

50-15051-01  
Rev. B

# **T-BERD 307 DS3/DS1 ANALYZER USER'S MANUAL**

**AUGUST 1997**

**Software Level B**

**This User's Manual applies to all T-BERD 307 DS3  
Communications Analyzers Incorporating Software Level B.x.**

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## SECTION 1 GETTING STARTED

### 1.1 MANUAL OVERVIEW

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This manual provides basic operating information for the T-BERD 307 DS3 Communications Analyzer. The manual is divided into the following sections; Getting Started, Auxiliary Functions, Test Results, and Options. The following paragraphs describe the contents of each of the manual sections.

- **Section 1 — Getting Started:** This section includes a description of this User's Manual, an instrument description, specifications for the analyzer, instrument checkout procedure, and preventive maintenance procedures.
- **Section 2 — User Interface Description:** This section provides a description of the T-BERD 307 User Interface. Included are descriptions of the operation of the front-panel controls used to select, configure, and edit the menu items in the Front-Panel Display. This section also includes the process for generating printouts using the PRINT auxiliary function.
- **Section 3 — Auxiliary Functions:** This section provides a description of the auxiliary functions of the analyzer, which control parameters of functions that are not frequently used and do not have dedicated switches.
- **Section 4 — Test Results:** This section provides a description of the available test results, the category of the results, and the test type with which it is associated.
- **Section 5 — Application Cards:** This section contains the application "quick" cards available for the analyzer at the time the manual was printed.

## **1.2 INSTRUMENT DESCRIPTION**

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The T-BERD 307 is a handheld test instrument specifically designed to fully test DS3 circuits. The DS1 Analysis Option (Option 307-1) adds full DS1 testing capability. A T-BERD 307 with the DS1 Analysis Option installed can perform the following functions:

- Identify timing problems by accessing the DS1 timing reference from either DS3 or DS1 access points.
- Test far-end equipment by transmitting appropriate loop codes to loop back a transmitted signal, then verifying the transmitted data is received without errors.
- Troubleshoot individual DS1 Channels within a DS3 signal by inserting test patterns or loop codes on one or all DS1 channels. DS1 channels can be dropped from the received DS3 signal to test and monitor.
- Measure VF level and frequency by monitoring individual VF channels.
- Troubleshoot DS0 problems by listening to individual channels and monitoring ABCD signaling bits on all 24 channels.
- Perform stress testing by transmitting and analyzing pre-programmed, long user patterns including 55 OCTET and T1 DALY.
- Reduce test setup time by recognizing and automatically configuring for the proper framing and pattern.

**1.2.1 Front Panel Controls, Indicators, and Connectors**

The front panel of the T-BERD 307 is shown in Figure 1-1 with each control or control group and indicator marked with a numbered callout. Table 1-1 provides a brief description of each control, indicator, and connector referenced to the numbered callouts in Figure 1-1.

**Table 1-1. Front-Panel Controls and Indicators**

#	Item	Description
1	<b>MODE</b> Switch	<p>The <b>MODE</b> switch selects the display mode. The choices are: RESULTS, DS3, and DS1.</p> <p><b>RESULTS</b> - enables the Test Results display, which shows three test results with the ability to independently select the rate (DS3 or DS1), category, and test result for each display.</p> <p><b>DS3</b> - activates the DS3 Test Configuration menu.</p> <p><b>DS1</b> - activates the DS1 Test Configuration menu.</p>
2	<b>CURSOR</b> Switch	The <b>CURSOR</b> switch up and down arrows are used to scroll through configuration items in the setup menus, auxiliary functions, and test results displays.
3	<b>SELECT</b> Switch	The <b>SELECT</b> switch up and down arrows are used to scroll through parameters in the selected configuration item.
4	Front-Panel Display	<p>This eight-line LCD display shows three screens:</p> <p><b>SETUP Screen</b> - used to configure basic functions (Test Configuration Window - top five lines) and display test results (Results Window - bottom two lines).</p> <p><b>AUX Screen</b> - used to set up infrequent configuration features and display Software level and date.</p> <p><b>RESULTS Screen</b> - used to display three test results simultaneously (DS3 and DS1 results on the same screen).</p>

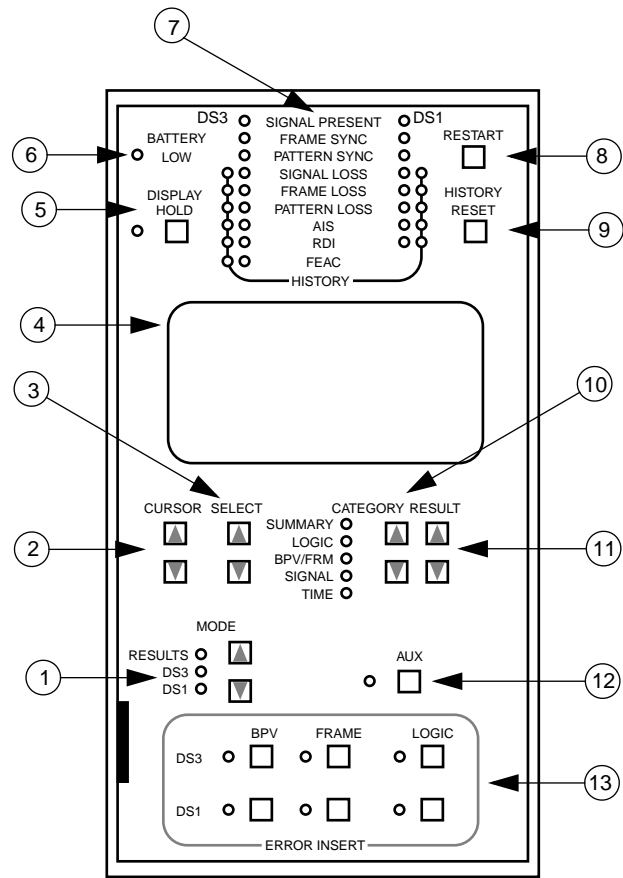
Table 1-1. Front-Panel Controls and Indicators (Continued)

#	Item	Description
5	<b>DISPLAY HOLD</b> Switch	Press the <b>DISPLAY HOLD</b> switch to freeze the display with the current values. The T-BERD 307 continues to accumulate test results in the background.
6	Battery Low LED	The Battery Low LED illuminates when only 15 minutes of battery power remain. AC power should be connected to recharge the battery and continue testing.
7	Status/Alarm Group	<p>DS3 LEDs are on the left. DS1 LEDs are on the right.</p> <p><b>Status LEDs</b> - illuminate green to indicate Signal Present, Frame Sync, and Pattern Sync.</p> <p><b>Alarm LEDs</b> - illuminate red to indicate a signal problem. The Alarm LEDs are two columns of LEDs; current alarms are on the inner column by the labels, while history alarms are on the outer column.</p> <p><b>Current Alarm LEDs</b> - illuminate when a condition is present.</p> <p><b>History Alarm LEDs</b> - illuminate after the condition clears and remain on until <b>HISTORY RESET</b> switch is pressed.</p>
8	<b>RESTART</b> Switch	Press the <b>RESTART</b> switch to clear all current test results and begin a test.
9	<b>HISTORY RESET</b> Switch	Press the <b>HISTORY RESET</b> switch to clear the History alarm LEDs.
10	<b>CATEGORY</b> Switch	The <b>CATEGORY</b> switch up and down arrows are used to scroll through and select a test result category to display in the Results Window.

**Table 1-1. Front-Panel Controls and Indicators (Continued)**

#	Item	Description
1	<b>RESULT</b> Switch	The <b>RESULT</b> switch up and down arrows are used to scroll through the test results available in the selected category.
2	<b>AUX</b> Switch	The <b>AUX</b> switch is used to activate the auxiliary functions menu, which allows the setting of test parameters that do not appear in the main configuration menus.
3	<b>ERROR INSERT</b> Switches and LEDs	The <b>ERROR INSERT</b> switches are used to select the type and rate of errors to be inserted on the selected channel. The error types are BPV, Frame, and Logic. If a switch is pressed for more than two seconds, the LED stays illuminated indicating an error rate is being inserted.

SECTION 1 - GETTING STARTED  
*Instrument Description*



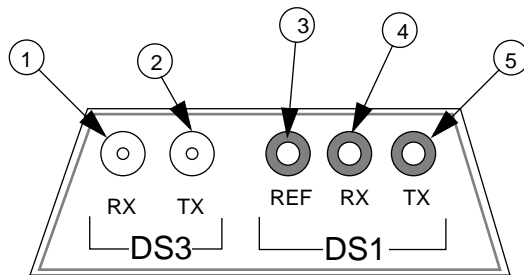
**Figure 1-1. T-BERD 307 Front Panel**

### 1.2.2 Top-Panel Connectors

The top panel of the T-BERD 307 is shown in Figure 1-2 with each connector marked with a numbered callout. Table 1-2 provides a brief description of each control, indicator, and connector referenced to the numbered callouts in Figure 1-2

**Table 1-2. Top-Panel Connectors**

No.	Connector	Description
1	DS3 RX Jack	A WECO 560A jack used to receive the DS3 signal from the circuit.
2	DS3 TX Jack	A WECO 560A jack used to transmit a DS3 signal to the circuit.
3	DS1 REF Jack	A Bantam jack connector used to connect an external reference clock source.
4	DS1 RX Jack	A Bantam jack used to receive the DS1 signal from the circuit.
5	DS1 TX Jack	A Bantam jack connector used to connect the output signal to the circuit.



**Figure 1-2. Top-Panel Connectors**

**1.2.3 Lid-Panel Controls, Indicators, and Connectors**

The lid panel of the T-BERD 307 provides connections for accessories and the **POWER** switch. Table 1-2 provides a brief description of each control, indicator, and connector on the lid panel.

**Table 1-3. Lid-Panel Controls, Indicators, and Connectors**

No.	Connector	Description
1	<b>POWER</b> Switch	Press the <b>POWER</b> switch to turn the unit on or off.
2	EXT. Power LED	The EXT. Power LED illuminates to indicate that external AC power is being supplied to the T-BERD 307. The external AC power source can be used to power the unit and charge the battery.
3	External Power Connector	The External Power connector is used with the AC Power Adaptor to provide external power to the T-BERD 307.
4	Auxiliary Port Connector	The Auxiliary Port Connector is an 8-pin round connector used to connect the Software Upgrade Module.



### 1.3 SPECIFICATIONS

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The specifications for the analyzer are presented in the following paragraphs.

#### 1.3.1 General Specifications

The general specifications for the analyzer are presented in Table 1-4.

**Table 1-4. Specifications**

Specification	Value
<b>Physical Characteristics:</b>	
Height:	8.5" (21.6 cm)
Width:	4.25" (10.8 cm)
Depth:	3.25" (8.3 cm)
Weight:	4.1 lb. (1.9 kg.)
<b>Environmental Characteristics:</b>	
Temperature:	
Operating:	32°F to 104°F (0°C to +40°C)
Non-Operating:	-4°F to 140°F (-20°C to +60°C)
Humidity:	10% to 90% Relative Humidity, non-condensing
<b>Electrical Characteristics:</b>	
Battery Type:	12 V Sealed lead-acid
Operating Time:	Typically provides two hours of continuous operation on a full charge.
Storage Period:	@68°F, holds 85% of charge after 5 months. Requires recharging every six months.

### **1.3.2 DS3 Input Specifications**

#### **1.3.2.1 *RX Jack***

Connector Type:	WECO 560A jack.
Frequency:	44,736,000 Hz $\pm$ 300 ppm.
Impedance:	75 ohms $\pm$ 5%, unbalanced to ground.
Level	
HIGH:	Accepts a typical signal level of 0.9 V <sub>p</sub> that represents 0 feet of cable attenuation from a HIGH source. With resistive attenuation, accepts levels from +6 dB to -26 dB from the typical signal level. With cable attenuation, accepts levels from +6 dB (-450 feet) to -6 dB (450 feet) from the typical signal level.
DSX:	Accepts a typical signal level of 0.5 V <sub>p</sub> that represents 450 feet of cable attenuation from a HIGH source. With resistive attenuation, accepts levels from +6 dB to -26 dB from the typical signal level. With cable attenuation, accepts levels from +6 dB (-450 feet) to -6 dB (450 feet) from the typical signal level.
Line Code:	B3ZS.

### **1.3.3 DS3 Output Specifications**

#### **1.3.3.1 *TX Jack***

Connector Type:	WECO 560A jack.
Frequency:	44,736,000 Hz $\pm$ 5 ppm.
Impedance:	75 ohms $\pm$ 5%, unbalanced to ground.
Level	
HIGH:	Nominal 0.91 V <sub>p</sub> .
DSX	Nominal 0.6 V <sub>p</sub> .
Line Code:	B3ZS.

**1.3.4 DS3 Measurements**

Frequency

Range: 44,736,000 Hz  $\pm$ 1,500,000 Hz.

Accuracy:  $\pm$  5 ppm.

Resolution: 10 Hz.

Level

Range: 3.0 Vpp to 30 mVpp

Accuracy:  $\pm$ 50 mVp over measurement range.

Resolution: 10 mVp.

**1.3.5 DS3 Alarm Criteria**

Signal Loss: 0.02 ms without valid input pulses after initial signal detected.

Pattern Loss

FAST: 1024 errors per 32,767 data bits.

SLOW: 250,000 errors per 1,000,000 bits.

Frame Loss

3 OUT OF 15: 3 out of 15 F-bits in error, or 2 out of 3 M-bit sequences (010) in error.

6 OUT OF 15: 6 out of 15 F-bits in error.

AIS (Blue)

STUCK C-BIT: Valid framing, valid parity, all stuffing indicator C-bits equal zero, and the 1010 criteria.

1010: 30 ms of 1010 pattern with framing.

RDI (Yellow): Both X-bits equal zero.

Far-End Alarm: Receipt of valid far-end alarm message (not loop codes) through the third C-bit in subframe 1 (FEAC-bit).

**1.3.6 DS1 Input Specifications (DS1 Analysis Option)****1.3.6.1 RX Jack**

Connector Type:	Bantam jack.
Frequency:	1,544,000 Hz $\pm$ 4000 Hz.
Impedance	
BRIDGE:	1000 ohms minimum.
TERM:	100 ohms $\pm$ 5%.
DSX-MON:	100 ohms $\pm$ 5%.
Range	
BRIDGE:	+6 to -35.0 dBdsx.
TERM:	+6 to -35.0 dBdsx.
DSX-MON:	+6 to -24.0 dBdsx of resistive loss.

**1.3.6.2 REF Jack**

Connector Type:	Bantam jack.
Frequency:	1,544,000 Hz $\pm$ 1000 Hz.
Impedance:	1000 ohms (nominal).
Range:	+6 to -24.0 dBdsx of resistive loss.

**1.3.6.3 Loop Codes Detect Criteria**

In-Band:	At least 177 error-free bits of the selected repetitive pattern must be received (loop up or loop down).
Out-of-Band:	Datalink monitored every 125 ms for loop codes (loop up and loop down).

**1.3.6.4 Pattern Synchronization Detection Criteria**

Fixed Patterns:	30 consecutive error-free bits.
QRSS:	30 + n consecutive error-free bits for a pattern length of $2^n - 1$ .

**1.3.7 DS1 Output Specifications (DS1 Analysis Option)****1.3.7.1 TX Jack**

Connector Type:	Bantam jack.
LBO Level:	Line build-out of 0, -7.5, -15.0, and -22.5 dB of cable loss at 772 Hz.
LBO Tolerance:	$\pm 1$ dB at 772 kHz for 0, -7.5, or -15.0 dB. $\pm 2$ dB at 772 kHz for -22.5 dB.
Timing:	$\pm 5$ ppm internal, external, or recovered.
Line Codes:	AMI or B8ZS.
Error Insert Type:	Logic, BPV, or Frame.
Error Insert Rate:	Single or 1E-2 through 1E-7.
Pulse Shape:	With output terminated in 100 ohms resistive load and 0 dB line build-out selected, the T-BERD 307 meets ITU-T Recommendation G.703; AT&T Publications CB113, CB119, CB132, CB143, and PUB62508; and AT&T PUB62411 pulse shape specifications.

**1.3.7.2 Transmitted Loop Codes**

## In-Band

CSU:	Loop-up: 10000; Loop-down: 100.
Facility 1:	Loop-up: 1100; Loop-down: 1110.
Facility 2:	Loop-up: 11000; Loop-down: 11100.
Programmable:	3-8 bit programmable pattern.

## Out-of-Band

Line:	Loop up: 1111 1111 0111 0000 Loop down: 1111 1111 0001 1100.
Payload:	Loop up: 1111 1111 0010 1000 Loop down: 1111 1111 0100 1100.
Network:	Loop up: 1111 1111 0100 1000 Loop down: 1111 1111 0010 0100

**1.3.8 DS1 Measurements (DS1 Analysis Option)**

## Frequency

Range: 1,544,000  $\pm$ 5000 Hz.Accuracy:  $\pm$  5 ppm.

Resolution: 1 Hz.

## Received Level

Range: +6 dBdsx to -40 dBdsx.

Accuracy:  $\pm$ 1.0 dB between +6 and -10 dBdsx  
 $\pm$ 2.0 dB between -10 and -20 dBdsx  
 $\pm$ 3.0 dB between -20 and -40 dBdsx.Resolution: 0.1 dB between +6 and -6 dBdsx  
0.5 dB between -6 and -40 dBdsx.

Vp-p Range: 60 mV to 12.0 V.

Vp-p Resolution: 0.05 V.

## Simplex Current

Range: 10 mA to 180 mA.

Accuracy:  $\pm$ 5%.

Resolution: 1 mA.

Voltage Drop: 8.5 volts (nominal) at 60 mA.

## DS1 Timing Slips

Range: 0 to 999 frame slips and 192 bit slips.

Resolution: 1 bit slip.

**1.3.9 DS1 Alarm Criteria (DS1 Analysis Option)**

Signal Loss: 150 ms without input pulses after valid frequency and level are detected.

## Frame Loss

D4: 2 out of 5 Ft bits in error.

ESF: 2 out of 5 frame bits in error.

SLC-96: 2 out of 4 Ft bits in error.

Pattern Loss

QRSS: 250 errors detected in 1000 or fewer bits.

Fixed Pattern: 100 errors detected in 1000 or fewer bits.

Ones Density

QRSS: Alarm is suppressed.

Other Patterns: Received data contains less than n ones in 8(n+1) bits, where n=1 to 23.

Excess Zeros

AMI: 16 or more consecutive zeros.

B8ZS: 8 or more consecutive zeros.

RDI (Yellow Alarm)

D4: Bit 2 is a 0 for 255 consecutive channels.

ESF: 256 bits  $\pm$ 16 bits of a repetitive (1111 1111 0000 0000) pattern received in the 4 kb/s datalink.

SLC-96: Bit 2 is a 0 for 255 consecutive channels.

AIS: Unframed T1 signal has 2048 consecutive ones.

Low Battery: Battery has approximately 15 minutes of power remaining.

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## 1.4 INSTRUMENT CHECKOUT

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Perform the following procedure to verify the operation of the T-BERD 307. Perform the option checkout procedure for the DS1 Analysis Option if it is installed.

### 1.4.1 Instrument Checkout Basic Setup

1. Open the T-BERD 307 Cover by releasing the latch on the right side and opening the cover to its full extension.
2. Connect AC power to the T-BERD 307 by inserting the AC Power Adaptor into the External Power connector and plugging the other end into an AC power source.

3. Power on the unit using the **POWER** switch. During power up the T-BERD 307 initiates an automatic self test that performs the following functions.
  - Momentarily illuminates all LEDs.
  - Checks memory and restores front-panel settings to the previous settings selected before the last power down. If any changes are found, the factory default settings are reloaded, and the message RELOADING NOVRAM is displayed. The T-BERD 307 remains fully functional even though the switch settings may not be saved during the power cycle. While the instrument may be used, contact TTC Instrument Service Center at (800) 638-2049.
  - If it becomes necessary to restore the test set configuration to the factory default settings, press and hold the **RESTART** switch, then turn the power on. Hold the **RESTART** switch down until the display illuminates. All the LEDs illuminate, and the message RELOADING NOVRAM is displayed for a few seconds.
  - The T-BERD 307 random access memory (RAM) and read-only memory (ROM) are also checked during self-test. If an error is found, the message TESTING RAM... FAIL or TESTING ROM... FAIL appears. In such instances, contact the TTC Instrument Service Center at (800) 638-2049. There are no user serviceable parts within the T-BERD 307.

#### 1.4.2 **DS3 BERT Instrument Checkout**

4. Configure the T-BERD 307 for a DS3 loopback test, as shown in Table 1-5.

**Table 1-5. DS3 BERT Loopback Configuration**

<b>Switch</b>	<b>Action</b>
MODE	Select DS3
CURSOR	Select Frame



**Table 1-5. DS3 BERT Loopback Configuration**

Switch	Action
SELECT	Select M13
CURSOR	Select PATT
SELECT	Select 2^23-1
CURSOR	Select RXLEV
SELECT	Select DSX
CURSOR	Select TX
SELECT	Select ON
CURSOR	Select TXLEV
SELECT	Select DSX
CURSOR	Select TXTIM
SELECT	Select INTERNAL
MODE	Select RESULTS

5. Connect the DS3 TX jack to the DS3 RX jack using a 440A to 440A cable.
6. Verify the Signal Present, Frame Sync, and Pattern Sync LEDs illuminate.
7. Press the **RESTART** switch. Select the DS3 SUMMARY category and verify the display indicates ALL RESULTS OK.

#### 1.4.3 DS1 Drop From DS3 Instrument Checkout

8. Configure the T-BERD 307 for a Muxed DS3 loopback test, as shown in Table 1-6.

**Table 1-6. Muxed DS3 Loopback Configuration**

Switch	Action
MODE	Select DS3
CURSOR	Select Frame
SELECT	Select MUXED M13
CURSOR	Select PATT
SELECT	Select T1D4 QRSS
CURSOR	Select RXLEV
SELECT	Select DSX

**Table 1-6. Muxed DS3 Loopback Configuration**

<b>Switch</b>	<b>Action</b>
CURSOR	Select TX
SELECT	Select ON
CURSOR	Select TXLEV
SELECT	Select DSX
CURSOR	Select TXTIM
SELECT	Select INTERNAL

9. Configure the T-BERD 307-1 for a DS1 drop from DS3 test, as shown in Table 1-5.

**Table 1-7. DS1 Drop From DS3 Configuration**

<b>Switch</b>	<b>Action</b>
MODE	Select DS1
CURSOR	Select SRC
SELECT	Select DS3 DROP
CURSOR	Select FRAME
SELECT	Select AUTO
MODE	Select RESULTS

10. Connect the DS3 TX jack to the DS3 RX jack using a 440A to 440A cable.

11. Verify the Signal Present, Frame Sync, and Pattern Sync LEDs illuminate.
12. Press the **RESTART** switch. Select the SUMMARY category and verify the display indicates ALL RESULTS OK for DS1 and DS3.

**1.4.4 DS1 BERT Instrument Checkout (DS1 Analysis Option)**

13. Configure the T-BERD 307 for a DS1 loopback test, as shown in Table 1-5.

**Table 1-8. DS1 BERT Loopback Configuration**

<b>Switch</b>	<b>Action</b>
MODE	Select DS1
CURSOR	Select SRC
SELECT	Select EXTERNAL
CURSOR	Select FRAME
SELECT	Select D4
CURSOR	Select PATT
SELECT	Select 2^23-1
CURSOR	Select CODE
SELECT	Select B8ZS
CURSOR	Select RXLEV
SELECT	Select DSX-MON
CURSOR	Select TX
SELECT	Select ON
CURSOR	Select TXLEV
SELECT	Select 0 dB(DSX)
CURSOR	Select TXTIM
SELECT	Select INTERNAL
MODE	Select RESULTS

14. Connect the DS1 TX jack to the DS1 RX jack using a bantam to bantam cable.

15. Verify the Signal Present, Frame Sync, and Pattern Sync LEDs illuminate.
16. Press the **RESTART** switch. Select the DS1 SUMMARY category and verify the display indicates ALL RESULTS OK.

## **1.5 PREVENTIVE MAINTENANCE**

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Preventive maintenance (PM) consists of visually inspecting and cleaning the T-BERD 307. The required frequency of maintenance depends on the environment in which the instrument is used. The analyzer should be visually inspected and cleaned as often as operating conditions require. The accumulation of dirt on the instrument can cause overheating and component failure. The following paragraphs describe inspecting and cleaning the exterior of the analyzer.

### **1.5.1 Exterior Inspection**

Inspect the external portions of the instrument for damage, wear, and loose or missing parts. Instruments that appear to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Deficiencies found that could cause personal injury or lead to further damage to the instrument should be repaired immediately.

### **1.5.2 Exterior Cleaning**

Loose dust on the outside of the instrument can be removed with a soft cloth. Dirt that remains can be removed with a soft cloth dampened in a mild detergent and water solution (e.g. Miller Stephenson Cleaner MS-260). Do not use abrasive cleaners. Use only enough water to dampen the cloth.

\*\*\*\*\*  
\* **CAUTION** \*  
\*\*\*\*\*

**Do not get moisture inside the instrument**

## SECTION 2 USER INTERFACE DESCRIPTION

### 2.1 INTRODUCTION

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This section provides a description of the T-BERD 307 User Interface. Included are descriptions of the operation of the front-panel controls (**MODE**, **CURSOR**, **SELECT**, **CATEGORY**, and **RESULT** switches) used to select, configure, and edit the menu items in the Front-Panel Display.

### 2.2 USER INTERFACE CONTROLS

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The following paragraphs describe the operation of the front-panel controls associated with the user interface. Figure 2-1 shows the Front-Panel Display and associated controls.

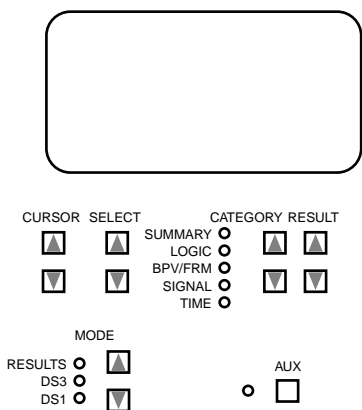


Figure 2-1. User Interface Controls

#### 2.2.1 **MODE** Switch

The **MODE** switch selects the user interface mode, DS3, DS1, or RESULTS which illuminates the associated LED. The DS3 position

activates the DS3 Test Configuration Menu. The DS1 position activates the DS1 Test Configuration Menu. The RESULTS position activates the Test Results display.

#### **2.2.2 CURSOR Switch**

The **CURSOR** switch up and down arrows are used to scroll through the configuration items in the Test Configuration Menu.

#### **2.2.3 SELECT Switch**

The **SELECT** switch up and down arrows are used to cycle through the available choices for the highlighted configuration item.

#### **2.2.4 CATEGORY Switch**

The **CATEGORY** switch up and down arrows are used to select the test results category. The test results categories are discussed in Section 4 Test Results.

#### **2.2.5 RESULT Switch**

The **RESULT** switch up and down arrows are used to cycle through the available test results for the selected test results category. The test results are discussed in Section 4 Test Results.

#### **2.2.6 AUX Switch**

The **AUX** switch activates the Auxiliary Functions Display, which provides access to parameters not frequently used and not having dedicated switches. The auxiliary functions are discussed in Section 3 Auxiliary Functions.

### **2.3 DS3 TEST CONFIGURATION MENU**

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When the **MODE** switch is set to DS3, the DS3 Test Configuration Menu selections are available. Only the first five configuration items are displayed, but an arrow to the left of the fifth item indicates there are more items below. Pressing the **CURSOR** switch down arrow when you reach the fifth configuration item pushes the first five items up one position and displays the next item. This

action also creates a second arrow to the left of the top configuration item indicating that additional items are above the current group of five.

In the following paragraphs, the **CURSOR** switch up or down arrow is used to highlight the active selection and the **SELECT** switch is used to cycle through the available choices.

### **2.3.1 FRAME**

FRAME enables selection of the data format for transmission and analysis (default value is M13). The choices are:

**UNFRAMED** — Configures the T-BERD 307 to test unframed DS3 circuits.

**M13** — Configures the T-BERD 307 to test non-channelized DS3 M13 formatted signals.

**MUXED M13** — Configures the T-BERD 307 to generate a multiplexed (channelized) DS3 M13 signal.

**C-BIT** — Configures the T-BERD 307 to test non-channelized DS3 C-bit parity formatted signals.

**MUXED C-BIT** — Configures the T-BERD 307 to generate a multiplexed (channelized) DS3 C-bit parity signal.

**DS1 INSERT** — Configures the T-BERD 307 to insert a signal on a DS1 channel.

**AUTO** — Configures the receiver to automatically scan and synchronize to the input signal framing and pattern. After achieving synchronization, the transmitter regenerates the framing and test pattern without errors. When the framing format is recognized, the framing format name appears in lowercase characters in the display. If *live* data is declared, the transmit timing defaults to Recovered.

If the received signal is recognized as a test pattern, the following actions occur:

- The test pattern name appears in lowercase characters.
- The transmitter is configured to generate the recognized framing format and test pattern.
- Logic and BPV errors can be inserted.
- Full DS3 logic, BPV, parity, frame, and signal error analysis is performed on the received signal.
- The appropriate LEDs illuminate.

### **2.3.2** **PATT**

PATtern enables selection of the required test pattern (default is  $2^{23}-1$ ). The choices available are determined by the selected framing. The choices for M13 and C-bit framing are as follows:

**2<sup>23</sup>-1** — An 8,388,607-bit pseudorandom pattern with a maximum of 22 sequential 0's and 23 sequential 1's. This pattern conforms to ITU-T Recommendation O.151.

**2<sup>20</sup>-1** — 1,048,575-bit pseudorandom pattern with a maximum of 19 sequential 0's and 20 sequential 1's. This pattern conforms with Bell Compatibility Bulletin No. 114.

**2<sup>15</sup>-1** — A 32,767-bit pseudorandom pattern with a maximum of 14 sequential 0's and 15 sequential 1's. This pattern conforms to ITU-T Recommendation O.151.

**1111** — An all marks (1) pattern that is only available in M13 and C-bit modes.



**1100 (IDLE)** — A repeating marks (1) and spaces (0) pattern that equates to sending the DS3 Idle Signal.

**1010 (AIS)** — An alternating marks (1) and spaces (0) pattern that equates to sending the DS3 AIS Signal.

**USER1** — A 3- to 24-bit user-programmable test pattern. This allows the T-BERD 310 to transmit specific patterns to test circuit sensitivity. The pattern is entered in binary through the USER1 DS3 setup function.

The choices for MUXED M13 and MUXED C-BIT are as follows:

**T1D4 QRSS** — A modified  $2^{20}-1$  pseudorandom pattern with a maximum of 14 sequential 0's and 20 sequential 1's. The T1D4 QRSS pattern simulates live data for T1 applications.

**T1D4 3/24** — A fixed test pattern of F0100 0100 0000 0000 0000 0100.... The pattern is aligned with the D4 F-bits.

**T1D4 1:7** — A fixed test pattern of F01000000.... The pattern is aligned with the D4 F-bits to prevent false Yellow Alarms.

**T1D4 1004HZ** — A 1004 Hz tone that is transmitted over the selected DS1 channel. The tone is phase shifted between adjacent DS0 channels to prevent Yellow Alarms.

**T1D4 LPUP** — A loop-up code selected with the LCODE DS3 setup function.

**T1D4 LPDN** — A loop-down code selected with the LCODE DS3 setup function.

**T1ESF QRSS** — A modified  $2^{20}-1$  pseudorandom pattern with a maximum of 14 sequential 0's and 20 sequential 1's. The T1ESF QRSS pattern simulates live data for T1 applications.

**T1ESF 3/24** — A fixed test pattern of F0100 0100 0000 0000 0000 0100.... The pattern is aligned with the ESF F-bits.

**T1ESF 1:7** — A fixed test pattern of F01000000....

**T1ESF 1004HZ** — A 1004 Hz tone which is transmitted over the selected DS1 channel.

**T1ESF LPUP** — A loop-up code selected with the LCODE DS3 setup function.

**T1ESF LPDN** — A loop-down code selected with the LCODE DS3 setup function.

The choices for DS1 INSERT are as follows:

**EXTERNAL DS1** — An external DS1 signal from the DS1 RX jack is inserted.

**INTERNAL DS1** — An internally generated DS1 signal is inserted.

### **2.3.3** **DROP**

DROP enables selection of the DS1 channel to be dropped. The choices are as follows:

**1 to 28** — Drops the selected DS1 channel.

### **2.3.4** **INS**

INSert enables selection of the DS1 channel on which to insert the test pattern. The choices are as follows:

**N/A** — This indicates that DS1 insertion is not enabled and is displayed for all framing modes except DS1 INSERT, MUXED M13, and MUXED C-BIT.

**NONE** — Inserts a framed All Ones pattern on all 28 DS1 channels.

**1 to 28** — Inserts the test pattern on the selected DS1 channel. A framed All Ones pattern is inserted on the other 27 DS1 channels.

**ALL** — Inserts the selected test pattern on all 28 DS1 channels.

### **2.3.5** **RXLEV**

RXLEV (Receive Level) sets the RX jack receiver for the desired DS3 signal level. The choices are as follows:

**HIGH** — Accepts a typical signal level of 0.9 Vp (0 feet of cable attenuation from a HIGH source). For cable attenuation, the input signal level can range from +6 dB (-450 feet) to -6 dB (450 feet) from the typical input level (0.9 Vp). For resistive attenuation, the signal level can range from +6 dB to -26 dB from the typical input level (0.9 Vp).

**DSX** — Accepts a typical signal level of 0.5 Vp (450 feet of cable attenuation from a HIGH source). For cable attenuation, the

input signal level can range from + 6 dB (-450 feet) to -6 dB (450 feet) from the typical level (0.5 Vp). For resistive attenuation, the input signal level can range from +6 dB to -26 dB from the typical level (0.5 Vp)

### **2.3.6 TX**

TX (Transmit) the transmitter ON or OFF. The choices are:

**ON** — **SELECT** switch up arrow toggles the transmitter on.

**OFF** — **SELECT** switch down arrow toggles the transmitter off.

### **2.3.7 TXLVL**

TXLVL (Transmit Level) sets the transmitter output for the desired DS3 signal level. The choices are as follows:

**HIGH** — Sets the transmit output signal level to 0.91 Vp. Used to send the DS3 signal from the DS3 terminal location toward the DSX-3 patch panel.

**DSX** — Sets the transmit output signal level to 0.6 Vp. Used to send the DS3 signal from the DSX-3 patch panel IN jack. The signal level is equal to a HIGH signal sent through 450 feet of coaxial cable.

### **2.3.8 TXTIM**

TXTIM (Transmit Timing) selects the transmit clocking source. The choices are as follows:

**INTERNAL** — Selects the internal crystal-controlled oscillator.

**RECOVERED** — Selects the clock signal recovered from the received data.

### **2.3.9 ER RT**

ER RT (Error Rate) selects the error rate to be applied to the signal. The choices are as follows:

**1E-2 to 1E-7** — Selects the error rate for insertion into the signal.

### **2.3.10 BURST**

BURST selects the time increment for transmitting the user-selected error rate. The choices are as follows:

**SINGLE** — Selects a single error at the user-selected error rate.

**25 mS to 975 mS** — Selects the error burst time in 25 mS increments.

**1.0 S to 5.0 S** — Selects the error burst time in 0.1 second increments.

### **2.3.11 ALARM**

ALARM to be inserted into the signal. The choices are as follows:

**AIS** — Selects the Alarm Indication Signal.

**RDI** — Selects the Remote Defect Indicator Signal.

### **2.3.12 ALMIN**

ALMIN (Alarm Insert) toggles the alarm insert function. The choices are as follows:

**OFF** — Turns off alarm insertion.

**ON** — Turns on alarm insertion.

### 2.3.13 **X-BIT**

X-BIT selects the X-bit value. The choices are as follows:

**00, 01, 10, and 11** — Selects the value for the X-bits.

**EMULATE** — Causes the T-BERD 307 to automatically transmit the X-bits according to the received signal frame status. If the received framing is lost, 00 (Yellow Alarm) is transmitted. If the received framing is valid, 11 (no Yellow Alarm) is transmitted.

#### **NOTE**

If either pattern, IDLE (1100) or BLUE (1010) is transmitted, the T-BERD 307 overrides the 00 bit pattern and transmits 11.

### 2.3.14 **AIS**

AIS (Alarm Indication Signal) selects the AIS transmit and detection criteria. The choices are as follows:

**1010** — The T-BERD 307 declares an AIS alarm if the received signal contains a 1010 pattern.

**STUCK C-BIT** — The T-BERD 307 declares an AIS alarm if the received signal C-bits are set to zero, and the signal contains a 1010 pattern.

### 2.3.15 **FRMTH**

FRMTH (Frame Loss Threshold) selects the threshold value that will be identified as a frame loss. The choices are as follows:

**3 OUT OF 15** — Frame synchronization is declared lost when three frame errors are counted in 15 received frame bits.

**6 OUT OF 15** — Frame synchronization is declared lost when six frame errors are counted in 15 received frame bits.

### 2.3.16 **ERRTH**

ERRTH (Error Threshold) selects errored second threshold value for bit errors, frame errors, and BPVs. The choices are as follows:

**1E-2 to 1E-8** — Selects the errored second threshold value.

### **2.3.17 PAR R**

PAR R (Parity Error Rate) selects the parity error rate calculation method. The choices are as follows:

**BIT ERRORS** — The bit parity error rate is calculated as the ratio of the total number of parity errors to the total number of bits over which the parity was calculated (number of received M-frames multiplied by 4704). The bit parity error rate gives the best indication of the actual bit error rate.

**BLOCK ERRORS** — The block error method is calculated as the ratio of the total number of parity errors to the total number of M-frames received.

### **2.3.18 USER1**

USER1 (User Programmable Pattern) sets the 3- to 24-bit programmable pattern (the default pattern is 100). Use the **CATEGORY** switch to move the cursor to the bit to be set: Use the **RESULT** switch to toggle the bit between 1 and 0. Use the **SELECT** switch to save the pattern.

### **2.3.19 LPUP**

LPUP (Programmable Loop Up Pattern) programs a 3- to 8-bit user-defined loop-up code. The programmed loop-up code is transmitted when the MUXED M13 or MUXED C-BIT mode and the T1D4 LPUP or T1ESF LPUP pattern are selected. The LCODE function must be set to PROGRAMMABLE.

Use the **CATEGORY** switch to move the cursor to the bit to be set: Use the **RESULT** switch to toggle the bit between 1 and 0. Use the **SELECT** switch to save the pattern.

### **2.3.20 LPDN**

LPDN (Programmable Loop Down Pattern) programs a 3- to 8-bit user-defined loop-down code. The programmed loop-down code is transmitted when the MUXED M13 or MUXED C-BIT mode and the T1D4 LPDN or T1ESF LPDN pattern are selected. The LCODE function must be set to PROGRAMMABLE.

Use the **CATEGORY** switch to move the cursor to the bit to be set: Use the **RESULT** switch to toggle the bit between 1 and 0. Use the **SELECT** switch to save the pattern.

### **2.3.21 LCODE**

LCODE (Loop Code Type) selects the DS1 loop code for the MUXED M13 and MUXED C-BIT modes (the default type is CSU). The appropriate loop code is transmitted when the T1D4 LPDN, T1D4 LPUP, T1ESF LPDN, or T1ESF LPUP pattern is selected. The choices are as follows:

- CSU** — Selects the customer service unit (CSU) loop code type.
- FACILITY 1** — Selects the Facility 1 NIU loop code type.
- FACILITY 2** — Selects the Facility 2 NIU loop code type.
- PROGRAMMABLE** — Selects the programmable loop code.

### **2.3.22 FCALM**

FCALM (FEAC Alarm Selection) selects the alarm message to be applied to the signal. The choices are as follows:

- DS3 EF NSA** — Selects the DS3 Equipment Failure, Non-Service Affecting message.
- DS3 EF SA** — Selects the DS3 Equipment Failure, Service Affecting (Type 1 equipment failure) message.
- DS3 L/H** — Selects the DS3 Loss-of-Signal/High Bit Error Ratio message.
- DS3 OOF** — Selects the DS3 Out-of-Frame, Loss of DS3 Frame Synchronization message.
- DS3 AIS RX** — Selects the DS3 Alarm Indication Signal Received message.

**DS3 IDLE RX** — Selects the DS3 Idle signal Received message.

**COMM EF NSA** — Selects the Communication Equipment Failure, Non-Service Affecting message.

**DS1 EF NSA** — Selects the DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) message.

**DS1 EF SA** — Selects the DS1 Equipment Failure, Service Affecting (Type 1 equipment failure) message .

**SING DS1 L/H** — Selects the Single DS1 Loss-of-Signal/High Bit Error Ratio message .

**MULT DS1 L/H** — Selects the Multiple DS1 Loss-of-Signal/High Bit Error Ratio message.

### **2.3.23 FCALS**

FCALS (FEAC Alarm Send) toggles the transmission of the selected far end alarm on or off. The choices are as follows:

**SENDING** — Transmits the selected far end alarm.

**NOT SENDING** — Does not transmit the selected far end alarm.

### **2.3.24 FCLP**

FCLP (FEAC Loop Code) selects the FEAC loop code to be applied to the signal. The choices are as follows:

**ALL DS1s** — Loopback all the low-speed DS1 channels at the DS3 multiplexer.

**DS1 #1 to DS1 #28** — Loopback the selected low-speed DS1 channel at the DS3 multiplexer.

**DS3 LINE** — Loopback the DS3 line at the DS3 multiplexer.

**DS3 NIU** — Loopback the DS3 network interface unit (NIU).



### **2.3.25 FCLPS**

FCLPS (FEAC Loop Code Send) selects the loop code transmitted. The choices are as follows:

**LOOPING UP** — Transmits the selected loop up code.

**NOT SENDING** — Does not transmit any loop code.

**LOOPING DOWN** — Transmits the selected loop down code.

## **2.4 DS1 TEST CONFIGURATION MENU**

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When the **MODE** switch is set to DS1, the DS1 Test Configuration Menu selections are available. Only the first five configuration items are displayed, but an arrow to the left of the fifth item indicates there are more items below. Pressing the **CURSOR** switch down arrow when you reach the fifth configuration item pushes the first five items up one position and displays the next item. This action also creates a second arrow to the left of the top configuration item indicating that additional items are above the current group of five.

In the following paragraphs, unless otherwise stated in the description, the **CURSOR** switch up or down arrow is used to highlight the active selection and the **SELECT** switch is used to cycle through the available choices.

### **2.4.1 SRC**

SRC (DS1 Source) enables toggling of the DS1 source. The choices are:

**EXTERNAL** — Configures the T-BERD 307 to test the DS1 at the DS1 RX jack.

**DS3 DROP** — Configures the T-BERD 307 to test the DS1 dropped from the DS3 signal.

#### **2.4.2 FRAME**

FRAME enables selection of the data format for transmission and analysis. The choices are:

**D4** — Configures the T-BERD 307 to test D4 framed signals.

**ESF** — Configures the T-BERD 307 to test ESF framed signals.

**SLC-96** — Configures the T-BERD 307 to test SLC-96 framed signals.

**AUTO** — Configures the receiver to automatically scan and synchronize to the input signal framing and pattern. After achieving synchronization, the transmitter regenerates the framing and test pattern without errors. When the framing format is recognized, the framing format name appears in lowercase characters in the display. If *live* data is declared, the transmit timing defaults to Recovered.

If the received signal is recognized as a test pattern, the following actions occur:

- The test pattern name appears in lowercase characters.
- The transmitter is configured to generate the recognized framing format and test pattern.
- Logic and BPV errors can be inserted.
- Full DS1 logic, BPV, parity, frame, and signal error analysis is performed on the received signal.
- The appropriate LEDs illuminate.

**UNFRAMED** — Configures the T-BERD 307 to test unframed signals.

### 2.4.3 PATT

PATT (Pattern) enables selection of the required test pattern. The choices for framing are as follows:

**2^23-1** — An 8,388,607-bit pseudorandom pattern with a maximum of 22 sequential 0's and 23 sequential 1's. This pattern conforms to ITU-T Recommendation O.151.

**2^20-1** — 1,048,575-bit pseudorandom pattern with a maximum of 19 sequential 0's and 20 sequential 1's. This pattern conforms with Bell Compatibility Bulletin No. 114.

**2^15-1** — A 32,767-bit pseudorandom pattern with a maximum of 14 sequential 0's and 15 sequential 1's. This pattern conforms to ITU-T Recommendation O.151.

**USER1** — A 3- to 24-bit user-programmable test pattern. This allows the T-BERD 307 to transmit specific patterns to test circuit sensitivity. The pattern is entered in binary through the USER1 DS1 setup function.

**ALL ZEROS** — An all zeros pattern that allows the T-BERD 307 to test T1 circuits for B8ZS clear channel capability. The pattern can be transmitted framed or unframed.

**T1-DALY** — A fixed framed or unframed 55-octet pattern (except the seventh octet is 80H instead of 00H) that meets the ones density and excess zeros criteria to test timing recovery circuits.

**T1-2** — A fixed framed or unframed 96-octet pattern for stressing M12 circuits in DS3 equipment. When the pattern is frame aligned, it provides a maximum of 15 zeros and meets the ones density criteria.

**T1-3** — A fixed 54-octet pattern for stressing T1 circuits and equipment. When the pattern is frame aligned, it exceeds the maximum zeros criteria and ones density criteria.

**T1-4** — A fixed 120-octet pattern for stressing T1 circuits and equipment. When the pattern is frame aligned, it contains a maximum of eight zeros and meets the ones density criteria.

**T1-5** — A fixed 53-octet pattern for stressing T1 circuits and equipment. When the pattern is frame aligned, it does not exceed the maximum zeros criteria, but it does exceed the  $8(n+1)$  one density criteria.

**55-OCTET** — A fixed unframed 55-octet pattern for stressing repeater timing recovery and ALBO circuitry. When the pattern is frame aligned, it violates the maximum zeros and ones density criteria. This pattern should only be transmitted over the repeatered span and not the network.

**MIN/MAX** — A fixed 72-octet minimum/maximum density pattern for stressing repeater pre-amplification, equalization, and ALBO circuitry. When the pattern is frame aligned, it meets the maximum zeros and ones density criteria.

**ALL ONES** — A fixed test pattern of AMI pulses (marks) that is used to stress span repeater current regulator circuits. It can be used as an Alarm Indication Signal (AIS) in unframed circuits, or a keep alive signal, idle code, or red alarm in other circuits.

**1:1** — A fixed test pattern of alternating AMI ones (marks) and zeros (spaces) that is used to perform a minimum level stress test on clock recovery circuits.

**1:7** — A fixed test pattern of F0100 000 that is used to stress the minimum ones density requirement for AMI-encoded T1 circuits.

**3/24** — A fixed test pattern of F0100 0100 0000 0000 0000 0100... that provides the minimum ones density and the maximum excess zeros (15) requirements to stress T1 circuits. This pattern violates the minimum ones density requirement when framed.

**QRSS** — A modified  $2^{20}-1$  pseudo-random pattern that allows a maximum of 14 sequential zeros and 20 sequential ones. This pattern simulates live data for T1 circuits.

#### **2.4.4** CODE

CODE (Line Coding) enables toggling of the line coding between AMI and B8ZS. The choices are as follows:

**AMI** — Alternate Mark Inversion.

**B8ZS** — Binary eight zero substitution encoding.

#### **2.4.5** **DROP**

DROP (DS0 Drop) enables selection of the DS0 channel to be dropped. The choices are as follows:

**NONE** — No DS0 channel will be dropped.

**1 to 24** — Selects the DS0 channel to be dropped.

#### **2.4.6** **RXLEV**

RXLEV (Receive Level) selects the input impedance and signal conditioning applied to the received signal. The choices are as follows:

**TERM** — Provides a nominal input impedance of 100 ohms. The TERM setting provides compensation for cable losses of up to 35 dB for T1 lines. This is useful for terminating a circuit.

**BRIDGE** — Provides an input impedance greater than 1000 ohms for bridging lines that are already terminated. The BRIDGE setting provides compensation for cable losses of up to 35 dB.

**DSX-MON** — Provides a nominal 100 ohms of input impedance and compensates for resistive loss. The DSX-MON setting is useful for monitoring T1 lines at resistor-isolated DSX monitor points.

#### **2.4.7** **TX**

TX (Transmit Status) toggles the transmitter ON or OFF: The choices are as follows:

**ON** — Transmitter activated.

**OFF** — Transmitter disabled.

#### **2.4.8** **TXLVL**

TXLVL (Transmit Output Level) enables selecting the transmitted signal's Line Build-Out (LBO) level in dB. The selections are 0, -7.5, -15.0, and -22.5 dB. The LBO value plus the received signal level should range between -15 and -22.5 dB.

#### **2.4.9 TXTIM**

TXTIM (Transmit Timing Source) enables selecting the transmit signal's timing source. The selections are as follows:

**INTERNAL** — Selects the internal crystal-controlled oscillator.

**RECOVERED** — Selects the clock signal recovered from the received data.

**BITS CLOCK** — Selects an external clock source received through the top-panel DS1 REF jack.

#### **2.4.10 SLIPR**

SLIPR (Timing Slips Reference) enables selecting the source for the timing slips reference signal. The choices are as follows:

**DS1 REFERENCE** — The reference clock is taken from the signal on the DS1 REF jack.

**DS1 RECEIVE** — The reference clock is taken from the signal on the DS1 RX jack.

**DS3 DROP** — The reference clock is taken from the DS1 signal dropped from the DS3 signal.

#### **NOTE**

The timing slips measurement is performed by comparing the DS1 source from the SRC selection and the reference signal source from the SLIPR selection.

#### **2.4.11 ER RT**

ER RT (Error Rate) selects the error rate to be applied to the signal. The choices are as follows:

**1E-2 to 1E-7** — Selects the error rate for insertion into the signal.

#### **2.4.12 BURST**

BURST selects the time increment for transmitting the user-selected error rate. The choices are as follows:

**SINGLE** — Selects a single error.

**25 mS to 975 mS** — Selects the error burst time in 25 mS increments.

**1.0 S to 5.0 S** — Selects the error burst time in 0.1 second increments.

#### **2.4.13 ALARM**

ALARM indication to be applied to the signal. The choices are as follows:

**AIS** — Selects the Alarm Indication Signal.

**RDI** — Selects the Remote Defect Indication alarm.

#### **2.4.14 ALMIN**

ALMIN (Alarm Insert) toggles the insertion of alarm selected in ALARM. The choices are as follows:

**OFF** — Turns off alarm insertion.

**ON** — Turns on alarm insertion.

#### **2.4.15 USER1**

USER1 (User Programmable Pattern) sets the 3- to 24-bit programmable pattern. Use the **CATEGORY** switch to move the cursor to the bit to be set. Use the **RESULT** switch to toggle the bit between 1 and 0. Use the **SELECT** switch to save the pattern.

#### **2.4.16 LPUP**

LPUP (Programmable Loop Up Pattern) programs a 3- to 8-bit user-defined loop-up code. Use the **CATEGORY** switch to move the cursor to the bit to be set: Use the **RESULT** switch to toggle the bit between 1 and 0. Use the **SELECT** switch to save the pattern.

#### **2.4.17 LPDN**

LPDN (Programmable Loop Down Pattern) programs a 3- to 8-bit user-defined loop-down code. Use the **CATEGORY** switch to move the cursor to the bit to be set: Use the **RESULT** switch to toggle the bit between 1 and 0. Use the **SELECT** switch to save the pattern.

#### **2.4.18 ESFLP**

ESFLP (ESF Loop Code Type) toggles the ESF Loop Code Type between IN BAND and OUT OF BAND.

#### **2.4.19 LCODE**

LCODE (Loop Code Type) selects the loop code type to be transmitted. The choices are as follows:

**CSU** — Selects the customer service unit (CSU) loop code type.

**FACILITY 1** — Selects the Facility 1 NIU loop code type.

**FACILITY 2** — Selects the Facility 2 NIU loop code type.

**PROGRAMMABLE** — Selects the programmable loop code.

#### **2.4.20 LPSND**

LPSND (Loop Code Send) sets the T-BERD 307 to transmit the appropriate loop code. The choices are as follows:

**LOOPING UP** — Transmits the selected loop up code.

**NOT SENDING** — Does not transmit any loop code.

**LOOPING DOWN** — Transmits the selected loop down code.



## **2.5 PRINTOUT GENERATION**

---

Standard RS-232 serial printers, like the PR-40A Thermal Printer, can be connected to the T-BERD 307 to provide test results printouts. Printout capability is provided via the Auxiliary Port Connector on the lid panel. If a printer is not attached to the Auxiliary Port Connector, the T-BERD 307 stores the printouts in nonvolatile memory (NOVRAM) until a printer is available.

Auxiliary functions are used to select the interface parameters of baud rate, parity, and line terminator. Column length is preset to 40 characters. The default interface parameter settings match the PR-40A Thermal Printer parameters.

### **2.5.1 Connecting the Printer**

Perform the following procedure to connect the TTC PR-40A Thermal Printer to the T-BERD 307.

1. Ensure the printer is turned off.
2. Turn on the T-BERD 307.
3. Verify the T-BERD 307 interface parameters match the serial printer parameters by checking the BAUD, PRITY, and TRMTR auxiliary functions.
4. Connect the printer to the T-BERD 307 using an 8-pin round to 25-pin D-type cable.
5. Turn on the printer.
6. Place the printer ON LINE

#### **NOTE**

When the printer is placed ON LINE, the T-BERD 307 immediately sends any printouts that are stored in memory.

### 2.5.2 **Generating a Printout**

The PRINT auxiliary function controls the type of printout and provides the ability to clear the print buffer of stored printouts. The choices for the PRINT auxiliary function are DS3, DS1, or DS3/DS1 results printout.

Selecting the PRINT auxiliary function opens a lower window (see Figure 2-2) that displays the printout type, interface parameters, buffer status, and the printout activation button.

PRINT:	DS3
PEVNT:	OFF
BAUD:	9600
PRITY:	NONE
BUF NOT EMPT	
clearbuf↑ rslt↑	

**Figure 2-2. Printout Pop-up Window**

Results printouts appear as shown in Figure 2-3.

```

                                RESULTS PRINT
-----
Manual Printout
April 2                          18:30:00
-----
                                DS3 RESULTS
-----

DS3 STATUS
-----
Signal Present:                   ON
Frame Sync:                       ON
Pattern Sync:                     ON

DS3 ALARMS                        HIST CURR
-----
Signal Loss:                      OFF  OFF
Frame Loss:                       OFF  OFF
Pattern Loss:                     OFF  OFF
AIS:                              OFF  OFF
RDI:                              OFF  OFF
FEAC:                             OFF  OFF

LOGIC
-----
Bit Errors:                       0
Bit Err Rate:                     0
.
.
.
TIME
-----
Time:                             18:30:00
Date:                             April 2
Elapsed Time:                     00:00:00
Test Length:                      N/A
Time Left:                        N/A

```

**Figure 2-3. Sample Results Printout**



## SECTION 3 AUXILIARY FUNCTIONS

### 3.1 INTRODUCTION

---

Auxiliary functions allow access to parameters not frequently used and not having dedicated switches. The auxiliary functions appear in the front-panel display. The **CURSOR**, **SELECT**, **CATEGORY**, and **RESULT** switches are used to manipulate the auxiliary functions as follows:

**CURSOR switch** — Pressed to scroll through the auxiliary functions that appear in the front-panel display.

**SELECT switch** — Pressed to scroll through or toggle the parameters of the selected auxiliary function. In some auxiliary functions, the **SELECT** switch is used to save parameter changes to memory.

**CATEGORY switch** — Used to change or enter auxiliary function information.

**RESULT switch** — Used to change or enter auxiliary function information.

### 3.2 AUXILIARY FUNCTIONS

---

The T-BERD 307 auxiliary functions contain general setup configuration items for the test set and enable the printing of test results. Pressing the **AUX** switch activates the Auxiliary Functions Display. The following paragraphs provide a description of each auxiliary function, the selection choices available for the function, and how the function is selected or edited.

**PRINT - Printout Selection** — Selects the results printout type and opens a window that enables you to clear the print buffer or activate the printout. Use the **SELECT** switch to choose, DS3, DS1, or DS3/DS1 results printout.

**PEVNT - Print Event** — Allows the printing of test results at the end of a timed test. Use the **SELECT** switch to toggle between TEST END and OFF.

**BAUD - Baud Rate** — Selects the RS-232 interface baud rate. Use the **SELECT** switch to choose, 4800 or 9600.

**PRITY - Parity** — Selects the RS-232 interface parity condition. Use the **SELECT** switch to choose, EVEN, ODD, or NONE.

**TRMTR - Line Terminator** — Selects the RS-232 interface line terminator. Use the **SELECT** switch to choose, CR (carriage return), LF (Line Feed), or CRLF (both).

**T MOD - Timing Mode** — Selects the test timing mode. Use the **SELECT** switch to toggle between TIMED and CONTINUOUS. If TIMED is selected, the test length is set using the T LEN auxiliary function.

**T LEN - Timed Test Length** — Sets the amount of time, in HHH:MM (Hours:Minutes) format, that a timed test is to run. Use the **CATEGORY** switch to set the Hours (000 to 999). Use the **RESULT** switch to set the Minutes (00 to 59). Use the **SELECT** switch to save the settings.

**TIME** — Sets the time in HH:MM (Hours:Minutes) format. Use the **CATEGORY** switch to set the Hours (00 to 23). Use the **RESULT** switch to set the Minutes (00 to 59).

**DATE** — Sets the date in MMM DD (Month Day) format. Use the **CATEGORY** switch to set the Month (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC). Use the **RESULT** switch to set the Day (1 to 31). Set the Month first, then the Day is limited to the maximum number for that month.

**BKLGHT - Backlight** — Selects the display backlight condition. Use the **SELECT** switch to toggle between ON and OFF.

**VOLUM - Volume** — Sets the speaker Volume level. Use the **SELECT** switch to set the Volume (0 to 10).

**BEEP** — Selects the status of the audible tone. Use the **SELECT** switch to toggle between Beep ON and Beep OFF.

**SWREV - Software Revision Level** — It displays the software revision level in ### format and the date the software was installed in MM/DD/YY format.

## SECTION 4 TEST RESULTS

### 4.1 INTRODUCTION

---

This section provides information on the T-BERD 307 test results. The test results are divided into two sections; DS3 Test Results and DS1 Test Results.

### 4.2 DS3 TEST RESULTS

---

The DS3 receiver has full Bit Error Rate Test (BERT) capabilities and supports all the DS3 results defined in the following sections.

The available results depend on framing type, pattern synchronization, etc. Results that are not available display the message *UNAVAILABLE* in place of the result count. The results that are not applicable to the current mode display *N/A* in place of the result count. When the displayed count exceeds 99,999,999, a “>” (greater than sign) appears in the window. When the number rolls over, the count continues.

#### 4.2.1 **SUMMARY Category Test Results**

The following DS3 test results appear in the SUMMARY category when they begin to detect error conditions.

- BIT ERRORS (LOGIC category)
- VIOLATIONS (BPV/FRM category)
- FRM ERRORS (BPV/FRM category)
- RX FREQ (SIGNAL category)
- PAR ERRORS (BPV/FRM category)
- C-BIT ERRORS (BPV/FRM category)
- FEBE (BPV/FRM category)
- FEAC Messages

When all SUMMARY results are error-free, the message *ALL RESULTS OK* is displayed. When an error is detected, the appropriate test result appears in the SUMMARY category window. When more than one error is detected, press the **RESULTS** switch to scroll through the results.

#### **4.2.2 FEAC Message and Loop Code Summary Test Results**

The Far-End Alarm and Control (FEAC) messages (Table 4-1) and loop codes (Table 4-2) appear in the SUMMARY category under the FEAC Code result. The FEAC messages are accumulated as they are detected. Only the last FEAC loop code is stored in the FEAC Code result. The results remain in the SUMMARY category until a test restart is initiated. The messages comply with the ANSI T1.107a-1990 standard and can be transmitted using the FCALM, FCALS, FCLP, and FCLPS DS3 Configuration Menu items. They are also printed as status (loop code messages) and alarm messages.

**Table 4-1. Far-End Alarm and Control Messages**

<b>Message</b>	<b>Description</b>
DS3 EF NSA	DS3 Equipment Failure, Non-Service Affecting (Type 2 equipment failure)
DS3 EF SA	DS3 Equipment Failure, Service Affecting (Type 1 equipment failure)
DS3 L/H	DS3 Loss-of-Signal/High Bit Error Ratio
DS3 OOF	DS3 Out-of-Frame, Loss of DS3 Frame Synchronization
DS3 AIS RX	DS3 Alarm Indication Signal Received
DS3 IDLE RX	DS3 Idle Signal Received
COMM EF NSA	Common Equipment Failure, Non-Service Affecting (Type 2 equipment failure)
DS1 EF NSA	DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure)
DS1 EF SA	DS1 Equipment Failure, Service Affecting (Type 1 equipment failure)



**Table 4-1. Far-End Alarm and Control Messages (Continued)**

Message	Description
SING DS1 L/H	Single DS1 Loss-of-Signal/High Bit Error Ratio
MULT DS1 L/H	Multiple DS1 Loss-of-Signal/High Bit Error Ratio

**Table 4-2. Far-End Loop Codes**

Loop Code	Description
ALL DS1 LPDN	All DS1 Lines loop-down code
ALL DS1 LPUP	All DS1 Lines loop-up code
DS1 xx LPDN	DS1 Line No. xx loop-down code (xx = 1 to 28)
DS1 xx LPUP	DS1 Line No. xx loop-up code (xx = 1 to 28)
DS3 LN LPUP	DS3 Line loop-up code
DS3 LN LPDN	DS3 Line loop-down code

#### **4.2.3 LOGIC Category Test Results**

Logic errors are based on discrepancies between the transmitted and received bit stream. The accumulation of logic errors is dependent on frame synchronization (if in a framed mode) and pattern synchronization. Logic errors are not available until initial pattern synchronization. The results are also not available when transmitting a channelized test pattern (i.e., the operating mode is set for MUXED M13 or MUXED C-BIT). During loss of frame or pattern synchronization, the accumulation of errors is halted.

The DS3 ERRORS category test results are defined as follows:

**BIT ERRORS** (Bit Errors) — The number of received bits with a value opposite the transmitted bit since DS3 pattern synchronization.

**BIT ERR RT** (Bit Error Rate) — The ratio of bit errors to received pattern bits over the previous  $10^8$  bits.

**BIT ERR SEC** (Bit Errored Seconds) — The number of seconds with one or more bit errors since initial DS3 pattern synchronization.

**SYNC L SEC** (Synchronization Loss Seconds) — The number of seconds during which the receiver has lost pattern synchronization, even momentarily, since initial DS3 pattern synchronization.

**AVAIL SEC** (Available Seconds) — A count of elapsed seconds since pattern synchronization with a BER less than  $10^{-3}$ .

**%AVAIL SEC** (Percent Available Seconds) — The percentage of available seconds to total seconds.

**SEV ERR SEC** (Severely Errored Seconds) — A count of seconds with a bit error rate worse than  $10^{-3}$ .

**%SEVERR SEC** (Percent Severely Errored Seconds) — The percentage of severely errored seconds to total available seconds.

**CSES** (Consecutive Severely Errored Seconds) — A count of 3 or more contiguous SES.

**DEG MIN** (Degraded Minutes) — The number of minutes with a BER worse than  $10^{-6}$ .

**%DEG MIN** (Percent Degraded Minutes) — A ratio of degraded minutes to total available minutes.

**UNAVAIL SEC** (Unavailable Seconds) — A count of unavailable seconds since the test started.

#### 4.2.4 **BPV/FRM Category**

The DS3 BPV/FRM (BPV & Frame) category test results are defined as follows:

**VIOLATIONS** (Bipolar Violations) — The number of bipolar violations (BPVs) detected. Intentional B3ZS code violations are excluded from the count.

**BPV ERR RT** (BPV Error Rate) — The ratio of BPVs to received bits over the previous block of  $10^8$  bits.

**BPV ERR SEC** (BPV Errored Seconds) — The number of seconds during which one or more BPVs occurred.

**PAR ERRORS** (Parity (P-bit) Errors) — The number of parity errors detected since initial DS3 frame synchronization.

**PAR ERR RT** (Parity (P-bit) Error Rate) — The ratio of parity errors to (1) the number of bits over which parity was calculated (Bit mode), or (2) the number of DS3 M-frames received (Block mode). The error rate is computed over the previous block of  $10^8$  bits. The result is derived as a bit or block error rate based on the setting of ERR RECEIVE-PAR ERR RT auxiliary function.

**PAR ERR SEC** (Parity (P-bit) Errored Seconds) — The number of seconds with one or more parity errors.

**C-BIT ERRORS** (C-bit Parity Errors) — The number of parity errors detected since initial DS3 C-bit frame synchronization.

**C-BIT ERR RT** (C-bit Parity Error Rate) — The ratio of C-bit parity errors to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed over the previous block of  $10^8$  bits. The result is derived as a bit or block error rate based on the setting of the ERR RECEIVE-PAR ERR RT auxiliary function.

**FEBE** (Far-End Block Errors) — The number of far-end block errors (FEBEs) detected since initial DS3 C-bit frame synchronization.

**FEBE RT** (Far-End Block Error Rate) — The ratio of FEBEs to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed over the previous block of  $10^8$  bits. The result is derived as a bit or block error rate based on the setting of the ERR RECEIVE-PAR ERR RT auxiliary function.

**FRM ERRORS** (Frame Errors) — The number of frame errors detected since the start of the test.

**FRM ERR RT** (Frame Error Rate) — The ratio of frame errors to framing bits over the previous of  $10^8$  bits.

**FRM ERR SEC** (Frame Errored Seconds) — The number of seconds with one or more frame errors.

**FRM LOSS CNT** (DS3 Frame Loss Count) — The number of DS3 frame losses since initial frame synchronization.

**FEOOF SEC** (Far-End Out-of-Frame Seconds) — The number of seconds during which the received X-bits are zero within the one second interval.

**NEOOF SEC** (Near-End Out-of-Frame Seconds) — The number of seconds during which an out-of-frame condition or an AIS is detected.

**DS2 FRM ERR** (DS2 Frame Errors) — The number of DS2 frame errors since initial frame synchronization. The result applies only to the DS2 signal that contains the DS1 channel being dropped. The count is reset when the new channel being dropped corresponds to a different DS2 signal. (Refer to Table 4-3 for DS2 channels and their DS1 channels.)

**DS2 FRM ERT** (DS2 Frame Error Rate) — The ratio of DS2 frame errors to total DS2 framing bits received. The result applies only to the DS2 signal that contains the DS1 channel being dropped. The count is reset when the new channel being dropped corresponds to a different DS2 signal. (Refer to Table 4-3 for DS2 channels and their DS1 channels.)

**Table 4-3. DS2 Channels vs. the Dropped DS1 Channels**

Signal	Channels						
DS2	1	2	3	4	5	6	7
DS1	1-4	5-8	9-12	13-16	17-20	21-24	25-28

**RX X-BIT** (Received X-Bit) — The status of the received X-bits when in a framed mode. The result is available after receiving DS3 frame synchronization.

#### 4.2.5 **SIGNAL Category**

The DS3 SIGNAL category test results are defined as follows:

**SIG L SEC** (Signal Loss Seconds) — The number of seconds during which the received DS3 signal was lost, even momentarily, since initial signal detection.

**TX FREQ** (Transmit Frequency) — The frequency of the Transmit clock in Hz.

**RX FREQ** (Receive Frequency) — The frequency of the clock recovered from the received data in Hz.

**RX LVL Vp** (Receive Signal Level in Volts peak) — The level of the received DS3 signal in volts peak.

**RX LVL dBdsx** (Receive Signal Level in dBdsx) — The level of the received DS3 signal in dBdsx.

**4.2.6 TIME Category**

The DS3 TIME category test results are defined as follows:

**TIME** (Current Time of Day) — The current time of day in hours, minutes, and seconds.

**DATE** (Current Date) — The current day and month.

**ELAPSED TIME** (Elapsed Time) — The elapsed time in hours, minutes, and seconds since the last test restart. If no DS3 signal is present after test restart, the test will not begin.

**TEST LENGTH** (Timed Test Length) — The currently set test length for a timed test in hours and minutes. This result is N/A unless the T MOD auxiliary function is set to TIMED.

**TIME LEFT** (Timed Test Time Remaining) — The time remaining in the current test based on the test length and the elapsed time since the start of the test. This result is N/A unless the T MOD auxiliary function is set to TIMED.

### **4.3 DS1 TEST RESULTS**

---

The DS1 receiver has full Bit Error Rate Test (BERT) capabilities and supports all the DS3 results defined in the following sections.

The available results depend on framing type, pattern synchronization, etc. Results that are not available display the message *UNAVAILABLE* in place of the result count. The results that are not applicable to the current mode display *N/A* in place of the result count. When the displayed count exceeds 99,999,999, a “>” (greater than sign) appears in the window. When the number rolls over, the count continues.

#### 4.3.1 **SUMMARY Category Test Results**

The following DS1 test results appear in the SUMMARY category when they begin to detect error conditions.

- BIT ERRORS (ERRORS category)
- VIOLATIONS (BPV & FRAME category)
- FRM ERRORS (BPV & FRAME category)
- RX FREQ (SIGNAL category)
- PAR ERRORS (BPV & FRAME category)
- C-BIT ERRORS (BPV & FRAME category)
- TIMING SLIPS (SIGNAL category)

When all SUMMARY results are error-free, the message *ALL RESULTS OK* is displayed. When an error is detected, the appropriate test result appears in the SUMMARY category window. When more than one error is detected, press the **RESULTS** switch to scroll through the results.

#### 4.3.2 **LOGIC Category**

Logic errors are based on discrepancies between the transmitted and received bits. The accumulation of logic errors is dependent on frame synchronization (if in a framed mode) and pattern synchronization. Logic errors are not available until initial pattern synchronization is obtained. During loss of frame or pattern synchronization, the accumulation of errors is halted.

The DS1 LOGIC category test results are defined as follows:

**BIT ERRORS** (Bit Errors) — The number of received bits with a value opposite the transmitted bit since initial pattern synchronization.

**BIT ERR RT** (Bit Error Rate) — The ratio of bit errors to received bits since initial pattern synchronization.



**BIT ERR SEC** (Bit Errored Seconds) — The number of seconds with one or more bit errors since initial DS1 pattern synchronization.

**SYNC L SEC** (Out-of-Synchronization Seconds) — The number of seconds during which the receiver has lost pattern synchronization, even momentarily, since initial DS1 pattern synchronization.

**AVAIL SEC** (Available Seconds) — A count of seconds with no errors since initial pattern synchronization.

**%AVAIL SEC** (Percent Available Seconds) — The ratio of available seconds to total seconds since test start.

**SEV ERR SEC** (Severely Errored Seconds) — The number of seconds with a BER worse than  $10^{-3}$ .

**%SEVERR SEC** (Percent Severely Errored Seconds) — The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.

**CSES** (Consecutive Severely Errored Seconds) — A count of groups of three or more contiguous SES.

**DEG MIN** (Degraded Minutes) — The number of minutes with a BER worse than  $10^{-6}$ .

**%DEG MIN** (Percent Degraded Minutes) — The ratio of degraded minutes to total available minutes.

**UNAVAIL SEC** (Unavailable Seconds) — The number of unavailable seconds since the test started.

#### **4.3.3 BPV/FRM Category**

The DS1 BPV/FRM (BPV & FRAME) category test results are defined as follows:

**VIOLATIONS** (Bipolar Violations) — The number of bipolar violations (BPVs) detected. Intentional B8ZS code violations are excluded from the count.

## SECTION 4 - TEST RESULTS

### *DS1 Test Results*

---

**BPV ERR RT** (BPV Error Rate) — The ratio of BPVs to received bits since initial pattern synchronization.

**BPV ERR SEC** (BPV Seconds) — The number of seconds during which one or more BPVs occurred.

**FRM ERRORS** (Frame Errors) — A count of frame errors since initial DS1 frame synchronization.

**FRM ERR RT** (Frame Error Rate) — The ratio of frame errors to received framing bits.

**FRM ERR SEC** (Frame Errored Seconds) — The number of seconds with one or more frame errors.

**FRM SES** (Frame, Severely Errored Seconds) — The number of seconds with frame errors equal to 12 or more (D4 framing only).

**FRM L SEC** (Frame Loss Seconds) — The number of seconds during which one or more frame synchronization losses occurred or during which frame synchronization could not be achieved, since initial DS1 frame synchronization.

**CRC ERRORS** (Cyclic Redundancy Check Errors) — The number of CRC errors detected. CRC errors are counted only when ESF framing is present.

**CRC ERR RT** (CRC Error Rate) — The ratio of CRC errors to the number of ESF superframes analyzed.

**CRC ERR SEC** (CRC Errored Seconds) — The number of seconds with one or more CRC errors.

**CRC SES** (CRC Severely Errored Seconds) — The number of seconds with 320 or more CRC errors.

#### 4.3.4 **SIGNAL Category**

The DS1 SIGNAL category test results are defined as follows:

**SIG L SEC** (Signal Loss Seconds) — The number of seconds during which the received DS1 signal was lost for all or part of a second.

**TX FREQ** (Receive Frequency) — The frequency of the Transmit clock in Hz.

**RX FREQ** (Receive Frequency) — The frequency of the clock recovered from the received data in Hz.

**RX LVL dBdsx** (Receive Signal Level in dBdsx) — The level of the received DS1 signal in dBdsx.

**RX LVL Vpp** (Received Signal Level in Vp-p) — The level of the received signal in Volts peak-to-peak.

**VF FREQUENCY** (Voice Signal Frequency) — The VF frequency (60 to 3904 Hz) for the selected channel. If the dropped channel is set to NONE, the VF FREQ displays N/A.

**VF LVL dBm** (Voice Frequency Level) — The VF signal level (+3.0 to -40.0 dBm) for the selected channel. If the dropped channel is set to NONE, the VF LVL displays N/A.

**SIMPLEX CURR** (Simplex Current) — The simplex current (10 to 200 mA) between the transmit output tip and ring and the receive input tip and ring. If the current is less than 10 mA, displays <10 mA. If the current exceeds 200 mA, displays >200 mA.

**SIG BIT AB** (Signaling A/B Bits) — The A and B bits for all 24 DS0 channels.

**SIG BIT CD** (Signaling C/D Bits) — The C and D bits for all 24 DS0 channels (ESF Framing only).

**TIMING SLIPS** (Timing Slips) — The number of bit slips and framing slips counted when the DS1 signal source has slipped from the REF jack input. A framing slip equals 193 bit slips. The framing slip total (-999 to +999) appears in the third line of the display. The bit slip total (-192 to +192) appears in the bottom line of the display.

#### **4.3.5 TIME Category**

The DS1 TIME category test results are defined as follows:

**TIME** (Current Time of Day) — The current time of day in hours, minutes, and seconds.

**DATE** (Current Date) — The current day and month.

**ELAPSED TIME** (Elapsed Time) — The elapsed time in hours, minutes, and seconds since the last test restart. If no DS1 signal is present after test restart, the test will not begin.

**TEST LENGTH** (Timed Test Length) — The currently set test length for a timed test in hours and minutes. This result is N/A unless the T MOD auxiliary function is set to TIMED.

**TIME LEFT** (Timed Test Time Remaining) — The time remaining in the current test based on the test length and the elapsed time since the start of the test. This result is N/A unless the T MOD auxiliary function is set to TIMED.

## **SECTION 5 APPLICATION CARDS**

### **5.1 INTRODUCTION**

---

This section consists of the “quick” cards currently available for the T-BERD 307 DS3/DS1 Analyzer. Each quick card provides the information required to configure the analyzer for a particular type of test. Cabling information is provided as well as a step-by-step procedure for performing the test. Typical results may also be provided.



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