the data stream when the **ERROR INSERT** key is pressed (default is **LOGIC**). Choices include:

> **LOGIC** — Enables insertion of bit (logic) errors. Single errors or an error rate can be selected.
>
> **BPV** — Enables insertion of bipolar violation errors. Single errors or an error rate can be selected.
>
> **L&BPV** — Enables insertion of logic and bipolar violation errors. Single errors or an error rate can be selected.

The logic and BPV errors are generated independently and are not guaranteed to coincide (e.g., the logic and BPV errors may not be generated on the same bit). In addition, the amount of errors inserted is determined by the use of the front panel **ERROR INSERT** ***key. Press the*** **ERROR INSERT** ***key once to insert a single error. Press and hold the*** **ERROR INSERT** ***key for approximately two (2) seconds to insert errors at a rate of 1x10-3. Press the*** **ERROR INSERT** ***key again to cancel the rate.***

> **FRAME** — Enables insertion of a single frame error (**Secondary Channel** must be set to **ON**).

Test Results

Test results for the DDS LL option appear on the analyzer Two-Line Display. The Two-Line Display and associated controls and indicators are located on the front panel above the keypad. See ‘Test Results Display’ on page 90. for a detailed description of the Two-Line Display.

Test results are also shown on the Large Graphical Display Results view. See ‘Results View’ on page 33. for a detailed description of the Large Graphical Display. A typical DDS LL Results view is shown in Figure 24.

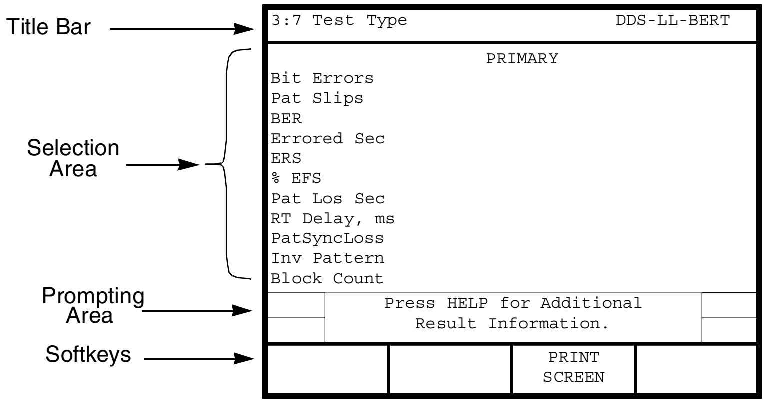


Figure 24 • DDS LL Results Test Type View

Status/Alarm LEDs

The SIGNAL Status/Alarm LED illuminates green when a valid DDS signal is being received.

A red illuminated LED indicates the Status/Alarm condition was previously true or present, since the start of the current test.

Summary Category Results

The Summary category automatically lists key results that are out of specification. If all results are within specification for the LINE or EQUIPMENT receiver, the message `All Results OK` appears on the appropriate side of the Two-Line Display.

For* Test Type, Time, *and* Performance *results see T1 "Test Results" on page 125.

Interface Category Results

The Interface category results are described in Table 33.

Table 33 • DDS LL Interface Results

Result Name	Description
BPVs (Bipolar Violations)	Counts BPVs detected in the received signal since start of test.
BPV Rate	Displays ratio of BPVs received to total bits received.
Rcv Byte (Receive Byte)	Displays data byte samples in binary form. Applicable only when Primary Rate is set to 64 kbps or secondary channel is active.
Rcv Code (Receive Code)	Displays the received bytes, which are interpreted as special network codes, in text form.
DDS Frm Err (Frame Errors)	Counts frame errors received since start of test.
DDS FE Rate (Frame Error Rate)	Counts frame errors received divided by the number of framing bits received.
Rx Dat Freq (Receive Data Frequency)	Displays the receive data rate of the Primary or Secondary channel being analyzed, in bits per second (b/s).
Data Mode % (Data Mode Percent)	Displays percentage of total control bits received in data mode to the count of total control bits received. Applicable only when secondary channel is active.

Signal Category Results

The Signal category results are described in Table 34.

Table 34 • DDS LL Signal Results

Result Name	Description
Rcv Lvl, dB (Receive Level in dB)	Displays power level of an all-ones signal measured in dB. Measurement range is 0 dB to -45.0 dB.
Rcv Lvl, Vp (Receiver Signal Level in Volts peak-to-peak)	Displays level of received signal in peak-to-peak volts. Measurement range is 1.00 V to 4.00 V if under 1.00 V the range is 0 V to 0.999 V.
Seal Cur, mA (Sealing Current)	Measures the loop up or loop down sealing current, in milliamps. Applicable in **MONITOR** and **EMULATE DSU/CSU** modes only.
Rcv Freq, Hz (Receive Frequency, in Hertz)	Displays current measurement of the receiver clock frequency in Hertz (.01 Hz resolution from 0000.00 to 9999.99 Hz; 0.1 Hz resolution from 10000.0 to 99999.9 Hz).
Timing Slip	Measures the difference between the T/R and T1/R1 receivers while in **MONITOR** mode.

Alarm Messages

Table 35 describes `Sealing Current Range`, which appears on the Results Alarms view. When no alarms are present, `No Alarms Detected` appears on the display.

Table 35 • DDS LL Alarms

Result	Description
Seal Curnt Range	Indicates the receive sealing current on the DDS circuit is less then ±4.0mA or greater then ±20.0mA. Measurement range is +20 mA to -20 mA, with an accuracy of ±10% or 2mA whichever is greater. `Out of Range` appears when the value is greater in magnitude than ±20 mA or lower in magnitude than ±4 mA.

Frame Relay Option

This section provides step-by-step instructions for the Frame Relay option for the T-BERD 950 and discusses the following topics:

- Option Description
- TNT Setups
- Manual Test Setups
- Test Results

Option Description

The Frame Relay option, in conjunction with the Protocol Services Board option, enables the T-BERD 950 Communications Analyzer to transmit and receive frame relay packets via the T1 interfaces (LINE or EQUIPMENT), the Optional DDS LL or Datacom interfaces.

The Frame Relay option enables generation of frame relay packets with various traffic scenarios. The scenarios include varying the frame size and link utilization (throughput) and the ability to send data in a random or bursty manner. In addition, the Frame Relay option enables the collection of basic protocol statistics concerning the frame relay circuit under test. Test results are collected on one specific Data Link Connection Identifier (DLCI) and on the aggregate frames for all DLCIs.

Operating Modes

The Frame Relay option operates in one of two modes, either Terminate mode (D&I mode is also available for T1 interface) or Monitor mode. The following paragraphs discuss each mode in detail.

Terminate Mode

In Terminate mode the option utilizes one receiver/transmitter pair. The option transmits/receives frame relay packets at rates up to 1.544 Mbps. The analyzer can emulate the following types of link management (CPE only): LMI Rev.1 or T1.617 Annex D. In addition, the analyzer can transmit TTC test frames (see Figure 25 on page 133) to test provisioned circuits, in a loopback configuration or in conjunction with another T-BERD 950 (or a TTC FIREBERD 6000 with the Frame Relay option installed).

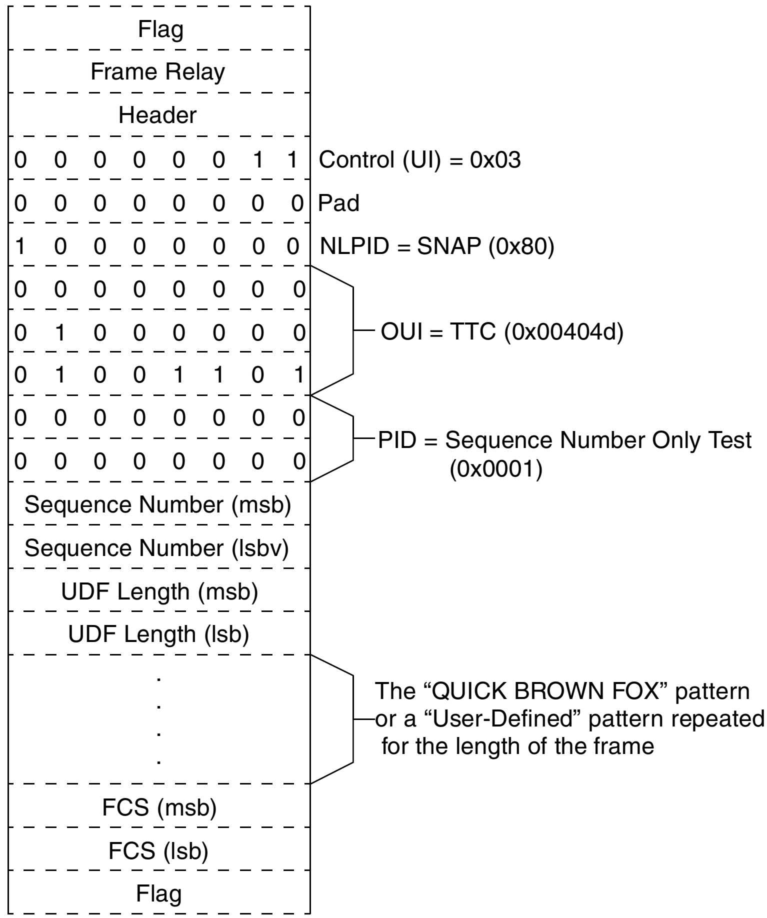


Figure 25 • TTC Test Frame Format

Monitor Mode

Monitor mode lets you monitor frame relay circuits from both receivers simultaneously and accumulate basic layer 2 statistics. The accumulated results for each receiver can appear separately.

Option Specifications

Table 36 lists the specification for the Frame Relay option.

Table 36 • Option Specificatio n s

Item	Specification
Test Modes	Terminate Drop & Insert (T1 Interface only) Monitor
Link Management Analysis	LMI Rev.1 T1.617 Annex D Auto None
Test Frame Structure	TTC Test frames (See Figure 25 on page 133.)
PING Testing	ICMP Echo Test NLPID Encapsulation

Option Messages

The following alarm message, `Rcv Overflow,` flashes in the Two-Line Display when frames are dropped by the receiver. In addition, the Pattern Sync LED illuminates when frame relay traffic is present.

Setting Up TNT

The Frame Relay TNT option is designed to make a routine test setup simple and intuitive. TNT configurations are designed around common tasks that let you perform turnup quickly, easily, and accurately. Select the interface, task, and test. TNT automatically sets certain parameters based on common test scenarios, minimizing configuration settings and key presses.

Performing T1 Interface Frame Relay Turn-up

Table 37 lists the TNT setups for the T1/FT1 Frame Relay Turn-up test in Router Emulation. For descriptions of the test setup parameters, see "Setting Up Manual Frame Relay Test" on page 141. For descriptions of all results see"Test Results" on page 146.

The three tests listed in Table 37, Table 38, and Table 39 perform different functionality testing for frame relay service using the various interfaces, T1, T1 DDS, and DDS LL. These tests verify that the customer is properly configured making sure that the Link Management Interface (LMI) is functioning properly, the actual frame relay service operates at the Committed Information Rate (CIR), and PING checks connectivity to a far-end router.

The objective of the **LMI/PVC Check** verifies that the Link Management Interface (LMI) is functioning properly, and that all DLCIs have Permanent Virtual Circuits (PVCs) that are properly configured and active.

The objective of the **CIR Check** verifies that the customer is provided actual frame relay service at their Committed Information Rate (CIR), without losing frames due to congestion, improper Discard Eligibility (DE) flags, incorrect PVCs configurations, and others. Physical layer results may also be viewed.

The objective of the **PING Test** is to check connectivity to a far-end router without taking it out-of-service. In this mode, the you can send IP Pings to an installed IP address (typically another router) in the network. The goal is to ensure that all IP PING messages sent to the far-end device are responded back with an echo reply.

Table 37 • T1 Interface — Frame Relay Turn-up

Test	TNT Setup	TNT Results
LMI/PVC CHECK This is an out-of-service TERMINATION mode test. This scenario assumes that the T1 physical layer has already been tested. The test set is plugged into the circuit after the actual frame relay service has been turned on by the NOC. This test requires connecting to the circuit and gathering results; it is a one person test. This is the recommended first step to testing a frame relay circuit.	Framing (AUTO) Payload (FULL) Line Coding (B8ZS) Tx Timing (RECOVERED) Show Results For (LINK) Receive DLCI (16) Transmit DLCI (16) Rate (384 KBPS) LMI Type (T1.617-D)	Frm Cnt Avg% Util Avg Tput LMI Cnt LMI Errs LMI TMOS DLCIs Lost Frms
CIR CHECK (NIU/DSX Access) This scenario assumes that the T1 physical layer and an LMI/PVC check have already been performed. The test set is plugged into the circuit after the actual frame relay service has been turned on by the NOC. The TB950 is used to send/receive frames with another test set located within the CO or with the NOC responsible for Packet Switched Services. **Note**: Testing can also be performed to a soft loopback within the POP frame relay switch or to a hard loopback within the CO or at the far-end.	Framing (AUTO) Payload (FULL) Line Coding (B8ZS) Tx Timing (RECOVERED) Show Results For (RECEIVE DLCI) Receive DLCI (16) Transmit DLCI (16) Rate (384 KBPS) LMI Type (T1.617-D)	Frm Cnt Avg% Util Avg Tput LMI Cnt LMI Errs LMI TMOS DLCIs Lost Frms
PING FAR END (NIU/DSX access) This is an out-of-service TERMINATION mode. This scenario assumes that the T1 physical layer and an LMI/PVC check have already been tested. The test set is plugged into the circuit after the actual frame relay service has been turned on by the NOC. This test requires connecting to the circuit and sending and receiving a PING to a currently installed IP device such as a far-end router; it is a one person test.	Framing (AUTO) Payload (FULL) Line Coding (B8ZS) Tx Timing (RECOVERED) Show Results For (RECEIVE DLCI) Receive DLCI (16) Transmit DLCI (16) Source IP Address ( ) Destination IP Address ( ) LMI Type (T1.617-D)	Lost Png Tx Png Echo Png Avg Png Dly Min Png Dly Max Png Dly

Performing T1 Interface DDS Frame Relay Turn-up

Table 38 lists the TNT setups for the T1 Interface DDS Frame Relay Turn-up test. For descriptions of the test setup parameters, see “Setting Up Manual Frame Relay Test” on page 141. For descriptions of all results see“Test Results” on page 146.

Table 38 • T1 Interface — DDS Frame Relay

Test	TNT Setup Functions	TNT Results
LMI/PVC CHECK —- DSX Access This is an In-Service D&I mode test. This scenario assumes that the DDS physical layer has already been tested. The test set is plugged into the circuit after the actual frame relay service has been turned on by the NOC. This test requires connecting to the circuit and gathering results; it is a one person test. This is the recommended first step to testing a frame relay circuit.	Framing (ESF) Channel (1) Rate (DS0A 56K) Line Coding (B8ZS) Insert Side (LINE TX) Insert Payload (OFF) * Show Results For (LINK) Receive DLCI (16) Transmit DLCI (16) Rate (384 Kbps) LMI TYPE (T1.607-D) * User is prompted to turn this to on.	Frm Cnt Avg% Util Avg Tput LMI Cnt LMI Errs LMI TMOS DLCIs Lost Frms
CIR CHECK This scenario assumes that the DDS physical layer and a LMI/PVC check have already been tested. Now, the test set is plugged into the circuit after the actual frame relay service that has been turned on by the NOC. The TB950 is used to send/receive frames with another test set located within the CO or with the NOC responsible for Packet Switched Services. **Note**: Testing can also be performed to a soft loopback within the POP frame relay switch or to a hard loopback within the CO or at the far-end.	Framing (ESF) Channel (1) Rate (DS0A 56K) Line Coding (B8ZS) Insert Side (LINE TX) Insert Payload (OFF) * Show Results For (LINK) Receive DLCI (16) Transmit DLCI (16) Rate (384 Kbps) LMI TYPE (T1.617-D) * User is prompted to turn this ON.	Frm Cnt Avg% Util Avg Tput LMI Cnt LMI Errs LMI TMOS DLCIs Lost Frms

Table 38 • T1 Interface — DDS Frame Relay (Continued)

Test	TNT Setup Functions	TNT Results
PING — DSX Access This scenario assumes that the DDS physical layer and a LMI/PVC check have already been tested. The test set is plugged into the circuit after the actual frame relay service has been turned on by the NOC. This test requires connecting to the circuit and sending and receiving a PING to a currently installed IP device such as a far-end router; it is a one person test.	Framing (ESF) Channel (1) Rate (DS0A 56K) Line Coding (B8ZS) Insert Side (LINE TX) Insert Payload (OFF) * Show Results For (RECEIVE DLCI) Receive DLCI (16) Transmit DLCI (16) Source IP Address ( ) Destination IP Address ( ) Rate (384 Kbps) LMI TYPE (T1.617-D) Bert Pattern (QRSS) * User is prompted to turn this ON.	Lost Png Tx Png Echo Png Avg Png Dly Max Png Dly Min Png Dly

Performing DDS LL Interface Frame Relay Turn-up

Table 39 lists the TNT setups for the DDS LL Interface Frame Relay Turn-up test in Router Emulation. For descriptions of the test setup parameters, see “Setting Up Manual Frame Relay Test” on page 141. For descriptions of all results see“Test Results” on page 146.

Table 39 • DDS LL Interface — Frame Relay Turn-up

Test	TNT Setup Summary	Results Summary
LMI/PVC Check This is an in-service D&I mode test. This scenario assumes that the DDS physical layer has already been tested. The test set is plugged into the circuit after the actual frame relay service has been turned on by the NOC. This test requires connecting to the circuit and gathering results; it is a one person test. This is the recommended first step to testing a frame relay circuit.	Primary Rate (56K) Show Results For (LINK) Receive DLCI (16) Transmit DLCI (16) Rate (28kbps)	Frm Cnt Avg% Util Avg TPUT LMI Cnt LMI Errs LMI TMOS Lost Frms DLCIs
CIR CHECK (NIU/DSX Access) This is an in-service D&I mode test. This scenario assumes that the DDS physical layer and an LMI/PVC check have already been tested. Now, the test set is plugged into the circuit after the actual frame relay service that has been turned on by the NOC. The TB950 is used to send/receive frames with another test set located within the CO or with the NOC responsible for Packet Switched Services. **Note**: Testing can also be performed to a soft loopback within the POP frame relay switch or to a hard loopback within the CO or at the far end.	Primary Rate (56K) Show Results For (RECEIVE DLCI) Receive DLCI (16) Transmit DLCI (16) Rate (28kbps)	Frm Cnt Avg% Util Avg TPUT LMI Cnt LMI Errs LMI TMOS Lost Frms DLCIs
PING FAR END (NIU/DSX Access) This is an in-service D&I mode test. This scenario assumes that the DDS physical layer and a LMI/PVC check have already been tested. Now, the test set is plugged into the circuit after the actual frame relay service that has been turned on by the NOC. This test requires connecting to the circuit and sending and receiving a PING to a currently installed IP device such as a far-end router; it is a one person test.	Primary Rate (56K) Show Results For (RECEIVE DLCI) Receive DLCI (16) Transmit DLCI (16) Source IP Address ( ) Destination IP Address ( ) LMI (Annex D)	Lost Png Tx Png Echo Png Avg Png Dly Min Png Dly Max Png Dly

Performing Frame Relay Monitor Test

Table 39 lists the TNT setups for the T1 and DDS LL interfaces to perform a monitor test on Frame Relay. For descriptions of the test setup parameters, see “Setting Up Manual Frame Relay Test” on page 141. For descriptions of all results see “Test Results” on page 146.

The objective of performing a monitor test is to verify that the live frame relay traffic is transmitted without excessive congestion at the proper rate. Results such as FCS errors, frame rate, utilization, along with physical layer results can be viewed.

Table 40 • Frame Relay Monitor Tests

Test	TNT Setup	TNT Results
T1 Interface In this scenario, you can connect to the monitor point and review the results.	Payload (FULL) Line Coding (AUTO) Show Results For (RECEIVE DLCI) Receive DLCI (16) Long Frame (4095) (IF PAYLOAD = DDS) Channel (1) Rate (DS0A 56) (IF PAYLOAD = nx64K or nx56K) Channels (pop up edit screen)	CRC Errors Frm Errors BPVs Frm Cnt LMI Cnt LMI Errs DLCIs Avg% Util Avg% Tput
DDS LL Interface In this scenario, you can connect to the monitor point and review the results.	Primary Rate (56K) Show Results For (LINK)	Frm Cnt LMI Cnt LMI Errs DLCIs Avg% Util Avg TPUT

Setting Up Manual Frame Relay Test

This section provides descriptions of the Test setup parameters for the Interface and Test Type views for the Frame Relay option.

Setting Up the Interface View

The Interface Setup (see Figure 26) view lets you configure the mode, framing, rate, transmit clock for the selected interface. Depending on the interface you select, see “Setting Up the T1 Interface View” on page 62, or see “Setting Up the DDS LL Interface View” on page 120.

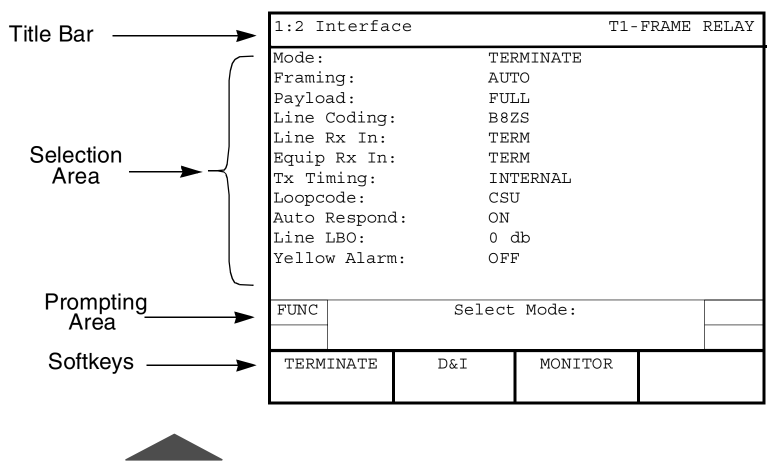


Figure 26 • Frame Relay Setup Interface View

Setting Up the Test Type View

The Test Type Setup view (see Figure 27) lets you configure the Frame Relay option. Press the **SETUP** key again to access the Test Type View.

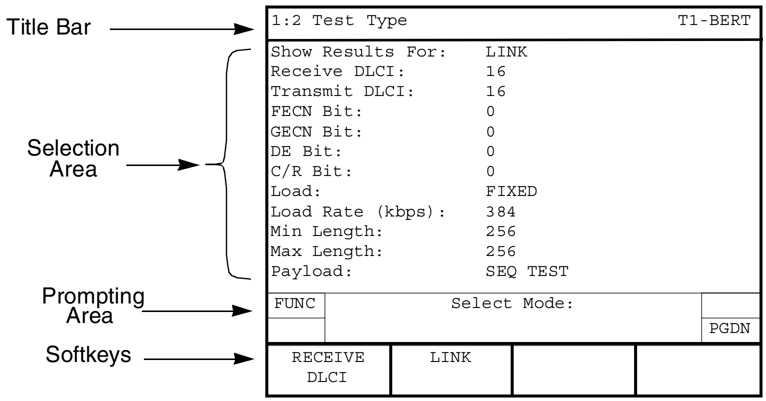


Figure 27 • Frame Relay Setup Test Type View

Show Results For — *(all operating modes)* Used to specify what results are shown (default is **RECEIVE DLCI**). Choices include:

> **RECEIVE DLCI** — Selects results for a single Data Link Connection Identifier (DLCI).
>
> **LINK** — Selects the aggregate total of all frame relay packets received over a single circuit.

Receive DLCI — *(all operating modes)* Enables entry of an individual DLCI (default is **16**). The entry can be from 0 to 1023. Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

Transmit DLCI — *(TERMINATE or D&I modes only)* Enables entry of an individual DLCI (default is **16**). The entry can be from 0 to 1023. Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

FECN Bit — *(TERMINATE or D&I modes only)* Enables entry of the FECN (Forward Explicit Congestion Notification) bit (default is **0**). This is a binary entry field; the keypad keys **0** or **1** are used to enter the required value.

BECN Bit — *(TERMINATE or D&I modes only)* Enables entry of the BECN (Backward Explicit Congestion Notification) bit (default is **0**). This is a binary entry field; the keypad keys **0** or **1** are used to enter the required value.

DE Bit — *(TERMINATE or D&I modes only)* Enables entry of the DE (Discard Eligibility) bit (default is **0**). This is a binary entry field; the keypad keys **0** or **1** are used to enter the required value.

C/R Bit— *(TERMINATE or D&I modes only)* Enables entry of C/R (Command/Response Indication) bit (default is **0**). This is a binary entry field; the keypad keys **0** or **1** are used to enter the required value.

Load — *(TERMINATE or D&I modes only)* Selects the frame payload type (default is **OFF**). Choices include the following: **OFF, FIXED, BURST,** or **PING**.

> **FIXED —** When selected, the analyzer sends traffic at a fixed rate, the following choices include:
>
> > **Rate** — Enables entry of the load transmission rate from 1 to 8192 kbps (default is **1**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.
> >
> > **Min Length** — Enables entry of the minimum frame length. The length must be between 4 and 9999 (default is **256**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.
> >
> > **Max Length** — Enables entry of the maximum frame length. The length must be between 4 and 9999 (default is **256**).Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.
>
> **PING** — When selected, the analyzer transmits PING packets at a fixed rate of one per second. Enter the following parameters:
>
> > **Source IP Address** — Enables entry of the source IP address, format is xxx.xxx.xxx.xxx. Use the keypad to enter the address. (Leading zeros are deleted from the IP address when you exit from this field.)

Destination IP Address — Enables entry of the destination IP address, format is xxx.xxx.xxx.xxx. Use the keypad to enter the address. **NOTE**: Leading zeros are deleted from the IP address when you exit this field.

Frame lengths of 15 octets, or less, prevents the detection of lost test frames.

BURST — When selected, the analyzer enables you to set the characteristics of bursty traffic to transmit. Choices include:

Transmit Time — Enables entry of the **BURST** transmit time in seconds from .5 to 99.9 (default is **0.5**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

Idle Time — Enables entry of the **BURST** idle time in seconds from .5 to 99.9 (default is **4.5**). The keypad is used to enter the required time. Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

Min Length — Enables entry of the minimum frame length. The length must be between 4 and 9999 (default is **256**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

Max Length — Enables entry of the maximum frame length. The length must be between 4 and 9999 (default is **256**).Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

Payload — *(Burst and Fixed loads)* Enables selection of the type of frame payload transmitted by the analyzer (default is **SEQ TEST**). Choices include:

SEQ TEST — Selects a test frame structure as shown in Figure 25 on page 133.

USER n — (Where **n** is the number of the **USER** data pattern i.e., **1** or **2.**) Selects the test pattern as the test frame payload.

SEQ+USER n — (Where **n** is the number of the **USER** data pattern i.e., **1** or **2**.) Selects the sequential test followed by the data from the **LONG USER n** test pattern. The “FOX” payload of the test frame in Figure 25 on page 133, is replaced with the **LONG USER n** test pattern.

When **Payload** is set to **USER n** or **SEQ+USER n**, the following selection line appears:

USERn Data — (Where **n** is the number of the **USER** data pattern i.e., **1** or **2**.) When selected, the **Edit** softkey appears, enabling you to edit the data pattern. Press the **Edit** softkey to access the **USERn Data** screen and the and the following softkeys:

Clear String — Clears the entire pattern.

Abort Changes — Aborts any changes made to the pattern.

Save & Exit — Saves the pattern and exits the User Pattern screen.

Press the **MORE** key to show these additional softkeys:

Cursor Home — Moves the cursor to the first digit of the pattern.

Cursor End — Moves the cursor to the last digit of the pattern.

Save & Exit — Saves the pattern and exits the User Pattern screen.

Press the **MORE** key to show these additional softkeys:

Next Page — Moves to the next page in the pattern.

Prev Page — Moves to the previous page in the pattern.

Save & Exit — Saves the pattern and exits the User Pattern screen.

Press the **MORE** key to show the original set of softkeys.

LMI — *(All operating modes)* Selects the Link Management Interface link management type. Choices include:

OFF — Selects no link management.

AUTO — Selects auto detection of LMI messages and determines the type of LMI being used on the link.

LMI REV. 1 — Selects the frame relay consortium LMI link management.

T1.617-D — Selects ANSI T1-617 Annex D link management.

When LMI is set to **AUTO**, **LMI REV.1**, or **T1.617-D,** choices include:

Poll Time — Sets the time interval for heartbeat polling of the frame relay network. The interval can be set to any number from 5 up to 30 seconds (default is **10**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

Full Interval — Sets the Full Status Poll interval (measured in heartbeat poll cycles). The polling interval can be set to occur every 1 to 10 Poll cycles (default is **6**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

Long Frame — *(all operating modes)* Enables setting of the Long Frame threshold. The threshold can be set between 0 and 9999 octets (default is **4095**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to change the value.

Test Results

Refer to “Results View” on page 33 for a detailed description of the Large Graphical Display Results view. A typical Frame Relay Test Type results view is shown in Figure 28 on page 147.

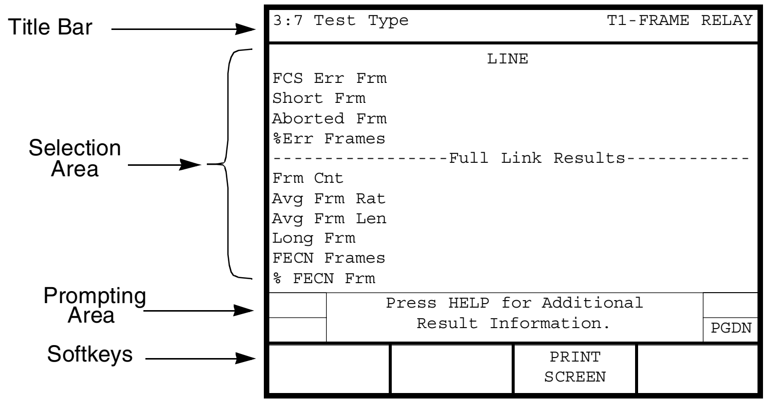


Figure 28 • Frame Relay Test Type Results

Test results for the Frame Relay option appear on the analyzer Two-Line Display. The Two-Line Display and associated controls and indicators are located on the front panel above the keypad. Refer to “Test Results Display” on page 90 for a detailed description.

Results can be generated for the aggregate total (all frame relay packets received on a single circuit) or for frame relay packets on a single DLCI (DLCI filtered). The selection line, **Show Results For:** ***(on the Test Type Setup view), specifies which results appear.***

Test results can also be listed on the Large Graphical Display Results view. Refer to “Results View” on page 33 for a detailed description.

Alarm/Status LEDs

The SIGNAL Status/Alarm LED illuminates green when the T-BERD 950 is receiving a valid signal for the configured interface. The PATTERN SYNC Status/Alarm LED illuminates green when the T-BERD 950 is receiving a valid frame relay packet.

A red illuminated LED indicates the Status/Alarm condition was present since the start of the current test.

Summary Category Results

The Summary category automatically lists the main results that are out of specification. If all results are within specification for the LINE or EQUIPMENT receiver, the message `All Results OK`appears on the appropriate side of the Two-Line Display.

There are no* Time *or* Signal Category *results for the Frame Relay option.

Interface Category Results

Interface category results are available for the physical layer interface selected. For T1 results see“Interface Category Results” on page 94 in T1 Test Results, Chapter 7. For DDS LL results see “Interface Category Results” on page 127 in the DDS LL option.

Test Type Category Results

The Test Type category results are described in Table 41.

***In the following table, the letter in brackets following the Result Name indicates whether the result applies to a single DLCI* [F]*, the aggregate total of all frame relay packets received* [A] *or both* [B].**

Table 41 • Frame Relay Test Type Results

Result Name	Description
FCS Err Frm [B] (FCS Errored Frames)	Counts the errored frames detected, includes FCS (Frame Check Sequence) errored frames only.
Short Frm [B] (Short Frames)	Counts the short frames detected by the SCA (Serial Communications Adapter); the frame length is between 24 and 31 bits.
Aborted Frm [B] (Aborted Frames)	Counts the aborted frames detected (only available on the Two-Line Display when **Show Results For** is set to **LINK**; always available on the Large Graphical Display Results view).
%Err Frames [B] (% Errored Frames)	Displays percent of errored Frame Relay frames detected calculated as (FCS errored frames + short frames + aborted frames) ÷ Physical frame count.
Frm Cnt [B] (Frame Count)	Counts the total number of valid Frame Relay frames detected.
Avg Frm Rat [B] (Average Frame Rate)	Counts Frame Relay frames received per second, since the start of the test.
Avg Frm Len [B] (Average Frame Length)	Calculates the average frame size as an integer (Frame Relay frame octets ÷ Frame Relay frame count).
Long Frm (Long Frames)	Counts the Frame Relay frames that exceed the user-specified length in octets.
FECN Frames [B]	Counts the frames with the FECN (Forward Explicit Congestion Notification) bit set.
% FECN Frm [B] (% FECN Frames)	Displays percent of frames with the FECN bit set.
BECN Frames [B]	Counts the frames with the BECN (Backward Explicit Congestion Notification) bit set.
% BECN Frm [B] (% BECN Frames)	Displays percent of frames with the BECN bit set.

Table 41 • Frame Relay Test Type Results (Continued)

Result Name	Description
DE Frames [B]	Counts the frames with the DE (Discard Eligibility) bit set.
% DE Frames [B]	Displays percentage of frames with the DE bit set.
Lost Frm [F] (Lost Frames)	Counts TTC test frames that appear to have been lost by the network based on the test frame sequence number. This result is calculated on a single DLCI only. If the test frame length is less than 16 octets, lost frames are not counted.
% Lost Frm [F] (% Lost Frames)	Calculates percentage of TTC test frames that appear to have been lost by the network based on the test frame sequence number. This result is calculated on a single DLCI only.
LMI Type	Indicates the type of LMI available on the frame relay circuit. In **MONITOR** mode, this result is an aggregate of the LINE and EQUIPMENT receivers, but appears for the LINE receiver only.
LMI Count	Counts LMI messages received since the start of the test (an incrementing count indicates a “heartbeat”). In **MONITOR** mode, this result is an aggregate of the LINE and EQUIPMENT receivers, but appears for the LINE receiver only.
LMI Errs (LMI Errors)	Counts LMI **STATUS ENQUIRY** messages received that contained incorrect sequence numbers or an incorrect information element length. In **MONITOR** mode, this result is an aggregate of the LINE and EQUIPMENT receivers, but appears for the LINE receiver only.
LMI TMOS (LMI Timeouts)	Counts LMI **STATUS ENQUIRY** messages sent that yielded no response from the network before the next poll cycle. In **MONITOR** mode, this result is an aggregate of the LINE and EQUIPMENT receivers, but appears for the LINE receiver only.

Table 41 • Frame Relay Test Type Results (Continued)

Result Name	Description
DLCIs	Displays all configured DLCIs (Data Link Connection Identifiers) for a circuit, indicating the status of the DLCI as provided by the Full Status Poll. Deleted DLCIs apply to LMI Rev. 1 only. A status of “traffic” indicates that traffic was detected on the DLCI, but that DLCI was not listed in the Full Status Poll. **NOTE:** This result appears on the Large Graphical Display Results view.
Lost Pings	Counts echo packets that were not replied to (includes out of order echo reply packets and corrupted echo reply packets). **NOTE:** This result is only available in **TERMINATE** mode.
Tx Pings (Transmitted Pings)	Counts echo packets/frames transmitted by the analyzer since the start of the test. **NOTE:** This result is only available in **TERMINATE** mode.
Echo Pings	Counts echo replys transmitted by the analyzer since the start of the test. **NOTE:** This result is only available in **TERMINATE** mode.

Performance Category Results

Performance category results are described in Table 42.

In the following table, the letter in brackets following the Result Name indicates that the result applies to both* [B]*, a single DLCI, and the aggregate total of all frame relay packets received.

Table 42 • Frame Relay Performance Results

Result	Description
Avg % Util [B] (Average % Utilization)	Calculates 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 [B] (Maximum % Utilization)	Calculates maximum percentage of link utilization on the received channel in any one second since the start of the test.
Avg Thruput [B] (Average Throughput)	Calculates average received throughput since the start of the test, calculated as (total Frame Relay Frame bits (header + UDF + CRC) ÷ total seconds).
Max Thruput [B] (Maximum Throughput)	Calculates maximum received throughput, in bits per second, during any one second since the start of the test.
Avg Png Dly (Average PING Delay)	Calculates average round trip delay, measured in milliseconds, since the start of the test. **NOTE:** This result is only available in **TERMINATE** mode.
Max Png Dly (Maximum PING Delay)	Calculates maximum round trip delay, measured in milliseconds, since the start of the test. **NOTE:** This result is only available in **TERMINATE** mode.
Min Png Dly (Minimum PING Delay)	Calculates minimum round trip delay, measured in milliseconds, since the start of the test. **NOTE:** This result is only available in **TERMINATE** mode.

Alarm Messages

Table 43 provides a list of results that appear on the Results Alarms view, along with a description of the alarm.

Table 43 • Frame Relay Alarms

Result	Description
Inactive Tx DLCI	Indicates the DLCI entered as the transmit address is not valid. There is not an active PVC associated with this DLCI
Rx Overflow	Indicates when frames are dropped by the receiver.

ISDN PRI Option

This section provides step-by-step instructions for the ISDN Primary Rate Interface (PRI) option for the T-BERD 950 and discusses the following topics:

- Option Description
- TNT Setups
- Manual Test Setups
- Test Results

Option Description

The ISDN Primary Rate Interface (PRI) option, in conjunction with the Protocol Services Board option, enables the T-BER D950 Communications Analyzer to initiate, answer, or monitor ISDN PRI calls via the T1 interface. The option can be connected to ISDN circuits terminated by the following switches: AT&T 5ESS Ver. 9 (or later), NT DMS 100 Ver. BCS 38 (or later), and National ISDN-2 (NI-2) compliant switches.

In Terminate mode, the option has the capability to connect two calls simultaneously (two incoming, two outgoing, or one incoming and one outgoing). For example, it can call itself on a different B-channel. The interface can BER test up to two data calls or connect up to two voice calls. The call setup for these calls does not have to occur simultaneously. The call generation capability of the option enables you to specify the type of service to be connected (Voice, 56 kbps, 64 kbps, H0, H11, Nx64, or Nx56).

When the call setup acknowledge message is received for incoming or outgoing calls, it connects the speaker and microphone for that call. You can also change the connection of the call dynamically. A call can be dynamically connected to BERT, 1004 Hz tone, or Speaker/Microphone. If the ISDN PRI option is connected to two voice calls simultaneously, the first call is connected to the push-to-talk interface and a holding tone is placed on the second call. The unit can measure the loopback delay for each B-channel by connecting the calls to BERT.

ISDN Services

The T-BERD 950 supports testing of Non-Facility Associated Signaling (NFAS) and NFAS/D-channel Back Up (DCBU) operation. NFAS allows a single D-channel to control multiple T1 interfaces. Up to 20 T1 interfaces can be controlled via a single D-channel utilizing NFAS. Although this alleviates the customer from allocating a DS0 on every T1 for D-channel activity (i.e., this DS0 can now be used for customer data), it introduces a higher level of risk. For example, if the primary T1 carrying the D-channel is taken out of service, the remaining associated T1s also must go out of service. This risk is minimized if NFAS service is ordered with back-up D-channel functionality. This functionality enables a standby D-channel to become activated if the IS D-channel is no longer reliable. The standby D-channel is dedicated to a DS0 on a secondary T1.

Operating Modes

The ISDN PRI option operates in one of two modes, Monitor mode or Terminate mode. The following paragraphs discuss each mode in detail.

Monitor Mode

In Monitor mode, the option monitors both directions of the ISDN D-channel. The mainframe is capable of collecting results on the D-channel simultaneously with the T1 interface specific results. Refer to “Test Results” on page 171 for a listing of the ISDN PRI option results.

Terminate Mode

In Terminate mode, the option emulates a TE (Terminal Equipment) device such as a PBX, a router, or an I-MUX. The analyzer originates all required frames for terminal emulation, Layer 2 startup, and basic call processing for the AT&T 5ESS, NT DMS 100, and NI-2 switches. When terminating a link, the results collected are for the received D-channel only.

Option Specifications

Refer to “T1 Specifications” on page 43 for ISDN PRI option specifications.

Setting Up TNT

This section describes the TNT test setups for the ISDN PRI option. A sample TNT Setup view is shown in Figure 29.

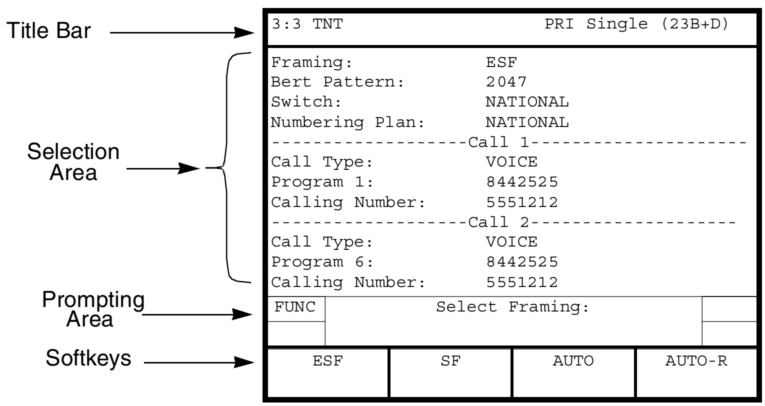


Figure 29 • ISDN PRI TNT Setup View

Performing T1 Interface ISDN PRI Turn-up

Table 44 lists the TNT test setup for performing T1 Interface ISDN PRI Turn-up in PBX Emulation. For descriptions of the test setup parameters, see “Setting Up Manual ISDN Test” on page 161. For descriptions of all results see“Test Results” on page 171.

The objective of these tests is to verify that a circuit can place and receive voice and data calls through the CO switch, then perform a BER test, if applicable. This verifies that there are no problems associated with improper switch translations, service configurations, specific DS0 errors, or D-channel signaling.

Table 44 • ISDN PRI Turn-up (PBX Emulation)

Test	TNT Setup	TNT Results
SINGLE CALL (23B+D) In this scenario, the T-BERD 950 is used to place and receive voice and data calls to either a known telephone number or to an ISDN test line such as the TPI 560P.	Framing (ESF) Bert Pattern (2047) Switch (NATIONAL) Numbering Plan (NATIONAL) --------CALL 1/2------------ Call Type (VOICE) Call Mode (Prog 1/6) Program 1/6 () Calling Number ()	BPVs CRC Errors Frm Count Layer 2 Stat Call Status Reports
NFAS/DCBU — (46B+2D) In this scenario, the T-BERD 950 is used to place and receive voice and data calls to either a known telephone number or to an ISDN test line such as the TPI 560P.	Framing (ESF) Bert Pattern (2047) Switch (NATIONAL) Numbering Plan (NATIONAL) Equip Intf # (0) Line Intf # (0) --------CALL 1/2------------ Call Type (VOICE) Call Mode (Prog 1-6) Program 1-6 () Calling Number () Interface (LINE)	BPVs CRC Errors Frm Count Layer 2 Stat Call Status Reports

Table 44 • ISDN PRI Turn-up (PBX Emulation) (Continued)

Test	TNT Setup	TNT Results
MULTIPLE (47B+D) In this scenario, the T-BERD 950 is used to place and receive voice and data calls to either a known telephone number or to an ISDN test line such as the TPI 560P.	Framing (ESF) Bert Pattern (2047) Switch (NATIONAL) Numbering Plan (NATIONAL) Equip Intf # (0) Line Intf # (0) --------CALL 1/2------------ Call Type (VOICE) Call Mode (Prog 1/6) Program 1/6 () Calling Number () Interface (LINE)	BPVs CRC Errors Frm Count Layer 2 Stat Call Status Reports

Performing ISDN PRI Monitor Test

Table 45 lists the TNT test setup for performing T1 Interface ISDN PRI Monitor Test. For descriptions of the test setup parameters, see “Setting Up Manual ISDN Test” on page 161. For descriptions of all results see “Test Results” on page 171.

The objective of this test is to passively verify the ability to place and receive calls between the PBX and the CO switch by looking at live calls, T1 results, and actual D-channel decodes. In addition, T1 physical layer results such as receive level, receive frequency, BPVs, and CRCs can be gathered.

Table 45 • ISDN PRI Monitor Test

Test	TNT Setup	TNT Results
MONITOR In this scenario, you can connect to the monitor point and review the results.	Switch (NATIONAL) Line Interface # (0) D Channel # (24)	BPVs CRC errors Fram Counts Layer 2 Stat CALL STATUS REPORTS

Setting Up Manual ISDN Test

This section provides descriptions of the analyzer setup (see Figure 30) as it applies to the ISDN Primary Rate Interface (PRI) option.

Setting Up the Interface View

The Interface Setup view is used to configure the T1 interface, see “Setting Up the T1 Interface View” on page 62. The **SCROLL** and **PAGE** keys control this selection area.

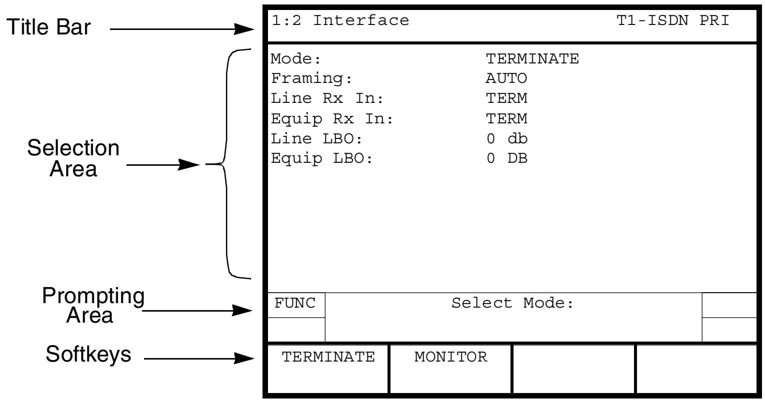


Figure 30 • ISDN PRI Setup Interface View

Setting Up the Test Type View

The ISDN PRI Test Type Setup view is used to configure the test to be performed (see Figure 31). The **SCROLL** and **PAGE** keys control this selection area.

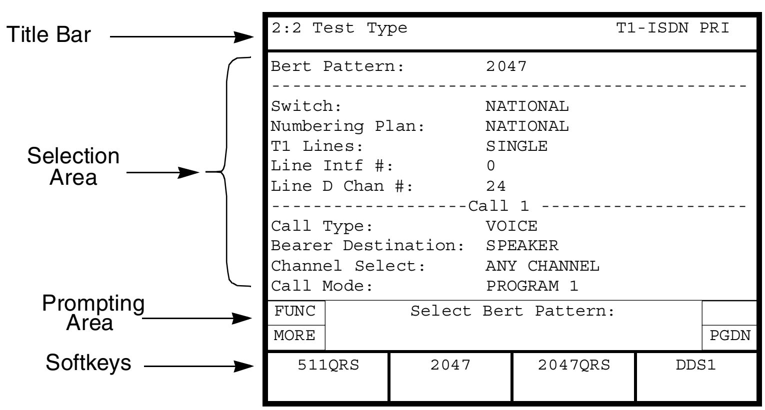


Figure 31 • ISDN PRI Setup Test Type View

Bert Pattern — Selects the appropriate BERT pattern "Setting Up the T1 Test Type View" on page 80.

Switch — Enables entry of the switch type used on the ISDN link (default is **NATIONAL**). Choices include:

AT&T — Selects theAT&T 5ESS custom as the switch type.

NT — Selects the NT DMS 100 custom as the switch type.

NATIONAL — Selects the National ISDN-2 (NI-2) as the switch type.

Numbering Plan — Enables selection of the appropriate ISDN numbering plan for the desired circuit. The six numbering plan choices include:

UNKNOWN —Unknown number in numbering plan.

INTERNATIONAL —International number in ISDN numbering plan.

NATIONAL —National number in the ISDN numbering plan.

NETWORK —Network-specific number in private numbering plan.

LOCAL — Local directory number in ISDN numbering plan.

ABBREVIATED —Abbreviated number in private numbering plan.

T1 Lines — *(TERMINATE mode only)* Specifies the number of T1 interfaces to be tested (default is **SINGLE**). The choice is:

SINGLE — Specifies a single T1 line interface to be tested. The D-channel must be located on the LINE Tx/Rx pair.

Line Intf # — Use to set the primary T1 LINE interface number; any number between 0 and 19 can be selected (default is **0**). Use either the keypad or the **INCREASE VALUE** or **DECREASE VALUE** softkeys to enter the value.

If the Line Interface # selected does not match the Line Interface # provided by the switch, the analyzer reconfigures to use the Line Interface # provided by the switch.

Line D Chan # — Use to set the D-channel number; any number between 1 and 24 can be selected (default is **24**). Use either the keypad or the **INCREASE VALUE** or **DECREASE VALUE** softkeys to enter the value.

MULTIPLE — *(TERMINATE mode only)* Allows testing of NFAS service using multiple T1s controlled by a single D-channel. The D-channel must be located on the LINE Tx/Rx pair. When selected, in addition to **Line Intf #** and **Line D Chan #**, the following parameter choice is available:

Equip Intf # — *(Multiple or NFAS/DCBU)* Use to set the T1 EQUIPMENT interface number, any number between 0 and 19 can be selected (default is **1**). Use either the keypad or the **INCREASE VALUE** or **DECREASE VALUE** softkeys to enter the value.

The Equip Intf # should not be the same as the Line Intf #.

NFAS/DCBU — Enables testing of NFAS circuits optioned with DCBU. When selected, in addition to **Line Intf #**, **Line D Chan #**, and **Equip Intf #**, Choices include:

In DCBU, the primary D-channel must be located on the T1 connected to the LINE Interface, and the secondary D-channel must be located on the T1 connected to the EQUIPMENT Interface.

Equip D Chan # — Use to set the D channel number; any number between 1 and 24 can be selected (default is **24**). Use either the keypad or the **INCREASE VALUE** or **DECREASE VALUE** softkeys to enter the value.

The following parameters must be set for each call you want to place.

Call Type — Selects the type of call to be originated by the option (default is **VOICE**). The choices include:

VOICE — Selects a voice type call.

56K — Selects an unrestricted circuit-switched data connection with 56 kbps CCITT I.463 rate adaptation.

64K UNRESTRICTED — Selects a clear channel, unrestricted, circuit-switched data connection with the full 64 kbps available for use, with no rate adaptation.

H0 — Selects an **H0** 384 kbps type data call.

H11 — Selects an **H11** 1536 kbps type data call (only available when **T1 Lines** is set to **MULTIPLE** and the call is placed on EQUIPMENT T1 Interface).

Nx64 — Selects contiguous/noncontiguous 64 kbps timeslot operation.

Nx56 — Selects contiguous/noncontiguous 56 kbps timeslot operation.

3.1K AUDIO — Selects a 3.1 kbps call type.

Bearer Destination — Selects the initial destination of the connected call (default is **SPEAKER**). Choices include:

SPEAKER — The call is initially connected to speaker/ microphone for voice conversation.

BERT— The call is initially configured for BER testing.

After the call is connected, use the Dynamic Payload softkeys to change the Bearer Destination, such as BERT or a speaker. (See "Using ISDN and Call Control Features" on page 167.)

Channel Select — Enables the user to specify a preferred channel to be used by the switch (default is **ANY CHAN**). Choices include:

ANY CHANNEL — When selected, the channel is assigned by the switch.

SPECIFIC — Enables you to specify the preferred channel to be used by the switch.

Depending on the settings you choose for **Call Type** and **Channel Select** the following choice may appear:

Channel — Selects the channel to be used; any number between 1 and 24 can be entered (default is **1**). Use either the keypad or the **INCREASE VALUE** or **DECREASE VALUE** softkeys to enter the value.

If the channel provided by the switch is different from the channel requested, the analyzer reconfigures to use the channel provided by the switch.

When **Channel Select** is set to **SPECIFIC,** the following choice appears:

Channel — Selects the channel to be used; any number between 1 and 24 can be entered (default is **1**). Use either the keypad or the **INCREASE VALUE** or **DECREASE VALUE** softkeys to enter the value.

When **Channel Select** is set to **SPECIFIC,** and **T1 Lines** is set to **MULTIPLE** or **NFAS/DCBU**, choices include:

Interface — Selects which T1 interface the outgoing call is placed on. Choices include:

LINE — Selects the T1 LINE interface to place the outgoing call.

EQUIPMENT — Selects the T1 EQUIPMENT interface to place the outgoing call.

If the **Call Type** is set to **H0** and **Channel Select** is set to **SPECIFIC**, the following parameter choice is available:

Channels — Use to set the channel group (default is **1-6**. The channel group choices are **1-6**, **7-12**, **13-18**, **19-24**.

If the **Call Type** is set to **VOICE**, **3.1K AUDIO, 56K, 64K UNRESTRICTED**, choices include:

Channel — Selects the channel to be used; any number between 1 and 24 can be entered (default is **1**). Use either the keypad or the **INCREASE VALUE** or **DECREASE VALUE** softkeys to enter the value.

If the **Call Type** is set to **Nx56** or **Nx64**, and **Channel Select** is set to **Specific**, choices include:

Channel Map — Enables entry of the channel mapping (default is **Channel 1** and **Channel 2**) to be used for the originated call using the **Edit** softkey. Press the **Edit** softkey to access the Edit Channel Map screen and the **Select/Deselect**, **Clear All**, **Abort Changes**, and **Save & Exit** softkeys.

When **Call Type** *is* **Nx56** *or* **Nx64**, *you must select at least two (2) channels for* **Channel Map.**

Call Mode — Selects the appropriate Program Number **(N)**. **PROGRAM 1** through **PROGRAM 5** (for Call 1), and **PROGRAM 6** through **PROGRAM 10** (for Call 2).

Program (N) — Enables entry of the number to be called, up to 18 digits (default is **8442525**). You may program up to five numbers on **PROGRAM 1** through **PROGRAM 5** (for Call 1), and five numbers on **PROGRAM 6** through **PROGRAM 10** (for Call 2). Use the keypad (valid keys are **0** through **9)** and softkeys (**HOME**, **END**, and **CLEAR**) to edit this field.

Calling Number — Enables entry of the Directory Number (DN) of the circuit being analyzed, up to 15 digits (default is **5551212**). Use the keypad (valid keys are **0** through **9)** and softkeys (**HOME**, **END**, and **CLEAR**) to edit this field.

Using ISDN and Call Control Features

The **ISDN CONTROL** softkey provides access to **CALL 1 CONTROL, CALL 2 CONTROL**, and **SWITCH D-CHAN** softkeys. When pressed, the Results Test Type view appears.

CALL 1 CONTROL or **CALL 2 CONTROL** provide the following choices:

DIAL CALL — Places the call.

DISC CALL — Disconnects the call in progress.

ANSWER — Answers the call if there is an incoming call present.

Dynamic Payload Softkeys provide the ability to dynamically change the payload of the call when the call is connected.

BERT — Connects the call for BERT testing

VOICE — Connects the call to the speaker/microphone.

TONE — Connects the call to a 1004 Hz tone.

SWITCH D-CHAN — (*NFAS/DCBU mode only*) This softkey initiates a D-channel backup switchover that switches the current IS D-channel to Standby, and the current Standby D-channel to IS.

You must have an In Service (IS) and a Standby D-channel to perform a DCBU switch over.

In addition to a manual switchover, the analyzer will automatically respond to the IS T1 interface being physically removed or logically removed by the network.

When physically removing the T1 jacks connected into the interface, it is recommended that you remove the T1 jacks from the analyzer, not the smart jack. Removing the connection at the smart jack could set up an automatic loopback within the smart jack that may cause problems.

Placing a Call

To place a call, choose from five possible program (or memory dial) numbers, then press the call **DIAL CALL** softkey. (See "Using ISDN and Call Control Features" on page 167 for Call Control information.)

In general, the call emulation feature must simulate a normal call setup exchange. If the call setup exchange fails, extensive error reporting in the form of a call fail report is generated.

The T-BERD 950 is capable of transmitting DTMF tones if a call progresses or connects. The microphone disables briefly while the DTMF tones are transmitted. This feature allows you to enter digits such as phone extensions in response to an automated attendant.

Answering a Call

When an incoming call is detected, the T-BERD 950 a popup window on the current view will appear. This window gives you three choices: answer the call, ignore the call, and disconnect the call.

The action you choose will cause one of several results. Those actions and results are listed in Table 46.

Table 46 • ISDN PRI Incoming Call Activitie s

Action	Result
Press **Answer** sofkey.	The call connects to the speaker and microphone (voice). You can then choose to begin BER testing if it is a data call. After the call is connected, you can dynamically change the connection, data to voice or voice to data, using softkeys.
Press **Disconnect** softkey.	The call is cleared.
Press **Ignore** softkey.	The call remains in the alerting state until the far end cancels the call or you select the ISDN Control softkey, press the appropriate Call 1 or 2 softkey, then press the Answer softkey.

Interpreting D-Channel Display

This feature shows English translations of messages received and transmitted on the D-channel. This display provides complete Q.921 and/or Q.931 text-based information for all valid ISDN frames.

For monitor mode operations, connect the LINE Tx/Rx pair towards the Network Termination (NT) equipment and the EQUIPMENT Tx/Rx pair towards the Customer Premise Equipment (CPE). This will provide proper information when determining the direction of the traffic on the D-channel. If the hookup is backwards, the direction of the traffic will be wrong.

You may activate the D-channel Display (Figure 32 on page 171) by pressing the **D-channel Display** softkey. After pressing the softkey, the Large Graphical Display shows one message at a time. Messages are captured in the order they are transmitted and/or received.

The following softkeys allow you to navigate the messages as follows:

FIRST MESSAGE — Shows first message.

LAST MESSAGE — Shows last message.

PREVIOUS MESSAGE — Shows previous message.

NEXT MESSAGE — Shows next message.

The Print softkeys are as follows:

PRINT CURRENT — Prints the current message.

PRINT TO LAST — Prints all messages from the current to the last message.

PRINT ALL — Prints messages from the first to the last message.

Press the **CLEAR STORAGE** softkey to clear all capture messages. Press the **EXIT** softkey to exit the D-channel Display and return to the Home, Setup, Results, or System view.

Status messages are shown on the Two-Line Display to indicate print activity and capture status. A message flashes when the capture buffer is full, indicating that frame capture is inactive. You must clear the capture buffer by pressing the **CLEAR STORAGE** softkey to resume frame capture. Capture storage will also be indicated as a percentage result (% full) on the Test Type Results view.

Capture storage is only maintained for the lifetime of the current test (for example, switching from PRI ISDN to BERT will clear the capture storage). Use the print softkeys to save relevant capture information before changing tests.

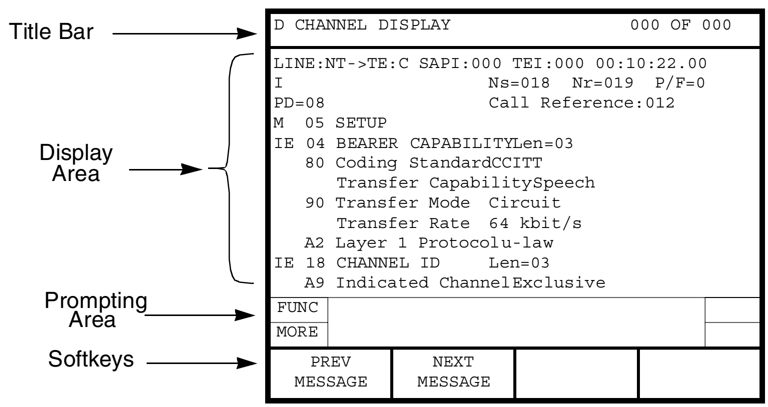


Figure 32 • ISDN PRI D-Channel Display

Test Results

Test results are shown on the T-BERD 950 analyzer screen on the Results I and II Two-Line Display. Other common results may also be available.

Test results for the ISDN PRI option are shown on the analyzer Two-Line Display. The Two-Line Display and associated controls and indicators are located on the front panel above the keypad. Refer to “T1 Test Results” on page 89 for a detailed description of the Results Display.

Test results can also appear on the Results view (refer to “Results View” on page 33).

Typical ISDN PRI Test Type results are Summary, Interface, and Test Type Category results. Each type is described in the following sections.

Summary Category Results

The Summary category automatically shows key results that are out of specification. If all results are within specification for the LINE or EQUIPMENT receiver, the message `All Results OK` appears on the appropriate side of the Two-Line Display.

Interface Category Results

Interface results are available for the T1 physical layer interface selected. See ‘Interface Category Results’ on page 94.

Test Type Category Results

Test Type category results are described in Table 47. Unless stated otherwise, all results are available in **MONITOR** and **TERMINATE** modes. BERT results are listed with the Test Type results. For descriptions of BERT results see “T1 Test Results” on page 92.

Table 47 • ISDN PRI Test Type Result s

Result Name	Description
DCBU Stat	Displays the status of the D-channel in relation to DCBU operation. A DCBU switchover can be performed when both D channels are in the Ready status. **Ready** — Indicates that the D-channel is in the proper state for DCBU operation (IS or Standby). **Not Ready** — Indicates that the D-channel is not ready and is in the Out of Service state. **Not In Serv** — Indicates that the D-channel is attempting to become the IS D-channel. The D-channel may be in this state during normal DCBU initialization and switchover operations and should eventually transition to Ready status indicating normal operation. **Not Standby** — Indicates that the D-channel should be in Standby state. This status occurs during normal DCBU initialization and switchover operations and should eventually transition to Ready status indicating normal operation.
D-Chan Stat	Displays state of the D-channel for DCBU operation. **In Service —** The indicated D-channel is the IS D-channel and is operating normally. **Standby** — The indicated D-channel is the Standby D-channel and is operating normally. **Out of Service —** The indicated D-channel is currently Out of Service, indicating problems in the operation of the D-channel. **Wait** — The indicated D-channel is waiting to become the IS D-channel. **Maint Busy —** The indicated D-channel declines establishment attempts while the other D-channel is becoming IS (Wait State).
Layer2 Stat	Displays Layer 2 Status Values include: TEI Not Assigned, Awaiting TEI, Link Not Established, Awaiting Establishment, Link Established, Timer Recovery, Awaiting Release, TEI Denied, Link Unknown. If the status is Link Not Established, a flashing two-line message appears on RESULTS I and or RESULTS II to indicate that calls cannot be placed.
Frm Count	Counts the valid ISDN frames received.
Err Frm	Counts the errored frames received with at least one of the following conditions: undefined control field, U frame with an improper length, and I frame with a length exceeding limit.

Table 47 • ISDN PRI Test Type Results (Continued)

Result Name	Description
Aborted Frm	Counts the aborted ISDN frames received, excluding Out of Frame aborts.
Reject Frm	Counts the received frames with a sequence number error.
Frm Rejects	Counts the received frames with ISDN Frame Reject frames. A Frame Reject is sent when a device receives a frame with a protocol error.
Invalid Frm	Counts the frames with at least one of the following invalid conditions: short frame, FCS errored frame, single octet address, and unapproved Service Access Point Identifier (SAPI).
Act Calls	Counts the total number of currently active calls. Includes calls in progress, connected calls, and calls being disconnected.
Comp Calls	Counts the number of completed calls that successfully connect and disconnect.
Call Fails	Counts the number of call attempts that ended in call failure (does not include busy replies or normal call clears).
Call 1 and Call 2 Status	**Call Status** — Displays current call status. **Call Type** — Displays **DATA** or **VOICE** call type. **Caller ID** — Displays the number from where the call is being placed. **Channel #** — Displays the **Bearer Channel** being used by the call. **Cause Code**[a] — Displays the plain English text for the Cause Code. **Location** — Displays the location of the Cause Code.
Call Failure Report	Displays the status of the last 5 failed ISDN calls. **Call Type** — Displays **DATA** or **VOICE** call type. **Channel #** — Displays the **Bearer Channel** being used by the call. **Cause Code** — Displays the plain English text for the Cause Code. **Location** — Displays the location of the Cause Code. **Calling # —** Displays the number from where the call is being placed. **Called # —** Displays the number to where the call is being placed.
Call Progress Report	Displays the status of the last five ISDN calls. **Call Status —** Displays current call status. **Call Type** — Displays **DATA** or **VOICE** call type. **Channel #** — Displays **Bearer Channel** being used by the call. **Calling # —** Displays the number from where the call is being placed. **Called # —** Displays the number the call.

Table 47 • ISDN PRI Test Type Results (Continued)

Result Name	Description
% FULL	Displays the current amount of storage used (% full) for D-channel message capture.
Messages	Displays the current number of messages available to the D-channel display (see “Interpreting D-Channel Display” on page 170).

a. The analyzer interprets the Cause code for you; however, a complete list of Cause Codes can be found in Table 48, on page 176,

Sample Test Type Results

D-channel Back Up Results are shown in Figure 33. Call Status Results are shown in Figure 34.

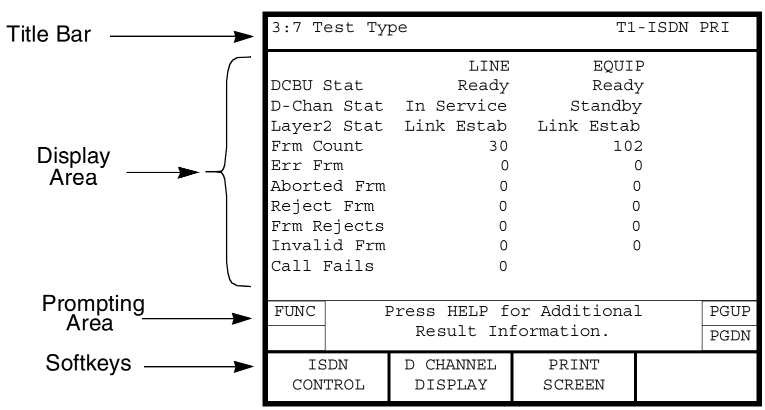


Figure 33 • ISDN PRI D-channel Backup Results

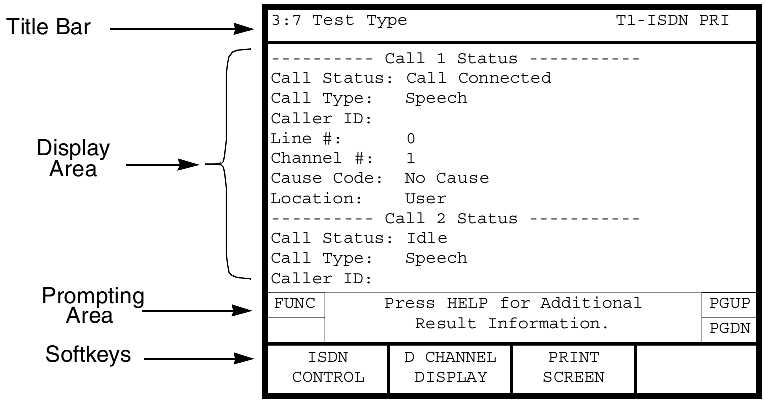


Figure 34 • ISDN PRI Call Status Results

ISDN Q.931 Cause Codes

Table 48 provides English translations of Q.931 messages received and transmitted on the D-channel.

Table 48 • ISDN PRI Results Reports Cause Code s

Class	Value	No.	Cause Code
— Q.931 Cause Codes (1988) —			
000	0001	1	Unassigned number.
	0010	2	No route to specified transit network.
	0011	3	No route to destination.
	0110	6	Channel unacceptable.
	0111	7	Call awarded and being delivered in an established channel.

Table 48 • ISDN PRI Results Reports Cause Codes (Continued)

Class	Value	No.	Cause Code
001	0000	16	Normal call clearing.
	0001	17	User busy.
	0010	18	No user responding.
	0111	19	No answer from user (user alerted).
	0101	21	Call rejected.
	0110	22	Number changed.
	1010	26	Non-selected user clearing.
	1011	27	Destination out of order.
	1100	28	Invalid number format.
	1101	29	Facility rejected.
	1110	30	Response to STATUS INQUIRY.
	1111	31	Normal, unspecified.
010	0001	34	No circuit/channel available.
	0110	38	Network out of order.
	1001	41	Temporary failure.
	1010	42	Switching equipment congestion.
	1011	43	Access information discarded.
	1100	44	Requested circuit/channel not available.
	1111	47	Resources unavailable, unspecified.
011	0001	49	Quality of service unavailable.
	0010	50	Requested facility not subscribed.
	0110	54	Incoming calls barred[a]
	1001	57	Bearer capability not authorized.
	1010	58	Bearer capability not presently available.
	1111	63	Service or option not available, unspecified.
100	0001	65	Bearer capability not implemented.
	0010	66	Change type not implemented.
	0101	69	Requested facility not implemented.
	0110	70	Only restricted digital information bearer capability is available.
	1111	79	Service or option not implemented, unspecified.

Table 48 • ISDN PRI Results Reports Cause Codes (Continued)

Class	Value	No.	Cause Code
101	0001	81	Invalid call reference value.
	0010	82	Identified channel does not exist.
	0011	83	A suspended call exists, but this call identity does not.
	0100	84	Call identity in use.
	0101	85	No call suspended.
	0110	86	Call having the requested call identity has been cleared.
	1000	88	Incompatible destination.
	1011	91	Invalid transit network selection.
	1111	95	Invalid message, unspecified.
110	0000	96	Mandatory information element is missing.
	0001	97	Message type nonexistent or not implemented.
	0010	98	Message not compatible with call state or message type nonexistent or not implemented.
	0011	99	Information element nonexistent or not implemented.
	0100	100	Invalid information element contents.
	0101	101	Message not compatible with call state.
	0110	102	Recovery on timer expired.
	1111	111	Protocol error, unspecified.
111	1111	127	Interworking, unspecified.
— National-specific Cause Codes Defined in TA-NWT-001268 —			
000	0100	4	Vacant code.
	1000	8	Prefix 0 dialed in error.
	1001	9	Prefix 1 dialed in error.
	1010	10	Prefix 1 not dialed.
	1011	11	Excessive digits received, call is proceeding.
110	0101	101	Protocol error, threshold exceeded.

a. This code was defined in the 1984 revision of Q.931, but omitted from the 1988 revision. The DMS 100 switch supports this code.

Signaling Option

This section provides step-by-step instructions for using the Signaling option and discusses the following topics:

- Option Description
- TNT Test Setups
- Manual Signaling Test Setups
- Test Results

Option Description

The Signaling option enables the T-BERD 950 Communications Analyzer to perform signaling tests and to test against different trunk types. In addition, this option enables the analyzer to establish a voice or data call so that the microphone, PCM TIMS option (if installed), or BERT source/sync can transmit/receive tones, voice, or data without dropping the call.

The external interface to the Signaling option is the T1 interface (both LINE and EQUIPMENT connectors are used). The PCM in-band robbed bit signaling works with channel data dropped from or inserted in a T1 line.

Operating Modes

The Signaling option operates in one of the following T1 operating modes: Terminate, Drop & Insert, or Monitor mode. The following paragraphs provide a brief discussion of each mode.

Terminate Mode

In Terminate mode both sides of a T1 path are separated; the input signal is terminated at the receive side; and a totally independent signal is generated for the output.

Drop & Insert Mode

The Drop & Insert mode enables the analyzer to access specific channels from the T1 line while leaving the other channels unaffected.

Monitor Mode

Monitor mode enables you to monitor originating sequences (originating supervision events and digits) transmitted on one line and monitor terminating response sequences (terminating supervision events) on the other line. While in Monitor mode, data cannot be inserted on a T1 line. This test is used to monitor two in-service switches that are communicating with each other.

You can select the trunk type of the lines monitored and the direction to the station or central office, thus enabling the analyzer to recognize the originating line automatically. The speaker is enabled at all times during the test so you can listen to the channel data being dropped. The speaker allows you to listen to one or both directions of the full duplex DS0 channel being monitored. The signaling scan feature allows the unit to cycle through the channels sequentially and automatically selects the first channel on which an off-hook signaling event is detected.

Signaling Sequence Types

The following paragraphs describe the signaling sequence types available for use with the Signaling option.

Call Origination Signaling

Call Origination enables the analyzer to transmit complex sequences of supervision events and digits (pre-defined sequences and manual dialing is supported) to switches/PBXs to test the ability of switching equipment to receive incoming calls.

TERMINATE or D&I must be selected on the Setup Interface view (for T1) in order to run this test.

Pre-defined Signaling Sequences

Pre-defined signaling sequences enable you to program complex signaling sequences that emulate switch-to-switch or PBX-to-switch communications. Both originating and terminating supervision events, as well as digits, can be programmed in a sequence. The originating supervision events and digits are transmitted by the test set, while terminating supervision events are received by the test set and provide handshaking with the digit-receiving device. Up to 64 digits/supervision events can be programmed into a sequence. Digits are transmitted as programmed in the sequence. The Dial Tone is a terminating supervision event and can also be programmed into a sequence. After the pre-programmed sequence is selected, you can initiate transmission.

Manual Dialing Signaling

Manual dialing enables you to originate a call just as if a regular telephone was being used. The following digit types are available for use in manual dialing: Dial Pulse (DP), Multifrequency (MF), and Dual Tone Multifrequency (DTMF). You must press the On Hook and Off Hook softkeys (located on the Signaling Test Type Results Test Type view) at the appropriate time to complete a call. The speaker is enabled at all times during the test so that you can listen to the channel data being dropped and inserted.

Call Termination Signaling

Call Termination enables the analyzer to emulate a switch/PBX in order to receive a signaling sequence from a far end PBX/switch.

TERMINATE or D&I must be selected on the Setup Interface view (for T1) in order to run this test.

In Call Termination, a pre-defined sequence of originating supervision events, digits, and terminating supervision events is required. The originating supervision events and digits are received by the analyzer, while the terminating supervision events are transmitted by the analyzer and provide the handshaking with the digit-sending device. Up to 64 digits/supervision events can be programmed into a sequence. These sequences are the same sequences used for call origination. See 'Call Origination Signaling' on page 181. The Dial Tone is considered to be a terminating supervision event, which can also be programmed into a sequence.

Signaling Trunk Types

The Trunk Type signaling is used to define the On Hook and Off Hook signaling status of the A, B, C, and D signaling bits. All trunk types are available regardless of the T1 Interface framing mode (e.g., SLC trunk types can be selected without SLC framing). The available trunk types are Standard (E&M), Ground Start, Loop Start, and User Defined. The following paragraphs describe each trunk type. An 'X' indicates a "don't care" condition, and a '/' indicates switching.

Standard (E&M) Signaling

The standard E&M signaling is used on trunks between switches in the public switched telephone network (PSTN). The E&M signaling is listed in Table 49.

Table 49 • Standard E&M Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT:	On Hook	A=0 B=0 (C=0 D=0)
	Off Hook	A=1 B=1 (C=1 D=1)
RECEIVE:	On Hook	A=0 B=X (C=0 D=X)
	Off Hook	A=1 B=X (C=1 D=X)

Ground Start Signaling

Ground Start trunk type circuits provide additional supervision to prevent outgoing calls commencing on circuits with incoming calls present. The signaling for the various types of Ground Start trunks [Foreign Exchange Station (FXS), Foreign Exchange Office (FXO), Subscriber Line Carrier (SLC) Station, and SLC Office] is as follows:

Ground Start FXS Signaling

The Ground Start FXS signaling is described in Table 50.

Table 50 • Ground Start FXS Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT	On Hook	A=0 B=1 (C=0 D=1)
	Ground	A=0 B=0 (C=0 D=0) Ground on Ring
	Off Hook	A=1 B=1 (C=1 D=1) Loop closed after the far end FXO sends A=0 (Ground on Tip)

Table 50 • Ground Start FXS Signaling (Continued)

Direction	Trunk Status	Signaling Bits
RECEIVE	On Hook	A=1 B=X (C=1D=X) No Tip Ground
	Off Hook	A=0 B=1 (C=0 D=1) Tip Ground
	Ringing	A=X B=0 (C=X D=0)

Ground Start FXO Signaling

The Ground Start FXO signaling is described in Table 51.

Table 51 • Ground Start FXO Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT	On Hook	A=1 B=1 (C=1 D=1) No Ground on Tip
	Off Hook	A=0 B=1 (C=0 D=1) Ground on Tip
	Ringing	A=0 B=0 (C=X D=0)
RECEIVE	On Hook	A=0 B=1 (C=0 D=1) Loop Idle
	Ground	A=0 B=0 (C=0 D=0) Ground on Ring
	Off Hook	A=1 B=1 (C=1 D=1) Loop closed

Ground Start SLC Station Signaling

Ground Start SLC Station signaling is described in Table 52.

Table 52 • Ground Start SLC Station Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT	On Hook	A=0 B=0
	Ground	A=0 B=1 Ground on Ring
	Off Hook	A=1 B=0 Loop closed after the far end FXO sends B=0 (Ground on Tip)
RECEIVE	On Hook	A=0 B=0 No Tip Ground
	Off Hook	A=0 B=0/1 Tip Ground
	Ringing	A=1 B=1/0

Ground Start SLC Office Signaling

Ground Start SLC Office signaling is described in Table 53.

Table 53 • Ground Start SLC Office Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT	On Hook	A=0 B=0 No Ground on Tip
	Off Hook	A=0 B=0/1
	Ringing	A=1 B=1/0
RECEIVE	On Hook	A=0 B=0 Loop Idle
	Ground	A=0 B=1 Ground on Ring
	Off Hook	A=1 B=1 Loop closed

Loop Start Trunk Type Signaling

The Loop Start trunk type circuits emulate standard signaling between a telephone and a switch. The signaling for the various types of Loop Start trunks (FXS, FXO, SLC Station, and SLC Office) is as follows.

Loop Start FXS Signaling

Loop Start FXS signaling is described in Table 54.

Table 54 • Loop Start FXS Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT:	On Hook	A=0 B=1 (C=0 D=1)
	Off Hook	A=1 B=1 (C=1 D=1) Loop closed
RECEIVE:	On Hook	A=0 B=1 (C=0 D=1)
	Off Hook	A=0 B=1 (C=0 D=1)
	Ringing	A=X B=0 (C=X D=0)

Loop Start FXO Signaling

Loop Start FXO signaling is described in Table 55.

Table 55 • Loop Start FXO Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT:	On Hook	A=0 B=1 (C=0 D=1)
	Off Hook	A=0 B=1 (C=0 D=1)
	Ringing	A=0 B=0 (C=0 D=0)
RECEIVE:	On Hook	A=0 B=X (C=0 D=X) Loop Idle
	Off Hook	A=1 B=X (C=1 D=X) Loop closed

Loop Start SLC Station Signaling

Loop Start SLC Office signaling is described in Table 56.

Table 56 • Loop Start SLC Station Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT	On Hook	A=0 B=0
	Off Hook	A=1 B=0 Loop closed
RECEIVE	On Hook	A=1 B=1 Idle
	Off Hook	A=1 B=1 Idle
	Ringing	A=1 B=1/0

Loop Start SLC Office Signaling

Loop Start SLC Office signaling is described in Table 57.

Table 57 • Loop Start SLC Office Signaling

Direction	Trunk Status	Signaling Bits
TRANSMIT	On Hook	A=1 B=1 Idle
	Off Hook	A=1 B=1 Idle
	Ringing	A=1 B=1/0
RECEIVE	On Hook	A=0 B=0 Loop Idle
	Off Hook	A=1 B=0 Loop closed

User-Defined Trunk Type Signaling

The user-defined trunk type signaling enables you to specify your own signaling states for On Hook and Off Hook signaling status. Transmit states can vary from the receive states. The signaling bit settings are 0, 1, and “don’t care.” The “don’t care” is treated as a 1 when transmitted.

The On Hook and Off Hook signaling bits are duplicated for both the transmit and receive sides.

Programmable Signaling Elements

A pre-defined signaling sequence can contain both originating and terminating supervision events as well as digits. Up to 64 supervision events/digits can be pre-programmed into a sequence. The analyzer can store five origination sequences and five termination sequences. The digit type and associated symbols are detailed in Table 58 and the supervision events and associated symbols are detailed in Table 59. When an element in a sequence does not match with the test, that element is ignored by the test.

Table 58 • Digit Type Symbols for User-Defined Signalin g

Digit Type	Digit Symbol
DP	0 through 9
DTMF	0 through 9, A, B, C, D, #, *
MF	0 through 9, KP, ST, STP, ST2P, ST3P

Table 59 • Supervision Event Symbols for User-Defined Signalin g

Supervision Event	Supervision Event Symbol
Originating On Hook	O
Originating Off Hook	H
Originating Ring	R
Ground on Ring	G
Originating Pause	P
Terminating On Hook	o
Terminating Off Hook	h
Terminating Wink	w
Terminating Delay Dial	d
Terminating Dial Tone	t

For Ground Start Trunk selections, the Off Hook sequence is automatically initiated.

Option Specifications

The Signaling option signaling element specifications are provided in Table 60.

Table 60 • Signaling Option Specificatio n s

Item	Specification
Transmit Signaling Element	
Tone Digit Duration:	70 msec
Tone Digit Inter-digit Time:	70 msec
Pulse Digit Pulse Per Second:	10
Pulse Digit %Break:	60
Pulse Digit Inter-digit Time:	800 msec
Consecutive Originating Event Delay[a]:	60 msec
Consecutive Terminating Event Delay:	60 msec
Tone Digit Level:	-7 dBm
Wink Delay:	200 msec
Wink Duration:	150 msec
Delay Dial Delay:	200 msec
Delay Dial Duration:	150 msec
Origination Off Hook:	> 600 msec
Receive Signaling Element	
Wink Delay:	0 to 16 sec
Wink Duration:	70 msec to 600 msec
Delay Dial Delay:	0 to 16 sec
Delay Dial Duration:	70 msec to 16 sec
Off Hook Delay:	0 to 60 sec
Off Hook Duration:	> 600 msec
Pulse Digit Pulse Per Second:	7 to 21 pps
Pulse Digit %Break:	40 to 68%
Pulse Digit Inter-digit Time:	> 300 msec
Tone Digit Frequency:	< ± 2.5%
Tone Digit Level:	> -30 dB
MF Twist:	< ± 6 dB
DTMF Twist Low Freq relative to High Freq:	-4 dB to 8 dB
Tone Digit Duration:	> 30 msec
Tone Digit Inter-digit Time:	> 25 msec
Disconnect Time:	5 sec

a. In an H O sequence, there is no terminating event with which to handshake; so the event On Hook is sent 60 msec after the Off Hook event.

Option Messages

The message `Sequence Fail` flashes on the Two-Line Display when a pre-defined Call Origination or Call Termination sequence is not satisfied by the signaling events that occurred on the line. This message also appears when a signaling event delays more than 60 seconds.

Setting Up TNT

This section describes the TNT test setups to perform a T1 Interface PBX/Switch Turn-up.

Performing T1 Interface PBX/Switch Turn-up

Table 61 lists the TNT test setups for PBX/Switch Turn-up. For descriptions of the test setup parameters, see "Setting Up the T1 Interface View" on page 62. For descriptions of all results see "T1 Test Results" on page 92.

The objective of this test is to verify that the circuit can be used to place or receive a voice call. When the test is performed at the NIU access point, the call is tested through the CO switch while at a T1 access point. When the test is performed at the DSX access point, the call is tested while at a T1 access point. This will verify that there are no problems associated with improper timing, improper number of digits, wrong digit type, and/or overall switch translations.

Table 61 • T1 Interface PBX/Switch Turn-up

Test	TNT Setup	Results Summary
Voice Call — NIU In this scenario, the technician is usually located at the customer premise at the Network Interface Unit (NIU) or a HTU-R. The T-BERD 950 is emulating a PBX or CO Switch. The test is performed after the T1 physical layer has been tested and the actual voice service has been activated by the switch technician. Normally, a call is placed to any known telephone number.	Framing (ESF) Channel (1) Line Coding (B8ZS) Tx Timing (RECOVERED) Drop to Speaker (BOTH) Trunk (E&M) Emulate (FXS) Seq Type (DIAL) Dial Seq (MANUAL)	BPVs CRC Errors T1 Rcv Frq T1 Rcv Lvl (dB) Signaling Events
Voice Call — DSX In this scenario, the technician is located within a central office at a DSX patch panel. The T-BERD 950 is emulating a PBX or CO Switch. The test is performed after the T1 physical layer has been tested and the actual voice service has been activated by the switch technician. Normally, a call is placed to any known telephone number.	Framing (ESF) Channel (1) Line Coding (B8ZS) Insert Side (LINE TX) Drop to Speaker (BOTH) Trunk (E&M) Seq Type (DIAL) Dial Seq (MANUAL) Emulate (FXS)	BPVs CRC Errors T1 Rcv Frq T1 Rcv Lvl Signaling Events

Performing T1 Monitor Tests

The purpose of the Voice Monitor test verifies the ability to place and receive calls between the PBX and the CO switch by looking at the completion of live calls. Table 62 provides detailed test scenarios, TNT setup items, and test results.

Table 62 • T1 Monitor Tests

Test	TNT Setup Items	TNT Results
VOICE In this scenario, you can connect to the monitor point and review the results.	Channel (1) Drop to Spkr (BOTH) Trunk (GROUND START) Origin (FXS) Origin Side (LINE) Sig Scan (DISABLE)	T1 Rcv Lvl T1 Rcv Freq CRCs BPVs Timing Slips Signaling Scan Status Active Channel ABCD Bits Signaling Events

Setting Up Manual Signaling Test

This section provides descriptions of the new test setup parameters as they apply to the Signaling option.

Setting Up the Interface View

The T1 Interface Setup View is used to configure the T1 interface (see Figure 35). The **SCROLL** and **PAGE** keys are used to control this selection area.

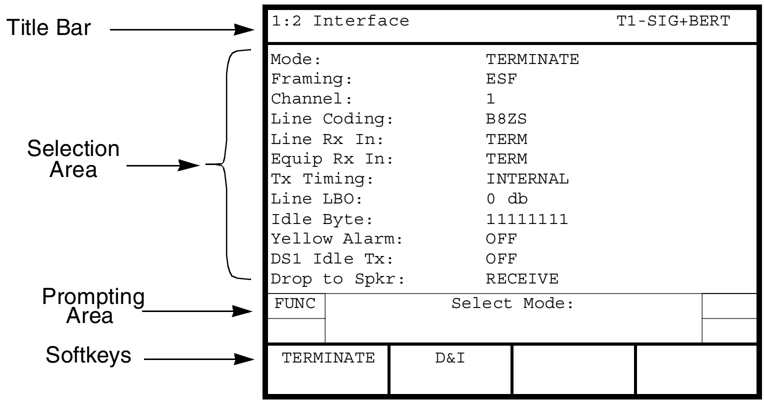


Figure 35 • Signaling Setup Interface View

The following additional parameter choices are available when Signaling is the selected test type.

When **Framing** is set to **SF**, the following parameter is available:

> **Channel Format** — Used to select the timeslot to channel assignment format (default is **D3/D4**). Choices include **D1D**, **D2**, or **D3/D4**.

Drop to Speaker — *(TERMINATE or D&I modes)* Selects which line is dropped to the speaker (default is **RECEIVE**). Choices include **RECEIVE**, **TRANSMIT**, or **BOTH**.

When **Mode** is set to **MONITOR,** the choices are **LINE**, **EQUIP**, or **BOTH**.

Setting Up the Test Type View

The Signaling Test Type Setup view (see Figure 36) configures the Signaling option. The **SCROLL** and **PAGE** keys control this selection.

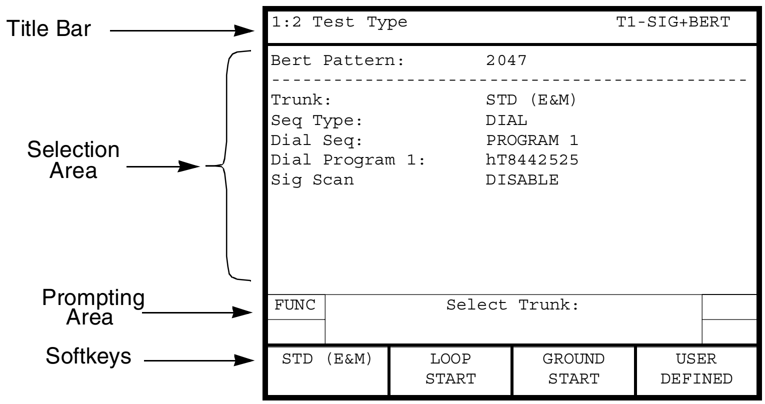


Figure 36 • Signaling Setup Test Type View

The following parameters and associated choices are available when the **Test Type** (selectable on the **Home** view) is set to either **SIG** or **SIG+BERT** (or **SIG+TIMS** if the PCM TIMS option is installed).

Trunk — *(all operating modes)* Enables selection of the trunk type which defines the On Hook and Off Hook signaling status for the A, B, C, and D signaling bits (default is **STD (E&M)**). Choices include:

> **STD (E&M)** — Selects the standard E&M signaling used on trunks between switches in the public switched telephone network.
>
> **LOOP START** — Selects the Loop Start trunk type that emulates standard signaling between a telephone and a switch. When selected, the following parameter choice is available:
>
> > **Emulate** — *(Loop and Ground Start)* Selects the type of emulation used on the trunk (default is **FXS**). Choices include:

FXS — Selects Foreign Exchange Station as the emulation type.

FXO — Selects Foreign Exchange Office as the emulation type.

SLC STATION — Selects SLC Station as the emulation type.

SLC OFFICE — Selects SLC Office as the emulation type.

GROUND START — Selects the Ground Start trunk type that provides additional supervision to prevent outgoing calls on circuits with incoming calls. Same choices as **Loop Start**.

USER DEFINED — Enables you to specify the On Hook and Off Hook signaling states:

Bit A — *(SF and ESF framing)* Used to define the A signaling bit (default is **1**). The choices are **1** and **0.**

Bit B — *(SF and ESF framing)* Used to define the B signaling bit (default is **1**). The choices are **1** and **0**.

Bit C — *(ESF framing)* Used to define the C signaling bit (default is **1**). The choices are **1** and **0**.

Bit D — *(ESF framing)* Used to define the D signaling bit (default is **1**). The choices are **1** and **0**.

Origin — *(TERMINATE mode only)* Selects the type of emulation where the originator of the call is connected. Use the same choices as **Emulate** (default is **FXS**).

Origin Side — *(MONITOR mode only)* Selects T1 interface where the originator of the call is connected (default is **LINE**). Choices include:

LINE — Selects the T1 LINE interface.

EQUIP — Selects the T1 EQUIPMENT interface.

Seq Type — *(TERMINATE and D&I modes only)* Selects sequence type to be used. The choices are **DIAL** or **RECEIVE** (default is **DIAL**).

When sequence type is **DIAL**, choices include:

Dial Seq — Selects the Call Origination sequence transmitted by the analyzer; both preprogramming sequences and manual dialing are selectable (default is **PROGRAM 1**). Choices include:

MANUAL DIAL — Enables manual dialing. Use the keypad and softkeys to place the call.

PROG N — Selects **Dial Program N** (where **N i**s the number of the Dial Program sequence, 1 through 5.) as the sequence to be transmitted by the analyzer.

Dial Program N — (Where **N** is the number of the Dial Program sequence, 1 through 5.) Enables setting the **Dial Program N** pattern. (The program string can be up to 64 supervision event/digits, see Table 59, on page 190, for the valid supervision event symbols). Use the keypad to enter numeric values and the softkeys to enter supervision events.

Use the* MORE *key to access additional softkeys used in editing the sequence.

(O)n Hook — Selects Originating On Hook supervision event.

Off (H)ook — Selects Originating Off Hook supervision event.

(R)ing — Selects Originating Ring supervision event.

(P)ause — Selects Origination Pause supervision event.

(w)ink — Selects Terminating Wink supervision event.

(d)elay dial — Selects Terminating Delay Dial supervision event.

(o)n hook — Selects Terminating On Hook supervision event.

off (h)ook — Selects Terminating Off Hook supervision event.

dial (t)one — Selects Terminating Dial Tone supervision event.

DTMF — Selects the Dual Tone Multifrequency digit type.

DP — Selects the Dial Pulse digit type.

MF — Selects the Multifrequency digit type.

When **RECEIVE** is the selected sequence type the following parameters are available:

Rcv Seq — Selects the preprogramming Call Termination sequence to be used by the analyzer (default is **PROGRAM 1**). Choices include **PROGRAM 1** through **PROGRAM 5**.

Rcv Program N — (Where **N** is the number of the Receive Program sequence, 1 through 5.) Enables setting the **Rcv Program N** pattern. (The program string can be up to 64 supervision event/digits, see Table 59 for the valid supervision event symbols). Use the keypad to enter numeric values and the softkeys to enter supervision events. Press **More** to cycle through the available softkey selections.

Dial Program N — (Where **N** is the number of the Receive Program sequence, 1 through 5.) Enables setting the **Rcv Program N** pattern. (The program string can be up to 64 supervision event/digits, see Table 59 for the valid supervision event symbols). Use the keypad to enter numeric values and the softkeys to enter supervision events. Press **More** to cycle through the available softkey selections.

Notice the softkeys* (O)n Hook *and* (o)n hook. *These softkeys are not duplicates; each softkey performs a specific supervision event function.

(O)n Hook — Selects the Originating On Hook supervision event.

Off (H)ook — Selects the Originating Off Hook supervision event.

(R)ing — Selects the Originating Ring supervision event.

(G)nd on Ring — Selects the Ground on Ring supervision event.

(P)ause — Selects the Origination Pause supervision event.

(w)ink — Selects the Terminating Wink supervision event.

(o)n Hook — Selects the Terminating On Hook supervision event.

off (h)ook — Selects the Terminating Off Hook supervision event.

(d)elay dial — Selects the Terminating Delay Dial supervision event.

dial (t)one — Selects the Terminating Dial Tone supervision event.

Sig Scan — *(Monitor mode only)* Activates signaling scan feature, which enables the unit to automatically select the first channel on which signaling events are detected. Choices include:

Enable — Activates the signaling scan feature. The unit cycles through the channels sequentially and automatically selects the first channel on which an off-hook signaling event is detected. The selected channel is then displayed in the Test Type Setup and Results Views. Status of the signaling scan (enabled or disabled) is also displayed in the Results View.

Disable — Deactivates the signaling scan. The channel selected in the Interface Setup View will be used.

Call Control — Controls operation of pre-programmed signaling sequences. When pressed, the following softkeys are available:

Start Program N — (Where **N** is the number of the pre-programmed sequence, 1 through 5.) Starts the pre-programmed sequence.

On Hook — Provides an On Hook supervision event.

Once the **Start Program N** softkey has been pressed, the following softkeys are available:

Restart Program N — (Where **N** is the number of the pre-programmed sequence, 1 through 5.) Restarts the pre-programmed sequence.

Stop Program N — (Where **N** is the number of the pre-programmed sequence, 1 through 5.) Stops the pre-programmed sequence.

Test Results

Test results for the Signaling option are shown on the analyzer Two-Line Display. The Two-Line Display and associated controls and indicators are located on the front panel above the keypad. Refer to “Test Results Display” on page 90 for a detailed description of the Results Display.

Test results also appear on the Results view (refer to “Results View” on page 33).

Summary Category Results

The Summary category automatically lists out of specification key results. If all results are within specification for the LINE or EQUIPMENT receiver, the message `All Results OK` appears on the appropriate side of the Two-Line Display.

There are no Performance Category results for the Signaling Option. For details on the Interface, Signal, and Time Category test results, see “T1 Test Results” on page 92.

Test Type Category Results

The Test Type category results are described in Table 63.

Table 63 • Signaling Test Type Results

Result	Description
Seq	Displays the signaling supervision events and digits for the current call. When a pre-defined Call Termination or Call Origination sequence is not satisfied by the signaling events that occurred on the line or a signaling event delays more that 60 seconds, the message **`Sequence Fail`** appears.
Type	Displays a description of the signaling event (for example, Originating Off Hook) or digit type (DP, DTMF, or MF).
Duration	Measures the duration of a supervision event or digit. The range is 0 through 60 seconds with overflow indication. This result is applicable to signaling supervision events ‘R,’ ‘w,’ ‘d,’ and ‘t’ or any digit.
Delay	Measures the delay from one supervision event/digit to the previous supervision event/digit. The range is 0 through 60 seconds with overflow indication.
Signaling Scan	Displays the status of the signaling scan feature (Enabled or Disabled) and the active channel selected. This information is only displayed in Monitor mode.

PCM TIMS Option

This section provides step-by-step instructions for the PCM TIMS (Pulse Code Modulation Transmission Impairment Measurement Set) option for the T-BERD 950. and discusses the following topics:

- Option Description
- TNT Setups
- Manual Test Setups
- Test Results

Option Description

The PCM TIMS option enables the T-BERD 950 to performVoice Frequency (VF) testing on µ-Law encoded PCM data. The external interface to the option is via the T1 interface (LINE or EQUIPMENT, or both).

Digital Signal Processing (DSP) based testing is performed on the PCM data accessed from a DS1 access point. All option testing can be performed on DS0 channel PCM data dropped or inserted from a T1 line. The speaker output can be from either the LINE or EQUIPMENT T1 input or from both T1 inputs simultaneously (user selectable).

With the PCM TIMS option installed, the analyzer has the capability to pass through signalling bits while performing D&I testing, or insert signalling bits while performing TERMINATE or D&I testing.

Operating Modes

The PCM TIMS option operates in one of the following T1 operating modes: Terminate, Drop & Insert, or Monitor mode. The following paragraphs provide a brief discussion of each mode.

Terminate Mode

Terminate mode separates both sides of a T1 path, terminates the input signal at the receive side, and generates a totally independent output signal.

Drop & Insert Mode

The D&I mode enables the analyzer to access specific channels from the T1 line while leaving the other channels unaffected.

Monitor Mode

In Monitor mode, the option measures the parameters of the received PCM data signal. The following results are provided with two receivers enabled: Level (with tone present), Frequency (with tone present), C Message Noise, C Notch Noise, C Message Signal to Noise Ratio, and DC Offset.

Test Routines

The PCM TIMS option operates in one of the following test routines: Holding Tone, Variable Tone, 3 Tones, or Quiet. The following paragraphs provide a brief discussion of each mode.

Holding Tone Test

The Holding Tone test (with one receiver and/or one transmitter enabled) transmits a tone to the channel under test and the following parameters are measured with the corresponding results provided: Level, Frequency, C Filter Signal to Noise Ratio, D Filter Signal to Noise Ratio, 3.4 Filter Signal to Noise Ratio, C Notch Noise, 3.4 kHz Flat with Notch Noise, D Notch Noise, DC Offset, Dropouts, and Impulse Noise.

Only one set of measurements (C, D, or 3.4) can be derived at a time.

Variable Tone Test

The Variable Tone test transmits the selected tone frequency (from 20 to 3904 Hz) as is the level of the tone (from 3.0 through -40.0 dBm). The following results are provided: Level, Frequency, and DC Offset.

3 Tones Test

The 3 Tone test (with one receiver and/or one transmitter enabled) measures the frequency response of a channel at three frequencies: 404, 1004, and 2804 Hz. The 3 tones are transmitted automatically and repetitively as a sweep. The transmission time of each tone is adjustable from 2 to 15 seconds (the default is 5 seconds). The following parameters are measured with the corresponding results are provided: 404 Hz Level, 404 Hz Frequency, 1004 Hz Level, 1004 Hz Frequency, 2804 Hz Level, and 2804 Hz Frequency. A result takes approximately 4 seconds to appear on the Results view.

Quiet Test

Quiet test (with one receiver and/or one transmitter enabled) is used to perform noise measurements on a PCM data circuit when no tones are present and one end of the circuit has been terminated. To simulate this condition, a code representing zero signal (0xFE) is inserted on the channel under test. This test provides the following results: C Message Noise, D Message Noise, 3.4 kHz Flat Noise, DC Offset, and Impulse Noise.

Only one set of measurements (C, D, or 3.4) can be performed at a time.

Setting Up TNT

This section describes the TNT test setups to perform a T1 Interface PBX/Switch Turn-up.

Performing T1 Interface PBX/Switch Turn-up

Table 64 lists the TNT test setup for PBX/Switch Turn-up TIMS Test. For descriptions of the test setup parameters, see “Setting Up the T1 Interface View” on page 62. For descriptions of all results see “T1 Test Results” on page 92.

The objective of this test is to verify the DSO does not have excessive loss or noise, which will result in poor voice quality. Usually a 1004Hz loss or C-message noise measurement is made.

Table 64 • T1 Interface PBX/Switch Turn-up

Test	TNT Setup	Results Summary
TIMS (Lvl/Noise) Test In this scenario, the TB950 is one unit used to perform TIMS measurements along with another analog TIMS unit located on a 2-wire pair at the customer premise. The access at the customer premise is typically a punch down block.	Framing (ESF) Channel (1) Line Coding (B8ZS) Drop to Speaker (BOTH) Test (VARIABLE TONE) Transmit Level (0) Transmit Frequency (1004) Mode (D&I) Insert Side (LINE TX) Insert Payload (OFF) * * User is instructed to turn this ON. (IF MODE = TERMINATE) Tx Timing	BPVs CRC Errors T1 Rcv Frq T1 Rcv Lvl Use TEST TYPE Results for specific TIMS test.

Setting Up Manual PCM TIMS Test

This section provides descriptions of the test setup parameters for the Setup Interface view and the Test Type view, as shown in Figure 37, for the PCM TIMS option.

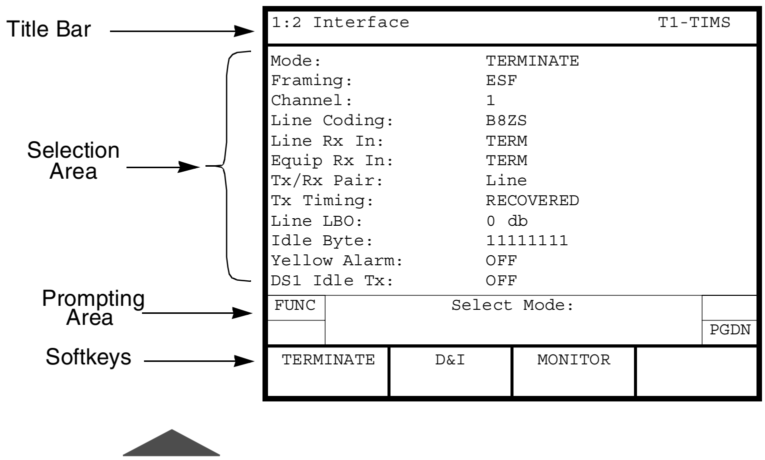


Figure 37 • PCM TIMS Setup Interface View

Setting Up the Interface View

The Interface view configures the T1 interface (see "Setting Up the T1 Interface View" on page 62 for further details). Use the **Scroll** and **Page** keys to control this selection area. When Test Type PCM TIMS is selected choices include:

When **Framing** is set to **SF**, the following parameter is available *(PCM TIMS Option only)*:

> **Channel Format** — Selects the timeslot to channel assignment format (default is **D3/D4**). Choices include: **D1D**, **D2**, or **D3/D4**.

Drop to Speaker — *(TERMINATE or D&I modes)* Selects which line is dropped to the speaker (default is **RECEIVE**). Choices include: **RECEIVE**, **TRANSMIT**, or **BOTH**.

When SF is set to Monitor, choices include **LINE**, **EQUIPMENT**, or **BOTH**.

ABCD Bits Thru — *(D&I mode)* Selects whether signalling bits are passed through the analyzer (default is **YES**). Choices include: **YES** and **NO**. This parameter can be set to **NO** only if **INS Payload** is **ON**. (This is not available in Terminate mode.)

When **ABCD Bits Thru** is set to **NO** (or when mode is set to **TERMINATE)** and the **Framing** is set to **SF** or **ESF**, choices include (note that **Bits C** and **D** are for ESF framing only):

Bit A — Sets the A signalling bit (default is **0**). The choices are **0** or **1**.

Bit B — Sets the B signalling bit (default is **1**). The choices are **0** or **1**.

Bit C — Sets the C signalling bit (default is **1**). The choices are **0** or **1**.

Bit D — Sets the D signalling bit (default is **1**). The choices are **0** or **1**.

In Terminate mode,* ABCD Bits Thru *does not appear.

Setting Up the Test Type View

PCM TIMS Test Type view configures the PCM TIMS test. The **Scroll** and **Page** keys control this selection area.

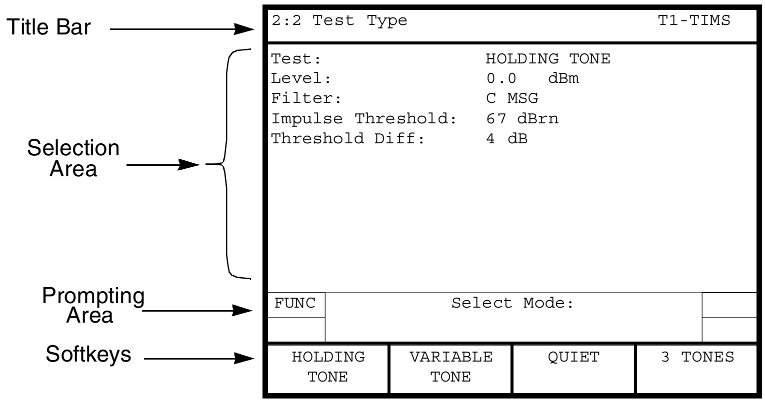


Figure 38 • PCM TIMS Setup Test Type View

Test — *(TERMINATE and D&I modes only)* Enables selection of the test mode type used for PCM TIMS testing (default is **HOLDING TONE**). Choices include:

HOLDING TONE — Selects Holding Tone as the test mode. In this operating mode, a holding tone (1004 Hz) is inserted into the channel under test. Choices include:

Level — Sets the level of the transmitted tone, selectable from **3.0 dB** to **-40.0 dB** in 0. 1dB increments (default is **0.0**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the level.

Filter — Selects filter used for the selected test (default is **C MSG**). Choices include: **C MSG**, **D WEIGHT**, and **3.4K FLAT**.

When **Filter** is set to **C MSG**, choices include:

Impulse Threshold — Sets the Impulse Noise threshold, which is selectable from 30 dBrn to 90 dBrn (default is **67**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the threshold.

Threshold Diff — Sets the Impulse Noise Registers Difference. The choices are: **2 dB**, **4 dB**, and **6 dB** (default is **4**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the level.

VARIABLE TONE — Selects Variable Tone as the test mode. Choices include:

> **Level** — Sets the level of the transmitted tone, selectable from **3.0 dB** to **-40.0 dB** in 0. 1dB increments (default is **0.0**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the level.
>
> **Frequency** — Sets frequency of transmitted tone, selectable from 20 Hz to 3904 Hz. Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the tone frequency.

QUIET — Selects Quiet Tone (no tone) as the test mode. Choices include:

> **Filter** — Selects filter used for selected test (default is **C MSG**). Choices include: **C MSG**, **D WEIGHT**, and **3.4K FLAT**.
>
> When **Filter** is set to **C MSG**, choices include:
>
> > **Impulse Threshold** — Sets the Impulse Noise threshold, which is selectable from 30 dBrn to 90 dBrn (default is **67**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the threshold.
> >
> > **Threshold Diff** — Sets the Impulse Noise Registers Difference. The choices include: **2 dB**, **4 dB**, and **6 dB** (default is **4**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the level.

3 TONES — Selects 3 Tone Slope as the test mode. Choices include:

> **Level** — Sets the level of the transmitted tones, adjustable from **3.0 dB** to **-40.0 dB** in 0. 1dB increments (default is **0.0**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the level.
>
> **Tone Duration** — Sets the length of time that tones are transmitted, selectable from 4 through 15 seconds in increments of 1 second (default is **5**). Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the time.

Front Panel Keys

The following analyzer front panel keys are used in conjunction with the PCM TIMS option.

LOOP UP — Transmits the 2713 Hz loop up tone at a fixed level of -10.0 dBm, until the far end is looped. Loop up is recognized when the receiver detects the 2713 Hz tone on the line.

LOOP DOWN — Transmits the 2713 Hz loop down tone at a fixed level of -10.0 dBm, until the far end is looped down. Loop down is recognized when the receiver no longer detects the 2713 Hz tone on the line.

VOLUME CONTROL (Up and Down) — Sets the volume of the speaker.

Test Results

PCM TIMS option test results are shown on the analyzer Two-Line Display. The Two-Line Display and associated controls and indicators are located on the front panel above the keypad. Refer to "Test Results Display" on page 90 for a detailed description of the Results Display.

Test results as shown in Figure 39 also appear on the Large Graphical Display Results view (see "Results View" on page 33).

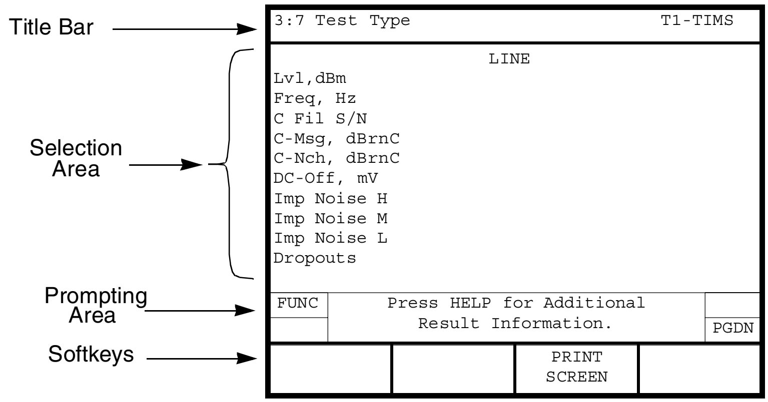


Figure 39 • PCM TIMS Test Type Results View

Summary Category Results

The Summary category automatically lists out of specification key results. If all results are within specification for the LINE or EQUIPMENT receiver, the message `All Results OK` appears on the appropriate side of the Two-Line Display.

There are no* Performance *Category results for the PCM TIMS Option. For details on the* Interface, Signal *and* Time *Category test results see "T1 Test Results" on page 92.

Test Type Category Results

The Test Type category results are described in Table 65.

Table 65 • PCM TIMS Test Type Results

Result Name	Description
Freq, Hz (Frequency)	Measures VF frequency in Hertz from 20 to 3904 Hz with an accuracy of 1 Hz. Result available in **MONITOR** operating mode and **HOLDING TONE** and **VARIABLE TONE** test modes.
Lvl, dBm (Level)	Measures VF level in dBm, with an accuracy of 0.2 dB from 200 Hz to 3900 Hz (+3 dBm to -40.0 dBm) and 0.1 dB from 1002 Hz to 1022 Hz (0 to -19 dBm). Result available in **MONITOR** operation mode, **HOLDING TONE**, and **VARIABLE TONE** test modes.
C Fil S/N (C Filter Signal to Noise Ratio)	Calculates ratio in dB, (using C-Message weighting) of the power of the test tone signal to the power of the background noise on the channel under test (accuracy is 1 dB, from 0 to 45 dB). For this measurement, a 1004 Hz tone is transmitted or 0xFE is inserted in the channel under test. Result available in **MONITOR** operating mode and **HOLDING TONE** and **QUIET** test modes.
C-Msg, dBrnC (C-Message Noise)	Measures (using C-Message weighting) the noise on an idle channel or circuit (a channel or circuit with a termination at one end and no holding tone at the transmitting end), expressed in dBrnC. Measurement range is 22 to 90 dBrnC with 1 dBrnC resolution. Result available in **MONITOR** operating mode and **QUIET** test modes.
C-Nch, dBrnC (C-Notch Noise)	Measures (using C-Message weighting and a 1010 Hz notch filter) the noise power on a channel with a holding tone at the transmitted end, expressed in dBrnC. Measurement range is 22 to 90 dBrnC with 1 dBrnC resolution. Result available in **MONITOR** operating mode and **HOLDING TONE** test mode.
D Fil S/N (D Filter Signal to Noise Ratio)	Calculates ratio in dB, (using D-Message weighting) of the power of the test tone signal to the power of the background noise on the channel under test (accuracy is 1 dB, from 0 to 45 dB). For this measurement, a 1004 Hz tone is transmitted or 0xFE is inserted in the channel under test. Result available in **HOLDING TONE** test modes.

Table 65 • PCM TIMS Test Type Results (Continued)

Result Name	Description
D Wgt Noise (D-Weighting Noise)	Measures (using D-Message weighting) the noise on an idle channel or circuit (a channel or circuit with a termination at one end and no holding tone at the transmitting end), expressed in dBrnD. Measurement range is 22 to 90 dBrnD with 1 dBrnD resolution. Result available in **QUIET** test mode.
D Nch Noise (D Notch Noise)	Measures (using D-Message weighting and a 1010 Hz notch filter) the noise power on a channel with a holding tone at the transmitted end, expressed in dBrnD. Measurement range is 22 to 90 dBrnD with 1 dBrnD resolution. Result available in **HOLDING TONE** test mode.
DC-Off, mV (DC-Offset)	Measures DC offset from -128 mV to 128 mV with a resolution of 1 mV. Result available in **MONITOR** operating mode and **HOLDING TONE**, **VARIABLE TONE**, and **QUIET** test modes.
Dropouts	Counts holding tones having levels that decreased by 12 dB (±1 dB) or more from the level established at the start of the current test, and for a period of time greater than the qualification interval (4 ± ½ periods of the holding tone). Result available in **HOLDING TONE** mode.
Imp Noise H (Impulse Noise High Count)	Counts signals exceeding the Impulse Noise threshold by 6 dB, threshold accuracy is ±1 dB. Result available in **HOLDING TONE** and **QUIET** test modes.
Imp Noise M (Impulse Noise Medium Count)	Counts signals exceeding the Impulse Noise threshold by 4 dB, threshold accuracy is ±1 dB. Result available in **HOLDING TONE** and **QUIET** test modes.
Imp Noise L (Impulse Noise Low Count)	Counts signals exceeding the Impulse Noise threshold by 2 dB, threshold accuracy is ±1 dB. Result available in **HOLDING TONE** and **QUIET** test modes.

Table 65 • PCM TIMS Test Type Results (Continued)

Result Name	Description
3.4K Fil S/N (3.4 kHz Filter Signal to Noise Ratio)	Calculates ratio of the test tone signal to the power of the background noise on the channel under test, (accuracy is 1 dB, from 0 to 4 5dB). For this measurement, a 1004 Hz tone is transmitted or 0xFE is inserted in the channel under test. Result available in **HOLDING TONE** and **QUIET** test modes.
3.4KFlat, dB (3.4 kHz Flat Noise)	Measures the low frequency noise present on the channel under test, expressed in dBrn. Measurement range is 22 to 90 dBrn with 1 dBrn resolution. Result available in **QUIET** test mode.
3.4K Nch, dB (3.4 kHz Flat with Notch-Noise)	Measures (using a 1010 Hz notch filter) the noise power on a channel with a holding tone at the transmitted end, expressed in dBrn. Measurement range is 22 to 90 dBrn with 1 dBrn resolution. Result available in **HOLDING TONE** test mode.
404Hz Lvl (404 Hz Level)	Measures the level of the 404 Hz test tone. Result available in **3 TONES** test mode.
404Hz Freq (404 Hz Frequency)	Measures the frequency of the 404 Hz test tone. Result available in **3 TONES** test mode.
1004Hz Lvl (1004 Hz Level)	Measures the level of the 1004 Hz test tone. Result available in **3 TONES** test mode.
1004Hz Freq (1004 Hz Frequency)	Measures the frequency of the 1004 Hz test tone. Result available in **3 TONES** test mode.
2804Hz Lvl (2804 Hz Level)	Measures the level of the 2804 Hz test tone. Result available in **3 TONES** test mode.
2804Hz Freq (2804 Hz Frequency)	Measures the frequency of the 2804 Hz test tone. Result available in **3 TONES** test mode.

ISDN BRI Option

This section provides step-by-step instructions for using the Basic Rate Interface (BRI) ISDN option for the T-BERD 950 and discusses the following topics:

- Option Description
- TNT Setups
- Manual Test Setups
- Test Results

Option Description

The ISDN BRI option, in conjunction with the Protocol Services Board option, enables the T-BERD 950 Communications Analyzer to perform the following:

- BER testing
- Protocol analysis (D-channel analysis)
- Voice and data (call placement and receipt)
- X.25 D-channel packet calls

The ISDN BRI interface generates required frames for terminal initialization, Layer 2 start-up, and basic call processing for the AT&T 5ESS, NT DMS 100, and National standards. It gathers and processes the proper call setup information for two simultaneous calls and the proper frames to maintain the call connections simultaneously.

The BRI module provides physical layer status and statistics for the U interface side of the ISDN network. These include activation status, U interface sealing current, and framing status. Block errors are also counted. See “Test Results” on page 246 for detailed results information.

The ISDN BRI option originates two circuit-switched calls, terminates two circuit-switched calls, or originates one circuit-switched call while terminating a second circuit-switched call. In addition, the unit can place and/or receive X.25 Packet Data calls over the D-channel.

When the call setup acknowledge message is received for incoming or outgoing calls, it connects the speaker and microphone for that call. You can also change the connection of the call dynamically. A call connected to BERT can be changed to connect to the speaker/ microphone.

If the ISDN BRI option is connected to two voice calls simultaneously, Call 1 is connected to the push-to-talk interface and a holding tone is placed on Call 2. If two data calls are connected, then the BERT settings are the same on both calls. The unit measures the loopback delay for each B-channel. After the D-packet call is connected, the analyzer can send the FOX message, show the received data, and provide X.25 packet analysis.

U Interface

The ISDN BRI option is capable of emulating the ISDN Terminal Equipment (TE) device from the U access point.

The NT1 is the first customer premise device on a two-wire ISDN circuit coming in from the ISDN CO. It accomplishes several tasks. It converts the two-wire ISDN circuit (called a U interface) to a four-wire S/T so you can connect several terminals. The NT1 CO can thereby “talk” to the NT1 and do testing and maintenance by instructing the NT1 to loop signals back to the CO.

Interface Between NT and the Network

The U reference point describes the interface between the Network Termination (NT) and the network Line Termination (LT). It is a two-wire interface with 2B1Q line coding. The network provides power via the U interface. Figure 40 shows the relationship between the customer premises and the local loop for the S/T and U interfaces.

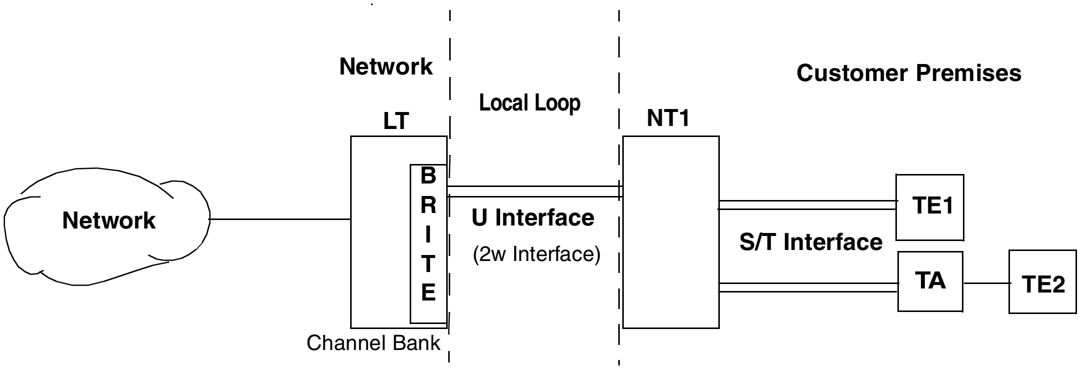


Figure 40 • ISDN BRI S/T and U Reference Points

Operating Modes

You can configure the ISDN BRI option to operate in these modes:

- Line Termination (LT) BERT Mode
- Network Termination (NT) BERT Mode
- Network Termination and Terminal Equipment (NT1/TE) Mode

Detailed descriptions of these modes of operation are found below.

LT BERT Mode

The purpose of the LT mode is to BERT the physical layer of the U interface toward the NT device. This mode is not capable of placing or receiving a call. This mode can BERT the B1, B2, B1 and B2, or 2B+D-channels. The BERT operations can either be end-to-end (with another BERT device on the NT side) or looped back. Phantom power is not provided. Figure 41 shows BER testing using full or partial bandwidth for this mode.

The ISDN BRI option can request loopbacks on the B1, B2, B1 and B2, or 2B+D-channel.

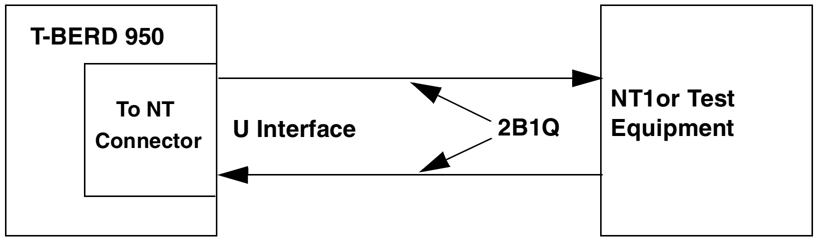


Figure 41 • ISDN BRI LT Terminate Mode

NT1 BERT Mode

The purpose of the Network Termination (NT1) mode is to test the physical layer of the U interface toward the LT device. The NT1 mode cannot place a call, but it can BERT the B1, B2, B1 and B2, or 2B+D-channels. The test operations can only be in end-to-end, with another BERT device on the LT side. Figure 42 shows testing using full or partial bandwidth for this mode.

In NT1 mode, the U interface can be looped back manually or via the EOC messages received from the LT. The BRI interface can loopback the B1, B2, B1 and B2, or 2B+D-channel.

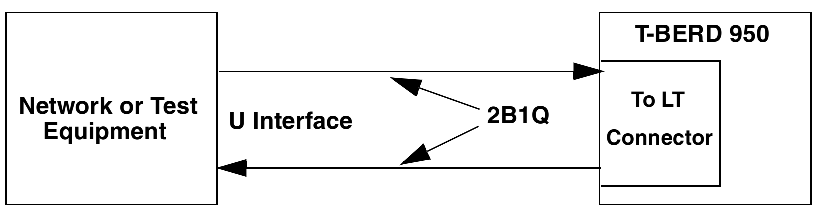


Figure 42 • ISDN BRI NT1 Terminate Mode

NT1/TE Mode

The T-BERD 950 can originate and terminate Circuit-Switched Voice (CSV), Circuit-Switched Data (CSD) 56K, and 64K Unrestricted calls. In addition to the circuit operations listed above, the unit can originate and terminate D-packet switched calls.

The NT1/TE mode allows the unit to emulate a Network Termination (NT1) and Terminal Equipment (TE) simultaneously. This mode is used to place calls at the U interface. The ISDN BRI option emulates Terminal Equipment (TE) at the U interface and is available with the ISDN test type. In the NT1/TE mode, you can manually loopback the U interface. Figure 43 shows ISDN calls placed and received using the D-channel for either B-channel.

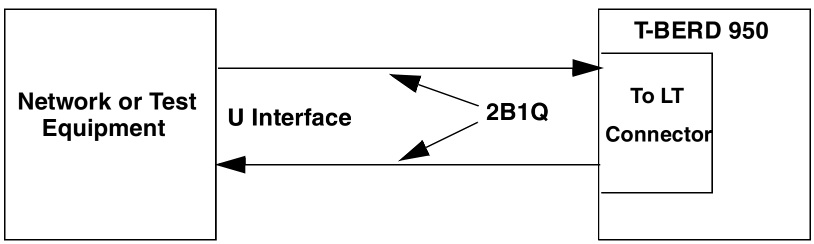


Figure 43 • ISDN BRI NT1/TE in Terminate Mode

Call-generating capabilities include the ability to vary the type of service to connect. You can generate either 56 kbps or 64 kbps calls. Either call connects to the BERT engine or the push-to-talk interface based on the Bearer Destination.

Calls can be placed or received on either B-channel and dropped to the BERT engine or speaker and microphone (with DTMF dialing). After a call is connected, the B-channel(s) destination (either the BERT engine or speaker and microphone) for that call can be changed without disconnecting the call. The ISDN BRI option can loopback the B1, B2, or B1 and B2 channel.

Manual and EOC Loopbacks

Depending on your mode of operation, the T-BERD 950 can be looped back manually or via Embedded Operations Channel (EOC) messages. These loopbacks are logical in that they loop the selected bandwidth. (See Table 66 for information on the different types of loopbacks available in each BRI mode.)

In LT mode, you configure the type of loopback and press the **Loop Up** key to loop up the far end. The ISDN BRI option then transmits an EOC loopback request to the NT device. Press the **Loop Down** key to deactivate these loopbacks.

In NT1 mode, EOC automated loopback requests are enabled from the user interface. A status message appears on the Results I and II Display that announces an active loopback. Any manual loopbacks are configured from the user interface.

Table 66 • ISDN BRI Loopbacks

BRI Mode	Loopback Type	Loopbacks Available
LT	Sends EOC loopback requests to the NT	B1, B2, B1 and B2, 2B+D
NT1	Either manual or responds to EOC loopback requests	B1, B2, B1 and B2, 2B+D
NT1/TE	Manual loopbacks	B1, B2, B1 and B2

External Interface Requirements

The ISDN BRI option provides two RJ-45 8-pin modular jacks. The RJ connectors support BER testing, protocol analysis, and emulation over the B and D-channel. Table 67 describes the **To LT** and **To NT** connectors on the U interface.

Table 67 • ISDN BRI Option Connectors

No.	Connectors	Description
1	To LT	An RJ-45 (8-pin) connector is used to connect the T-BERD 950 to the U interface of ISDN BRI circuit. This connector should be used when the T-BERD 950 is emulating a NT1/TE or NT1 device.
2	To NT	An RJ-45 (8-pin) connector is used to connect the T-BERD 950 to the U interface of the ISDN BRI circuit. This connector should be used when the T-BERD 950 is emulating an LT device.

Option Specifications

Figure 68 lists the specifications for the ISDN BRI option.

Table 68 • ISDN BRI U Interface Specifications

Feature	Specification
Interface	U Interface with To LT and To NT
Devices	NT1
Physical Configuration	Point to Point, Synchronous and Full-Duplex
Bit Rate	160 kbps
User Data Rate	144 kbps
Line Coding	2B1Q
Line Rate	192 kbps
Maximum Voltage	± 2.5 V
Number of Wire Pairs	1

Table 68 • ISDN BRI U Interface Specifications (Continued)

Feature	Specification
Full-Duplex Method	Echo Cancellation
Interleaving Scheme	$B1_8B2_8$ (12X/Frame)
Bits Per Frame	240
Bits User Data	216
Bits Overhead	24
Frames Per Second	666.66666...

Setting Up TNT

This section describes the TNT test setups for the ISDN BRI option. A sample TNT Setup view is shown in Figure 44.

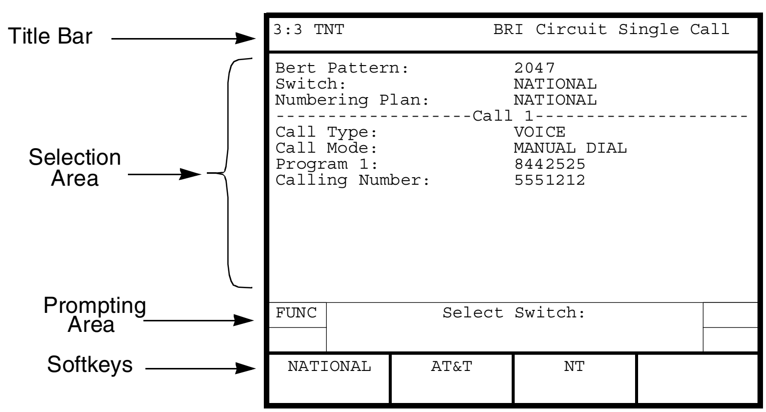


Figure 44 • ISDN BRI TNT Setup View

Performing Line Qualification Test

Table 69 lists the TNT test setup for performing a line qualification test. For descriptions of the test setup parameters, see “Setting Up Manual BER Test” on page 230. For descriptions of all results see “Test Results” on page 246.

The objective of this test is perform a physical layer test of the U interface towards the LT or NT device. By sending or responding to EOC loopbacks, either B1, B2, B1 and B2, or 2B+D channels can be tested using a BERT pattern such as 2047. Physical layer results such as CRC errors, and bit errors are available. This is performed as a an out-of-service test in LT or NT mode.

Table 69 • ISDN BRI Line Qualification Test

Test	TNT Setup	TNT Results
LINE QUALIFICATION (BERT) LT or NT emulation In this scenario, the T-BERD 950 is used to send or respond to the appropriate EOC loopcode. Otherwise, the technician is performing end-to-end BER testing with someone else located at the far-end.	Test Mode (NT) Bert Pattern (2047) Channels (2B+D) If channels = B1, B2 Rate (64K) If Mode = LT Tx Loop (B1)	CRC Err Seal Cur Layer1 Stat Bit Errors Pat Slips BER EFS FEBE Err

Placing and Receiving Circuit Calls

Table 70 lists the TNT test setups for placing and receiving various types of circuit calls. For descriptions of the test setup parameters, see “Setting Up Manual ISDN Test” on page 234. For descriptions of all results see “Test Results” on page 246.

The objective of these tests is to verify service parameters by placing and receiving voice and data calls. A 2047 BERT analysis is typically performed on a data circuit. In addition, physical layer results such as BPVs, CRC errors, and frame counts can be gathered. Layer 3 D Channel Decodes can also be viewed.

Table 70 • ISDN BRI Circuit Calls

Test	TNT Setup	Results Summary
Single Call (NT1/TE emulation) In this scenario, the T-BERD 950 is used to place and receive voice and data calls to either a known telephone number or to an ISDN test line such as the TPI 560P. It is assumed that only one call is placed at a time on each B channel.	Bert Pattern (2047) Switch (NATIONAL) Numbering Plan (NATIONAL) SWITCH = NT Type (DMS-F) SWITCH = AT&T Line Type (Multi-Pt) ----Call 1 & 2---- Call Type (VOICE) Call Mode (MANUAL DIAL) Calling Number () SPID Mode (user) SPID (80055512120101) Directory Number ()	CRC Err Seal Cur Frm Cnts Err Frms Assigned TEI SPID STAT Layer2 Stat Call Status Reports Call Failure Reports
Self Call In this scenario, the T-BERD 950 is used to place and receive voice and data calls. The technician will place an outgoing data call on one B channel and receive this call on the second B channel.	Bert Pattern (2047) Switch (NATIONAL) Numbering Plan (NATIONAL) SWITCH = NT Type (DMS-F) SWITCH = AT&T Line Type (Multi-Pt) ----Call 1 & 2---- Call Type (VOICE) Call Mode (MANUAL DIAL) Calling Number () Directory Number ()	CRC Err Seal Cur Err Frms Frm Cnt SPID STAT Assigned TEI Layer2 Stat Call Status Reports Call Failure Reports

Table 70 • ISDN BRI Circuit Calls (Continued)

Test	TNT Setup	Results Summary
Dual Call In this scenario, the T-BERD 950 is used to place and receive voice and data calls to either a known telephone number or to an ISDN test line such as the TPI 560P. In this case, both B1 and B2 calls are placed or received simultaneously to verify true dual call functionality.	Bert Pattern (2047) Switch (NATIONAL) Numbering Plan (NATIONAL) SWITCH = NT Type (DMS-F) SWITCH = AT&T Line Type (Multi-Pt) ----Call 1 & 2---- Call Type (VOICE) Call Mode (MANUAL DIAL) Calling Number () Directory Number ()	CRC Errs Sealing Cur Frm Cnts Err Frms Assigned TEI SPID STAT Layer2 Stat Call Status Reports Call Failure Reports

Placing and Receiving Packet Calls

Table 71 lists the TNT test setups for placing and receiving various types of packet calls. For descriptions of the test setup parameters, see “Setting Up ISDN Packet and Advanced Test Type View” on page 240. For descriptions of all results see “Test Results” on page 246.

The objective of these tests is to verify service parameters by placing a receiving data packet calls over the Dchannel and then performing analysis on the received FOX message. In addition, physical layer results such as BPVs, CRC errors, and frame counts can be gathered. Layer 3 D Channel Decodes can also be viewed.

Table 71 • ISDN BRI Packet Calls

Test	TNT Setup	TNTN Results
0B+D Call (NT1/TE emulation) In this scenario, the T-BERD 950 is used to place and receive data packets calls to either a known TE packet device or to an ISDN test line such as the TPI 560P.	Bert Pattern (2047) Switch (NATIONAL) Numbering Plan (NATIONAL) SWITCH = NT Type (DMS-F) SWITCH = AT&T Line Type (Multi-Pt) SPID Mode (USER) SPID (80055512120101) ----PACKET CALL---- LCN (1) Packet Echo (OFF) Called Number ( ) Calling Number ( ) Call User Data (OFF) CUG Mode (OFF)	CRC Errs Sealing Cur Frm Cnts Err Frms Assigned TEI SPID STAT Layer2 Stat X.25 Call Result Rx REJ Pkts Packet Stat X.25 Call Failure Report X.25 Call Data Result

Table 71 • ISDN BRI Packet Calls (Continued)

Test	TNT Setup	TNTN Results
2B+D Call (NT1/TE emulation) In this scenario, the T-BERD 950 is used to place and receive data packet and B channel voice and data calls to either a known telephone number or to an ISDN test line such as the TPI 560P.	Bert Pattern (2047) Switch (NATIONAL) Numbering Plan (NATIONAL) SWITCH = NT Type (DMS-F) SWITCH = AT&T Line Type (Multi-Pt) ----Call 1 & 2---- Call Type (VOICE) Call Mode (MANUAL DIAL) Calling Number () SPID Mode (USER) SPID (80055512120101) Directory Number () ----PACKET CALL---- LCN (1) Packet Echo (OFF) Called Number ( ) Calling Number ( ) Call User Data (OFF) CUG Mode (OFF)	CRC Err Sealing Cur Frm Count Err Frm Assigned TEI SPID STAT Layer2 Stat Call Status Reports Call Failure Reports X.25 Call Result Rx REJ Pkts Packet Stat X.25 Call Result X.25 Call Failure Report X.25 Call Data Result

Setting Up Manual BER Test

This section provides descriptions of the Test Setup parameters to perform a BER test. Use the Setup Interface and the Test Type views, as shown in Figure 45.

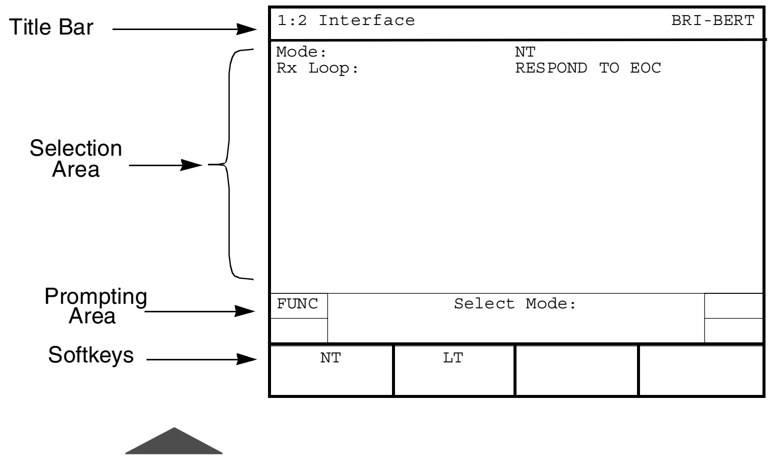


Figure 45 • ISDN BRI BERT Setup Interface View

Setting Up the Interface View

The Interface Setup view is used to configure the BRI interface. The following parameter choices are available when ISDN BRI is the selected test type.

Test Mode — Selects the test mode. (The default is **NT**.)

NT — The unit emulates a Network Termination device.

LT — The unit emulates a Line Termination device.

Rx Loop — Selects the type of loopback to enable on the receiver. The default is **RESP TO EOC**. Choices include:

MANUAL — Allows you to manually loop up the selected bandwidth of the received 2B1Q signal.

RESP TO EOC — Embedded Operations Channel (EOC). The unit responds automatically to a loopback request.

Channel Loop — (*MANUAL mode*) Selects the channel to manually loop up theT-BERD 950. The default is **NONE**. Choices include:

NONE — No channel selected to be looped back on the unit.

B1 — Selects channel B1 for the test.

B2 — Selects channel B2.

B1&B2 — Selects both B-channels.

2B+D — Selects both B-channels and the D-channel.

Tx Loop — (LT mode) Selects the type of EOC transmit to loop a far-end device. Choices include:

B1 — Selects channel B1.

B2 — Selects channel B2.

2B+D — Selects both B-channels and the D-channel.

Setting Up the Test Type View

The ISDN BRI BERT Test Type Setup view is used to configure the test to be performed (see Figure 46). The **SCROLL** and **PAGE** keys are used to control this selection area.

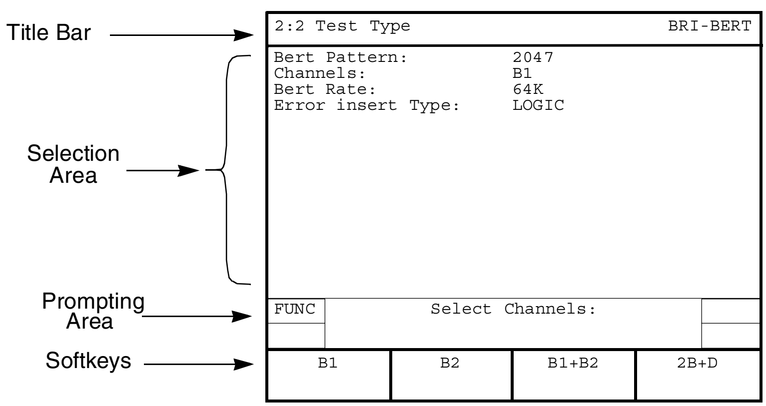


Figure 46 • ISDN BRI BERT Setup Test Type View

BERT Pattern — Selects the BERT pattern for the test. Refer to "Setting Up the T1 Test Type View" on page 80 for more information on these patterns. (The default is the 2047 pattern).

Channels — Selects the channel for the BER test. (The default is **B1**.) If your Channel selection is **B1** or **B2**, you need to select the **Bert Rate**. Choices include:

B1 — Selects channel B1.

B2 — Selects channel B2.

B1&B2 — Selects both B-channels.

2B+D — Selects both B-channels and the D-channel.

Bert Rate — *(B1 or B2)* Selects the bearer channel data rate. Choices include:

56K — Selects an unrestricted circuit-switched data connection with 56 kbps CCITT I.463 rate adaptation.

64K — Selects a clear channel, unrestricted, circuit-switched data connection with the full 64 kbps available for use, with no rate adaptation.

Error Insert Type — Selects error type to be inserted in the data stream when the **ERROR INSERT** key is pressed (default is **LOGIC**). Choices include:

LOGIC —Enables insertion of bit (logic) errors. Single errors or an error rate can be selected using the **ERROR INSERT** key.

FEBE — Enables insertion of Far End Block Error (FEBE) framing, parity and out of frame (OOF) errors. Single errors or an error rate can be selected by using the **ERROR INSERT** key.

CRC —Enables insertion of Cyclic Redundancy Check (CRC) errors. Single errors or an error rate can be selected by using the **ERROR INSERT** key.

Setting Up Manual ISDN Test

This section provides descriptions of the Test Setup parameters to test the ISDN service. Use the Interface and the Test Type views, as shown in Figure 47.

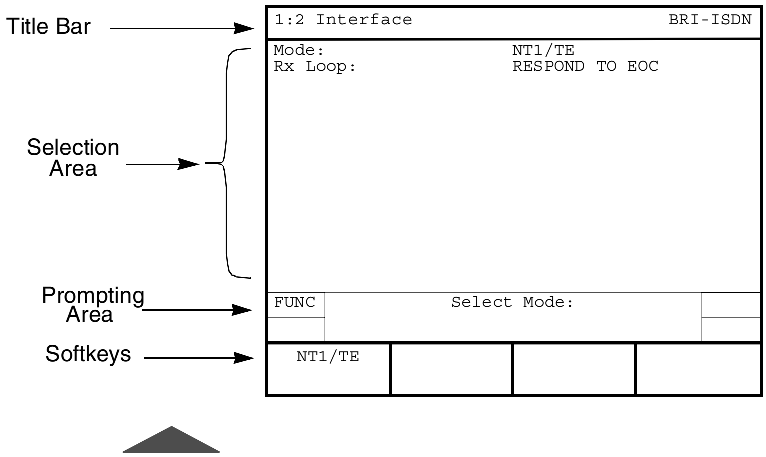


Figure 47 • ISDN BRI Setup Interface View

Setting Up the Interface View

The Interface Setup view is used to configure the BRI interface. The following parameter choices are available when ISDN BRI is the selected test type.

Mode — The only choice is **NT1/TE** Network Termination/ Terminating Equipment. In this mode, the unit emulates an integrated NT1/TE device at the U interface.

Rx Loop — Selects the type of loopback to enable on the receiver. The default is **RESP TO EOC**. Choices include:

> **MANUAL** — Allows you to manually loop up the selected bandwidth of the received 2B1Q signal.

RESP TO EOC — Embedded Operations Channel (EOC). The unit responds automatically to a loopback request.

Channel Loop — *(Manual)* Selects the channel to loop up (default is **NONE**). Choices include:

NONE — No channel selected to be looped back on the unit.

B1 — Selects channel B1.

B2 — Selects channel B2

B1&B2 — Selects both B-channels.

2B+D — Selects both B-channels and the D-channel.

Setting Up the Test Type View

The ISDN BRI Test Type Setup view configures the test to be performed. The **SCROLL** and **PAGE** keys control this selection area.

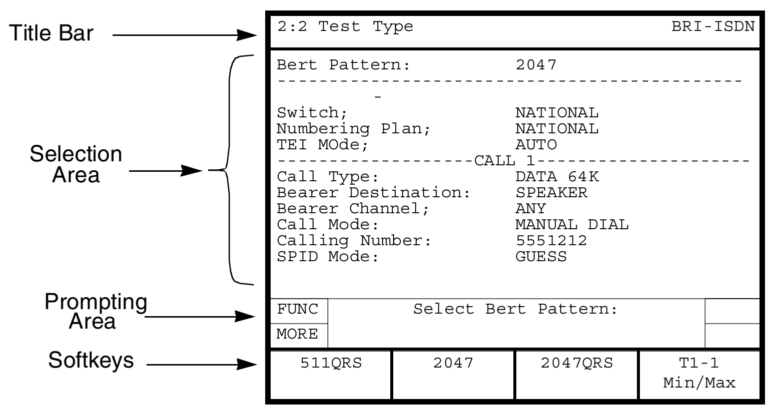


Figure 48 • ISDN BRI Test Type Setup View

Bert Pattern — The BER test patterns are listed here. Refer to “Setting Up the T1 Test Type View” on page 80 for more information on these patterns (default is 2047).

Switch — Enables entry of the switch type used on the ISDN link (default is **NATIONAL**). Choices include:

NATIONAL — Selects National as the switch type.

AT&T — Selects theAT&T 5ESS Custom as the switch type. When AT&T is the switch type, the following parameter is available:

Line Type — Select the line type if the Switch is the AT&T 5ESS (default is **MULT-PT)**. Choices include:

PT-PT — Selects a point-to-point circuit or two-point circuit.

MULTI-PT — Selects a multipoint circuit.

NT — Selects the Northern Telecom DMS 100 Custom as the switch type. When NT is the switch type, the following parameter is available:

Type — Selects the NT type (default is **DMS-F**). Choices include:

DMS-F — DMS Functional

DMS-S — DMS Stimulus

Number Plan — Enables the selection of the appropriate ISDN numbering plan for the desired circuit (default is **NATIONAL**). Numbering plan choices include:

UNKNOWN — Unknown number in numbering plan.

INTERNATIONAL — International number in ISDN numbering plan.

NATIONAL — National number in the ISDN numbering plan.

NETWORK — Network-specific number in private numbering plan.

LOCAL — Local directory number in ISDN numbering plan.

ABBREVIATED — Abbreviated number in private numbering plan.

TEI Mode — Terminal Equipment Identifier (TEI) (Circuit operation mode only) is part of the layer 2 link access procedure of D-channels (Q.921) address that identifies frames to and from a particular terminal (default is **AUTO)**.

AUTO — Automatic TEI values selected by the network. Assigns TEI values **64-126**.

FIXED — Non-automatic TEI user-selected values.

TEI — *(Fixed)* Choices for fixed assignment are **[0-63]** (default is **0)**.

The following parameters must be set for both* Call 1 *and* Call 2 *when connecting to two calls simultaneously.

Call Type — Selects the type of call to be generated by the unit (default is **VOICE**). Choices include:

DATA 56K — Selects an unrestricted circuit-switched data connection with 56 kbps CCITT I.463 rate adaptation.

DATA 64K — Selects a clear channel, unrestricted, circuit-switched data connection with the full 64 kbps available for use, with no rate adaptation.

VOICE — Selects a voice type call. If another call is connected to the SPKR (speaker/microphone combination), a tone is sent. Otherwise the call is connected through the speaker/mike combination.

3.1K AUD — Selects a 3.1 kHz audio call type.

Bearer Destination — Selects the appropriate destination of the connected call (default is **SPEAKER**). Choices include:

SPEAKER — The call is connected to speaker/microphone for voice conversation which allows you to place two voice calls. The first call connects to the speaker/microphone, the second connects to the 1004 Hz tone generator.

BERT— BER testing is performed on the selected channels of the connected call.

Bearer Destination determines where the call is initially connected. Once the call is connected, it can be switched between the BERT engine and the Speaker using the softkeys.

Bearer Channel — Enables selection of the bearer (B) channel for the call (default is **ANY**). Choices include:

ANY — Allows the switch to allocate the bearer channel.

B1 — Selects bearer channel 1.

B2 — Selects bearer channel 2.

Call Mode — Selects **MANUAL DIAL** or the appropriate Program Number **Program (N)**. **PROGRAM 1** through **PROGRAM 5** (for Call 1), and **PROGRAM 6** through **PROGRAM 10** (for Call 2).

MANUAL DIAL — Enables manual entry of the number to be called.

Program (N) — Enables entry of number to be called, up to 18 digits (default is **8441212**). Program up to five numbers on **PROG 1** through **PROG 5** (for Call 1), and five numbers on **PROG 6** through **PROG 10** (for Call 2). Use the keypad to edit this field.

Calling Number — Enables entry of the Directory Number (DN) of the circuit being analyzed, up to 15 digits (default is **8441212**). Use the keypad to edit this field.

SPID Mode — This is the Service Profile ID, which identifies the types of services and features supported for a given device. SPIDs are optional in the ISDN standard, but usually required in North America (default is **USER)**.

GUESS — The unit will attempt to add the most common prefix and suffix on the Directory number (DN) depending on the switch selected. Table 72 shows the combinations, in order, the T-BERD 950 uses when performing a SPID Guess. For example, if the configured directory number is 800.555.1212, then the seven digits used would be 555.1212.

DN — *(Guess)* Enter the [7-16 digits] (default is **8005551212).**

Table 72 • ISDN BRI SPID GuessTabl e

Prefix	# Directory Number Digits Used	Suffix
01	7	000
NONE	10	0100
NONE	10	0101
01	7	0
NONE	10	1
NONE	10	0000
NONE	10	01
NONE	10	100
NONE	10	2
NONE	7	00
NONE	7	1111
NONE	10	0
NONE	10	00
NONE	10	000
NONE	10	0001
NONE	10	02
NONE	10	0200
NONE	10	10

Table 72 • ISDN BRI SPID Guess Table (Continued)

Prefix	# Directory Number Digits Used	Suffix
NONE	10	0111
NONE	10	1000
NONE	10	20
NONE	10	200
NONE	10	2000
NONE	10	Repeat last digit of DN
NONE	10	Repeat last 2 digits of DN

USER — Enter the appropriate **SPID**.

SPID — *(USER mode)* Enter a 9- to 20-digit number (default is **80055512120101).**

Setting Up ISDN Packet and Advanced Test Type View

The ISDN BRI Test Type setup for Packet and Advanced features is listed after the ISDN circuit operation configurations. Use the **SCROLL** key to scroll the list past the Call 1 and Call 2 setup areas.

TEI —Same as circuit operation described on page 237; however, it only applies to Packet operation.

LCN — Logical Channel Number values are **1** to **15** (default is **1)**.

If the call is placed on an invalid LCN, the X.25 call status result indicates that the call was placed on an invalid LCN. See the Call Failure Report on Figure 53 on page 253.

PACKET ECHO — Choices include **OFF** and **ON**. Takes data packet received and echoes (sends) it back to the sender.

CALLED NUMBER — User programmed Directory Number (DN).

CALLING NUMBER — User programmed, based on the switch requirements, whether 10 or 7 digits.

CALL USER DATA — **OFF**, **ON**. Select **ON** to edit the data string used to identify a specific user or call. This makes the data unique. A line appears that you can edit using the keypad, which emulates a keyboard. The 1- 9 plus 0 keys are assigned the alpha characters marked on the keys, plus other specific values that you can select when editing the field. The arrow keys on the keypad allow you to move forward and backward through the character string.

Editing CALL USER DATA

When **Call User Data** is set to **ON**:

1. Select the line below **CALL USER DATA**. The **EDIT** softkey appears.
2. Press **EDIT** softkey. A popup window and additional softkeys appear.

   Clear String — Clears the current character string.

   Clear Set — Clears the selected set, allowing you to choose another set.

   Cursor Home — Places the cursor at the beginning of the string.

   Cursor End — Places the cursor at the end of the string.

   Prev Page — Places the cursor on the previous page.

   Next Page — Places the cursor on the next page.

   Abort Changes — Clears all changes and returns to the setup view.

Save & Exit — Saves the changes and Exits the editing function.

3. Press a 1 through 9 or 0 the key on keypad to select a character set. The assigned values for that key appear in the popup window.
4. Press the corresponding number for the character you want to place into the user data information. Press "0" to add spaces if needed.
5. Repeat steps 3 and 4 until your User Data information is complete.
6. Press **Save & Exit** when finished.

CUG Mode — Closed User Group mode. This packet mode is used for Automatic Teller Machines (ATMs) or Point of Sales Terminals, and provides password security protection to the connection. Choices include: **ON**, **OFF** (default is **OFF)**.

CUG — Closed User Group. Appears when CUG Mode is set to **ON**. Use the Select value of **0-9999**. Use the **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the value.

Setting Up Advanced Call Configurations

Call Appearance — Set to **YES** or **NO** (default is **NO)**. When **YES** selected, Appearance Id selection appears.

Appearance Id — Appears when **Call Appearance** set to **YES**. Values 1-254, and increments by one (default is 1) for the second call.

Reverse Charge — Allows placing collect packet calls. Set to **ON** or **OFF**. Default value is **OFF**.

RPOA Mode — Registered Private Operating Agency. Routing information is similar to an area code for packet calls. Set to **ON**, **OFF**.

RPOA Value — Available when RPOA mode is set to **ON**. Select value of **0-9999**.

Configuring ISDN Control

The **ISDN CONTROL** softkey provides access to the **CALL 1 CONTROL, CALL 2 CONTROL,** and **PACKET CALL** softkeys. When one of the keys is pressed, the Results Test Type view appears. From this view you may choose from the **CALL 1, CALL 2,** or **PACKET CALL** softkeys.

CALL 1 CONTROL, CALL 2 CONTROL, and **PACKET CONTROL** provides the following choices:

DIAL CALL — Places the call.

DISC CALL — Disconnects the call in progress.

ANSWER — Answers the call if an incoming call is present.

SEND FOX — Sends the FOX message *(**PACKET CALL** only)*.

Dynamic Payload Softkeys provide the ability to dynamically change the payload of the call when the call is connected (circuit calls only).

BERT — Connects the call for BER testing.

VOICE — Connects the call to the speaker/microphone.

TONE — Connects the call to a 1004Hz tone.

Placing a Call

You can place a call in two ways: **Manually** or **Program Dial**.

Manually — *(overlap dialing)* Use a called party number from the keypad. The digits are outpulsed as they are entered on the keypad.

Program Dial — Program 1-5 for Call 1 and program 6-10 for Call 2.

To place a call in manual dial mode, press the **DIAL** softkey for that call, and then enter the called party's number using the keypad. Manual dialing mode continues until the call progresses or fails.

To place a call in program dial mode, choose from five possible program (or memory dial) numbers, then press the **DIAL** softkey for that call.

In general, the call emulation feature must simulate a normal call setup exchange. If the call setup exchange fails, extensive error reporting in the form of a call fail report is generated.

The T-BERD 950 is capable of transmitting DTMF tones if a call progresses or connects. The microphone disables briefly while the DTMF tones are transmitted. This feature allows you to enter digits such as phone extensions in response to an automated attendant.

Answering a Call

When an incoming call is detected, the T-BERD 950 a popup window appears on the current view display. This window gives you three choices: answer the call, ignore the call, and disconnect the call.

Whatever action you choose causes one of several results. Those actions and results are listed in Table 73.

Table 73 • Incoming Call Activitie s

Action	Result
Press **ANSWER** sofkey.	Connects calls to the speaker and microphone (voice). You can then choose to begin BER testing if it is a data call. After the call is connected, you can dynamically change the connection, data to voice or voice to data, via softkeys.
Press **DISCONNECT** softkey.	Clears calls.
Press **IGNORE** softkey.	Holds call in the alert state until the far end cancels the call or you select the Call Control softkey, press the appropriate Call 1 or 2 softkey, then press the Answer softkey.

Interpreting D-Channel Display

This feature shows English translations of messages received and transmitted on the D-channel. As shown in Figure 49, this display provides complete Q.921, Q.931, and X.25 text-based information for all valid ISDN frames. See “ISDN Q.931 Cause Codes” on page 255 for Q.931 Cause Code Table.

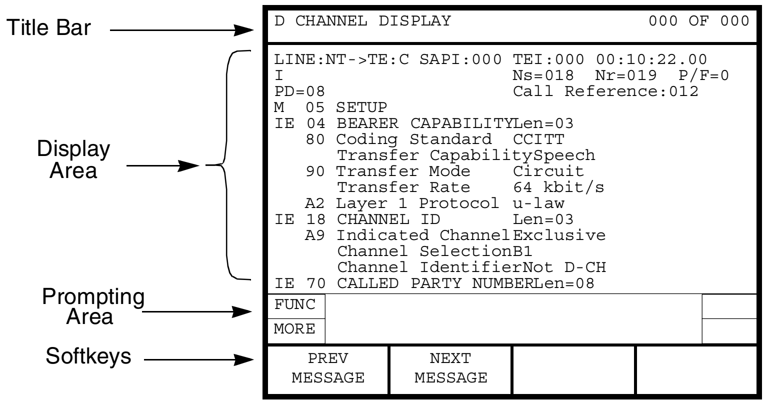


Figure 49 • ISDN BRI D-Channel Display

You can activate the D-Channel Display by pressing the **D-Channel Display** softkey. After pressing the softkey, the Large Graphical Display shows one message at a time. Messages are captured in the order they are transmitted and/or received.

The following softkeys allow you to navigate the messages as follows:

FIRST — Shows first message.

LAST — Shows last message.

PREVIOUS — Shows previous message.

NEXT — Shows next message.

The Print softkeys are listed below:

PRINT CURRENT — Prints the current message.

PRINT TO LAST — Prints all messages from the current to the last message.

PRINT ALL — Prints messages from the first to the last message.

Press the **CLEAR STORAGE** softkey to clear all capture messages. Press the **EXIT** softkey to exit the D-Channel Display and return to the Home, Setup, Results, or System view.

Status messages appear on the Two-Line Display to indicate print activity and capture status. A message flashes when the capture buffer is full, indicating that frame capture is inactive. You must clear the capture buffer by pressing the **CLEAR STORAGE** softkey to resume frame capture. Capture storage will also be indicated as a percentage result (% full) on the result views.

Capture storage is only maintained for the lifetime of the current test (for example, switching from PRI ISDN to a nonprotocol test will clear the capture storage). Use the print softkeys to save relevant capture information.

Test Results

Test results are shown on theT-BERD 950 analyzer view on the RESULTS I and II Two-Line Display. Other common results may also be available.

Test results for the ISDN BRI option are shown on the analyzer Two-Line Display. The Two-Line Display and associated controls and indicators are located on the front panel above the keypad. Refer to "Test Results Display" on page 90 for a detailed description of the Results Display.

Test results also appear on the Large Graphical Display Results view (refer to "Results View" on page 33).

Status and Alarm LEDs

The ISDN BRI option uses the mainframe Status and Alarm LEDs. Depending on the interface or option in use, these LEDs have alternate meanings. Table 74 gives the option specific use for the affected LEDs for the BRI option.

Table 74 • Status and Alarm LEDs

LED	Description
SIGNAL (U Interface Signal Detected)	Illuminates green to indicate that the T-BERD 950 is receiving a 2B1Q signal.
FRAME SYNC (U Interface Activation)	Illuminates green to indicate that the T-BERD 950 is receiving a valid ISDN BRI layer 1 status.

An illuminated red LED indicates that the Status and Alarm condition was previously true or present since the start of the current test.

Summary Category Results

The Summary category automatically lists key results that are out of specification. If all results are within specification for the LINE or EQUIPMENT receiver, the message `All Results OK` appears on the appropriate side of the Two-Line Display.

Signal results are not available for BRI.

Interface Category Results

The Interface Category results are described in Table 75. Unless stated otherwise, all results are available in NT1, NT1/TE, and LT modes.

Table 75 • ISDN BRI Interface Category Result s

Result	Description
Layer1 Stat	Displays the last U interface activation state. Its activation states are awaiting signal, synchronized, and alerting.
FEBE Err	Far End Block Error (FEBE). Provides status information sent from the near-end terminal to the far-end terminal to indicate the presence of a Framing Error, Parity Error, Out of Frame (OOF), or Alarm Indication Status (AIS) events at the far-end terminal.
CRC Err	Counts Cyclical Redundancy Check 6 errors detected since the beginning of the test. An algorithm is performed on a packet on the transmitting end. It is then recalculated at the receiving end. If the measurements are not equal, it indicates an error occurred in the packet.
Seal Cur	Displays if sealing current is present on the U interface.
Loop State	Displays current loop state and channel looped. Valid results include the following: No Loop, Loop B1, Loop B2, Loop B1 & B2.
EOC Msg	Embedded Operations Channel message. Valid results include the following: Loopback B1, Loopback B2, Loopback 2B+D, Normal, Hold, Unable to Comply, Request Corrupt CRC, Sending Corrupt CRC.

Test Type Category Results

The ISDN BRI option collects Test Type Category results when it terminates a link. These results are based on the received D-channel (the transmitted frames are ignored). The mainframe collects statistics on basic rate ISDN frames at the same time that it collects interface-specific results. BERT Test Type results are described in “T1 Test Results” on page 92.

The ISDN BRI terminating ISDN statistics collected are listed in the ISDN Test Type Category Results. These results are described in Table 76. Unless otherwise stated, all results are available in NT1/TE mode only.

A typical ISDN BRI Test Type results view is shown in Figure 50.

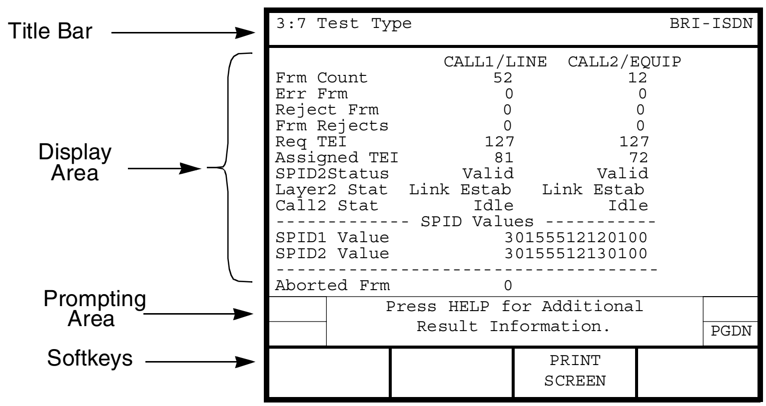


Figure 50 • ISDN BRI Test Type Results

Table 76 • ISDN BRITest Type Category Result s

Result	Description
Frm Count	Counts the valid ISDN frames detected in circuit operation mode.
Err Frm	Counts the errored frames with at least one of the following conditions: undefined control field, S or U frame with an improper length, and an I frame with a length exceeding limit.
Reject Frm	Counts the frames with a sequence number error.
Frm Rejects	Counts the frames with ISDN Frame Reject frames. A Frame Reject is sent when a device receives a frame with a protocol error.
Req TEI	Displays the TEI that was requested. This is the value of the TEI request configuration.
Assigned TEI	Displays the TEI that was assigned. This may or may not be equal to the requested TEI value.
SPID Status	Displays the SPID status. This result can have the values: Valid, Invalid, Unassigned.
Layer2 Stat	Displays the Layer 2 Status. Status messages are: TEI Not Assigned, Awaiting TEI, Link Not Established, Awaiting Establishment, Link Established, Timer Recovery, Awaiting Release, TEI Denied, Link Unknown. If the status is Link Not Established, a flashing two-line message on Results I and/or Results II indicates calls that cannot be placed.
Call Stat	Displays the current call State.
SPID1 Value	Displays the SPID value for Call 1 that was assigned during SPID assignment. Use in NT1 and LT modes also.
SPID2 Value	Displays the SPID value for Call 2 that was assigned during SPID assignment. Use in NT1 and LT modes also.
Aborted Frm	Counts the aborted ISDN frames detected, excluding Out of Frame aborts.

Table 76 • ISDN BRI Test Type Category Results (Continued)

Result	Description
Invalid Frm	Counts the frames with at least one of the following invalid conditions: short frame, FCS errored frame, single octet address, unapproved Service Access Point Identifier (SAPI).
Call Fails	Counts the number of call attempts that ended in call failure (does not include busy replies or normal call clears).
Call 1 and Call 2 Status	**Call Status** — Displays current call status. **Call Type** — Displays **DATA** or **VOICE** call type. **Caller ID** — Displays the number from where the call is being placed. **Channel #** — Displays the **Bearer Channel** being used by the call. **Cause Code**[a] — Displays the plain English text for the Cause Code. **Location** — Displays the location of the Cause Code.
Call Failure Report	Displays the status of the last 5 failed ISDN calls. **Call Type** — Displays **DATA** or **VOICE** call type. **Channel #** — Displays the **Bearer Channel** being used by the call. **Cause Code** — Displays the plain English text for the Cause Code. **Location** — Displays the location of the Cause Code. **Calling # —** Displays the number from where the call is being placed. **Called # —** Displays the number to where the call is being placed.

a. The analyzer interprets the Cause code for you; however, a complete list of Cause Codes can be found in Table 78, on page 256,

Figure 51 shows a Typical ISDN call status and call failure report.

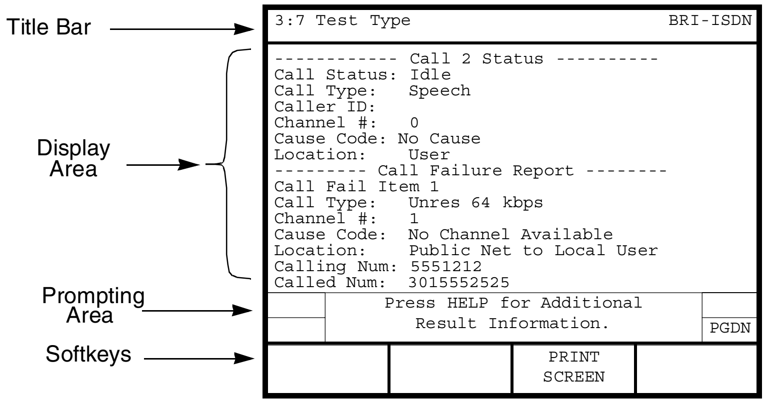


Figure 51 • ISDN BRI Call Status and Call Failure Report

X.25 Test Type Category Results

The ISDN BRI option collects X.25 Test Type Category results when it terminates a link. These results are based on the received D-channel (the transmitted frames are ignored). See Figure 52 and Figure 53 for sample X.25 Test Type Category results.

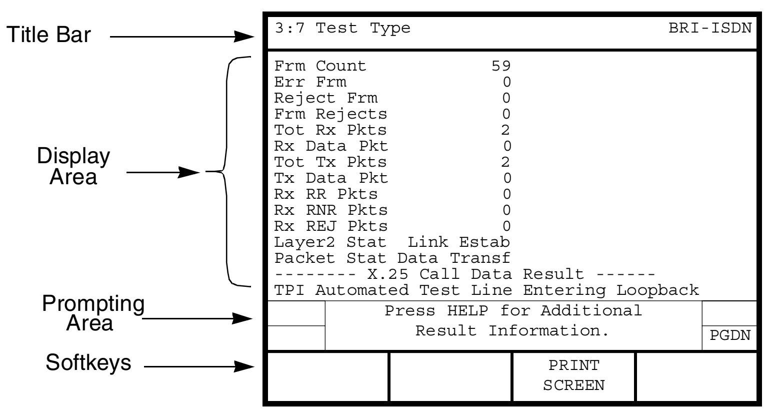


Figure 52 • ISDN BRI X.25 Results

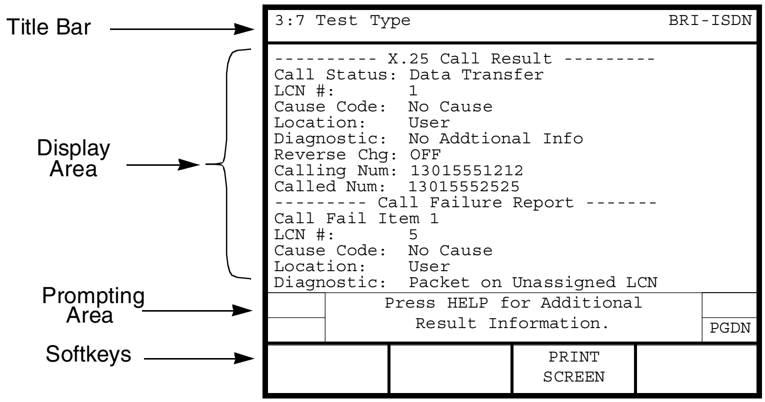


Figure 53 • ISDN BRI X.25 Call Results

The mainframe collects statistics on basic rate ISDN frames at the same time that it collects interface-specific results. These results are described in Table 77.

Table 77 • ISDN BRI X.25 Test Type Category Results

Result	Description
Frm Count	Counts the valid ISDN frames detected.
Err Frm	Counts the errored frames with at least one of the following conditions: undefined control field, S or U frame with an improper length, and an I frame with a length exceeding limit.
Reject Frm	Counts the frames with a sequence number error.
Frm Rejects	Counts the frames with ISDN Frame Reject frames. A Frame Reject is sent when a device receives a frame with a protocol error.
Tot Rx Pkts	Counts the total number of X.25 packets received.
Rx Data Pkt	Counts the received data packets.

Table 77 • ISDN BRI X.25 Test Type Category Results (Continued)

Result	Description
Tot Tx Pkts	Counts the total number of X.25 packets transmitted.
Tx Data Pkt	Counts the transmitted data packets.
Rx RR Pkts	Counts the receiver ready packets.
Rx RNR Pkts	Receiver Not Ready. Counts the receiver-not-ready packets.
Rx REJ Pkts	Counts the Reject Packets received.
Req TEI	Displays the value of the user requested TEI.Value is 0-63.
Assigned TEI	Displays the TEI assigned by the network. Values range from 64 - 126.
Layer2 Stat	Displays Layer 2 Status. Status messages are: TEI Not Assigned, Awaiting TEI, Link Not Established, Awaiting Establishment, Link Established, Timer Recovery, Awaiting Release, TEI Denied, Link Unknown. If the status is Link Not Established, a flashing two-line message will appear on Results I and or Results II to indicate that calls cannot be placed.
Packet Stat	Displays the current call state. Results include: Ready — no call active. DTE Waiting — waiting for far end to connect. DCE Waiting — received incoming call but not answered. Data Transfer — call is connected.
X.25 Call Data Result	Displays incoming received data in the data packet in this two-line field. (For example, this would list the FOX message if SEND FOX is pressed and the circuit is looped back at the far end.)

Table 77 • ISDN BRI X.25 Test Type Category Results (Continued)

Result	Description
X.25 Call Result	**Call Status** — Displays current call status **LCN #** — Displays the Logical Channel Number (LCN) of the X.25 call. **Cause Code** — Displays the plain English text for the Cause Code. **Location** — Displays the location of the Cause Code. **Diagnostic** — Displays the diagnostic code if appropriate for the call. **Reverse Chg** — Indicates if the call is a collect call. **Calling Num** — Displays the number from where the call is being placed. **Called Num** — Displays the number to where the call is being placed.
Call Failure Report	Displays the number of call attempts that ended in call failure (does not include busy replies or normal call clears). **LCN #** — Displays the Logical Channel Number (LCN) of the X.25 call. **Cause Code** — Displays the plain English text for the Cause Code. **Location** — Displays the location of the Cause Code. **Diagnostic** — Displays the diagnostic code if appropriate for the call. **Reverse Chg** — Indicates if the call is a collect call. **Calling Num** — Displays the number from where the call is being placed. **Called Num** — Displays the number to where the call is being placed.
% Full	Displays the current amount of storage used (% full) for D-channel message capture.
Messages	Displays the current number of messages available to the D-channel display (see “Interpreting D-Channel Display” on page 245).

ISDN Q.931 Cause Codes

Table 78 provides English translations of Q.931 messages received and transmitted on the D-channel; however, the analyzer interprets the cause code for you.

Table 78 • ISDN BRI Results Reports Q.931 Cause Codes

Class	Value	No.	Cause Code
— Q.931 Cause Codes (1988) —			
000	0001	1	Unassigned number.
	0010	2	No route to specified transit network.
	0011	3	No route to destination.
	0110	6	Channel unacceptable.
	0111	7	Call awarded and being delivered in an established channel.
001	0000	16	Normal call clearing.
	0001	17	User busy.
	0010	18	No user responding.
	0111	19	No answer from user (user alerted).
	0101	21	Call rejected.
	0110	22	Number changed.
	1010	26	Non-selected user clearing.
	1011	27	Destination out of order.
	1100	28	Invalid number format.
	1101	29	Facility rejected.
	1110	30	Response to STATUS INQUIRY.
	1111	31	Normal, unspecified.
010	0001	34	No circuit/channel available.
	0110	38	Network out of order.
	1001	41	Temporary failure.
	1010	42	Switching equipment congestion.
	1011	43	Access information discarded.
	1100	44	Requested circuit/channel not available.
	1111	47	Resources unavailable, unspecified.
011	0001	49	Quality of service unavailable.
	0010	50	Requested facility not subscribed.
	0110	54	Incoming calls barred
	1001	57	Bearer capability not authorized.
	1010	58	Bearer capability not presently available.
	1111	63	Service or option not available, unspecified.

Table 78 • ISDN BRI Results Reports Q.931 Cause Codes (Continued)

Class	Value	No.	Cause Code
100	0001	65	Bearer capability not implemented.
	0010	66	Change type not implemented.
	0101	69	Requested facility not implemented.
	0110	70	Only restricted digital information bearer capability is available.
	1111	79	Service or option not implemented, unspecified.
101	0001	81	Invalid call reference value.
	0010	82	Identified channel does not exist.
	0011	83	A suspended call exists, but this call identity does not exist.
	0100	84	Call identity in use.
	0101	85	No call suspended.
	0110	86	Call having the requested call identity has been cleared.
	1000	88	Incompatible destination.
	1011	91	Invalid transit network selection.
	1111	95	Invalid message, unspecified.
110	0000	96	Mandatory information element is missing.
	0001	97	Message type nonexistent or not implemented.
	0010	98	Message not compatible with call state or message type nonexistent or not implemented.
	0011	99	Information element nonexistent or not implemented.
	0100	100	Invalid information element contents.
	0101	101	Message not compatible with call state.
	0110	102	Recovery on timer expired.
	1111	111	Protocol error, unspecified.
111	1111	127	Interworking, unspecified.
— National-specific Cause Codes Defined in TA-NWT-001268 —			
000	0100	4	Vacant code.
	1000	8	Prefix 0 dialed in error.
	1001	9	Prefix 1 dialed in error.
	1010	10	Prefix 1 not dialed.
	1011	11	Excessive digits received, call is proceeding.
110	0101	101	Protocol error, threshold exceeded.

10 BaseT/ Ethernet Option

This section provides step-by-step instructions for using the 10BaseT/ Ethernet option for the T-BERD 950 and discusses the following topics:

- Option Description
- TNT Test Setup
- Manual Test Setup
- Test Results

Option Description

The 10BaseT option enables the T-BERD 950 Communications Analyzer to perform the following:

- PING testing
- IP traffic generation

Operating Modes

Terminate mode is the only available operating mode for the 10BaseT option. After the TB-950 detects a valid Ethernet signal, it is ready to perform the required tests (PING or Load Generation).

You can configure the 10BaseT option for static or dynamic IP addresses. Dynamic addresses should be selected for Dynamic Host Control Protocol (DHCP) network implementations. In this case, the T-BERD 950 is assigned an IP address by the DHCP server.

PING Testing

The 10BaseT option provides the ability to verify network connectivity by transmitting and responding to Internet Control Message Protocol (ICMP) Echo requests (PING) between the customer premises and other points within the network, such as a server or router located at the CO, POP, or NOC. PING testing verifies that connectivity has been established and provides a basic measure of expected network performance. PING testing allows you to isolate faulty or misoptioned equipment and identify network congestion problems.

Traffic Generation Testing

The 10BaseT option allows you to transmit and receive traffic between the customer premises and another logical point, using the network to check service performance against the expected rate. Traffic Generation testing verifies service performance using measurements such as throughput. Traffic Generation testing can also isolate between LAN and network/WAN trouble. LAN problems, such as improper Ethernet wiring, improper addressing schemes, over-utilization, or excessive collisions, are in many cases wrongly associated with WAN service.

External Interface Requirements

The 10BaseT/Ethernet module provides an RJ-45 (8 pin) connection.

Option Specifications

Table 79 lists the specifications for the 10BaseT/Ethernet option.

Table 79 • 10BaseT/Ethernet Option Specifications

Item	Specification
Test Modes	Terminate
DHCP Implementation	RFC 2131
PING Testing	ICMP Echo Test
Traffic Generation	Load Rate (user selectable) valid range: 1 kbps to 10 Mbps Packet Length (user selectable) valid range: 70 to 1518 bytes
Payload Compensation	Variable length ICMP echo response

Setting up TNT Testing

This section describes the TNT test setups for the 10BaseT/Ethernet option. A sample TNT Setup view is shown in Figure 54.

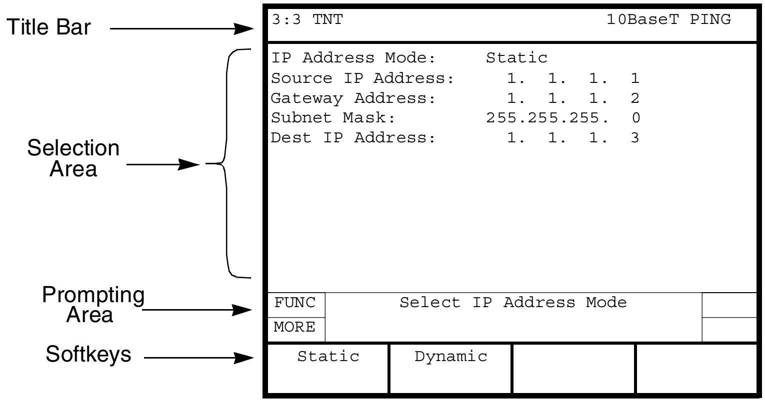


Figure 54 • 10BaseT TNT Setup View

Table 80 lists the TNT test setup for performing 10BaseT/Ethernet Turn-up tasks. For descriptions of the test setup parameters, see “Setting up Manual Testing” on page 263. For descriptions of all results, see “Test Results” on page 266.

Table 80 • 10BaseT/Ethernet Turn-up

Test	TNT Setup	TNT Results
PING	IP Address Mode (STATIC) Source IP Address (1.1.1.1) Gateway Address (1.1.1.2) Subnet Mask (255.255.255.0) Dest IP Address (1.1.1.3)	FCS Err Frames Checksum Err Frames Source IP Address Avg Thruput Tx Pings Echo Pings Lost Pings Min. Ping Delay Max. Ping Delay Avg. Ping Delay
Traffic Generation	IP Address Mode (STATIC) Source IP Address (1.1.1.1) Gateway Address (1.1.1.2) Subnet Mask (255.255.255.0) Dest IP Address (1.1.1.3) Load Rate (kbps) (XXX) Packet Length (XXX)	FCS Err Frames Collisions Checksum Err Frames Source IP Address Total Rx Packets Total Tx Packets Avg. Frame Rate Avg. Frame Length Avg. Thruput Max. Thruput

Setting up Manual Testing

This section provides descriptions of the analyzer setup as it applies to the 10BaseT/Ethernet option. Figure 55 shows a sample Interface Setup view.

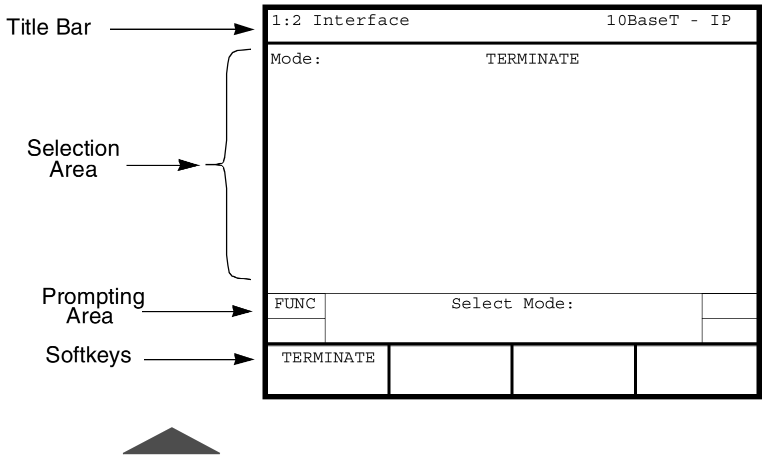


Figure 55 • 10BaseT Setup Interface View

Setting up the Interface View

The Interface Setup view configures the 10BaseT/Ethernet interface. Currently, only the Terminate interface is available for the 10BaseT/ Ethernet option.

Mode — Enables selection of the operating mode. Only **TERMINATE** is available (see “Operating Modes” on page 260).

Setting up the Test Type View

The Test Type Setup view configures the test to be performed. The **SCROLL** key controls this selection area. Figure 56 shows a sample Test Type Setup view.

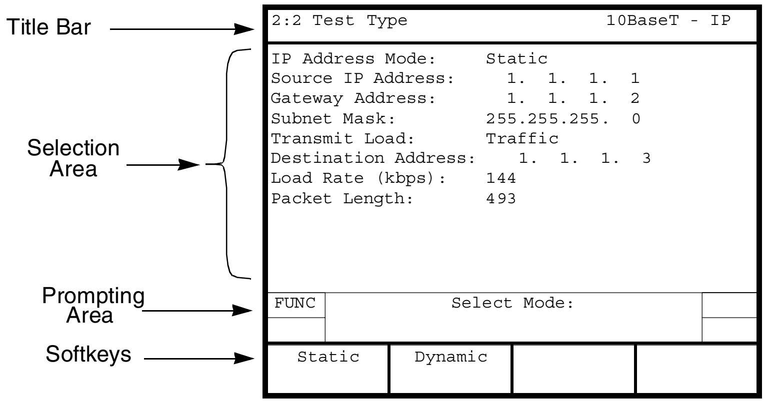


Figure 56 • 10BaseT Setup Test Type View

IP Address Mode — Select the IP Address Mode as **DYNAMIC** or **STATIC**.

> **DYNAMIC** — Configures the T-BERD 950 to accept an IP address that is assigned dynamically by the server using DHCP.
>
> **STATIC** —Allows you to enter the specified source IP address for the device or location at which testing is conducted.

Source IP Address — (STATIC). Enables you to specify the source IP address. Use the keypad to enter the address in this format: xxx.xxx.xxx.xxx. (Leading zeros are deleted from the IP address when you exit this field.) Address entries of 0.0.0.0 or 255.255.255.255 are not valid.

Gateway Address — (STATIC). Enables you to specify the gateway address. Use the keypad to enter the address in this format: xxx.xxx.xxx.xxx. (Leading zeros are deleted from the IP address when you exit this field.) Address entries of 0.0.0.0 or 255.255.255.255 are not valid.

Subnet Mask — (STATIC). Enables you to specify the subnet mask address. Use the keypad to enter the address in this format: xxx.xxx.xxx.xxx. (Leading zeros are deleted from the IP address when you exit this field.)

Example: A subnet mask of 255.255.255.252 limits the number of devices (unique IP addresses) on that subnet to four.

Transmit Load — Select the Transmit Mode as **OFF**, **PING**, or **TRAFFIC**.

OFF — No transmit load is selected.

PING — Allows you to perform PING testing.

TRAFFIC — Allows you to perform Traffic Generation testing.

Dest IP Address — Enables entry of the destination IP address, format is xxx.xxx.xxx.xxx. Use the keypad to enter the address. (Leading zeros are deleted from the IP address when you exit this field). Address entries of 0.0.0.0 or 255.255.255.255 are not valid.

Load Rate (kbps) — (TRAFFIC). Enables you to specify the load rate. Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the level.Valid entry ranges 1 Kbps to 10 Mbps.

Packet Length — (TRAFFIC). Enables you to specify the packet length in bytes. Use the keypad or **INCREASE VALUE** or **DECREASE VALUE** softkeys to set the level.Valid entry ranges from 70 to 1518 bytes.

Test Results

Test results for the 10BaseT option appear on the analyzer Two-Line Display. The Two-Line Display and associated controls and indicators are located on the front panel above the keypad. For a detailed description of the Two-Line Display, see “Test Results Display” on page 90. Test results are also shown on the Large Graphical Display Results view. For a detailed description of the Large Graphical Display, see “Results View” on page 33. A typical 10BaseT Results view is shown in Figure 57.

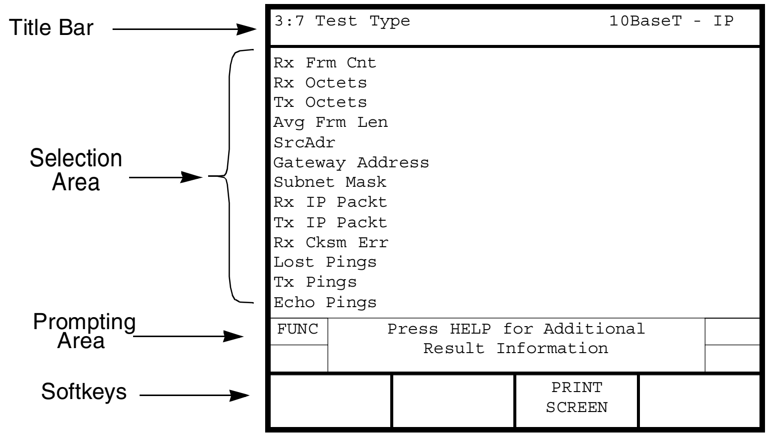


Figure 57 • 10BaseT Results Test Type View

Status and Alarm LEDs

The 10BaseT/Ethernet option uses the mainframe Status and Alarm LEDs. Depending on the interface or option in use, these LEDs have alternate meanings. Table 81 describes the LEDs used for the 10BaseT/Ethernet option.

Table 81 • Status and Alarm LEDs

LED	Description
SIGNAL (Description)	Illuminates green to indicate that the Ethernet Link is detected.
FRAME SYNC (Receiver Status)	Illuminates green to indicate that the T-BERD 950 is receiving a Ethernet data.
YELLOW ALARM (Collision Detection)	Illuminates when an Ethernet Collision is detected.

Summary Category Results

The Summary category automatically lists key results that are out of specification. If all results are within specification for the LINE or EQUIPMENT receiver, the message `All Results OK` appears on the appropriate side of the Two-Line Display.

Interface Category Results

The Interface Category results are described in Table 82.

Table 82 • 10BaseT/Ethernet Interface Category Results

Result	Description	Troubleshooting
FCS Err Frm	Counts the Ethernet frames received with FCS errors.	The presence of FCS errored frames indicates corruption or loss of data within the Ethernet frame. This indicates a physical layer problem, such as poor connections or faulty equipment. Because many devices on the network, such as servers and routers, automatically detect and discard errored frames, it is likely that the problem is located between the last device and the point at which the test is performed.
Short Frm	Counts the number of received frames that are less than the minimum length of 64 bits defined for the channel.	The presence of Short Frames may be the result of a faulty or misconfigured host device that originated the traffic. It may also be a physical layer problem within the network causing the truncation or corruption of valid frames (FSC Errored Frames will also be present).
Collisions	Indicates when a collision is detected.	A collision occurs when two or more devices on the same Ethernet interface attempt to transmit at the same time. An excessive number of collisions is typically caused by one or more devices attempting to transmit a large volume of data in a short period of time. The detection and resolution of collisions is a normal function of the Ethernet interface, but when the number of collisions become excessive, throughput decreases. [a]
Long Frm	Counts the frames received with a length that is greater than 1518 bytes.	The presence of Long Frames may be the result of a faulty or misconfigured host that originated the traffic. It may also indicate a physical layer problem within the network causing the frames to be misinterpreted as part of the previously transmitted frame (FSC Errored Frames will also be present).
Rx Overflow	Counts the times the receiver has overflowed and lost data.	An Rx Overflow is an indication that an excessive amount of traffic exists on the network segment on which the test is being performed.

Table 82 • 10BaseT/Ethernet Interface Category Results (Continued)

Result	Description	Troubleshooting
Aln Err Frm	Counts the frames received with alignment errors (i.e., fragments).	The frames received with alignment errors indicates that the number of bits contained in the received frame is not divisible by eight. This may indicate problems with the host device that originated the traffic, or a physical layer problem within the network causing the truncation or corruption of valid frames. In most cases, alignment errors also indicate FCS errored frames.
%Err Frames	Displays the percentage of total frames received that contain errors.	A high percentage of errored frames indicate a problem with the specific host device that generated the traffic, or a physical layer problem within the network that causes the corruption or loss of frame data. Because many devices on the network, such as servers and routers, automatically detect and discard errored frames, it is likely that the problem is located between the last device and the point at which the test is performed.
Avg % Util	Displays the ratio of received Ethernet octets in a second over the maximum possible Ethernet octets in a second (constant 10,000 for 10BaseT).	The Avg % Util results should be greater than zero and approximately equal to the percentage of the total 10 Mbps Ethernet interface bandwidth used for traffic transmission by both ends (sum of near- and far-end local rate(s) divided by circuit data rate).
Max % Util	Displays the maximum calculated ratio of receive Ethernet octets in a second over the maximum possible Ethernet octets in a second (constant 10,000 for 10BaseT).	The Max % Util results should be greater than zero and approximately equal to the percentage of the total 10 Mbps Ethernet interface bandwidth used for traffic transmission by both ends (sum of near- and far-end local rate(s) divided by circuit data rate).

a. Collisions are typically resolved locally between the devices in which they occur. Therefore, in most cases, this result indicates the presence of collisions between the T-BERD 950 and the device to which it is connected, and does not indicate collisions occurring between devices elsewhere in the network.

Test Type Category Results

The Test Type category results are described in Table 83.

Table 83 • 10BaseT/Ethernet Test Type Category Results

Result	Description	Troubleshooting
Rx Frm Cnt	Counts the Ethernet frames successfully received.	If no Ethernet frames are received, they are not being transmitted through the network from the far-end.
Rx Octets	Counts the valid Ethernet octets (bytes) successfully received.	If the valid Ethernet octets are successfully received, the Rx Octets result should increment in conjunction with the Rx Frame Count.
Tx Octets	Counts the valid Ethernet octets (bytes) successfully transmitted.	If the valid Ethernet octets are successfully transmitted, the Tx Octets result will increment with transmitted traffic or PINGs.
Avg Frm Len	Displays the average length for all received Ethernet frames.	For all received Ethernet frames, the average frame length can vary, but should remain within a valid range of 64 to 1518 bytes.
Source Address	Displays the address assigned by the server in a DHCP implementation. If a static address is used, the address entered in the setup view is displayed.	For DHCP implementations (Dynamic IP addressing selected), the lack of an assigned address (all zeroes) indicates that the DHCP server does not recognize the test set and assigned an address.
Gateway Address	Displays the address assigned by the server in a DHCP implementation. If a static address is used, the address entered in the setup view is displayed.	For DHCP implementations (Dynamic IP addressing selected), the lack of an assigned address (all zeroes) indicates that the DHCP server does not recognize the test set and assigned an address.
Subnet Mask	Displays the address assigned by the server in a DHCP implementation. If a static address is used, the address entered in the setup view is displayed.	For DHCP implementations (Dynamic IP addressing selected), the lack of an assigned address (all zeroes) indicates that the DHCP server does not recognize the test set and assigned an address.
Rx IP Packt	Counts the valid IP packets successfully received.	If a count does not appear, either the far-end is not generating traffic or traffic generated at the far end is not being properly passed through the network.

Table 83 • 10BaseT/Ethernet Test Type Category Results (Continued)

Result	Description	Troubleshooting
Tx IP Packt	Counts the valid IP packets successfully transmitted.	If a count does not appear, IP traffic is not being transmitted through the network.
Rx Cksm Err	Counts the IP packets received with checksum errors.	If and IP packet is received that contains a checksum error, this can indicate a problem. The problem may be with the host device that originates the traffic, or a physical layer problem causing the IP packet data corruption or loss. Because most routers that handle Layer 3 routing discard packets with checksum errors, it is likely that the problem is located between the last device and the point at which the test is performed.
Lost Pings	Counts the transmitted PINGs that have timed out waiting for a response. (Echo replies that are not received within 5 seconds of the transmission of an echo request (PING) are declared lost.)	If an excessive number of lost PINGs occurs, but some echo replies are received from the far-end device, network congestion is most likely the source of the problem. If no echo replies are received from the far-end device, then the addressing may be incorrect or a problem with the device itself may exist.
Tx Pings	Counts the transmitted PINGs.	If a count does not appear, theT-BERD 950 is not transmitting PING Packets.
Echo Pings	Counts the transmitted PING responses.	If a count does not appear, the far-end device may not be sending PING packets successfully to the T-BERD 950.

Performance Category Results

Performance category results are described in Table 84.

Table 84 • 10BaseT/Ethernet Performance Category Results

Result	Description	Troubleshooting
Avg Frm Rat	Displays the average rate in frames per second for all transmitted and received Ethernet frames.	The average frame ratio should increment in correspondence to traffic generated and received. If the results do not correspond, Ethernet frames are not being transmitted or received.
Avg Thruput	Displays the ratio of Ethernet octets over elapsed time (in Kbps).	The average throughput should correspond to the rate being transmitted. (Assuming this fixed rate is below the maximum near-end circuit data rate.)
Max Thruput	Displays the maximum calculated ratio of Ethernet octets over elapsed time (in Kbps).	The maximum throughput should correspond to the rate being transmitted. (Assuming this fixed rate is below the maximum near-end circuit data rate.)
Min Png Dly	Displays the minimum time taken for a PING echo packet to be transmitted and an echo reply received (in msec).	The difference between minimum, average, and maximum PING delay provides a baseline measure of network performance. This occurs when a series of PINGs are transmitted over a period of time. Excessive delays are typically caused by congestion at some point on the network. By sending PINGs to devices located at different points within the network, areas of congestion can be isolated.
Max Png Dly	Displays the maximum time taken for a PING echo packet to be transmitted and an echo reply received (in msec).	
Avg Png Dly	Displays the average time taken for the PING echo packet to be transmitted and an echo reply received (in msec).	

Chapter 10 Acterna Customer Services

This chapter describes services, service locations, and available training through Acterna (formerly TTC and WWG). Both warranty and out-of-service warranty service information is provided.

Overview

Acterna offers unmatched services to support purchased equipment, including a wide range of customer care, technical support, instrument maintenance, and training services. Acterna customer service specialists are fully trained to help customers find the answers they are looking for. Call Customer Services for:

- Information on products and services, including upgrades, calibration, training, software enhancement agreements (SEAs), and product maintenance agreements. Our representatives can also provide assistance with product returns and repairs.
- Expert technical support, including help with product configuration, circuit qualification, and complete network trouble sectionalization. Acterna is also available on a contractual basis to provide customized application development, network consulting and management services, software customization, and test procedure development.

All Acterna products are backed by an industry-leading warranty that guarantees mainframe repair or replacement for 3 years and all other parts for 1 year.

Customer Service Locations

For questions regarding Acterna products and services, including return authorizations and repairs, technical support, training, and all other available services, contact your local distributor or Acterna Customer Service at one of the locations listed in the Acterna Contact list at the beginning of this manual.

Services

Instrument Service

To maintain your organization's long-term investment, Acterna will structure a service plan to fit your network performance goals and budget. Acterna understands the impact of equipment down time on operations and is staffed to ensure a quick turnaround. Available services include:

Product Repair — All equipment returned for service is tested to the same rigorous standards as newly manufactured equipment. This ensures products meet all published specifications, including any applicable product updates.

Calibration — Acterna's calibration methods are ISO 9001 approved and based on NIST standards. Each calibration comes with a dated certificate, instrument stickers, and a data sheet.

Factory Upgrades — Any unit returned for a hardware feature enhancement will also receive applicable product updates and will be thoroughly tested, ensuring peak performance of the complete feature set.

Software Enhancement Agreements — These agreements assist in keeping equipment up to date with the latest software features, by providing automatic notification of any new software enhancements and changes for Acterna products.

Product Maintenance Agreements — Yearly service and calibration maintenance agreements simplify billing and help ensure the equipment is always operating at optimum levels. Product maintenance agreements can be used to extend a current warranty or provide protection for out-of-warranty units.

Other Pricing Options — For out-of-warranty repairs, Acterna offers two additional pricing options: time and material pricing and flat rate pricing. Under time and material pricing, customers are billed for the actual cost of the repair, making this a cost-effective method for minor repairs. Under flat rate pricing, customers pay a fixed service charge to repair unit failures (excluding damage or abuse), resulting in simplified paperwork and easier budgeting.

Product Enhancement Group

The Product Enhancement Group staff offers one of the broadest and most experienced resource portfolios in the communications testing industry. This team of professionals offers expertise in software development, test procedure development, and network consulting, as well as years of expert test knowledge. Support is available for all core Acterna product lines:

Network Consulting and Management — Provides services such as productivity analysis, test strategy assessment, on-site applications assistance, and specialized training.

Software Customization — Develops scripts for remote and automated testing, statistics, and emulation.

Test Procedure Development — Creates procedures for automated testing, network testing, and compliance testing.

Test Systems Field Engineering and Installation

Acterna offers a range of support services for our centralized test systems, designed around the needs of the customer's network. These services help preserve the investment over the life of the equipment. Available services include:

Critical Services Program — Provides technical support at any time, 7 days a week, 24 hours a day. Replacement parts are guaranteed to arrive within 48 hours of contacting Acterna.

Maintenance Contracts — Cost-effective management for networks with multiple test systems.

Out-of-Warranty Service Agreement — Covers the test system for failures after the warranty expires, including all time and material costs and return shipping costs to the customer site.

Field Engineering and Installation Service — Provides a variety of options for implementing the test system into the network, including installation, configuration, upgrades, and on-site technical support.

Technical Training

By providing both experienced instructors and a hands-on atmosphere, Acterna training is designed to optimize test strategies and employee development requirements. Available services include:

Customized Technical Training — Designed to incorporate real-life challenges technicians face daily, while addressing the customer's training requirements, Acterna provides training at the customer's designated site, so the whole staff is trained at one time. Step-by-step reviews of current technologies and products enable new or experienced technicians to translate theory into practical, hands-on expertise.

Public Courses — Regularly scheduled, in-depth, hands-on product and technology courses are offered worldwide. Public courses provide a learning environment that allows individuals from different companies to share their knowledge and experience with their peers.

Computer-Based Training (CBT) — Acterna's CBT complements our hands-on technical training. With CBT, customers can learn about emerging communications technologies at their own convenience — at work, at home, or while traveling. Acterna's CBT courses cover technology topics such as ATM, frame relay, ISDN, LAN basics, and more.

Customized Multimedia Course Development — Multimedia courseware can be created to customer specifications, making it easier to learn new test instruments or applications. These custom packages provide consistent educational content and training for the entire staff. Students learn at their own pace on their own PC.

Consulting and Needs Analysis Services — Acterna can help identify training needs and develop customized training curricula to maximize learning opportunities, all while providing a measurable return on investment.

Warranty Information

The warranties described herein shall apply to all commercially available Acterna products. Any additional or different warranties shall apply only if agreed to by Acterna in writing. These warranties are not transferable without the express written consent of Acterna.

Hardware Warranty — Acterna warrants that Hardware Product sold to customer shall, under normal use and service, be free from defects in materials and workmanship. The warranty period shall be three (3) years for mainframes and options (parts and labor), and (1) one year for accessories and field-replaceable batteries. If installation services have been ordered, the warranty period shall begin on the earlier of (1) completion of installation, or (2) thirty (30) days after shipment to Customer. If Installation Services have not been ordered, the warranty period shall begin upon shipment to Customer. Hereafter these periods of time shall be collectively referred to as the “Initial Warranty Period.”

Acterna’s obligation and customer’s sole remedy under this Hardware Warranty is limited to the repair or replacement, at Acterna’s option, of the defective product. Acterna shall have no obligation to remedy any such defect if it can be shown: (a) that the Product was altered, repaired, or reworked by any party other than Acterna without Acterna’s written consent; (b) that such defects were the result of customer’s improper storage, mishandling, abuse, or misuse of Product; (c) that such defects were the result of customer’s use of Product in conjunction with equipment electronically or mechanically incompatible or of an inferior quality; or (d) that the defect was the result of damage by fire, explosion, power failure, or any act of nature.

Acterna warrants that Products returned to Acterna for repair shall be warranted from defective materials and workmanship for one (1) year for the same repair issue, and ninety (90) days for a different repair issue from date of shipment from Acterna to customer, or until the end of the Initial Warranty Period, whichever is longer. Risk of loss or damage to Product returned to Acterna for repair or replacement shall be borne by customer until delivery to Acterna. Upon delivery of such product, Acterna shall assume the risk of loss or damage until that time that the product being repaired or replaced is returned and delivered to customer. Customer shall pay all transportation costs for equipment or software shipped to Acterna for repair or replacement. Acterna shall pay all transportation costs associated with returning repaired or replaced product to customer.

Software Warranty — Acterna warrants that Software Products licensed to Customer shall, under normal use and service, and for a period of ninety (90) days from the date of shipment of the Software to Licensee (the "Warranty Period"), perform in all material respects in accordance with the published specifications for such Software as established by Acterna. However, Acterna does not warrant that the Software will operate uninterrupted or error free, operate in the combination with other software, meet Customer's requirements, or that its use will be uninterrupted.

Acterna's obligation and Customer's sole and exclusive remedy under this Software Warranty is limited to, at Acterna's option, either (i) correcting the material errors reported to Acterna in writing by Customer during the Warranty Period and which Acterna is able to reproduce, (ii) replacing such defective Software, provided that Acterna received written notice of such defect within the Warranty Period, or (iii) provided that Acterna received written notice of such defect within the Warranty Period, terminating the License and, upon return to Acterna of the Software, Documentation and all other materials provided by Acterna under the applicable License, providing Customer with a refund of all charges paid with respect thereto. Acterna shall have no warranty obligations hereunder if (a) the Software is altered or modified or is merged with other software by Customer or any third party or (b) all or any part of the Software is installed on any computer equipment other than the Designated Server or used with any operating system for which the Software is not designed.

Services Warranty — Acterna warrants that the Services provided by Acterna, if any, shall be performed promptly, diligently and in a professional manner in accordance with the commercial standards of the industry. Acterna shall not, however, be responsible for any delays that are not due to Acterna's fault or negligence or that could not have reasonably been foreseen or provided against.

WARRANTY DISCLAIMER — FOR HARDWARE, SOFTWARE, AND/OR SERVICES FURNISHED BY ACTERNA, THE FOREGOING WARRANTEES ARE IN LIEU OF ALL OTHERWARRANTEES AND CONDITIONS, EXPRESS OR IMPLIED. ACTERNA SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, ON ANY HARDWARE, SOFTWARE, DOCUMENTATION OR SERVICES INCLUDING BUT NOT LIMITED TO WARRANTIES RELATING TO QUALITY, PERFORMANCE, NONINFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AS WELL AS THOSE ARISING FROM ANY COURSE OF DEALING, USAGE OR TRADE PRACTICE. UNDER NO CIRCUMSTANCES WILL ACTERNA BE LIABLE FOR ANY INDIRECT OR CONSEQUENTIAL DAMAGES RELATED TO BREACH OF THISWARRANTY.

Equipment Return Instructions

For each piece of equipment returned for repair, attach a tag that includes the following information:

1. Owner's name, address, and telephone number.
2. The serial number, product type, and model.

3. Warranty status. (If you are unsure of the warranty status of your instrument, contact Acterna Customer Service.)
4. A detailed description of the problem or service requested.
5. The name and telephone number of the person to contact regarding questions about the repair.
6. The return authorization (RA) number (US customers), or reference number (European Customers).

If possible, return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit; when needed, appropriate packing materials can be obtained by contacting Acterna Customer Services. Acterna is not liable for any damage that may occur during shipping. The customer should clearly mark the Acterna-issued RA or reference number on the outside of the package and ship it prepaid and insured to Acterna.

Appendix A

Repeater Loop Codes

This appendix provides the loop code addresses by repeater and HDSL card type, the Repeater commands, and loop codes.

Teltrend Repeater Command Loop Codes are listed in Table 85.

Table 85 • Teltrend Repeater Command Loop Code s

Repeater	Command	Loop Code
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Arm (Inband)	11000
	Arm ESF Datalink	0001 0010 1111 1111
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Disarm (Inband)	11100
	Disarm ESF Datalink	0010 0100 1111 1111
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Near End Arm	11000
7231 LP IOR 7231 LW IOR 9132 LP IHR	Loop Up	1101 0011 1101 0011
7231 LW IOR 7231 LW IHR	Loop Up	1100 0101 0100 0001
7239 LP/LW ILR	Loop Up	1100 0111 010A AAAA [a]
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Loop Down	1001 0011 1001 0011
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Loop Back Timeout Disable	1101 0101 1101 0110
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Loop Back Query	1101 0101 1101 0101
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Power Loop Query	0101 1011 0101 1011
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Issues Query	0101 0110 1011 0111

Table 85 • Teltrend Repeater Command Loop Codes (Continued)

Repeater	Command	Loop Code
7231 LP IOR 9132 LP IHR	Power Down	0110 0111 0110 0111
7231 LW IOR 9132 LW IHR	Power Down	0101 0110 1111 1011
7231 LP/LW IOR 9132 LP/LW IHR	Power Up	Removes Power Down Code
7231 LP/LW IOR 7239 LP/LW ILR 9132 LP/LW IHR	Sequential Loop Back	1100 0111 1101 0010

a. Replace the A in the loop code with the repeater address.

Westell Repeater Command Loop Codes are listed in Table 86.

Table 86 • Westell Repeater Command Loop Codes

Repeater	Command	Loop Code
3130-80 IOR 3150-80 ILR 3150-81 ILR 3150-56 ILR 3151-56 ILR 3130-56 IOR	Arm (Inband)	11000
	Arm ESF Datalink	1111 0100 1000
3130-80 IOR 3150-80 ILR 3150-81 ILR 3150-56 ILR 3151-56 ILR 3130-56 IOR	Disarm (Inband)	11100
	Disarm ESF Datalink	1111 1111 0010 0100
3130-80 IOR	Loop Up	1100 0AAA AAAA AAAA [a]
3150-80 ILR 3150-81 ILR	Loop Up	1100 1AAA AAAA AAAA

Table 86 • Westell Repeater Command Loop Codes (Continued)

Repeater	Command	Loop Code
3150-56 ILR 3151-56 ILR	Loop Up	1100 0111 010A AAAA
3130-56 IOR	Loop Up	1101 0011 1101 001A
3130-80 IOR	Loop Down	1110 0AAA AAAA AAAA
3150-80 ILR 3150-81 ILR	Loop Down	1110 1AAA AAAA AAAA
3150-56 ILR 3151-56 ILR 3130-56 IOR	Loop Down	1001 0011 1001 0011
3130-80 IOR 3150-80 ILR 3150-81 ILR 3150-56 ILR 3151-56 ILR 3130-56 IOR	Timeout Disable	1101 0101 1101 0110
3130-80 IOR 3150-80 ILR 3150-81 ILR 3150-56 ILR 3151-56 ILR 3130-56 IOR	Loop Back Query	1101 0101 1101 0101
3150-56 ILR 3151-56 ILR	Power Loop Query	0101 1011 0101 1011
3130 56 IOR	Power Down	0110 0111 0110 0111
3130-80 IOR	Power Down	1100 0111 1101 0001
3130 56 IOR 3130-80 IOR	Power Up	Removes Power Down Code

a. Replace the A in the loop code with the repeater address.

XEL Line Repeater Command Loop Codes are listed in Table 87.

Table 87 • XEL Line Repeater Command Loop Codes

Repeater	Command	Loop Code
XEL 7853-200 ILR	Arm (Inband)	11000
	Arm ESF Datalink	0001 0010 1111 1111
	Disarm	11100
	Disarm ESF Datalink	0010 0100 1111 1111
	Loop Up	16-bit BCD Exchange Code + 12-bit BCD Location Code + 1111
	Loop Down	1110 0101 0101 0101
	Timeout Disable	12-bit BCD Location Code + 1111

PairGain Generic HDSL Command Loop Codes are listed in Table 88.

Table 88 • PairGain Generic HDSL Command Loop Codes

HDSL Component	Command	Loop Code
HLU	Loop Up (from CO)	1111000
HRU	Loop Up (from CO)	1110000
HDU1 (1st Doubler)	Loop Up (from CO)	110000
HDU2 (2nd Doubler)	Loop Up (from CO)	111000

Table 88 • PairGain Generic HDSL Command Loop Codes (Continued)

HDSL Component	Command	Loop Code
HDU3 (3rd Doubler)	Loop Up (from CO)	1010001
HDU4 (4th Doubler)	Loop Up (from CO)	1010010
HLU	Loop Up (from Customer Prem)	1111110
HRU	Loop Up (from Customer Prem)	1111100
HDU1 (1st Doubler)	Loop Up (from Customer Prem)	111100
HDU2 (2nd Doubler)	Loop Up (from Customer Prem)	111110
HDU3 (3rd Doubler)	Loop Up (from Customer Prem)	1011001
HDU4 (4th Doubler)	Loop Up (from Customer Prem)	1011010
All PairGain Components	Loop Down	11100

PairGain A2LB HDSL Command Loop Codes are listed in Table 89. Each command and loop code will loop up repeaters from the CO.

Table 89 • PairGain A2LB HDSL Command Loop Code s

HDSL Component	Command	Loop Code
All Components	Arm (Inband)	11000
	Arm ESF Datalink	1111 1111 0100 1000
	Disarm (Inband)	11100
	Disarm ESF	1111 1111 0010 0100
HLU	Loop Up	1101 0011 1101 0011
HRU	Loop Up	1100 0111 0100 0010
HDU1 (1st Doubler)	Loop Up	1100 0111 0100 0001
HDU2 (2nd Doubler)	Loop Up	1100 0111 0101 0100
HDU3 (3rd Doubler)	Loop Up	1100 0111 0100 0011
HDU4 (4th Doubler)	Loop Up	1100 0111 0100 0100
All Components	Loop Down	1001001
All Components	Timeout Disable	1101 0101 1101 0110

Adtran Abbreviated HDSL Command Loop Codes are listed in Table 90.

Table 90 • Adtran Abbreviated HDSL Command Loop Codes

HDSL Component	Command	Loop Code
HTU-R (CO)	Loop Up	1110000
HTU-C (CO)	Loop Up	1111000
1st Repeater (CO)	Loop Up	110000
2nd Repeater (CO)	Loop Up	111000
HTU-R (Customer Prem)	Loop Up	1111100

Table 90 • Adtran Abbreviated HDSL Command Loop Codes (Continued)

HDSL Component	Command	Loop Code
HTU-C (Customer Prem)	Loop Up	1111110
1st Repeater (Customer Prem)	Loop Up	111100
2nd Repeater (Customer Prem)	Loop Up	111110
All Components	Loop Down	11100

Adtran Standard HDSL Command Loop Codes are listed in Table 91.

Table 91 • Adtran Standard HDSL Command Loop Codes

HDSL Component	Command	Loop Code
All Components	Arm (Inband)	11000
	Arm ESF Datalink	0001 0010 1111 1111
	Disarm (Inband)	11100
	Disarm ESF Datalink	0010 0100 1111 1111
HTU-C	Loop Up	1101 0011 1101 0011
HTU-R	Loop Up	1100 0111 0100 0010
HRE 1 (Repeater 1)	Loop Up	1100 0111 0100 0001
HRE 2 (Repeater 2)	Loop Up	1100 0111 0101 0100
All Components	Loop Down	1001 0011
All Components	Timeout Disable	1101 0101 1101 0110

Appendix B Glossary

This glossary contains definitions for acronyms, abbreviations and terms used throughout this guide.

Glossary

AIS	Alarm Indication Signal (Blue Alarm)
AMI	Alternate Mark Inversion
Associated Path	Configured to be on the same T1 Path
AUX	Auxiliary
B_1 or B_2	First or Second Bearer Channel
B8ZS	Bipolar 8 Zero Substitution
BECN	Backward Explicit Congestion Notification
BER	Bit Error Rate
BERT	Bit Error Rate Test(ing)
BPV	Bipolar Violation
BRI	Basic Rate Interface
Bridgetap	Automated test that transmits 21 consecutive test patterns: ALL ONES, 1:1, 1:3, 1:5, 1:6, 1:7, 2:8, 2:9, 2:10, 2:11, 2:12, 2:13, 2:14, 3 in 18, 3 in 19, 3 in 20, 3 in 21, 3 in 22, 3 in 23, 3 in 24, and QRSS.
CLIP	Calling Line Identification Presentation
C/R	Command/Response Indication
CO	Central Office
CPE	Customer Premise Equipment
CSU	Channel Service Unit
D&I	Drop and Insert
DCE	Data Communications Equipment
DDS LL	Digital Data System Local Loop
DE	Discard Eligibility
DLCI	Data Link Connection Identifier
DL-LLB	Data Link - Line Loopback
DL-Net	Data Link - Network Loopback
DL-PLB	Data Link - Payload Loopback

DN	Directory Number (part of SPID)
DP	Dial Pulse
DSP	Digital Signal Processor
DSU	Data Service Unit
DSX	Digital Cross Connect
DTE	Data Terminal Equipment
DTMF	Dual Tone Multifrequency
EOC	Embedded Operations Channel (U Interface)
EQUIPMENT switch	Switch used to select T1 EQUIPMENT interface results to appear on the analyzer Two-Line Display
ESF	Extended Superframe
ETSI	European Telecommunications Standards Institute
FAC	Facility Access Code
FCS	Frame Check Sequence
FECN	Forward Explicit Congestion Notification
FT1	Fractional T1
FXO	Foreign Exchange Channel Unit - Office End
FXS	Foreign Exchange Channel Unit - Station End
HDLC	High Level Data Link Control
HDSL	High bit-rate Digital Subscriber Line
HELP key	Key used to access help related to the active selection line. Information is will appear on the Large Graphical Display.
ISDN	Integrated Services Digital Network
ITU	International Telecommunication Union
KP	Key Pulse
LAPD	Link Access on the D-Channel
Large Graphical Display	The 3.75” x 2.75” liquid crystal display used for the Home, Setup, Results, and System views.
LBO	Line Build Out

LCD	Liquid Crystal Display
LE	Local Exchange or Network Cloud, implies protocol layers
LL	Local Loop
LLB	Line Loop Back
LMI	Local Management Interface
LT	Local Termination (U Interface) implies physical layer
MF	Multifrequency
Multipat	Automated test that transmits 5 consecutive test patterns: ALL ONES, 1:7, 2:8, 3 in 24, and QRSS.
Multipat 2	Automated test that transmits 5 consecutive test patterns: 3 in 24, 1:7, ALL ONES, QRSS, ALL ZERO.
NLPID	Network Level Protocol Identifier
NT, NT1	Network Terminal (converts U to S/T interfaces)
OCU-DP	Office Channel Unit - Data Port
PBX	Private Branch Exchange
PCM	Pulse Code Modulation
PRI	Primary Rate Interface
PVC	Permanent Virtual Circuit
QRSS	Quasi-Random Signal Sequence
SAPI	Service Access Port Identifier
SF	Superframe
SLC	Subscriber Loop Carrier
SNAP	Subnetwork Access Protocol
SNOT	Sequence Number Only Test
SPID	Service Profile Identifiers
ST	Start Signal
STP	Start Signal Prime
ST2P	Start Signal Two Prime
ST3P	Start Signal Three Prime

T1 path	Path of signal flow, a T1 receiver and its associated Transmitter.
TA	Terminal Adapter
Two-Line Display	Two-line liquid crystal display used for results and error/status messages
TERM	Terminate
TIMS	Transmission Impairment Measurement Set
UDF	User Defined Frame
VF	Voice Frequency

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The index provides an alphabetized listing of terms and acronyms used throughout this guide.

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