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Rev. K

T-BERD 224
PCM ANALYZER

USER'S MANUAL

JUNE 1999

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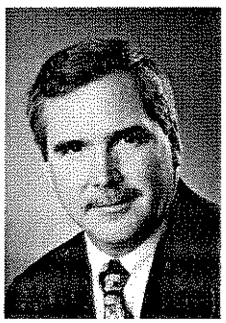

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Sincerely,

John Peeler
President and CEO

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SECTION 1 GENERAL INFORMATION

1.1 INSTRUMENT OVERVIEW

The T-BERD 224 PCM Analyzer is a T1 BERT set that provides comprehensive, full-duplex, T1 channel access. It performs test and monitor applications such as Full T1, Fractional T1, DDS, Signaling, Switched 56, VF, SS7, PRI, Caller ID, SLC and TR-303 from virtually any T1 access point. Dual drop capabilities allow users to observe or listen to live voice and data traffic. Bidirectional insert capabilities allow users to insert test tones or data into a channel(s) in either T1 transmission direction to perform out-of-service channel tests. With its two T1 receivers and two T1 transmitters, the T-BERD 224 can be placed in line to provide drop and insert in either direction on a T1 line. SONET/DS3 Analyzer lid is also available for high speed access and testing.

1.2 STANDARD FEATURES

Easy to use front panel controls and indicators allow test setups to be confirmed at a glance.

AUTO mode automatically configures the T-BERD 224 transmitters and receivers to the incoming T1 signal framing.

SUMMARY Results Category displays key non-zero or out-of-specification results.

Custom results prints and displays only the results you want.

Timing slip analysis detects differences in system timing between two T1 inputs.

Dual T1 receivers compatible with D1D, D2, D3/D4, ESF, and SLC™-96 (Mode 1 and 2) framing format provide simultaneous BPV, frame, and CRC error results, as well as received frequency and signal level measurements for both T1 inputs.

Full-duplex drop and insert capabilities allow out-of-service tests in either T1 transmission direction.

Split ESF/D4 mode capability enables the T-BERD 224 to monitor T1-ESF framing on one line and T1-D4 framing on the other line.

Traffic analysis displays the signaling bits of all 24 channels for one or both T1 transmission directions.

Built-in speaker enables the user to monitor VF transmissions in one or both directions.

Side panel interfaces provide full-duplex channel access to an external test set through a 2- or 4-wire VF interface.

Signaling bit control allows users to emulate signaling toward switches, PBXs, and channel banks.

VF signal analysis measures tone level and frequency within a VF channel.

AMI or Bipolar 8-Zero Substitution (B8ZS) transmit capability.

ISO 9000 registered.

UL approved and listed.

CSA approved and listed.

1.3 OPTIONS

1.3.1 SONET/DS3 Analyzer Option — Model 224-1

Dual STS-1/DS3 receivers provide analysis of the received signal.

STS-1/DS3 transmitter enables the T-BERD 224 to insert a DS1 signal into a DS3 or STS-1 output.

Drops DS1 (VT1.5) channels to the T-BERD 224 from the STS-1/DS3 input signals for DS1 and DS0 analysis.

Inserts DS1 (VT1.5) channels from the T-BERD 224 to the STS-1/DS3 output to test specific DS1 signals.

Lid provides user interface control to qualify STS-1 and DS3 (M13 and C-Bit framing) circuits with appropriate test patterns.

STS-1/DS3 Error and Alarm insertion enables the T-BERD 224 to test and verify network continuity and integrity.

DS1 BITS clock input provides an external connection for a STS-1 transmit timing reference.

1.3.2 Primary Rate ISDN Option — Model 12709

Monitors all messages on the Primary Rate ISDN D channel, (Layer 2 (LAPD).

Provides test results for counting packets, CRC errored packets, discarded packets, Information and Receiver Ready frames.

Isolates transmission and protocol problems between the network and user for Primary Rate ISDN.

Monitors all layer 3 (Q.931) call processing messages that correspond to that call. Reports, in real-time, the call state and other important information about the traced call.

Accesses the Primary Rate ISDN service from any T1 Access point, from a Channel Bank, or a DLC terminal.

1.3.3 SS7 Call Trace Option — Model 12710

DSP Option Board Required (42659)

Monitors and reports on all layer 3 (Q.931) call processing messages corresponding to a specifically traced call over an SS7 link.

Monitors and reports on all layer 2 link statistics such as number of packets, errored packets, and percent of utilization.

1.3.4 T1 BERT Option — Model 4301

Tests T1 circuits with over 15 different test patterns.

Transmits in-band and out-of-band (ESF) loop codes.

Provides automated MULTIPAT pattern testing with a 15-minute test that includes standard All Ones, 1:7, 2 IN 8, 3 IN 24, and QRSS test patterns.

Performs automated BRIDGTAP pattern testing to evaluate T1 circuits for bridge taps using 21 different test patterns.

Inserts single, burst, or variable rate logic errors, BPVs, frame errors, and yellow alarm.

Emulates T1 CSUs and Smart Jacks by terminating the T1 span, auto-responding to T1 loop codes, passing simplex current, and receiving signal levels down to -35 dBdsx.

Measures simplex current.

Beeps when the BER result is displayed and an errored second, loss of pattern synchronization, or test completion is detected.

Measures round trip path delay of a T1 circuit.

1.3.5 Fractional T1 Option — Model 13466

T1 BERT Option Required (43016)

Tests Fractional T1 circuits with over 20 different test patterns.

Tests and loops contiguous and non-contiguous Fractional T1 bandwidths.

Tests 64 x N and 56 x N Fractional T1 circuits.

Measures the round trip path delay of any group of channels in the T1 circuit.

1.3.6 DDS Option — Model 13467

T1 BERT Option Required (43016)

Tests DDS circuits with over 20 different test patterns.

Generates alternating and latching DDS loop codes for sectionalizing and troubleshooting DDS circuits.

Tests both DS0A and DS0B formatted DDS circuits at rates from 2.4 kb/s to 64 kb/s. A selected DS0B channel can be tested without affecting other channels.

Displays the logic states of the received byte for one or both dropped channels.

Tests DDS Primary and Secondary channels.

Controls MJU operations in the DDS network from a single T1 access point.

Measures the round trip path delay of any channel within the T1 circuit.

1.3.7 Advanced Stress Patterns Option — Model 12042

T1 BERT Option Required (43016)

Stresses DDS and T1 networks with eight additional test patterns.

1.3.8 G.821 Performance Analysis Option — Model 12041

T1 BERT Option Required (43016)

Evaluates long-term system performance using the CCITT Recommendation G.821 standard.

1.3.9 Enhanced ESF/SLC Option — Model 11704

Monitors and transmits T1.403 Performance Report Messages (PRMs) on ESF and ESFz framed circuits.

Monitors and transmits SLC-96 circuit alarms for Mode 1 and Mode 2, such as major shelf, minor shelf, and power/miscellaneous.

Monitors and transmits SLC-96 automated maintenance test sequences for Mode 1 only.

Monitors and transmits the SLC-96 switch to protection line function for Mode 1 and Mode 2.

Monitors and transmits the SLC-96 far-end shelf loopback for Mode 1 and Mode 2. The far-end loop command automatically switches the selected shelf to the protection line if it is available.

Monitors and transmits SLC-96 idle signal for Mode 1 and Mode 2.

1.3.10 Smart Loopback/Command Codes Option — Model 13963

T1 BERT Option Required (43016)

Adds intelligent network equipment loop codes that enable the T-BERD 224 to control intelligent network equipment.

Adds maintenance switch commands that enable the T-BERD 224 to activate maintenance switch ramp and switch functions.

Adds Smart NIU commands to enable the T-BERD 224 to query, retrieve, store, and clear T1 circuit statistics obtained by the performance monitor feature ofthe Westell NIU/Performance Monitor.

1.3.11 VF Option — Model 41502

DSP Option Board Required (42659)

Tests VF circuits at the T1 access points.

Qualifies voice-grade VF circuits by measuring Signal-to-Noise ratio (S/N), C-Message, C-Notch, Echo Return Loss (ERL), and Singing Return Loss High and Low (SRL-HI and SRL-LO).

Tests data-grade VF circuits with Peak-to-Average Ratio (PAR), 3 kHz Flat, and 3 kHz Notch noise.

Performs automated frequency sweeps.

Provides VF THRU Capability.

1.3.12 Signaling Option — Model 41934

DSP Option Board Required (42659)

Originates calls by sending complex sequences of DTMF, MF, or DP digits to switches/PBXs.

Terminates calls by receiving digits from a far-end switch/PBX, by sending supervision events, and by providing a dial tone.

Monitors in-service switch-to-switch, and switch-to-PBX communications by automatically detecting digit type (DTMF, MF, or DP).

Automatically scans signaling activity and monitors live traffic on pre-selected channels or on all 24 channels of a T1 circuit. All digit/supervision events are recorded for the seized channel.

Measures wink delay and duration.

Dials and tests Switched 56 circuits (DDS Option required).

1.3.13 Digit Analysis Option — Model 1270

Signaling Option Required (41934)

Measures DTMF and MF tone frequencies (high and low tones) and levels for individual digits captured while monitoring DS0 channel activity.

Measures dial tone delay, duration, frequency, and level.

Measures digit on and off time.

1.3.14 Caller ID Option — Model 13964

DSP Option Board Required (42659)

Monitors Caller ID frequency shift key (FSK) data at a T1 access point by decoding and displaying the Caller ID number on a selected channel. Also decodes and displays Caller ID name on systems that transmit both the Caller ID number and name.

Automatically scans for Caller ID activity by monitoring live traffic on pre-selected channels or all 24 channels of a T1 circuit and locking onto the first channel with ringing activity. Then, it decodes the FS data on that channel.

Emulates Caller ID Customer Premises equipment by sending Caller ID activation and deactivation commands to the switch.

1.3.15 IEEE-488 Remote Control Option — Model 41243

Provides automated IEEE-488.1 (HP-113) remote control ability.

Enables testing in engineering and manufacturing environments where multiple test equipment/ peripherals are operated via a master controlle .

1.3.16 TR-303 Option — Model 14875

DSP Option Board Required (42659)

Monitors TR-303 link statistics messages (Layer 2 (LAPD)) over the Timeslot Management Channel (TMC) or Embedded Operations Channel (EOC).

Provides test results for counting packets, FCS errored packets, discarded packets, information and RR frames.

Monitors all layer 3 TMC call processing messages corresponding to a specifically traced call.

Supports both BRITE and TR-303 applications.

1.3.17 RS-232/V.35 DSU-DP Data Port Option — Model 41249

Provides full-duplex drop and insert access to synchronous data at a variety of customer data rates, including DS0A-Framed DDS, DS0B-Framed DDS, Clear Channel, Fractional T1, and ESF datalink.

Multiplexes/demultiplexes RS-232, RS-449, and V.35 electrically formatted signals into the T1 bit stream.

Connects external test equipment or data terminal equipment directly to the T-BERD 224 to analyze channels within the T1 bit stream.

1.3.18 RS-232/RS-449 DSU-DP Data Port Option — Model 41441

Provides full-duplex drop and insert access to synchronous data at a variety of customer data rates, including DS0A-Framed DDS, DS0B-Framed DDS, Clear Channel, Fractional T1, and ESF datalink.

Multiplexes/demultiplexes RS-232, RS-449, and V.35 electrically formatted signals into the T1 bit stream.

Connects external test equipment or data terminal equipment directly to the T-BERD 224 to analyze channels within the T1 bit stream.

1.3.19 RS-232/V.35/RS-449 DSU-DP Data Port Option — Model 11772

Provides full-duplex drop and insert access to synchronous data at a variety of customer data rates, including DS0A-Framed DDS, DS0B-Framed DDS, Clear Channel, Fractional T1, and ESF datalink.

Multiplexes/demultiplexes RS-232, RS-449, and V.35 electrically formatted signals into the T1 bit stream.

Connects external test equipment or data terminal equipment directly to the T-BERD 224 to analyze channels within the T1 bit stream.

1.3.20 ZBTSI Framing Option — Model 11425

Tests and analyzes ZBTSI clear channel encoded T1 lines.

1.4 ACCESSORIES

Table 1-1 shows the list of accessories available for the T-BERD 224:

Table 1-1. Accessories

Part No.	Description
10966	Thermal printer paper
41297	Thermal 40-column lid printer
41306	Soft carrying case
41404	Side panel cover plate
41444-01	Rack mount (19") for T-BERD 224
41444-02	Rack mount extender (19" to 23") (41444-01 required)
41855-02	Rack mount extender (19" to 23") (41238 required)
42138	Rack mount for Signaling Option (41934 required)
51120	100-ohm bantam terminating plug
51130	WECO 310 to bantam converter plug
DTM	TTC Distributed Test Manager Software
ML11387	Replacement operating manual set
PR-35	Rack mounted thermal printer (40-column)
PR-40A	Thermal 40-column graphics printer w/cable and carrying case (battery or AC operation)
RTM	Remote Test Manager Software

1.5 CABLES

Table 1-2 shows the list of cables available for the T-BERD 224:

Table 1-2. Cables

Part No.	Description
06153	Bantam plug to AT&T 800 Series-type male (12')
06154	WECO 310 plug to AT&T 800 Series-type male (12')
10213	RS-232 male-to-male (6')
10215	RS-449/MIL-188 37-pin D male-to-male (6')
10417	RS-449/MIL-188 37-pin D male-to-male (10')
10418	RS-232 male-to-male (10')
10420	WECO 310 plug to WECO 310 plug (10')
10558	WECO 310 plug to alligator clips (10')
10559	WECO 310 plug to bantam plug (10')

Table 1-2. Cables (Continued)

Part No.	Description
10598	WECO 310 plug to WECO 310 plug (4')
10599	WECO 310 plug to bantam plug (4')
10615	Bantam plug to bantam plug (10')
10648	Bantam plug to alligator clips (10')
20309	9-pin D male to 9-pin audio male (10')
30611	9-pin D male to 5-pin audio male (4')
30771	Extender cable for lid printer (8')
31141	Dual Drop RS-232 protocol adaptor
31142	Dual Drop RS-449 protocol adaptor
31143	Dual DropV.35 protocol adaptor
31270-01	V.35/306 male-to-male (6')
31270-02	V.35/306 male-to-male (10')
41645	Dual bantam plug to RJ-48
41646	Dual bantam plug to RJ-45
41648	Dual bantam plug to 15-pin D male
41649	Dual bantam plug to 15-pin D female
CB-30598	440A to 440A (10')
CB-30598-02	440A to 440A (1')
CB-30599	440A to 358 (10')
CB-31211	440A male to 358 female (8')
AD-10830	440A to BNC adapter plug

1.6 ORDERING INFORMATION

Contact TTC Customer Service Department at 800-638-2049 for information on ordering options, accessories, or cables.

SECTION 2 INSTRUMENT CHECKOUT AND SERVICE

2.1 UNPACKING AND INITIAL INSPECTION

Inspect the T-BERD 224 shipping container for damage when it is received. If the shipping container or material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. If the contents are incomplete, or if the T-BERD 224 does not pass the performance tests (see Section 2.5), notify TTC. If the shipping container is damaged, notify the carrier as well as TTC, and keep the shipping container and material for the carrier's inspection.

2.2 EQUIPMENT INCLUDED

The following equipment should be included when the T-BERD 224 PCM Analyzer shipment is received and unpacked.

- T-BERD 224 PCM Analyzer
- Power cord
- Reference Manual and Users Guide
- Front cover
- Snap-on pouch
- Help cards (Inside Users Guide)

2.3 WARNINGS AND CAUTIONS

Observe the following cautions before and during all phases of instrument operation. Failure to comply with these and other specific warnings contained elsewhere in this manual may cause physical harm to the operator and/or damage to the instrument. TTC assumes no liability due to customer failure to comply with these requirements.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis must be connected to an approved three-contact electrical outlet or used with a three-contact to two-contact adaptor with the grounding wire firmly connected to an electrical ground at the power outlet.

KEEP AWAY FROM LIVE VOLTAGES

Do not remove the instrument top cover or insert fingers or other objects through the side-panel holes while power is applied to the unit.

DO NOT OPERATE IN AN AMBIENT TEMPERATURE ABOVE 50°C

2.4 POWER REQUIREMENTS

The T-BERD 224 is configured to operate with a single phase 48 to 66 Hz power source at 90-135 VAC. With a factory installed option, the T-BERD 224 can be configured to operate with a single phase 50 Hz power source at 195-240 VAC.

AC Power Connector — The T-BERD 224s power cord is plugged into this receptacle to provide line voltage to the unit. The safety ground connection is wired directly to the T-BERD 224 chassis.

AC Power Cord — The three-conductor AC power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adaptor with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet.

AC Line Fuse — The AC Line Fuse compartment is located between the AC Power connector and the AC Power switch. A spare fuse is located inside the fuse compartment. The T-BERD 224 requires a 1.6 Amp, 250 V, Slo-Blo fuse installed (Littlefuse type #21801.6, or its equivalent).

AC Power Switch — The **Power** switch is located on the side panel above the AC receptacle and fuse holder. The **Power** switch is marked with a "1" for the ON position and a "0" for the OFF position.

2.5 INSTRUMENT SELF-TEST/CHECKOUT

1. **AC Power cord**
   Insert the power cord in the power connector on the side panel.

2. **AC Power switch**
   Press this side panel switch to the ON (1) position to apply power to the unit. Powering on the unit initiates an automatic self-test.

   - Momentarily illuminates all front panel and switch LEDs.
   - Checks to see if any front-panel switches are stuck in an active position.
   - Verifies the data stored in Non-Volatile RAM (NOVRAM) is unchanged since the last power down If changes are found in the NOVRAM data, a failure message is displayed, and the factory settings are reloaded. The T-BERD 224 remains fully functional, and while the instrument may be used, TTC should be called for service.
   - Momentarily press the **RESTART** switch during power-up, to clear the T-BERD 224 NOVRAM and set all switch configurations to the factory default settings listed in Appendix A.
   - Checks internal components. If a self-test error message is visible in the display window, record the message and call TTC for service. There are no user-serviceable parts inside the T-BERD 224, except the AC fuse located on the side panel.

3. **RECEIVE INPUT switches**
   Select TERM.

4. **LINE 1 & LINE 2 jacks**
   Connect a cable from the LINE 1 TRANSMIT jack to the LINE 2 RECEIVE jack.

5. **MODE switch**
   Select T1-ESF

6. **CHANNEL FORMAT switch**
   Select VF

7. **SOURCE CONFIGURATION I switch**
   Select 1004 Hz.

8. **LINE 1 and LINE 2 CHANNEL switches**
   Select channel 01.

9. **RESULTS I & II Blank switches**
   Select SUMMARY category.

10. **DROP (RX) switch**
    Select LINE 2.

11. **INSERT (TX) switch**
    Select LINE 1.

12. **RESTART switch**
    Press to clear alarms and begin the test. Verify LINE 2 Signal and Frame Sync LEDs illuminate and SUMMARY category results read *RESULTS OK*.

13. **Volume**
    Adjust to medium volume level. Verify the presence of a 1004 Hz tone on the side-panel speaker for the Line 2 dropped channel (Channel 01).

14. **SIGNALING INSERT switches**
    Press A, B, C, and D switches and verify the corresponding signaling LED illuminates for Line 2.

15. **BPV ERROR INSERT switch**
    Press this switch three times. Three BPVs should register in the n25 BPVS results.

16. **RESTART switch**
    Press **RESTART** switch to clear alarms and begin the test.

17. **FRAME ERROR INSERT switch**
    Press this switch three times. Three frame errors should register in the n30 FRM ERR result.

18. **RESTART switch**
    Press **RESTART** switch to clear alarms and begin the test.

19. **YELLOW ALARM ERROR INSERT switch**
    Press this switch. Verify the LINE 2 Yellow Alarm Local Status LED is illuminated. Press this switch again to turn off the Yellow Alarm. Verify the Yellow Alarm history LED is illuminated.

20. **INSERT (TX) switch**
    Select NONE.

21. **LINE 1 & 2 jacks**
    Remove the cable connected from the LINE 1 TRANSMIT jack to the LINE 2 RECEIVE jack. Connect a cable from the L2 TRANSMIT jack to the L1 RECEIVE jack.

22. **RESTART switch**
    Press **RESTART** switch to clear alarms and begin the test.

23. **Repeat steps 10 to 19 transposing LINE 1 and LINE 2**
After determining that the T-BERD 224 LINE 1 and LINE 2 interfaces are functioning properly, disconnect the cables. The T-BERD 224 is ready for testing.

2.6 IN CASE OF DIFFICULTY

If theT-BERD 224 fails to operate and no front-panel indicators are illuminated:

- Check the AC power cord to ensure that it is securely connected.
- Make sure that the power supply is operating by plugging another electrical device into the electrical outlet used by the T-BERD 224.
- Verify a proper, working AC line fuse is installed.

If theT-BERD 224 still fails to operate, contact TTCs Customer Service Department at 1-800-638-2049.

If the front-panel indicators illuminate, but the instrument does not operate properly, note the procedures that failed and contact TTC for assistance.

2.7 AC LINE FUSE REPLACEMENT

The T-BERD 224 AC line fuse is located in the AC fuse compartment just below the **Power** switch. If the fuse is blown, it should be replaced with a 1.6 Amp, 250V, Slo-Blo fuse (Littlefuse #21801.6 or its equivalent). A spare fuse is located inside the fuse compartment. <u>Always use the correct fuse rating</u>.

1. **Disconnect the power cord from the power receptacle .**
2. **Locate the tab on the power switch receptacle.**
3. **Using a small screwdriver or similar instrument, gently pry the fuse cover open.**
4. **Remove the old fuse and install a new fuse of the correct size.**
5. **Press the plastic fuse holder securely back into place.**

SECTION 3 INSTRUMENT DESCRIPTION

3.1 INTRODUCTION

Use this section as a test reference and as a guide to understanding the functions of the T-BERD 224. The controls, indicators, and connections of the mainframe and each of the options are described in the following order (see Figure 3-1).

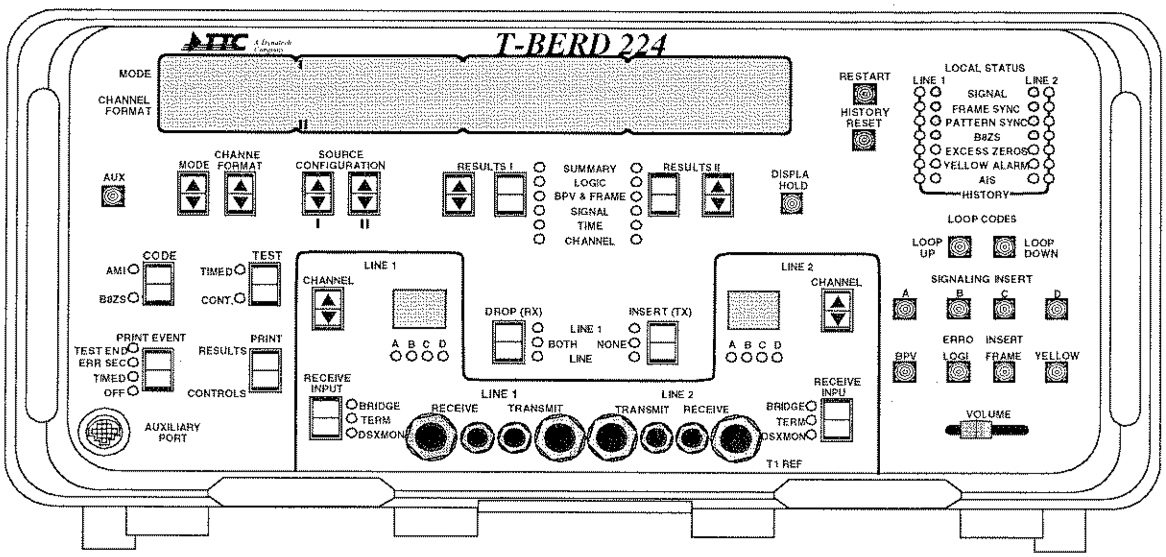


Figure 3-1. T-BERD 224 Front Panel

- Mainframe and T1 BERT Option
- Fractional T1 Option
- DDS Option
- SLC Option
- ESF Option
- Smart Loopback/Command Codes Option
- VF Option
- Signaling Option
- Caller ID Option
- Primary Rate ISDN Option
- SS7 Option
- TR-303 Option
- SONET/DS3 Analyzer Lid Option
- DSU-DP Option
- ZBTSI Option

NOTE

Unless indicated, the capabilities of the mainframe T-BERD 224 are applicable to the options.

The controls, indicators, and connections are grouped into the following functional areas

Test Setup — Describes the switches used to configure the T-BERD 224 for testing.

Circuit Connections — Discusses the connections and switches used to provide access to the circuit being tested.

Results Verification — Explains how to start a test and how to view, collect, and analyze the test results.

Troubleshooting Controls — Describes the switches that are used to troubleshoot the circuit.

Printer Controls — Explains how to manually or automatically generate printouts.

NOTE

Throughout this section, a number appears in brackets ([ ]) after each control name. These numbers match the callouts in the figures. Use these numbers to quickly locate switches, indicators, and connectors on the front panel.

MAINFRAME AND T1 BERT OPTION

3.2 TEST SETUP

Test setup switches configure the T-BERD 224 for T1 testing (see Figure 3-2).

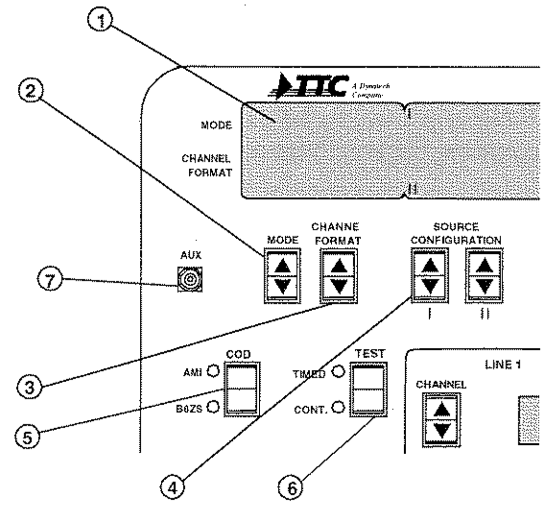


Figure 3-2. Test Setup Controls

Table 3-1 shows the available **MODE**, **CHANNEL FORMAT**, and **SOURCE CONFIGURATION I** (**SCI**) switch settings.

Table 3-1. Mainframe and T1 BERT Switch Configuratio n

Switch	Configuration	
MODE	AUTO, T1, T1-D1D, T1-D2, T1-D4, T1-ESF,SLC-D1D, SLC-M2, T1SLC96, T1 TLB, T1 LLB, ESF/D4	
CHANNEL FORMAT	VF	FULL T1
SCI	1004 Hz, VF INTF, DROP CHAN	AUTO, MULTIPAT, BRIDGTAP, ALL ONES, ALL ZEROS, USER, MIN/MAX, 2^23-1, 2^20-1, 2^15-1, 2^15-1 INV, QRSS, 2 IN 8,3 IN 24, 1:7

NOTE

A help card set is located in the storage pouch. Use the help cards as a quick test reference.

3.2.1 Front-Panel Display [1]

The front-panel display is an 80-character, green vacuum fluorescent display used to view instrument setups, test results, and auxiliary functions. It is divided into four windows. The first window is controlled with the **MODE** and **CHANNEL FORMAT** switches, the second with the **SOURCE CONFIGURATION** switches, and the two rightmost with the **RESULTS** switches. Auxiliary functions use all four windows.

3.2.2 MODE Switch [2]

The **MODE** switch configures the T-BERD 224 to the framing on the line (see Table 3-1). Modifying the **MODE** switch selection:

- Causes a test restart.
- Changes the frame synchronization parameters and the transmitted frame pattern.
- Disables the insert function for 3 seconds if the **INSERT (TX)** switch is set to LIN E1 or LI NE2.

The **MODE** switch selections include:

AUTO — Automatically configures the unit receivers and transmitters to incoming framed and unframed T1 signals.

In AUTO mode, *scan...* is displayed while the unit identifies the received framing mode. If frame synchronization is achieved, the detected mode is displayed in lowercase letters as indicated in Table 3-2.

Table 3-2. AUTO Mode Selection

T1 Signal Format	AUTO Mode Selection
D1D	t1-d4
D2	t1-d4
D4	t1-d4
ESF	t1-esf
ZBTSI	t1-esfz
SLC-96	t1slc96
SLC-M2	slc-m2
Unframed	t1

AUTO mode is performed concurrently on LINE 1 and LINE 2. The T-BERD 224 tries to synchronize to the LINE 1 input. If framing synchronization is achieved, the green LINE 1 Frame Sync LED illuminates, the detected mode appears in lowercase letters, and the T-BERD 224 tries to synchronize to the same frame format in LINE 2. If LINE 2 frame format is not the same as LINE 1, then the green LINE 2 Frame Sync LED does not illuminate. If the T-BERD 224 does not achieve synchronization with LINE 1, LINE 2 is analyzed for framing synchronization. If synchronization is achieved with LINE 2, the green LINE 2 Frame Sync LED illuminates and the detected mode appears in lowercase letters. If synchronization is not achieved for either line, *scan...* continues to appear in the display. This proces continues until synchronization is achieved or AUTO mode is exited.

NOTE

When an unframed signal is recognized, *t1* appears in the Mode display and *FULL T1* appears in the Channel Format display.

T1 — Enables the T-BERD 224 to transmit and receive unframed T1 data for testing unframed T1 circuits or those with proprietary framing formats.

When the T1 mode is selected, *FULL T1* appears in the CHANNEL FORMAT display and all other channel formats are disabled.

NOTE

When testing unframed T1 lines, the following controls and indicators are disabled: Frame Sync LED,Yellow Alarm LED, **FRAME ERROR INSERT** switch, **YELLOW ALAR INSERT** switch, and signaling drop and insert test points and switches.

T1-D1D — Provides standard D4 framing used for channel banks with D1D channel sequencing.

T1-D2 — Provides standard D4 framing used for channel banks with D2 channel sequencing.

T1-D4 — Provides standard D4 framing used for channel banks with D4 channel sequencing.

T1-ESF — Uses an extended superframe (24 frames) to provide a Cyclic Redundancy Check (CRC) for improved in-service testing.

SLC-D1D — Operates with the B, C, and D shelves of Mode I SLC-96 systems.

T1SLC96 Operates on the A shelf using SLC-96 formatting. When the T-BERD 224 is used as the signal source, the datalink bits are all set to zero. The datalink can be analyzed further with the Enhanced ESF/SLC Option.

SLC-M2 — Operates on the A shelf using Mode II SLC-96 formatting. When the T-BERD 224 is used as the signal source, the datalink bits are all set to zero. The datalink can be analyzed further with the Enhanced ESF/SLC Option.

ESF/D4 — Provides independent Line 1 and Line 2 monitoring of signals across an ESF/D4 converter. Enables the T-BERD 224 to monitor an ESF signal on Line 1 and simultaneously monitor a D4 signal on Line 2. This mode can be used to verify the conversion from ESF to D4 (or D4 to ESF) framing is successful. When in the ESF/D4 mode, the **CODE** switch is disabled. The code must be set using the AUX 32 LN CODE function for each of the lines.

T1-TLB (Test Loopback) — Loops data from each line receiver to the opposite lines transmitter while monitoring each input for T1 and channel results. In this mode, the T-BERD 224 strips incoming BPVs and does NOT allow the T-BERD 224 to insert test signals. However, the T-BERD 224 can insert BPVs, frame errors, and yellow alarms into one of the framed data streams. The **CODE** switch allows B8ZS coding to be removed or inserted. Unframed data can be accepted, but frame errors and yellow alarms cannot be inserted into the unformatted data stream

T1-LLB (Line Loopback) — Loops data from each line receiver to the opposite line transmitter. Each input is monitored for T1 and channel results, but data is unaffected bythe T-BERD 224. In this mode, BPVs are not stripped and errors can not be inserted.

In TLB and LLB modes the T-BERD 224 attempts to synchronize to a framing format, but it does not indicate the framing format. If the T-BERD 224 recognizes a framing format, the Frame Sync LED illuminates.

3.2.3 CHANNELFORMAT Switch [3]

The **CHANNELFORMAT** switch selects the type of test to perform. Press the **CHANNEL FORMAT** switch to select either voice or data channel formats.

Modifying the **CHANNELFORMAT** switch selection:

- Causes a test restart.
- Disables the insert function for 3 seconds if the **INSERT (TX)** switch is set to LIN E1 or LI NE2.
- May change the available **SOURCE CONFIGURATION I** and **II** switch selections.

Channel format selections are:

FULL T1 — Enables the T-BERD 224 to test the full T1 signal in any mode.

VF (Voice Frequency) — Use when testing voice frequency circuits. This selection enables the internal speaker, **SIGNALING INSERT** switches, VF channel measurements, and specific drop and insert source configurations.

3.2.4 SOURCE CONFIGURATION I Switch [4]

The **SOURCE CONFIGURATION I** switch selects specific tones/data to be inserted into the specified channels (see Table 3-1).

Modifying the **SOURCE CONFIGURATION I** switch selection:

- Causes a test restart.
- Modifies the drop and insert source for the channel(s) selected using the **CHANNEL, DROP (RX)**, and **INSERT (TX)** switches.

In VF, the **SOURCE CONFIGURATION I** switch selects the signal (internal or external) to be analyzed. The channel(s) are selected with the **CHANNEL, DROP (RX)**, and **INSERT (TX)** switches. **SOURCE CONFIGURATION I** selection availability depends on the **MODE** and **CHANNELFORMAT** switch selections. The selections are:

1004 Hz — Allows the insertion of a digitally-encoded 1004 Hz, 0 dBm, sine wave that is suitable for VF testing.

VF INTF (VF Interface) — Enables the side panel 2- or 4-wire VF interface as the drop and insert source. A selected drop channel is decoded and output to the side panel connector. Tones from the external VF signal source are inserted into the selected channel.

DROP CHAN (Dropped Channel) — Provides a channel loopback and allows a channel which is dropped from one line to be re-inserted into a selected channel on the opposite line. The dropped channel is provided to the side panel 2-wire and 4-wire VF interfaces. When DROP CHAN is selected and the **CHANNEL** switch for the dropped line is set to ALL, time slot 1 is dropped.

In Full T1, the **SOURCE CONFIGURATION I** switch selects test patterns. All patterns, except BRIDGTAP and MULTIPAT, can be used in any framed or unframed operating mode. No patterns are transmitted in the T1 TLB, or T1 LLB modes. However, logic results can be obtained for these modes if frame and pattern synchronization are achieved. Changing test patterns always causes a test restart. The selections are:

AUTO — Automatic Pattern Search — Enables the T-BERD 224 to automatically search for and identify a known test pattern on the dropped line. If the **DROP (RX)** switch is set to BOTH, only LINE 1 is searched. If a pattern match occurs, the pattern name appears in the SOURCE CONFIGURATION I display in lowercase characters. While displaying AUTO, theT-BERD 224 transmits an all ones patterns. Once the received pattern is recognized, the T-BERD 224 transmits the pattern on the inserted line. If the received pattern is not recognized or live data is received, *AUTO* is replaced with the word *live*.

When testing DDS circuits, the AUTO mode only applies when it is receiving live data.

MULTIPAT — Transmits five consecutive test patterns: ALL ONES, 1:7 , 2 IN8 , 3 IN24, and QRSS. This automated test pattern sequence is used during the acceptance testing of a new T1 span or while troubleshooting an existing T1 span.

When MULTIPAT is selected, a test restart occurs and the pattern is transmitted. As each pattern is transmitted, it is identified in the display in lowercase letters. The MULTIPAT test takes approximately 15 minutes with each pattern transmitted for three minutes. MULTIPATis only available in the FULL T1 channel format.

BRIDGTAP — 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. This automated test pattern sequence is used during initial installation to identify bridge taps or stress the T1 span during routine maintenance. When a bridge tap exists on the line, reflections occur during the transmission of data which interfere with the performance of the T1 span. BRIDGTAP

When BRIDGTAP is selected a test restart occurs and the pattern is transmitted. As each pattern is transmitted, it is identified in the display in lowercase letters. The BRIDGTAP test takes approximately ten minutes. BRIDGTAP is only available in the FULL T1 channel format.

ALL ONES — Provides a fixed test pattern of all ones (AMI pulses). This pattern is generally used to stress span repeater current regulator circuits. It can also be used as an AIS in unframed circuits, a keep alive signal, or an idle code. This pattern is required to measure the T1 signal power in dBm (n42 RX LVL result).

ALL ZEROS — Allows the T-BERD 224 to test T1 circuits for B8ZS clear channel capability (CCC). The **CODE** switch should be set for B8ZS when sending the ALL ZEROS pattern. The pattern can be transmitted framed or unframed, or with the T1-ESFz mode selected.

USER — User Programmable Bit Pattern — Enables the T-BERD 224 to transmit a 3- to 24-bit user programmable test pattern, which can be used to test a circuits sensitivity to a particular pattern. The pattern is entered in binary form through AUX 15 USER function.

MIN/MAX — Minimum/Maximum Density Stress Pattern— Generates rapid transitions from low one density octets to high ones density octets. This pattern is used to test the ability of repeaters to adjust to rapid changes in ones density.

2^23-1 — 8,388,607-Bit Pseudorandom Pattern — Generates a maximum of 22 sequential zeros and 23 sequential ones. The pattern exceeds excess zeros and does not meet the minimum ones density requirements for T1 applications.

2^20-1 — 1,048,575-Bit Pseudorandom Pattern — Generates a maximum of 19 sequential zeros and 20 sequential ones. The pattern exceeds excess zeros and does not meet the minimum ones density requirements for T1 applications.

2^15-1 — 32,767-Bit Pseudorandom Pattern — Generates a maximum of 14 sequential zeros and 15 sequential ones. The pattern provides a maximum number of zeros allowed for framed, non-B8ZS testing. The pattern does not meet the minimum ones density requirement.

2^15-1 INV — Inverted 32,767-Bit Pseudorandom Pattern — Generates a maximum of 15 sequential zeros and 14 sequential ones. The pattern provides a maximum number of zeros allowed for framed, non-B8ZS testing. The pattern does not meet the minimum ones density requirement.

QRSS — T1 Quasi-Random Signal Source Pattern — Simulates live T1 data. T1 QRSS is a modified 2^{20}-1 pseudorandom pattern that allows a maximum of 15 sequential zeros and 20 sequential ones. The *Ln 1's DENS VIOLATED* message is disabled when this pattern is transmitted.

2 IN 8 — Two Ones In 8-Bits Pattern — Provides a fixed test pattern of F0100 0010 01.... This pattern is generally used to test mis-optioned equipment for B8ZS encoding. The pattern is aligned with the framing (F) bits as indicated.

3 IN 24 — Three Ones In 24-Bit Pattern — Stresses the minimum ones density (12.5%) and the maximum zeros (15) requirement of T1 circuits. 3 IN 24 is a fixed test pattern of F0100 0100 0000 0000 0000 0100.... The pattern is aligned with the framing (F) bits as indicated. When the pattern is framed, at least n ones must appear in 8(n+1) bits where n = 1 to 23.

1:7 — A One and Seven Zeros Pattern — Stresses the minimum 12.5% ones density requirement for T1 circuits using AMI coding. 1:7 is a fixed test pattern of F01000000.... The pattern is aligned with the framing (F) bits as indicated.

The following patterns are available through the Advanced Stress Patterns Option:

T1-2/TRIP — Provides a fixed 96-octet HEX pattern used to stress test T1 circuits and equipment.

T1-3 — Provides a fixed 54-octet HEX pattern used to stress test T1 circuits and equipment.

T1-4 — Provides a fixed 120-octet HEX pattern used to stress test T1 circuits and equipment.

T1-5 — Provides a fixed 53-octet HEX pattern used to stress test T1 circuits and equipment.

T1-6/55 OCT — Provides a fixed unframed 55-octet HEX pattern and a variant of the MIN/MAX repeater stress pattern used to test the repeaters' ability to lock onto the incoming clock when the data changes from high ones density to low ones density.

T1-DALY — Provides a fixed framed 55-octet HEX pattern used with framed T1 circuits without causing exces zeros (excess zeros is more than 15 consecutive zeros). This pattern is a variant of T1-6.

3.2.5 CODE Switch [5]

The **CODE** switch selects the line coding the T-BERD 224 uses when transmitting or receiving a T1 signal. The LEDs to the left of this switch illuminate to indicate the selected coding.

NOTE

When in the ESF/D4 mode, the **CODE** switch is disabled. The code must be set using the AUX 32 LN CODE function for each of the lines.

AMI (Alternate Mark Inversion)

B8ZS (Bipolar with 8 Zero Substitution) — When receiving a T1 signal, B8ZS decoding is automatic, regardless of the **CODE** switch selection, but if B8ZS code is received while set for AMI, *B8ZS DETECTED* flashes in the display.

3.2.6 TEST Switch [6]

The **TEST** switch controls test duration. CONTinuous selects an unlimited test duration. TIMED enables the user to conduct a timed test of up to 200 hours, 59 minutes, 45 seconds.

NOTE

Changing from CONTinuous to TIMED causes a test restart and displays the message *SEE AUX 03 TO SET TEST LENGTH*. The default setting in switches and signaling applications is CONTinuous. Changing from TIMED to CONTinuous allows the test to continue and results to accumulate.

3.2.7 AUX Switch [7]

Press the **AUX** switch to access the auxiliary functions, which allow access to parameters that are less frequently used and do not have dedicated switches. The LED within the switch illuminates when the auxiliary functions are accessed. Press the **MODE** switch to scroll through the auxiliary functions.

Refer to Section 4 for detailed information on the following mainframe and T1 BERT auxiliary functions. There are, however, auxiliary functions found within *specific options* surrounded by parenthesis (e.g. SS7 Call Trace). For clarification of those auxiliary functions within those options, refer to their sections within the reference manual:

- AUX 01 CL FIFO — Clear Print FIFO
- AUX 02 TIM PRI — Timed Print Event
- AUX 03 TES LEN — Timed Test Length
- AUX 04 TIM/DAY — Clock Time and Date
- AUX 05 LBO — Line Build-Out
- AUX 06 BACK TM — Backup Timing Source
- AUX 07 DSO TM — DSO Interface Timing (**DSU-DP Option*)
- AUX 08 RS 232 — RS-232 Configuration
- AUX 09 488 MODE — IEEE-488 Mode and Address (also **T1 Bert Option*)
- AUX 10 N-CONTG — Non Contiguous Channel (** DSU-DP* and **Fractional T1 Option*)
- AUX 11 ANL CHA — DSU-DP Analysis Channel (**DSU-DP Option*)
- AUX 12 ERR COR — DSOA Error Correction (** DSU-DP and *DDS Option*)
- AUX 13 ERR RT — Error Rate (**T1 Bert Option*)
- AUX 14 FRM ERR — Frame Error Insertion (**T1 Bert Option*)
- AUX 15 USER — User Programmable Test Pattern (**T1 Bert Option*)
- AUX 16 PGM LP — Programmable Loop Codes (**T1 Bert Option*)
- AUX 17 LOOP CD — Loop Codes (**T1 Bert Option*)
- AUX 18 AUT RES — Automatic Loop Code Response (**T1 Bert Option*)
- AUX 19 DDS CHN — DDS Analysis Channel and Secondary Channel Pattern (**DDS Option*)
- AUX 20 PRM TX — PRM Transmission (**Fractional T1 Option*)
- AUX 21 VF SWEEP — Sets Sweep Parameters of VF Burst function.
- AUX 22 VF BURST— Sets Frequency and Level of VF Burst function.
- AUX 23 PRT OPT — Print Option for Frequency Sweep
- AUX 24 TRK DEF — Trunk Type Definition (**Signaling Option*)
- AUX 25 DIG MAR — Digit Margining (**Signaling Option*)
- AUX 26 DIAL SEQ — Dial Sequence (**Signaling Option*)
- AUX 27 REC SEQ — Receive Sequence (** Signaling Option*)
- AUX 28 DEF SPV — Define Supervision Events (**Signaling Option*)
- AUX 29 SCANSET — Channel Signaling Scan Setting (**Signaling Option*)
- AUX 29 SCANSET — Channel Signaling Scan Setting (**Caller ID Option*)
- AUX 30 MJU — DDS Analysis Channel and Secondary Channel Pattern (**DDS Option*)
- AUX 31 CALLID — Caller ID Signaling Selection (**Caller ID Option*)
- AUX 32 LN CODE — Independent Line Coding
- AUX 35 CUSTOM — Custom Results
- AUX 41 TRC RST — Sets Trace Restart (**SS7 Call Trace Option*)
- AUX 42 303 TRC — Sets Call Trace Criteria (** TR-303 Options*)
- AUX 43 PRI TRC — Sets Call Trace Criteria (**Primary Rate ISDN Option*)
- AUX 46 SS7 TRC — Sets Call Trace Criteria (**SS7 Option*)
- AUX 99 HELP — Describes Cause Value Messages (**PRI and *TR-303 Options*)

3.3 CIRCUIT CONNECTIONS

The circuit connections controls configure the T-BERD 224 for T1 testing (see Figure 3-3).

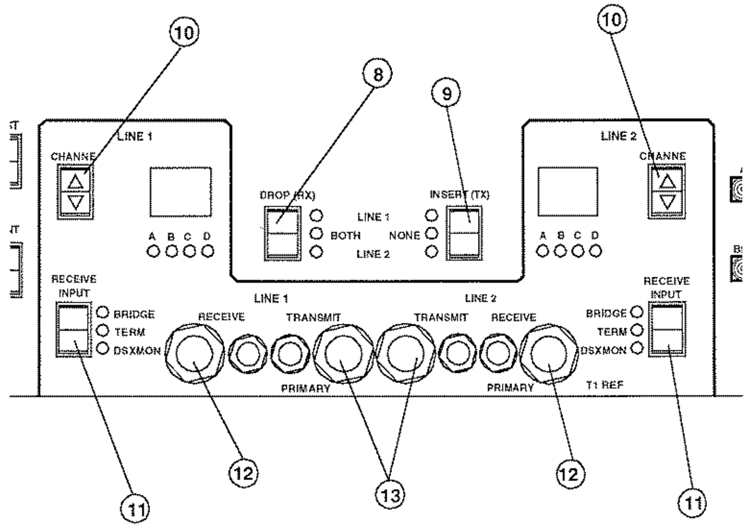


Figure 3-3. Circuit Connections Controls

3.3.1 DROP (RX) Switch [8]

The **DROP (RX)** switch selects the T1 source(s) to be received for testing. The illuminated LED to the right of the **DROP (RX)** switch indicates the T1 line source(s). Modifying the **DROP (RX)** switch selection causes a test restart. **DROP (RX)** switch selections are:

LINE 1 — Selects LINE 1 as the source from which the data is received.

BOTH — Selects both lines as the source to be received.

LINE 2 — Selects LINE 2 as the source from which the data is received.

3.3.2 INSERT (TX) Switch [9]

The **INSERT (TX)** switch selects the T1 line in which data and errors are transmitted. The illuminated LED to the left of the **INSERT (TX)** switch indicates the selected T1 line. After a power loss, the **INSERT (TX)** switch is always reset to NONE. **INSERT (TX)** switch selections are:

LINE 1 — Selects LINE 1 to insert the data and errors.

NONE — Selects neither line for data and error insertion.

LINE 2 — Selects LINE 2 to insert the data and errors.

If the **INSERT (TX)** switch is set to NONE, no test data is transmitted. If the **INSERT (TX)** switch is set to LINE 1 or LINE 2, the data is transmitted into the selected line and an idle code (ALL ONES) is transmitted into the opposite line. The T1 data clock is defined in the AUX 06 BACK TM function.

NOTE

The T-BERD 224 cannot act as the T1 signal source if a T1 signal is being received (DROPPED) on the line selected by the **INSERT (TX)** switch.

Changing the **INSERT (TX)** switch selection from NONE to LINE 1 or LINE 2 inserts data, user-selected errors, and signaling bits (if applicable) three seconds after the switch is released. During this 3-second delay, the selected channel number flashes in the **CHANNEL** switch display. Changing the **MODE, CHANNEL FORMAT, SOURCE CONFIGURATION I** and **II, INSERT (TX),** and **CHANNEL** switches for the line being inserted on (LINE 1 or LINE 2) causes the insertion to be reset and also disables insertion for 3 seconds. Changing the **INSERT (TX)** switch from LINE 1 or LINE 2 to NONE immediately aborts the insert function.

3.3.3 LINE 1 & 2 CHANNEL Switches [10]

The **LINE 1** and **LINE 2 CHANNEL** switches are available in the **VF CHANNELFORMAT** and select the channel to be monitored or tested. The selected channel number is visible in one of the two seven-segment CHANNEL displays. Pressing the up arrow increments the displayed channel number; pressing the down arrow decrements the channel number. If a **CHANNEL** switch is pressed and held for more than one second, the channel numbers scroll until the switch is released. **LINE 1** and **LINE 2 CHANNEL** switch selections are:

1 to 24 — Displays the channel number selected for testing.

ALL Available only for the 1004 Hz **SOURCE CONFIGURATION I** switch selection. Inserts the 1004 Hz tone in all channels (1-24) on the line set with the **INSERT (TX)** switch.

When the **CHANNEL FORMAT** switch is set to FULL T1, the **CHANNEL** switch number is displayed as "——".

3.3.4 LINE 1 & 2 RECEIVE INPUT Switches [11]

The **LINE 1** and **LINE 2 RECEIVE INPUT** switches determine the input impedance and signal conditioning for the corresponding receiver. Modifying the **RECEIVE INPUT** switch selection causes a test restart. **RECEIVE INPUT** switch selections are:

BRIDGE — Select when the monitored line is already properly terminated. When BRIDGE is selected, greater than 1000 ohms input impedance and ALBO (Automatic Line Build-Out) compensation is provided. ALBO automatically adjusts for up to 35 dB of cable loss.

TERM — Select when the monitored line is terminated by the T-BERD 224. When TERM is selected, 100 ohms input impedance and ALBO compensation is provided. ALBO automatically adjusts for up to 35 dB of cable loss.

DSX MON — Select when monitoring signals at DSX monitoring points which are resistor-isolated. When DSX MON is selected, 100 ohms input impedance is provided and the incoming signal is amplified to compensate for resistive attenuation.

3.3.5 LINE 1 & 2 RECEIVE Jacks [12]

Two RECEIVE jacks are provided for each line: a WECO 310 and a bantam. The connectors can be used simultaneously to accept a T1 signal input.

3.3.6 LINE 1 & 2 TRANSMIT Jacks [13]

Two TRANSMIT jacks are provided for each line: a WECO 310 and a bantam. The connectors simultaneously provide transmit output. The transmitted signal is passed through a switchable line build-out circuit. The AUX 05 LBO function determines the amount of line build-out applied.

3.3.7 Side-Panel Connections

The following connections, illustrated in Figure 3-4, are located on the T-BERD 224 side panel.

3.3.7.1 DSO INTF Jacks

The DS0 INTF jack provides two bantam jacks for external access to bipolar, 64 kb/s, DS0 signals within the T1 bit stream data. TheT-BERD 224 requires the DDS Option to use this interface. The TX IN jack is used to insert a 64 kb/s DS0 signal into a channel designated by the front panel **INSERT (TX)** and **CHANNEL** switches. The RX OUT jack is used to drop a 64 kb/s DS0 signal from a T1 as designated by the front panel **DROP (RX)** and **CHANNEL** switches. These jacks are commonly used by external KS-type test sets for testing DDS circuits from a T1 access point. The DS0 interface is electrically identical to DS0-DP interfaces on channel bank cards.

3.3.7.2 TEST PTS. Connecto

The 37-pin D-type TEST PTS. connector provides TTL access to 22 test points. The test points have a one-to-one correspondence to the front panel indicators and can be used to trigger external equipment when alarm conditions occur. For additional information on the TEST PTS. connector pin designations, refer to Section 8.

3.3.7.3 4-WIRE VF Interface Jacks

Two WECO 310 jacks, with 600-ohm termination, provide 4-wire VF access to a digitally encoded VF channel. This interface allows analog VF test sets, which were traditionally only used at analog test points, to access VF information at a T1 access point. The 4-WIRE VF interface converts analog signals received at the input connector into digital signals suitable for transmission on the T1 span. VF channels from the digital T1 bit stream are converted into analog VF signals at the output connector.

3.3.7.4 VF 2-WIRE INTF Terminals

These two turret-type posts provide 2-wire test access to a digitally encoded VF channel. Using an external butt set, users can connect to the interface, dial DTMF digits, and talk to another party.

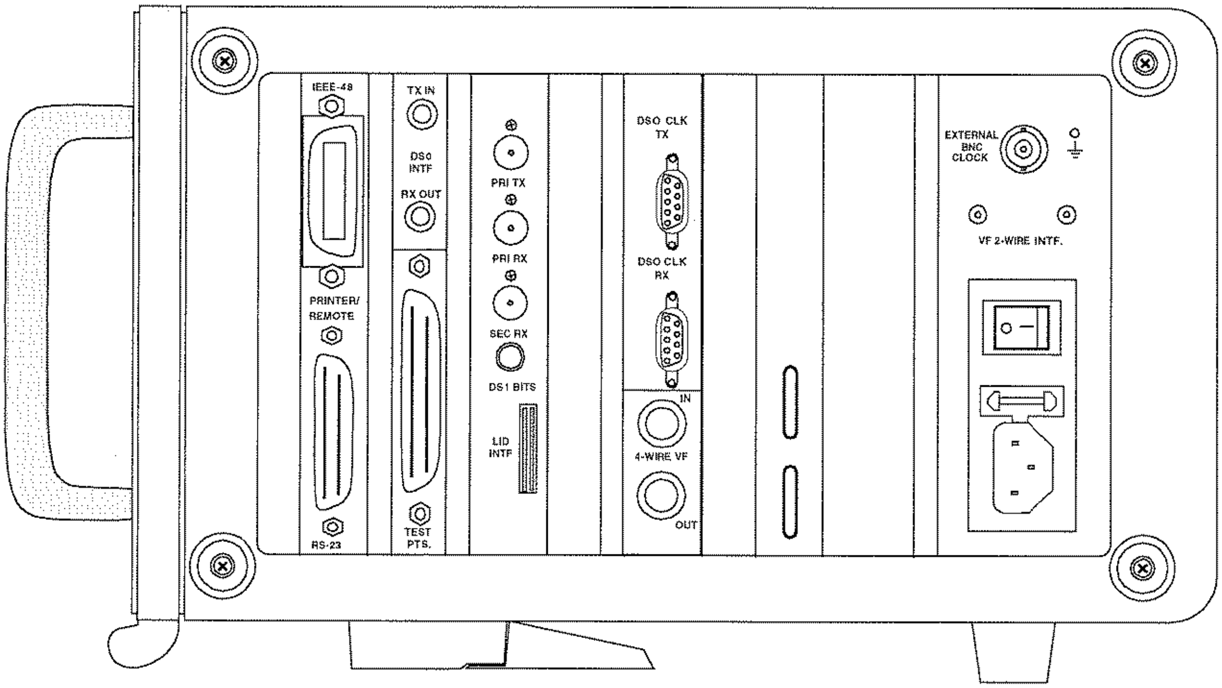


Figure 3-4. Side-Panel Connections

3.3.7.5 EXTERNAL BNC CLOCK Connector

This BNC connector provides an AC-coupled input impedance of 75 ohms for an external T1 clock source, which can provide the reference clock source for measuring timing slips. The backup clock source is selected via the AUX 06 BACK TM function.

3.4 RESULTS VERIFICATION

Once the T-BERD 224 is configured and connected to the circuit, use the following switches and LEDs to initiate the test and collect test results (see Figure 3-5).

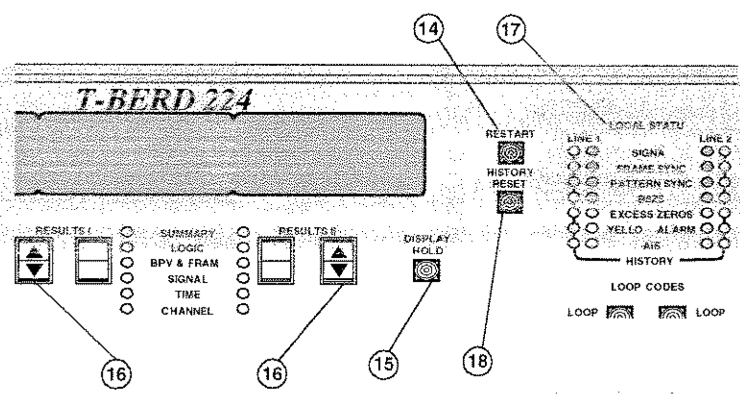


Figure 3-5. Results Verification Controls and Indicators

3.4.1 RESTART Switch [14]

The **RESTART** switch initializes all local status and history LEDs and resets all results to zero. Pressing and holding this switch during a power-up clears Non-Volatile RAM (NOVRAM) and sets all the parameters to their default factory settings, as listed in Appendix A.

The following actions cause a test restart:

- Pressing a major switch: **MODE**, **CHANNELFORMAT**, **RECEIVE INPUT**, **DROP (RX)**, and **CHANNEL**
- Changing the **TEST** switch from CONT. to TIMED
- Changing the AUX 03 TES LEN function when the **TEST** switch is set to TIMED

3.4.2 DISPLAY HOLD Switch [15]

The **DISPLAY HOLD** switch freezes the displayed results, Local Status LEDs, and History LEDs. The switch LED illuminates when it is enabled. During a display hold, the **RESULTS** switches can be used to scroll through the results, the results continue to accumulate in the background, a test restart can be performed, and a results printout can be generated to report the current values. When display hold is disabled, the results and LEDs are updated to reflect their current values. When display hold is enabled the **HISTORY RESET** switch is disabled.

3.4.3 RESULTS Switches [16]

The RESULTS I and II windows allow two sets of test results to be displayed simultaneously. Below each RESULTS window is a corresponding pair of **RESULTS** switches that select the category and test result. Results for LINE 1or LINE 2 can be displayed in either RESULTS window

Each pair of **RESULTS** switches consists of two rocker switches. The **RESULTS I** and **II Blank** switches select between the six result categories. The Illuminated LED next to a category label indicates that it has been selected. The **RESULTS I** and **II Arrowed** switches scroll through and display individual test result within the selected category

A result number is assigned using an nXX(x) format; n is the LINE number (1 or 2) and XX(x) is the result number (00 to 110) for the indicated LINE. Refer to Section 5 for detailed descriptions of each category and test result.

NOTE

Changing **RESULTS** switch selections does not affect the test in progress.

3.4.4 Local Status LEDs [17]

Four columns of LEDs, two columns for LINE 1 and two columns for LINE 2, indicate each T1 inputstatus. The two inside columns provide the current status of the incoming T1 signal; the two outside columns display the history status. The LEDs are color coded according to their function. Green LEDs indicate positive conditions (e.g., Frame Sync) and red LEDs indicate history, alarm, or failure conditions (e.g., Signal Loss).

The Local Status LEDs illuminate for at least 100 ms to indicate a condition. This *on* time allows users to see transient events. All status and alarm LEDs are frozen at the end of a timed test.

The Local Status LEDs indicate the following four conditions:

Both LEDs Off — No occurrence of the corresponding condition, past or present.

Only Local Status LED On — The corresponding condition is presently occurring.

Only History LED On — The corresponding condition occurred but is not occurring now.

History LED On, Local Status LED On — The corresponding condition is occurring now and has also occurred in the past.

The following list identifies the conditions that illuminate the Local Status LEDs:

Signal — This green LED illuminates when theT-BERD 224 detects a T1 signal with frequency equal to 1,544,000 Hz ± 5,000 Hz and a level greater than -35 dBdsx. The LED indicates at which RECEIVE input (LINE 1 or LINE 2) the signal is detected. The red History LED illuminates when no signal is detected for a period of 150 ms.

Frame Sync — This green LED illuminates when the T-BERD 224 achieves frame synchronization with the received T1 data stream. The LED indicates at which RECEIVE input (LINE 1 or LINE 2) the signal is detected. The red History LED illuminates when two out of four received frame bits are in error.

Pattern Sync — This green LED illuminates when the received test pattern is recognized by the T-BERD 224 and pattern synchronization is achieved on the dropped line. Pattern synchronization depends on receiving a given number of consecutive error-free bits for the specific test pattern.

NOTE

If the **DROP (RX)** switch is set to BOTH, only the Line 1 Local Status Pattern Sync LEDs are functional.

B8ZS — This green LED illuminates when the T-BERD 224 detects Bipolar 8-Zero Substitution (B8ZS) clear-channel coding. The LED indicates which receive input (LINE 1 or LINE 2) detected the B8ZS coding. The red History LED illuminates when the B8ZS code is no longer detected at the corresponding input. If the **CODE** switch is set to AMI, *B8ZS DETECTED* flashes in the display when B8ZS coding is detected.

Excess Zeros — This red LED illuminates when the T-BERD 224 detects 16 or more consecutive zeros. The LED indicates at which RECEIVE input (LINE 1 or LI NE2) the excess zeros are detected. The red History LED illuminates when excess zeros are no longer detected.

Yellow Alarm — This red LED illuminates when the T-BERD 224 detects a yellow alarm. The LED indicates on which receive input (LINE 1 o r LINE2) the yellow alarm is detected. The red History LED is illuminated when a yellow alarm is no longer detected. Neither the Status nor the History LED illuminates for a yellow alarm if T1 frame synchronization has not been achieved.

AIS — This red LED illuminates when the T-BERD 224 detects an AIS signal. The LED indicates on which receive input (LINE 1 or L INE2) the AIS signal is detected. The red History LED illuminate when AIS is no longer detected.

3.4.5 HISTORY RESET Switch [18]

The **HISTORY RESET** switch clears all illuminated History LEDs. This switch does not restart a test, affect any of the current Local Status LEDs, or affect any accumulated test results.

3.5 TROUBLESHOOTING CONTROLS

During T1 circuit testing, it is often necessary to isolate problem (see Figure 3-6). Use the following switches to help sectionalize the span.

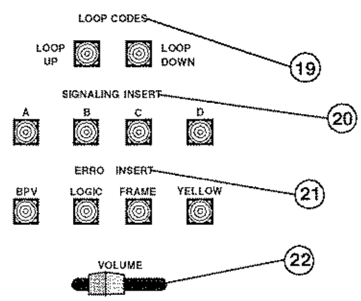


Figure 3-6. Troubleshooting Controls

3.5.1 LOOP CODES Switches [19]

The **LOOP CODES** switches transmit loop-up and loop-down codes from the T-BERD 224 to terminals that can respond to T1 in-band and T1 out-of-band loop codes. The loop codes are used to establish an out-of-service loopback at specific terminals along the span. The loop code type is configured in the AUX 17 LOOP CD function.

The **LOOP CODES** switches are *disabled* when: the T1 TLB and T1 LLB modes are selected; the **INSERT (TX)** switch is set to NONE; the CHANNEL number display is flashing during the three second insert wait time; the T-BERD 224 is automatically responding to a loop code; the channel format is set to VF; or T1 frame synchronization is not acquired.

The **LOOP CODES** switches perform the following functions:

LOOP UP switch — Controls the transmission of the selected loop-up code. When the switch is pressed (LED ON), the loop code is transmitted until an appropriate response is detected, a pre-determined time-out interval is exceeded, or the **LOOP UP** switch is pressed again (LED OFF). During loop code transmission, the loop code name appears in the SOURCE CONFIGURATION I and SOURCE CONFIGURATION II displays. In-band T1 and DDS loop-up codes overwrite the selected data pattern. ESF out-of-band loop codes are transmitted in the datalink channel and do not overwrite the test pattern.

LOOP DOWN switch — Controls the transmission of the selected loop-down code. When the switch is pressed (LED ON), the loop code is transmitted until the loop code is no longer detected, a pre-determined time-out interval is exceeded, or the **LOOP DOWN** switch is pressed again (LED OFF). During loop code transmission, the transmitted loop code name appears in the SOURCE CONFIGURATION I and SOURCE CONFIGURATION II displays. In-band T1 and DDS loop-down codes overwrite the selected data pattern. ESF out-of-band loop codes are transmitted in the datalink channel and do not overwrite the test pattern.

3.5.2 SIGNALING INSERT Switches [20]

The four **SIGNALING INSERT** switches control the logic state (one or zero) for each of the A, B, C, and D signaling bits transmitted in the selected insert channel. Pressing the **SIGNALING INSERT** switch illuminates the switch LED and causes a binary one to be inserted in the corresponding signaling bit position. Pressing the same signaling switch again extinguishes the LED and inserts a binary zero into the corresponding bit position. The following list describes the signaling bits associated with each operating mode.

- A and B signaling bits — T1 D1D, T1-D2, T1-D4, T1SLC96, and SLC-D1D
- A, B, C, and D signaling bits — T1-ESF and T1-ESFz
- Unavailable — SLC-M2

The **SIGNALING INSERT** switches are only applicable when the **CHANNEL FORMAT** switch is set to VF. They are disabled when the **INSERT (TX)** switch is set to NONE and when in the SLC-M2 mode.

In T1SLC96 and SLC-D1D modes, the T-BERD 224 provides three signaling insert states: *on*, *off*, and *toggling on* and *off*. If the **SIGNALING INSERT** switch is *off*, pressing it once for less than a second turns the switch *on*, sets the signaling bit to a logic one, and illuminates the LED continuously. Pressing and holding the switch in for more than a second places the signaling bit in the *toggling* state and illuminates the LED intermittently. In the *toggling* state, the signaling bit toggles between logic one and logic zero with every other superframe. Pressing the **SIGNALING INSERT** switch a second time inserts a logic zero into the signaling bit and extinguishes the LED. Modifying the selection of the **SIGNALING INSERT** switch does not affect the test in progress.

3.5.3 ERROR INSERT Switches [21]

The functions of the **ERROR INSERT** switches include the following list. The LED illuminates to indicate when errors are being inserted.

- Single BPV,logic, and/or frame error insertion
- Bursts of BPV and/or logic errors at specified lengths and insertion rates
- Continuous BPV, logic, and/or frame error insertion at specified insertion rates
- Consecutive frame error insertion
- Yellow Alarm insertion

The **ERROR INSERT** switches are disabled in the T1 LLB and AUTO LLB modes and when the **INSERT (TX)** switch is set to NONE. The **ERROR INSERT** switches perform the following functions:

BPV ERROR INSERT Switch — Inserts bipolar violations into the data stream of the selected T1 line. The BPV is inserted on any transmitted logic one bit, including the framing bits. The **BPV ERROR INSERT** switch performs the following functions:

Single BPV error insertion — If the AUX 13 ERR RT function is set to SINGLE, pressing the **BPV ERROR INSERT** switch for less than one second momentarily illuminates the LED and inserts a single BPV into the T1 data stream.

Burst of BPV errors — If the AUX 13 ERR RT function is set to BURST, pressing the **BPV ERROR INSERT** switch for less than one second momentarily illuminates the LED and inserts a single burst of BPVs into the T1 data stream. The burst length and insertion rate are set by the AU 13 ERR RT function.

Continuous BPV error insertion — Pressing the **BPV ERROR INSERT** for more than one second illuminates the LED and inserts continuous BPVs into the T1 data stream at the selected insertion rate. Pressing the **BPV ERROR INSERT** switch again disables the BPV error insertion (LED OFF). The error insertion rate is set by the AUX 13 ERR RT function.

LOGIC ERROR INSERT Switch — Inserts logic errors into the data stream of the selected T1 line. Logic errors are inserted on any transmitted bits of the selected test pattern. In framed operating modes with the FULL T1 channel format selected, unframed T1 errors are inserted on the entire bandwidth (data and framing bits). Frame synchronization is required at the T1 level before logic errors can be inserted. In DDS, errors are only inserted on the selected test bandwidth. The **LOGIC ERROR INSERT** switch performs the following functions:

Single logic error insertion — If the AUX 13 ERR RT function is set to SINGLE, pressing the **LOGIC ERROR INSERT** switch for less than one second flashes the LED on and inserts a single logic error into the selected test bandwidth.

Burst of logic errors — If the AUX 13 ERR RT function is set to BURST, pressing the **LOGIC ERROR INSERT** switch for less than one second flashes the LED on and inserts a single burst of logic errors into the selected test bandwidth. The burst length and insertion rate are set by the AUX 13 ERR RT function.

Continuous logic error insertion — Pressing the **LOGIC ERROR INSERT** switch for more than one second illuminates the LED and inserts continuous logic errors into the selected test bandwidth at the selected insertion rate. Pressing the **LOGIC ERROR INSERT** switch again disables the logic error insertion (LED OFF). The error insertion rate is set by the AUX 13 ERR RT function.

NOTE

Logic errors and BPVs are inserted without regard to B8ZS sequences. This may cause the same error multiplication (one inserted error causing multiple errors) that occurs on a repeater span.

FRAME ERROR INSERT Switch — Inserts frame errors on the transmitted framing bits in the data stream of the selected T1 line. The **FRAME ERROR INSERT** switch performs the following functions:

Single frame error insertion — If the AUX 14 FRM ERR function is set to SINGLE, pressing the **FRAME ERROR INSERT** switch for less than one second momentarily illuminates the LED and inserts a single frame error into the T1 signal framing bits.

Burst of consecutive frame errors — If the AUX 14 FRM ERR function is set for two to six CONSECutive frame errors, pressing the **FRAME ERROR INSERT** switch for less than one second momentarily illuminates the LED and inserts a single burst of consecutive frame errors into the T1 signal framing bits.

Continuous frame error insertion — Pressing the **FRAME ERROR INSERT** switch for more than one second illuminates the LED and inserts continuous frame errors into the T1 signal framing bits. Pressing the **FRAME ERROR INSERT** switch again disables the frame error insertion (LED OFF). The number of inserted frames errors is controlled by the AUX 14 FRM ERR function.

The **FRAME ERROR INSERT** switch is disabled when the **INSERT (TX)** switch is set to NONE. The **FRAME ERROR INSERT** switch requires frame synchronization.

YELLOW ALARM ERROR INSERT Switch — Inserts a continuous yellow alarm into the selected T1 line. The LED momentarily illuminates when the switch is pressed. Pressing this switch again disables the yellow alarm insertion (LED OFF). For D1D, D2, D4, and SLC-96 (Mode 1 and 2) framing, bit 2 of every DS0 is set to zero. For ESF framing, a repetitive pattern of eight ones and eight zeros is generated in the datalink. The **YELLOW ALARM ERROR INSERT** switch requires frame synchronization.

3.5.4 VOLUME Control [22]

The **VOLUME** control adjusts the audio level of the T-BERD 224 internal speaker. Sliding the switch to the right increases the volume. The speaker is used to listen to voice or tone on a dropped channel.

The T-BERD 224 provides an audible beep when: the n00 BIT ERR or n01 ASYN ES results are displayed and an errored second is detected; loss of pattern synchronization occurs; or the n04 BER result is displayed and the timed test interval is complete.

3.6 PRINTER CONTROLS

The T-BERD 224 can generate a manual or automatic printout that provides a hard copy of the test results and the test set configuration. The following switches and connectors are used to generate printouts (see Figure 3-7).

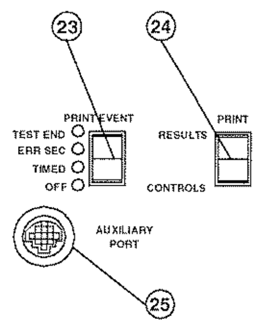


Figure 3-7. Printer Controls

3.6.1 PRINT EVENT Switch [23]

The **PRINT EVENT** switch selects the event that triggers an automatic results printout. All of the print event selections, except for OFF, print a status message if an alarm condition changes.

TEST END — If the **TEST** switch is set to timed, this selection generates a time- and date-stamped results printout at the end of a timed test. The AUX 03 TES LEN function sets the timed test length.

ERR SEC — Generates a time- and date-stamped results printout on the occurrence of aBPV, frame error, or CRC error. If the selected error is disabled in the AUX 35 CUSTOM function, a results print is not generated.

TIMED — Generates a time- and date-stamped results printout at the specified time interval. When TIMED is first selected, the message *SEE AUX 02 TO SET PRI EVENT TIME* is displayed in the right-most window. AUX 02 sets the time interval for the print event.

OFF — Prevents generation of automatic results printouts. This selection does not affect the **PRINT** switch operation.

3.6.2 PRINT Switch [24]

The **PRINT** switch initiates a results or controls printout. For more information regarding printer operation, refer to Section 6.

RESULTS — Pressing the switch up generates a date- and time-stamped printout of the current test results.

CONTROLS — Pressing the switch down generates a date- and time-stamped printout of the current test set configuration.

3.6.3 AUXILIARY PORT [25]

The AUXILIARY PORT 8-pin connector provides the serial data port that supplies power and signaling leads to the optional Lid Printer and Signaling Option Keypad Lid. It is connected in parallel to the RS-232 Printer/Controller Interface, allowing data to be directed to both the side panel (RS-232) and the front panel connector (AUX port). The T-BERD 224 polls the connectors to determine which one has a device connected to it before initiating a printout.

3.6.4 PRINTER/REMOTE RS-232 Connector

The PRINTER/REMOTE RS-232 connector is a 25-pin, female, D-type connector. It is configured as data communications equipment (DCE) to connect the to an external printer, terminal, modem, computer, or other asynchronous communications equipment. The AUX 08 RS 232 function sets up the interface.

NOTE

A DTE/DCE crossover cable may be required to operate the T-BERD 224 with a modem.

FRACTIONAL T1 OPTION

3.7 INTRODUCTION

The T-BERD 224 Fractional T1 Option offers the following features and capabilities:

- Test Fractional T1 circuits with over 20 different test patterns.
- Tests 64xN and 56xN Fractional T1 circuits.
- Transmits and responds to fixed and programmable Fractional T1 loop codes.
- Inserts single, burst, or continuous logic errors across Fractional T1 bandwidth.
- Measures round trip delay of any group of channels in the T1 circuit.
- Transmits an idle code (ALL ONES) in the selected bandwidth of the opposite line to prevent inadvertent loopbacks.
- Enables the T-BERD 224 to replace and emulate a Fractional T1 CSU.
- ***T1 BERT Option Required***

NOTE

Unless indicated, the capabilities of the mainframe and T1 BERT Option for the T-BERD 224 are applicable to the Fractional T1 Option.

3.8 TEST SETUP

The following test setup controls and indicators are affected by the Fractional T1 Option (see Table 3-3).

Table 3-3. Fractional T1 Option Switch Configurations

Switch	Configuration
MODE	AUTO, T1-D4, T1-ESF, T1 TLB, T1 LLB
CHANNEL FORMAT	56 x N, 64 x N
SCI	AUTO, ALL ONES, ALL ZEROS, USER, MIN/MAX, 2^23-1, 2^20-1, 2^15-1,2^15-1 INV, QRSS, 2 IN 8, 3 IN 24, 1:7, 63, 511, 2047, DDS1, DDS2, DDS3, DDS4
SCII	N = 1-24, NON CONTIG

3.8.1 CHANNEL FORMAT Switch

In addition to the mainframe channel format selections, the following is also available:

56xN or 64xN — Use when monitoring or testing Fractional T1 circuits. Drop and insert access is available to 1 to 7 bits (56xN) or 1 to 8 bits (64xN) of any combination of contiguous or non-contiguous DS0 channels. AUX 10 N-CONTG function is applicable.

3.8.2 SOURCE CONFIGURATION I Switch

The **SOURCE CONFIGURATION I** switch selections include all the FULL T1 selections except BRIDGTAP and MULTIPAT, which are only available in FULL T1. In addition, the Fractional T1 Option adds patterns 63, 511, 2047, DDS1, DDS2, DDS3, DDS4. No patterns are transmitted in the FT1 LLB mode, but logic results can be obtained if frame synchronization is achieved and the received pattern matches the selected test pattern.

3.8.2.1 Fractional T1 Option Patterns

63 — 63-Bit Pseudorandom Pattern — is used when testing 56 kb/s circuits with secondary channel to avoid the introduction of an all zeros network byte. The 63-bit (2^6-1) pseudorandom pattern generates a maximum of five sequential zeros and six sequential ones.

511 — 511-Bit Pseudorandom Pattern — is generally used to test DDS and other circuits operating below 9.6 kb/s. The 511-bit (2^9-1) pseudorandom pattern generates a maximum of eight sequential zeros and nine sequential ones.

2047 — 2047-Bit Pseudorandom Pattern — is generally used to test DDS and other circuits operating between 9.6 and 56 kb/s. The 2047-bit (2^{11}-1) pseudorandom pattern generates a maximum of 10 sequential zeros and 11 sequential ones.

DDS1 — DDS 1 Stress Pattern — is generally used to provide a minimum and maximum ones density which can stress the DDS circuit signal recovery capability. DDS1 is a repeating pattern of 100 octets of 1111 1111 and 100 octets of 0000 0000.

DDS2 — DDS 2 Stress Pattern— is generally used to provide a minimum ones density and to simulate bit-oriented protocol flags (e.g., HDLC) to ensure that the DDS circuit can pass the signal properly. DDS2 is a repeating pattern of 100 octets of 0111 1110 and 100 octets of 0000 0000.

DDS3 — DDS 3 Stress Pattern — is generally used to provide a medium ones density and simulates a typical signal transmitted over the DDS circuit. DDS3 is a continuous series of octets of 0100 1100.

DDS4 — DDS 4 Stress Pattern — is generally used to provide a low ones density. DDS4 is a continuous series of octets of 0100 0000.

3.8.2.2 Advanced Stress Pattern Option Patterns

NOTE

See Appendix D for the bit pattern sequence.

DDS5 — DDS 5 Stress Pattern — is a quick method to test circuits with the first four DDS stress patterns. DDS5 is not detected in the AUTO mode.

DDS6 — DDS 6 Stress Pattern — is useful in simulating a DDS signal transition from IDLE mode to DATA mode and aids in detecting marginal equipment in multi-point applications. DDS6 is a seven octet fixed pattern of 1111 1110 followed by one octet of 1111 1111.

3.8.3 SOURCE CONFIGURATION II Switch

When the **CHANNELFORMAT** switch is set to either 56 x N or 64 x N, the available **SOURCE CONFIGURATION II** switch selections are:

N = (1 - 24) —Select the number of contiguous DS0s to analyze as a single FT1 channel bandwidth. Use the **LINE 1** and **LINE 2 CHANNEL** switches to select the first channel of the FT1 bandwidth.

NOTE

DS0s may *wrap around* the frame bit. For example, if N=4 and CHANNEL = 23, then channels 23, 24, 1, and 2 are analyzed.

NON CONTIG — Analyze non-contiguous DS0 channels as a single non-contiguous FT1 bandwidth. Pressing the **AUX** switch automatically accesses the AUX 10 N-CONTG function. Enter the desired DS0 channel numbers for the non-contiguous FT1 channel bandwidth.

NOTE

The same number of channels must be selected for both lines, but the actual channels selected can be different. See Section 4 for more information on setting the AUX 10 N-CONTG function.

3.8.4 AUX Switch

The Fractional T1 Option adds the following auxiliary function:

- AUX 10 N-CONTG — Non-Contiguous Channel

Refer to Section 4 Auxiliary Functions, for a complete description of this auxiliary function.

DDS OPTION

3.9 INTRODUCTION

The T-BERD 224 DDS Option offers the following features and capabilities:

- Test DDS circuits with over 20 different test patterns.
- Measures round trip delay of any channel within the T1 circuit.
- Displays the received byte logic states of bits 1 through 8 of both dropped channels.
- Tests DS0A and DS0B formatted DDS circuits.
- Transmits alternating and latching DDS loop codes.
- Control MJU operations in the DDS network from a single T1 access point.
- Transmits an idle code (ALL ONES) in the selected channel(s) of the opposite line to prevent inadvertent loopbacks.

NOTE

Unless indicated, the capabilities of the mainframe and T1 BERT Option for the T-BERD 224 are applicable to the DDS Option.

3.10 TEST SETUP

The following test setup controls and indicators are affected by the DDS Option. Table 3-4 illustrates the additional configurations.

Table 3-4. DDS Option Switch Configurations

Switch	Configuration			
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, SLC-D1D, T1SLC96, T1 TLB, T1 LLB			
CHANNEL FORMAT	DS0A2.4 DS0A4.8 DS0A9.6 DS0A192 DSOB192 DS0A56 DS064	DS0B2.4	DS0B4.8	DS0B9.6
SCI	AUTO, ALL ONES, ALL ZEROS, USER, MIN/MAX, 2^23-1, 2^20-1, 2^15-1, 2^15-1 INV, QRSS, 2 IN 8, 3 IN 24, 1:7, 63, 511, 2047, DDS1, DDS2, DDS3, DDS4			
SCII		CHAN 1-20	CHAN 1-10	CHAN 1-5

3.10.1 CHANNELFORMAT Switch

In addition to the mainframe and T1 BERT Option channel format selections, the following are also available:

DS0A2.4, DS0A4.8, DS0A9.6 — Use when monitoring or testing DS0A-formatted DDS data at 2.4, 4.8, or 9.6 kb/s. The AUX 12 ERR CORand AUX 19 DDS CHN functions are applicable.

DS0A192 — Use when monitoring or testing DS0A-formatted DDS data at 19.2 kb/s. Data is inserted in bytes 2 and 3, while UMC codes are placed in bytes 1, 4, and 5. AUX 19 DDS CHN is applicable.

DS0B192 — Use when monitoring or testing Channel 1 of DS0B-formatted DDS data at 19.2 kb/s. Data is inserted in bytes 2 and 3, while bytes 1, 4, and 5 pass through unaffected. If no T1 signal is received, UMC codes are placed in bytes 1, 4, and 5. Subrate frame synchronization must be acquired before the T-BERD 224 can insert test data. AUX 19 DDS CHN is applicable.

DS0A56 — Use when monitoring or testing DS0A-formatted DDS data at 56 kb/s. AUX 19 DDS CH function is applicable.

DS064 — Use when monitoring or testing 64 kb/s DS0 data circuits.

DS0B2.4, DS0B4.8, DS0B9.6 — Use when monitoring or testing DS0B-formatted DDS data at 2.4, 4.8, or 9.6 kb/s. Use the **SOURCE CONFIGURATION II** switch to select one of 20 DS0B2.4, 10 DS0B4.8, or 5 DS0B9.6 channels to be analyzed. AUX 19 DDS CHN function is applicable. Subrate frame synchronization must be acquired before the T-BERD 224 can insert test data.

3.10.2 SOURCE CONFIGURATION I Switch

The additional **SOURCE CONFIGURATION I** switch selections are:

63 — 63-Bit Pseudorandom Pattern — is used when testing 56 kb/s circuits with secondary channel to avoid the introduction of an all zeros network byte. The 63-bit (2^6-1) pseudorandom pattern generates a maximum of five sequential zeros and six sequential ones.

511 — 511-Bit Pseudorandom Pattern — is generally used to test DDS and other circuits operating below 9.6 kb/s. The 511-bit (2^9-1) pseudorandom pattern generates a maximum of eight sequential zeros and nine sequential ones.

2047 — 2047-Bit Pseudorandom Pattern — is generally used to test DDS and other circuits operating between 9.6 and 56 kb/s. The 2047-bit (2^{11}-1) pseudorandom pattern generates a maximum of 10 sequential zeros and 11 sequential ones.

DDS1 — DDS 1 Stress Pattern — is generally used to provide a minimum and maximum ones density which can stress the DDS circuit signal recovery capability. DDS1 is a repeating pattern of 100 octets of 1111 1111 and 100 octets of 0000 0000.

DDS2 — DDS 2 Stress Pattern — is generally used to provide a minimum ones density and to simulate bit-oriented protocol flags (e.g., HDLC) to ensure that the DDS circuit can pass the signal properly. DDS2 is a repeating pattern of 100 octets of 0111 1110 and 100 octets of 0000 0000.

DDS3 — DDS 3 Stress Pattern — is generally used to provide a medium ones density and simulates a typical signal transmitted over the DDS circuit. DDS3 is a continuous series of octets of 0100 1100.

DDS4 — DDS 4 Stress Pattern — is generally used to provide a low ones density. DDS4 is a continuous series of octets of 0100 0000.

3.10.2.1 Advanced Stress Pattern Option

See Appendix D for the bit pattern.

DDS5 — DDS 5 Stress Pattern — is a quick method to test circuits with the first four DDS stress patterns. DDS5 is not detected in the AUTO mode.

DDS6 — DDS 6 Stress Pattern — is useful in simulating a DDS signal transition from IDLE mode to DATA mode and aids in detecting marginal equipment in multi-point applications. DDS6 is a seven octet fixed pattern of 1111 1110 followed by one octet of 1111 1111.

3.10.2.2 Additional SOURCE CONFIGURATION I Switch Selection

With the **CHANNELFORMAT** switch set to DS064, the additional **SOURCE CONFIGURATION I** switch selections are:

DS0 INTF (DS0 Interface) — Enables the side panel DS0 interface as the drop and insert source. A selected drop channel specified by the **DROP (RX)** and **CHANNEL** switch settings is output to the side panel connector. Data from the external KS-type test set is inserted into a selected channel. Data is transmitted using the bit and byte clocks output from the side panel connector.

DROP CHAN (Dropped Channel) — Provides a channel loopback and allows data from a channel which is dropped from one line to be inserted into a selected channel on the opposite line. The dropped channel is provided to the DS0 Interface. When DROP CHAN is selected and the **CHANNEL** switch for the dropped line is set to ALL, time slot 1 is dropped.

3.10.3 SOURCE CONFIGURATION II Switch

The **SOURCE CONFIGURATION II** switch augments the **SOURCE CONFIGURATION I** switch selections. The availability of **SOURCE CONFIGURATION II** switch selections depends on the **MODE, CHANNEL FORMAT**, and **SOURCE CONFIGURATION I** switches.

Modifying the **SOURCE CONFIGURATION II** switch selection causes a test restart.

When the **CHANNELFORMAT** switch is set to either DS0B2.4, DS0B4.8, or DS0B9.6 the available **SOURCE CONFIGURATION II** switch selections are:

CHAN = (1 - 5, 1 - 10, or 1 - 20) — Select one of the five 9.6 kb/s, ten 4.8 kb/s, or twenty 2.4 kb/s DD DS0B channels to analyze. The remaining 4, 9, or 19 DDS DS0B channels are unaffected.

3.10.4 AUX Switch

The DDS Option adds the following auxiliary functions:

- AUX 07 DSO TM — DS0 Interface Timing
- AUX 12 ERR COR — DS0A Error Correction
- AUX 19 DDS CHN — DDS Analysis Channel
- AUX 30 MJU — DDS MJU Control

Refer to Section 4 Auxiliary Functions, for a complete description of the auxiliary functions.

3.11 RESULTS VERIFICATION

The following results verification control is affected by the DDS Option.

3.11.1 RESTART Switch

Changing the AUX 07 DS0 TIM function causes a test restart when set to DS0 INTF.

3.12 TROUBLESHOOTING CONTROLS

The following troubleshooting controls are affected by the DDS Option.

3.12.1 LOOP CODES Switches

When configured for any DDS channel format, except DS0A192, transmission of the selected loop up or loop down code occurs over the selected bandwidth for that channel format. When configured for the DS0A192 channel format, transmission of the selected loop code follows the guidelines outlined in the industry standard, ANSI T1.107b-1991 (carries loop code in bytes 2 and 3 of the 5-byte subrate framing scheme, with byte 3 (bits 2 to 8) repeated in bytes 4 and 5, and byte 1 of the next subrate frame).

3.12.2 LOGIC ERROR INSERT Switch

- When testing DS0A channel formats, logic errors are only inserted in the DS0A bytes of the selected DS0A data rate.
- When testing DS0B channel formats, subrate frame synchronization is required before logic error can be inserted.

SLC OPTION

3.13 INTRODUCTION

The SLC Option is part of the ESF/SLC Option package.

NOTE

Unless indicated otherwise, the capabilities of the mainframe T-BERD 224 are applicable to the Enhanced ESF/SLC Option.

The SLC Option enables the T-BERD 224 to generate commands and report the status of the SLC datalink alarm, far-end loopback, maintenance test, and switch to protection line messages. The SLC Option sends and monitors the following:

SLC-96 (Mode 1 and 2) circuit alarms — Indicate varying system conditions that cause failures in signal quality, loss, or line backup capabilities. These alarms include major shelf, minor shelf, and power/miscellaneous.

SLC-96 (Mode 1) automated maintenance test procedures— Indicate the status of the circuit during test and the sequence of events that occur when a customer loop is connected to the bypass pair.

SLC-96 (Mode 1 and 2) switch to protection line function— Indicates which of the primary DS1 data lines has been switched over to the protection line.

SLC-96 (Mode 1 and 2) far-end shelf loopback — Indicates which DS1 line is looped back (A, B, C, D, or Protection). The far-end loop command automatically switches the selected shelf to the protection line if it is available.

SLC-96 (Mode 1 and 2) idle signal — Indicates the data line (transmit only) is not carrying information.

Tri-state SLC-96 A and B signaling bits — Indicate on-hook or off-hook ring conditions.

3.13.1 Functional Description

When configuring the T-BERD 224 to transmit and receive SLC-96 datalink signals, the T-BERD 224 automatically frames to either the received Network OfficeTerminating Equipment (NOTE) and WP1B Alarm Control Unit (ACU) 16-bit datalink alarm message format, or the WP1 ACU 13-bit datalink alarm message format. The NOTE alarm message format provides framing, major alarm, and A, B, C, and D shelf alarm indications. The WP1B and WP1 ACU alarm message formats provide framing, major alarm, minor alarm, power/miscellaneous alarm, A, B, C, and D shelf alarm, and A, B, C, D, and protection line far-end loop.

The T-BERD 224 automatically aligns to the format it receives. If no alarm message or NOTE is received, the T-BERD 224 defaults to transmit the WP1B ACU 16-bit datalink alarm message format.

The alarm messages are categorized as major, minor, and power/miscellaneous. Major alarms identify service-effecting system failures: signal loss, datalink failure, loss of frame synchronization, and power/miscellaneous alarms. Due to the severity of the alarm condition, the shelf where the alarm occurs is reported. Minor alarms identify non-service-effecting failures: protection line switching, far-end loops, and power/miscellaneous alarms. Power/miscellaneous alarms identify a power failure: open door, fan failure, high water, or similar condition at the remote terminal.

Channel signaling (on hook, off hook, and ring) can be generated and monitored when the T-BERD 224 is connected to a SLC shelf (Mode 1 only) and an individual channel is selected. The signaling bits (A, B, C, and D) can be manipulated individually with front-panel switches or the Signaling Option keypad.

3.14 TEST SETUP

The SLC portion of the Enhanced ESF/SLC Option affects the following test setup controls and indicators (see Table 3-5).

Table 3-5. SLC Option Switch Configurations

Switch	Configuration		
MODE	T1SLC96 and SLC-M2		
CHANNEL FORMAT	DATLINK		
SCI	F END LOOP	MAJOR ALRM and SW PROT	MINOR ALRM, POWER/MISC, IDLE, and MAINT
SCII	SHELF A SHELF B[1] SHELF C SHELF D[1] PROTECTION	SHELF A SHELF B[1] SHELF C SHELF D[1]	
[1]Only functional in T1SLC96 mode.			

3.14.1 CHANNELFORMAT Switch

In addition to the mainframe and T1 BERT Option channel formats, the following is also available:

DATLINK — Configures the T-BERD 224 to transmit information on the SLC-96 datalink. The **CHANNEL** switch display is set to "— —" when selecting the DATLINK channel format. The T-BERD 224 must be connected to the A shelf to perform this function.

3.14.2 SOURCE CONFIGURATION I and II Switches

The following **SOURCE CONFIGURATION I** switch selections are available when the DATLINK channel format and T1SLC96 or SLC-M2 operating mode are selected. The **SOURCE CONFIGURATION II** switch selects the type of shelf or protection line message transmitted by the T-BERD 224 over the datalink.

MAJOR ALR — Select the MAJOR ALRM source configuration to transmit a major alarm message. Press the **SOURCE CONFIGURATION II** switch to select SHELF A, B, C, or D for the message.

MINOR ALRM — Select the MINOR ALRM source configuration to transmit a minor alarm message to the far end.

POWER/MISC — Select the POWER/MISC source configuration to transmit a power/miscellaneous alarm message to the far end.

F END LOOP — Select the F END LOOP to transmit a far-end loop code. Press the **SOURCE CONFIGURATION II** switch to select either the A, B, C, or D shelf, or protection loopback code. When the **INSERT (TX)** switch is changed to LINE 1, the appropriate alarm bits are set on LINE 1 to request the selected shelf or protection line to loop the transmitter to the receiver. The alarm bits on LINE 2 are forced to indicate an idle condition (no loop or alarm). When the **INSERT (TX)** switch is changed to

LINE 2, the LINE 2 datalink alarm bits carry the loop or alarm request and the LINE 1 datalink alarm bits indicate an idle condition. No other datalink tests can be performed until the far-end loop is released.

SW PROT — Select SW PROT to switch the selected shelf to the protection line. Press the **SOURCE CONFIGURATION II** switch to select Shelf A, B, C, or D. If the switch to the protection line is successful, the message Ln SLC ALM (x) ON PROT appears in the SUMMARY category. If the switch to the protection line fails, *SW PROT FAILED* flashes on the display. If another line is already on the protection line when the command is sent, the T-BERD 224 flashes *SW PROT FAILED* and waits until the protection line is cleared to switch the selected shelf to the protection line.

MAINT — Emulates the central office equipment by sending the automated maintenance test sequence on Shelf A. The test sequence messages are displayed in the SOURCE CONFIGURATION II section of the display. Responses to the test sequence can be monitored in the SUMMARY category. Select the desired DS0 channel to be tested with the **CHANNEL** switch and set to the appropriate line with the **INSERT (TX)** switch . This capability is not available in the SLC-M2 mode.

IDLE — Sends the idle message on the datalink. Alarms are not indicated, shelves are not switched to the protection line, and the maintenance test does not continue.

Depending on the NOTE or ACU used at the far end, the T-BERD 224 will transmit the appropriate alarm message (see Table 3-6).

Table 3-6. NOTE and ACU Alarm

NOTE	WP1 ACU and WP1B ACU
Major Alarm	Major Alarm
A shelf Alarm	Minor Alarm
B shelf Alarm	Power/Misc. Alarm
C shelf Alarm	A shelf Alarm
D shelf Alarm	B shelf Alarm
	C shelf Alarm
	D shelf Alarm
	A Line Far-end Loop
	B Line Far-end Loop
	C Line Far-end Loop
	D Line Far-end Loop
	Protection Line Far-end Loop

3.15 RESULTS VERIFICATION

The following results verification switches and indicators are affected by the SLC Option.

3.15.1 RESULTS I and II Switches

The T-BERD 224 monitors and reports on the SLC-96 datalink maintenance, alarm, and protection line switch. The maintenance and alarm messages appear in the SUMMARY category as datalink Maintenance (M1 to M3), Alarm (A1 and A2), and Protection line switch (S1 to S4). The messages are removed from the SUMMARY category when frame synchronization is lost (Frame Sync LED on). For more information see Section 5.

NOTE

The DATLINK channel format does not need to be selected to monitor for SLC-96 datalink alarms and messages.

3.15.2 Local Status LEDs

Yellow alarms are reported through the Yellow Alarm LEDs. Only SLC systems operating in Mode III transmit yellow alarms.

3.16 TROUBLESHOOTING CONTROLS

The following troubleshooting controls are affected by the SLC Option.

3.16.1 A and B SIGNALING INSERT Switches

The SLC A and B signaling bits can be set to a logic one, logic zero, or toggled between logic one and zero by pressing the **A** and **B SIGNALING INSERT** switches while in the VF mode. The toggling state is only applicable in SLC-D1D and T1SLC96 modes. Press the **SIGNALING INSERT** switch for less than one second to set the signaling bit to a logic one (LED ON). Press the switch again to set the signaling bit to a logic zero (LED OFF). Press the switch for more than one second to toggle the signaling bit continuously (LED flashes). The signaling bits are toggled every other superframe. The received signaling bits are monitored through the SIGNAL category 55-TRAFFIC result (see Table 3-7).

Table 3-7. Signaling States for SLC-96 System Channel Units

Channel Unit Type	Customer State	Bits Sent To the LDS		Bits Sent To the RT		Channel State
		A	B	A	B	
Single Party	On-Hook	0	0	0	1	Channel Test
	Off-Hook	1	0	1	0	Fwd Disconnect
	Unequipped	1	1	1	1	Idle
	Unequipped			1	1/0	-R Ringing
Superimposed Ringing Multiparty	On-Hook	0	0	0	1	Channel Test
	Tip Party Gnd	0	1	1	0	Tip Party Test
	Off-Hook	1	0	1	1	Idle
	Unequipped	1	1	1	1/0	-R Ringing
	Unequipped			1/0	0	+T Ringing
	Unequipped			1/0	1	-T Ringing
	Unequipped			1/0	1/0	+R Ringing
Frequency Selective Ringing Multiparty	On-Hook	0	0	0	1	Channel Test
	Off-Hook	1	0	1	1	Idle
	Unequipped	1	1	1	1/0	Freq. Band 1Ring
	Unequipped			1/0	1/0	Freq. Band 2Ring
	Unequipped			1/0	1	Freq. Band 3Ring
	Unequipped			1/0	0	Freq. Band 4Ring

Table 3-7. Signaling States for SLC-96 System Channel Units (Continued)

Channel Unit Type	Customer State	Bits Sent To the LDS		Bits Sent To the RT		Channel State
		A	B	A	B	
Coin	On-Hook	0	0	0	0	- Loop Mode
	Coin Gnd	0	1	0	1	Channel Test
	Off-Hook	1	0	1	0	+ Loop Mode
	Unequipped	1	1	1	1	Ground Start
	Unequipped			0	1/0	+ Coin Check
	Unequipped			1	1/0	-R Ringing
	Unequipped			1/0	0	+ Coin Ctrl
	Unequipped			1/0	1	- Coin Ctrl
	Unequipped			1/0	1/0	- Coin Check
Universal Voice Grade	On-Hook	0	0	0	0	Ground Start
	Ring Ground	0	1	0	1	Channel Test
	Off-Hook	1	0	1	1/0	-R Ringing
	Unequipped	1	1	0	1/0	Idle
DID DPT	Normal	0	0	0	0	Loop Open
	Battery					
	Reverse	1	1	1	1	Loop Closure
	Battery					

ESF OPTION

3.17 INTRODUCTION

The ESF Option is part of the ESF/SLC Option package.

NOTE

Unless indicated otherwise, the capabilities of the mainframe T-BERD 224 are applicable to the Enhanced ESF/SLC Option.

The ESF Option enables the T-BERD 224 to report and send out the Performance Report Messages (PRMs) on the datalink. The ESF Option:

- Displays the ESF (4 kb/s) and ESFz (2 kb/s) datalink ANSI T1.403 PRMs.
- Enables the T-BERD 224 to transmit ESF datalink bit oriented protocol (BOP) command response messages.
- Enables the T-BERD 224 to transmit and respond to out-of-band datalink loop codes if the T1 BERT Option is installed.
- Enables the T-BERD 224 to bit error rate test the ESF datalink if the T1 BERT Option is installed.

3.17.1 Functional Description

When the T-BERD 224 is connected to the ESF datalink and the AUX 20 PRM TX function is set to AUTO for the PRM TRANS selection, the T1 signal and datalink PRM flow through the T-BERD 224. This process is illustrated in Figure 3-8 and explained in the following steps:

1. The T1 signal on LINE 1 RECEIVE is analyzed and retransmitted on LINE 1 TRANSMIT.
2. The T1 signal analysis is reported in the RESULTS display and in a PRM encoded into the datalink and inserted on LINE 2 TRANSMIT.
3. The datalink PRM on LINE 1 RECEIVE is decoded and the results are displayed in the BPV & FRAME category results. The PRM from LINE 1 RECEIVE is not the same as the PRM on LINE 2 TRANSMIT.

NOTE

When the AUX 20 PRM TX function is set to ON for the PRM TRANS selection, the received PRM from the far end and the PRM generated by the T-BERD 224 are transmitted out to the far end. When PRM TRANS is set to OFF, the T-BERD 224 receives, but does not generate PRMs.

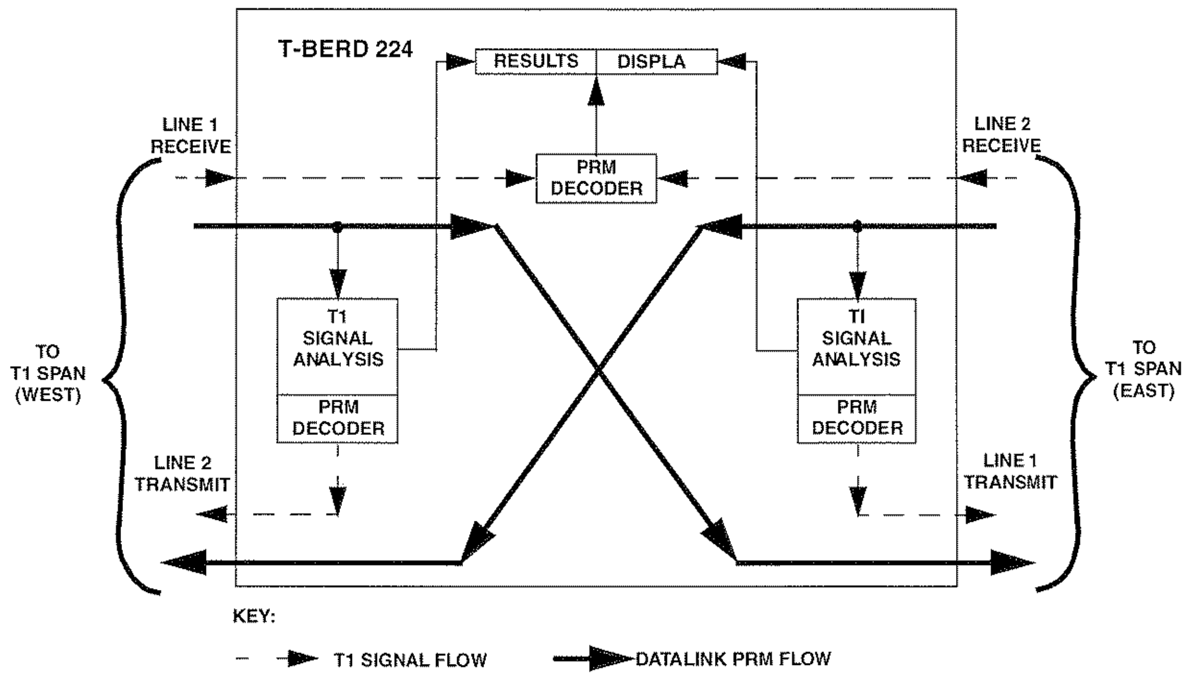


Figure 3-8. T1 and Datalink PRM Signal Flow

In the T1-LLB mode, the received datalink PRM and T1 channels are retransmitted as they are received. However, in the T1-TLB mode, the received datalink PRM is only reported in the BPV & FRAME category results and not retransmitted. The T-BERD 224 in turn analyzes the received T1 signal to determine what it has seen and transmits the appropriate PRM back to the source of the received signal.

3.18 TEST SETUP

The following test setup controls are affected by the ESF Option (see Figure 3-8).

Table 3-8. ESF Option Switch Configurations

Switch	Configuration
MODE	T1-ESF
CHANNEL FORMAT	DATALINK

3.18.1 MODE Switch

Select the T1-ESF operating mode to analyze the T1-ESF datalink.

3.18.2 CHANNELFORMAT Switch

In addition to the mainframe and T1 BERT Option channel formats, the following is also available:

DATLINK —To analyze the ESF datalink select any channel format except DATLINK. Selecting DATLINK enables the T-BERD 224 to insert on the 4 Kb/s datalink itself using any of the available source configurations.

3.19 TROUBLESHOOTING CONTROLS

3.19.1 YELLOW ALARM ERROR INSERT Switch

When the ESF mode is selected, the **YELLOW ALARM ERROR INSERT** switch sends the yellow alarm over the datalink. The yellow alarm is a priority message that overrides any messages already on the datalink.

SMART LOOPBACK/COMMAND CODES OPTION

3.20 INTRODUCTION

The T-BERD 224 Smart Loopback/Command Codes Option provides the following features and capabilities:

- Transmits intelligent network equipment loop codes to control intelligent network equipment.
- Sends maintenance switch commands to activate maintenance switch ramp and switch functions.
- Retrieves stored T1 circuit performance data from an NIU/Performance Monitor and clears the NIU/Performance Monitor memory, so that it is available to store new data.
- Sets the time and date on an NIU/Performance Monitor to match the time and date of the T-BERD 224.

NOTE

Unless indicated, the capabilities of the T-BERD 224 mainframe are applicable to the Smart Loopback/Command Codes Option.

3.21 TEST SETUP

The following controls and indicators are affected by the Smart Loopback/Command Codes Option.

3.21.1 MODE Switch

In addition to the mainframe mode selections, the following is also available with the Smart Loopback/Command Codes Option.

SMRTNIU — Smart NIU/Performance Monitor mode configures theT-BERD 224 to query the Performance Monitor portion of the Westell combined NIU/Performance Monitor equipment for the T1 span statistics it recorded. When this mode is enabled, all unrelated functions are disabled, framing is set to T1 ESF, format is set to FULL T1, and the transmitted pattern is set to 1:1. The SMRTNIU mode enables three functions; Query, Clear Results, and Set Clock.

3.21.2 CHANNELFORMAT Switch

When the SMRTNIU mode is enabled, the following **CHANNELFORMAT** switch selections are available:

RESULTS — Configures the Query function of the SMRTNIU mode, which queries, retrieves, and stores the performance monitor statistics. Only one complete set of performance monitor statistics can be stored at a time, so previously stored statistics are cleared by the next query.

SETUP — Activates the Set Clock function and the Clear Results function. The Set Clock function (SET CLOCK) is used to set the time and date of the NIU/Performance Monitor to match the T-BER 224 time and date according to the parameters set in the AUX 04TIM/DAY function. NIU/Performance Monitor time and date are maintained internally and recorded with each alarm and error message. The Clear Results function (CLEAR NIU) clears recorded statistics from the NIU/Performance Monitor, which is usually performed after the results are retrieved.

3.21.3 SOURCE CONFIGURATION Switches

When the SMRTNIU mode is enabled and the **CHANNELFORMAT** switch is set to SETUP, the following source configuration action is available.

SET CLOCK — The Set Clock function sets the NIU/Performance Monitor time and date to match the T-BERD 224 time and date (set in the AUX 04 TIM/DAY function). Pressing the **SOURCE CONFIGURATION I** switch initiates the set clock function. It should take approximately 30 seconds to complete the Set Clock function. During this time, the *SET CLOCK IN PROGRESS* message is displayed.

Upon completion, one of two messages appears for 5 seconds; *CLOCK SET* (Set Clock function was successful) or *SET CLOCKFAILED*. A failure could be the result of poor connections. Check the T1 circuit connections and try again.

SMRTNIU	**SET CLOCK**	**CLEAR NIU**
SETUP		**IN PROGRESS**

3.21.4 AUX Switch

The Smart Loopback/Command Codes Option adds intelligent network equipment loop codes to the AUX 17 LOOP CD function. Refer to Section 4, Auxiliary Functions, for a detailed description.

3.21.5 TEST Switch

In SMRTNIU mode, the **TEST** switch selection is forced to CONTinuous.

3.22 CIRCUIT CONNECTIONS

The following switches are affected by the Smart Loopback/Command Codes Option.

3.22.1 LINE 1 & 2 CHANNEL Switches

The **LINE 1** and **LINE 2 CHANNEL** switches are available in the **VF CHANNELFORMAT** and select the channel to be monitored or tested. The selected channel number is visible in one of the two seven-segment CHANNEL displays.

When the **CHANNELFORMAT** switch is set to FULL T1 or the **MODE** switch is set to SMRTNIU, the **CHANNEL** switch number is displayed as "— —".

3.23 RESULTS VERIFICATION

The following switches are affected by the Smart Loopback/Command Codes Option.

3.23.1 RESTART Switch

When in the SMRTNIU mode with the RESULTS position selected, pressing the **RESTART** switch activates the Query function, which retrieves the T1 span performance statistics from the NIU/Performance Monitor. The T-BERD 224 initially displays the following message.

QUERY IN PROGRESS/### OF nnn RECEIVED — Indicates the Query function is continuing and has retrieved a portion of the total messages stored in the NIU/Performance Monitor, where *###* is the number of messages retrieved and *nnn* is the number of messages stored in the NIU/Performance Monitor.

The T-BERD 224 retrieves the Performance Indication Ratio (PIR) statistics first. Once the PIR result is available, it is displayed in place of the *QUERY IN PROGRESS ...* message until the query is complete.

SMRTNIU	eee	PIR	fff	10 OF 793
RESULTS	sss	AZ/ZA	ttt	RECEIVED

The PIR displays represent the following:

AZ — Indicates the direction from the NIU to the Central Office.

ZA — Indicates the direction from the Central Office to the NIU.

eee — Indicates the percent of error-free seconds in the AZ direction.

fff — Indicates the percent of error-free seconds in the ZA direction.

sss — Indicates the percent of time that all status (alarm) bits were clear in the AZ direction.

ttt — Indicates the percent of time that all status (alarm) bits were clear in the ZA direction.

When the Query function stops, one of the following messages is displayed to indicate the results:

QUERY COMPLETE/ALL DATA OK — Indicates Query function is complete with no errors reported.

QUERY COMPLETE/ERRORS DETECTED — Indicates Query function is complete with one or more errors reported.

QUERY FAILURE/NO DATA AVAILABLE — Indicates the Query function failed with no data retrieved. Query failure was caused by loss of signal, loss of frame, excessive re-transmission of a message, time-out of a response to a query message, or loss of power.

QUERY FAILURE/PARTIAL DATA OK — Indicates the Query function failed with some messages retrieved. The retrieved data reported no errors. Query failure was caused by loss of signal, loss of frame, excessive re-transmission of a message, time-out of a response to a query message, or loss of power.

QUERY FAILURE/ERRORS DETECTED — Indicates the Query function failed with some messages retrieved. The retrieved data included error messages. Query failure was caused by loss of signal, loss of frame, excessive re-transmission of a message, time-out of a response to a query message, or loss of power.

3.23.2 RESULTS Switches

In the SMRTNIU mode, the **RESULTS I Blank**, **RESULTS II Blank**, and **RESULTS II Arrowed** switches are disabled.

In the SMRTNIU mode with the SETUP position selected, pressing the **RESULTS I Arrowed** switch activates the Clear Results function. The message *CLEAR NIU IN PROGRESS* is displayed in the RESULTS I window for approximately 5 seconds, which indicates the Clear Results function is activated. When the Clear Results function stops, one of the following messages is displayed to indicate the results.

CLEAR NIU FAILED — Indicates the Clear Results function failed to clear the NIU/Performance Monitor of all messages. This could be the result of poor connections. Check the T1 circuit connections and try again.

NIU CLEARED — Indicates all results are cleared from the NIU/Performance Monitor.

SMRTNIU	**SET CLOCK**	**CLEAR NIU**
SETUP		**IN PROGRESS**

3.23.3 DISPLAY HOLD Switch

In the SMRTNIU mode, the **DISPLAY HOLD** switch is disabled.

3.24 TROUBLESHOOTING CONTROLS

The following switches are affected by the Smart Loopback/Command Codes Option.

3.24.1 LOOP CODES Switches

When in the SMRTNIU mode, the **LOOP UP** and **LOOP DOWN** switches are disabled unless the AUX 17 LOOP CD function is set to WESTELL NIMS20 or WESTELL NIMS60 in the DS1MSRAMP selection.

3.24.2 SIGNALING INSERT Switches

When in the SMRTNIU mode, the four **SIGNALING INSERT** switches for each of the A, B, C, and D signaling bits are disabled.

3.24.3 ERROR INSERT Switches

When in the SMRTNIU mode, the **BPV**, **LOGIC**, **FRAME**, and **YELLOW ALARM ERROR INSERT** switches are disabled.

3.25 PRINTER CONTROLS

In the SMRTNIU mode, the **PRINT EVENT** switch is disabled.

With the Smart Loopback/Command Codes Option, press the **PRINT** switch to generate the SMART NIU RESULTS DATA printout (see Figure 3-9). A complete SMART NIU RESULTS DATA printout lists recorded results for the current hour (CURRENT HOUR), each of the previous 23 hours (HISTORY HOUR 1 through HISTORY HOUR 23), the current day (CURRENT DAY), and the previous week (HISTORY DAY 1 through HISTORY DAY 07) in the format shown.

```
SMART NIU RESULTS DATA COLLECTED AT
  13:14                05-15-95

Key for STAT reg.
---------------------------------------
1 = Loop Back
2 = Data Incomplete
3 = Loss of Signal
4 = Unused
5 = Power Loss
6 = AIS
7 = Yellow Alarm
8 = Out of Frame

AZ-PIR EFS: <=91     AZ-PIR STAT: <=92
ZA-PIR EFS: <=92     ZA-PIR STAT: <=92

CURRENT HOUR    13:00  05-15-95
AZ-CVL    :          13722     AZ-ESL     :        14
AZ-SESL   :              0     AZ-UASL    :         0
AZ-CVP    :          13722     AZ-ESP     :        14
AZ-SESP   :              0     AZ-UASP    :         0
AZ-PDVS   :              0     AZ-B9ZS    :         0
AZ-MSEC   :              0     AZ-STAT    :        21

ZA-CVL    :          35836     ZA-ESL     :        32
ZA-SESL   :             NA     ZA-UASL    :        NA
ZA-CVP    :          43560     ZA-ESP     :         0
ZA-SESP   :             NA     ZA-UASP    :        NA
ZA-PDVS   :             NA     ZA-B9ZS    :        NA
ZA-MSEC   :             NA     ZA-STAT    :        NA

HISTORY HOUR 01      12:00     05-15-95
AZ-CVL    :              0     AZ-ESL     :         6
AZ-SESL   :              0     AZ-UASL    :         0
•
•
•

HISTORY DAY 07             05-08-95
AZ-CVL    :           1234     AZ-ESL     :         3
AZ-SESL   :              0     AZ-UASL    :         0
```

Figure 3-9. Sample Smart NIU Results Printout

VF OPTION

3.26 INTRODUCTION

The T-BERD 224 VF Option provides the following features and capabilities:

- Measures Echo Return Loss (ERL) and Singing Return Loss (SRL-HI and SRL-LO).
- Measures C-message noise and C-notch noise for qualifying voice-grade communications.
- Measures 3 kHz flat noise and 3 kHz notch noise for qualifying analog data-grade circuits.
- Computes signal-to-noise ratio (S/N Ratio).
- Measures DC offset.
- Determines Peak-to-Average Ratio (PAR).
- Generates and transmits a VF frequency tone between 20 Hz and 3904 Hz (default frequency of 1004 Hz).
- Adjusts the VF frequency tone level from -40.0 dBm to +3.0 dBm (default level of -10.0 dBm).
- Provides a VF burst (VFBURST) to disable the echo canceller prior to a return loss measurement.
- Automatically sweeps a user-defined range of frequencies to analyze frequency response of an analog circuit.
- **DSP Board Required**

NOTE

Unless indicated the capabilities of the mainframe T-BERD 224 are applicable to the VF Option.

3.27 TEST SETUP

The following controls and indicators are affected by the VF Option (see Table 3-9).

Table 3-9. VF Option Switch Configuration

Switch	Configuration						
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, T1SLC96, SLC-D1D, SLC-M2, T1-TLB, T1-LLB						
CHANNEL FORMAT	VF or VF THRU						
SCI	FREQ	LEVEL SWEEP	ERL SRL-HI SRL-LO	PAR	2713 Hz	3-TONE SLP	1004Hz VF INTF DROP CHAN QUIET
SCII	20 Hz to 3904 Hz	-40.0 to +3.0 dBm	fixed at -10.0 dBm	-40.0 to -10.0 dBm	ON/OFF	404 Hz 1004 Hz 2804 Hz	

3.27.1 CHANNEL FORMAT Switch

In addition to the mainframe and T1 BERT Option format selections, the following is also available.

VF THRU (Voice Frequency Through Signaling) — Use when testing or monitoring voice circuit without disrupting the channel signaling states. This selection enables the internal speaker, VF channel measurements, and specific drop and insert source configurations. In this mode the **SIGNALING INSERT** switches are disabled.

3.27.2 SOURCE CONFIGURATION I and II Switches

The following source configuration selections are available with the VF Option. The selections for the **SOURCE CONFIGURATION II** switch depend upon the **SOURCE CONFIGURATION I** switch selection. No **SOURCE CONFIGURATION II** switch selections are available with the SRL-HI, SRL-LO, 1004 Hz, V INTF, DROPCHAN, or QUIET **SOURCE CONFIGURATION I** switch selections.

FREQ (Frequency) — Transmits a single tone at an output level set in the LEVEL source configuration. The frequency of the tone appears in the display. Press the **SOURCE CONFIGURATION II** switch to modify the frequency of the transmitted tone from 20 Hz to 3904 Hz.

LEVEL — Selects a transmit level for the tone generated by the FREQ source configuration. The output level of the tone appears in the display. Press the **SOURCE CONFIGURATION II** switch to modify the level of the transmitted frequency from -40.0 dBm to +3.0 dBm in 0.1 dBm increments.

SWEEP (Frequency Sweep) — Automatically steps through a user-selected range of frequencies. This test is used to analyze attenuation distortion and frequency response on a VF circuit. Once sweep is selected, the message *SEE AUX 21 TO SET SWEEP PARAMS* is displayed. Press the **SOURCE CONFIGURATION II** switch to modify the level of the transmitted frequencies from -40.0 dBm to +3.0 dBm. A Frequency Sweep printout is generated if selected in the AUX 23 PRT OPT function.

NOTE

Changing the level setting for the frequency sweep function changes the VF tone level setting and vice versa.

ERL (Echo Return Loss) — Transmits a band limited noise to measure return loss on VF circuits. The transmit level for return loss signals is fixed at -10.0 dBm. Once ERL is selected, the message *SEE AUX 22 TO SET BURST PARAMS* is displayed. If VF burst is ON, the previous parameters for burst frequency and burst level will be used to transmit a tone to disable any echo cancellers.

SRL-HI (Singing Return Loss High) — Transmits band limited noise to simulate high frequency voice-grade operation and measures the return loss. The level for return loss signals is fixed at -10.0 dBm. Once SRL-HI is selected, the message *SEE AUX 22 TO SET BURST PARAMS* is displayed. If VF burst is ON, the previous parameters for burst frequency and burst level will be used to transmit a tone to disable any echo cancellers.

SRL-LO (Singing Return Loss Low) — Transmits band limited noise to simulate low frequency voice-grade operation and measures return loss. The level for return loss signals is fixed at -10.0 dBm. Once SRL-LO is selected, the message *SEE AUX 22 TO SET BURST PARAMS* is displayed. If VF burst is ON, the previous parameters for burst frequency and burst level will be used to transmit a tone to disable any echo cancellers.

PAR (Peak To Average Ratio) — Transmits a complex waveform with a spectral content consisting of 16 non-harmonically related tones, with a known envelope shape that approximates a data signal. This test measures the combined effects of envelope delay, amplitude distortion, and return loss on a VF circuit. Press the **SOURCE CONFIGURATION II** switch to modify the level of the transmitted frequency from -40.0 dBm to -10.0 dBm. The default level is -13.0 dBm.

1004 Hz — Allows the insertion of a digitally-encoded 1004 Hz, 0 dBm, sine wave that is suitable for VF testing.

VF INTF (VF Interface) — Enables the side panel 2- or 4-wire VF interface as the drop and insert source. A selected drop channel is decoded and output to the side panel connector. Tones from the external VF signal source are inserted into the selected channel.

DROP CHAN (Dropped Channel) — Provides a channel loopback, and allows data from a channel which is dropped from one line to be re-inserted into a selected channel. The dropped channel is provided to the side panel 2-wire and 4-wire VF interfaces. When DROP CHAN is selected and the **CHANNEL** switch for the dropped line is set to ALL, time slot 1 is dropped.

3-TONE SLP (3-Tone Slope) — Transmits one of three frequencies at an output level set in the LEVEL source configuration. This test obtains a quick measure of the channel amplitude distortion. Press the **SOURCE CONFIGURATION II** switch to select the transmitted frequency (404 Hz, 1004 Hz, or 2804 Hz).

2713 — Transmits a 2713 Hz tone at an output level set in the LEVEL source configuration. This test loops the analog loopback (829) devices on 4-wire VF circuits. Press the **SOURCE CONFIGURATION II** switch to turn this feature ON or OFF.

QUIET — Transmits an idle code. This position is used to measure absolute noise levels on the VF circuit.

3.27.3 AUX Switch

The following additional auxiliary functions are available with the VF option:

- AUX 21 SWEEP — Sweep Parameters
- AUX 22 VFBURST — VF Burst Parameters
- AUX 23 PRT OPT — Print Option

Refer to Section 4 for descriptions of the auxiliary functions.

SIGNALING OPTION

3.28 INTRODUCTION

The T-BERD 224 Signaling Option works in conjunction with the VF Option. The Signaling Option provides the following features and capabilities:

- Send complex sequences of DialTone Multifrequency (DTMF), Multifrequency (MF), or Dial Pulse (DP) digits to switches/PBXs to test the switching equipment ability to handle incoming calls.
- Receive digits from a switch/PBX and send supervision events to test voice services on a PBX.
- Monitor call detail on any DS0 channel and automatically detect digit type (DTMF, MF, or DP).
- Dial-up and BERT (DDS Option required) Switched 56 circuits from either the customer premise or central office.
- Automatically scan signaling activity on any of the 24 channels of a T1 circuit and monitor traffic on selected channels. Once a channel is seized, all digit/supervision events are recorded for that channel.
- **DSP Board Required**

The Digit Analysis Option adds the following digit analysis capabilities to the Signaling Option.

- Measure DTMF and MF tone frequencies and levels (high and low tones and levels) for each individual number that is captured.
- Measure interdigit timing (delay and duration).
- Measure dial tone delay, duration, frequency, and level.

NOTE

Unless indicated, the capabilities of the T-BERD 224 mainframe are applicable to the Signaling Option.

3.28.1 Functional Description

Signaling is the term used to describe the addressing, control, and supervisory functions necessary for a call to be connected through a switching network. These functions include call initiation, address information for call routing, call supervision, and termination. They can be divided into the following categories:

Supervisory signals — Initiate a request for service, hold a connection, or terminate a connection.

Address signals — Provide information on the call origination and destination. These signals are identified as either DTMF, MF, or DP

Call progress tone — Provide information to the calling party about the progress of the call. The information is provided with tones such as dial tone and busy tone.

Alerting signals — Inform the caller and the called party that there is an incoming call.

Control signals — Provide additional information such as party identification.

The Signaling Option includes a Keypad Lid. The Signaling Keypad Lid is used to edit dial and receive signaling sequences and to analyze test result sequences.

3.29 TEST SETUP

The following controls and indicators are affected by the Signaling Option.

3.29.1 CHANNELFORMAT Switch

In addition to the mainframe, T1 BERT Option, and VF Option channel format selections, the following are also available with the Signaling Option.

SIGNLNG (Signaling) — Configures the T-BERD 224 to send, monitor, and receive digit sequences.

SWI-56 (Switched 56) — Configures the T-BERD 224 to send or receive digits and then transmit BERT patterns (requires DDS Option) on the selected timeslot.

3.29.2 SOURCE CONFIGURATION Switches

The following source configuration selections are available with the Signaling Option. The **SOURCE CONFIGURATION I** switch selections depend upon the **CHANNEL FORMAT** switch selection. The **SOURCE CONFIGURATION II** switch selections depend upon the **SOURCE CONFIGURATION I** switch selection (see Table 3-10).

Table 3-10. Signaling Option Switch Configuration

Switch/Aux Function	Configuration					
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, SLC-D1D, T1SLC96, SLC-M2, T1 TLB, T1 LLB					
CHANNEL FORMAT	SIGNLNG				SWI-56	
SCI	REC SEQ	DIAL SEQ	MONITOR	SCAN	REC SEQ	DIAL SEQ
SCII	SEQ 1 - 10	SEQ 1 - 10 MAN DTMF MAN DP MAN MF	ORG = L1 ORG = L2	ORG = L1 ORG = L2 AUTO	SEQ 1 - 10	SEQ 1 - 10 MAN DTMF MAN DP MAN MF

3.29.2.1 SIGNLNG - Signaling Channel Format

The **CHANNELFORMAT** switch configures the T-BERD 224 to send, monitor, and receive digit sequences as follows:

REC SEQ — Configures the T-BERD 224 to receive digit sequences and send supervision events. The **SOURCE CONFIGURATION II** switch determines which digit sequence is expected and what supervision events are transmitted.

SEQ 1 - 10 — Select one of ten pre-defined signaling sequences, which are programmed in the AUX 27 REC SEQ function. The AUX 24 TRK DEF function defines the trunk type of the receive sequence. The sequence defines the number of digits, the type of digits, the originating supervision events, and the terminating supervision events.

The **DROP (RX)** and **CHANNEL** switches select the source of the received digits. The **INSERT (TX)** and **CHANNEL** switches select the destination of the supervision events transmitted. After a complete sequence is received, the VF interface is enabled to provide a talk path with a butt set connected to the 4-wire interface on the side of the T-BERD 224. The **RESTART** switch clears the display, transmits an ON HOOK for two seconds to clear the line, and prepares the T-BERD 224 to receive a new sequence.

DIAL SEQ — Select one of the ten pre-defined signaling sequences, or manually send originating supervision events and digit sequences and receive terminating supervision events. The **SOURCE CONFIGURATION II** switch determines the sequence transmitted.

SEQ 1 - 10 — Select one of ten pre-defined digit sequences. The AUX 24 TRK DEF function defines the trunk type. The sequences are programmed in the AUX 26 DIAL SEQ function. Up to 80 digits/supervision events may be programmed in a sequence. The digit sequence is transmitted by pressing the **RESTART** switch.

MAN DTMF - Manual Dual Tone Multi-Frequency — The T-BERD 224 transmits DTMF digits from the signaling keypad. These digits simulate dialing from a touch tone telephone and are generally used in signaling between the telephone and the central office.

MAN DP - Manual Dial Pulse — The T-BERD 224 transmits DP digits from the signaling keypad. These digits simulate dialing from a rotary telephone.

MAN MF - Manual Multifrequency — The T-BERD 224 transmits MF digits from the signaling keypad. These digits are normally used to signal between central office switches. When MF digits are configured in the dial sequence, they must be preceded by a Key Pulse (KP) and terminated with a Start Signal (ST) or Start Signal Prompt (STP,ST2P,ST3P).

MONITOR — Configures the T-BERD 224 to receive both digit sequences and supervision events. The T-BERD 224 automatically distinguishes between DTMF, MF, and DP digit types. When the **SOURCE CONFIGURATION I** switch is set to MONITOR, the **DROP (RX)** switch is automatically set to BOTH and the **INSERT (TX)** switch is set to NONE. The T-BERD 224 monitors the originating side for digit and originating supervision events, and monitors the terminating side for terminating supervision events. The **SOURCE CONFIGURATION II** switch selects the originating line.

ORG = L1 — Configures the T-BERD 224 to monitor LINE 1 for digits and originating supervision events, and monitor LINE 2 for terminating supervision events.

ORG = L2 — Configures the T-BERD 224 to monitor LINE 2 for digits and originating supervision events, and monitor LINE 1 for terminating supervision events.

NOTE

For loop start or ground start trunks, the originating line is interpreted as the station or office selected in the AUX 24 TRK DEF function. Supervision events are mapped into particular AB(CD) signaling bit status in this auxiliary category.

SCAN — Configures the T-BERD 224 to scan both lines on selected channels (1 to 24) for channel seizure. The **DROP (RX)** switch is automatically set to BOTH, the **INSERT (TX)** switch is set to NONE, and the Channel Number display reads "— —" when scan is selected. A channel is seized on an ON HOOK to OFF HOOK transition or ringing on one line. Once the channel is seized, the seized channel number is displayed and the T-BERD 224 monitors both lines for all signaling transitions and digits. When both lines return to the ON HOOK state or a time-out occurs, the T-BERD 224 resumes scanning the selected channels for channel seizure. The AUX 29 SCANSET function selects the time-outs and the desired channels to be scanned for signaling activity. Scanning is also resumed by pressing the **RESTART** switch. The **SOURCE CONFIGURATION II** switch selects the originating line.

ORG = L1 — Configures the T-BERD 224 to monitor LINE 1 for an ON HOOK to OFF HOOK transition and for digits. LINE 2 is monitored for supervision events only.

ORG = L2 — Configures the T-BERD 224 to monitor LINE 2 for an ON HOOK to OFF HOOK transition and digits. LINE 1 is monitored for supervision events only.

NOTE

For loop start or ground start select the station or office to originate the call in the AUX 24 TRK DEF function. Exit the auxiliary functions and select the appropriate originating line to monitor the call.

AUTO — The line which first goes OFF HOOK becomes the originating line and is monitored for digits. Auto mode is only valid when the AUX 24 TRK DEF function is set to STD (E&M) or DEFINED for the trunk type.

VF INTF — Establishes a talk path to verify the continuity in the channel. After a sequence is completely sent or received, theT-BERD 224 automatically switches the drop and insert source to the VF Interfaces. VF INTF provides the same functionality applicable in DIALSEQ and REC SEQ.

VF Testing Source Configurations — When the **CHANNEL FORMAT** switch is set to SIGNLNG the VF source configurations are available to test the dialed line.

3.29.2.2 SWI-56 - Switched 56 Channel Format

REC SEQ — Configures the T-BERD 224 to receive digit sequences and send supervision events. The **SOURCE CONFIGURATION II** switch determines which digit sequence is expected and what supervision events are transmitted.

SEQ 1 - 10 — Select one of ten pre-defined signaling sequences programmed in the AUX 27 REC SEQ function. The AUX 24 TRK DEF function defines the trunk type of the receive sequence. The sequence defines the number of digits, the type of digits to be received, the originating supervision events to be received, and the terminating supervision events to be transmitted.

The **DROP (RX)** and **CHANNEL** switches select the source of the received digits. The **INSERT (TX)** and **CHANNEL** switches select the destination of the supervision events transmitted. After a complete sequence is received, the VF interface is enabled to provide a talk path with a butt set connected to the 4-wire interface on the side of the T-BERD 224. The **RESTART** switch clears the display, transmits an ON HOOK for two seconds to clear the line, and preparesthe T-BERD 224 to receive a new sequence.

DIAL SEQ — Selects one of the ten pre-defined signaling sequences or manually send originating supervision events and digit sequences, and receive terminating supervision events. The **SOURCE CONFIGURATION II** switch determines the sequence transmitted.

SEQ 1 - 10 — Select one of ten pre-defined digit sequences. The AUX 24 TRK DEF function defines the trunk type. The sequences are programmed in the AUX 26 DIAL SEQ function. Up to 80 digits/supervision events may be programmed in a sequence. The digit sequence is transmitted by pressing the **RESTART** switch.

MAN DTMF - Manual Dual Tone Multi-Frequency — The T-BERD 224 transmits DTMF digits from the signaling keypad. These digits simulate dialing from a touch tone telephone and are generally used in signaling between the telephone and the central office.

MAN DP - Manual Dial Pulse — The T-BERD 224 transmits DP digits from the signaling keypad. These digits simulate dialing from a rotary telephone.

MAN MF - Manual Multifrequency — The T-BERD 224 transmits MF digits from the signaling keypad. These digits are normally used to signal between central office switches. When MF digits are configured in the dial sequence, they must be preceded by a Key Pulse (KP) and terminated with a Start Signal (ST) or Start Signal Prompt (STP,ST2P,ST3P).

BERT Patterns — When the DDS Option is installed and the **CHANNELFORMAT** switch is set to SWI-56, a BERT pattern may be selected after a call is established. The transmit signaling state maintains the call.

NOTE

Set AUX 22 VF BURST function to ON to disable any echo suppressors present.

3.29.3 TEST Switch

When the **SOURCE CONFIGURATION I** switch is set to DIAL SEQ, REC SEQ, MONITOR, or SCAN the **TEST** switch is forced to the CONT. position.

3.29.4 AUX Switch

The following auxiliary functions are added with the Signaling Option. The auxiliary functions are only available when the **CHANNEL FORMAT** switch is set to either SIGNLNG or SWI-56. The Signaling Keypad Lid is required to configure the auxiliary functions. Refer to Section 4, Auxiliary Functions, for descriptions of the auxiliary functions.

- AUX 24 TRK DEF — Trunk Defined
- AUX 25 DIG MAR — Digits Margining
- AUX 26 DIAL SEQ — Dial Sequence
- AUX 27 REC SEQ — Receive Sequence
- AUX 28 SPV DEF — Supervision Definitions
- AUX 29 SCANSET — Channel Signaling Scan Setting

3.29.5 Signaling Keypad

The Signaling Option includes an attachable Keypad. The Keypad is used to edit signaling sequences, to manually dial, and then to analyze test result sequence (see Figure 3-10).

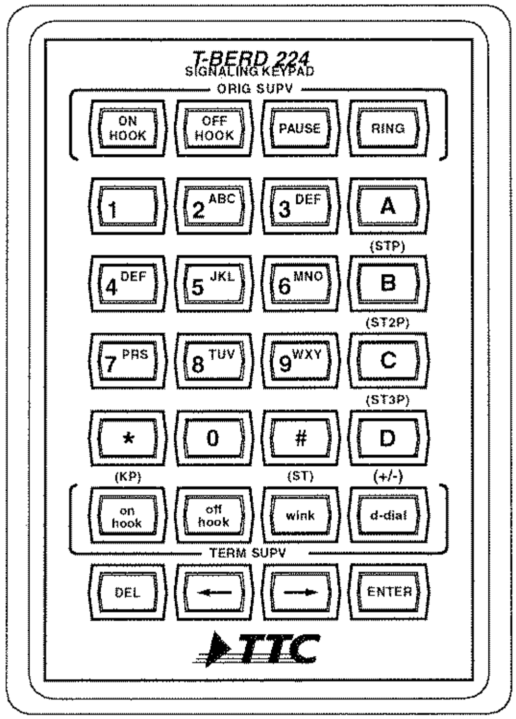


Figure 3-10. Signaling Keypad

3.29.5.1 TERM SUPV

The Terminating Supervision events are sent by the device receiving a call. Lowercase letters signify terminating supervision events.

wink (w) — A temporary OFF HOOK (approximately 200 ms) sent in response to the originating end. This indicates that the terminating end is ready to receive digits.

d-dial (d) - Delay-dial — This supervision event is very similar to a wink. If d-dial and wink are specifically programmed to different parameters in the AUX 28 SPV DEF function, the T-BERD 224 can distinguish between the two events. The d-dial event is sent as soon as the terminating switch goes fro on-hook to off-hook, while the wink waits for a few milliseconds before sending the digits.

on hook (o) — Indicates that the equipment is releasing the line.

off hook (h) — Response to the originating equipment seizing the line or answering a call.

dial tone (t) — An event generated by the PBX indicating the PBX is ready to receive digits.

3.29.5.2 ORIG SUPV

The Originating Supervision events are sent by the device initiating a call. Capital letters signify the originating supervision events.

MARGINAL DIGIT (M) — Identifies an event similar to a recognized frequency, but it cannot be specifically determined.

ON HOOK (O) — Indicates that the equipment is releasing the line.

OFF HOOK (H) — Indicates that the equipment is seizing the line.

PAUSE (P) — A one second wait before the next event is sent. Single or multiple pauses can be input.

RING (R) — A signal sent from the central office to the station telling the station to ring the telephone.

GROUND ON RING (G) — A signal sent from the PBX to the far-end channel back, which is translated by the switch into signaling bits.

3.29.5.3 Keypad

The keypad is grouped as a telephone keypad except for the A, B, C, and D keys.

0 - 9 # * — These digits are available in all address types.

A B C D — These characters are only available in the DTMF address type.

KP ST STP ST2P ST3P — These characters are only available in the MF address type.

3.29.5.4 Cursor

Digits and supervision events entered on the keypad are inserted into the sequence at the cursor position. The sequence to the right of the cursor shifts to the right as new digits and events are entered.

DEL — Press this key to remove an event or digit at the cursor position and cause the sequence to the right of the cursor to shift left.

Arrow Keys — Press the right and left arrow switches on the keypad to scroll through the received sequence using the cursor. When the cursor is under the desired event, the **RESULTS II Arrowed** switch is used to view the desired result.

3.29.5.5 Enter

Press this key to save the entire sequence regardless of the cursor position.

3.30 CIRCUIT CONNECTIONS

The following circuit connections controls are affected by the Signaling Option.

3.30.1 DROP (RX) Switch

When the T-BERD 224 is configured to MONITOR or SCAN the **DROP (RX)** switch is set to BOTH.

3.30.2 INSERT (TX) Switch

When the T-BERD 224 is configured to MONITOR or SCAN the **INSERT (TX)** switch is set to NONE.

3.30.3 CHANNEL Switches

When the T-BERD 224 is configured to SCAN the **CHANNEL** switch number is displayed as"— —". The T-BERD 224 controls the channel selection. After a channel is seized, the channel number is displayed. The channel number is always the same for LINE 1 and LINE 2.

3.31 RESULTS VERIFICATION

The Signaling Option adds five results to the CHANNEL category:nl00 DELAY, n101 DUR, n102 ADDR, n104FQ/LVL, and n105FQ/LVL. The n104FQ/LVL and nl05FQ/LVL results are only available with the Digit Analysis Option.

The results require the entire display window. To exit the result display, the corresponding **RESULTS Blank** or **Arrowed** switch must be pressed.

Example: DIAL SEQ

H w 3531550h			**1100DUR**
DIAL	**SEQ 1**	**STD (E&M)1**	**50 ms**

The top line of the Results display shows the transmitted digit sequence. The sequence number is displayed in the bottom of window two. The rightmost window displays results and their measured values. The result selected may be changed by pressing the **RESULTS II Arrowed** switch.

Press the Signaling Keypad arrow keys to cause the cursor to appear and move left or right. The cursor indicates the event to be analyzed. Only received supervision events (small letters) may be analyzed. If the sequence has not been sent or is in the process of being sent, the display beneath the result will read UNAVAIL. When the sequence is complete, the RESULTS windows displays the result of the last received supervisory command. If an expected supervision event is not received, the channel result displays an error message.

Press the **SOURCE CONFIGURATION II** switch to send a different digit sequence or manually enter the digits without exiting the result display.

Press the **RESTART** switch or toggle from ON HOOK back to OFF HOOK to clear the selected results and prepare the T-BERD 224 to re-send digits.

3.32 TROUBLESHOOTING CONTROLS

The following troubleshooting controls are affected by the Signaling Option.

3.32.1 LOOP CODES Switches

The **LOOP UP** and **LOOP DOWN** switches are only available when the **CHANNEL FORMAT** switch is set to SWI-56 and the **SOURCE CONFIGURATION I** switch is set to a BERT pattern.

3.32.2 SIGNALING INSERT Switches

The **SIGNALING INSERT** switches are disabled but provide a visual indication of the signaling bits transmitted by the Dial Sequence and the Receive Sequence. The internal switch LED illuminates when a binary one is transmitted and is extinguished when a binary zero is sent.

3.32.3 ERROR INSERT Switches

When the **CHANNELFORMAT** switch is set to SWI-56 and the DDS Option is installed, all of the **ERROR INSERT** switches are available. When the **CHANNELFORMAT** switch is set to SIGNLNG only the **BPV**, **FRAME**, and **YELLOW ERROR INSERT** switches are available.

3.32.4 VOLUME Control

When the T-BERD 224 is configured to SCAN for a channel, the speaker is muted until the channel is seized.

3.33 PRINTER CONTROLS

With the Signaling Option, four new results printouts are available: DIAL SEQ, REC SEQ, MONITOR, and SCAN. See Section 6 for an explanation of the printouts.

A results printout is generated automatically when the **PRINT EVENT** switch is set to any setting except OFF. A MONITOR and SCAN results printout is generated when both lines have returned to the ON HOOK state. DIAL SEQ and REC SEQ printouts are generated when the sequence has completed.

CALLER ID OPTION

3.34 INTRODUCTION

The T-BERD 224 Caller ID Option provides the following features and capabilities:

- Monitors a channel for Caller ID activity.
- Decodes and displays Caller ID Frequency Shift Key (FSK) information, including Caller ID name and/or number.
- Scans for signaling activity on pre-selected channels of a T1 circuit or on all 24 channels and locks onto the first channel that exhibits ringing activity. Once a channel is seized, all Caller ID data is decoded for that channel.
- Emulates the Caller ID activation and deactivation codes sent by Customer Premises Equipment (CPE).

NOTE

Unless indicated, the capabilities of the T-BERD 224 mainframe are applicable to the Caller ID Option.

3.35 TEST SETUP

The following controls and indicators are affected by the Caller ID Option.

3.35.1 MODE Switch

When CALL ID is the channel format selection, the mode selections are limited to: AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, SLC-D1D, and T1SLC96.

3.35.2 CHANNELFORMAT Switch

In addition to the mainframe channel format selections, the following is also available.

CALL ID — Configures the T-BERD 224 to either:

- Monitor the FSK Caller ID messages.
- Scan a selected channel for the Caller ID name and number.
- Emulate a CPE (Caller ID unit in the on-hook state).

3.35.3 SOURCE CONFIGURATION Switches

The following source configuration selections are available. The **SOURCE CONFIGURATION I** switch selections depend upon the **CHANNELFORMAT** switch selection. The **SOURCE CONFIGURATION II** switch selections depend upon the **SOURCE CONFIGURATION I** switch selection (see Table 3-11).

Table 3-11. Caller ID Option Switch Configuration

Switch	Configuration		
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, SLC-D1D, T1SLC96		
CHANNEL FORMAT	CALL ID		
SCI	CID MON	CID SCA	CPE EMUL
SCII	SWI=L1 SWI=L2	SWI=L1 SWI=L2	DTMF ACT DTMF DEACT DP ACT DP DEACT

CID MON — Configures the T-BERD 224 to decode and display the FSK Caller ID data that is sent from the SPCS to the CPE during the silent interval between the first and second ringing cycle on a known T1 channel.

SWI=L1, SWI=L2 — Use the **SOURCE CONFIGURATION II** switch to select the line coming from the switch (SWI=L1 or SWI=L2). The selection depends upon the test connections.

When the **SOURCE CONFIGURATION I** switch is set to CID MON, the **DROP (RX)** switch is automatically set to BOTH, and the **INSERT (TX)** switch is set to NONE. The **CHANNEL** switches must be set to the correct channels to monitor. The **RECEIVE INPUT** switches must be set to DSX MON. The AUX 31 CALLID auxiliary function must be set to the signaling format of the circuit equipment being monitored (SLC or FX).

CID SCAN — Configures the T-BERD 224 to scan the pre-selected channels (see AUX 29 SCANSET function) of the T1 line from the switch and decodes the FSK Caller ID data on the first channel that exhibits ringing activity. After locating a channel with ringing activity, the T-BERD 224 locks onto that channel and functions the same as in CID MON. While scanning the channel(s) selected, the display shows two dashes in place of the channel until it locks onto a channel with activity. Then, the channel number appears.

A time-out period can be set using the AUX 29 SCANSET function, so the T-BERD 224 resumes scanning after monitoring the active channel for the time-out period.

SWI=L1, SWI=L2 — The **SOURCE CONFIGURATION II** switch selects the line coming from the switch (SWI=L1 or SWI=L2). The selection depends upon the test connections.

When the **SOURCE CONFIGURATION I** switch is set to CID SCAN, the **DROP (RX)** switch is automatically set to BOTH, and the **INSERT (TX)** switch is set to NONE. The **CHANNEL** switch displays change to "— —" while scanning. The **RECEIVE INPUT** switches must be set to DSX MON. The AUX 31 CALLID auxiliary function must be set to the signaling format of the circuit equipment being scanned (SLC or FX).

CPE EMUL — Configures the T-BERD 224 to emulate Customer Premises Equipment (CPE). The CPE Emulation enables the T-BERD 224 to transmit a user-selected Caller ID activation or deactivation code to the switch using DP or DTMF digits in the stored sequences or by using the keypad on the Keypad Lid (if Signaling Option installed) for manual dialing.

DTMF ACT or DTMF DEACT — The **SOURCE CONFIGURATION II** switch selects the appropriate stored sequence of DTMF digits for the activation code (*65) or the deactivation code (*85).

DP ACT or DP DEACT — The **SOURCE CONFIGURATION II** switch selects the appropriate stored sequence of DP digits for the activation code (1165) or the deactivation code (1185).

When the **SOURCE CONFIGURATION I** switch is set to CPE EMUL, the **INSERT (TX)** switch must be set to the line that is connected to the IN jack on the DSX-1 patch panel (towards the switch). The **CHANNEL** switches must be set to the correct channel to emulate. The **RECEIVE INPUT** switches must be set to DSX MON. The AUX 31 CALLID auxiliary function must be set to the signaling format of the circuit equipment being emulated (SLC or FX).

3.35.4 AUX Switch

The following auxiliary functions are added or affected by the Caller ID Option. The AUX 31 CALLID auxiliary function is only available when the **CHANNELFORMAT** switch is set to CALL ID.

- AUX 31 CALLID — Caller ID Signaling Selection
- AUX 29 SCANSET — Channel Signaling Scan Setting
- AUX 35 CUSTOM — Custom Results

Refer to Section 4, Auxiliary Functions, for descriptions of the auxiliary function.

3.35.5 Signaling Keypad

The Caller ID Option does not include a signaling Keypad (Signaling Option required). However, the Keypad can be used to send Caller ID activation and deactivation codes.

3.36 CIRCUIT CONNECTIONS

The following circuit connections controls are affected by the Caller ID Option.

3.36.1 DROP (RX) Switch

When the T-BERD 224 is configured for CID MON or CID SCAN the **DROP (RX)** switch is set to BOTH.

3.36.2 INSERT (TX) Switch

When the T-BERD 224 is configured for CID MON or CID SCAN, the **INSERT (TX)** switch is set to NONE.

3.36.3 CHANNEL Switches

When the T-BERD 224 is configured for CID SCAN, the **CHANNEL** switch number is displayed as "— —". The T-BERD 224 controls the channel selection. After a channel is seized, the channel number is displayed. The channel number is always the same for LINE 1 and LINE 2.

3.37 RESULTS VERIFICATION

The Caller ID Option adds results to the CHANNEL category: n100 DELAY, n106 CKSUM, n107 MSG DUR, n108 MK LVL, n109 MK FRQ, n110SP LVL, and n111 SP FRQ, .

The captured Caller ID results are displayed in a scrolling display window. To view the complete Caller ID captured data the **MODE** switch is used as a cursor key. If the Signaling Lid keypad is installed, either the **MODE** switch or the **Cursor** keys on the keypad can be used to scroll to the results.

Example: CID MON Mode Captured Data (Scrolled results displays)

```
o O R (George Smith 042514      1100 DEL
CID MON  SWI=L1SLC              550 ms
```

```
ith 042514533013531550) R h     1100 DEL
CID MON  SWI=L1SLC              550 ms
```

The top line of the Results display shows the received Caller ID data. The CPE (lowercase o), and switch (uppercase O) identify on-hook conditions. The first ringing signal (uppercase R) was sent from the switch. The first parenthesis "(" represents channel seizure. The next 12 characters are the calling name of the originating party (up to 15 characters can be displayed). These characters are followed by four digits that represent the date. The first two digits represent the month, then the next two digits represent the day. These four digits are followed by another four digits that represent the time in military format; hour (2 digits) and minute (2 digits). The time is followed by the calling number (up to 10 digits). The final parenthesis ")" represents the checksum and the conclusion of the FSK data. The second ring (uppercase R) and off-hook (lowercase h) denote the end of the sequence.

The second line displays the test function (CID MON), the originating switch line (SWI=L1), and the trunk type format (SLC).

The rightmost upper and lower line characters are the DELay result for line 1 (550 millisecond delay from first ring to the start of the Caller ID information).

NOTE

If the Caller ID service does not support Caller Name, the T-BERD 224 display is the same, except the calling name is not displayed.

3.38 PRINTER CONTROLS

With the Caller ID Option, an additional results printout is available: CALLER ID. See Section 6 for an explanation of printouts.

A results printout is generated automatically when the **PRINT EVENT** switch is set to any setting except OFF. A CALLER ID results printout is generated when the second ring from the originating switch is detected or an off-hook signal is received from the receiving side. Figure 3-11 shows a sample CALLER ID results printout.

```
CALLER ID   PRINT          10:51:06      Jun 07
o O R (Robert Peterson 0607110503013531550) R h

Channel # 23

CKSUM OK     MSG DUR 2365 ms

MARK  FRQ     1202 Hz     MARK  LVL -15.2 dBm
SPACE FRQ     2199 Hz     SPACE LVL -14.9 dBm

EVENT     DEL
     ms
     o     N/A
     O     0
     R     1500
     (     60
     )     60
     R     3000
     h     5000
```

Figure 3-11. Caller ID Results Printout

SS7 CALL TRACE OPTION

3.39 INTRODUCTION

The SS7 Call Trace Option allows the T-BERD 224 to non-intrusively monitor link statistics over Signaling System 7 (SS7) and enables SS7 call tracing over the link. This feature enables the user to lock onto a specific call and monitor all call processing messages (SS7 ISUP messages) that correspond to that call. While tracing the call, it reports, in real time, the call state and other important information about the traced call. The T-BERD 224 SS7 Call Trace Option provides the following features and capabilities:

- Accesses the SS7 facility link from a DS1 access point.
- Non-intrusively monitors SS7 link statistics.
- Traces calling number, called number, OPC, and DPC values.
- Quickly retrieves and displays link statistics information.
- Isolates transmission and protocol problems betweenSSP,STP, and SCP.
- Sectionalizes transmission problems on the link.

NOTE

This option requires the DSP Board Option wherein access to protocol is from a DS1 access point.

3.40 FUNCTIONAL DESCRIPTION

3.40.1 Monitoring SS7 Protocol — Link Statistics

SS7 protocols transmit signaling information using an HDLC packet format. Its protocol uses CCITT standard Q.700 and the local exchange switch acts as a translator between the SS7 call status messages and corresponding ISDN messages.

The basic elements of the SS7 network can be described as follows:

Service Switching Point (SSP) — Performs all the functions of the SP and can also query SCPs.

Signaling Transfer Point (STP) — Serves as a switching point for the signaling and database query messages generated by SSPs and SPs. STPs are always deployed in pairs.

Service Control Point (SCP) — Contains a centralized network database for providing network enhancements. SCPs are usually deployed in pairs for database protection and are always accessed through STPs.

Signaling Link (SL) — Provides a link with one of six specific types of connections within the SS7 network. The links, labeled A through F, are deployed in pairs throughout the network and operate at a maximum 40% utilization. If an outage occurs on one of the pairs, the utilization maximizes at 80%.

SS7 is a unique protocol structure supporting OSI Layer 2 protocol carrying bidirectional signal units. The T-BERD 224 decodes the Layer 2 packets (signal units). There are three types of signal units:

Message Signal Units (MSUs) — Contain vital call setup and messaging information.

Link Status Signal Units (LSSUs) — Convey the health of the signaling link between terminals.

Fill In Signal Units (FISUs) — Keep the signal "alive" when no other information is being transmitted.

3.40.2 SS7 Link Statistics

The option enables the T-BERD 224 the ability to monitor all layer 2 (OSI) messages on the SS7 link. Test results are provided that count the error-free packets, i.e., Message Signal Units, Link Status Signal Units, and Fill-In Signal Units on the SS7 link and classifies them as good, CRC errored, or discarded, as well a reporting CRC errored seconds and error rate. In addition, it counts the Backward Indicator Bit field state transitions, indicates the percent of MSU Utilization, and monitors SS7 link status messages (e.g., busy, processor outage, out of service, etc.).

3.40.3 SS7 CallTrac

The T-BERD 224 starts an SS7 call trace by searching for a SETUP message that meets a specific trace criteria (set through AUX 46). When a call is detected, the call reference value is extracted and all related messages are captured and processed; all other messages are ignored. A call trace is automatically restarted when a preset call state condition occurs (set through AUX 41). Test results provide the necessary information to track a call (call state, called number, calling number, call type, call OPC code, call DPC code, and cause value).

The T-BERD 224 restarts the SS7 Call Trace after a specified call state is detected (set through AUX 41). The restart occurs on one of the following events: CONNECTED, PROCEEDING, ALERTING, or RELEASED. If the detected call state corresponds to the AUX 41 restart event setting, then the T-BERD 224 starts searching for a new call after a specified delay (also set through AUX 41). All results remain valid during the delay.

There are two types of restart delays set with AUX 41: release and event. The release delay is used when the RELEASED state is detected. The event delay is used when other call states are detected and the restart event is set to something other than RELEASED.

3.41 TEST SETUP

The following test setup controls are affected by the SS7 Option (see Table 3-12):

Table 3-12. SS7 CallTrace Option Switch Configurations

Switches	Configuration	
MODE	AUTO, T1-DID, T1-D2, T1-D4, T1-ESF, T1-ESFz, T1SLC96, SLC-DID, T1-TLB, T1-LLB	
CHANNEL FORMAT	PROTOCL	
SCI	SS7 MON	
SCII	CALL TRACE	LINK STAT

3.41.1 CHANNELFORMAT Switch

In addition to the mainframe channel format selections, the SS7 Call Trace Option adds the following:

PROTOCL — Configures the T-BERD 224 to monitor SS7 Call Trace or SS7 messaging links. The appropriate channel format is B8ZS (framing) and AMI (line code).

3.41.2 SOURCE CONFIGURATION I Switch

The following source configuration selection is available when the PROTOCL channel format is selected:

SS7 MON — Monitor SS7 signaling and messaging link information on a 56 kb/s DDS link.

3.41.3 SOURCE CONFIGURATION II Switch

The following selections are available when the **SOURCE CONFIGURATION II** switch is selected:

CALL TRACE — Monitors call processing of a selected call over the SS7 channel.

LINK STAT — Monitors all OSI Layer 2 (LAPD) signaling units over the SS7 channel.

3.41.4 SS7 Call Trace Controls and Indicators

SS7 call tracing is configured by setting the **CHANNELFORMAT** switch to PROTOCL, the **SOURCE CONFIGURATION I** switch to SS7 MON, and **SOURCE CONFIGURATION 11** TO CALL TRACE.

Pressing the **RESTART** switch abandons the current call trace and restarts the search for a new call.

When call tracing is selected, the **DROP** switch is forced to BOTH and the **INSERT** switch is forced to NONE.

Select the desired DS0 channel with the **LINE 1** and **LINE 2 CHANNEL** switches (D channel typically appears on DS0 #24).

3.41.5 SS7 Link Statistics Controls and Indicators

Monitoring an SS7 link statistic is configured by setting the **CHANNELFORMAT** switch to PROTOCOL, the **SOURCE CONFIGURATION I** switch to SS7 MON, and the **SOURCE CONFIGURATION II** switch to LINK STAT(see Table 3-12).

When monitoring SS7 link statistics, the **DROP** switch is forced to BOTH and the **INSERT** switch is forced to NONE.

Select the desired DS0 channel with the **LINE 1** and **LINE 2 CHANNEL** switches (D channel typically appears on DS0 #24).

3.41.6 SS7 Call Trace / Link Statistics Feature Interaction

Within the SS7 Call Trace option, the call trace feature will not operate while the link statistics feature is invoked and vice-versa. However, the T-BERD 224s basic T1 monitoring features, i.e., errors and alarms, can operate concurrently with the SS7 Call Trace features.

3.42 CIRCUIT CONNECTIONS

3.42.1 SS7 Call Trace Connections

To perform SS7 Call Trace, theT-BERD 224 must be connected (LINE 1 RECEIVE and LINE 2 RECEIVE) to both sides of the DS1 line to monitor calls. Set the operating mode framing (**MODE** switch) and line code (**CODE** switch) for the line being used.

3.42.2 SS7 Link Statistics Connections

Link statistics can be monitored from either direction, individually or simultaneously through the LINE 1 and LINE 2 RECEIVE connections.

3.43 AUXILIARY FUNCTIONS

The following auxiliary functions enable the T-BERD 224 to perform call traces over SS7.

3.43.1 AUX 41 TRC RST — Set SS7 Call Trace Restart Criteria

AUX 41	***SS7**	**RLS DELAY**
TRC RST		**1 SECON**

The AUX 41 TRC RST function sets the SS7 call trace restart criteria. A test restart consists of abandoning the existing call trace and starting a new call trace. Press the **RESULTS I Arrowed** switch to select the following:

***RLS DELAY** — Sets the release delay criteria. Press the **RESULTS I Blank** switch to select the following release delays: NONE, 1 SECOND, 2 SECONDS, 5 SECONDS, 10 SECONDS, 30 SECONDS, or FOREVER.

Changing the settings causes a test restart.

NOTE

The TR-303 and Primary Rate ISDN features also use an AUX 41 Trace Restart function. However, the user will *not* be able to access the 303 AUX 41 function or the PRI AUX 41 function from the SS7 mode (or vice-versa). Also, there is no EVENT parameter in the SS7 mode.

Table 3-13 contains the factory default settings that are stored in memory for AUX 41 SS7 Call Trace Restart. (Once in the default setting, AUX 46 sets the call trace criteria for SS7.) The T-BERD 224s controls can be forced to their default settings by clearing the NOVRAM. As soon as the SOFTWARE REVISIO message is visible while the unit is being powered-up, momentarily press the RESTART switch. The message CLEARING NOVRAM appears in the RESULTS display. Below are the following default values:

Table 3-13. Default Settings for Aux 41 and 46

Parameter	Default Setting
AUX 41 *RLSDELAY	10 SECONDS
AUX 46 display group	*CALLED NUMBER
AUX 46 *CALLED NUMBER AUX 46 *CALLED NUMBER (SELECT setting)	ANY
AUX 46 *CALLING NUMBER AUX 46 *CALLING NUMBER (SELECT setting)	ANY
AUX 46 *OPC AUX 46 *OPC (SELECT setting)	ANY
AUX 46 *DPC AUX 46 * DPC (SELECT setting)	ANY

3.43.2 AUX 46 SS7 TRC — Set SS7 CallTrace Criteria

```
AUX 46        *CALLED NUMBER
SS7  TRC      SELECT
```

The AUX 46 SS7 TRC function configures the SS7 call trace filters. The filter sets the origination point code, destination point code, called number, and calling number. The test instrument can only trace one call at a time. This auxiliary function is only available when the **AUX** switch is pressed in the SS7 call trace mode.

Press the **SOURCE CONFIGURATION I** switch to select the following auxiliary function options:

***OPC** — Sets the call trace originating point code. Press the **SOURCE CONFIGURATION I** switch to select one of the following:

ANY — Call trace looks for any OPC.

SELECT — Enter a specific OPC from 0 to 9 digits with the Signaling Option keypad. Only the following keys are active for this function: 0 to 9, DELETE, ENTER, and left/right arrow keys. All or part of a number can be entered. Press the **RESULTS II Arrowed** switch to select the previously saved number.

***DPC** — Sets the call trace destination point code. Press the **SOURCE CONFIGURATION I** switch to select one of the following:

ANY — Call trace looks for any DPC.

SELECT — Enter a specific DPC from 0 to 9 digits with the Signaling Option keypad. Only the following keys are active for this function: 0 to 9, DELETE, ENTER, and left/right arrow keys. All or part of a number can be entered. Press the **RESULTS II Arrowed** switch to select the previously saved number.

***CALLING NUMBE** — Sets the calling number to be traced. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

ANY — Call trace looks for any calling number.

SELECT — Enter a specific calling number from 0 to 12 digits with the Signaling Option keypad. Only the following keys are active for this function: 0 to 9, DELETE, ENTER, and left/right arrow keys. All or part of a number can be entered. Press the **RESULTS II Arrowed** switch to select the previously saved number.

***CALLED NUMBER** — Sets the calling number to be traced. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

ANY — Call trace looks for any called number.

SELECT — Enter a specific called number from 0 to 12 digits with the Signaling Option keypad. Only the following keys are active for this function: 0 to 9, DELETE, ENTER, and left/right arrow keys. All or part of a number can be entered. Press the **RESULTS II Arrowed** switch to select the previously saved number.

Changing the settings causes a test restart. Table 3-14 shows an example of SS7 AUX 46 results.

Table 3-14. SS7 CallTrace Restart Results

Result	Label(s)
Call State	CALL STATE
Called Number	CALLED NM_1 CALLED NM_2 CALLED NM_3
Calling Number	CALLNG N_1
	CALLNG N_2
Call Type	CALL TYPE
Origination Point Code	OPC
Destination Point Code	DPC
Cause	CAUSE

The RESULTS display can report the *Call State* to determine where the call originated from as well as the following information messages listed in Table 3-15.

Table 3-15. SS7 Call State Results

Message(s)	Call State Result
IAM	INIT ADDR
ACM	ADDR COMP
AN	ANSWERED
REL	RELEASED
RLC	RLS COMP

NOTE

If the T-BERD 224 is being remotely controlled with the TTC DTM software, the Signaling Option software must be installed on the T-BERD 224 to enter the calling and called numbers.

3.44 TEST RESULTS

Refer to Section 5.7.5 for SS7 Call Trace Option test results regarding Link Statistics and Section 5.7.4 for SS7 Link Statistics test results.

3.45 PRINTOUTS

If the **PRINT EVENT** switch is set to TEST END, the call trace test results are printed when the call state i RELEASED. The SS7 results printout is only available when the front panel display configuration is set for SS7 Call Trace as shown below in Figure 3-12.

```
CALL TRACE PRINT     10:15:37 AUG 23 96
CALL STATE:          RELEASED
CALLED NUM:          8006382049
CALLNG NUM:          3013531560
CALL TYPE:           SPEECH
OPC:                 UNAVAIL/5.1.250
DPC:                 UNAVAIL/5.1.251
CAUSE:               UNAVAIL/XX
```

Figure 3-12. SS7 Call Trace Printout

3.45.1 SS7 Call Trace Controls Printout

When the system is configured for SS7 Call Trace, the following block of print will be added to the end of the CONTROLS printout. The data printed is based on the AUX function settings specified above. The printout is formatted as shown in Figure 3-13.

```
SS7 CALL TRACE:
      OPC:                  ANY / 5.1.255
      DPC:                  ANY / 5.1.255
      CALLED NUMBER:        ANY / 12345678901234567890
      CALLING NUMBER:       ANY / 12345678901234567890
SS7 TRACE RESTART:
      RELEASE DELAY TIME:   NONE/FOREVER/xx SEC (xx = 1, 2, 5, or 10)
```

Figure 3-13. SS7 Call Trace Controls Printout

PRIMARY RATE ISDN OPTION

3.46 INTRODUCTION

Primary Rate ISDN Option allows the T-BERD 224 to non-intrusively monitor link statistics over the Primary Rate Integrated Services Digital Network systems. It also enables ISDN call tracing over the primary ISDN D channel. The T-BERD 224 Primary Rate ISDN Option provides the following features and capabilities:

- Accesses the ISDN facility link from any T1 access point.
- Non-intrusively monitors Primary Rate ISDN link statistics.
- Quickly retrieves and displays link statistics information.
- Sectionalizes transmission problems on the link.

Primary Rate ISDN protocols transmit signaling information using an HDLC packet format. Its protocol uses CCITT standard Q.931.

3.47 FUNCTIONAL DESCRIPTION

3.47.1 Primary Rate ISDN Link Statistics

The option enables the T-BERD 224 the ability to monitor all layer 2 (LAPD) messages on the Primary Rate ISDN D channel. Test results are provided that count packets on each line and classifies them as good, CRC errored, or discarded, as well as reporting CRC errored seconds and error rate. In addition, Information frames and Receiver Ready frames are also counted.

3.47.2 Primary Rate ISDN Call Trace

The T-BERD 224 starts a Primary Rate ISDN call trace by searching for a SETUP message that meets a specific trace criteria (set through AUX 43). When a call is detected, the call reference value is extracted and all related messages are captured and processed; all other messages are ignored. A call trace is automatically restarted when a preset call state condition occurs (set through AUX 41). Test results provide the necessary information to track a call (call state, called number, calling number, call type, interface and channel, network identification, call origination source, call disconnect source, and cause value).

The T-BERD 224 restarts the call trace after a specified call state is detected (set through AUX 41). The restart occurs on one of the following events: CONNECTED, PROCEEDING, ALERTING, or RELEASED. If the detected call state corresponds to the AUX 41 restart event setting, then the T-BERD 224 starts searching for a new call after a specified delay (also set through AUX 41). All results remain valid during the delay.

There are two types of restart delays set with AUX 41: release and event. The release delay is used when the RELEASED state is detected. The event delay is used when other call states are detected and the restart event is set to something other than RELEASED.

3.48 TEST SETUP

The following test setup controls are affected by the Primary Rate ISDN Option (see Table 3-16):

Table 3-16. Primary Rate ISDN Option Switch Configurations

Switches	Configuration	
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, T1-ESFz, T1SLC96, SLC-D1D, T1-TLB, T1-LLB	
CHANNEL FORMAT	PROTOCL	
SCI	PRI MON	
SCII	CALL TRACE	LINK STAT

3.48.1 CHANNELFORMAT Switch

In addition to the mainframe channel format selections, the Primary Rate ISDN Option adds the following:

PROTOCL — Configures the T-BERD 224 to monitor Primary Rate ISDN links. This channel format is available in all framed modes.

3.48.2 SOURCE CONFIGURATION I Switch

The following source configuration selection is available when the PROTOCL channel format is selected:

PRI MON — Monitor Primary Rate ISDN signaling and messaging link on a 64 kb/s D channel.

3.48.3 SOURCE CONFIGURATION II Switch

The following selections are available when the **SOURCE CONFIGURATION I** switch is set to PRI MON:

CALL TRACE — Monitor call processing of a selected call over the Primary Rate ISDN D channel.

LINK STAT — Monitor layer 2 link statistics over the Primary Rate ISDN D channel.

3.48.4 Primary Rate ISDN Call Trace Controls and Indicators

Primary Rate ISDN call tracing is configured by setting the **CHANNELFORMAT** switch to PROTOCL, the **SOURCE CONFIGURATION I** switch to PRI MON, and the **SOURCE CONFIGURATION II** switch to CALL TRACE (see Table 3-12).

Pressing the **RESTART** switch abandons the current call trace and restarts the search for a new call.

When call tracing is selected, the **DROP** switch is forced to BOTH and the **INSERT** switch is forced to NONE.

Select the desired DS0 channel with the **LINE 1** and **LINE 2 CHANNEL** switches (D channel typically appears on DS0 #24).

3.48.5 Primary Rate ISDN Link Statistics Controls and Indicators

Monitoring a Primary Rate ISDN link statistics is configured by setting the **CHANNELFORMAT** switch to PROTOCL, the **SOURCE CONFIGURATION I** switch to PRI MON, and the **SOURCE CONFIGURATION II** switch to LINK STAT (see Table 3-12).

When monitoring Primary Rate ISDN link statistics, the **DROP** switch is forced to BOTH and the **INSERT** switch is forced to NONE.

Select the desired DS0 channel with the **LINE 1** and **LINE 2 CHANNEL** switches (D channel typically appears on DS0 #24).

3.49 CIRCUIT CONNECTIONS

3.49.1 Primary Rate ISDN Call Trace Connections

To perform Primary Rate ISDN call trace, the T-BERD 224 must be connected (LINE 1 RECEIVE and LINE 2 RECEIVE) to both sides of the DS1 line to monitor calls. Set the operating mode framing (**MODE** switch) and line code (**CODE** switch) for the line being used.

3.49.2 ISDN Link Statistics Connections

Link statistics can be monitored from either direction, individually or simultaneously through the LINE 1 and LINE 2 RECEIVE connections.

3.50 AUXILIARY FUNCTIONS

Primary Rate ISDN Custom Results are part of the auxiliary functions of Auxiliary 35, Custom Results. Refer to Section 4.2.34 for detailed description of that function.

3.50.1 AUX 41 TRC RST — Set Primary Rate ISDN Call Trace Restart Criteria

```
AUX 41          *CALLED NUMBER
PRI TRC RST      SELECT
```

The AUX 41 TRC RST function sets the Primary Rate ISDN call trace restart criteria.

Press the **RESULTS I Arrowed** switch to select one of the following:

***SELECT** — The user selects the results available in the display and included in a results printout.

***RLS DELAY** — Sets the release delay criteria. Press the **RESULTS I Blank** switch to select one of the following release delays: NONE, 1 SECOND, 2 SECONDS, 5 SECONDS, 10 SECONDS, 30 SECONDS, or FOREVER.

***EVENT** — Sets the restart event criteria. Press the **RESULTS I Blank** switch to select one of the following restart events: PROCEEDING, ALERTING, CONNECTED, or RELEASED. Press the**RESULTS II Arrowed** switch to select one of the following event delays: NONE, 1 SECOND, 2 SECONDS, 5 SECONDS, 10 SECONDS, 30 SECONDS, or FOREVER.

Changing the settings causes a test restart.

3.50.2 AUX 43 PRI TRC — Set Primary Rate ISDN Call Trace Criteria

AUX 43	***CALLED NUMBER**
PRI TRC	**SELECT**

The AUX 43 PRI TRC function configures the Primary Rate ISDN call trace filters. The filter sets the origination source, call type, called number, and calling number. The test instrument can only trace one call at a time. For example, trace a voice call that originates from the network and with a called number starting with 234. This auxiliary function is only available when the **AUX** switch is pressed in the Primary Rate ISDN call trace mode.

Press the **SOURCE CONFIGURATION I** switch to select the following auxiliary function options:

***SELECT** — The user selects the results available in the display and included in a results printout.

***SOURCE** — Sets the call trace origination source criteria. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

NETWORK — Call trace looks for a call from the network.

USER — Call trace looks for a call from the user.

ANY — Call trace looks for a call from either direction.

***CALL TYPE** — Sets the call trace call type criteria. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

VOICE — Call trace looks for a voice call: speech or 3.1 kHz audio.

DATA — Call trace looks for a data call.

ANY — Call trace looks for any type call.

***CALLED NUMBER** — Sets the called number to be traced. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

ANY — Call trace looks for any called number.

SELECT — Enter a specific called number from 0 to 12 digits with the Signaling Option keypad. Only the following keys are active for this function: 0 to 9, DELETE, ENTER, and left/right arrow keys. All or part of a number can be entered. Press the **RESULTS II Arrowed** switch to select the previously saved number.

***CALLING NUMBE** — Sets the calling number to be traced. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

ANY — Call trace looks for any calling number.

SELECT — Enter a specific calling number from 0 to 12 digits with the Signaling Option keypad. Only the following keys are active for this function: 0 to 9, DELETE, ENTER, and left/right arrow keys. All or part of a number can be entered. Press the **RESULTS II Arrowed** switch to select the previously saved number.

NOTE

The called or calling number string represents the minimum number of digits necessary to activate a trace. If the selected number matches the beginning of the number, the call is traced.

Changing the settings causes a test restart.

NOTE

If the T-BERD 224 is being remotely controlled with the TTC DTM software, the Signaling Option software must be installed on the T-BERD 224 to enter the calling and called numbers.

3.51 TEST RESULTS

Refer to Section 5.7.11 for Primary Rate ISDN Option test results regarding Link Statistics and Section 5.7.12 for Primary Rate ISDN Option Call Trace test results.

3.52 PRINTOUTS

If the **PRINT EVENT** switch is set to TEST END, the call trace test results are printed when the call state i RELEASED. Select PRI CALL TRACE for a printout as shown in Figure 3-14.

```
CALL TRACE PRINT     10:15:37 AUG 23 96
 CALL STATE:          RELEASED
 CALLED NUM:          8006382049
 CALLNG NUM:          3013531560
 CALL TYPE:           SPEECH
 INTF CHAN:           11  14
 NETWORK ID:          UNAVAIL
 ORIG SRC:            NETW   (L1)
 DISC SRC:            USER   (L2)
 CAUSE:               16
```

Figure 3-14. Primary Rate ISDN Call Trace Printouts

3.52.1 Primary Rate ISDN Controls Printout

When the system is configured for PRI Call Trace, the following block of print will be added to the end of the CONTROLS printout. The data printed shall be based on the AUX function settings specified above. The printout appears as shown in Figure 3-15

```
PRI CALL TRACE:
     SOURCE:                  NETWORK/USER/ANY
     CALL TYPE:               VOICE/DATA/ANY
     CALLED NUMBER:           12345678901234567890
     CALLING NUMBER:          12345678901234567890
PRI TRACE RESTART:
     EVENT TYPE:              PROCEEDING/ALERTING/CONNECTED/RELEASED
    EVENT DELAY TIME:     NONE/FOREVER/xx SEC (xx = 1, 2, 5, or 10)
    RELEASE DELAY TIME:   NONE/FOREVER/xx SEC (xx = 1, 2, 5, or 10)
```

Figure 3-15. Primary Rate ISDN Controls Printout

DSU-DP OPTION

3.53 INTRODUCTION

The DSU-DP Option allows the T-BERD 224 to drop a channel(s) to the DSU-DP interface for analysis by an external test set. The T-BERD 224 DSU-DP Option provides the following data channel applications:

- Decode and analyze DS0A, DS0B, or fractional T1 circuit protocol using the DSU-DP Option and an external data scope or protocol analyzer
- Verify bi-directional signaling of SS7 and primary rate ISDN circuits with an external data scope or protocol analyzer after identifying a problem.
- Replace Fractional T1 CSU/DSUs by terminating the T1 span and connecting customer DTE to the T-BERD 224s DSU-DP.

When inserting Fractional T1 data into N channels, the remaining 24-N channels are passed through the test set without being disrupted.

NOTE

Unless indicated, the capabilities of the mainframe T-BERD 224 are applicable to the DSU-DP Option.

3.54 TEST SETUP

The following controls and indicators are affected by the DSU-DP Option (see Table 3-17).

Table 3-17. DSU-DP Option Switch Configurations

Switch	Configuration				
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, SLC-D1D, T1SLC96, SLC-M2, T1 TLB, T1 LLB				
CHANNEL FORMAT	DS0A2.4 DS0A4.8 DS0A9.6 DS0A192 DS0B192 DS0A56 DS064 DATLINK[1]	DS0B2.4	DS0B4.8	DS0B9.6	56xN[2] 64xN[2]
SCI	DSU-DP				
SCII		CHAN 1 • • CHAN 20	CHAN 1 • • CHAN 10	CHAN 1 • • CHAN 5	N = 1 • • N = 24 NON CONTIG

[1] DATLINK is only available in the T1-ESF mode.
[2] 56xN and 64xN are only available in the T1-D4 or T1-ESF modes.

3.54.1 CHANNELFORMAT Switch

In addition to the mainframe channel format selections the following are also available with the DSU-DP Option.

DS0A2.4, DS0A4.8, DS0A9.6 — Use when monitoring or testing DS0A-formatted DDS data at 2.4, 4.8, or 9.6 kb/s. Drop and insert access to unformatted 2.4, 4.8, or 9.6 kb/s data is provided via the DSU-DP Option interfaces. AUX 11 ANL CHA and AUX 12 ERR COR functions are applicable.

DS0A192 — Use when monitoring or testing DS0A-formatted DDS data at 19.2 kb/s. Drop and insert access to unformatted 19.2 kb/s data is provided through the DSU-DP Option interfaces. Data is inserted in bytes 2 and 3, while UMC codes are placed in bytes 1, 4, and 5. AUX 11 ANL CHA is applicable.

DS0B192 — Use when monitoring or testing Channel 1 of DS0B-formatted DDS data at 19.2 kb/s. Drop and insert access to unformatted 19.2 kb/s data is provided through the DSU-DP Option interfaces. Data is inserted in bytes 2 and 3, while bytes 1, 4, and 5 pass through unaffected. If no T1 signal is received, UMC codes are placed in bytes 1, 4, and 5. Subrate frame synchronization must be acquired before the T-BERD 224 can insert test data. AUX 11 ANL CHA is applicable.

DS0A56 — Use when monitoring or testing DS0A-formatted DDS data at 56 kb/s. Drop and insert access to unformatted 56 kb/s data is provided via the DSU-DP Option interfaces. AUX 11 ANL CHA function is applicable.

DS064 — Use when monitoring or testing 64 kb/s data. Drop and insert access to clear channel data is provided via the DSU-DP Option interfaces.

DS0B2.4, DS0B4.8, DS0B9.6 — Use when monitoring or testing DS0B-formatted DDS data at 2.4, 4.8, and 9.6 kb/s. Drop and insert access to an unformatted data channel is provided via the DSU-DP Option. Use the **SOURCE CONFIGURATION II** switch to select one of the 20 DS0B2.4, 10 DS0B4.8, or 5 DS0B9.6 channels to be analyzed. AUX 11 ANL CHA function is applicable. A message flashes in the RESULTS display to indicate the primary or secondary channel is being analyzed under this configuration. Subrate frame synchronization must be acquired before the T-BERD 224 inserts test data.

56xN and 64xN — Use when monitoring or testing Fractional T1 circuits. Drop and insert access to bit 1-7 (56xN) or bits 1-8 (64xN) of any combination of contiguous or noncontagious DS0 channels via the DSU-DP Option interfaces. AUX 10 N-CONTG is applicable. This selection is only available when the **MODE** switch is set to T1-D4 or T1-ESF.

DATLINK — Use when monitoring or testing the ESF datalink.

3.54.2 SOURCE CONFIGURATION I Switch

The DSU-DP **SOURCE CONFIGURATION I** switch selection is added by the DSU-DP Option.

DSU-DP — Selects the side panel DSU-DP Option interface (RS-232, V.35, or RS-449) as the drop and insert source. Data is transmitted at the rate indicated in the CHANNEL FORMAT display.

3.54.3 SOURCE CONFIGURATION II Switch

The **SOURCE CONFIGURATION II** switch selections are only available for the following settings.

When the **CHANNELFORMAT** switch is set to DS0B2.4, DS0B4.8 or DS0B9.6, the available **SOURCE CONFIGURATION II** switch selections are:

CHAN = (1-5, 1-10, or 1-20) — select one of the 5 (9.6 kb/s), 10 (4.8 kb/s), or 20 (2.4 kb/s) DDS DS0B channels to analyze. The remaining 4, 9, or 19 channels are unaffected.

When the **CHANNELFORMAT** is set to 56xN or 64xN, the available **SOURCE CONFIGURATION II** switch selections are:

N = (1-24) — select the number of contiguous DS0s to analyze as a single FT1 bandwidth. Use the**LINE 1** and **LINE 2 CHANNEL** switches to select the first channel of the FT1 bandwidth.

NOTE

DS0s may *wrap around* the frame bit. For example, if N=4 and CHANNEL = 23, then channels 23, 24, 1, and 2 are analyzed.

NON CONTIG — analyze non-contiguous DS0 channels as a single FT1 bandwidth. Pressing the **AUX** switch automatically accesses the AUX 10 N-CONTG function. Enter the desired DS0 channel numbers for the non-contiguous FT1 bandwidth.

NOTE

The same number of channels must be selected for both lines, but the actual channels selected can be different. See Section 4 for more information on setting the AUX 10 N-CONFIG function.

3.54.4 CHANNEL Switches

When the **SOURCE CONFIGURATION II** switch is set to NON CONTIG the channel number is displayed as "— —" because the channel(s) to be used are defined by AUX 10 N-CONTG function. The **LINE 1** and **LINE 2 CHANNEL** switches are not available.

3.54.5 AUX Switch

The following auxiliary functions are added with the DSU-DP Option.

- AUX 10 N-CONTG — Non-contiguous Channel
- AUX 11 ANL CHA — DSU-DP Analysis Channel
- AUX 12 ERR COR — DS0A Error Correction

NOTE

Refer to Section 4, Auxiliary Functions, for a complete description of the auxiliary functions.

3.55 CIRCUIT CONNECTIONS

The DSU-DP Option side panel connections are shown in Figure 3-16. There are three versions of the DSU-DP Option: RS-232/V.35, RS-232/RS-449, and RS-232/V.35/RS-449. All three versions provide unique interfaces with identical functions. Refer to Section 8, Specifications, for details on the DSU-DP pin configuration.

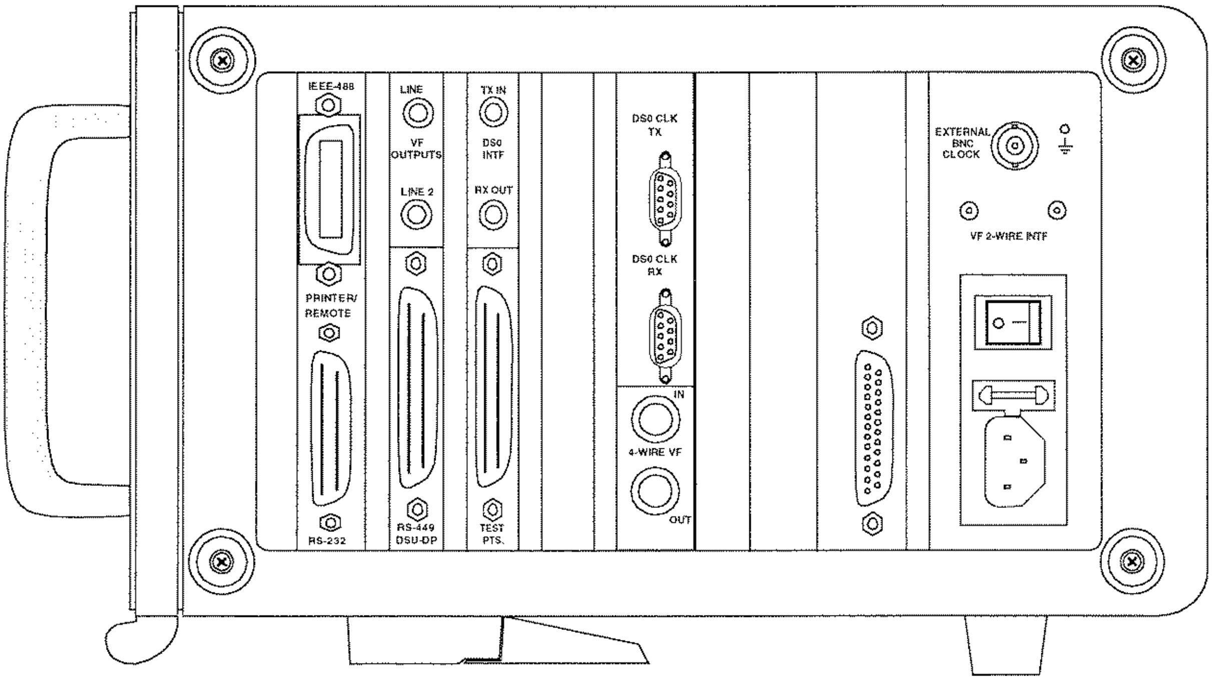


Figure 3-16. DSU-DP Side-Panel Connector

3.55.1 Connection To A Protocol Analyzer

3.55.1.1 Control Bit Monitoring on a DDS Circuit

With a DSU-DP Option (after March 1992) the T-BERD 224 takes a majority rule of the last three control bits and drops the status of the control bit from each line to the RLSD leads on each communications interface. If the majority rule equals a one then RLSD for that line is active. The control bit from the dropped line (LINE 1 or LINE 2) is output to the RLSD pin, see Table 3-18. If the **DROP (RX)** switch is set to BOTH, the control bit of LINE 1 is output on the RLSD pin and the control bit of LINE 2 is output to the pins in Table 3-19.

Table 3-18. Control Bit Access — DROP (RX) Switch LINE 1 or LINE 2

Interface	Pin Assignment(s)	Pin Name(s)
V.35	F	RLSD
RS-449/422	13(a) 31(b)	RR(a,b)
RS-232	8	RLSD

Table 3-19. Control Bit Access — DROP (RX) Switch BOTH

Interface	LINE 1		LINE 2	
	Pin Assignment(s)	Pin Name(s)	Pin Assignment(s	Pin Name(s)
V.35	F	RLSD	LL	Reserved
RS-449/427	13(a), 31(b)		RR(a,b)	32(a), 34(b)SS, NS
RS-232	8	RLSD	12	Sec RLSD

3.55.1.2 Terminal Emulation On A DDS Circuit

The DSU-DP Option allows theT-BERD 224 to emulate a CSU/DSU/OCU combination. The test set insert Control Mode Idle (CMI) when RTS is inactive and customer data when RTS is active. This is available in the AUX 11 ANL CHA function when DSU CHAN is set to PRIMARY and the CTRL BIT is set to RTS INSERT.

3.55.2 DSU-DP Cable Connections

For simplex drop and insert, use a straight-through, male-to-male cable to connect an external test set to a DSU-DP Option interface. This setup is used to monitor a circuit in one transmission direction or to perform an out-of-service channel test. Data transmitted toward the external test set is selected using the **INSERT (TX)** switch: LINE 1 or LINE 2. Data received from the external test set is inserted into the T1 circuit selected by the **DROP (RX)** switch: LINE 1 or LINE 2.

Table 3-20 through Table 3-22 provide detailed pin assignments for cable connections to an external test set/DTE.

Table 3-20. RS-232 Male-to-Male Adaptor Cabl

Signal Name	To 224 (Male)	To Monitor (Male)	Signal Name
PROT. GND	1	1	PROT. GND
SEC RX DATA	16	2	TX DATA
RX DATA	3	3	RX DATA
SEC RLSD	12	4	RTS
SEC RLSD	12	5	CTS
DSR	6	6	DSR
SIG. GND	7	7	SIG. GND
RLSD	8	8	RLSD
+12V	9	9	+12V
-12V	10	10	-12V
SEC RX CLK	18	15	TX CLK
RX CLK	17	17	RX CLK

Table 3-21. V.35 Male-to-Male Adaptor Cabl

Signal Name	To 224 (Male)	To Monitor (Male)	Signal Name
PROT. GND	A	A	PROT. GND
SIG. GND	B	B	SIG. GND
SEC RLSD	LL	C	RTS
SEC RLSD	LL	D	CTS
DSR	E	E	DSR
RLSD	F	F	RLSD
SEC RX DATA (A)	DD	P	TX DATA (A)
RX DATA (A)	R	R	RX DATA (A)
SEC RX DATA (B)	FF	S	TX DATA (B)
RX DATA (B)	T	T	RX DATA (B)
SCR (A)	V	V	SCR (A)
SCR (B)	X	X	SCR (B)
SEC SCR (A)	HH	Y	SCT (A)
SEC SCR (B)	KK	AA	SCT (B)

Table 3-22. RS-449 Male-to-Female Adaptor Cable

Signal Name	To 224 (Male)	To Monitor (Female)	Signal Name
PROT. GND	1	1	PROT. GND
SEC RX DATA (A)	3	4	SEND DATA (A)
SEC RX TIMING (A)	16	5	SEND TIMING (A)
RX DATA (A)	6	6	RX DATA (A)
SEC RR (A)	32	7	RTS (A)
RX TIMING (A)	8	8	RX TIMING (A)
SEC RR (A)	32	9	CTS (A)
DM (A)	11	11	DM (A)
RR (A)	13	13	RR (A)
SIG. GND	19	19	SIG. GND
RX COMMON	20	20	RX COMMON
SEC RX DATA (B)	21	22	SEND DATA (B)
SEC RX TIMING (B)	33	23	SEND TIMING (B)
RX DATA (B)	24	24	RX DATA (B)
SEC RR (B)	34	25	RTS (B)
RX TIMING (B)	26	26	RX TIMING (B)
SEC RR (B)	34	27	CTS (B)
DM (B)	29	29	DM (B)
RR (B)	31	31	RR (B)
SEND COMMON	37	37	SEND COMMON

ZBTSI FRAMING OPTION

3.56 INTRODUCTION

The ZBTSI Framing Option allows the T-BERD 224 to test and analyze T1-ESF circuits that use ZBTSI encoding. ZBTSI encoding is typically used to transmit clear-channel data over T1 AMI-encoded facilities. ZBTSI encoding permits the use of long-haul equipment (e.g., repeaters, multiplexers, line protection equipment, etc.) that is not B8ZS compatible for clear channel applications.

NOTE

Unless otherwise indicated, the capabilities of the mainframe T-BERD 224 are applicable to the ZBTSI Option.

3.57 FUNCTIONAL DESCRIPTION

ZBTSI encoding reorganizes the 576 octets (576 groups of eight bits) that form the 24 ESF frames into six blocks of 96 octets (four frames) each. These 96 octets are then rearranged, depending on the data content of each octet.

ZBTSI encoding follows the following process

1. The data is combined with a pseudorandom pattern to break up long strings of ones and zeros.
2. The data is loaded into a buffer, one octet at a time, until 96 octets are stored in the buffer and numbered from 1 to 96.
3. The contents of all 96 octets are examined for an all-zero condition. If no all-zero octets exist, the 96 octets exit the buffer and the next 96 octets are loaded into the buffer.
4. If non-zero octets exist, they are altered; a gap is created at the front of the first octet.
5. An address byte is inserted in the 8-bit gap; the first seven of the eight bits of this octet provide a binary address indicating the previous location of the octet. Bit 8 is used to indicate whether there are additional all-zero octets following. (If bit 8 is set to a zero, more all-zero octets follow; if bit 8 is set to one, no other all-zero octets follow).
6. When ZBTSI encoding is used, the 24 framing bits are assigned as follows: six Frame Pattern Sequence (FPS) bits, six Cyclic Redundancy Check (CRC-6) bits, six datalink (DL) bits, and six Zero (Z) bits. Half of the original ESF datalink is used to provide the Z bits, which indicate if ZBTSI encoding occurred in the next 96 octet grouping.
7. The 96 octets exit the buffer.

3.58 TEST SETUP

The following test setup controls are affected by the ZBTSI Option (see Table 3-23).

Table 3-23. ZBTSI Option Switch Configuration

Switch	Configuration
MODE	T1-ESFz

3.58.1 MODE Switch

T1-ESFz — Configures the T-BERD 224 to transmit and receive ZBTSI encoded ESF framed T1 data. Thi enables the T-BERD 224 to test ZBTSI-encoded circuits. In T1-ESFz operating mode, the T-BERD 224 adds an additional four frames of transmission delay (500 microseconds) to the 19 bits of delay typically encountered in other modes. In T1-ESFz, the T-BERD 224 can monitor and test the 2 kb/s ESFz datalink (**CHANNELFORMAT** switch set to **DATLINK**). If the ESFz Option is installed, the T-BERD 224 reports and sends the Performance Report Messages (PRMs) on the ESFz (2 kb/s) datalink - ANSI T1.403 PRMs.

3.59 TROUBLESHOOTING CONTROLS

The following troubleshooting controls are affected by the ZBTSI Option.

3.59.1 ERROR INSERT Switches

YELLOW ALARM ERROR INSERT Switch — For ESFz framing, a repetitive pattern of eight ones and eight zeros is generated in the datalink each time this switch is pressed (LED illuminated).

FRAME ERROR INSERT Switch — In ESFz framing, this switch is disabled in T1 LLB, AUTO LLB, and T1 modes.

TR-303 OPTION

3.60 INTRODUCTION

The TR-303 Option allows theT-BERD 224 to monitor link statistics and perform call tracing over Integrated Digital Loop Carrier (IDLC) systems from a DS1 access point. The option supports Timeslot Management Channel (TMC) layer 2 and 3 protocols and Embedded Operations Channel (EOC) layer 2 protocols as defined in the Bellcore specification, TR-NWT-000303 (commonly referred to as TR-303).

NOTE

This option requires the DSP Board Option.

3.61 FUNCTIONAL DESCRIPTION

3.61.1 TR-303 Call Trace

The T-BERD 224 starts a TR-303 call trace by searching for a SETUP message that meets a specific trace criteria (set through AUX 42). When a call is detected, the call reference value is extracted and all related messages are captured and processed; all other messages are ignored. A call trace is automatically restarted when a preset call state condition occurs (set through AUX 41). Test results provide the necessary information to track a call (call state, call reference value, call type, DS1/DS0, cause for disconnect, origination source, and disconnect source).

The T-BERD 224 restarts the call trace after a specified call state is detected (set through AUX 41). The restart occurs on one of the following events: CONNECTED or RELEASED. If the detected call state corresponds to the AUX 41 restart event setting, then the T-BERD 224 starts searching for a new call after a specified delay (also set through AUX 41). All results remain valid during the delay.

There are two types of restart delays set with AUX 41: release and event. The release delay is used when the RELEASED state is detected. The event delay is used when other call states are detected and the restart event is set to something other than RELEASED.

3.61.2 TR-303 Link Statistic

The option enables the T-BERD 224 the ability to monitor all layer 2 (LAPD) messages on the TMC and EOC. Test results are provided that count packets on each line and classifies them as good, CRC errored, or discarded, as well as reporting CRC errored seconds and error rate. In addition, Information frames and Receiver Ready frames are counted. Packets can be counted based on their SAPI/TEI (set through AUX 41)

3.62 TEST SETUP

The following test setup controls are affected by the TR-303 Option (see Table 3-24).

Table 3-24. TR-303 Option Switch Configurations

Switches	Configuration	
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, T1-ESFz, T1SLC96, SLC-D1D, T1-TLB, T1-LLB	
CHANNEL FORMAT	PROTOCL	
SCI	303 MON	
SCII	CALL TRACE	LINK STAT

3.62.1 CHANNELFORMAT Switch

In addition to the mainframe channel format selections, the TR-303 Option adds the following:

PROTOCL — Configures the T-BERD 224 to monitor TR-303 links. This channel format is available in all framed modes.

3.62.2 SOURCE CONFIGURATION I Switch

The following source configuration selections are available when the PROTOCL channel format is selected:

303 MON — Monitor signaling and messaging link information on the TMC or EOC.

3.62.3 SOURCE CONFIGURATION II Switch

The following selections are available when the **SOURCE CONFIGURATION I** switch is set to 303 MON:

CALL TRACE — Monitor call processing of a selected call over the TMC.

LINK STAT — Monitor layer 2 link statistics over the TMC or EOC.

3.62.4 TR-303 Call Trace Controls and Indicator

TR-303 call tracing is configured by setting the **CHANNELFORMAT** switch to PROTOCL, the **SOURCE CONFIGURATION I** switch to 303 MON, and the **SOURCE CONFIGURATION II** switch to CALL TRACE (see Table 3-24).

Pressing the **RESTART** switch abandons the current TR-303 call trace and restarts the search for a new call.

When TR-303 call tracing is selected, the **DROP** switch is forced to BOTH and the **INSERT** switch is forced to NONE.

Select the desired DS0 channel with the **LINE 1** and **LINE 2 CHANNEL** switches (TMC typically appears on DS0 #24).

3.62.5 TR-303 Link Statistics Controls and Indicators

Monitoring TR-303 link statistics is configured by setting the **CHANNEL FORMAT** switch to PROTOCL, the **SOURCE CONFIGURATION I** switch to 303 MON, and the **SOURCE CONFIGURATION II** switch to LINK STAT (see Table 3-24).

When monitoring TR-303 link statistics, the **DROP** switch is forced to BOTH and the **INSERT** switch is forced to NONE.

Select the desired DS0 channel with the **LINE 1** and **LINE 2 CHANNEL** switches (EOC typically appears on DS0 #12 and TMC appears on DS0 #24).

3.63 CIRCUIT CONNECTIONS

3.63.1 TR-303 Call Trace Connections

To perform a TR-303 call trace, the T-BERD 224 must be connected (LINE 1 RECEIVE and LINE 2 RECEIVE) to both sides of the DS1 line to monitor calls. Set the operating mode framing (**MODE** switch) and line code (**CODE** switch) for the line being used. TR-303 DLC terminals use ESF framing and B8ZS line coding.

3.63.2 TR-303 Link Statistics Connections

TR-303 link statistics can be monitored from either direction, individually or simultaneously through the LINE 1 and LINE 2 RECEIVE connections.

3.64 AUXILIARY FUNCTIONS

3.64.1 AUX 40 LNK SEL — Set TR-303 SAPI/TEI Link Selection Filter

The AUX 40 LNK SEL function sets the SAPI/TEI filter when LINK STAT is selected with the **SOURCE CONFIGURATION II** switch. Press the **RESULTS I Arrowed** switch to select one of the following:

***SAPI** — Sets the SAPI filter. Press the **RESULTS I Blank** switch to select one of the following conditions: ANY or SELECT. ANY enables all packets to be counted regardless of SAPI. SELECT enables a specific SAPI packet to be counted. Press the **RESULTS II Arrowed** switch to select the SAPI value from 0 to 63 in the RESULTS II window (hold switch down to accelerate scrolling).

***TEI** — Sets the TEI filter. Press the **RESULTS I Blank** switch to select one of the following conditions: ANY or SELECT. ANY enables all packets to be counted regardless of TEI. SELECT enables a specific TEI packet to be counted. Press the **RESULTS II Arrowed** switch to select the TEI value from 0 to 127 in the RESULTS II window (hold switch down to accelerate scrolling).

Changing the settings causes a test restart.

3.64.2 AUX 41 TRC RST — Set TR-303Call Trace Restart Criteria

The AUX 41 TRC RST function sets the TR-303 call trace restart criteria. Press the **RESULTS I Arrowed** switch to select one of the following:

***RLS DELAY** — Sets the release delay criteria. Press the **RESULTS I Blank** switch to select one of the following release delays: NONE, 1 SECOND, 2 SECONDS, 5 SECONDS, 10 SECONDS, 30 SECONDS, or FOREVER.

***EVENT** — Sets the restart event criteria. Press the **RESULTS I Blank** switch to select one of the following restart events: CONNECTED or RELEASED. Press the **RESULTS II Arrowed** switch to select one of the following event delays: NONE, 1 SECOND, 2 SECONDS, 5 SECONDS, 10 SECONDS, 30 SECONDS, or FOREVER.

Changing the settings causes a test restart.

3.64.3 AUX 42 303 TRC — Set TR-303 Call Trace Criteri

The AUX 42 303 TRC function configures the TR-303 call trace filters. The filter sets the origination source, call type, and call reference value (CRV). The test instrument can only trace one call at a time. For example, trace a voice call that originates from the CO and with a CRV of 234. This auxiliary function is only available when the **AUX** switch is pressed in the TR-303 call trace mode.

Press the **SOURCE CONFIGURATION I** switch to select the following auxiliary function options:

***SOURCE** — Sets the call trace origination source criteria. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

CO — Call trace looks for a call from the central office.

RT — Call trace looks for a call from the remote terminal.

ANY — Call trace looks for a call from either direction.

***CALL TYPE** — Sets the call trace call type criteria. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

POTS — Call trace looks for a POTS call.

ISDN — Call trace looks for a Basic Rate ISDN call.

ANY — Call trace looks for any type call.

***LINE (CRV)** — Sets the call trace subscriber line (call reference value) criteria. Press the **SOURCE CONFIGURATION II** switch to select one of the following:

ANY — Call trace looks for any CRV.

SELECT — Press the **RESULTS I Blank** switch to select a line (CRV) from 1 to 2048 (hold switch down to accelerate scrolling).

Changing the settings causes a test restart.

3.65 TEST RESULTS

Refer to Section 5.7.6 for TR-303 Link Statistics test results and Section 5.7.7 for TR-303 Call Trace test results.

3.66 PRINTOUTS

If the **PRINT EVENT** switch is set to TEST END, the TR-303 Call Trace test results are printed when the call state is RELEASED as shown in Figure 3-17.

```
CALL TRACE PRINT     10:15:37 AUG 23 96
 CALL STATE:  RELEASED
 LINE (CRV):     1468
 DS1/DS0:       27   15
 CALL TYPE:      POTS
 ORIG SRC:    RT (L2)
 DISC SRC:    CO (L1)
 CAUSE:           16
```

Figure 3-17. TR-303 Call Trace Test Results Printout

SONET/DS3 ANALYZER OPTION

3.67 INTRODUCTION

This section describes the installation and operation for the SONET/DS3 Analyzer Option (Model 224-1) for the T-BERD 224 which provides the following features:

Dual STS-1/DS3 receivers provide analysis of the received signal.

STS-1/DS3 transmitter enables the T-BERD 224 to insert a DS1 signal into a DS3 or STS-1 output.

Drops DS1 (VT1.5) channels to the T-BERD 224 from the STS-1/DS3 input signals for DS1 and DS0 analysis.

Inserts DS1 (VT1.5) channels from the T-BERD 224 to the STS-1/DS3 output to test specific DS1 signals.

Lid provides user interface control to qualify STS-1 and DS3 (M13 and C-Bit framing) circuits with appropriate test patterns.

Field installable printed circuit board provides dual WECO 560A receive connections and one WECO 560A transmit connection for STS-1 or DS3 signals, and a Bantam input connection for the DS1 BITS clock.

STS-1/DS3 Error and Alarm insertion enables the T-BERD 224-1 to test and verify network continuity and integrity.

Status LED identify the condition of the received STS-1/DS3 signals.

3.68 INSTALLATION

This section describes how to install and checkoutthe T-BERD 224 SONET/DS3 Analyzer Option.

3.68.1 Installing Hardware

Perform the following procedure to install the SONET/DS3 Analyzer Option Lid and printed circuit board (PCB). If the Signaling Option Keypad Lid is installed, a replacement Keypad is supplied that mounts to the SONET/DS3 Analyzer Option Lid.

WARNING

The PCBs in this procedure contain static sensitive devices. Follow standard electrostatic discharge precautions when handling the EPROM and Processor PCBs. When handling either PCB, wear a properly grounded static dissipation wrist strap and hold the PCB by the edges.

3.68.1.1 Installing SONET/DS3 Analyzer Option PCB

1. Remove power and power cord from the T-BERD 224.
2. Remove top cover.
3. Remove SONET/DS3 Analyzer Option PCB from plastic bag.

4. Remove screw and side-panel slot cover from Slot 5 (count from front panel).
5. Slide PCB into slot with left edge in PCB guide and PCB bracket screw slot over side-panel screw hole.
6. Press gently but firmly on PCB until PCB connector snaps into motherboard connector. PCB should be even with the other PCBs.
7. Secure PCB with screw previously removed with side-panel slot cover.

3.68.1.2 Removing Processor PCB

1. Locate Processor PCB in Slot 8 and remove Phillips-head screw from bracket flange. Save screw.
2. Pull Processor PCB out of chassis by alternately lifting up on ejector handle and top flange of bracket until PCB is freed from motherboard connector.
3. Lay Processor PCB down on a flat surface with component side up.

3.68.1.3 Replacing EPROM PCB

1. Locate EPROM PCB on upper middle of Processor PCB. Remove Phillips-head screw and washer securing EPROM PCB to Processor PCB. Save screw and washer.
2. Dislodge EPROM PCB by pushing card forward with your thumbs.
3. Remove new EPROM PCB from its wrapper and slide it into connector on Processor PCB with component side up. (EPROM PCB snaps into place when downward pressure is applied.)
4. Secure EPROM PCB to Processor PCB with previously removed Phillips-head screw and washer.
5. The old EPROM PCB is not recyclable. Dispose of it in accordance with local solid waste requirements.

3.68.1.4 Installing Processor PCB

1. Slide Processor PCB into Slot 8 until bottom edge connectors are aligned with, but only resting on, motherboard connector. Ensure the left side of PCB is in left side card guide. The bracket slot guide fits in slot at bottom of chassis.

****
CAUTION
****

Do not force Processor PCB bottom edge connector into motherboard connector.
Connector pins can be bent or broken if PCB is improperly inserted.

2. Press gently but firmly on PCB ejector handle and bracket flange until bottom edge connectors are fully seated into motherboard connectors. The bracket flange should be flush with chassis and flange screw slot should be aligned with screw hole in chassis. The ejector handle should be level with other PCB ejector handles.
3. Secure bracket flange with 4-40 panhead screw that was previously removed.
4. Replace top cover.

3.68.1.5 Installing SONET/DS3 Analyzer Option Lid

1. If necessary, remove current lid option from instrument by disconnecting AUXILIARY PORT cable, then compressing hinge clips and rotating them up toward front panel to release lid from test instrument.
2. Remove SONET/DS3 Analyzer Option lid from plastic bag.
3. Compress hinge clips and rotate up to secure hinge pins in retracted position.

4. Align lid hinge pins with test instrument hinges.
5. Release hinge clips to allow hinge pins to latch into test instrument hinges.
6. Verify lid swings freely. Plug Lid cable into side-panel connector of installed PCB, marked LID INTF.
7. Remove optional Signaling Keypad from plastic bag.
8. Slide Signaling Keypad onto left side of SONET/DS3 Option lid and plug cable into Auxiliary Port (see Figure 3-18).

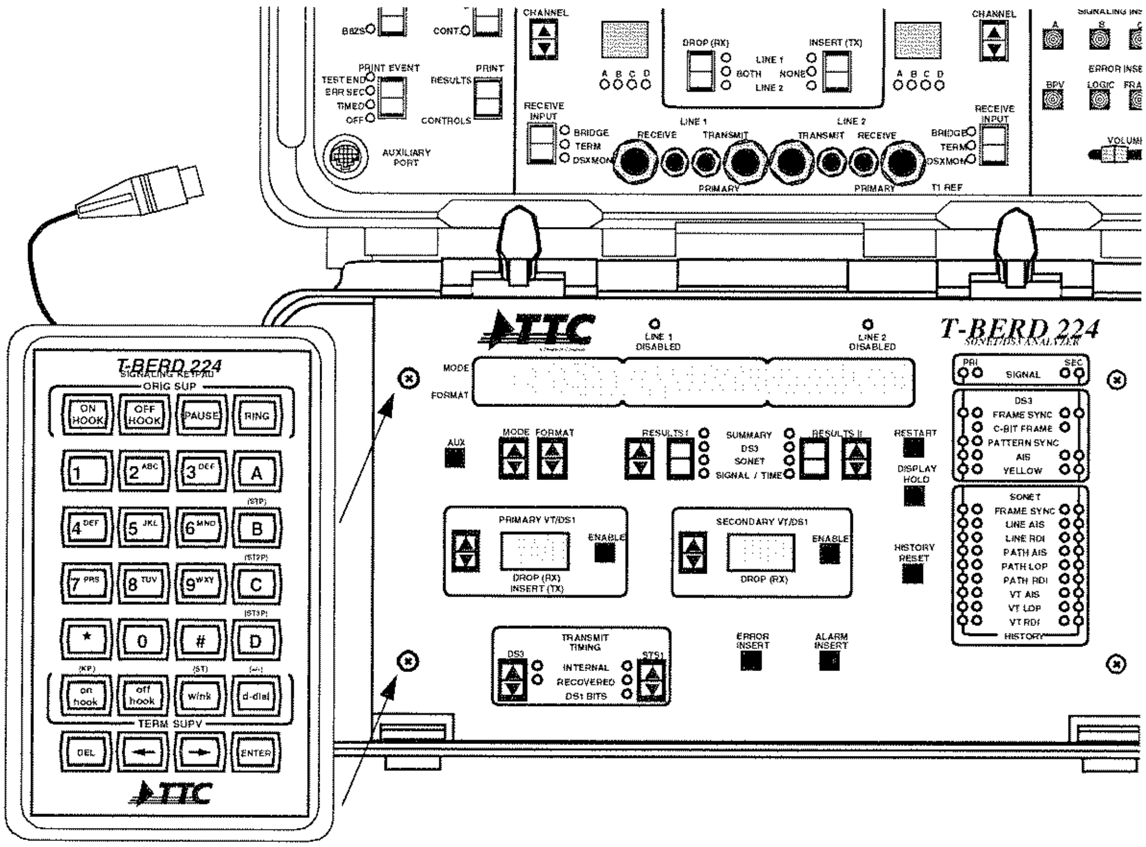


Figure 3-18. Installing Signaling Keypad

3.68.2 Option Checkout

Perform the following procedure to checkout the SONET/DS3 Analyzer Option.

1. Reconnect power cord and turn power on.
2. Verify the following self test and initialization sequence occurs on the Lid:
   a. The message ***Testing RAM . . .*** appears.
   b. After several seconds the message ***Testing RAM . . . PASS/FAIL*** appears. If the RAM test passes, the sequence continues with Step c.

      If the RAM test fails, the test instrument resets itself and attempts to test RAM again. Contact TTC Customer Service if the test fails again.

c. The message ***SW VERSION: A (c) TTC 3/15/97*** (date identifies release date) appears for 3 seconds and all of the LEDs illuminate for visual verification until the end of the initialization sequence.

d. The message ***Testing Mainframe Comm Link . . .*** appears for up to 60 seconds, while the mainframe is initializing, to test the communications link between the mainframe and Lid.

e. The message ***Testing Mainframe Comm Link . .. PASS*** appears when communications between the mainframe and Lid occurs; the sequence continues with Step f.

If the message ***ERROR: 0C02 SQIS: (0009) Mainframe Communications Fault*** appears, the communications link test failed. However, the Lid can still be used to test SONET/DS3 signals except it cannot perform DS1 drop and insert functions with the mainframe. Contact TTC Customer Service if the test fails.

f. The Lid switches are tested. If the message ***xxxx Key Stuck*** does not appear and the mode, pattern, and results appear, the Lid is ready for testing.

If the message does appear, the indicated switch (***xxxx***) may be pressed, perceived as stuck, or broken. After 3 seconds the message disappears and the Lid is ready for testing, with the exception of the indicated switch. Contact TTC Customer Service if the test fails.

The ***Key Stuck*** message applies to all front-panel switches, except the **RESTART** switch. Pressing the **RESTART** switch during power-up causes the Lid to reload NOVRAM with the factory defaults and display CLEARING NOVRAM.

3.69 INSTRUMENT DESCRIPTION

The SONET/DS3 Analyzer Option provides the T-BERD 224 with the ability to connect to either an STS-1 or DS3 test access point. This section describes the controls, indicators, and connections for the option to drop and insert a DS1 channel through a DS3 or STS-1 test access point, as well as transmit DS3/STS-1 test patterns and analyze DS3/STS-1 level errors and alarms. The option replaces the standard T-BERD 224 lid. The SONET/DS3 Analyzer Option lid is shown in Figure 3-19 with the controls and indicators marked with numbered callouts. Table 3-25 describes the controls and indicators.

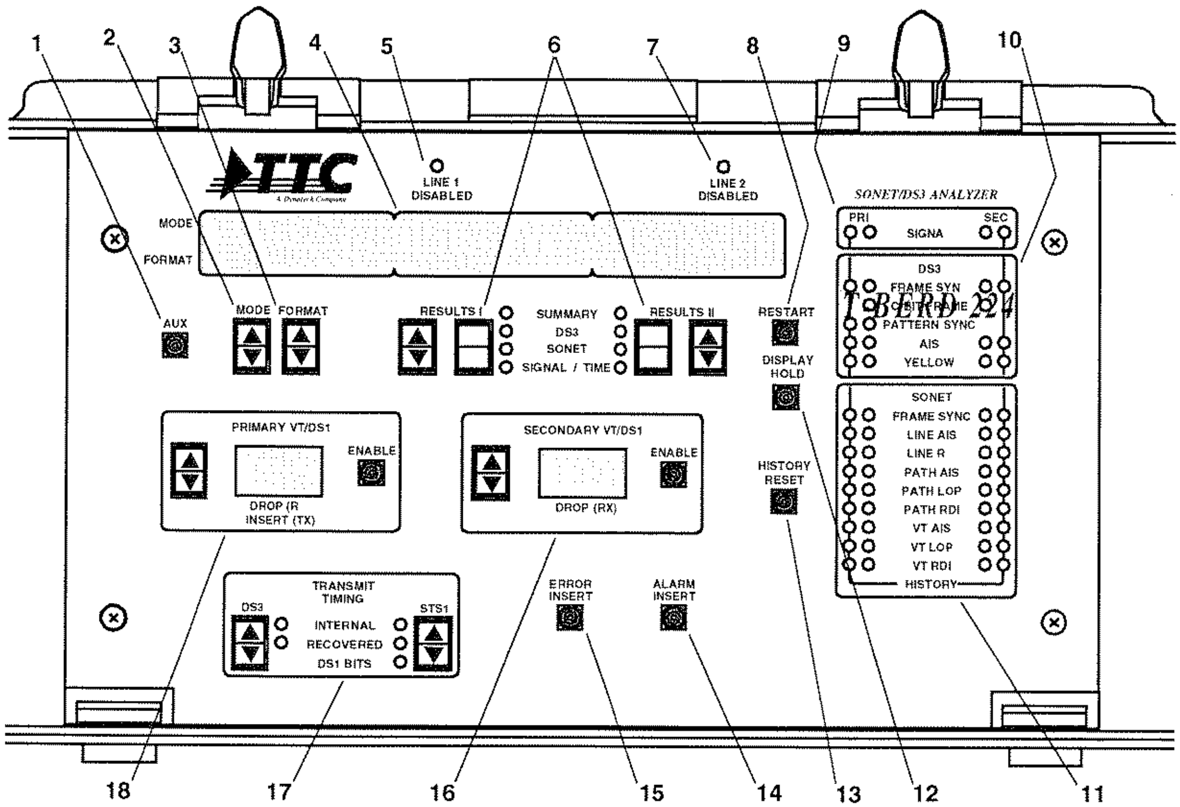


Figure 3-19. SONET/DS3 Analyzer Option Lid

Table 3-25. SONET/DS3 Option Lid Controls and Indicato r

Callout	Control/Indicator	Description
1	**AUX** Switch	Press switch to display auxiliary functions (see Section 3.71). Switch illuminates when it is active.
2	**MODE** Switch	Press switch to select an operating mode: DS3-M13, DS3-CBIT, DS3-UNFRAMED, STS/DS3-M13, STS/DS3-CBIT,STS/VT1.5, and AUTO (see Section 3.69.1.1). When **AUX** switch is illuminated, press switch to scroll/select auxiliary functions.
3	**FORMAT** Switch	Press switch to select pattern/source for operating mode: 2^23-1, 2^20-1, 2^15-1, 1100 (IDLE), ALL ONES, 1010 (BLUE) (framed), 1010 (unframed), DS1 DROP/INS, and MUXED (see Section 3.69.1.2).
4	LCD Display	Two by 40 column liquid crystal display (LCD) with three windows. The first window displays selected operating mode (see **MODE** switch) and pattern/source (see **FORMAT** switch). The second and third windows display test results (see **RESULTS I/II** switches). Also displays auxiliary functions (see **AUX** switch).
5/7	LINE1/2 DISABLED LEDs	LINE 1 DISABLED LED illuminates when the LINE 1 connections on the T-BERD 224 are disabled and the primary VT/DS1 drop/insert function is enabled. LINE 2 DISABLED LED illuminates when the LINE 2 connections on the T-BERD 224 are disabled and the secondary VT/DS1 drop function is enabled.
6	**RESULTS I/ RESULTS II** Switches	Press **RESULTS I/II Arrowed** switch (outer two switches) to select test results within a selected category. Press **RESULTS I/II Blank** switch (inner two switches) to select test results categories (LED illuminates when category is selected): SUMMARY, DS3, SONET, and SIGNAL/TIME (see Section 5.8). When **AUX** switch is illuminated, press **RESULTS I blank** switch to select auxiliary function parameters.

Table 3-25. SONET/DS3 Option Lid Controls and Indicators (Continued)

Callout	Control/Indicator	Description
8	**RESTART** Switch	Press switch to clear status and alarm LEDs, restart AUTO mode when selected, and reset test results to zero on Lid only. Press and hold switch during power-up to reset NOVRAM to factory defaults on Lid only.
9	PRI/SEC SIGNAL LEDs	Indicates current (inner LEDs) and historic (outer HISTORY LEDs) status of the presence of a received DS3 or SONET signal (primary and secondary sources) after initial signal detection (see Section 3.69.1.3).
10	PRI/SEC DS3 Status LEDs	Indicates current (inner LEDs) and historic (outer HISTORY LEDs) status of the received DS3 signal (primary and secondary sources) after initial signal detection and synchronization (see Section 3.69.1.4).
11	PRI/SEC SONET Status LEDs	Indicates current (inner LEDs) and historic (outer HISTORY LEDs) status of the received SONET signal (primary and secondary sources) after initial signal detection and synchronization (see Section 3.69.1.5).
12	**DISPLAY HOLD** Switch	Press switch (illuminates when enabled) to freeze test result counts and status and alarm LEDs on Lid only. Press **RESULTS** switches to scroll through test results (results continue to accumulate in the background). Press switch again to release display and update results.
13	**HISTORY RESET** Switch	Press switch to clear HISTORY LEDs on Lid only.
14	**ALARM INSERT** Switch	Press switch to insert a DS3 and/or STS-1 alarm condition (illuminates when active). The alarms are selected through the auxiliary functions. Press switch again to halt alarm insertion.
15	**ERROR INSERT** Switch	Press switch to insert a variable error insert (flashes once when activated).
16	**SECONDARY VT/DS1** Switches	Press **SECONDARY VT/DS1 Arrowed** switch to select a VT number (1-1 to 7-4) or DS1 channel (01 to 28) from the STS-1 or DS3 source connected to the side-panel SEC RX jack. Press the **ENABLE** switch (illuminates when active) to drop the selected VT number or DS1 channel to the T-BERD 224 mainframe for further testing. Press **ENABLE** switch again to disable dropped signal. Table 3-26 lists the DS1 channel verses the VT group number.
17	**TRANSMIT TIMING** Switches	Press **DS3** switch to select the DS3 transmit timing source: INTERNAL or RECOVERED (LED illuminates for selected timing source). Press **STS1** switch to select the SONET transmit timing source: INTERNAL, RECOVERED, or DS1 BITS. RECOVERED and DS1 BITS LEDs flash when selected and the appropriate signal is not present (option reverts to internal timing during this period).
18	**PRIMARY VT/DS1** Switches	Press **PRIMARY VT/DS1 Arrowed** switch to select a VT number (1-1 to 7-4) or DS1 channel (01 to 28) from the STS-1 or DS3 source connected to the side-panel PRI RX jack and/or insert a generated DS1 signal into the transmitted STS-1/DS3 signal from the side-panel PRI TX jack. Press the **ENABLE** switch (illuminates when active) to drop/insert the selected VT number or DS1 channel. Press **ENABLE** switch again to disable dropped/inserted signal. Table 3-26 lists the DS1 channel verses the VT group number.

Table 3-26. DS1 Channel Vs. VT Group Number

DS1 Channel	VT Group Number	DS1 Channel	VT Group Number
1	1,1	15	1,3
2	2,1	16	2,3
3	3,1	17	3,3
4	4,1	18	4,3
5	5,1	19	5,3
6	6,1	20	6,3

Table 3-26. DS1 Channel Vs. VT Group Number (Continued)

DS1 Channel	VT Group Number	DS1 Channel	VT Group Number
7	7,1	21	7,3
8	1,2	22	1,4
9	2,2	23	2,4
10	3,2	24	3,4
11	4,2	25	4,4
12	5,2	26	5,4
13	6,2	27	6,4
14	7,2	28	7,4

3.69.1 Test Setup

The following controls and indicators are described in greater detail. The number in the paragraph heading refers to the callout in Table 3-25 and Figure 3-19.

3.69.1.1 MODE Switch (2)

The **MODE** switch configures the Lid option to synchronize to and transmit the following framing modes or automatically synchronize to the received signal.

DS3-M13 — DS3 signal with M13 framing.

DS3-CBIT — DS3 signal with C-bit framing.

DS3-UNFRAMED — Unframed DS3 signal.

STS/DS3-M13 — STS-1 signal with a DS3 M13 framed payload.

STS/DS3-CBIT — STS-1 signal with a DS3 C-bit framing payload.

STS/VT1.5 — STS-1 signal with a VT1.5 (DS1) payload.

AUTO — Automatically detects and configures test instrument for the indicated signal format (type and framing as well as the pattern). The detected signal format appears in the display MODE field. The following messages appear as the Lid scans and configures itself for testing.

scan... — Scanning both primary and secondary inputs for a valid signal format. While scanning, the received signal is looped from PRI RX receiver to the PRI TX transmitter, and the **PRIMARY VT/DS1** and **SECONDARY VT/DS1** switches are disabled ("— — —" appear in the displays). When a valid signal is detected (Signal LED illuminates), the loop between the receiver and transmitter is removed and the Lid transmits the detected pattern in the detected mode. Also, the **PRIMARY VT/DS1** and **SECONDARY VT/DS1** switches can be enabled if valid for detected mode. The test results are unavailable until a valid signal is detected. If the received pattern is not recognized or live data is received, the test set will display *"live"* in the format field. Therefore, when a supported mode is detected, the mode field changes to one of the following:

ds3-m13 — DS3 signal with M13 framing detected.

ds3-cbit — DS3 signal with C-bit framing detected.

ds3-unframed — Unframed DS3 signal detected.

sts/ds3-m13 — STS-1 signal with a DS3 M13 framed payload detected.

sts/ds3-cbit — STS-1 signal with a DS3 C-bit framing payload detected.

sts/vt1.5 — STS-1 signal with a VT1.5 (DS1) payload detected.

sts/live — STS-1 signal with an unsupported payload detected. The PRI receiver and transmitter remain looped.

live — None of the applicable stress patterns (above) detected .

3.69.1.2 FORMAT Switch (3)

The **FORMAT** switch provides the following DS3 test patterns and DS1/VT1.5 drop and insert functionality. When performing a BER test, the Lid must receive the selected test pattern to provide the necessary error results.

2^23-1 — Generates a DS3 framed or unframed 2^23-1 test pattern.

2^20-1 — Generates a DS3 framed or unframed 2^20-1 test pattern.

2^15-1 — Generates a DS3 framed or unframed 2^15-1 test pattern.

1010 (BLUE) — Generates a DS3 framed Blue alarm.

1100 (IDLE) — Generates a DS3 framed Idle pattern.

ALL ONES — Generates a DS3 framed or unframed All Ones test pattern.

1100 — Generates a DS3 unframed 1100 pattern.

1010 — Generates a DS3 unframed 1010 test pattern.

DS1 DROP/INS — Configures the Lid to drop a DS1/VT1.5 signal from both STS-1/DS3 inputs (PRI RX and SEC RX jacks) to the T-BERD 224 for analysis. It also configures the Lid to insert a DS1 signal from the T-BERD 224 into the transmitted STS-1/DS3 signal (PRI TX jack). The function is available for all operating modes, except DS3-UNFRAMED. Individual DS1/VT1.5 signals are selected with the **PRIMARY VT/DS1** and **SECONDARY VT/DS1** switches. Only the DS1/VT1.5 signal under test is affected when inserting the test signal. The remaining 27 DS1 channels pass through the T-BERD 224-1 unaffected.

MUXED — Enables a selected DS1 channel to be dropped/inserted into a DS3 signal while the remaining 27 DS1 channels are filled with a framed all ones pattern.

LIVE — No pattern from the above series of tests was received or recognized.

3.69.1.3 Signal LEDs (9)

The Signal LEDs indicate the presence (green LED illuminates) of STS-1 or DS3 signal pulses on either receiver (PRI RX and SEC RX). Signal presence is declared (green LED illuminates) when there is at least 10 ones in 32 consecutive bits, and the input amplitude is greater than 25 mV. Signal loss occurs (red History LED illuminates) when the input amplitude is 1 dB below 25 mVpk, or there are 160 ±32 consecutive zero in the received signal. A valid signal must be detected before testing can begin.

3.69.1.4 DS3 LEDs (10)

The DS3 LEDs indicate the presence or loss of specific DS3 framing, pattern synchronization (if expecting a specific pattern), and alarm conditions on either receiver (PRI RX and SEC RX). DS3 LEDs include the following:

Frame Sync LEDs — Indicates the presence (green LED illuminates) of DS3 frame synchronization. A valid signal must be detected before testing can begin. When framing is no longer detected, the green LED goes out and the associated red History LED illuminates.

C-Bit Frame LEDs — Indicates the presence (green LED illuminates) of C-bit framing.

Pattern Sync LEDs — Indicates the presence (green LED illuminates) of pattern synchronization between the transmitted and received test pattern (PRI RX only). Pattern synchronization is only available from the PRI RX connection. When pattern synchronization is no longer detected, the green LED goes out and the associated red History LED illuminates.

AIS LED — Indicates the presence (red LED illuminates) of an Alarm Indication Signal (AIS). When AIS is no longer detected, the LED goes out and the associated History LED illuminates.

Yellow LEDs — Indicates the presence (red LED illuminates) ofa Yellow alarm. Whena Yellow alar is no longer detected, the LED goes out and the associated History LED illuminates.

3.69.1.5 SONET LEDs (11)

The SONET LEDs indicate the presence or loss of specific STS-1 framing and alarm conditions on either receiver (PRI RX and SEC RX). SONET LEDs include the following:

Frame Sync LEDs — Indicates the presence (green LED illuminates) of STS-1 frame synchronization. A valid signal and frame synchronization must be detected before testing can begin. When framing is no longer detected, the green LED goes out and the associated red History LED illuminates.

NOTE

When any of the following alarms is no longer detected, the indicated LED goes out and the associated History LED illuminates.

Line AIS LEDs — Indicates the presence (red LED illuminates) of Line alarm indication signal (AIS) alarm. It is declared after detecting a 111 pattern in the Line overhead APS byte (K2), Bits 6 to 8, for five consecutive frames. Line AIS is removed after detecting a pattern other than 111 in Bits 6-8 of byte K2 for five consecutive frames. Line AIS indicates to downstream equipment that an upstream section terminating equipment (STE) has detected loss of signal or loss of framing.

Line RDI LEDs — Indicates the presence (red LED illuminates) of Line remote defect indication (RDI) alarm (also known as far-end receive fail (FERF) alarm). It is declared after detecting a 110 pattern in the Line overhead APS byte (K2), Bits 6 to 8, for five consecutive frames. Line RDI is removed after detecting a pattern other than 110 in Bits 6-8 of byte K2 for five consecutive frames. Line RDI alerts an upstream device of a downstream failure, such as loss of signal, loss of frame, or Line AIS.

Path AIS LEDs — Indicates the presence (red LED illuminates) of Path AIS alarm. It is declared after detecting an all ones pattern in the Line overhead pointer bytes (H1 and H2) for three consecutive frames. Path AIS is removed when a valid set of pointer bytes and active new data flags (NDFs) are received, or when a valid pointer value is observed in three consecutive frames. Path AIS alerts the downstream path terminating equipment (PTE) that an upstream failure has occurred.

Path LOP LEDs — Indicates the presence (red LED illuminates) of Path loss of pointer (LOP) alarm. It is declared when a valid pointer value cannot be determined from the Line overhead pointer bytes (H1 and H2). Specifically, Path LOP is declared if a valid pointer is not found in eight consecutive frames, or if eight consecutive active NDFs are received without the corresponding concatenation indication. The Path LOP alarm is removed when a consistent pointer value or concatenation indication is received for three consecutive frames.

Path RDI LEDs — Indicates the presence (red LED illuminates) of Path RDI alarm (also known as RAI or Yellow Alarm). It is declared after detecting a one in Bit 5 of the Path status byte (G1) for five consecutive frames. STS Path RDI is removed after Bit 5 of byte G1 contains a zero for five consecutive frames. Path RDI indicates to the upstream PTE that a downstream failure has been detected.

VT AIS LEDs — Indicates the presence (red LED illuminates) of VT AIS alarm. It is declared after detecting an all ones pattern in the VT pointer bytes (V1 and V2) for three consecutive VT superframes. VT AIS is removed under two conditions: when a valid VT pointer, valid VT size, and the NDF 1001 flag are detected, or three consecutive VT superframes containing a valid VT pointer, valid VT size, and a normal NDF are detected. VT AIS alerts the downstream VT PTE of an upstream failure.

VT LOP LEDs — Indicates the presence (red LED illuminates) of VT LOP alarm. It is declared when a valid pointer value cannot be determined from the VT Path overhead bytes (V1 and V2). Specifically, VT Path LOP is declared when a valid pointer is not found in eight contiguous VT superframes, or when eight contiguous VT superframes are detected with the VT NDF set to 1001. The VT Path LOP alarm is removed when a valid pointer is detected in three consecutive superframes with NDF set to 0110.

VT RDI LEDs — Indicates the presence (red LED illuminates) of VT RDI alarm (also known as RAI or Yellow Alarm). It is declared after detecting a one in Bit 8 of the VT Path overhead byte (V5) for five consecutive VT superframes. The VT Path RDI alarm is removed when a zero is detected in Bit 8 of byte V5 for five consecutive frames. VT RDI indicates to the upstream VT PTE that a downstream failure has been detected.

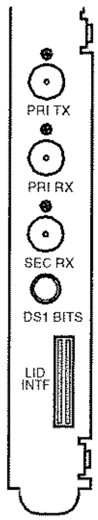
3.70 CIRCUIT CONNECTIONS

3.70.1 Front-Panel Connections

During drop and insert testing between the T-BERD 224 and the STS-1/DS3 connections, the T-BERD 224 front-panel LINE 1 and LINE 2 connections are disabled only when the **PRIMARY/SECONDARY VT/DS1 ENABLE** switch is enabled (switch illuminates when active). The LINE 1/2 DISABLED LEDs illuminate when a DS1 signal is being dropped and/or inserted indicating the T-BERD 224 connections are disabled.

3.70.2 Side-Panel Connections

The SONET/DS3 Analyzer Option provides side-panel connections for two STS-1/DS3 receivers, one SONET/DS3 transmitter connection, DS1 BITS clock input connection, and a Lid interface connection as show in Figure 3-20.



PRI TX Jack — This is a WECO 560A jack that transmits DS3 or STS-1 signals. A DS1 signal generated and inserted by the T-BERD 224 is available in the STS-1 or DS3 payload from this jack.

PRI RX Jack — This is a WECO 560A jack that accepts DS3 or STS-1 signals. A DS1 signal dropped from this connection is analyzed by the T-BERD 224 LINE 1 receiver.

SEC RX Jack — This is a WECO 560A jack that accepts DS3 or STS-1 signals. A DS1 signal dropped from this connection is analyzed bythe T-BERD 224 LINE 2 receiver.

DS1 BITS Jack — This is a Bantam jack that accepts DS1 clock source for STS-1 transmit timing. This source is selected through the **STS1 TRANSMIT TIMING** switch.

LID INTF Connector — This is a 15-pin straight connector that provides the Lid/T-BERD 224 interface.

Figure 3-20. SONET/DS3 Analyzer Side-Panel Connections

3.71 AUXILIARY FUNCTIONS

Auxiliary functions enable access to parameters that are not frequently used and do not have dedicated front-panel switches. The auxiliary functions appear when the **AUX** switch is pressed and illuminated. The individual auxiliary functions are selected by pressing the **MODE** switch. The auxiliary function parameters are selected by pressing the **RESULTS I blank** switch. Refer to Section 4.3 for a description of the following auxiliary functions:

- AUX 10 DS3 ALARM
- AUX 11 DS3 ERR INS
- AUX 20 STS1 ALARM
- AUX 21 SON ERR INS
- AUX 22 PATH TRACE

3.72 TEST RESULTS

The SONET/DS3 Analyzer Option provides four test result categories: SUMMARY, DS3, SONET, and SIGNAL/TIME. Refer to Section 5.8 for detailed information on the available test results.

SECTION 4 AUXILIARY FUNCTIONS

4.1 INTRODUCTION

Auxiliary functions allow access to parameters that are not frequently used and do not have dedicated switches. Press the **AUX** switch to access the auxiliary functions. The switch LED illuminates (LED on) when the auxiliary functions are active and is extinguished (LED off) when the auxiliary functions are not active. The auxiliary functions require the use of the entire display and the corresponding switches.

Table 4-1 lists the auxiliary functions and groups them according to the option required to access the auxiliary function.

Table 4-1. Auxiliary Function

Option	Message	Description
MAINFRAME	AUX 01 CL FIFO	Clear Print FIFO
	AUX 02 TIM PRI	Timed Print Event
	AUX 03 TES LEN	Timed Test Length
	AUX 04 TIM/DAY	Clock Time and Date
	AUX 05 LBO	Line Build-Out
	AUX 06 BACK TM	Backup Timing Source
	AUX 08 RS 232	RS-232 Port Configuration
	AUX 32 LN CODE	Independent Line Coding
	AUX 35 CUSTOM	Custom Results
	AUX 50 DELAY	Enable or Disable 3 Second Channel Delay
IEEE-488 OPTION	AUX 09 488 MODE	IEEE-488 Mode and Address
T1 BERT OPTION	AUX 09 488 MODE	IEEE-488 Mode and Address
	AUX 13 ERR RT	Error Rate
	AUX 14 FRM ERR	Frame Error Insert
	AUX 15 USER	User Programmable Test Pattern
	AUX 16 PGM LP	Programmable Loop Codes
	AUX 17 LOOP CD	Loop Codes
	AUX 18 AUT RES	Automatic Loop Code Response
DSU-DP OPTION	AUX 07 DS0 TM	DS0 Interface Timing
	AUX 10 N-CONTG	Non-Contiguous Channel
	AUX 11 ANL CHA	DSU-DP Analysis Channel
	AUX 12 ERR COR	DS0A Error Correction
FRACTIONAL T1 OPTION	AUX 10 N-CONTG	Non-Contiguous Channel
	AUX 20 PRM TX	PRM Transmission
DDS OPTION	AUX 12 ERR COR	DS0A Error Correction
	AUX 19 DDS CHN	DDS Analysis Channel and Secondary Channel Pattern
	AUX 30 MJU	DDS MJU Control
ENHANCED ESF/SLC OPTION	AUX 20 PRM TX	PRM Transmission
SMART LOOPBACK/COMMANDS CODES OPTION	AUX 17 LOOP CD	Loop Codes
	AUX 35 CUSTOM	Custom Results
VF OPTION	AUX 21 SWEEP	Sweep Parameters
	AUX 22 VFBURST	VF Burst
	AUX 23 PRT OPT	Print Option (Frequency Sweep)

Table 4-1. Auxiliary Functions (Continued)

Option	Message	Description
SIGNALING OPTION	AUX 24 TRK DEF	Trunk Type Definition
	AUX 25 DIG MAR	Digit Margining
	AUX 26 DIALSEQ	Dial Sequence
	AUX 27 REC SEQ	Receive Sequence
	AUX 28 DEF SPV	Define Supervision Events
	AUX 29 SCANSET	Channel Signaling Scan Setting
CALLER ID OPTION	AUX 29 SCANSET	Channel Signaling Scan Setting
	AUX 31 CALL ID	Caller ID Signaling Selection
	AUX 35 CUSTOM	Custom Results for Caller ID
TR-303 OPTION	AUX 42 303 TRC	Sets Call Trace of TR-303
	AUX 99 HELP	Describes Cause Value
SS7 CALL TRACE OPTION	AUX 22 PATH TRACE	Identifies Valid Path Trace
	AUX 35 CUSTOM	Custom Results for SS7
	AUX 41 TRC RST	Sets Trace Restart for SS7
	AUX 46 SS7 TRC	Sets Call Trace Criteria
	AUX 99 HELP	Describes Cause Value
PRIMARY RATE ISDN OPTION (PRI)	AUX 22 PATH TRACE	Identifies Valid Path Trace for PRI
	AUX 43 PRI TRC	Sets Call Trace Criteria for PRI
	AUX 99 HELP	Describes Cause Value
SONET/DS3 OPTION (found on Lid Option only)	AUX 10 DS3 ALARM	Inserts Yellow Alarm
	AUX 11 DS3 ERR INS	Inserts Three Types of DS3 Errors
	AUX 20 STS1 ALARM	Sets STS1 Alarms
	AUX 21 SON ERR INS	Inserts Four Types of SONET Errors
	AUX 22 PATH TRC	Identifies Valid Path Trace for SONET/DS3

4.2 AUXILIARY FUNCTIONS

The auxiliary functions are listed in numerical order. An example and description of each auxiliary function is provided.

4.2.1 AUX 01 CL FIFO — Clear Print FIFO Buffer

```
AUX 01      CLEAR PRINT FIFO
CL FIFO     YES? PRESS SRC CONFIG 2 SWITCH
```

The AUX 01 CL FIFO function allows the user to clear the print FIFO buffer.

Press the **SOURCE CONFIGURATION II** switch to reset the printer squelch feature. The message *FIFO CLEARE* flashes in the display when the print buffer is empty

4.2.2 AUX 02 TIM PRI — Set Timed Print Event Duration

AUX 02	TIMED PRINT EVENT		
TIM PRI	6 HRS	00 MINS	00 SECS

The AUX 02 TIM PRI function sets the time interval for results printouts. The interval is active when the **PRINT EVEN** switch is set to TIMED. The timed interval can vary from 15 seconds up to 6 hours.

Press the **SOURCE CONFIGURATION II** switch to set the hours, the **RESULTS I Blank** switch to set the minutes, and the **RESULTS II Arrowed** switch to set the seconds.

4.2.3 AUX 03 TES LEN — Set Timed Test Length Duration

AUX 03	TIMED TEST LENGTH		
TES LEN	200 HRS	0 MINS	00 SECS

The AUX 03 TES LEN function sets the time interval for a timed test. The interval is active when the **TEST** switch is set to TIMED. During a timed test, changing the test length causes a test restart. The timed interval can vary from 15 seconds up to 200 hours, 59 minutes, and 45 seconds.

NOTE

The **TEST** switch default setting in SWI-56 and SIGNLNG applications is CONTinuous.

Press the **SOURCE CONFIGURATION II** switch to set the hours, the **RESULTS I Blank** switch to set the minutes, and the **RESULTS II Arrowed** switch to set the seconds.

4.2.4 AUX 04 TIM/DAY — Clock Time and Date

AUX 04	CLOCK TIME and DATE		
TIM/DAY	12HRS	30MINS	JAN 1

The AUX 04 TIM/DAY function allows the user to set the real-time clock and calendar date.

Press the **SOURCE CONFIGURATION I** switch to set the hour and the **SOURCE CONFIGURATION II** switch to set the minutes. The time is based on a 24-hour (military) clock.

Press the **RESULTS I Arrowed** switch to set the month and the **RESULTS I Blank** switch to set the day. Press the **RESULTS II Arrowed** switch to set the year.

4.2.5 AUX 05 LBO — Line Build-Out Level

AUX 05	LINE 1	LINE 2
LBO	0 dB	-15 dB

The AUX 05 LBO function allows the user to emulate one of three different cable losses (0 dB, -7.5 dB, or -15 dB) for LINE 1 and LINE 2 transmitted outputs.

Press the **SOURCE CONFIGURATION II** switch to set the line build-out for LINE 1 and the **RESULTS I Blank** switch to set the line build-out for LINE 2.

4.2.6 AUX 06 BACK TM — Backup Timing Source

AUX 06	LINE 1	LINE 2
BACK TM	INTERNAL	RECOVERED

The AUX 06 BACK TM function sets the transmit timing source for LINE 1 and LINE 2. If a clock is recoverable from the line received input, this auxiliary function is ignored. However, if the input clock is lost for either line, this auxiliary function determines the timing source for that line.

Press the **SOURCE CONFIGURATION II** switch to select the LINE 1 backup timing source.

Press the **RESULTS I Blank** switch to select the LINE 2 backup timing source. The following transmit timing sources are available for each line.

INTERNAL — Selects the fixed, internal, crystal oscillator (operating at a nominal T1 rate) as the backup transmit timing source.

BNC — Selects the EXTERNAL BNC CLOCK connector, located on the right side panel, as the backup transmit timing source. If no timing source is connected to the EXTERNAL BNC CLOCK connector, a message EXT CLOCK LOSS is flashed in the results display indicating that no transmit timing source is present at the connector.

RECOVERED — Selects the recovered clock from the opposite received signal. If the received signal i not present from the opposite line receiver, then the internal crystal oscillator is used as the transmit timing source.

NOTE

This auxiliary function does not affect the T1 TLB, T1 LLB, and AUTO modes, where only recovered timing is used.

4.2.7 AUX 07 DS0 TM — DS0 Interface Timing

AUX 07	**DS0 INTERFACE TIMING**
DS0 TM	**COMMO**

The AUX 07 DS0 TM function sets the DS0 interface transmit and receive clocks. Note that if the **CHANNEL FORMAT** switch is set to DS064, changing this selection causes a test restart.

Press the **SOURCE CONFIGURATION II** switch to configure the DS0 clock connector.

COMMON — Configures the two side panel DS0 clock connectors to provide identically phased clocks. This setting is used when timing slips do not occur between the two T1 inputs.

SEPARATE — Configures each side panel DS0 clock connector to be individually synchronized to its respective T1 clock signal source. This setting is used when timing slips do occur between the two T1 inputs.

NOTE

Two external DS0 test sets are required when SEPARATE is selected, since the transmit bit and byte clocks are not in phase with the received bit and byte clocks.

4.2.8 AUX 08 RS 232 — Printer/Remote RS-23

AUX 08	**PARITY**	**BAUD**	**TERMINATOR**
RS 232	**NONE**	**9600**	**CR**

The AUX 08 RS 232 function sets the parity, baud, and line terminator for the side-panel RS-232 printer/remote control port.

Press the **SOURCE CONFIGURATION II** switch to set the RS-232 interface PARITY to NONE, EVEN, or ODD.

NONE — data is sent using 8 bits.

ODD or **EVEN** — data is sent using 7 bits.

Press the **RESULTS I Blank** switch to set the BAUD rate to 300, 1200, 2400, 4800, or 9600.

Press the **RESULTS II Arrowed** switch to set the TERMINATOR character for the printer/remote interface to CR, LF, or CRLF. The default termination character CR allows the test set to operate with the optional lid printer, as well as the portable PR-40A printer.

4.2.9 AUX 09 488MODE — IEEE-488 Mode and Address

AUX 09	IEEE-488	MODE and ADDRESS	
488MODE	ADDR:	0	SRQ: O

The AUX 09 488MODE function selects between the Addressable or Talk-Only operating mode. In the Addressable mode, the bus address and the Service Request (SRQ) function are also set.

Press the **SOURCE CONFIGURATION II** switch to select the desired interface operating mode.

Talk-Only Mode — Select this mode when the T-BERD 224 is connected to an IEEE-488 compatible listen-only printer.

Addressable Mode — Select this mode when the T-BERD 224 is connected to an IEEE-488 bus. The Addressable mode allows the T-BERD 224 to be assigned a unique bus address which is used by the IEEE-488 controller to identify the devices connected to the IEEE-488 bus. The SRQ state is also selected in this mode. Press the **RESULTS I Blank** switch to select the desired bus ADDRess from 0 to 30. The bus address must be unique for each device connected to the same bus.

Press the **RESULTS II Arrowed** switch to turn the SRQ function ON or OFF. With the SRQ set to ON, an SRQ is generated when an erroneous command is received or data is ready to be sent.

4.2.10 AUX 10 N-CONTG — Non-Contiguous Channel Drop and Insert

AUX 10	LINE	CHN UP↑/DN↓	ENTR↑/DEL↓
N-CONTG	L1:10 12 13 15 18 20		

The AUX 10 N-CONTG function selects the non-contiguous channels to be tested on each line. The channel numbers 1 to 24 must be entered in increasing order. The cursor must end to the right of the last number to save the sequence.

Press the **SOURCE CONFIGURATION II** switch to select the T1 LINE input to be configured for non-contiguous channels, L1 (LINE 1) or L2 (LINE 2).

Press the **RESULTS I Blank** switch to select the channel number above the flashing cursor. Press the switch up to increment the channel number and press down to decrement the channel number.

Press the **RESULTS II Arrowed** switch up to enter the displayed channel selection. The channel number is set, and the cursor automatically moves one position to the right for another channel number selection. The cursor must end be to the right of the last number entered to save the sequence. Press the **RESULTS II Arrowed** switch down to delete the displayed channel number above the cursor. The cursor will automatically move one position to the left.

NOTE

The same number of channels must be selected for LINE 1 and LINE 2. If not, the selected configuration is not saved, and the message *UNEQUAL # OF CHANNELS, CONFIGURATION NOT SAVED* is displayed. The newly selected and saved channels are enabled when the user scrolls to another auxiliary function or exits the AUX mode (LED OFF). If the T-BERD 224 is set to NON CONTIG, changing this auxiliary function cause a test restart.

4.2.11 AUX 11 ANL CHA — DSU-DP Analysis Channel

AUX 11	**DSU CHAN**	**CTRL BIT**
ANL CHA	**PRIMARY**	**RTS INS**

The AUX 11 ANL CHA function determines whether to drop and insert the PRIMARY or SECONDARY DSU channel.

Press the **SOURCE CONFIGURATION II** switch to select PRIMARY or SECONDARY.

SECONDARY — Provides test access to the secondary channel data of the DS0A or DS0B channel. When SECONDARY is selected, TRANSMITTING ON SECONDARY CHANNEL ANALYZING SECONDARY CHANNEL flashes in the display.

PRIMAR — Provides test access to the primary channel data of the DS0A or DS0B channel.

Press the **RESULTS I Blank** switch to set bit 8 to RTS INS or THRU. RTS INS inserts bit 8 with RTS. THRU allows bit 8 to pass unaffected.

NOTE

If the T-BERD 224 is configured to test DS0A2.4, DS0A4.8, DS0A9.6, DS0A192, DS0A56, DS0B2.4, DS0B4.8, or DS0B192, changing this auxiliary function causes a test restart.

4.2.12 AUX 12 ERR COR — DS0A Error Correction

AUX 12	**DS0A ERROR CORRECTION**
ERR COR	**OFF**

The AUX 12 ERR COR function determines whether or not majority-rule error correction is performed on subrate DS0A data. Error correction is performed on DS0A-formatted data rates of 9.6 kb/s, 4.8 kb/s, and 2.4 kb/s by the majority vote method.

Press the **SOURCE CONFIGURATION II** switch to choose whether DS0A error correction is ON or OFF.

ON — Provides test access to subrate DS0A data which has been error corrected.

OFF Provides test access to subrate DS0A data which has been selected from every fifth (9.6 kb/s), tenth (4.8 kb/s), or twentieth (2.4 kb/s) frame.

4.2.13 AUX 13 ERR RT — BPV and Logic Error Insert Parameters

AUX 13	**ERROR RATE**	**ERROR TYPE**
ERR RT	**1.0 E-6**	**SINGLE**

The AUX 13 ERR RT function selects the BPV and logic error insertion, type, rate, and burst length for the **BPV** and **LOGIC ERROR INSERT** switches.

Press the **SOURCE CONFIGURATION II** switch to set the ERROR RATE from 1.0 E-9 to 1.0 E-2 for continuous or burst errors. The error rate is interpreted as 1.0 E-2 = 0.01 = 1 bit error in 100 bits sent.

Press the **RESULTS I Blank** switch to set the ERROR TYPE to SINGLE or BURST. This determines how errors are injected into the transmitted data when the **BPV** and **LOGIC ERROR INSERT** switches are pressed for less than 1 second.

SINGLE — Inserts a single error when the **BPV** or **LOGIC ERROR INSERT** switch is pressed once.

BURST — Inserts a burst of errors when the **BPV** or **LOGIC ERROR INSERT** switch is pressed once. When BURST is selected, the BURST LEN is displayed.

AUX 13	**ERROR RATE**	**ERROR TYPE**	**BURST LEN**
ERR RT	**1.0 E-6**	**BURST**	**20 mss**

Press the **RESULTS II Arrowed** switch to set the BURST LEN from 20 ms to 5.0 sec. The burst length is incremental as follows:

- 20 ms to 170 ms in 50 ms steps.
- 170 ms to 200 ms in 30 ms step.
- 200 ms to 500 ms in 50 ms steps.
- 500 ms to 1.0 sec. in 100 ms steps.
- 1.0 sec. to 1.5 sec. in 100 ms steps.
- 1.5 sec. to 5.0 sec. in 500 ms steps.

NOTE

Pressing the **ERROR INSERT** switches for more than 1 second (LED ON), inserts errors continuously at the selected error rate.

4.2.14 AUX 14 FRM ERR — Consecutive Frame Error Insertion

AUX 14	**FRAME ERROR INSERT**
FRM ERR	**SINGLE**

The AUX 14 FRM ERR function selects the number of consecutive frame errors inserted into the T1 framing pattern when the **FRAME ERROR INSERT** switch is pressed. When the **FRAME ERROR INSERT** switch is pressed, the Ft bits in T1-D1D, T1-D2, T1-D4, T1SLC96, and SLC-D1D framing modes and the FPS bits in the ESF framing mode are errored. This auxiliary function is only applicable in framed operating modes.

Press the **SOURCE CONFIGURATION II** switch to select either SINGLE or 2 to 6 CONSECutive frame errors.

NOTE

Pressing the **FRAME ERROR INSERT** switch for more than 1 second (LED ON), inserts errors continuously.

4.2.15 AUX 15 USER — User Programmable Test Pattern

AUX 15	**1↑/0↓**	**FWD↑/REV↓**	**END↑**
USER	**100001 010101**	**101010**	**010101**

The AUX 15 USER function enters a3- to 24-bit user programmable test pattern to be entered. This enables the T-BERD 224 to transmit specific bit patterns for testing. When the appropriate operating mode is displayed and USER is selected with the **SOURCE CONFIGURATION I** switch, the pattern is transmitted from left to right as displayed. A test restart occurs if a user pattern is being saved while another user pattern is being transmitted.

Press the **SOURCE CONFIGURATION II** switch up to change the current bit to a 1 or down to change the current bit to a 0. Changing the value of the bit moves the cursor to the right.

Press the **RESULTS I Blank** switch up to move the cursor right or down to move the cursor left.

Press the **RESULTS II Arrowed** switch up to save and END the displayed bit pattern. Any bits to the right of the cursor are deleted, and the cursor returns to the left most bit position. The first three bits cannot be deleted.

4.2.16 AUX 16 PGM LP — User Programmable Loop Codes

AUX 16	**1↑/0↓**	**FWD↑/REV↓**	**END↑**
PGM LP	**UP: 10000**		**DOWN: 100**

The AUX 16 PGM LP function enters a 3- to 8-bit user programmable loop code to be entered. The loop code is available for transmission when the T1 PROGRAM loop code is selected from the AUX 17 LOOP CD function. The loop code is transmitted from left to right as displayed.

Press the **SOURCE CONFIGURATION II** switch up to change the current bit to a 1 or down to change the current bit to a 0. Changing the value of the bit moves the cursor to the right.

Press the **RESULTS I Blank** switch up to move the cursor forward or down to move the cursor backward. This switch also moves the cursor between the loop-UP code and loop-DOWN code positions.

Press the **RESULTS II Arrowed** switch up to save and END the displayed loop-up and loop-down bit patterns. If the cursor is positioned in the UP bit pattern and the **RESULTS II Arrowed** switch is pressed, any UP bits to the right of the cursor are deleted, the bits to the left are saved, and all the displayed DOWN bits are saved. If the cursor is positioned in the DOWN bit pattern and the **RESULTS II Arrowed** switch is pressed, any DOWN bits to the right of the cursor are deleted, the bits to the left are saved, and all the displayed UP bits are also saved.

4.2.17 AUX 17 LOOP CD — Loop Codes

AUX 17	***TYPE**	**EQUIP**
LOOP CD	**T1**	**CSU**

The AUX 17 LOOP CD function selects the loop code type, equipment, and location that is transmitted when the **LOOP CODES** switches are pressed. This function also selects the T1 loop code for automatic response (see AUX 18 AUT RES).

NOTE

In-band loop codes are transmitted only in the bandwidth selected by the **CHANNEL FORMAT** and **CHANNEL** switches. To loop T1 CSUs, intelligent network equipment, and smart jacks, the channel format selection must correspond to a full T1 bandwidth.

Press the **SOURCE CONFIGURATION II** switch to select either T1, DDS-ALT, or DDS-LAT as the TYPE of loop code transmitted.

NOTE

If the Smart Loopback/Command Codes Option is installed, an asterisk (*) appears to the left of TYPE to indicate there is an additional selection. Pressing the **SOURCE CONFIGURATION I** switch toggles between the *TYPE display and the *SMARTNET display.

Press the **RESULTS I Blank** switch to select the desired EQUIPment to be looped. Table 4-2 lists the available equipment under each loop code type.

Press the **RESULTS II Arrowed** switch to set the LOCATION (1 to 8) to be looped when the DDS-LAT TYPE and DS0-DP EQUIP are selected.

Table 4-2. Loop Code

Type	Code	Description.
T1	CSU	Customer Service Unit loop codes
	FAC1	Smart Jack loop codes, in-band 4-bit Facility or network.
	FAC2	Smart Jack loop codes, in-band 5-bit Facility or network.
	FAC3	Smart Jack loop codes, in-band 6-bit Facility or network.
	PROGRAM	3- to 8-bit programmable loop code
	ESF-LIN	ESF out-of-band Line loop codes.
	ESF-PAY	ESF out-of-band Payload loop codes.
	ESF-NET	ESF out-of-band Network loop codes.
DDS-ALT	OCU	Alternating Office Channel Unit loop code.
	OCU+HL96	Alternating Office Channel Unit loop code behind a HL96NY.
	HL96NY	Alternating HL96NY Office Channel Unit loop code.
	DSU	Alternating Data Service Unit loop code.
	CHANNEL	Alternating Channel Service Unit loop code.
	CHAN+1R	Alternating Channel Service Unit behind one repeater loop code.
	CHAN+2R	Alternating Channel Service Unit behind two repeaters loop codes.
	1ST RPTR	Alternating First Local Loop repeater loop code.
	2ND RPTR	Alternating Second Local Loop repeater loop code.
DDS-LAT	OCU	Latching Office Channel Unit loop code.
	CHANNEL	Latching Channel Service Unit loop code.
	DS0-DP	Latching DS0-Dataport loop code.
	(LOCATION 1 - 8)	When more than one DS0-DP is present, select the location of the DS0-DP from 1 to 8.
	LSI	Latching Line Side Interface (HL222) loop code.
	MJU	Latching Multi Junction Unit loop code
	V.54	Latching Fractional T1 loop code (also used to loop Switched 56 circuits)
	NEI/RPTR	Latching Network Element Interface and Adtran™ repeater loop code.
	DSU	Latching Data Service Unit loop code.

If the Smart Loopback/Command Codes Option is installed, the AUX 17 LOOP CD function also selects the intelligent equipment type (SMARTNET), loop code type (ILR, IOR, etc.), command, and programmable command (if any).

An asterisk (*) appears to the left of the TYPE selection to indicate there is an additional selection. Pressing the **SOURCE CONFIGURATION I** switch toggles between the *TYPE selection display and the *SMARTNET intelligent equipment selection display.

```
AUX 17        *SMARTNET     SELECT
LOOP CD       IOR           TELTREND     7231LD
```

When *SMARTNET is selected, press the **SOURCE CONFIGURATION II** switch to scroll through the list of supported intelligent network equipment type (IOR, ILR, DS1 MSW) and select one.

Then, press the **RESULTS I Blank** switch to scroll through the specific manufacturers models that the T-BERD 224 supports (see Table 4-3).

Table 4-3. Intelligent Network Equipment

Manufacturer	Equipment Type
ADTRAN	HTU-C and HTU-R
Pair Gain	HLU-231 and HRU-412
Tellabs	HTU-C and HTU-R
Teltrend (7231/7239)	IOR and ILR
Teltrend (7231/7239LC)	IOR and ILR
Teltrend (7231/7239LD)	IOR and ILR
Teltrend (7231/7239LP)	IOR and ILR
Teltrend (7231/7239LS)	IOR and ILR
Teltrend (7231/7239LW)	IOR and ILR
Teltrend (7231/7239)	IOR and ILR
Teltrend 7231E	IOR only
Teltrend 7239-I2	ILR only
Teltrend (DS1 MSW	Maintenance Switch
TxPORT	231-OR and 239-SR
Wescom (F Series)	IOR and ILR
Westell (3130-56/3150-56)	IOR and ILR
Westell (3151-56)	ILR only
Westell (3130-80/3150-80)	IOR and ILR
Westell (3150-81)	ILR only
Westell (3150-CO)	IOR and ILR
Westell (NIMS-20)	Maintenance Switch
Westell (NIMS-28)	Maintenance Switch
Westell (NIMS-60)	Maintenance Switch
XEL (7853-000)	ILR only
XEL (7854-008)	ILR only

Press the **SOURCE CONFIGURATION II** switch to select INT EQUIP as the TYPE of loop code transmitted. The SMARTNET equipment manufacturer and model selection determines what loop code choices are available for each intelligent equipment type.

AUX 17	*TYPE	SELECT	ADDRESS
LOOP CD	INT EQUIP	ILR	20

Press the **RESULTS I Blank** switch to select one of the following:

- IOR (intelligent office repeater)
- ILR (intelligent line repeater)
- IORCMD (intelligent office repeater commands)
- ILRCMD (intelligent line repeater commands)
- IORPGM (intelligent office repeater programmable commands)
- ILRPGM (intelligent line repeater programmable commands)

- DS1MSWITCH (DS1 Maintenance Switch)
- DS1MSRAMP (DS1 Maintenance Switch Ramp)
- DS1MSCMD (DS1 Maintenance Switch commands)

AUX 17	*TYPE	SELECT	ADDRESS
LOOP CD	INT EQUIP	DS1MSWITCH	01

For XEL intelligent repeaters, the **RESULTS II Blank** switch is used to set the Exchange Code. For XEL intelligent repeaters, the **RESULTS II Arrowed** switch is used to set the Location Code.

AUX 17	*TYPE	SELECT	EXCH:LOC
LOOP CD	INT EQUIP	ILR LOC	0001:001

Press the **RESULTS II Arrowed** switch to scroll through the ILR or IOR commands (see Table 4-4).

AUX 17	*TYPE	SELECT	COMMAND
LOOP CD	INT EQUIP	IORCMD	ARM/DSARM

Table 4-4. IOR and ILR Comman d

Command	Description
Address Change	Manually reassigns addresses to individual line repeaters. Press the LOOP UP switch to send the Address Change command. The ILR responds with its address or address code. Then, transmit an ILR loopback code with the new address. The ILR remains in loopback and responds with its new address or address code.
AIS Disable	Disables the automatic AIS transmission for the looped up repeater. Press the **LOOP UP** or **LOOP DOWN** switch to send the command.
Arm/Disarm	Selects the arming/disarming code. The arming code (**LOOP UP** switch) loops up the NIU and prepares the repeaters to respond to addressed loop codes. The disarming code (**LOOP DOWN** switch) loops down the NIU and the repeaters.
Auto Learn	Reassigns addresses to line repeaters automatically based on their position in the span. Press the **LOOP UP** or **LOOP DOWN** switch to send the command.
Auto Query	Queries each line repeater for its address or address code (bit errors). Press the**LOOP UP** or **LOOP DOWN** switch to send the command. If 555 is displayed, the repeater has no assigned address.
Clear FT1	Restores the office repeater to Full T1 mode temporarily. Press the **LOOP UP** or **LOOP DOWN** switch to send the command.
CPE Arm	Selects the CPE arming/disarming code. The CPE arming code (**LOOP UP** switch) is sent from the NIU toward the Central Office (CO). The disarming code (**LOOP DOWN** switch) loops down all the span repeaters.
Dual LPBK	Selects the dual loopback code. If an office repeater DSX-1 side is looped up, press the **LOOP UP** switch to loopback the office repeater far-end side. Press the **LOOP DOWN** **s**witch to loop down the office repeater.
Far-End NIU Activate	Unblocks an armed near-end T1 office repeater, which allows standard NIU loop-up and loop-down codes to pass through to the far-end NIU. Press the **LOOP UP** or **LOOP DOWN** switch to send the command.

Table 4-4. IOR and ILR Commands (Continued)

Command	Description
Issue Query	Queries the repeater type and issue. Press the **LOOP UP** switch to send the command. ILR in loopback returns its type and issue (for example, an issue 2 ILR would return a code 120, where 100 = ILR and issue 20 = issue 2).
Manual Learn	Assigns addresses to line repeaters manually. Press the **LOOP UP** switch to clear the current addresses, loop back each repeater, and prepare each repeater to receive a new address. Select the ILR command and program an address, then press the **LOOP UP** switch to send the command. The first repeater accepts the address and loops down, so the second repeater is ready for its address.
Near-end Ar	Selects the near-end arming/disarming code. When testing from the NIU toward the CO, press the **LOOP UP** switch to prepare the repeaters to respond to addressed loop codes. The disarming code (**LOOP DOWN** switch) loops down the span repeaters.
Option Query	Queries the option status of a repeater in loopback. Press the **LOOP UP** switch to send the command. The repeater returns its address or an address code, then its option status: • Framing Mode — Auto, Dual, or ESF • Loopback Code Detection — Synchronous or Asynchronous • AIS — Enabled or Disabled • CPE Arming Code Block — Enabled or Disabled • Automatic Loopback Timeout — Enabled or Disabled • Repeater Status — Programmed or Original Settings
Power Down	Removes power from the line during transmission and for five seconds after it is stopped. Press the **LOOP UP** or **LOOP DOWN** switch to send the command.
Power Loop/Query	Queries for and loops up the repeater in power loopback. Press the **LOOP UP** switch to send the command. Press the **LOOP DOWN** switch to loop down the first repeater that is looped up.
Power Thru	Returns the line repeater in power loopback to thru power mode, but only if sent from the DSX-1 side. Press the **LOOP UP** or **LOOP DOWN** switch to send the command.
Query	Queries the address or address code of the line repeater in loopback. Press the **LOOP UP** or **LOOP DOWN** switch to send the command. If *555* is displayed, the repeater does not have an assigned address.
Sequential Loopback	Loops up line repeaters on the span in sequence starting with the nearest repeater. Press the **LOOP UP** switch to send the command. The repeater loops up and returns its address or address code. The next time the code is sent or the **LOOP DOWN** switch is pressed, the repeater loops down. After looping down, the repeater ignores the sequential loop code until it is disarmed and re-armed.
Time-out Disable/ Time-out Extend	Disables/extends the automatic loopback timeout function. Loop up the repeater first, then send the timeout disable function. The timeout function is reset when the loopback is deactivated.

The programmable commands allow activation of specific functions of intelligent office and line repeaters. Remote programming can only be done from the central office side while the repeater is in loopback. Press the **RESULTS II Blank** switch to scroll through the ILR or IOR programmable command (see Table 4-5). Press the **RESULTS II Arrowed** switch to set the ILR or IOR programmable command parameter or address, as applicable. Pressing the **LOOP UP** switch transmits the selected programming command to the repeater.

```
AUX 17      *TYPE        SELECT     COMMAND
LOOP CD     INT EQUIP    IORPGM     ARM FRM  DUAL
```

Table 4-5. IOR and ILR Programmable Comma n d

Command	Description
ADDR	Assigns an address to a repeater. Press the RESULTS II Arrowed switch to assign an address from 0 to 1999.
ARM CDE	Selects the arming code the repeater in loopback recognizes. Press the **RESULTS II Arrowed** switch to select the NIU or CPE arming codes.
ARM FRM	Selects the framing mode the repeater recognizes (AUTO, DUAL, or ESF). • In AUTO mode, the repeater automatically recognizes the received framing as ESF or SF framing. If SF framing, the repeater only arms to the in-band arming code. If ESF framing, it only arms to the datalink arming code. • In DUAL mode, the repeater arms to an in-band arming code in both SF and ESF modes. If ESF framing, the repeater also arms to the datalink (out-of-band) arming code. • In ESF mode, the repeater only arms to the datalink (out-of-band) arming code.
AIS	Enables or disables the Alarm Indication Signal (AIS). When AIS is enabled, the repeater sends an all ones AIS toward the Customer Premises Equipment (CPE) indicating the repeater is in loopback. Press the **RESULTS II Arrowed** switch to select ENABLE or DISABLE.
BLK CPE	Enables or disables the CPE arming code block, which prevents further arming of the span from the CPE side when the repeater is in loopback. Press the **RESULTS II Arrowed** switch to select ENABLE or DISABLE.
CODE RX	Selects the code detection, which determines if the repeater responds to asynchronous or synchronous loop codes. Press the **RESULTS II Arrowed** switch to select ASYNC or SYNC. NOTE: TheT-BERD 224 always transmits synchronous loop codes.
RESET	Resets the programmable features to either the factory default settings or the settings prior to the current loopback session. Press the **RESULTS II Arrowed** switch to select MASTER (default) or SESSION (prior).
TIMEOUT	Disables or enables the automatic loopback timeout function of the repeater. Press the **RESULTS II Arrowed** switch to select ENABLE or DISABLE.

Press the **RESULTS II Arrowed** switch to scroll through the DS1 maintenance switch commands (see Table 4-6).

AUX 17	*TYPE	SELECT	COMMAND
LOOP CD	INT EQUIP	DS1MSCMD	ARM/DISARM

Table 4-6. DS1 Maintenance Switch Command

Command	Description
Arm/Disarm	Selects the maintenance switch arming/disarming code. An arming code (LOOP UP switch) is sent to prepare the maintenance switch to loop up or switch a channel upon receipt of the appropriately addressed code. Press the LOOP DOWN switch to disarm the maintenance switch.
Query	Reveals if the maintenance switch is in loopback mode. If it is looped, the switch returns a bit error count equal to the address times 10 plus 1000. If it is not looped, the switch returns a bit error count of 1350. Press either the **LOOP UP** or **LOOP DOWN** switch to send the command.
Restore	Loops down the maintenance switch and restores normal operations. Press either the **LOOP UP** or **LOOP DOWN** switch to send the command.
Time-out Disable	Disables the automatic timeout function of the maintenance switch. Loop up the maintenance switch first, then send the timeout disable function.

The intelligent network equipment loop codes configuration is displayed in a controls print as follows:

```
LP CD TYPE <source>
LP EQUIP <code to TX>

INTELLIGENT NETWORK CONFIGURATION:
IOR         <manufacturer>         <model>        <address>
ILR         <manufacturer>         <model>        <address>
DS1MS       <manufacturer>         <model>        <address>
```

4.2.18 AUX 18 AUT RES — Automatic T1 Loop Code Response

AUX 18	**AUTO RESPONSE TO T1 LOOP CODES**
AUT RES	**NO RESP**

The AUX 18 AUT RES function determines whether the T-BERD 224 enters an automatic line loopback (AUTO LLB) mode in response to a received in-band or out-of-band T1 loop code. The instrument only responds to the T1 loop codes matching the code selected from the AUX 17 LOOP CD function. Press the **SOURCE CONFIGURATION II** switch to set the loop code response to either NO RESPonse or AUTO RESPonse.

NO RESP — The T-BERD 224 does not respond to received loop codes.

AUTO RESP — The T-BERD 224 automatically responds to the received T1 loop-up codes by entering either the AUTO LLB, AUTO PLB, or FT1 LLB mode. The AUTO LLB mode indicates the T-BERD 224 has responded to either a CSU,FAC1,FAC2, PROGRAM, ESF-LIN, or ESF-NET loop code. The AUTO PLB mode indicates the T-BERD 224 has responded to the ESF-PAYloop code. The FT1 LLB mode indicates the T-BERD 224 has responded to a loop code when the channel format is set to 56 x N or 64 x N.

In AUTO RESPonse mode, the T-BERD 224 emulates a CSU in loopback and functions the same as the T1 LLB operating mode. In this mode, the T-BERD 224 automatically responds to the received T1 loop-up codes after receiving five seconds of an in-band loop-up code or after receiving seven out of ten ESF out-of-band loop-up codes. If set to T1 LLB mode or SMARTNET (Smart Loopback/Command Codes Option installed) mode, the T-BERD 224 does not respond to the received loop codes. The T-BERD 224 exits AUTO RESPonse mode after receiving the in-band or ESF out-of-band loop-down code. When the loopback is disabled, the instrument returns to the previously selected operating mode.

4.2.19 AUX 19 DDS CHN — DDS Analysis Channel and Secondary Channel Pattern

AUX 19	**TRANSMIT**	**ANALYZE**
DDS CHN	**PRIMARY**	**PRIMARY**

The AUX 19 DDS CHN function determines how the T-BERD 224 tests the DDS primary and secondary channel data.

Press the **SOURCE CONFIGURATION II** switch to select which DDS channel will have a transmitted pattern: PRIMARY, SECONDARY, or BOTH.

When the TRANSMIT selection is set to BOTH, press the **RESULTS I Blank** switch to select which channel is being analyzed, PRIMARY or SECONDARY.

When the TRANSMIT selection is set to SECONDARY or BOTH, press the **RESULTS II Arrowed** switch to select the SEC CHPAT (secondary channel test pattern), 511 or 2047.

```
AUX 19      TRANSMIT    ANALYZE     SEC CH PAT
DDS CHN     SECONDARY   SECONDARY   511
```

The T-BERD 224 can transmit data on either the primary channel, the secondary channel, or on both channels simultaneously. It can analyze the data on one channel at a time. Table 4-7 indicates the possible transmit, analysis, and secondary channel pattern configurations.

Table 4-7. Testing DDS Channel

Transmit	Analyze	Secondary Pattern	INSERT Switch	Messages
Primary	Primary	Idle code	L1 or L2	
Both	Primary	511 or 2047	L1 or L2	Transmitting On Both Channels Analyzing Primary Channel
Both	Secondary	511 or 2047	L1 or L2	Transmitting On Both Channels Analyzing Secondary Channel
Secondary	Secondary	511 or 2047	L1 or L2	Transmitting On Secondary Channel Analyzing Secondary Channel
Both	Secondary	511 or 2047	None	Analyzing Secondary Channel
Secondary	Secondary	511 or 2047	None	Analyzing Secondary Channel

NOTE

When performing DDS alternating loopback testing, the AUX 19 DDS CHN function TRANSMIT and ANALYZE selections must be set to PRIMARY.

4.2.20 AUX 20 PRM TX — ESF Datalink PRM Transmission Control

```
AUX 20      L1 EMULATE   L2 EMULATE   PRM TRANS
PRM TX      CUSTOMER     CARRIER      OFF
```

The AUX 20 PRM TX function determines how the PRM is transmitted and emulated on LINE 1 and LINE 2 in ESF and ESFz operating modes. The PRM is transmitted over the datalink to the far end and reports on the quality and performance of the received signal from the far end.

Press the **SOURCE CONFIGURATION II** switch to select the PRM emulation (L1 EMULATE) for LINE 1, or press the **RESULTS I Blank** switch to select the PRM emulation (L2 EMULATE) for LINE 2.

CUSTOMER — The transmitted PRM emulates the customer-generated PRM. Selecting CUSTOMER sets the PRM C/R bit to 0. The opposing line should be set to CARRIER for normal testing.

CARRIER — The transmitted PRM emulates the carrier-generated PRM. Selecting CARRIER sets the PRM C/R bit to 1. The opposing line should be set to CUSTOMER for normal testing.

Press the **RESULTS II Arrowed** switch to determine whether the PRM is transmitted.

AUTO — The T-BERD 224 automatically determines whether it should transmit PRM. The LINE 1 and LINE 2 datalinks are tested to determine which received datalink is active or inactive. An inactive datalink is defined as idle, e.g., the line receiver is not connected to the circuit, or a Bit-Oriented Protocol (BOP) or message-oriented protocol (MOP) idle code is received. The datalink is considered active if four consecutive non-idle BOP or MOP messages are received. If the datalink is inactive, the T-BERD 224 generates PRMs until activity is detected.

ON — The T-BERD 224 transmits the PRM on both lines simultaneously. If LINE 1 and LINE 2 are receiving data, the transmitted PRM on LINE 1 is the PRM generated from the received data on LINE 2. Likewise, the transmitted PRM on LINE 2 is the PRM generated from the received data on LINE 1.

OFF Disables the PRM transmission function. However, the received PRM is still reported in the BPV & FRAME category PRM results.

4.2.21 AUX 21 SWEEP — Frequency Sweep Parameter

AUX 21	***END-POINT**	**START**	**STOP**
SWEEP		**100 Hz**	**2500 Hz**

The AUX 21 SWEEP function allows the user to set the Frequency Sweep parameters.

NOTE

The asterisk (*) indicates this is one of three possible selections.

Press the **SOURCE CONFIGURATION I** switch to select one of the three displayed parameters, END-POINT, STEP, or SKIP.

END-POINT — Sets the START and STOP frequencies for the monitored frequency band. Press the **RESULTS I Blank** switch to modify the START frequency from 20 Hz to 3904 Hz. Press the **RESULTS II Arrowed** switch to modify the STOP frequency from 20 Hz to 3904 Hz.

NOTE

If the START frequency is higher than the STOP frequency, the sweep counts downward (instead of upward).

AUX 21	***STEP**	**STEP-SIZE**	**STEP-INTVL**
SWEEP		**100 Hz**	**2.0 SECS**

STEP — Selects the step size and time spent at each frequency (STEP-SIZE and STEP-INTVL). Pres the **RESULTS I Blank** switch to modify the STEP-SIZE frequency from 10 Hz to 1000 Hz. Press the **RESULTS II Arrowed** switch to modify the STEP-INTVL (Frequency Step Interval) from 1.5 seconds to 9.9 seconds.

AUX 21	*SKIP	SKIP-HI	SKIP-LO
SWEEP		2750 Hz	2450 Hz

SKIP — Allows the user to block a portion of the frequency band. This avoids unintentional transmission of frequency tones that can be interpreted as loopback codes. The SKIP interval is determined by establishing high and low frequencies ranges (SKIP-HI and SKIP-LO). Press the **RESULTS I Blank** switch to modify the SKIP-HI frequency from 20 Hz to 3904 Hz. Press the **RESULTS II Arrowed** switch to modify the SKIP-LO frequency from 20 Hz to 3904 Hz. SKIP-LO should always be set lower than the SKIP-HI frequency.

4.2.22 AUX 22 VFBURST —Voice Frequency Burst Parameters

AUX 22	BURST	FREQ	LEVEL
VFBURST	ON	2125 Hz	-10.0 dBm

The AUX 22 VFBURST function allows the user to set the frequency and level of theVF burst function. The burst is used before a return loss measurement or Switched 56 BERT to disable the echo canceller on the channel. The duration of a burst is 2700 ms.

- Press the **SOURCE CONFIGURATION II** switch to toggle between burst ON and burst OFF.
- Press the **RESULTS I Blank** switch to set the burst frequency parameter from 20 Hz to 3904 Hz.
- Press the **RESULTS II Arrowed** switch to set the burst level parameter from -40.0 dBm to +3.0 dBm.

4.2.23 AUX 23 PRT OPT — Frequency Sweep Print Option

AUX 23	FREQ SWP
PRT OPT	ON

The AUX 23 PRT OPT function allows the user to toggle the Frequency Sweep printout ON or OFF. When SWEEP is selected by the **SOURCE CONFIGURATION I** switch, the T-BERD 224 generates a frequency vs. level chart (see Figure 4-1).

Press the **SOURCE CONFIGURATION II** switch to set the Frequency Sweep printout ON or OFF with a default value of OFF.

```
Rx Freq Sweep Print     05:32:38    DEC
 Frequency    Level

204 Hz    -25.0 dBm    304 Hz    -16.5 dBm    ...
604 Hz    -4.7 dBm     704 Hz    -2.7 dBm     ...
        •
        •
        •
3904 Hz   -12.5 dBm
```

Figure 4-1. Frequency Sweep Printout

4.2.24 AUX 24 TRK DEF — Trunk Type Defined

AUX 24	**TRUNK TYPE**
TRK DEF	**STD (E&M)**

The AUX 24 TRK DEF function defines the ON HOOK and OFF HOOK signaling status for the A, B, C, and D signaling bits used in SIGNLNG and SWI-56 channel formats.

Press the **SOURCE CONFIGURATION II** switch to select the trunk type.

STD (E&M) — Selects the standard E & M signaling structure used on trunks between switches in the public switched telephone network.

GROUND ST — Enables the T-BERD 224 to test a ground start foreign exchange or a SLC circuit.

Press the **RESULTS I Blank** switch to emulate or monitor equipment on either end of the trunk.

FXS — Foreign Exchange Station

FXO — Foreign Exchange Office

SLC STATION — SLC Station

SLC OFFICE — SLC Office

LOOPSTART — Enables the T-BERD 224 to emulate or monitor standard signaling between telephone and switch.

Press the **RESULTS I Blank** switch to emulate equipment on either end of the trunk.

FXS — Foreign Exchange Station

FXO — Foreign Exchange Office

SLC STATION — SLC Station

SLC OFFICE — SLC Office

DEFINED — Enables the user to program the events sent or received by the T-BERD 224.

Press the **RESULTS I Arrowed** switch to select ON HOOK or OFF HOOK definitions.

Press the **RESULTS II Blank** switch to move the cursor between the A, B, C, or D signaling bits.

Press the **RESULTS II Arrowed** switch to scroll the value of the bit between the following values.

0 - Logic zero.

1 - Logic one.

X - Don't Care State. A logic one is transmitted by default.

T -Toggles between logic zero and logic one. Toggling in invalid in ESF and ESFz modes, and is treated as an X (Don't Care).

4.2.25 AUX 25 DIG MAR — Digit Margining (Interdigit Timing)

The AUX 25 DIG MAR function defines the parameters of the DTMF/MF, and DP digits used in SIGNLNG and SWI-56 channel formats.

Press the **SOURCE CONFIGURATION II** switch to select the address type of the digits.

AUX 25	TYPE	DIGIT ON	DIGIT OFF
DIG MAR	DTMF/MF	70 ms	70 ms

DTMF/MF — Dual Tone Multifrequency/Multifrequency

Press the **RESULTS I Blank** switch to set the length of time the digits are transmitted. DIGIT ON ranges from 13 ms to 250 ms.

Press the **RESULTS II Arrowed** switch to set the length of time between transmitted digits. DIGIT OFF ranges from 13 ms to 250 ms.

DP — Dial Pulse

Press the **RESULTS I Blank** switch to set the number of pulses per second. PPS ranges from 7 to 21 pps

Press the **RESULTS II Arrowed** switch to set percentage of time the digit pulse will be in the ON HOOK state. % BREAK ranges from 40 to 68.

AUX 25	TYPE	PPS	% BREAK
DIG MAR	DP	10	60

4.2.26 AUX 26 DIAL SEQ — Dial Sequence

AUX 26	H w KP 3531550 ST h		
DIAL SEQ	SEQ 1	DP	01

The AUX 26 DIAL SEQ function, which supports the SIGNLNG and SWI-56 modes, allows users to program and store up to 10 different digit sequences. The sequences define the events and digits the T-BERD 224 transmits and the events expected in response.

Press the **SOURCE CONFIGURATION II** switch to select a SEQuence number from 1 to 10.

Press the **RESULTS I Blank** switch to set the address of the selected digits.

Signaling Keypad — Use the Signaling Keypad to enter the sequence to be transmitted.

Cursor Keys — Press to position the cursor and edit the sequence (MF, DTMF, DP). The position of the cursor is identified by the number in the lower right corner of the RESULTS I window.

TERM SUPV — Select events the T-BERD 224 expects to receive (lowercase).

ORG SUPV — Select events the T-BERD 224 will transmit (uppercase letters).

Keypad — Program the telephone number to be transmitted.

ENTER Key — Press to save the current sequence.

NOTE

When the sequence has been altered, the prompt RECALL SEQ appears in the RESULTS II window. This indicates that a change has been made and gives you the opportunity to recall the previous sequence by pressing the **RESULTS II Arrowed** switch. The sequence is automatically saved when the auxiliary function is exited.

If more than 80 events and digits are entered, the message *SIGNALING SEQUENCE IS FULL* is displayed.

4.2.27 AUX 27 REC SEQ — Receive Sequenc

AUX 27	**H w 07 h**		
REC SEQ	**SEQ 1**	**AUTO**	**01**

The AUX 27 REC SEQ function, which supports the SIGNLNG and SWI-56 modes, allows users to program and store up to ten different sequences. The sequences define the events and digits the T-BERD 224 expects to receive and the terminating supervision events transmitted.

Press the **SOURCE CONFIGURATION II** switch to select a SEQuence number from 1 to 10.

Press the **RESULTS I Blank** switch to set the address of the expected digits (MF,DTMF, DP, or AUTO). In AUTO mode theT-BERD 224 automatically determines the digit type.

Signaling Keypad — Use the Signaling Keypad to enter the sequence to be transmitted.

Cursor Keys — Press to position the cursor and edit the sequence. The position of the cursor is identified by the number in the lower right corner of the RESULTS I window.

TERM SUPV — Select events the T-BERD 224 will transmit (lowercase letters).

ORG SUPV — Select events the T-BERD 224 expects to receive (uppercase).

Keypad — Program the number of digits expected to be received. The digits are entered in pairs. If a single digit is pressed, it is converted to a pair when a non digit is entered following the single digit.

ENTER Key — Press to save the current sequence.

NOTE

When the sequence has been altered, the prompt RECALL SEQ appears in the RESULTS II window. This indicates that a change has been made and gives you the opportunity to recall the previous sequence by pressing the **RESULTS II Arrowed** switch. The sequence is automatically saved when the auxiliary function is exited.

Up to 16 events may be programmed.

4.2.28 AUX 28 SPV DEF— Transmit Supervision

AUX 28	SUP EVENT	DELAY	DURATIO
SPV DEF	WINK	70 ms	200 ms

The AUX 28 SPV DEF function, which supports SIGNLNG and SWI-56 channel formats, defines the parameters of the transmitted winks and delay-dial events.

Press the **SOURCE CONFIGURATION II** switch to select either a WINK or DELAY DIAL.

Press the **RESULTS I Blank** switch to set the DELAY. DELAY determines the time between the receipt of the last digit/supervision event and the start of the wink or delay-dial.

- The WINK DELAY ranges between 50 ms and 1 second.
- The DELAY DIAL DELAY ranges between 30 ms and 16 seconds.

Press the **RESULTS II Arrowed** switch to determine the length of the wink or delay-dial.

- The WINK DURATION ranges between 30 ms and 600 ms.
- The DELAY DIAL DURATION ranges between 30 ms and 16 seconds.

4.2.29 AUX 29 SCANSET — Channel Signaling Scan Setting

AUX 29	*CHAN 1↑/0↓	FWD↑/REV↓		
SCANSET	110111	100011	100011	111100

The AUX 29 SCANSET function allows the user to select which DS0 channels to scan and monitor for signaling activity on both lines. This auxiliary function appears when the SIGNLNG channel format and SCAN source configuration are selected (Signaling Option required) or when the CALL ID channel format and CID SCAN source configuration are selected (Caller ID Option required).

NOTE

When an asterisk (*) appears to the left of an item, it indicates that it is one of two possible selections.

Press the **SOURCE CONFIGURATION I** switch to select either the CHANnel selection display or the TIME-OUT display.

CHAN Press the following switches to set the flag for the channels to be scanned. The bits or flag (1 or 0) represent the DS0 channels 1 to 24 from left to right in the display.

```
AUX 29      *CHAN 1↑/0↓          FWD↑/REV↓
SCANSET     110111          100011   100011   111100
```

Press the **SOURCE CONFIGURATION II** switch up to change the current flag to a 1, which selects the channel for scanning, or down to change the current flag to a 0, which deselects the channel. The cursor advances to the right when the flag is changed.

Press the **RESULTS I Blank** switch up to move the cursor right or down to move the cursor left without changing the flag.

TIMEOUT — Press the following switches to set the OFF HOOK and DISCONNECT timeout durations.

```
AUX 29      *TIMEOUTS     *DISCONNECT
SCANSET                    5 SECONDS
```

Press the **RESULTS I Arrowed** switch to select either the OFF HOOK or DISCONNECT time-outs.

OFF HOOK — Resumes scanning after either line is off hook for the indicated time.

DISCONNECT — Resumes scanning after both lines are on hook for the indicated time.

Press the **RESULTS I Blank** switch to select the timeout duration for either timeout function.

OFF HOOK — Set timeout from 5 seconds to 1 minute in 5 second steps, and from 1 to 5 minutes in 1 minute steps. Set timeout to NONE to resume scanning only after a disconnect or test restart occurs.

DISCONNECT — Set timeout from 1 to 15 seconds in 1 second steps. Restarts scanning after both lines are on hook.

4.2.30 AUX 30 MJU — MJU Controls

```
AUX 30      OPERATION     BRANCH      HUB ID
MJU         SELECT        1           SEND?
```

AUX 30 MJU allows the user to control DDS MJUs. The execution of the commands is through this auxiliary function. During the execution of the command, status messages appear in the display.

Press the **SOURCE CONFIGURATION II** switch to select the MJU operation.

SELECT — Access the selected branch. After a successful SELECT operation the HUB ID of the selected MJU is displayed.

BLOCK — Blocks the selected branch from transmitting or receiving data.

UNBLOCK — Unblocks the selected branch previously blocked.

RESTORE — Deletes the last SELECT/BLOCK or SELECT/UNBLOCK sequence.

RELEASE — Releases all branches to normal operation.

Press the **RESULTS I Blank** switch to select the BRANCH (1 to 4) for the operation.

Press the **RESULTS II Arrowed** switch to SEND the command for the operation. During the MJU operation, the *SEND?* prompt is overwritten with the name of the operation. When the MJU control operation is complete, the *SEND?* prompt is restored.

NOTE

A test restart is performed at the beginning of each MJU operation. The MJU operation is aborted after any major switch change.

4.2.31 AUX 31 CALLID — Caller ID Signaling Selection

AUX 31	FORMAT
CALLID	SLC

AUX 31 CALLID allows the user to select between loop start SLC and FX offices and stations for Caller ID testing.

Press the **SOURCE CONFIGURATION II** switch to select the CALLID format.

SLC — Subscriber Loop Carrier (SLC) offices.

FX — Foreign Exchange (FX) offices.

AUX 31 CALLID is only active in the CALLID channel format.

4.2.32 AUX 32 LN CODE — Independent Line Coding

AUX 32	INDEPENDENT L1 & L2 CODE CONFIG	
LN CODE	LINE 1	B8ZS

AUX 32 LN CODE allows the independent selection of line coding (AMI or B8ZS) for Line 1 and Line 2. This auxiliary function is only active in the ESF/D4 mode, and it disables the **CODE** switch during that mode.

Press the **SOURCE CONFIGURATION II** switch to select either LINE 1 or LINE 2. Use the **RESULTS I Blank** switch to toggle between AMI and B8ZS line coding.

4.2.33 AUX 35 CUSTOM — CUSTOM Results

AUX 35	***CHANNEL**
CUSTO	**ALL**

AUX 35 CUSTOM selects specific test results and Alarm LED conditions to be displayed on the front panel, included in a results printout, and returned by remote control.

NOTE

When an asterisk (*) appears to the left of **CHANNEL**, it indicates that it is one of six possible selections.

Press the **SOURCE CONFIGURATION I** switch to select the category from which the results are chosen: **LOGIC** (if BERT Option installed), **BPV/FRAME**, **SIGNAL**, **TIME**, **CHANNEL**, **ALARMS**, and **SONET** and **DS3** (if SONET/DS3 Lid Option installed).

Press the **SOURCE CONFIGURATION II** switch to select the condition of the category.

ALL — All results in the selected category are displayed and included in a results printout.

NONE — None of the results in the selected category are available in the display or are included in a results printout. When NONE is selected the message *RESULTS UNAVAIL* is displayed in the RESULTS window for the selected category.

NOTE

When the condition of the category is changed from ALL or NONE, the results previously SELECTED as ENABLED or DISABLED are active.

SELECT — The user selects the results available in the display and included in a results printout.

AUX 35	***CHANNEL**	**180 RCV BYT**
CUSTO	**SELECT**	**ENABLED**

Press the **RESULTS I Arrowed** switch to scroll through the results in each category. The results in the selected category depend on the options available.

Press the **RESULTS I Blank** switch to set the condition of the result.

ENABLE — The selected result is available in the display and included in a results printout.

DISABLE — The selected result is not available in the display and is not included in a results printout.

NOTE

When the ERR SEC is selected with a result disabled by AUX 35 CUSTOM, a results printout is not generated by the **PRINT EVENT** switch.

4.2.34 AUX 35 CUSTOM — Primary Rate ISDN Custom Results

```
AUX 35        *CHANNEL
CUSTO         ALL
```

AUX 35 CUSTOM selects specific test results and Alarm LED conditions to be displayed on the front panel, included in a results printout, and returned by remote control.

NOTE

When an asterisk (*) appears to the left of **CHANNEL**, it indicates that it is one of several possible selections.

SIGNAL INFORMATION test results are part of the CHANNEL category group within AUX 35.

Press the **SOURCE CONFIGURATION I** switch to select the category from which the results are chosen: **LOGIC**, **BPV/FRAME**, **SIGNAL**, **TIME**, **CHANNEL**, or **ALARMS**.

Press the **SOURCE CONFIGURATION II** switch to select the condition of the category.

ALL — All results in the selected category are displayed and included in a results printout.

NONE — None of the results in the selected category are available in the display or are included in a results printout. When NONE is selected the message *RESULTS UNAVAIL* is displayed in the RESULTS window for the selected category.

NOTE

When the condition of the category is changed from ALL or NONE, the results previously SELECTED as ENABLED or DISABLED are active.

4.2.35 AUX 50 DELAY — Set Channel Insert Delay

The AUX 50 DELAY function allows the user to enable or disable the 3-second channel insert delay. The default is ENABLE. Specific test results and Alarm LED conditions are displayed on the screen below:

```
AUX 50        *INSERT  DELAY:
DELAY         ENABLED
```

4.3 SONET/DS3 ANALYZER LID OPTION AUX FUNCTIONS

The following auxiliary functions are found on the SONET/DS3 Analyzer Lid Option.

4.3.1 AUX 10 DS3 ALARM — Set DS3 Alarm Type

AUX 10 allows the user to insert two types of DS3 alarm errors into the data stream individually or simultaneously: AIS (BLUE) and YELLOW. This testing capability provides timed-specific, random, and/or continual signal degradation across the entire DS3 signal.

```
AUX 10        TYPE
DS3 ALAR      YELLOW
```

The AUX 10 DS3 ALARM function selects the DS3 Alarm types within the DS3 and STS/DS3 modes. Press the **RESULTS I Blank** switch to select one of the following:

(YELLOW) — DS3Yellow alarm is transmitted.

AIS (BLUE) — DS3 AIS Blue alarm is transmitted.

NONE — None of the results in the selected category are available in the display or are included in a results printout. When NONE is selected the message *RESULTS UNAVAIL* is displayed in the RESULTS window for the selected category.

4.3.2 AUX 11 DS3 ERR INS — Setting DS3 Error Insert Function

The AUX 11 DS3 ERR INS function allows the user to insert three types of DS3 errors into the data strea individually or simultaneously: LOGIC, BPV and FRAME. This testing capability provides timed-specific, random, and/or continual signal degradation across the entire DS3 signal.

The AUX 11 DS3 ERR INS function allows the user to control in-service monitoring and analysis, as well as out-of-service loopback or end-to-end test. Verifying a transmitted signal by inserting an error into the transmitted signal is an effective measure of identifying the problem. Execute the following commands by using the auxiliary function switches. During the execution of the following commands, status messages appear in the display.

Press the **RESULTS 1 Arrow** switch to select the following errors:

LOGIC BURST — Inserts logic errors in single, burst, or continuous streams into the transmitted DS3 data and overhead bits.

```
AUX 11        *LOGIC BURST        RATE
DS3 ERR INS   5 . 0 sec           1E - 2
```

BPV BURST — Inserts BPV errors in single, burst, or continuous BPVs into the transmitted DS3 signal.

```
AUX 11        *BPV BURST          RATE
DS3 ERR INS   5 . 0 sec           1E - 2
```

FRAME — Inserts frame errors in single, multiple, or continuous consecutive M-frame errors into the transmitted DS3 framing bits.

```
AUX 11          *FRAME
DS3 ERR INS     1 / M - FRAME
```

NONE — None of the results in the selected category are available in the display or are included in a results printout. When NONE is selected the message *RESULTS UNAVAIL* is displayed in the RESULTS window for the selected category.

Press the **RESULTS I Blank** switch to scroll through the following *TIMING* options in **LOGIC BURST** or **BPV BURS** : SINGLE, 25ms, 50ms, 100ms, 500ms, 1.0 sec, 2.0 sec, 3.0 sec, 4.0 sec, and 5.0 sec.

Press the **RESULTS I Blank** switch to scroll through the following *FRAMING* options in **FRAME INS:**

1/M-FRAME — Inserts a single frame error (the switch flashes once)

2/M-FRAME — Inserts multiple consecutive frame errors (the switch flashes for 1 second)

Press the **RESULTS I I Blank** switch to scroll through the following options in **LOGIC** or **BPV RATE** *only*: 1E-2, 1E-4, 1E-6, and 1E-9.

When SINGLE is selected with **RESULTS 1 Blank** switch, no rate is displayed. The LED illuminates continuously for the entire duration of the programed period. If the duration is 500 ms or less, the LED illuminates for 500 ms. Note that the default setting is SINGLE. Errors are not interchangeable; therefore, the user must press the **ERROR INSERT** switch to initiate a new rate setting.

4.3.3 AUX 20 STS1 ALARM — Setting STS-1 Alarms

The AUX 20 STS1 ALARM function allows the user to insert STS1 alarms into the data stream when the test set is in an STS1 mode.

```
AUX 20          *TYPE
STS1 ALAR       LINE AIS
```

Press the **RESULTS 1 Blank** switch to scroll through the following ERROR TYPE options:

LINE AIS — Selects AIS (blue) alarm for insertion.

LINE R — Selects RDI (yellow) alarm for insertion.

PATH AIS — Selects Path AIS alarm for insertion in the selected STS1 mode.

PATH RDI — Selects Path RDI alarm for insertion in the selected STS1 mode.

NONE — None of the results in the selected category are available in the display or are included in a results printout. When NONE is selected the message *RESULTS UNAVAIL* is displayed in the RESULTS window for the selected category.

4.3.4 AUX 21 SON ERR INS — Setting SONET Error Insert Function

The AUX 21 SON ERR INS function allows the user to insert four types of SONET errors into the data stream when the test set is in an STS-1 mode. It is important to note that when in an STS-1 mode, AUX 21 *overrides* AUX 11 unless **NONE** is selected with the **RESULTS 1 Arrow** switch. Only single SONET errors can be inserted.

```
AUX 21          *SECTION BIP
SON ERR INS     SINGLE
```

Press the **RESULTS 1 Arrow** switch to scroll through the following ERROR TYPE options:

SECTION BIP — Selects Section BIP errors for insertion.

LINE BIP — Selects Line BIP errors for insertion.

PATH BIP — Selects Path BIP errors for insertion in the selected STS ID.

VT BIP — Selects VT BIP errors for insertion in the selected STS ID and DS1 channel.

NONE — None of the results in the selected category are available in the display or are included in a results printout. When NONE is selected the message *RESULTS UNAVAIL* is displayed in the RESULTS window for the selected category.

The LED illuminates for 500 ms each time **ERROR INSERT** switch is pressed.

4.3.5 AUX 22PATH TRACE —Transmit PathTrace Messages

The AUX 22 PATH TRACE function allows the user to determine the origin of the signal and is a convenient method of determining path connectivity. Specific test results and Alarm LED conditions are displayed on the lid option.

```
AUX 22          *SELECT       Message:
PATH TRACE      USER 1        The quick bro
```

SELECT — The user shall use the **RESULTS I BLANK** switch to scroll through the following options:

NONE — No message transmitted.

USER 1 — The quick brown fox jumps over the lazy dog...1234567890...!@#$%&*

USER 2 — TelecommunicationsTechniques Corporation...Expect Excellence

USER 3 — T-BERD 224: SONET/DS3/DS1/DS0 Communications Analyzer

Since the entire message will not be viewable at once due to the size of the results display, the user will use the **RESULTS II** blank switch to scroll the message from right to left.

Press the **RESULTS II** blank switch up to move the display to the right.

Press the **RESULTS II** blank switch down to move the display to the left.

Upon exiting the **AUX** function, the user message display will reset to the beginning.

SECTION 5 TEST RESULTS

5.1 INTRODUCTION

The T-BERD 224 test results are displayed in the RESULTS window. The available test results depend on the settings in the AUX 35 CUSTOM function, the T-BERD 224 configuration, and the installed options. Categories where all results are unavailable display the message *RESULTS UNAVAIL.* Results that are applicable but not yet available display the message *UNAVAIL.* Results that are not applicable to the current mode display *N/A*.

The test results are numbered using an nXX format where n = the line number (1 for LINE 1 and 2 for LINE 2) and XX = the result number. If the displayed result count exceeds 99,999,999, a > (greater than sign) appears in the window, then the number rolls over and the count continues.

Table 5-1 lists the results categories and the section where they are discussed.

Table 5-1. Test Result Categories

Category	Section
Summary	section 5.2 on page 1
Logic	section 5.3 on page 7
BPV & Frame	section 5.4 on page 9
Signal	section 5.5 on page 12
Time	section 5.6 on page 13
Channel	section 5.7 on page 14

5.2 SUMMARY CATEGORY

Table 5-2 lists the results messages and the option that makes them available.

Table 5-2. SUMMARY Catego r

Option	Message	Option	Message
Caller ID Test Results	n106 CKSUM	Mainframe Test Results	n25 BPVS
DDS Test Results	n96DDS F E		n30FRM ERR
Enhanced ESF/SLC Test Results	n17F FR ES		n32CRC ERR
	n18F F SES		n34FRM LOS
	n19F BPV S		n40RX FREQ
	n20F SLP S		n51TM SLIP
	n22F CRC E	Mainframe Status	n 1's DENS VIOLATE
Enhanced ESF/SLC Alarms	n DATLINK SYNC LOSS		B8ZS DETECTED
	n FE LOOP PROTECTION		FAILEDPAT xxxxx
	n FE LOOP SHELF (x)		NOT B8ZS COMPATIBLE
	n SLC ALARM MAJOR		POWER LOSS
	n SLC ALARM MINOR		RESULTS OK
	n SLC ALM (x) ON PROT		RESULTS UNAVAIL
	n SLC ALM POWER/MISC		SIGNAL LOSS
	n SLC ALM SHELF (x)	Smart Loopback Status	ILR DOWN
	SW PROT FAILED		ILR UP
Enhanced ESF/SLC Maintenance Messages	n MAINT HOOK/SEIZE		IN PWR LP
	MAINT PROCEED		IOR DOWN
	n MAINT TEST ALR		IOR UP
SS7 Protocol Alarms	n BUSY STATUS		PGM AIS
	n DISC PKTs		PGM ARM
	n EMRGNCY ALIGNSTAT		PGM BLK CP
	n ER PKCRC		PGM CODE
	n NACKs		PGM TME
	n NORMAL ALIGNSTAT		RPTR PROG
	n OUT OF ALIGNMENT	T1 BERT Test Results	n00BIT ERR
	n OUT OF SERVICE		n09PATSLP
	n PROCESR OUTAGE		

The SUMMARY category allows quick access to key nonzero and out-of-specification results without having to scroll through several categories. The results that appear in the SUMMARY category include:

5.2.1 Test Results

n00BIT ERR

Bit Errors — A count of received bits that have a value opposite that of the corresponding transmitted bits after pattern synchronization is achieved.

n09PAT SLP

Pattern Slips — A count of the total number of pattern slips detected since the beginning of the test. The result is only valid when using pseudorandom test patterns. A pattern slip is a difference (one or more bits are missing or added) between the transmitted and received test patterns.

n17F FR ES

Far-End Frame Error Seconds — A count of seconds in which one or more frame errors were received at the far end. This result reads the PRM Frame-Synchronization-Bit Error Event Bit (FE = 1) status.

n18F F SES

Far-End Severely Errored Framing Seconds — A count of seconds in which two or more frame errors were received in less than 3 ms at the far end. This result reads the PRM Severely-Errored Framing Event Bit (SE = 1) status.

n19F BPV S

Far-End BPV Seconds — A count of seconds in which one or more BPVs were received at the far end. This result reads the PRM Line-Code Violation Event Bit (LV = 1) status.

n20F SLP S

Far-End Controlled Slip Seconds — A count of seconds in which controlled slips were received at the far end. This result reads the PRM Controlled-Slip Event Bit (SL = 1) status.

n22F CRC E

Far-End CRC Errored Events — A count of the minimum number of CRC errors reported in the n F SI CRC to n F SV CRC results in the BPV & FRAME category. This result reports on the accumulated PRM CRC Error Event Bit (G1 to G6) results. A ">" (greater than) preceding the count indicates that Bins 2 through 6 are nonzero.

n25 BPVS

Bipolar Violations — A count of BPVs since the start of elapsed time (excluding intentional violation found within B8ZS codes).

n30FRM ERR

Frame Errors — A count of frame errors detected since initial frame synchronization or the last test restart. For D1D, D2, and D4 (Superframe) frame errors are counted if either an $_t$ or F_s frame bit is errored. For SLC-96 framing, frame errors are counted if F_t bits are errored. For ESF and ESFz framing, frame errors are counted only if an error is found on the FPS bits. Frame errors are not detected on CRC or datalink bits.

n32CRC ERR

CRC Errors — A count of CRC errors detected since initial frame synchronization or the last test restart. CRC errors are counted only when ESF framing is detected.

n34FRM LOS

Frame Losses — A count of discrete losses of frame synchronization since initial frame synchronization or the last test restart.

n40RX FREQ

Receive Frequency — The frequency of the clock recovered from the received data.

n51TM SLIP

Timing Slips — The frequency deviation of uncontrolled clock slips between two input signals measured in positive or negative shifts in bit and frame positions.

n36DDS F E

DDS Frame Errors — A count of the DS0B frame errors detected since the last test restart. Subrate DS0B frame synchronization must be established to display the result.

n106 CKSUM

Checksum — The result of the comparison between the received Caller ID checksum and the embedded checksum contained within the captured Caller ID message. Only displayed when a checksum error occurs (OK or ERROR).

n ER PKCRC

CRC Errored Packets — A count of packets with CRC errors detected since test restart. This result is available when SS7 MON or ISDNMON is selected.

n DISC PKTs

Discarded Packets — A count of discarded packets since test restart. Discarded packets include packets with seven successive ones (aborts), terminating flag out of alignment, not a multiple of 8 bits, packet too long, or packet too short. This result is available when SS7 MON or ISDNMON is selected.

n NACKs

Negative Acknowledgments — A count of Backward Indicator Bit (BIB) field state transitions since test restart. A NACK identifies a transmission error is received in the far-end device. Only packets with good CRCs are used for this calculation. This result is available when SS7 MON is selected.

5.2.2 Status Message

In addition to test results, the following status messages appear in the SUMMARY category.

RESULTS OK

This message is displayed if a signal is detected and no errors are counted.

RESULTS UNAVAIL

This message is displayed if a signal has not been detected.

POWER LOSS

This message is displayed at power-up if the power has been turned off or when power to the unit has been interrupted. This message is cleared when power has been restored and a test restart is performed.

SIGNAL LOSS

This message is displayed if the cabling from the Line 1 or Line 2 jack is removed. This result replaces RESULTS OK when it occurs. This message is cleared when the signal has been restored and a test restart is performed.

NOT B8ZS COMPATIBLE

The received signal is not B8ZS compatible, occurs when transmitting B8ZS encoded ALL ZEROS over a circuit containing equipment not optioned for B8ZS coding.

n 1's DENS VIOLATED

The T1 signal violated the ones density criteria, there must be at least n ones in 8(n+1) bits.

FAILED PAT xxxxx

This message is displayed when a BRIDGTAP or MULTIPAT pattern fails. xxxxx is the failed pattern.

5.2.3 Maintenance Alarms and Messages

The SLC-96 datalink maintenance and alarm messages are also displayed in the SUMMARY category with the Enhanced ESF/SLC Option installed.

The maintenance field (M1 to M3) controls customer loop testing between the Central Office Terminal (COT) and Remote Terminal (RT). This field links the Central Office (CO) pair gain controller access to the customer loop over a bypass pair which bypasses the DS1 circuits. The T-BERD 224 can monitor the process. The following maintenance messages indicate that the bypass procedure is in progress:

n **MAINT HOOK/SEIZE**

SLC On-Hook/Seize RC Maintenance Message— This message appears when either the *On-Hook* or *Seize RC* message is received.

n **MAINT PROCEED**

SLC Proceed CR/ RC Maintenance Message — Receiving the message from the COT, the COT is asking to proceed. Receiving the message fromthe RT, the RT is ready to continue.

n **MAINT TEST ALRM**

SLC Test Alarm CR/ RC Maintenance Message— Either the COT or the RT has failed the bypass procedure.

These messages occur between the COT and RT in approximately 2 seconds. However, if the bypass sequence fails, the *Test Alarm CR/RC* message is transmitted. When the pair gain controller initiates the bypass, the COT sends the *On-Hook* message to the RT. The RT connects the customer loop to the bypas pair and returns the *On-Hook* message to the COT. The COT then sends the Channel Test A and B bit signaling pattern to the RT identifying the channel being bypassed. The RT in turn sends the *Seize RC* message to the COT indicating the channel has been switched. The COT receives the *Seize RC* message and sends a *Proceed CR* message to the RT asking if the bypass is complete. If the bypass is complete, the RT returns the *Proceed RC* message to the COT. The COT in turn notifies the pair gain controller that the bypass is complete and loop testing can proceed.

5.2.4 Major and Minor Alarms

The alarm field (A1 and A2) identifies conditions that cause disruptions in customer service, changes in signal quality, changes in signal path, and mechanical integrity of the system. The alarms are generally classified as major and minor alarms.

Major alarms indicate system failures that cause disruptions in customer service. Minor alarms indicate system conditions that occur to prevent a major alarm or identify a far-end loop. The T-BERD 224 displays the following alarms:

n **DATLINK SYNC LOSS**

Datalink Synchronization Loss — Datalink synchronization is lost on the indicated line.

n **FE LOOP PROTECTION**

SLC Protection Line Far-End Loop Alarm — Indicates the protection line is in loopback.

n **FE LOOP SHELF (x)**

SLC Shelf Far-End Loop Alarm — The indicated DS1 shelf is in loopback. (x) indicates which shelf (A, B, C or D) is looped.

n **SLC ALM (x) ON PROT**

SLC Shelf on Protection Line Alarm— A shelf DS1 is switched over to the protection line. (x) indicates which shelf (A, B, C or D) is switched to the protection line.

n **SLC ALM MAJOR**

SLC Major Alarm — A condition characterized by a loss of service to subscribers served by a shelf or shelf group. If a shelf alarm (Ln SLC ALM SHELF (x)) is also reported, this result is not displayed.

n **SLC ALM MINOR**

SLC Minor Alarm — A condition characterized by a non-service affecting fault. If a far-end loop alar message is reported for the same line (L1 or L2), this message is not displayed.

n SLC ALM POWER/MISC

SLC Power/ Miscellaneous Alarm — An RT state in which power loss or miscellaneous conditions have occurred.

n SLC ALM SHELF (x)

SLC Shelf Alarm — A condition characterized by shelf loss of operational integrity. (x) indicates the shelf (A, B, C or D) generating the shelf alarm.

SW PROT FAILED

Switch to Protection Line Failed — During either a far-end loopback or a switch to protection line sequence the switch to protection line operation failed.

5.2.5 Smart Loopback Status and Alarms

The following messages only apply when the Smart Loopback/Command Codes Option is installed, and intelligent network equipment is being tested.

ILR UP/DOWN

Intelligent Line Repeater Looped Up/Looped Down — This message accompanies the address of the intelligent line repeater that is looped up or looped down.

IOR UP/DOWN

Intelligent Office Repeater Looped Up/Looped Down — This message accompanies the address of the intelligent Office repeater that is looped up or looped down.

IN PWR LP

Intelligent Line Repeater in Power Loop — This message accompanies the address of the intelligent line repeater that is looping power

PGM ARM

Programmable Repeater Arming Configuration — This message displays the programmable repeater arming configuration.

PGM CODE

Programmable Repeater Code Detection Configuration — This message displays the programmable repeater code detection configuration.

PGM AIS

Programmable Repeater AIS Configuration — This message displays the programmable repeater AI configuration.

PGM BLK CP

Programmable Repeater CPE Arming Block Configuration — This message displays the programmable repeater CPE arming block configuration.

PGM TME

Programmable Repeater Timeout Configuration — This message displays the programmable repeater timeout configuration.

RPTR PROG

Programmable Repeater Programmable Configuration — This message displays the programmable repeater programmable configuration.

5.2.6 SS7 Status and Alarms

The following messages only apply when the SS7 Option is installed and the channel format and SS7 MON source configuration are selected.

n BUSYSTATUS

Busy Status Alarm — Receiving end of the signaling link has detected traffic congestion and is sending a message to the opposite end. This message is sent to the transmitting end to distinguish between congestion and failures in the signaling link.

n EMRGNCY ALIGN STAT

Emergency Alignment Status Alarm — Signaling link is being realigned with the emergency alignment procedure. The message is sent, after having started an initial alignment, the out of alignment, normal alignment, or emergency alignment status indication is received and the terminal is in the emergency alignment procedure.

n NORMAL ALIGN STAT

Normal Alignment Status Alarm— Signaling link is being realigned with the normal alignment procedure. The message is sent, after having started an initial alignment, the out of alignment, normal alignment, or emergency alignment status indication is received and the terminal is in the normal alignment procedure.

n OUT OF ALIGNMENT

Out of Alignment Alarm — Signaling link is not aligned. The message is transmitted when the initial alignment has been started, and the out of alignment, normal alignment, or emergency alignment status indication has not been received from the signaling link.

n OUT OF SERVICE

Out of Service Alarm — Signaling link terminal is out of service. The message is transmitted when the terminal cannot transmit or receive MSUs. This message does not appear during a processor outage.

n PROCESR OUTAGE

Processor Outage Alarm — Local processor outage or failure has occurred at the switch sending the message. This message is transmitted by Level 2 when the signaling messages cannot be transferred to functional Levels 3 and/or 4.

5.3 LOGIC CATEGORY

Table 5-3 lists the results messages and the option that makes them available.

Table 5-3. LOGIC Category

Option	Message	Option	Message
T1 BERT Test Results	n00BIT ERR	G.821 Performance Analysis Test Results	n10 SES
	n01ASYN ES		n11 %SES
	n04 BER		n12 DEG MN
	n05 EFS		n13 %DEGMN
	n06 % EFS		n14 UNAV S
	n07 SYN ES		n15 %AVLBL
	n08OOS SEC		n16 CSES
	n09PAT SLP		

Logic errors are based on discrepancies between the transmitted and received bit stream. Logic errors are not available until pattern synchronization is obtained. If signal, frame, or pattern synchronization are lost during testing, the logic results stop accumulating.

5.3.1 Test Results, T1 BERT

n00BIT ERR

Bit Errors — A count of received bits that have a value opposite that of the corresponding transmitted bits after pattern synchronization is achieved.

n01ASYN ES

Asynchronous Errored Seconds — A count of test seconds where one or more bit errors occurred.

n04 BER

Bit Error Rate — The ratio of bit errors to received pattern data bits.

n05 EFS

Error-Free Seconds — A count of the seconds during which pattern synchronization was maintained through the entire second and no bit error occurred.

n06 % EFS

Percent Error-Free Seconds — The ratio, expressed as a percentage, of error-free seconds to the total number of seconds during which pattern synchronization is present.

n07 SYN ES

Synchronous Errored Seconds — A count of errored seconds synchronized to the occurrence of an error (the count and time intervals begin with the occurrence of an error).

n08OOS SEC

Out-of-Synchronization Seconds — A count of seconds during which pattern synchronization was not maintained for the entire second.

n09PAT SLP

Pattern Slips — A count of the total number of pattern slips detected since the beginning of the test. The result is only valid when using pseudorandom test patterns. A pattern slip is a difference (one or more bits are missing or added) between the transmitted and received test pattern.

5.3.2 Test Results, G.821 Performance Analysis

n10 SES

Severely Errored Seconds — A count of seconds during which the bit error ratio was greater than 10^3 within available time.

n11 %SES

Percent Severely Errored Seconds — The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.

n12 DEG MN

Degraded Minutes — A count of minutes in which the bit error ratio was greater than 10^{-6}.

n13 %DEGMN

Percent Degraded Minutes — The ratio, expressed as a percentage, of degraded minutes to the number of available minutes.

n14 UNAV S

Unavailable Seconds — A count of unavailable time per CCITT G.821.

n15 %AVLBL

Percent Availability — The ratio, expressed as a percentage, of available seconds to the number of test seconds.

n16 CSES

Consecutive Severely Errored Seconds — A count of the number of groups of three or more contiguous seconds in which an error rate greater than 10^3 was found in each second.

5.4 BPV & FRAME CATEGORY

Table 5-4 lists the results messages and the option that makes them available.

Table 5-4. BPV & FRAME Category

Option	Message	Option	Message
	n17F FR ES		n25 BPVS
	n18F F SES		n26BPV SEC
	n19F BPV S		n27 BPV RT
	n20F SLP S		n28 FRM ES
	n21PRM TIM		n29FRM SES
	n22F CRC E		n30FRM ERR
Enhanced ESF/SLC Test Results	n23PAY SRC	Mainframe Test Results	n31FRM ERT
	n F HI CRC		n32CRC ERR
	n F LO CRC		n33 CRC ES
	n F MD CRC		n34FRM LOS
	n F MH CRC		n35FR LS S
	n F SI CRC		n36CRC SES
	n F SV CRC		n37CRCERT

Bipolar violations and frame errors are available when monitoring T-Carrier spans that are transmitting live traffic or test patterns.

5.4.1 Test Results, Enhanced ESF/SLC

n17F FR ES

Far-End Frame Error Seconds — A count of seconds in which one or more frame errors were received at the far end. This result reads the PRM Frame-Synchronization-Bit Error Event Bit (FE = 1) status.

n18F F SES

Far-End Severely Errored Framing Seconds — A count of seconds in which two or more frame errors were received in less than 3 ms at the far end. This result reads the PRM Severely-Errored Framing Event Bit (SE = 1) status.

n19F BPV S

Far-End BPV Seconds — A count of seconds in which one or more BPVs were received at the far end. This result reads the PRM Line-Code Violation Event Bit (LV = 1) status.

n20F SLP S

Far-End Controlled Slip Seconds — A count of seconds in which controlled slips were received at the far end. This result reads the PRM Controlled-Slip Event Bit (SL = 1) status. In addition, the T-BERD 224 transmits the PRM with the Controlled-Slip Event Bit (SL) set to 0.

n21PRM TIM

Received Performance Report Time — A count of the total number of seconds, since test restart, in which a valid PRM was received.

n22F CRC E

Far-End CRC Errored Events — A count of the minimum number of CRC errors reported in the n F SI CRC to n F SV CRC results in the BPV & FRAME category. This result reports on the accumulated PRM CRC Error Event Bit (G1 to G6) results. A ">" (greater than) preceding the count indicates that Bins 2 through 6 are nonzero.

n23PAY SRC

Far-End Payload Source/Loopback — Identifies the direction of the PRM according to the PRM Command/Response Bit (C/R) and the Payload Loopback Activated Bit (LB). In end-to-end applications, a customer generated PRM is indicated as CUST (C/R = 0 and LB = 0) and a carrier generated PRM is indicated as CARR (C/R = 1 and LB = 0) in the display. In payload loopback applications, the customer generated PRM is indicated as CUST LOOP (C/R = 0 and LB = 1) in the display. In customer loopback, the carrier generated PRM is indicated as CARR LOOP (C/R = 1 and LB = 1) in the display.

n F SI CRC

Far-End Single CRC Errored Seconds — A count of seconds with only 1 CRC error received at the far end. This result reports on the first PRM CRC Error Event Bit (G1 = 1).

n F LO CRC

Far-End Low CRC Errored Seconds — A count of seconds with 2 to 5 CRC errors reported in the signal received at the far end. This result reports on the second PRM CRC Error Event Bit (G2 = 1).

n F MD CRC

Far-End Medium CRC Errored Seconds — A count of seconds with 6 to 10 CRC errors reported in the signal received at the far end. This result reports on the third PRM CRC Error Event Bit (G3 = 1).

n F MH CRC

Far-End Medium High CRC Errored Seconds — A count of seconds with 10 to 100 CRC errors reported in the signal received at the far end. This result reports on the fourth PRM CRC Error Event Bit (G4 = 1).

n F HI CRC

Far-End High CRC Errored Seconds — A count of seconds with 101 to 319 CRC errors reported in the signal received at the far end. This result reports on the fifth PRM CRC Error Event Bit (G5 = 1).

n F SV CRC

Far-End Severe CRC Errored Seconds — A count of seconds with 320 to 333 CRC errors reported in the signal received at the far end. This result reports on the sixth PRM CRC Error Event Bit (G6 = 1).

5.4.2 Test Results, Mainframe

n25 BPVS

Bipolar Violations — A count of BPVs since the last test restart (excluding intentional violations found within B8ZS codes).

n26BPV SEC

Bipolar Violation Seconds — A count of seconds within which one or more BPVs occurred since the last test restart.

n27 BPV RT

Bipolar Violation Rate — The ratio of BPVs to total bits.

n28 FRM ES

Frame Errored Seconds — A count of seconds during which one or more frame errors occurred since the last test restart.

n29FRM SES

Frame Severely Errored Seconds — A count of seconds during which 12 or more frame errors occurred (D4 framing only).

n30FRM ERR

Frame Errors — A count of frame errors detected since initial frame sync. For D1D, D2, and D4 (Superframe) frame errors are counted if either an F_t or F_s frame bit is errored. For SLC-96 framing, frame errors are counted if F_t bits are errored. For ESF and ESFz framing, frame errors are counted only if an error is found on the frame bits. Frame errors are not detected on CRC or datalink bits.

n31FRM ERT

Frame Error Rate — The ratio of frame errors to the number of analyzed framing bits. See frame errors (FRM ERR) above.

n32CRC ERR

CRC Errors — A count of CRC errors detected since initial frame synchronization or the last test restart. CRC errors are counted only when ESF framing is detected.

n33 CRC ES

CRC Errored Seconds — A count of seconds within which one or more CRC errors were detected.

n34FRM LOS

Frame Losses — A count of discrete losses of frame synchronization since initial frame synchronization or the last test restart.

n35FR LS S

Frame Loss Seconds — A count of seconds within which frame synchronization was lost or not achieved since initial frame synchronization or the last test restart. This includes seconds when a signal loss causes a frame synchronization loss.

n36CRC SES

CRC Severely Errored Seconds — A count of seconds during which the total number of CRC errors and frame synchronization losses equaled 320 or more.

n37CRC ERT

CRC Error Rate — The ratio of CRC errors to the number of extended superframes received.

5.5 SIGNAL CATEGORY

Table 5-5 lists the results messages and the option that makes them available.

Table 5-5. SIGNAL Category

Option	Message
Enhanced ESF/SLC Test Results	n110 ALRM
Mainframe Test Results	n40RX FREQ
	n41 RX LVL
	n42 RX LVL
	n43 RX LVL
	n51TM SLIP
	n52SLP SEC
	n55 TRAFFIC
	n56 TRAFFIC
T1 BERT Test Results	n50SPX CUR
	n53 DELAY

Signal category results analyze the characteristics of the input signal.

5.5.1 Test Results, Enhanced ESF/SLC

n110ALRM

Alarm Field Format — Identifies the received SLC datalink alarm field format as either 13 bit or 16 bit. This test result is only available when the Enhanced ESF/SLC Option is installed.

5.5.2 Test Results, Mainframe

n40RX FREQ

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

n41 RX LVL

Receive Level (in dBdsx) — The level of the received signal in dB, relative to a standard 3-volt base-to-peak signal (DSX level).

n42 RX LVL

Receive Level (in dBm) — The power level of an unframed all-ones signal (available only when AIS is detected).

n43 RX LVL

Receive Level (in Vp-p) — The level of the received signal in peak-to-peak volts. The signal level is displayed as volts (V) when the signal level is greater than 1 volt or as millivolts (mV) when the signal level is less than 1 volt.

n51TM SLIP

Timing Slips — The frequency deviation of uncontrolled clock slips between two input signals measured in positive or negative shifts in bit and frame positions.

n52SLP SE

Slip Analysis Seconds — A count of test seconds during which Timing Slip Analysis occurred.

n55 TRAFFIC

Traffic Results — A display of the A and B signaling bits for all 24 channels of T1 on LINE 1 and LINE 2. This result uses the entire display to show the signaling bit states for each line of 24 channels in 4 fields of 6 channels each.

The TRAFFIC result uses the entire display window. To return to the normal display, press the appropriate **RESULTS Blank** or **Arrowed** switch.

n56 TRAFFIC

Traffic Results (For ESF and ZBTSI framed signals) — A display of the A, B, C, and D signaling bits for all 24 channels of T1 on LINE 1 or LINE 2. This result uses the entire display to show the signaling bit states for each line of 24 channels in 4 fields of 6 channels each.

The TRAFFIC result uses the entire display window. To return to the normal display, press the appropriate **RESULTS Blank** or **Arrowed** switch.

5.5.3 Test Results, T1 BERT

n50SPX CUR

Simplex Current — The magnitude of the simplex current flowing between the LINE 1 receiver and LINE 2 transmitter, or LINE 2 receiver and LINE 1 transmitter. The line number is determined by the **DROP** switch setting. The result measurement range is 0 mA to 250 mA with an accuracy of ±2 mA.

n53 DELAY

Round Trip Delay — The time it takes a pseudorandom test pattern to be transmitted and received in a loopback test. Consult the Test Pattern Technology Card or Section 3 of the T-BERD 224 Reference Manual for the appropriate test pattern. The result can measure round trip delay from 0.324 ms to 10 seconds.

5.6 TIME CATEGORY

Table 5-6 lists the results messages and the option that makes them available.

Table 5-6. TIME Category

Option	Message	Option	Message
Mainframe Test Results	n70SG LS S	Mainframe Test Results	75 TIME
	n71ALM SEC		76 DATE
	72TST LEN		
	n73ELAP TM	Enhanced ESF/SLC Test Results	n79SLC AS
	74TST END		

Time-related measurements are available in this category.

5.6.1 Test Results, Mainframe

n70SG LS S

Signal Loss Seconds — A count of seconds during which signal synchronization was lost or not achieved since the last test restart.

n71ALM SEC

Alarmed Seconds — A count of seconds during which a yellow alarm, unframed all ones (AIS), or excess zeros alarm was detected. Continues to count through signal loss once an alarm condition i detected.

72TST LEN

Test Length — The length for a timed test, in HHH:MM:SS format. The test length is set using AUX 03 TES LEN function.

n73ELAP TM

Elapsed Time — The time in hours, minutes, and seconds since the last test restart after a signal has been detected. Elapsed time continues to increment during signal losses.

74TST END

Test Ends — The time remaining in a TIMED test using the HH:MM:SS format. "****" is displayed when the T-BERD 224 is in CONTINUOUS test mode.

75 TIME

Clock Time — The time of day using a 24 hour (military) clock in the HH:MM:SS format.

76 DATE

Calendar Date — The date in the MMM DD YY format.

5.6.2 Test Results, Enhanced ESF/SLC

n79SLC A S

SLC Alarm Seconds — A count of seconds during which a SLC-96 Datalink Alarm was detected.

5.7 CHANNEL CATEGORY

Table 5-7 lists the results messages and the option that makes them available.

Table 5-7. CHANNEL Category

Option	Result	Option	Result
Caller ID Test Results	n100 DELAY	TR-303 Link Statistics Test Results	n PACKETS
	n106 CKSUM		n DISC PKTs
	n107 MSG DUR		nER PKCRC
	n108 MK LVL		n PKT ES
	n109 MK FRQ		nPKT ERT
	n110 SPLVL		nINFO PKT
	n111 SP FRQ		nRR PKT

Table 5-7. CHANNEL Category (Continued)

Option	Result	Option	Result
DDS Test Results	n80RCV BYT	TR-303 Call Trace Test Results	CALL STATE
	n95 RCODE		LINE
	n96DDS F E		CALL TYPE
	n98% IN SR		DS1/DS0
Digit Analysis Test Results	n104FQ/LVL		ORIG SRC
	n105FQ/LVL		DISC SRC
SS7 Call Trace Test Results	CALL STATE		CAUSE
	CALLED NM	VF Testing Test Results	n84 3KFLAT
	CALLING NM		n85 3K NCH
	OPC		n86 C-MSG
	DPC		n87 C-NCH
	CAUSE		n88 S/N
			n89 DC-OFF
SS7 Link Statistics Test Results	nPACKETS		n90 P/AR
	nMSUs		n91 PAR LV
	nFISUs		n92 ERL
	nER PKCRC		n93 SRL-HI
	nPKT ES		n94 SRL-LO
	nDISC PKTs	Mainframe Test Results	n81VF FREQ
	nPKT ERT		n82 VF LVL
	nNACKs	Signaling Test Results	n100 DELAY
	nER MSU		n101 DUR
	n%UTIL		n102 ADDR
	nLSSU	PRI ISDN Link Statistics Test Results	n PACKETS
PRI Call Trace Test Results	CALL STATE		n ER PKCRC
	CALLED NM		n DISC PKTS
	CALLING NM		n PKT ES
	CALL TYPE		nPKT ERT
	INTF CHAN		nINFO PKT
	NETWORK ID		nRR PKT
	ORIG SRC		
	DISC SRC		
	CAUSE		

Information on the selected channel is available in this category.

5.7.1 Test Results, Caller ID

n100 DELAY

Delay — The period of time between the indicated event or digit and the previous event or digit.

n106 CKSUM

Checksum — The result of the comparison between the received Caller ID checksum and the embedded checksum contained within the captured Caller ID message. The result is displayed as either OK or ERROR. If an error is found, the result is also displayed in the SUMMARY category.

n107 MSG DUR

Message Duration — The total duration in milliseconds of the transmission of the FSK information. It is the difference between the time of channel seizure and the receipt of the checksum (end message).

n108 MKLVL

Mark Level — The average carrier level (in dBm) of a Mark (logical one).

n109 MK FRQ

Mark Frequency — The average frequency (in Hz) of a Mark.

n110 SPLVL

Space Level — The average carrier level (in dBm) of a Space (logical zero).

n111 SP FRQ

Space Frequency — The average frequency (in Hz) of a Space.

5.7.2 Test Results, DDS

n80RCV BYT

DDS Received Byte — Displays the received 8-bit byte of the selected channel. If the received byte is recognized as a control code, the control code name is displayed in the n95 RCODE result.

n95 RCODE

Received DS0 Control Code— Displays the name of the received DS0 code identified in the n80 RCV BYT result (see Table 5-11).

n96DDS F E

DDS Frame Errors — A count of DS0B frame errors detected since the last test restart. Subrate DS0B frame synchronization must be present.

n98%IN SB

Percent of In-Service Bits — The percentage of time the DDS control bit (bit 8) is a 1. The control bit state is determined by a majority vote of three bits and excludes transitions caused by secondary channel activity.

5.7.3 Test Results, Digit Analysis

The following test results are only available when the Digit Analysis Option is installed.

n104FQ/LVL

Lower DTMF/MF Tone Frequency and Level — The lower DTMF/MF tone frequency (Hz) and signal level (dBm). See Table 5-10 and Table 5-12 for the list of the DTMF and MF tone frequencies.

n105FQ/LVL

Upper DTMF/MFTone Frequency and Level — The upper DTMF/MF tone frequency (Hz) and signal level (dBm). See Table 5-10 and Table 5-12 for the list of the DTMF and MF tone frequencies.

5.7.4 Test Results, SS7 Link Statistics

The following test results are only available when the SS7 Call Trace Option is installed.

n PACKETS

Packets The count of error-free packets (or signal units) detected on the link since test restart. Packets include Message Signal Units (MSUs), Link Status Signal Units (LSSUs), and Fill-In Signal Units (FISUs). This result is available when SS7 MON is selected.

n MSUs

Message Signal Units — The count of error free MSU packets detected since test restart. MSUs contain messages and useful information. This result is available when SS7 MON is selected.

n FISUs

Fill-In Signal Units — A count of error free FISU packets detected since test restart. FISUs keep the signaling link "alive" when no other information is being transmitted. This result is available when SS7 MON is selected.

n ER PKCRC

CRC Errored Packets — A count of packets with CRC errors detected since test restart. This result is available when SS7 MON is selected.

n PKT ES

Packet CRC Errored Seconds — A count of seconds with at least one errored packet detected since test restart. PKT ES help to determine if the error type is constant or intermittent. This result is available when SS7 MON is selected.

n DISC PKTs

Discarded Packets — A count of discarded packets since test restart. Discarded packets include packets with seven successive ones (aborts), terminating flag out of alignment, not a multiple of 8 bits, packet too long, or packet too short. This result is available when SS7 MON is selected.

n PKT ERT

Packet CRC Error Rate — A count of CRC Errored Packets (ER PKCRC) divided by the total number of packets (PACKETS) plus the total number of discarded packets (DISC PKTs) detected since test restart. This result is available when SS7 MON is selected.

n NACKs

Negative Acknowledgments — A count of Backward Indicator Bit (BIB) field state transitions since test restart. A NACK identifies a transmission error is received in the far-end device. Only packets with good CRCs are used for this calculation. This result is available when SS7 MON is selected.

n ER MSU

Errored Message Signal Units — A count of MSU packets with CRC errors detected since test restart. A packet is an MSU if the Length Indicator (LI) field is between 3 and 63. This result is available when SS7 MON is selected.

n %UTIL

% of MSU Utilization — A count of good MSUs (MSUs) divided by the total number of packets (PACKETS) plus discarded packets (DISC PKTs) since test restart. This result is available when SS7 MON is selected.

n LSSUs

Link Status Signal Units — A count of error free LSSU packets detected since test restart. LSSUs provide link status messages that indicate the "health" of the link. This result is available when SS7 MON is selected.

5.7.5 Test Results, SS7 Call Trace

The following test results are only available when the SS7 Call Trace Option is installed. None of the following call trace test results appear in the SUMMARY category.

CALLSTATE

Call State — Displays state of the current call. During a search for a call, the message, SEARCHING appears; all other results display UNAVAIL. The following messages indicate the state of a traced call:

INIT ADDR - Initiated Address message has been detected (call has been initiated).

ADDR COMP - Address Complete message has been detected (the receiving end has recognized the initial Address Message).

ANSWERED - Answered message has been detected (call has been received).

RELEASED - Release message has been detected (call has terminated).

REL COMP - Release Complete message has been detected (call has been terminated at both ends).

Result does not display information on any other messages.

CALLED NM

Called Number — Identifies called number contained in the Initial Address Message. Result only displays digits and not any other Called Number information elements (e.g.,Type of Number and Numbering Plan Identification).

The result displays up to 26 digits of a number in 3 windows (NM_1 to NM_3, displayed as required) at 10 digits (0 to 9, #, or *) each. Greater than (>) and less than (<) signs appear on either end of the result when the called number exceeds the window limit. UNAVAIL appears during the initial call trace search. NM_2 and NM_3 only appear when the number exceeds the previous window limit.

CALLING NM

Calling Number — Identifies calling number contained in the Initial Address message. Result only displays digits and not any other Calling Number information elements (Type of Number, Numbering Plan Identification, and Screening Indicator). An *R-* appears at the beginning of a number if the calling number is "presentation restricted" (instrument checks Presentation Indicator field). The result is presented in the same manner as the CALLED NM result.

OPC

Origination Point Code — Identifies the call origination source contained in the Initial Address message.

DPC

Destination Point Code — Identifies the call destination source contained in the Initial Address message.

CAUSE

Cause Value — Displays why or how the call was disconnected or released. The value appears as a 1 to 3 digit number, and is recovered from the Cause Information Element. The most recent cause value detected is displayed. (Press the **AUX** switch to display AUX 99, on-line help, which describes the indicated cause value.) Refer to Table 5-8 for more information on SS7 CauseValues.

Table 5-8. SS7 Cause Values

Cause Value	Definition
1	Unallocated (Unassigned) Number
2	No Route To Specified Transit Network
3	No Route To Destination
4	Send Special Information Tone
5	Misdialled Trunk Prefix (No Procedure Specified For U.S. Networks)
8	Preemption
9	Preemption — Circuit Reserved For Reuse
16	Normal Call Clearing
17	User Busy
18	No User Responding
19	User Alerted, No Answer
20	Subscriber Absent
21	Call Rejected
22	Number Changed
23	Redirect To New Destination
27	Destination Out Of Order
28	Invalid Number Format (Address Incomplete)
29	Facility Rejected
31	Normal, Unspecified
Resource Unavailable	
34	No Circuit/Channel Available
38	Network Out Of Order
41	Temporary Failure
42	Switch Equipment Congestion
43	Access Information Discarded
44	Requested Circuit/Channel Not Available
46	Precedence Call Blocked
47	Resources Unavailable Or Unspecified
Service or Option Unavailable	
50	Requested Facility Not Subscribed
53	Outgoing Calls Barred Within CUG (No Procedure Specified For U.S. Networks)
55	Incoming Calls Barred Within CUG (No Procedure Specified For U.S. Networks)
57	Bearer Capability Not Authorized
58	Bearer Capability Not Presently Available
62	Inconsistency In Designated Outgoing Access Information And Subscriber Class
63	Service Or Option Not Available Or Unspecified
Service Or Option Not Implemented	
65	Bearer Capability Not Implemented
69	Requested Facility Not Implemented
70	Only Restricted Digital Information Bearer Capability Is Available
79	Service Or Option Not Implemented Or Unspecified
Invalid Message (For Example, Parameter Out Of Range)	
87	User Not Member Of CUG (No Procedure Specified For U.S. Networks)
88	Incompatible Destination
91	Invalid Transit Network Selection
95	Invalid Message, Unspecified

Table 5-8. SS7 Cause Values (Continued)

Cause Value	Definition
	Protocol Error (For Example, Unknown Message)
97	Message Type Non-existent Nor Not Implemented
99	Information Element Non-existent Or Not Implemented
102	Recover On Timer Expiry
103	Parameter Non-existent Or Not Implemented — Passed On
110	Message With Unrecognized Parameter Discarded
111	Protocol Error, Unspecified
127	Internetworking, Unspecified

5.7.6 Test Results, TR-303 Lin Statistics

The following test results are only available when the TR-303 Option is installed.

n PACKETS

Packets The count of error-free packets (or signal units) detected on the link since test restart. Packets include Message Signal Units (MSUs), Link Status Signal Units (LSSUs), and Fill-In Signal Units (FISUs).

n DISC PKTs

Discarded Packets — A count of discarded packets since test restart. Discarded packets include packets with seven successive ones (aborts), terminating flag out of alignment, not a multiple of 8 bits, packet too long, or packet too short.

n ER PKCRC

CRC Errored Packets — A count of packets with CRC errors detected since test restart.

n PKT ES

Packet CRC Errored Seconds — A count of seconds with at least one errored packet detected since test restart. PKT ES help to determine if the error type is constant or intermittent.

n PKT ERT

Packet CRC Error Rate — A count of CRC Errored Packets (ER PKCRC) divided by the total number of packets (PACKETS) plus the total number of discarded packets (DISC PKTS) detected since test restart. Counts errors regardless of AUX 40 setting.

n INFO PKT

Information Packets — A count of all layer 2 Information (I) packets received since test restart. This determines if layer 3 information is being exchanged.

n RR PKT

Receiver Ready Packets — A count of all layer 2 Receiver Ready (RR) packets received since test restart. These messages are keep alive messages and determine if the link is capable of transferring information.

5.7.7 Test Results, TR-303 Call Trace

CALLSTATE

Displays state of the current call. During a search for a call, the message, SEARCHING appears; all other results display UNAVAIL. The following messages indicate the state of a traced call:

INITIATED - Call initiated (SETUP message detected).

CONNECTED - Call connected (CONNECT message detected).

DISCONNECT - Call disconnected (DISCONNECT message detected).

RELEASED - Call released (RELEASE or RELEASE COMPLETE message detected).

LINE

Displays Line Value which identifies the subscriber line number (protocol call reference value) from 1 to 2048.

CALL TYPE

Identifies the call type from the CRV Suffix section in the SETUP message. The following messages appear indicating the detected call type:

POTS — POTS call being traced.

ISDN B1 — Basic Rate ISDN B1 channel call being traced.

ISDN B2 — Basic Rate ISDN B2 channel call being traced.

UNKNOWN — Call type is not recognized or not supported

DS1/DS0

Identifies the DS1 and DS0 assignment of the traced call from the Channel Information Element of the following messages: SETUP or CONNECT. The DS1 result displays 1 to 28. The DS0 result displays 1 to 24.

ORIG SRC

Identifies the call origination source (CO or RT) from the C/R bit in the Layer 2 Information frame header carried in the original SETUP message. The T-BERD 224 line number, which the call was received on, is also indicated (L1 or L2). The following messages appear:

CO (L1) - Call originated from the central office on Line 1.

CO (L2) - Call originated from the central office on Line 2.

RT (L1) - Call originated from the remote terminal on Line 1.

RT (L2) - Call originated from the remote terminal on Line 2

DISC SRC

Identifies the call disconnect source (CO or RT) from the C/R bit in the Layer 2 Information frame header carried in the first DISCONNECT, RELEASE, or RELEASE COMPLETE message. The T-BERD 224 line number, which the call was received on, is also indicated (L1 or L2). The following messages appear:

CO (L1) - Call disconnected from the central office on Line 1.

CO (L2) - Call disconnected from the central office on Line 2.

RT (L1) - Call disconnected from the remote terminal on Line 1.

RT (L2) - Call disconnected from the remote terminal on Line 2.

CAUSE

Displays why or how the call was disconnected or released. The value appears as a 1 to 3 digit number, and is recovered from the Cause Information Element. The most recent cause value detected is displayed. (Press the **AUX** switch to display AUX 99, on-line help, which describes the indicated cause value.) Refer to Table 5-9 for the coding of the TR-303 Cause Values.

Table 5-9. TR-303 Cause Value

Cause Value	Definition
16	Normal Clearing
27	Destination Out Of Service
30	Response To Status Enquiry
34	Channel Unavailable
41	Temporary Failure
44	Line Unit Unavailable
47	Ring Failure
81	Invalid Call Reference
96	Mandatory Information Element Missing
97	Message Unimplemented
99	Information Element Unimplemented
100	Invalid Information Element Contents

5.7.8 Test Results, VF Testing

n84 3KFLAT

3 kHz Flat Noise — A measure of the noise (dBrn) weighted with a 3 kHz flat filter. Used when qualifying data-grade circuits.

n85 3K NCH

3 kHz Notch Noise — A measure of the noise (dBrn) against a weighted 3 kHz flat filter. A transmitted 1004 Hz tone is filtered out prior to the measurement for analog data-grade analysis. This measurement includes quantization noise caused by analog/digital conversion in the CODEC.

n86 C-MSG

C-Message Noise — A measure of the noise (in dBrnC) weighted with a C-Message filter for voice-grade analysis. This measurement determines the noise on an idle channel.

n87 C-NCH

C-Message Notch Noise — A measure of the noise (in dBrnC) against a weighted C-message filter. transmitted 1004 Hz tone is filtered out prior to the measurement for voice-grade analysis.

n88 S/N

Signal-to-Noise Ratio — The ratio (in dB) of received signal level to noise level. The noise level is measured with a C-message filter and the transmitted 1004 Hz tone is filtered out prior to measurement.

n89 DC-OFF

DC-Offset — The average DC voltage level (in mV) of the received analog signal with respect to time. VF signals should have DC offsets of approximately zero millivolts (0 mV).

n90 P/AR

Peak to Average Ratio — The ratio (in P/AR units) of transmitted peak signal level of 16 non-harmonically related frequencies to the average received level of the signal. This measurement is only available when PAR is selected as the test.

n91 PARLV

Peak to Average Ratio Level — The RMS level (in dBm) of the received signal. This measurement is only available when PAR is selected as the test.

n92 ERL

Echo Return Loss — The ratio (in dB) of the power transmitted by the T-BERD 224 to the power reflected by the terminated circuit [ERL = 10 log (TX power/RX power)].

n93 SRL-HI

Singing Return Loss - High — The ratio (in dB) of the noise power transmitted for a shaped high frequency band to the power reflected by the terminated circuit.

n94 SRL-LO

Singing Return Loss - Lo — The ratio (in dB) of the noise power transmitted for a shaped low frequency band to the power reflected by the terminated circuit. Refer to Table 5-10 for Dual-Tone Multifrequency Codes and to Table 5-11 for Reportable DSO Control Codes.

Table 5-10. Dual-Tone Multifrequency Codes (DTM F

Low Frequency Tones (Hz)	High Frequency Tones (Hz)			
	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Table 5-11. Reportable DS0 Control Co d e

Code ID	Control Byte	Description
ASC	x001 1110	Abnormal Station Code. Generated by the OCU due to a signal loss from the DSU/CSU, the DSU/CSU isn't attached, or a faulty OCU.
BLOCK	x000 1010	MJU Block Code.
C IDLE	x111 1110	Control Mode Idle. Equivalent to RTS set to OFF. Neither the customer nor the network is using the channel.
CHAN	x010 1000	Alternating Channel (CSU) Loopback.
D IDLE	x111 1111	Data Mode Idle. Equivalent to RTS set to ON, but no data is being sent by the computer
DSU	x010 1100	Alternating DSU Loopback.
FEV	x101 1010	Far End Voice Byte. Last (Fourth) byte sent in latching loop up sequence.
LBE	x101 0110	Loopback Enable. Third byte sent in the latching loop up sequence.
MA	x111 0010	MJU Alert Code. Second byte sent during an MJU loop up sequence.
MAP0	x001 0011	MAP 0 Confirmation Code (line/T1 side). Sent by the second DS0-DP being looped.
MAP1	x110 1101	MAP 1 Confirmation Code (drop/DS0 side). Sent by the first DS0-DP being looped.
MOS	x001 1010	Multiplexer Out of Synchronization. Sent by SRMU when it loses subrate frame synchronization.
OCU	x010 1010	Alternating OCU Loopback.
RELEASE	x111 1000	MJU Release Code.
TA	x110 1100	Test Alert. First byte sent during an MJU loop up sequence.
TEST	x001 1100	Test Code. Sent in opposite direction during loop up.

Table 5-11. Reportable DS0 Control Codes (Continued)

Code ID	Control Byte	Description
TIP	x011 1010	Transition In Progress. First byte sent during a DDS latching loop up sequence. Also sent for DDS latching loop down.
UMC	x001 1000	Unassigned Multiplexer Channel. Sent by DS0-DP when no OCU-DP installed in channel bank.

x = a subrate framing bit when the byte is transmitted or received as a DS0B signal. Framing bit pattern determined by DS0B data rate.
x = a *don't care* mode when the byte is received at a DS0A subrate.
x = a 1 when the byte is transmitted at a DS0A subrate.
x = a 0 when control codes (except IDLE) are transmitted at the DS0A 56 kb/s rate.
x = a *don't care* mode when control codes (except IDLE) are received at the DS0A 56 kb/s rate.
x = a 1 when the IDLE code is transmitted or received at the DS0A 56 kb/s rate.

Refer to Table 5-12 for the Multifrequency Codes for the T-BERD 224..

Table 5-12. Multifrequency Code s (M F

Frequencies (Hz)		Multifrequency Signals			
High	Low	Digit and Control	Expanded Inband	TSPS Equal Access	CCITT System 5
900	700	1			1
1100	700	2	Coin Collect		2
1100	900	3			3
1300	700	4			4
1300	900	5			5
1300	1100	6			6
1500	700	7			7
1500	900	8	Operator Released		8
1500	1100	9			9
1500	1300	0	Operator Attached		0
1700	700		Ring Back	ST3P (ST''')	Code 11
1700	900			STP (ST')	Code 12
1700	1100	KP	Coin Return		KP1
1700	1300			ST2P (ST'')	KP2
1700	1500	ST	Coin Collect	ST	ST
			Operator Released		

5.7.9 Test Results, Mainframe

n81VF FREQ

Voice Frequency — The frequency (Hz) of a VF tone within a selected DS0 channel.

n82 VF LVL

VF Level — The level (dBm) of a VF tone within a selected DS0 channel.

5.7.10 Test Results, Signaling

The following test results are only available when the Signaling Option is installed.

n100 DELAY

Delay — The period of time between the indicated event or digit and the previous event or digit.

n101 DUR

Duration — The length of time during which the indicated event or digit occurred.

n102 ADDR

Address — The type of digit; DTMF, MF, or Dial Pulse.

5.7.11 Test Results, Primary Rate ISDN Link Statistics

The following test results are only available when the Primary Rate ISDN Option is installed.

n PACKETS

Packets The count of error-free packets (or signal units) detected on the link since test restart. Packets include Message Signal Units (MSUs), Link Status Signal Units (LSSUs), and Fill-In Signal Units (FISUs). This result is available when PRI MON is selected.

n ER PKCRC

CRC Errored Packets — A count of packets with CRC errors detected since test restart. This result is available when PRI MON is selected.

n DISC PKTs

Discarded Packets — A count of discarded packets since test restart. Discarded packets include packets with seven successive ones (aborts), terminating flag out of alignment, not a multiple of 8 bits, packet too long, or packet too short. This result is available when PRI MON is selected.

n PKT ES

Packet CRC Errored Seconds — A count of seconds with at least one errored packet detected since test restart. PKT ES help to determine if the error type is constant or intermittent. This result is available when PRI MON is selected.

n PKT ERT

Packet CRC Error Rate — A count of CRC Errored Packets (ER PKCRC) divided by the total number of packets (PACKETS) plus the total number of discarded packets (DISC PKTs) detected since test restart. This result is available when PRI MON is selected.

n INFO PKT

Information Packets — A count of all layer 2 Information (I) packets received since test restart. This determines if layer 3 information is being exchanged. This result is available when PRI MON is selected.

n RR PKT

Receiver Ready Packets — A count of all layer 2 Receiver Ready (RR) packets received since test restart. These messages are keep alive messages and determine if the link is capable of transferring information.

5.7.12 Test Results, Primary Rate ISDN Call Trace

The following test results are only available when the Primary Rate ISDN Call Trace is installed. None of the following call trace test results appear in the SUMMARY category.

CALLSTATE

Call State — Displays state of the current call. During a search for a call, the message, SEARCHING appears; all other results display UNAVAIL. The following messages indicate the state of a traced call:

INITIATED - Call initiated (SETUP message detected).

PROCEEDING - Call proceeding (CALL PROCEEDING message detected).

ALERTING - Call alerted (ALERTING message detected).

CONNECTED - Call connected (CONNECT message detected).

DISCONNECT - Call disconnected (DISCONNECT message detected).

RELEASED - Call released (RELEASE or RELEASE COMPLETE message detected).

Result does not display information on any other messages.

CALLED NM_1, CALLED NM_2, CALLED NM_3

Called Number — Identifies called number from the Called Number information element in the initial SETUP message. Result only displays digits and not any other Called Number information elements (e.g., Type of Number and Numbering Plan Identification).

The result displays up to 26 digits of a number in 3 windows (NM_1 to NM_3, displayed as required) at 10 digits (0 to 9, #, or *) each. Greater than (>) and less than (<) signs appear on either end of the result when the called number exceeds the window limit. UNAVAIL appears during the initial call trace search. NM_2 and NM_3 only appear when the number exceeds the previous window limit.

CALLING NM_1, CALLING NM_2

Calling Number — Identifies calling number from the Calling Number information element in the initial SETUP message. Result only displays digits and not any other Calling Number information elements (Type of Number, Numbering Plan Identification, and Screening Indicator). An *R-* appears at the beginning of a number if the calling number is "presentation restricted" (instrument checks Presentation Indicator field). The result is presented in the same manner as the CALLED NM result.

CALL TYPE

Call Type — Identifies the call type from the Information Transfer Capability, Information Transfer Rate, Rate Multiplier, and User Rate fields within the Bearer Capability information element in the SETUP message. The following messages appear indicating the detected call type:

SPEECH -Voice call being traced.

3.1K AUDIO - 3.1 kHz audio call being traced.

DATA 1536K - 1536 kb/s data call being traced.

DATA 384K - 384 kb/s data call being traced.

DATA 64K - 64 kb/s data call being traced.

DATA 56K - 56 kb/s data call being traced.

DATA ##x64 - N x 64 kb/s data call being traced (## is 1 to 24).

UNKNOWN - Call type is not recognized or not supported.

INTF CHAN

Interface/Channel — Identifies the interface (DS1) and channel (DS0) of the traced call from the Interface Identifier Present, Interface Identifier, Number/Map, and Channel Number fields within the Channel Identification Information element of the following messages: SETUP, CALL PROCEEDING.

ALERTING, or CONNECT. The interface result displays 0 to 31. The channel result displays 1 to 24. "--" appears when the interface identifier is not present in the Channel Identification element. MAP appears when the channel number is not present and a slot map is present.

NETWORK ID

Network Identification — Displays the network identification (4 alphanumeric characters) from the Transit Network Selection information element or Network Specific Facility information element.

ORIG SRC

Call Origination Source — Identifies the call origination source (network or user) from the C/R bit in the Layer 2 Information frame header carried in the original SETUP message. The T-BERD 224 line number, which the call was received on, is also indicated (L1 or L2). The following messages appear:

NETW (L1) - Call originated from the network on Line 1.

NETW (L2) - Call originated from the network on Line 2.

USER (L1) - Call originated from the user on Line 1.

USER (L2) - Call originated from the user on Line 2.

DISC SRC

Call Disconnect Source — Identifies the call disconnect source (network or user) from the C/R bit in the Layer 2 Information frame header carried in the first DISCONNECT, RELEASE, or RELEASE COMPLETE message. The T-BERD 224 line number, which the call was received on, is also indicated (L1 or L2). The following messages appear:

NETW (L1) - Call disconnect from the network on Line 1.

NETW (L2) - Call disconnect from the network on Line 2.

USER (L1) - Call disconnect from the user on Line 1.

USER (L2) - Call disconnect from the user on Line 2.

CAUSE

Cause Value — Displays why or how the call was disconnected or released. The value appears as a 1 to 3 digit number, and is recovered from the Cause Information Element. The most recent cause value detected is displayed. (Press the **AUX** switch to display AUX 99, on-line help, which describes the indicated cause value.) Refer to Table 5-13 for the coding of the Primary Rate ISDN Cause Values.

Table 5-13. Primary Rate ISDN Cause Values

Cause Value	Definition
1	Unallocated (Unassigned) Number
2	No Route To Specified Transit Network
3	No Route To Destination
6	Channel Unacceptable
16	Normal Call Clearing
17	User Busy
18	No User Responding
19	User Alerted, No Answer
21	Call Rejected
22	Number Changed
27	Destination Out Of Order
28	Invalid Number Format (Address Incomplete)

SECTION 6 PRINTER OPERATION

6.1 COMPATIBLE PRINTERS

The T-BERD 224 can generate printouts t oeither the thermal lid printer, an RS-232 compatible serial printer, or an IEEE-488 listen-only printer.

6.2 LID PRINTER OPERATION

The optional thermal lid printer is in the T-BERD 224 front panel cover which mounts on the T-BERD 224 with a hinge on its bottom front edge. The power, data, and control leads are supplied through the front panel 8-pin RS-232 serial port labeled AUXILIARY PORT.

The lid printer is a 40-column thermal dot-matrix printer. The printer operates at 9600 b/s with a character format of one start bit, eight data bits, and no parity.

NOTE

Do not operate the lid printer when the cover is closed.

6.2.1 Lid Printer Controls and Indicators

The lid printer has two switches; **ON LINE** and **PAPER FEED**. The **ON LINE** switch illuminates green when the printer is ready to print. Press the **ON LINE** switch to take the printer on and off line. Press the **PAPER FEED** switch to advance the paper when the printer is off line. The lid printer automatically goes off line when the T-BERD 224 is under remote control.

6.2.2 Setup and Operation

To set up the lid printer for operation, perform the following steps.

1. **Attach the lid printer to theT-BERD 224**
   Attach the lid printer hinge to the hinge on the T-BERD 224 bottom front edge.

2. **AUXILIARY PORT**
   Plug the lid printer connector into the T-BERD 224 AUXILIARY PORT located on the lower left side of the front panel.

3. **Power switch**
   Press to apply power to the T-BERD 224.

4. **ON LINE switch**
   This switch should illuminate when power is first applied to the printer.

6.2.3 Loading Printer Paper

When the printer is out of paper, the **PAPER FEED** switch illuminates red. A 4-3/8" wide roll of thermal paper fits inside the printer paper tray. The roll cannot exceed 1-3/4" in outside diameter and 7/16" in inside diameter. Perform the following procedure to load a new roll of paper.

1. **ON LINE switch**
   This switch should not be illuminated.

2. **PAPER FEED switch**
   Press this switch until the paper clears the print head.

3. **Remove paper tray cover**
   Gently lift the smoked plastic paper tray cover from the printer cover.

4. **Remove paper tube**
   To release the retaining tube, push the two retainer arms out and to the front. Pull the paper tube and white retaining rod out of the paper tray. Slide the retaining rod out of the spent paper tube.

5. **Insert new paper tube**
   Slide the new roll of paper over the white retaining rod and remove the tape from the end of the paper. Make sure the end of the paper has a clean square cut on it.

   Position the roll of paper over the paper tray with the end of the paper coming from under the roll. When the roll is placed in the tray, the paper should come up through the front of the tray the shiny side of the paper facing out and the end of the paper pointed at the mainframe front panel.

6. **Printer paper tray**
   Place the roll of paper (with the retaining rod in place) into the printer paper tray. Press down on each end of the roll until the retaining rod snaps into place on each side of the paper tray.

   Unroll about three inches of paper and loop the end of the paper toward the front of the printer. The dull side of the paper should be facing up.

7. **Paper feed slot**
   Look down inside the front edge of the paper tray and locate the paper feed slot located about 1" from the top of the printer cover. Slide the end of the paper into the slot.

8. **PAPER FEED switch**
   Press this switch several times until the paper is protruding through the paper slot in the top of the printer.

9. **ON-LINE switch**
   Press this switch to illuminate the LED and place the printer back on line.

6.3 RS-232 PRINTER OPERATION

With the RS-232 PRINTER/REMOTE connector, the T-BERD 224 can generate printouts to an RS-232 compatible serial printer. The RS-232 connector is located on the side panel of the T-BERD 224. The connector is configured as Data Communications Equipment (DCE), which allows it to be directly connected to Data Terminal Equipment (DTE). Connection to another DCE, such as a modem, is possible with the use of a DTE/DCE adaptor cable. Refer to Section 8.9.2 for the RS-232 pin assignments. The AUX 08 RS 232 function configures the RS-232 PRINTER/REMOTE connector baud rate, parity, and line terminator. The column length is preset to 80 characters. The default settings for AUX 08 RS 232 function match the PR-40A parameters.

6.4 IEEE-488 PRINTER OPERATION

With the IEEE-488 Interface Option installed and set to Talk-Only mode, the T-BERD 224 can be connected directly to a IEEE-488 compatible listen-only printer through the IEEE-488 PRINTER/REMOTE connector.

To configure the T-BERD 224 to operate with an IEEE-488 compatible printer perform the following procedure.

1. **Power switch**
   Press this switch to apply power to the T-BERD 224.

2. **AUX switch**
   Press to access auxiliary functions (LED ON).

3. **MODE and RESULTS II Arrowed switch**
   Scroll to AUX 08 RS 232 using the **MODE** switch. Set the line terminator to CR, LF, or CRLF using the **RESULTS II Arrowed** switch.

   Scroll to AUX 09 488MODE. Select TALK-ONLY mode.

4. **MODE and SOURCE CONFIGURATION II switches**
   Scroll to AUX 09 488MODE using the **MODE** switch. Select TALK-ONLY mode using the **SOURCE CONFIGURATION II** switch.

5. **PRINTER/REMOTE IEEE-488 Interface**
   Connect the printer to the T-BERD 224 with an appropriate cable.

6. **Printer Power switch**
   Turn the printer ON; if necessary place the printer on line.

6.5 GENERATING A PRINTOUT

Results and controls printouts are generated with the front-panel **PRINT** and **PRINT EVENT** switches.

PRINT switch — Press this switch to manually generate either a results or controls printout.

PRINT EVENT switch — When a print event is selected, a results printout is generated at the indicated time or event, status and alarm messages are automatically generated, a power-down results printout is generated, and the printer squelch function is enabled. All of the **PRINT EVENT** switch selections, except for OFF, cause a status message to print if an alarm condition changes, and cause a SIGNLNG/SWI-56 results printout when the selected line(s) return to the ON HOOK state.

> **TEST END** — Initiates a results printout at the end of a timed test if the **TEST** switch is set to TIMED. Use AUX 03 TES LEN function to set the timed test length.

ERR SEC — Initiates a results printout for each second that a BPV, frame error, or CRC error occurs for either LINE 1 or LINE 2. A results print is not generated if the selected error is disabled in the AUX 35 CUSTOM function.

TIMED — Initiates a results printout at the completion of a timed interval. The timed interval is set in the AUX 02 TIM PRI function.

OFF — Automatic results printouts are not generated.

If a printer is not connected or is off line at the time the printouts are generated, the T-BERD 224 print buffer can store up to ten results and ten controls printouts. In the event that a power loss occurs, a results printout is stored.

NOTE

Clear the printer buffer by selecting the AUX 01 CL FIFO function.

6.6 TYPES OF PRINTOUTS

The T-BERD 224 can generate three types of printouts: results, controls, and messages. Each printout is identified by a header and is time- and date-stamped.

6.6.1 Results Printout

A results printout is a hard-copy listing of the accumulated test results (see Figure 6-1). The available results depend on the settings in the AUX 35 CUSTOM function, the T-BERD 224 configuration, the installed options, and the presence of a signal on the line(s). Each result printout is labeled indicating how the printout was generated.

The results printout identifies an overflowed results count by preceding the result with two asterisks the first time it is printed out. All succeeding printouts of the overflowed results value are preceded by a single asterisk, indicating that the overflow condition has already occurred.

```
MANUAL PRINT       08:22:05     JAN 09 BPVS2:          0 BPV S2:          0
BPV RT2:    0. E-07 FRM ES2:    UNAVAIL FR SES2:  UNAVAIL FRM ER2:  UNAVAIL
FRM ERT2:  UNAVAIL FR LOS2:     UNAVAIL FR L S2:  UNAVAIL RCV FR2:  1544000
RCV LV2:  7.5dBdsx RCV LV2:     UNAVAIL RCV LV2:    14.3 V TM SLI2:  UNAVAIL
SLI SC2:  UNAVAIL
TRAFFIC:   L1    L2
CHAN  n:   AB    AB
CHAN  1:     -     - CHAN  2:       -     - CHAN  3:   -     - CHAN  4:   -   -
CHAN  5:     -     - CHAN  6:       -     - CHAN  7:   -     - CHAN  8:   -   -
CHAN  9:     -     - CHAN 10:       -     - CHAN 11:   -     - CHAN 12:   -   -
CHAN 13:     -     - CHAN 14:       -     - CHAN 15:   -     - CHAN 16:   -   -
CHAN 17:     -       CHAN 18:       -       CHAN 19:   -     - CHAN 20:
CHAN 21:     -     - CHAN 22:       -     - CHAN 23:   -     - CHAN 24:   -   -
SIG LS2:           0 ALM SC2:             0 ELA TM2: 00:14:15 TST END:      ****
RCV BY2:   UNAVAIL RCV CD2:       UNAVAIL
```

Figure 6-1. Results Printout

6.6.2 Results — Signaling Option

When the T-BERD 224 is configured for SIGNLNG, a signaling printout can be generated manually or automatically. Figure 6-2 illustrates how the dial tone and digit measurement results printout arranges the delay (DEL), duration (DUR), lower (FRQ1 and LVL1) and upper (FRQ2 and LVL2) frequencies and levels of the received dial tone and digits. The FRQ1,LVL1, FRQ2, and LVL2 results are only available when the Digit Analysis Option is installed.

```
SIGNALING PRINT 10:34:54 AUG 23

H w {MF} KP3531550ST h

Event   DEL    DUR   FRQ1    LVL1     FRQ2    LVL2
        ms     ms    Hz      dBm      Hz      dBm
H       N/A    N/A   N/A     N/A      N/A     N/A
w       250    150   N/A     N/A      N/A     N/A
KP      150     70   1700    -7.0     1100    -7.0
3       150     70   1100    -7.0     900     -7.0
5       150     70   1300    -7.0     900     -7.0
3       150     70   1100    -7.0     900     -7.0
1       150     70   900     -7.0     700     -7.0
5       150     70   1300    -7.0     900     -7.0
5       150     70   1300    -7.0     900     -7.0
0       150     70   1500    -7.0     1300    -7.0
ST      150     70   1700    -7.0     1500    -7.0
h      4800    N/A   N/A     N/A      N/A     N/A
```

Figure 6-2. Dial Tone and Digit Measurement Results Printout

6.6.3 Results — Printer Option for STS-1 and DS3 Testing

When the T-BERD 224 is configured for SONET/DS3 testing, a printer option can be generated manually or automatically. All of the STS-1 and DS3 RESULTS will be available on the printouts. In addition, the Time, Date, and all SIGNAL/TIME results will be available, as shown in Figure 6-3.

The user will also be able to select the ability to print *only* STS-1 and DS3 results through selection in AUX 35 on the T-BERD 224 mainframe. If those specific printouts are selected in AUX 35, they will be formatted as follows:

RESULTS PRINT	22:51:05	JAN 08
PRIMARY		SECONDARY
YES	SIGNAL	NO
DS3		
YES	FRAME SYNC	UNAVAIL
YES	C-BIT	UNAVAIL
	•	
	•	
	•	
0	PARITY ERRS	UNAVAIL
0	C-BIT ERRS	UNAVAIL
0	FEBE	UNAVAIL
0	DS2 FRM ERR	UNAVAIL
YES	DS2 FRAME SYNC	UNAVAIL
SONET		
NO	FRAME SYNC	N/A
NO	LINE AIS	N/A
	•	
	•	
	•	
0	VT FEBE	N/A
0	VT PT JUS	N/A
0	VT SIGLAB	N/A
SIGNAL		
44735990	DS3 RX FREQ	UNAVAIL
N/A	STS RX FREQ	N/A
00:12:23	ELAPSED TIME	00:12:23

Figure 6-3. STS-1/DS3 Results Printout

All LEDs and alarms will be denoted with either a "YES" or a "NO" to indicate active and inactive states.

6.6.4 Controls Printouts

The controls printout lists the current setting of all front-panel switches and the auxiliary functions (see Figure 6-4). A controls printout is initiated manually by pressing the **PRINT** switch to the CONTROLS position.

```
CONTROLS PRINT        08:22:07   JAN 09
MODE:          T1SLC96 CHAN FOR:      DS0 SOU 1:       BYTE SOU 2:     0000000
DIS HOL:           OFF CODE:          AMI TIMED/CONT:  CONT LI CHAN:    1
L2 CHAN:             1 DROP:         BOTH INSERT:      NONE L1 REC INP:    TERM
LS REC INP:       TERM PRI EVE:       OFF SIG A BIT:    OFF SIG B BIT:      OFF
SIG C BIT:         OFF SIG D BIT:     OFF ERR INS BPV:  OFF ERR INS FRA:    OFF
ERR INS YEL:      OFF
 AUX FUNCS:
TIM PRI:      06:00:00 TES LEN:200:00:00 LI LBO:        0dB L2 LBO: 0dB
BACK TIM:     INTERNAL DS0 TIM:    COMMON PARITY:      NONE BAUD:   9600
PRI/REM TERM:     CRLF DS0A ERR COR:  OFF ERR RATE:  1.0E-3 ERR TYPE:   SINGLE
BURST LEN:       20 ms FRM ERRS:   SINGLE PGM LP UP:  10000 PGM LP DN:      100
LP CD TYPE:         T1 LP EQUIP:      CSU RESPONSE: NO RESP DDS TX CH:      PRI
DDS ANA CH:        PRI
USER PAT:     10000
MJU OPT:          SELECT MJU BRANCH:     1 MJU HUB ID:
L1 N-CONTG:
L2 N-CONTG:
```

Figure 6-4. Controls Printout

6.6.5 Controls Printouts for SONET/DS3 Analyzer Option

When the T-BERD 224 is configured for SONET/DS3, a Controls Print option will be attached at the botto of the existing printout unless the user selects SONET/DS3 print only in AUX 35 of the T-BERD 224 mainframe. Time, date, and configuration of the test set will be available as shown in Figure 6-5.

```
CONTROLS PRINT   22:51:05   JAN 08

MODE:            STS/DS3-M13      FORMAT:          [illegible]
RESULTS I:       SUMMARY          RESULTS II:      SUMMARY

PRI VT/DS1:      DISABLED         SEC VT/DS1:      DISABLE
p VT/DS1 CHAN:   ---              s VT/DS1 CHAN:   ---

DS3 TX TIMING:   INTERNAL         STS1 TX TIME:    INTERNAL

DISPLAY HOLD:    OFF              ALARM INSERT:    ON

AUX FUNCTIONS:

10 DS3 ALARM:      YELLOW
11 DS3 ERR INS:  LOGIC    5.0 SEC   1E-6

20 STS1 ALARM:      NONE
21 SONET ERR INS:   NONE
22 PATH TRACE:      USER 1
```

Figure 6-5. Controls Printout for SONET/DS3

6.6.6 Alarm and Status Messages

Unless the **PRINT EVENT** switch is set to the OFF position, alarm and status messages are initiated automatically to inform you of any important developments related to your ongoing test. The format for an alarm message is:

```
alarm message name HH:MM:SS MMM DD
```

Possible alarm messages are shown in Table 6-1.

Table 6-1. Alarm Messages

Message	Description
L1|L2 SIGNAL LOSS X	Valid T1 pulses are no longer present on the specified line. XX = a running count of signal losses for that line since the start of the test.
L1|L2 FRM SYN LOS XX	The framing pattern is no longer present on the specified line. XX = a running count of frame sync losses for that line since the start of the test.
L1|L2 YELL ALARM ON	A yellow alarm has been received on the specified line.
L1|L2 YELL ALARM OFF	A yellow alarm is no longer being received on the specified line.
L1|L2 EXCESS ZERO ON	More than 16 consecutive zeros have been received on the specified line.
L1|L2 EXCESS ZERO OFF	Less than 16 consecutive zeros have been received on the specified line which previously detected excess zeros condition.
L1|L2 AIS ON	The specified line has no zeros on it. Consecutive unframed logical ones (AIS) have been detected in the data stream input on the specified line.
L1|L2 AIS OFF	A zero has been detected on the specified line. One or more zeros have been detected in the line previously marked as receiving all logical ones (AIS).
L1|L2 Ln 1's DENS VIOLATED	This message is displayed when the T1 signal violates the ones density criteria.
L1|L2 PATTERN SYNC LOSS	This message is displayed when loss of pattern synchronization occurs.

Possible status messages are shown in Table 6-2.

Table 6-2. Status Messages

Message	Description
L1|L2 SIGNAL DETECT	T1 pulses of valid frequency and level are present on the specified line.
L1|L2 FRM SYN ACQUIRE	The framing pattern has been detected on the specified line.
L1|L2 B8ZS DETECT	B8ZS line code is received on the specified line and the test set is configured for AMI.
***** BUFFER FULL *****	Internal print buffers have overflowed. At least one printout has been lost (discarded).
PRINT SQUELCH ON	More than 20 alarm or status prints have been generated within one minute. The printer squelch feature is enabled and no more messages or automatic ERR SEC results prints will print.
PRINT SQUELCH OFF	The generation of five or fewer alarm or status print requests, or errored second result prints within a minute while the SQUELCH is ON causes SQUELCH to turn OFF.
TEST COMPLETE	The end of a timed test has been reached.
TEST RESTART	A test restart occurred.
NEW CONFIGURATION	The configuration of the T-BERD 224 has been modified.
L1|L2 PATTERN SYNC GAIN	The T-BERD 224 has gained pattern synchronization.

6.7 AUTOMATIC SQUELCH FEATURE

The automatic squelch feature prevents more than 20 errored second results printouts or status and alarm messages from being generated in a 60-second period. After the printout of the 20th message, a time-stamped message is printed indicating that the squelch feature is on. While the squelch feature is on, the T-BERD 224 continues to monitor for errored events, but no automatic errored results printouts or status and alarm messages are generated or stored. The timed and manual printouts are not affected by the squelch feature.

The squelch feature is turned off when five or less error events occur in a 60-second interval. When this condition is met, another time-stamped message is generated indicating that the squelch feature is off.

NOTE

The squelch feature is reset by clearing the AUX 01 CL FIFO function, changing the **PRINT EVENT** switch selection, or completing a timed test.

SECTION 7 REMOTE CONTROL OPERATION

7.1 INTRODUCTION

This section provides information on how to control the T-BERD 224 from a terminal or a computer. These devices can access theT-BERD 224 through the PRINTER/REMOTE RS-232 connector or the PRINTER/REMOTE IEEE-488 connector via an IEEE bus.

7.2 RS-232 REMOTE CONTROL OPERATION

The PRINTER/REMOTE RS-232 connector is a 25-pin female D connector located on the T-BERD 224s right-side panel. The PRINTER/REMOTE RS-232 connector is configured as Data Communication Equipment (DCE); so it can be directly connected to DataTerminal Equipment (DTE). Connection to another DCE is possible with an adaptor cable. Refer to Section 8.9.2 for the PRINTER/REMOTE RS-232 connector pin configuration.

7.2.1 Remote Control Modes

In RS-232 remote control, the T-BERD 224 functions in three modes; terminal mode, remote mode, or computer mode.

In terminal mode, theT-BERD 224 operates interactively with a dumb terminal or computer. The terminal mode provides a prompt character whenever the T-BERD 224 is ready to receive a command, echoes all characters back to the remote device as the user types them, and transmits error messages when an improper command or syntax error occurs.

The remote and computer modes allow a computer to send commands and receive results from the T-BERD 224. The remote and computer modes eliminate program interruptions (e.g., extra linefeeds, error messages, etc.) and allow the computer to quickly process responses.

The T-BERD 224 powers up in LOCAL mode and remains in that mode until a remote control command is entered. If a remote control command is received that does not set one of the remote modes, the default remote control settings for **ECHO** and **PROMPT** are both set to OFF. Automatic prints and error messages are sent to the controlling device. In addition, the lid printer is turned OFF LINE. When the T-BERD 224 is in a remote mode, the **LOCAL** command returns control to the front panel.

7.2.2 Setup Procedure

To allow the T-BERD 224 to communicate with the remote controller, it must be configured using the auxiliary functions (baud rate and parity).

7.2.2.1 *Manual Setup for Remote Control Operation*

1. **AUX switch**
   Press to access auxiliary functions (LED ON).

2. **MODE, SOURCE CONFIGURATION II, and RESULTS switches**
   Scroll to AUX 08 RS 232 function using the **MODE** switch. Select ODD, EVEN, or NONE for the PARITY using the **SOURCE CONFIGURATION II** switch. Set the BAUD rate to match the remote control device baud rate using the **RESULTS I Blank** switch. Set the line TERMINATOR to CR, LF, or CRLF using the **RESULTS II Arrowed** switch.

AUX 08	PARITY	BAUD	TERMINATOR
RS 232	NONE	9600	CR

3. **AUX switch**
   Press to exit the auxiliary functions (LED OFF).

7.2.2.2 Auto Baud Setup at a Computer for Remote Control Operation

1. **BREAK key**
   Slowly press the BREAK key several times (once per second). On some terminals, the CTRL key and the BREAK key must be pressed simultaneously.

2. **Space bar**
   Press and hold the space bar until the message *Auto-baud achieved Press ESCAPE to continue* appears on the screen. If the space bar does not have an auto-repeat function, press the space bar repeatedly until the message appears.

3. **ESCAPE key**
   Press the ESCAPE key once; the message *Character format determined* is displayed.

NOTE

The auto baud function must be completed within 30 seconds. If auto baud is not acquired within the 30-second period, the auto baud function is aborted and a message is printed.

7.2.3 Remote Mode Operation

Once the T-BERD 224 is properly configured to communicate with the controller, it can be placed into the remote mode. The remote mode is established by sending a valid remote command. Typing a period followed by a terminator (CR or CRLF) sets the T-BERD 224 for terminal (CRT) control. The REMOTE command should be used to place the T-BERD 224 under control of a computer. Once a valid command is recognized by the T-BERD 224, it enters the remote mode, the message *UNDER REMOTE CONTRO* flashes in the left display window, and the front-panel switches are disabled.

To facilitate the passing of responses, character echoing, prompts, error messages, and printouts are all disabled. Printouts can be released by using the REL command. In the remote mode, the lid printer is turned OFF LINE.

7.2.3.1 Operating in Terminal Mode

When operating in terminal mode, each line of input is prompted by either the default prompt (>), a user defined prompt, or a printer hold prompt. These prompts signify that the T-BERD 224 is ready to accept commands and is in an interactive terminal mode. In terminal mode, the prompt, echo, and error message functions are enabled. When this mode is enabled, the lid printer is placed OFF LINE, and the following message is displayed.

```
Terminal mode initiated.
Type "HELP" followed by a <RETURN> for help.
>
```

Unless otherwise specified, sending a command that requires a response from the T-BERD 224 causes the information to be printed. This includes the appropriate status messages, prompts, extra linefeeds, character echo, or error messages.

Each command must have the proper syntax and line terminator before the command is accepted as being valid. The T-BERD 224 prints an error message when it receives an invalid command.

7.2.3.2 Prompts in TERMINAL Mode

A user-defined prompt (up to 100 characters) can be generated to replace the default prompt symbol. Sending the command **PROMPT STRING XXXX** (where XXXX are ASCII characters) defines the prompt. This command can also be used to create a prompt that identifiesthe T-BERD 224 that is attached to the terminal. User-defined prompts are not saved when theT-BERD 224 power is turned OFF.

The printer hold prompt is represented by the plus symbol (+). It indicates a **HOLD** command has been sent, and the printer buffer is not sending printouts to the terminal. The **REL** command releases the printer hold.

NOTE

Turning the power OFF also aborts the remote operating mode. The remote operating mode may be changed at any time by using one of the mode commands: **TERMINAL**, **COMPUTER**, or **REMOTE**.

7.2.4 Terminating Remote Control Operation

To return the T-BERD 224 to local control and end any remote operating mode, the **LOCAL** command or a / followed by a valid termination must be sent. When the command is received bythe T-BERD 224, the message *UNDER REMOTE CONTROL* is no longer visible in display window and local control is restored.

7.3 IEEE-488 REMOTE CONTROL OPERATION

The optional PRINTER/REMOTE IEEE-488 connector allows the T-BERD 224 to be connected to an IEEE-488 bus. The AUX 09 488MODE function selects the IEEE-488 operating mode and address. The two IEEE-488 operating modes are: talk-only and addressable.

Selecting talk-only automatically configures theT-BERD 224 to directly drive a listen-only device, such as a printer. If the AUX 09 488MODE function is set to talk-only or the IEEE-488 port is addressed by a controller, the IEEE-488 port is selected as the printer port. Otherwise, the PRINTER/REMOTE RS-232 connector is selected.

If the IEEE-488 addressable remote control mode is selected, the T-BERD 224 bus address must be set between 0 and 30 to determine which device should be addressed by the controller. Using the T-BERD 224 bus address, the controller commands the T-BERD 224 to *listen* (receive remote commands) or to *talk* (send data). The T-BERD 224 responds to the IEEE-488 Device Clear (DCL) command by performing another power-up.

The IEEE-488 bus requires that one device on the bus act as the controller. All other devices connected to the bus act as slaves to that controller. In addressable mode, the T-BERD 224 acts as a slave.

The following steps represent a typical remote control input sequence.

1. The controller device addresses the T-BERD 224 to listen, sends a valid remote control command, then sends a valid remote control line terminator.
2. Upon receiving the line terminator, the T-BERD 224 analyzes the remote command and performs the appropriate action.

When receiving characters, ASCII null and space characters are discarded and the remaining characters are saved until the line terminator is received. Upon receipt of the line terminator, the received command is analyzed. If no error is detected, the T-BERD 224 performs the appropriate action and then prepares to receive another command. However, if an error is detected in the command string and SRQ is on, an SRQ is issued, which sets the Least Significant Bit (LSB) of the serial poll register. If a response is appropriate, the Most Significant Bit (MSB) is set and a service request (SR) is issued. If this response is not read by the controller before the next command is sent, the response is discarded.

7.3.1 IEEE-488 Setup Procedure

Prior knowledge of IEEE-488 controller programming and operation is recommended before operating the T-BERD 224 through the PRINTER/REMOTE IEEE-488 connector. The following procedure describes how to setup and operate the T-BERD 224 from an IEEE-488 controller.

1. **AUX switch**
   Press to access auxiliary functions (LED ON).

2. **MODE, RESULTS I Blank, and RESULTS II Arrowed switches**
   Scroll to AUX 08 RS 232 using the **MODE** switch. Select the appropriate baud rate using the **RESULTS I Blank** switch. Select CR, LF, or CRLF using the **RESULTS II Arrowed** switch.

AUX 08	PARITY	BAUD	TERMINATOR
RS 232	NONE	9600	CR

3. **MODE, SOURCE CONFIGURATION II, and RESULTS I Blank switches**
   Scroll to AUX 09 488MODE using the **MODE** switch. Select the ADDRess mode using the **SOURCE CONFIGURATION II** switch. Select the desired T-BERD 224 bus address from 0 to 30 using the **RESULTS I Blank** switch. The bus address must be unique for each device connected to the same bus. If SRQ is set to ON, the T-BERD 224 generates an SRQ whenever an erroneous command is received or when it has data ready to transmit. If the SRQ is set to OFF, the T-BERD 224 sets the appropriate serial poll register bit, but does not issue an SRQ.

AUX 09	IEEE-488 MODE and ADDRESS	
488MODE	ADDR: 1	SRQ: ON

4. **AUX switch**
   Press to exit auxiliary functions (LED OFF).

5. **T-BERD 224 IEEE-488 interface**
   Connect the controller bus to the T-BERD 224 IEEE-488 interface.

6. **IEEE-488 controller**
   Program the controller to gain access and control over the T-BERD 224. Refer to the IEEE-488 controller operating manual for the programming instructions

7.3.2 IEEE-488 Programming Hints

Before attempting to read data from a device, it is necessary to know if the device has data to send. The controller has two ways of determining that the T-BERD 224 has data: if Bit 7 of the serial poll register (dav) is set and if the SRQ function is set to ON in the AUX 09 488MODE function. If SRQ is set to on, a service request is sent to the controller whenever data is available. An SRQ can also occur when a syntax error is detected.

The statement used to read data from the T-BERD 224 must terminate the read operation when the last character of the line is encountered. The most foolproof way to detect the last character is by sensing the EOI signal.

7.3.3 Disallowed IEEE-488 Remote Control Command

The following remote control commands cannot be used when controlling the T-BERD 224 from an IEEE-488 controller. An error message occurs when using any of these commands. See Table 7-1.

Table 7-1. Disallowed IEEE-488 Commands

Command	Description
CLS	Clear the terminal screen
COMPUTER	Configure the T-BERD 224 for remote control operation
DEVICE CLEAR	Reinitialize device
ECHO	Echo mode
PROMPT	Terminal remote control prompt
TERMINAL	Configure the T-BERD 224 for terminal mode

7.4 REMOTE CONTROL FORMAT

This section presents the formats and entry sequences for remote control commands and the three primary command types available with the T-BERD 224 remote control facility. The command types are:

Switch commands — Set the T-BERD 224 front-panel switches.

Auxiliary commands — Set the T-BERD 224 auxiliary functions.

Control commands — Pertain exclusively to the RS-232 Printer/Remote Control Interface.

7.4.1 Command Formats And Entry Sequenc

The general format for any remote control command is:

command_name [parameter]
or
command_name?

The **[parameter]** entry specifies any parameter(s) associated with the command. Any parameter should be separated from the command name by at least one space. The command name parameter string should always be followed by a carriage return or carriage return/line feed sequence.

The **command_name** entry specifies the name of the command to be executed. Where possible, commands that represent a front-panel or auxiliary activity are abbreviated to the first three characters of the switch or function; more characters may be typed if desired. Control commands have no front-panel equivalent. The on-line help feature displays the required characters in upper case and the optional characters in lower case.

Most remote control commands can be used to select a new command state or to display the current command state (without changing it). To select a new command state, enter both the command name and the desired parameter on the command line. To display the current state, enter the command name followed by a question mark (?). Note that some commands (e.g., **CLS**) are *executable only* and have no current or changeable state.

7.4.2 Switch Command Forma s

Switch commands control the functions associated with the T-BERD 224 front panel. The remote control commands use the first three characters of the switch name or switch position as they appear on the front panel and display.

Table 7-2 lists the mainframe switch commands with their equivalent front-panel switch names. The brackets indicate commands with the associated parameters. Each command is fully described in Appendix

Table 7-2. Mainframe Switch Command

Command	Switch
CHAnnel FORmat [ ]	CHANNEL FORMAT
CODe [ ]	CODE
CONtrols	CONTROLS
DISplay HOLd [ ]	DISPLAY HOLD
DROp [ ]	DROP
ERRor INSert BPV [ ]	BPV ERROR INSERT
ERRor INSert FRAme [ ]	FRAME ERROR INSERT
ERRor INSert LOGic [ ]	LOGIC ERROR INSER
ERRor INSert YELlow [ ]	YELLOW ALARM ERROR INSERT
HIStory RESet	HISTORY RESET
INSert [ ]	INSERT
L1 CHAnnel [ ]	LINE 1 CHANNEL
L2 CHAnnel [ ]	LINE 2 CHANNEL
L1 RECeive INPut [ ]	LINE 1 RECEIVE INPUT
L2 RECeive INPut [ ]	LINE 2 RECEIVE INPUT
LOOp Down [ ]	LOOP DOWN

Table 7-2. Mainframe Switch Commands (Continued)

Command	Switch
LOOp Up [ ]	LOOP UP
MODe [ ]	MODE
OFF HOOK	OFF HOOK Signaling Keypad Lid
ON HOOK	ON HOOK Signaling Keypad Lid
PRInt [ ]	PRINT
PRInt EVEnt [ ]	PRINT EVENT
RESult 1 [ ]	RESULTS I
RESult 2 [ ]	RESULTS II
RESTART	RESTART
RESULTS	RESULTS
SIGnal INSert [ ]	SIGNALING INSERT
SOUrce 1 [ ]	SOURCE CONFIGURATION I
SOUrce 2 [ ]	SOURCE CONFIGURATION II
TESt [ ]	TEST
VOLume [ ]	VOLUME

7.4.3 Auxiliary Function Command Formats

Auxiliary commands control functions associated with the T-BERD 224 auxiliary functions. Table 7-3 lists the auxiliary function commands with their equivalent AUX function names. The brackets indicate commands with the associated parameters. Each command is fully described in Appendix H.

Table 7-3. Mainframe Auxiliary Function Comman d

Command	Auxiliary Function
488 ADDress [ ]	AUX 09 488MODE
488 MODe [ ]	AUX 09 488MODE
488 SRQ [ ]	AUX 09 488MODE
BACkup TIMing [ ]	AUX 06 BACK TM
BURst [ ]	AUX 22 VFBURST
BURst LENgth [ ]	AUX 13 ERR RT
CALlid FORmat [ ]	AUX 31 CALL ID
CLEAR FIFO	AUX 01 CL FIFO
CLOck [ ]	AUX 04 TIM/DAY
CODe [ ]	AUX 32 LN CODE
CUStom [ ]	AUX 35 CUSTOM
DATe [ ]	AUX 04 TIM/DAY
DDIal [ ]	AUX 28 SPV DEF
DDS ANAlysis [ ]	AUX 19 DDS CHN
DDS SECondarypat [ ]	AUX 19 DDS CHN
DDS TRAnsmit [ ]	AUX 19 DDS CHN
DIAl SEQuence DEFine	AUX 26 DIAL SEQ
DIGit [ ]	AUX 25 DIG MAR
DS0 ERRor CORrection [ ]	AUX 12 ERR COR
DS0 INTerface TIMing [ ]	AUX 07 DSO TM
DSU ANAlysis CHAnnel [ ]	AUX 11 ANL CHA
DSUDp Bit 8 [ ]	AUX 11 ANA CHA, Primary Control Bit

Table 7-3. Mainframe Auxiliary Function Commands (Continued)

Command	Auxiliary Function
ERRor RATe [ ]	AUX 13 ERR RT
FREquency SWEep [ ]	AUX 21 SWEEP
FRM ERRor LENgth [ ]	AUX 14 FRM ERR
L1 LBO [ ]	AUX 05 LBO
L2 LBO [ ]	AUX 05 LBO
L1 PRM EMUlate	AUX 20 PRM TX
L2 PRM EMUlate	AUX 20 PRM TX
LOOp CODe [ ]	AUX 17 LOOP CD
MJU BRAnch	AUX 30 MJU
MJU HUD	AUX 30 MJU
MJU OPEration	AUX 30 MJU
MJU SENd	AUX 30 MJU
NON CONtiguous [ ]	AUX 10 N-CONTG
PGM LPDown [ ]	AUX 16 PGM LP
PGM LPUp [ ]	AUX 16 PGM LP
PRInt SWEep [ ]	AUX 23 PRT OPT
PRInt SWEep PARameters [ ]	AUX 21 SWEEP
PRInt TERminator [ ]	AUX 08 RS232
PRM TRAnsmit [ ]	AUX 20 PRM TX
RECeive SEQuence DEFine	AUX 27 REC SEQ
RESPonse [ ]	AUX 18 AUT RES
RS232	AUX 08 RS232
SCAN [ ]	AUX 29 SCANSET
TESt LENgth [ ]	AUX 03 TES LEN
TIMed PRInt EVEnt [ ]	AUX 02 TIM PRI
TRUnk TYPe	AUX 24 TRK DEF
USEr [ ]	AUX 15 USER
WINk [ ]	AUX 28 SPV DEF

7.4.4 Control (Non-Switch) Command Formats

Control commands have no front panel or AUX equivalent. These commands are used to obtain information from theT-BERD 224 or to modify the remote control/printer protocol. Table 7-4 lists the mainframe control commands. The brackets indicate commands with the associated parameters. Each command is fully described in Appendix H.

Table 7-4. Mainframe Control Command

Command	Command
ALArms [ ]	L1 RECeive SIGnal [ ]
BEEp	L2 RECeive SIGnal [ ]
CLS	LED
COMputer	LOCAl (/)
DEVICE CLEAR	MESsage [ ]
DISplay [ ]	PRInt SIGnal
ECHo [ ]	PROmpt [ ]
ERRor NUMber	RELease

Table 7-4. Mainframe Control Commands (Continued)

Command	Command
FAR END LOOp [ ]	REMote
FIRST Power Up	SETup
GTL	SLC ALArm
HELLO	SLC MAIntenance
HELP [ ]	SUMmary
HOLD	TERminal (.)

7.4.5 Input Sequence

A remote command consists of an ASCII character string followed by either a carriage return (CR), a line feed (LF), or a carriage return/line feed (CRLF). When specifying a remote control command, the following rules apply:

1. Commands may be entered in uppercase or lowercase.
2. A space must be inserted between the command name and a parameter.
3. Entering a CTL C (Control C) or a CTL X (Control X) prior to issuing a CR or LF cancels the input line. (CTL C also aborts all printing.)
4. Entering a CTL H (Control H) or a BACK SPACE erases the last character entered. This is available for RS-232 controllers only.
5. Up to 20 previously entered commands can be recalled by using the ESC key. When the number of previously sent commands exceeds 20, the earliest command entries are overwritten. This is available for RS-232 controllers only.

After receiving a carriage return or a carriage return/line feed sequence, the T-BERD 224 analyzes the data in its input buffer. It checks the data for parity, overrun, framing, overflow, and syntax errors. If an error is detected, the appropriate error message is returned to the controller. If no error is detected, the command is decoded and the appropriate response is generated.

If **ECHO** is enabled, the entered character string is echoed back to the controller. If the **PROMPT** command is enabled, the default prompt (>) or a user-defined prompt is used to indicate that the previous command has been processed and that the T-BERD 224 is ready to accept additional commands.

NOTE

The **TER** command automatically enables **ECHO** and **PROMPT** when the remote control mode is entered. With either the **PROMPT** or **ECHO** feature enabled, any characters used to cancel a line are echoed to the remote control unit. The prompt and echo features are only applicable for RS-232.

7.4.6 Output Sequence

The following rules apply for remote control and printer port outputs:

1. Remote control outputs have a higher priority than printer outputs. A printer output is halted (suspended) if a remote control output becomes available. Printer output resumes after the remote control output has been sent.
2. The **HOLD** command holds the printer output until the **REL** command releases the printer output. When

the **HOLD** command is sent and the prompt is ON, the prompt character changes to a "+" to indicate that data is waiting to be printed. When the **REL** command is sent, the default prompt (>) or the user-defined prompt is returned. Note that the remote control output is not held.

3. CTL S suspends all printer output. Sending a CTL Q, releases the printer output suspended by the CTL S. These control characters only apply for RS-232.
4. Sending a CTL C clears the entire printer FIFO.

8.4.2 T1 Timing Slip

Parameter		Specification
Count	Resolution	1 frame slip
	Range	0 to 999 frame slips
Bar Graph	Resolution	16 bit slips.
	Range	±192 bit slips.
Wheel	Resolution	1 bit slip.
	Range	±8 bit slips.
Timing Slip Printout	Resolution	1 frame slip.
	Range	0 to 999 frame slips.
Slip Analysis Seconds	Resolution	1 second.
	Range	0 to 99999999 seconds (>1,157 days).

8.4.3 VF Frequency & Level

Parameter		Specification
Frequency	Accuracy	±0.5 Hz.
	Resolution	1 Hz.
	Range	20 Hz to 3404 Hz at +3.0 dBm to -40 dBm.
		3404 Hz to 3904 Hz at +3.0 dBm to -10.0 dBm.
Level	Range	+3 dBm0 to -55 dBm0.
	Accuracy (300 Hz to 3000 Hz)	+3 to -30 dBm0 ±0.5 dB.
		-30 to -40 dBm0 ±1.0 dB.
		-40 to -50 dBm0 ±3.0 dB.
		-50 to -55 dBm0 ±4.0 dB.
	Resolution	0.1 dBm0.
Level VF Option Installed	Range	+3.0 dBm0 to -70.0 dBm0.
	Accuracy	+3 to -50 dBm0 ±0.05 dB.
		-50 to -70 dBm0 ±0.3 dB.

8.4.4 VF Transmitter — VF Option Installed

Parameter		Specification
Frequency	Accuracy	±0.5 Hz
	Resolution	1 Hz
	Range	20 Hz to 3904 Hz
Level	Range	+3.0 dBm to -40.0 dBm
	Accuracy	±0.1 dB
	Resolution	0.1 dBm0

8.4.5 VF Measurements — VF Option Installed

Parameter		Specification
Signal-to-Noise Ratio	Accuracy	±0.5 dB
	Resolution	1 dB
	Range (minimum)	0 dB to 45 dB
C-Message Noise	Range (minimum)	10 dBrnC to 93 dBrnC
	Accuracy	±1 dBrnC
C-Notch Noise	Range (minimum)	20 dBrnC to 93 dBrnC
	Accuracy	±1 dBrnC
3 kHz Flat Noise	Range (minimum)	20 dBrn to 93 dBrn
	Accuracy	±1 dBrn
3 kHz-Notch Noise (not IEEE-743 measurement)	Range	20 dBrn to 93 dBrn
	Accuracy	±1 dBrn
Echo Return Loss (ERL)	Range	0 dB to 50 dB
	Accuracy	±0.5 dB
Singing Return Loss - High/Low (SRL-HI/SRL-LO)	Range	0 dB to 50 dB
	Accuracy	±0.5 dB
Peak-to-Average Ratio (P/AR)	Range	0 P/AR units to 120 P/AR units
	Accuracy	±2 P/AR units between 40 P/AR and 110 P/AR
		±4 P/AR units between 0 P/AR and 40 P/AR; and greater than 110 P/AR
P/AR Level	Range	+3.0 dBm to -70.0 dBm
	Accuracy	±0.05 dBm between +3.0 dBm and -40.0 dBm
		±0.3 dBm between -40.0 dBm and -70.0 dBm
DC Offset (not IEEE-743 measurement)	Range	-128 mV to +128 mV
	Accuracy	±0.5 % or ±0.5 mV whichever is greater (scaled to digital mW into 600 ohms)
	Resolution	1 mV

8.4.6 Simplex Current — BERT Option Installed

Parameter	Specification
Range	0 mA to 250 mA.
Resolution	2 mA.
Accuracy	±2 mA from 0 to 100 mA.
	±2% from 100 mA to 250 mA.
Simplex Voltage Drop	600 ±2% mV at 60 mA.
	1000 ±2% mV at 100 mA.

8.4.7 Digit and Dialtone Frequency & Level Measurement

Parameter		Specification
Frequency	Accuracy	±1 Hz or 0.1%.
	Resolution	1 Hz.
	Range	±3.5%.
Level	Range	+3.0 to -30.0 dBm.
	Accuracy	±0.5 dB.
	Resolution	0.1 dBm0.
Twist	MF Range	±6.0 dB, high frequency over low frequency.
	DTMF Range	+4.0 dB to -8 dB, high frequency over low frequency.

8.4.8 Caller ID Option Measurements

Parameter		Specification
Mark (1) Frequency	Accuracy	±1 Hz or ±0.1%.
	Resolution	1 Hz.
	Range	1188 to 1212 Hz.
Space (0) Frequency	Accuracy	±1 Hz or ±0.1%.
	Resolution	1 Hz.
	Range	2178 to 2222 Hz.
Mark (1) Level	Range	-12.0 to -32.0 dBm
	Accuracy	±1 dBm.
	Resolution	0.1 dBm.
Space (0) Level	Range	-12.0 to -36.0 dBm
	Accuracy	±1 dBm.
	Resolution	0.1 dBm.

8.5 ALARM CRITERIA

Parameter	Specification
Signal Loss	No signal is detected for a period of 150 ms at the respective line input connector.
Frame Sync	2 out of 4 frame bits in error for D1D, D2, and D4.
	2 out of 4 Ft bits in error for SLC-96.
	2 of 4 frame bits in error ESF and ESFz.
B8ZS	B8ZS code is not detected for 150 ms.
Excess Zeros	16 or more consecutive zeros are detected.

Yellow Alarm	In D1D, D2, D4, and SLC-96, a yellow alarm is declared when bit 2 set to "0" for 255 consecutive DS0 channels.
	In ESF and ESFz, a yellow alarm is declared when 256 bits ±16 bits of a repetitive FF00 pattern appears in the datalink.
AIS	2048 consecutive unframed 1s.
Pattern Sync Loss	250 or more errors detected in 1000 or fewer bits.

8.6 TEST PATTERNS — T1 BERT OPTION

8.6.1 Pattern Definitions

Pattern	Definition
1:7	F01000000... Pattern is aligned with framing (F) patterns as indicated.
2^15-1	2^{15}-1 bit pseudorandom.
2^15-1 INV	Inverted 2^{15}-1 bit pseudorandom.
2^20-1	2^{20}-1 bit pseudorandom.
2^23-1	2^{23}-1 bit pseudorandom.
3 IN 24	F0100 0100 0000 0000 0000 0100... Pattern is aligned with framing (F) patterns as indicated.
63	2^{6}-1 bit pseudorandom.
511	2^{9}-1 bit pseudorandom.
2047	2^{11}-1 bit pseudorandom.
BRIDGTAP	Automated 21-pattern sequence with varying degrees of ones and zeros density that includes: 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.
MULTIPAT	Automated 5-pattern sequence that includes: ALL ONES, 1:7, 2 IN 8, 3 IN 24, and QRSS.
ALL ONES	All Ones (Marks).
ALL ZERO	AMI coding - all zeros, no pulses except framing.
	B8ZS coding - B8ZS BPV sequence 000V 10V1 (V = bipolar violation).
	ZBTSI coding - stresses the ZBTSI encoding algorithm.
DDS1	200 octet minimum/maximum ones density.
DDS2	200 octet minimum ones density.
DDS3	Single octet with medium ones density.
DDS4	Single octet with low ones density
DDS5	DDS1, 2, 3, and 4.
DDS6	Seven octet fixed pattern of 1111 1110 followed by one octet of 1111 1111.
QRSS	QRSS pattern (2^{20}-1 with zero suppression).
USER	3- to 24-bit programmable pattern. Factory default: 100000.
MIN/MAX	Minimum/Maximum ones and zeros density stress pattern (see Appendix D).
T1-2/TRIP	96-octet HEX pattern (see Appendix D).
T1-3	54-octet HEX pattern (see Appendix D).
T1-4	120-octet HEX pattern (see Appendix D).
T1-5	Unframed 53-octet HEX pattern (see Appendix D).
T1-DALY	Framed 55-octet HEX pattern (see Appendix D).
TT1-6/55 OCT	Unframed 55-octet HEX pattern (see Appendix D).

8.6.2 Pattern Sync Detection Criteri

Pattern	Definition
Fixed Patterns	30 consecutive error-free bits (ALL ONES, 1:7, 3 IN 24, programmable 3- to 24-bit pattern, ALL ZERO, DDS3, DDS4, DDS5).
DDS1, DDS2, DDS6	800 consecutive error-free bits.
MIN/MAX	220 consecutive error-free bits.
Pseudorandom Patterns	30 + n consecutive error-free bits for a pattern length of 2n-1.
	For QRSS, n = 20 (QRSS, 63, 511, 2047, 2^15-1, 2^15-1 INV, 2^20-1, and 2^23-1).

8.7 LOOP CODES — T1 BERT OPTION

8.7.1 Loop Code Generation and Detection Patterns

Type	Equip/Loc	Bit Pattern		Description
		Loop Up	Loop Down	
T1	CSU	10000	100	Customer Service Unit loop codes.
	FAC1	1100	1110	In-band 4-bit Facility or network (or smart jack) loop codes.
	FAC2	11000	11100	In-band 5-bit Facility or network (or smart jack) loop codes.
	PROGRAM	10000	100	3- to 8-bit programmable loop codes.
	ESF-LIN	0111 0000	0001 1100	ESF out-of-band Line loop codes.
	ESF-PAY	0010 1000	0100 1100	ESF out-of-band Payload loop codes.
ESF-NET	0100 1000	0010	0100	ESF out-of-band Network loop codes.
	FAC3	100000	100	In-band 6-bit Facility or network (or smart jack) loop codes.
	IOR	Note[1]	Note[1]	Intelligent Office Repeater Codes.
	IORCMD	Note[1]	Note[1]	Intelligent Office Repeater Command Codes.
	IORPGM	Note[1]	Note[1]	Intelligent Office Repeater Programmable Command Codes.
	ILR	Note[1]	Note[1]	Intelligent Line Repeater Codes.
	ILRCMD	Note[1]	Note[1]	Intelligent Line Repeater Command Codes.
	ILRPGM	Note[1]	Note[1]	Intelligent Line Repeater Programmable Command Codes.
	DS1MSWITCH	Note[1]	Note[1]	DS1 Maintenance Switch Switch Code.
	DS1MSRAMP	Note[1]	Note[1]	DS1 Maintenance Switch Ramp Code.
	DS1MSCMD	Note[1]	Note[1]	DS1 Maintenance Switch Command Codes.
DDS-ACT	OCU	$x^2$010 1010	N/A	Alternating Office Channel Unit loop code.
	OCU+HL96	$x^2$010 1010	N/A	Alternating Office Channel Unit loop code behind a HL96NY.
	HL96NY	$x^2$010 1010	N/A	Alternating HL96NY Office Channel Unit loop code.
	DSU	$x^2$010 1100	N/A	Alternating Data Service Unit loop code.
	CHANNEL	$x^2$010 1000	N/A	Alternating Channel Service Unit loop code.
	CHAN+1R	$x^2$010 1000	N/A	Alternating Channel Service Unit behind one repeater loop code.
	CHAN+2R	$x^2$010 1000	N/A	Alternating Channel Service Unit behind two repeaters loop code.
1ST RPTR	$x^2$010 1000	N/A		Alternating First Local Loop repeater loop code.
	2ND RPTR	$x^2$010 1000	N/A	Alternating Second Local Loop repeater loop code.

Type	Equip/Loc	Bit Pattern		Description
		Loop Up	Loop Down	
DDS-LAT	OCU	Note[3]	Note[3]	Latching Office Channel Unit loop code.
	CHANNEL	Note[3]	Note[3]	Latching Channel Service Unit loop code.
	DS0-DP (LOCATION 1 to 8)	Note[3]	Note[3]	Latching DS0-Dataport loop code.
				When more than one DS0-DP is present, select the location of the DS0-DP from 1 to 8.
	LSI	Note[3]	Note[3]	Latching Line Side Interface (HL222) loop code.
	NEI	Note[4]	Note[4]	Latching Network Element Interface and Adtran™ repeater and loop code.
	DSU	Note[3]	Note[3]	Latching Data Service Unit loop code.

1. Smart Loopback/Command Codes Option required (see the manufacturer specifications).
2. x = subrate framing bit when the byte is transmitted or received as a DS0B or DS0A 19.2 kb/s signal. Framing bit pattern determined by DS0B or DS0A 19.2 kb/s data rate.
   x = a "don't care" mode when the byte is received at a DS0A subrate, except DS0A 19.2 kb/s.
   x = a "1" when the byte is transmitted at a DS0A subrate, except DS0A 19.2 kb/s.
   x = a "0" when control codes (except IDLE) are transmitted at the DS0A 56 kb/s rate.
   x = a "don't care" mode when control codes (except IDLE) are received at the DS0A 56 kb/s rate.
   x = a "1" when the IDLE code is transmitted or received at the DS0A 56 kb/s rate.
3. As described in TR-TSY-000476, Issue 3, April 1987.
4. As described in TR-OPT-000489.

8.7.2 Loop Code Detection Criteria

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

8.8 SIGNALING PARAMETERS — VF/SIGNALING OPTION

8.8.1 Digit Receiving Templates

Parameter		Specification
DTMF	Frequency	<±1.5% accepted.
		>±3.5% rejected.
	Level	0 to -25 dBm per tone.
	Digit Duration	minimum 40 ms.
	I/D Timing	minimum 40 ms.
MF	Frequency	<±1.5% accepted.
		>±3.5% rejected.
	Level	0 to -25 dBm per tone.
	Digit Duration	minimum 30 ms.
	I/D Timing	minimum 30 ms.

DP	Pulses Per Second	7 to 21.
	%Break	40 to 68%.
	I/D Timing	>500 ms.

8.8.2 Receive Supervision Measurement Parameters

Parameter		Specification
Wink	Delay	0 to 16 seconds.
	Duration	70 ms to 600 ms.
Delay Dial	Delay	0 to 16 seconds.
	Duration	70 ms to 600 ms.
Off Hook	Delay	0 to 60 seconds.
	Duration	Greater than 600 ms.

8.9 SIGNAL INTERFACES

8.9.1 External Clock Interface

Parameter	Specification
Connector Type	BNC, Female bulkhead.
Input Impedance	75 ohms ±5%.
Input Configuration	AC-coupled. Outer conductor is signal ground. Inner conductor is signal.
Signal Level	High, greater than 2V.
	Low, less than 0.5 V.
Clock Voltage Level	2 V p-p, minimum.
	20 V p-p, maximum.
Clock Frequency	1.544 MHz ±5000 Hz.

8.9.2 RS-232 Printer/Remote Interface

Parameter	Specification
Connector Type	25-pin, D-type, Female.
Connector Configuration	DCE.
Connector Pin Assignment	See Table 8-1.
Character Format	7 or 8 data bits (ASCII coding).

Table 8-1. RS-232 Pin Assignme n

Pin No.	Signal Description	Function
1	Protective Ground	Connected to chassis ground
2	Transmit Data (TXD)	T-BERD 224 receives data on this lead
3	Receive Data (RCV Data)	T-BERD 224 transmits data on this lead
4	Request to Send (RTS)	This lead is ignored by the T-BERD 224
5	Clear to Send (CTS)	T-BERD 224 sets this lead to the ON (HIGH) state when the unit is ready to accept another character from the transmitting device. Fast devices, like computers, need to monitor this line before transmitting additional data.
6	Data Set Ready (DSR)	T-BERD 224 sets this line to the ON (HIGH) state whenever power is applied to it
7	Signal Ground	Connected to signal ground
8	Receive Line Signal Detect (RLSD)	T-BERD 224 sets this line to the ON (HIGH) state whenever power is applied to it
9	Pos. DC Test Voltage	This lead provides +12 Vdc (RS-232 ON) for use in strapping signaling leads ON.
10	Neg. DC Test Voltage	This lead provides -12 Vdc (RS-232 OFF) for use in strapping signaling leads OFF.
12	Sec RLSD	T-BERD 224 sets this lead ON (HIGH) whenever data in its FIFO is ready to print.
20	Data Terminal Ready (DTR)	When this lead is set ON (HIGH) by the receiving device, the T-BERD 224 transmits data.

8.9.3 Test Points

Parameter		Specification
Signaling Inputs	Input Voltage Range	-0.5 V to +25 V
	Logic 0 Input (On Hook)	Closure to ground
		-0.5 V to +1.0 V
	Logic 1 Input (Off Hook)	Open circuit
		+2.5 V to +25 V
	Input Current	-1.5 microamps, maximum at 0 V
		+1.0 microamps, maximum at +3V
Signaling Outputs	OutputVoltage Range	0.0 V to +5 V
	Logic 0 Output (On Hook)	+1.1 V, maximum for 0 to 100 mA sink current
		+1.6 V, maximum for 0 to 300 mA sink current
	Logic 1 Output (Off Hook)	+3.0 V, minimum for 0 to 350 microamps source current
		+4.0 V, minimum for 0 to 150 microamps source current
Connector		37-pin, Female, D-type connector. See Table 8-2 for pin assignments.

Table 8-2. T-BERD 224 Test Points Pin Assignm e n t

Pin No.	Input/ Output	Pin Name	Description
1	O	Line 1 Signaling Bit D	Active high
2	O	Line 1 Signaling Bit B	Active high
3	O	Line 1 Signaling Bit C	Active high
4	O	Line 1 Signaling Bit A	Active high
5	O	Line 1BPV	One bit wide, active low
6	I	Insert Signaling Bit D	Active high (ON) or low (OFF)
7	I	Insert Signaling Bit C	Active high (ON) or low (OFF)
8	I	Insert Signaling Bit B	Active high (ON) or low (OFF)
9	I	Insert Signaling Bit A	Active high (ON) or low (OFF)
10	I	Enable Insert Signaling Bits	Active low
11	O	Line 2 BPV	One bit wide, active low
12	N/C		
13	O	Line 1 AIS	Active low
14	O	Line 1 Yellow Alarm	Active high
15	O	Line 1 Frame Sync	Active high
16	O	Line 1 CRC Error	Active high for 7 ±1 microseconds for each CRC error
17-19	N/C		
20	O	Line 2 Signaling Bit D	Active high
21	O	Line 2 Signaling Bit C	Active high
22	O	Line 2 Signaling Bit B	Active high
23	O	Line 2 Signaling Bit A	Active high
24-30	N/C		
31	O	Line 2 AIS	Active low
32	O	Line 2 Yellow Alarm	Active high
33	O	Line 2 Frame Sync	Active high
34	O	Line 2 CRC Error	Active high for 7 ±1 microseconds for each CRC error
35-36	N/C		
37		Signal Ground	

8.9.4 VF 2-Wire & 4-Wire Interface

Parameter		Specification
VF 2-Wire	Connector	Turrets, 2 each.
	Loop Current	25 mA, typical.
	Return Loss at 1 kHz	Greater than 20 dB.

VF 4-Wire Output	Connector	WECO 310 jack.
	Driver	600 ohms with a minimum 28 dB return loss from 300 Hz to 3400 Hz.
	Frequency Response	±0.25 dB (300 Hz to 3000 Hz).
		+0.25 dB to -1.5 dB (3000 Hz to 3400 Hz).
	Tracking Distortion	+0.3 dB (+3 dBm0 to -40 dBm0).
	Relative to 1004 Hz	±0.6 dB (-40 dBm0 to -50 dBm0).
	-10 dBm0	±1.6 dB (-50 dBm0 to -55 dBm0).
	Transmission Level Points	0 dBm0 = 0 dBm.
VF 4-Wire Input	Connector	WECO 310 jack.
	Driver	600 ohms with a minimum 28 dB return loss from 300 Hz to 3400 Hz.
	Frequency Response	±0.25 dB (300 Hz to 3000 Hz).
		+0.25 dB to -1.5 dB (3000 Hz to 3400 Hz).
	Tracking Distortion[1]	+0.3 dB (+3 dBm0 to -40 dBm0).
		±0.6 dB (-40 dBm0 to -50 dBm0).
		±1.6 dB (-50 dBm0 to -55 dBm0).
	Transmission Level Points	0 dBm0 = 0 dBm.
	Clipping Point	+3 dBm0, typical.
	Signal to Distortion Ratio	33 dB, minimum (0 to -30 dBm0).
	Idle Channel Noise[2]	18 dBrnc0, maximum.

1. Relative to 1004 Hz, -10 dBm0.
2. Measured with C-message weighting and with C-message notch filter.

8.9.5 DS0 Bipolar Interface

Parameter		Specification
Bipolar Input	Connector	Bantam jack.
	Impedance	135 ohms ±10%.
	Operating Signal Level	3.0 V to 5.0 V peak.
	Cable Length	1500 feet (457 meters) of 24-gauge, maximum.
Bipolar Output	Data Rate	64 kb/s.
	Connector	Bantam jack.
	Test Load Impedance	135 ohms, resistive.
	Pulse Amplitude	4.0 V ±0.5 V with a maximum imbalance of 0.25 V
	Zero Output Level	0.7 V, maximum.
	Half-Amplitude Pulse Width	15.6 microseconds ±0.5 microseconds with a minimum imbalance of 0.7 microseconds.
	Rise and Fall Time	0.5 microseconds, maximum.
	Data Format	AMI and NRZ.

Tx Clocks	Pin 1	+5 V at 100 mA, maximum.
	Pin 2	Ground.
	Pin 3	Tx (Insert) Bit Clock (TTL level into 50 ohms).
	Pin 4	Tx (Insert) Byte Clock (TTL level into 50 ohms).
	Pin 5	Ground.
	Pin 6	Tx (Insert) Byte Clock + (differential).
	Pin 7	Tx (Insert) Byte Clock - (differential).
	Pin 8	Tx (Insert) Bit Clock + (differential).
	Pin 9	Tx (Insert) Bit Clock - (differential).
Rx Clocks	Pin 1	+5 V at 100 mA, maximum.
	Pin 2	Ground.
	Pin 3	Rx (Drop) Bit Clock (TTL level into 50 ohms).
	Pin 4	Rx (Drop) Byte Clock (TTL level into 50 ohms).
	Pin 6	Rx (Drop) Byte Clock + (differential).
	Pin 7	Rx (Drop) Byte Clock - (differential).
	Pin 8	Rx (Drop) Bit Clock + (differential).
	Pin 9	Rx (Drop) Bit Clock - (differential).

8.9.6 IEEE-488 Printer Interface

Parameter	Specification
ConnectorType	24-pin, D-type.
Connector Configuration	Addressable or Talk-Only.
Connector Pin Assignment	See Table 8-3.
Maximum Transfer Rate	1200 b/s.
Line Terminator	CR, LF, or CRLF.

Table 8-3. PRINTER IEEE-488 Connector Pin Assignments

Pin No.	Description	Pin No.	Description
1	Data In/Out 1 (DI/O1)	13	Data In/Out x (DI/O5)
2	Data In/Out 2 (DI/O2)	14	Data In/Out x (DI/O6)
3	Data In/Out 3 (DI/O3)	15	Data In/Out x (DI/O7)
4	Data In/Out 4 (DI/O4)	16	Data In/Out x (DI/O8)
5	End or Identify (EOI)	17	Remote Enable (REN)
6	Data Valid (DAV)	18	Gnd for twisted pair for 6
7	Not Ready for Data (NRFD)	19	Gnd for twisted pair for 7
8	Not Data Accepted (NDAC)	20	Gnd for twisted pair for 8
9	Interface Clear (IFC)	21	Gnd for twisted pair for 9
10	Service Request (SRQ)	22	Gnd for twisted pair for 10
11	Attention (ATN)	23	Gnd for twisted pair for 11
12	SHIELD	24	Signal Gnd

8.9.7 DSU-DP Option Interfaces

8.9.7.1 RS-232 Interfac

Parameter	Specification
Connector	25-pin, D-type, female.
Connector Pin Assignments	See Table 8-4.
Data Rates	Primary: 2.4, 4.8, 9.6, 19.2, 56[1], or 64[1] kb/s.
	Secondary: 0.133, 0.266, 0.533, 1.066, or 2.667 kb/s.
Data Polarity	Mark (binary 1): -3 V to -25 V.
	Space (binary 0): +3 V to +25 V.
Drivers[2]	Low level: -10 V ±1V, typical.
	High level: +10 V ±1V, typical.
Slew Rates[3]	Clock and data: 6 V/microsecond, typical.
	Signaling: 6 V/microsecond, typical.
Short-Circuit Current	+12 mA, maximum.
Receivers	Input impedance: 3000 to 7000 ohms.
	Input threshold: +2 V and -1 V
Input Voltage	±25 , maximum.

1. These data rates exceed the data rate limitations recommended in RS-232 andV.24. However, the RS-232 connector can still be used but with result of increased bias distortion and clock data skew.
2. Output levels into 3000-ohm load.
3. Into 7000-ohm resistive load.

Table 8-4. DSU-DP RS-232 Connector Pin Assignment

Pin No.	Signal Description	Signal Status
1	Protective Ground	Chassis Ground
2	Transmitted Data	Input
3	Received Data	Output
4	Request to Send	Input
5	Clear to Send	Output
6	Data Set Ready	Output
7	Signal Ground	Signal Ground
8	Received Line Signal Detect	Output
9	+12 V	Output
10	-12 V	Output
15	Transmit Signal Element Timing	Output
16	Secondary Received Data	Output
17	Receiver Signal Element Timing	Output
18	Secondary Received Clock	Output[1]

1. Non-standard pin configuration.

8.9.7.2 V.35 Interface

Parameter		Specification
Connector		34-pin, female.
Connector Pin Assignments		See Table 8-5.
Data Rates	Primary	2.4, 4.8, 9.6, 19.2, 56, or 64 kb/s.
	Secondary	0.133, 0.266, 0.533, 1.066, or 2.666 kb/s.
	56xN	56 kb/s to 1.344 Mb/s in 56 kb/s increments.
	64xN	64 kb/s to 1.536 mb/s in 64 kb/s increments.
Clock Polarity	OFF	"A" lead negative, with respect to the "B" lead.
	ON	"A" lead positive, with respect to the "B" lead.
Data Polarity	Mark (binary 1)	"A" lead negative, with respect to the "B" lead.
	Space (binary 0)	"A" lead positive, with respect to the "B" lead.
Signaling Polarity	ON	Greater than +3 V.
	OFF	Open, or less than -3 V
Data and Clock Drivers	Source Impedance	100 ohms ±50 ohms.
	Resistance[1]	50 ohms ±15 ohms.
	Rise Time	Less than 40 nanoseconds, into a 100-ohm resistive load.
	Short-Circuit Current	Less than 100 mA, maximum.
	Signal Swing	±0.55 V,into 100 ohms.
Data and Clock Receivers	Input Impedance	100 ohms ±10 ohms.
	Resistance[1]	50 ohms ±15 ohms.
	Input Hysteresis	70 mV, typical.
Signaling Drivers	Slew Rate	30 V/microsecond into 7000-ohm resistive load, typical.
	Rise and Fall Time	0.2 microseconds into 7000 ohm load.
	Short Circuit Current	±45 mA.
	Generator Impedance	300 ohms, typical.
Signaling Receivers	Input Impedance	3000 to 7000 ohms.
	Maximum Input Range	±25 V

1. from short-circuited terminals to ground.

Table 8-5. DSU-DP V.35 Connector Pin Assignmen t

Pin No.	Signal Description	Signal Status
A	Protective ground	Chassis Ground
B	Signal ground	Signal ground
C	Request to send	Input
D	Clear to send	Output
E	Data set ready	Output
F	Receive line signal detector	Output
P	Send data (A)	Input
R	Receive data (A)	Output
S	Send data (B)	Input
T	Receive data (B)	Output
V	Serial clock receive (A)	Output
X	Serial clock receive (B)	Output
Y	Serial clock transmit (A)	Output

Table 8-5. DSU-DP V.35 Connector Pin Assignments (Continued)

Pin No.	Signal Description	Signal Status
a	Serial clock transmit (B)	Output
d	Secondary receive data (A)[1]	Output
f	Secondary receive data (B)[1]	Output
h	Secondary serial clock receive (A)[1]	Output
k	Secondary serial clock receive (B)[1]	Output
l	Secondary receive line signal detector	Output

1. Non-standard pin configuration.

8.9.7.3 RS-449 Interfac

Parameter		Specification
Connector		37 pin, D-type, female.
Connector Pin Assignments		See Table 8-6.
Impedance		110 ohms, minimum.
Data Rates	Primary	2.4, 4.8, 9.6, 19.2, 56, or 64 kb/s.
	Secondary	0.133, 0.266, 0.533, 1.066, or 2.666 kb/s.
	56xN	56 kb/s to 1.344 Mb/s in 56 kb/s increments.
	64xN	64 kb/s to 1.536 kb/s in 64 kb/s increments.
Data Polarity	Mark (binary 1)	"A" lead more negative than "B" lead.
	Space (binary 0)	"B" lead more negative than "A" lead.
Clock Polarity	High (binary 1)	"A" lead more negative than "B" lead.
	Low (binary 0)	"B" lead more negative than "A" lead.
Signaling Polarity	OFF	"A" lead more negative than "B" lead.
	ON	"B" lead more negative than "A" lead.
Impedance[1]		65 ohms.
Short Circuit Current		±150 mA.
Output Differential	Swing	2 V minimum differential input into a 100-ohm load.
	Rise Time	20 nanoseconds, maximum.
Data and Clock Receivers	Input Resistance	120 ohms, ±10%.
	Input Hysteresis	200mV.
	Input Voltage	±25 V maximum.

1. Data, Clock, and Signal Driver Source.

Table 8-6. DSU-DP RS-449 Connector Pin Assignm e n

Pin No.	Signal Description	Signal Status
1	Shield	Chassis Ground
3	Secondary receive data (A)	Output
4	Send data (A)	Input
5	Send timing (A)	Output
6	Receive data (A)	Output

Table 8-6. DSU-DP RS-449 Connector Pin Assignment (Continued)

Pin No.	Signal Description	Signal Status
7	Request to send (A)	Input
8	Receive timing (A)	Output
9	Clear to send (A)	Output
11	Data mode (A)	Output
13	Receiver ready (A)	Output
16	Secondary receive data (A)[1]	Output
19	Signal ground	Signal Ground
20	Receive common	Signal Ground
21	Secondary receive data (B)[1]	Output
22	Send data (B)	Input
23	Send timing (B)	Output
24	Receive data (B)	Output
25	Request to send (B)	Input
26	Receive timing (B)	Output
27	Clear to send (B)	Output
29	Data mode (B)	Output
31	Receiver ready (B)	Output
32	Secondary receiver ready (A)	Output
33	Secondary receive timing (B)[1]	Output
34	Secondary receiver ready (B)	Output
37	Send common	Signal Ground

1. Non-standard pin configuration

8.10 GROUNDING

Location	Connection
Chassis and Signal Ground	Tied together.
Bantam and 310 Jack Sleeves	Connected to chassis ground.
Power Cord Ground	Connected to chassis ground.
25-pin D-type Connector	Pin 1 connected to chassis ground.
	Pin 7 connected to signal ground.
Optional 488 Connector	Pin 12 connected to chassis ground.
	Pins 18-24 connected to signal ground.
Test Point Connector	Pin 37 connected to signal ground.
DS0 Data Connector	Sleeve connected to chassis ground.
DS0 Tx Clock Connector	Pin 2 connected to signal ground.
	Shell connected to chassis ground.
DS0 Rx Clock Connector	Pin 2 connected to signal ground.
	Shell connected to chassis ground.
V.35 Connector	Pin A connected to chassis ground.
	Pin B connected to signal ground.

Location	Connection
RS-449 Connector	Pin 1 connected to chassis ground.
	Pin 19 connected to signal ground.
4-Wire VF Connector	Sleeve connected to chassis ground.

8.11 SONET/DS3 ANALYZER OPTION SPECIFICATIONS

Parameter		Specification
Physical Characteristics		
Dimensions	Lid	6.5" H x 14.0" W x 3.0" D (16.51 cm x 35.56 cm x 7.62 cm).
	Printed Circuit Board	5.5" H x 9.75" W x 0.75" D (13.97 cm x 24.77 cm x 1.91 cm).
Weight	Lid	1.5 lbs (0.85 kg).
	Printed Circuit Board	0.93 lbs (0.54 kg).
Environment Characteristics		
Temperature Range	Operating	32° F to 113° F (0° C to 45° C).
	Non-Operating	-40° F to 158° F (-40° C to 70° C).
Humidity	Operating	90% maximum, noncondensing.
	Storage	5% to 95%, noncondensing.
Shock and Vibration		Meets IEEE Standard 743.
Electrostatic Discharge Susceptibility		Withstands at least 10 consecutive direct static discharges of 0.01 joule and 15 kV to any operator-accessible switch or cable without malfunction. In addition, no malfunction occurs when the device is operated 1 meter distant from any object which receives at least 10 consecutive, direct static discharges of the same severity.
Electromagnetic Interference Susceptibility		No malfunction occurs when this device is operated near any source of EMI, including telemetry and radio communication equipment where the field strength and/or proximity to such sources is a typical operating environment for this type of device.
Power Requirements		Supplied by T-BERD 224 through Lid interface cable.
STS-1/DS3 Input Signal		
Connectors		WECO 560A jack (PRI RX and SEC RX).
Impedance		75 Ω ±5%, unbalanced..
Level	DSX-3	0.5 Vp (450 ft. of cable attenuation form a HIGH source).
	Cable	+6 dB to -3 dB (450 ft. of cable) from nominal signal level.
	Resistive	+6 dB to -20 dB from nominal signal level.
Line Code		B3ZS.
Frequency	DS3	44.736 MHz (center) ±200 ppm.
	STS-1	51.840 MHz (center) ±200 ppm.
Pulse Shape		IAW STS-1 GR-253 Section 4.4.
Jitter Tolerance		Meets or exceeds mask specified in AT&T PUB 43802 and Bellcore TR-TSY-000009. For pattern 2^15-1, mask is defined with a jitter amplitude of 5.0 UIp-p from 10 Hz to 2300 Hz, with slope of -24 dB/decade from 2.3 kHz to 60 kHz, and an amplitude of 0.1 UIp-p from 60 kHz to 300 kHz.
STS-1/DS3 Output Signal		
Connector		WECO 560A jack.
Impedance		75 Ω ±5%, unbalanced.
Level	DSX-3	Nominal 0.516 Vp ±10%.
Line Code		B3ZS.

Parameter		Specification
Frequency	DS3	44.736 MHz (center) ±10 ppm.
	STS-1	51.840 MHz (center), internal ±6 ppm, payload ±130 ppm, and BITS ±130 ppm.
Pulse Shape	DS3	Meets ANSI T1.102 and isolated pulse mask.
	STS-1	Meets ANSI T1.102-1989, Table 5 and CCITT Recommendation G.703, Section 5, and meets TR-NWT-000253 eye diagram mask for STSX-1 interconnection.
DS1 BITS Clock		
Connector		Bantam.
Input Impedance		DSX-MON, 100 Ω.
Line Code		AMI or B8ZS.
Level		+6 dBdsx to -24 dBdsx.
Frequency		1.544 MHz ±100 ppm.
Pulse Shape		IAW TR-NWT-000499.
Jitter		AT&T Publication 62411.
DS1 Signal		
Input		From T-BERD 224 with nominal DS1 timing.
Output		To T-BERD 224 with nominal DS1 timing.

SECTION 9 TTC CUSTOMER SERVICES

9.1 INTRODUCTION

TTC offers unmatched services to support purchased equipment, including a wide range of customer care, technical support, instrument maintenance, and training services. TTC 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. TTC is also available on a contractual basis to provide customized application development, network consulting and management services, software customization, and test procedure development.

All TTC products are backed by an industry-leading warranty that guarantees mainframe repair or replacement for 3 years and all other parts for 1 year.

9.2 CUSTOMER SERVICE LOCATIONS

For questions regarding TTC products and services, including return authorizations and repairs, technical support, training, and all other available services, contact your local distributor or TTC Customer Service at one of the locations listed in the TTC Worldwide Contact list at the beginning of the manual.

9.3 SERVICES

9.3.1 Instrument Service

To maintain your organization's long-term investment, TTC will structure a service plan to fit your network performance goals and budget. TTC 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 — TTC'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 TTC 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, TTC 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.

9.3.2 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 i available for all core TTC 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.

9.3.3 Test Systems Field Engineering and Installation

TTC 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 TTC.

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.

9.3.4 Technical Training

By providing both experienced instructors and a hands-on atmosphere, TTC 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, TTC 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) — TTCs 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. TTCs 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 package 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 — TTC can help identify training needs and develop customized training curricula to maximize learning opportunities, all while providing a measurable return on investment.

9.4 WARRANTY INFORMATION

9.4.1 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted agains defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

Mainframes will be repaired or replaced (at TTCs option) at no charge for a period of three (3) years after shipment to the customer. All other equipment, including batteries, will be repaired or replaced (at TTCs option) at no charge for a period of one (1) year after shipment to the customer. Contact TTC Customer Service to determine your equipment warranty status.

Liability under this warranty extends only to the replacement value of the equipment. The warranty is void under the following conditions.

(1) Equipment has been altered or repaired without specific authorization from TTC.

(2) Equipment is installed or operated other than in accordance with instructions contained in TTC literature and operating manuals.

No other warranty is expressed or implied. TTC is not liable for any direct, indirect, incidental, or consequential damages.

9.5 SERVICE AND REPAIR INFORMATION

9.5.1 In-Warranty Service

Equipment in warranty must be returned to the factory or authorized service center with shipping prepaid. The equipment should be packed and shipped in accordance with the *Equipment Return Instructions on page 4*. Before returning any equipment, the customer must obtain a return authorization (RA) number (reference number - European Customers) by contacting TTC Customer Service *(see page 1)* or the TTC office serving your region (call or visit our website for a current list of worldwide TTC locations). The RA or reference number should appear on all paperwork and be clearly marked on the outside of the shipping container.

After the equipment is repaired by TTC, it is tested to applicable specifications and returned to the customer with shipping prepaid. A detailed description of the work performed and parts replaced will be provided with each repair

9.5.2 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as the one used for equipment still in warranty. There is a minimum charge applied to each request for out-of-warranty service. The charge guarantees the customer an estimate of the repair costs and is used as credit against the actual repair costs should the equipment be repaired. There are three payment methods available for out-of-warranty service: service agreement, flat rate, and time and material. Contact TTC Customer Services or visit our website for more information on these options.

The customer will be required to furnish a purchase order number before repair work can be started, and a hard copy of the purchase order must be received by TTC before the repaired equipment may be shipped to the customer. A detailed description of the work performed and parts replaced will be provided with each repair.

Once an out-of-warranty repair is made, the repaired part or component is warranted for one (1) year. Thi warranty applies only to the part or component that was repaired; other parts or components are not covered under the one (1) year repair warranty.

9.5.3 Equipment Return Instruction

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 TTC 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 TTC Customer Services. TTC is not liable for any damage that may occur during shipping. The customer should clearly mark the TTC-issued RA or reference number on the outside of the package and ship it prepaid and insured to TTC.

APPENDIX A FACTORY DEFAULT SETTINGS

A.1 MAINFRAME SETTINGS

Table A-1 contains the factory default settings that are stored in memory. The T-BERD 224s controls can be forced to their default settings by clearing the NOVRAM. As soon as the software revision message is visible while the unit is being powered-up, momentarily press the **RESTART** switch. The message *CLEARING NOVRAM* appears in the RESULTS display. If the **RESTART** switch is held down for too long, the unit considers the **RESTART** switch to be stuck and will ignore it from that time on.

Table A-1. Factory Default Settin g

Parameter		Default
MODE		T1-DID
CHANNEL FORMAT		VF
SOURCE CONFIGURATION I		1004 Hz
RESULTS I & II		SUMMARY
DISPLAY HOLD		OFF
SIGNALING INSERT		OFF
ERROR INSERT		OFF
CODE		AMI
TEST		CONT.
PRINT EVENT		OFF
RECEIVE INPUT LINE 1		BRIDGE
RECEIVE INPUT LINE 2		BRIDGE
LINE 1		CHANNEL 1
LINE 2		CHANNEL 1
DROP		BOTH
INSERT		NONE
AUX 01 CL FIFO		N/A
AUX 02 TIM PRI		6 HRS 00 MINS 00 SECS
AUX 03 TES LEN		200 HRS 00 MINS 00 SECS
AUX 04 TIM/DAY		N/A
AUX 05 LBO	LINE 1	0 dB
	LINE 2	0 dB
AUX 06 BACKTM	LINE 1	INTERNAL
	LINE 2	INTERNAL
AUX 07 DS0 TM		COMMON
AUX 08 RS 232	Parity	NONE
	Baud	9600
	Term	CR
AUX 09 488MODE	ADDR	0
	SRQ:	OFF
AUX 10 N-CONTIG		NONE
	LINE 1	01
	LINE 2	01
AUX 11 ANL CHA		PRIMARY
	DSU CHAN	PRIMARY
	CTRL BIT	THRU

Table A-1. Factory Default Settings (Continued)

Parameter		Default
AUX 12 ERR COR		OFF
AUX 13 ERR RT	ERROR RATE	1.0 E-3
	ERROR TYPE	SINGLE
	BURST LEN	20 ms
AUX 14 FRM ERR		SINGLE
AUX 15 USER		100000
AUX 16 PGM LP	UP	10000
	DOWN	100
AUX 17 LOOP CD	TYPE	T1
	EQUIP	CSU
	SMARTNET	ILR ADTRAN
AUX 18 AUT RES		NO RESP
AUX 19 DDS CHN	TRANSMIT	PRIMARY
	ANALYZE	PRIMARY
AUX 20 PRM TX	L1 EMULATE	CUSTOMER
	L2 EMULATE	CUSTOMER
	PRM TRANS	OFF
AUX 21 SWEEP	START FREQ	1004Hz
	STOP FREQ	3704 Hz
	STEP-SIZE	100Hz
	STEP-INTERVAL	2.0 Seconds
	SKIP-HI	2750 Hz
	SKIP-LO	2450 Hz
AUX 22 VFBURST		OFF
	FREQ	2125 Hz
	LEVEL	-10dBm
AUX 23 PRT OPT		OFF
AUX 24 TRK DEF		STD(E&M)
AUX 25 DIG MAR	TYPE	DTMF/MF
	DIGIT ON	70 ms
	DIGIT OFF	70 ms
	PPS	10
	% BREAK	60
AUX 26 DIAL SEQ		NONE
AUX 27 REC SEQ		NONE
AUX 28 SPV DEF	SUP EVENT	WINK
	DELAY	200 ms
	DURATION	150 ms
SUP EVENT		DELAY DIAL
DELAY 200 ms DURATION		150 ms
AUX 29 SCANSET TIMEOUTS	CHAN	ALL ONES
	OFF HOOK	1 Minute
	DISCONNECT	5 Seconds
AUX 30 MJU	OPERATION	SELECT
	BRANCH	1
AUX 31 CALLID		FORMAT SLC

Table A-1. Factory Default Settings (Continued)

Parameter		Default
AUX 32 LN CODE	LINE 1	B8ZS
	LINE 2	AMI
AUX 35 CUSTO	LOGIC	ALL
	BPV&FRAME	ALL
	SIGNAL	ALL
	TIME	ALL
	CHANNEL	ALL
	ALARMS	ALL
	DS3	ALL
	SONET	ALL
AUX 50 DELAY		ENABLED

A.2 SONET/DS3 ANALYZER OPTION SETTINGS

Table A-2 lists the factory default settings for the SONET/DS3 Analyzer Option switches and auxiliary functions when NOVRAM is reloaded at power up.

Table A-2. SONET/DS3 Analyzer Option Default Settings

Switch/Auxiliary Function	Default Setting
AUX Switch	Disabled
MODE Switch	DS3-M13
FORMAT Switch	2^23-1
RESULTS I/II Switches	SUMMARY Category
RESTART Switch	N/A
DISPLAY HOLD Switch	Disabled
HISTORY RESET Switch	N/A
ALARM INSERT Switch	Disabled
ERROR INSERT Switch	Disabled
DS3 TRANSMIT TIMING Switch	INTERNAL
STS1 TRANSMIT TIMING Switch	INTERNAL
PRIMARY VT/DS1 Switch	— — —
SECONDARY VT/DS1 Switch	— — —
AUX 10 DS3 ALARM	NONE
AUX 11 DS3 ERR INS	LOGIC BURST
	SINGLE
AUX 20 STS1 ALARM	NONE
AUX 21 SON ERR INS	SECTION BIP
AUX 22 PATH TRACE	NONE

APPENDIX B CHANNEL TIMESLOT ASSIGNMENTS

This appendix contains the T1 timeslot assignments for the T1 framing formats supported by the T-BERD 224. Table B-1 lists the T1 timeslot numbers and the corresponding channel numbering for the selected framing format.

Table B-1. Channel Timeslot Assignment

T1 Time Slot	T1-D1D T1-SLC96	T1-D2	T1-D4 T1-ESF T1-ESFz
1	1	12	1
2	13	13	2
3	2	1	3
4	14	17	4
5	3	5	5
6	15	21	6
7	4	9	7
8	16	15	8
9	5	3	9
10	17	19	10
11	6	7	11
12	18	23	12
13	7	11	13
14	19	14	14
15	8	2	15
16	20	18	16
17	9	6	17
18	21	22	18
19	10	10	19
20	22	16	20
21	11	4	21
22	23	20	22
23	12	8	23
24	24	24	24

APPENDIX C OPERATING MESSAGES

C.1 INTRODUCTION

Operating messages are displayed to notify the operator of conditions that affect the test set. Some of these messages are displayed once and other messages are flashed until the cause of the condition is changed or corrected.

C.2 FRONT-PANEL MESSAGES

The following lists theT-BERD 224 operating messages in alphabetical order. Also included is a reason for each displayed message and a suggestion on how to correct, if necessary, the condition that caused the message to be displayed.

ALT LOOP DOWN COMPLETE — The T-BERD 224 is no longer receiving a DDS alternating loop-down code after the **LOOP DOWN** switch is pressed (LED ON).

ALT LOOP UP COMPLETE — The T-BERD 224 is receiving a DDS alternating loop-up code after the **LOOP UP** switch is pressed (LED ON).

ALT LOOP UP FAILED — The T-BERD 224 is not synchronized to the DDS alternating loop-up code pattern. This message appears after the **LOOP UP** switch is pressed (LED ON).

AUTO NOT VALID WITH THIS TRUNK TYPE SEE AUX 24 — Displayed when the T-BERD 224 is set to auto scan and a Ground Start or Loop Start Trunk type is selected.

COMMAND PORT FAILURE — Communication between the internal microprocessors is lost. If this error messages is observed, record it to help determine if repair is necessary.

ESF PAYLOAD LOOP CODE SENT — The T-BERD 224 is sending an ESF payload loop code after either the **LOOP UP** or **LOOP DOWN** switch is pressed (LED ON). Verify the loopback by checking for pattern synchronization or sending bit errors.

EXT CLOCK LOSS — AUX 06 BACK TM is set to BNC and no signal is detected at the side panel BNC connector. This message is cleared by setting AUX 06 BACK TM to INTERNAL or by connecting a T1 clock source to the BNC connector.

FRAMING PATTERN UNKNOWN — The **MODE** switch is set to AUTO and frame synchronization has not achieved. This message will only appear when the T1 BERT Option is installed.

FIFO CLEARED — The **SOURCE CONFIGURATION II** switch was pressed in response to the AUX 01 CL FIFO question (*CLEAR PRINT FIFO YES? PRESS SOURCE CONFIGURATION II SWITCH.*).

HUB ID — Displayed when the T-BERD 224 successfully completes a MJU SELECT operation.

LAT LOOP COMPLETE MAP1 DROP SIDE — Displayed when the T-BERD 224 receives a DDS DS0-DP latching loop code confirmation message from the selected DS0-DP location. The message appears after the **LOOP UP** switch is pressed (LED ON). MAP1 DROP SIDE indicates that the drop side of the DS0-DP is looped.

LAT LOOP COMPLETE MAP0 LINE SIDE— Displayed when the T-BERD 224 is receiving a DDS DS0-DP latching loop code confirmation message from the selected DS0-DP location. The message appears after the **LOOP UP** switch is pressed (LED ON). *MAP0 LINE SIDE* indicates that the line side of the DS0-DP is looped.

LAT LOOP DOWN COMPLETE/CONFIRMED — Displayed when the T-BERD 224 receives a confirmed DDS latching loop-down code after the **LOOP DOWN** switch is pressed (LED ON).

LAT LP DN COMPLETE/NOT CONFIRMED — Displayed when the T-BERD 224 receives an unconfirmed DDS latching loop-down code after the **LOOP DOWN** switch is pressed (LED ON).

LAT LOOP UP COMPLETE/CONFIRMED— Displayed when the T-BERD 224 receives a confirmed DDS latching loop-up code (Far-end voice code detected) after the **LOOP UP** switch is pressed (LED ON).

LAT LP UP COMPLETE/NOT CONFIRMED — Displayed when the T-BERD 224 receives an unconfirmed DDS latching loop-up code (Far-end voice code not detected) after the **LOOP UP** switch is pressed (LED ON). Check the loopback by verifying pattern synchronization or sending bit errors. If the response is positive, then the loopback is established.

LAT LOOP UP FAILED— Displayed when the T-BERD 224 is not synchronized to the DDS latching loop-up code pattern after the **LOOP UP** switch is pressed (LED ON).

n SLC DL ALAR — Displayed when the T-BERD 224 is in SLC-M2 or T1SLC96 mode, is monitoring the T1 circuit, and detects a SLC-96 datalink alarm. This message informs the operator that the alarm was detected and reported in the SUMMARY category. n = LINE 1 or LINE 2.

LOOP DOWN ABORTED — Displayed when the transmitted T1 loop-down code is interrupted by pressing the **LOOP DOWN** switch (LED ON). This message is also displayed when either the T1 in-band loop-down response is not received after a 30-second timeout or the ESF out-of-band loop-down response is not received after a 3-second timeout.

LOOP DOWN FAILURE — Displayed when the T-BERD 224 is not synchronized to the in-band or out-of-band loop-down code pattern after the **LOOP DOWN** switch is pressed (LED ON).

LOOP DOWN SUCCESSFUL — Displayed when the in-band loop-down response is briefly detected or the out-of-band loop-down response is not detected for one second.

LOOP UP ABORTED — Displayed when the transmitted T1 loop-up code is interrupted by pressing the **LOOP UP** switch (LED ON). This message is also displayed when the T1 in-band loop-up response is not received after a 30-second timeout or when the ESF out-of-band loop-up response is not received after a 3-second timeout.

LOOP UP FAILURE — The T-BERD 224 is not synchronized to the in-band or out-of-band loop-up code pattern after the **LOOP UP** switch is pressed (LED ON).

LOOP UP SUCCESSFUL — The in-band loop-up response is briefly detected or the out-of-band loop-up response is not detected for 1 second.

LOSS OF HOLDING TONE— Displayed during C-NCH noise, 3K NCH noise, or S/N testing. This message informs the operator that the expected holding tone that is filtered out in the notch range of 995 Hz to 1025 Hz (1004 Hz tone) is not detected. The operator should check the received signal VF FREQ (995 Hz to 1025 Hz) and VFLVL (greater than -40.0 dBm) are in the required ranges for valid test results.

MJU BLOCK COMPLETE — Displayed when the T-BERD 224 blocks the selected branch fro transmitting or receiving data.

MJU OPERATIONFAILED — Displayed when the T-BERD 224 is unable to complete the MJU operation selected in the AUX 30 MJU function.

MJU OPERATION ABORTED— Displayed when the selected MJU operation is aborted after being initiated from the AUX 30 MJU function.

MJU RELEASE COMPLETE — Displayed when an MJU RELEASE operation is completed after releasing all branches to normal operation.

MJU RESTORE COMPLETE — The T-BERD 224 successfully deletes the last SELECT/BLOCK or SELECT/UNBLOCK operation.

MJU SELECTFAILED — The T-BERD 224 is unable to access the selected branch.

MJU SELECT SUCCESSFUL — The T-BERD 224 accesses the selected branch.

MJU UNBLOCKED COMPLETE — The T-BERD 224 is able to unblock the branch previously blocked.

NO BYTE ALIGNMENT LINE 1/LINE 2/BOTH LINES— DS0A byte alignment cannot be achieved for LINE 1, LINE 2, or BOTH LINES (three separate messages). This message is applicable only when DS0A ERROR CORRECTION is set to ON in the AUX 12 ERR COR function and the **CHANNELFORMAT** switch is set to DS0A 2.4, DS0A 4.8, or DS0A 9.6.

NO SUBRATE FRAME SYNC LINE 1/LINE 2/BOTH LINES — DS0B framing sync cannot be achieved for LINE 1, LINE 2, or BOTH LINES (three separate messages). Synchronization must be achieved before being able to insert data on a subrate channel. This message is applicable only when the **CHANNEL FORMAT** switch is set to a DS0B subrate.

ONLY FULL SCRN AVAIL — Displayed when selecting the CHANNEL category in signaling or SWI 56 mode. The full screen will be used to display digits/events and associated results.

OPTION NOT INSTALLED — Displayed when an option, which is not currently installed, is required for a switch to operate properly.

OUT-OF-BAND CODES REQUIRE ESF or ESFz — Displayed when an ESF out-of- band loop code is sent and the T1-ESF or T1-ESFz mode is not selected. Correct the condition by either changing the AUX 17 LOOP CD function to an equipment loop code other than ESF-LIN,ESF-PAY, or ESF-NET, or changing the operating mode to T1-ESF or T1-ESFz.

SEE AUX 02 TO SET PRI EVENT TIME — Displayed when the **PRINT EVENT** switch is set to the TIME position. This reminds the operator that a time period must be set for the print event in the AUX 02 TIM PRI function. If no new length is selected, the last valid time length entered for AUX 02 TIM PRI is the default print length.

SEE AUX 03 TO SET TEST LENGTH — Displayed when the **TEST** switch is set to the TIMED position. This reminds the operator that a time period must be set for the test length in the AUX 03 TES LEN function. If no new length is selected, the last valid time length entered for AUX 03 TES LEN is the default test length.

SEE AUX 10 TO SET CHNL NUMBERS — This message is displayed when the channel format is set to 56xN or 64xN and NON CONTIG is selected by the **SOURCE CONFIGURATION II** switch. Use the AUX 10 N-CONTG function to set the non-contiguous channels for LINE 1 and LINE 2. Refer to Section 4 Auxiliary Functions for assistance.

SEE AUX 17 TO SET LOOP CD TYPE — Displayed as a reminder that the loop code type is set in the AUX 17 LOOP CD function. The message appears when the **LOOP CODES** switches are pressed to send a loop code signal. If no type is selected, the last valid type entered in AUX 17 LOOP CD is transmitted.

SEE AUX 19 TO SETSEC PATTERN — Displayed as a reminder that the DDS secondary channel test pattern is selected from the AUX 19 DDS CHN function. The message appears when the operating mode and test pattern are displayed and the **SOURCE CONFIGURATION I** switch is pressed in an attempt to change the test pattern.

SEE AUX 21 TO SETSWEEP PARAMS — Displayed when the **SOURCE CONFIGURATION I** switch is set to the SWEEP position. This reminds the operator that the frequency sweep parameters of START FREQ, STOP FREQ, STEP-SIZE, STEP-INTVL, SKIP-HI, and SKIP-LO are set in AUX 21 SWEEP. If no sweep parameters are selected, the last valid sweep parameters entered for AUX 21 SWEEP will be used.

SEE AUX 22 TO SETBURST PARAMS — The **SOURCE CONFIGURATION I** switch is set to any of the return loss measurements; ERL, SRL-LO, or SRL-HI. This reminds the operator that the frequency burst parameters of ON/OFF, FREQ, and LEVEL are set in AUX 22 VFBURST. If no burst parameters are selected, the last valid parameters entered for AUX 22 VFBURST will be used.

SEE AUX 32 TO SET LINE CODE — The front-panel **CODE** switch is disabled in ESF/D4 mode, because the line coding is selected for each line (LINE 1 and 2) via the AUX 32 LN CODE auxiliary function.

SIGNAL LOSS/NODATA LINE 1/LINE 2/BOTH LINES — The signal has been lost for LINE 1, LINE 2, or BOTH LINES (three separate messages).

SIGNALING SEQUENCE IS FULL — More than 80 events and digits are attempted to be programmed in the AUX 26 DIAL SEQ function.

SKIP HIGH SMALLER THAN SKIP LOW — Displayed after the AUX 21 SWEEP parameters have been set and the frequency sweep parameter of SKIP-HI is smaller than the SKIP-LO parameter. The T-BERD 224 automatically aborts all the parameters changes and restores the last valid parameters if the auxiliary function is exited. The operator must return and repeat the entire AUX 21 SWEEP parameters procedure to change the parameters.

SKIP RANGE TOO BIG — Displayed after the AUX 21 SWEEP parameters have been set and the frequency sweep parameters of SKIP-HI and SKIP-LO are too far apart and interfere with either the STEP-SIZE, START FREQ, or STOP FREQ range. The T-BERD 224 automatically aborts all the parameters change and restores the last valid parameters if the auxiliary function is exited. The operator must return and repeat the entire AUX 21 SWEEP parameters procedure to change the parameters.

STEP SIZE TOO LARGE DOESN'T MATCH ENDPOINTS — Displayed after the AUX 21 SWEEP parameters have been set and the frequency sweep parameters of START FREQ and STOP FREQ allow too small a frequency band for the selected STEP-SIZE. The T-BERD 224 automatically aborts all the parameters changes and restores the last valid parameters if the auxiliary function is exited. The operator must return and repeat the entire AUX 21 SWEEP parameters procedure to change the parameters.

TIMED TEST COMPLETE — Displayed when a timed test is finished. This message alternates with the displayed results and operating status. This message is disabled by setting the **TEST** switch to CONT., or by pressing the **RESTART** switch to begin the test again.

TRANSMITTING ON BOTH CHANNELS ANALYZING PRIMARY CHANNEL — Displayed when the AUX 19 DDS CHN function is set to transmit on both channels and to analyze the primary channel.

TRANSMITTING ON BOTH CHANNELS ANALYZING SECONDARY CHANNEL — Displayed when the AUX 19 DDS CHN function is set to transmit on both channels and to analyze the secondary channel.

TRANSMITTING ON SECONDARY CHANNEL ANALYZING SECONDARY CHANNEL — The AUX 19 DDS CHN function is set to both transmit and analyze on the secondary channel.

UNDER REMOTE CONTROL — Flashed when the unit is under remote control. This message alternates with the displayed results and operating status. This message is disabled by exiting the remote control mode and returning to local control.

UNEQUAL # OF CHANNELS, CONFIGURATION NOT SAVED — Displayed when an unequal number of channels is entered in AUX 10 N-CONTG. Redisplaying the channel numbers for AUX 10 N-CONTG shows the last valid channels that were selected.

USE RESULTS I/II TO EXIT TRAFFIC — This message is displayed when a front panel switch (**MODE**, **CHANNEL FORMAT**, **SOURCE CONFIGURATION I**, or **SOURCE CONFIGURATION II**) is pressed while the traffic results (n55 or n56) is still visible in the display. This message is disabled by pressing the same **RESULTS I** or **II Arrowed** switch to display another result or the **RESULTS I** or **II Blank** switch to select another category.

VF LEVEL OUT OF RANGE — Displayed during a P/AR test if the signal level drops below - 40.0 dBm. The operator should adjust the PAR LEVEL to bring the signal level within this range.

VF OPTION FAILED — Displayed if the VF Option is not functioning and the operator attempts a test that requires the VF Option. This message is also displayed if the VF Option is not operating correctly during a *T-BERD 224 Self Test*. The operator should call TTC Customer Assistance.

C.3 REMOTE CONTROL ERROR MESSAGES

The following remote control error messages are generated when an inappropriate command or parameter is executed. The number identifies the error message when the **ERRor NUMber** command is used to request the last error message generated.

00	INTERNAL ERROR: Unknown error code.
01	ERROR: Unrecognized command.
02	ERROR: Unrecognized parameter.
03	ERROR: Characters after statement end.
04	ERROR: Command not currently valid.
05	ERROR: RS-232 receiver parity error.
06	ERROR: RS-232 receiver overrun error.
07	ERROR: RS-232 receiver framing error.
08	ERROR: Receiver buffer overflow.
09	ERROR: Parameter is out of range.
10	ERROR: No such help page.
11	ERROR: Must be followed by a parameter

12	ERROR: Command not executable. - - End with "?" for status.
13	ERROR: Command has no status
14	ERROR: Invalid command for IEEE-488 remote control.
16	ERROR: Selection is not applicable.
17	ERROR: Option not installed.
18	ERROR: DSU-DP Option not installed.
19	ERROR: ADPCM Option not installed.
20	ERROR: IEEE-488 Option not installed.
21	ERROR: BERT Option not installed.
22	ERROR: VF Option not installed.
23	ERROR: SLC/ESF Option not installed.
24	ERROR: ZBTSI Option not installed.
25	ERROR: BERT or DSU-DP Option not installed.
26	ERROR: Non-contiguous channel numbers must be in ascending order.
27	ERROR: Non-contiguous channel lists must be the same length.
28	ERROR: Channel number is out of range.
29	ERROR: The other result window is currently displaying traffic.
30	ERROR: Floating point number can have only one decimal digit.
31	ERROR: BERT, DSU-DP or SLC/ESF Option not installed.
32	ERROR: Step size exceeds sweep range.
33	ERROR: Skip low is greater than skip high.
34	ERROR: Skip range exceeds sweep range.
35	ERROR: No frame sync on insert line.
36	ERROR: Equipment not valid for loop type.
37	ERROR: No location for loop type.
38	ERROR: Loop code transmission is not allowed, unit already in auto loopback.
39	ERROR: Change setting is not permitted, unit already in auto loopback.
40	ERROR: Insert is not allowed, loop up or loop down in progress.
41	ERROR: Source 1 selection is not valid when TX is set to secondary.
42	ERROR: Selection is not allowed with ALT-LOOP.
43	ERROR: Command not allowed during 3 second wait for insertion.
44	ERROR: No channel sync on insert line.
45	ERROR: Adv. Stress Patterns Option not installed.
46	ERROR: G.821 Option not installed.
47	ERROR: Signaling Option not installed.
48	ERROR: Signaling Sequence Syntax Error.
49	ERROR: Receive Sequence too long.
50	ERROR: Parameter out of valid range.
51	ERROR: Command line syntax error
52	ERROR: Invalid result name.
53	ERROR: Invalid category name.
54	ERROR: Category not in Select mode.
55	ERROR: The other results window is currently displaying signaling result.
56	ERROR: SS7/ISDN Option not installed.
57	ERROR: None of the PROTOCOL Options is installed.
58	ERROR: Digit Analysis Option is not installed.
59	ERROR: Fractional T1 Option not installed
60	ERROR: DDS Option not installed
61	ERROR: Fractional T1 or DSU-DP Option not installed
62	ERROR: DDS or DSU-DP Option not installed
63	ERROR: DDS and SIGNALING Options required
64	ERROR: DDS or Fractional T1 Options not installed
65	ERROR: Adv. Stress Patterns and either DDS or Fractional T1 Options required
66	ERROR: DSU-DP or SLC/ESF Option not installed

67 ERROR: Smart Loopback/Command Codes Option not installed.
68 ERROR: Caller ID Option not installed.
69 ERROR: Selection is not allowed with ESF/D4.

APPENDIX D STRESSPATTERNS

D.1 INTRODUCTION

The stress patterns are represented in a right-to-left format. When the pattern is transmitted in binary for the least significant bit is transmitted first (see Table D-1). This requires that the binary representation be turned over for transmission. Example: The binary representation of the hexadecimal value 01 would be 0000 0001. The stress patterns are provided with the Enhanced DS1 Testing Option.

Table D-1. Hexadecimal-to-Binary Conversion

H	8421
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111
Ex. MSB LSB 74_{16} = 0111 0100	

D.2 BRIDGTAP/MULTIPAT PATTERNS

Table D-2 and Table D-3 list the test patterns generated by the BRIDGTAP and MULTIPAT test patterns.

Table D-2. BRIDGTAP Patterns

Pattern Name	Bit Pattern[1]
ALL ONES	F 1111
1:1	F 1010
1:3	F 0100
1:5	F 0100 00
1:6	F 0100 000
1:7	F 0100 0000
2:8	F 1100 0000 00
2:9	F 1100 0000 000
2:10	F 1100 0000 0000

Table D-2. BRIDGTAP Patterns (Continued)

Pattern Name	Bit Pattern[1]
2:11	F 1100 0000 0000 0
2:12	F 1100 0000 0000 00
2:13	F 1100 0000 0000 000
2:14	F 1100 0000 0000 0000
3 IN 18	F 1101 0000 0000 0000 00
3 IN 19	F 1100 1000 0000 0000 000
3 IN 20	F 1100 0100 0000 0000 0000
3 IN 21	F 0100 0100 0000 0000 0000 1
3 IN 22	F 0100 0100 0000 0000 0000 10
3 IN 23	F 0100 0100 0000 0000 0000 100
3 IN 24	F 0100 0100 0000 0000 0000 0100
T1-QRSS	2^{20}-1 pseudorandom pattern with 14-zero suppression

1. F = Framing bit, shown in relative position to test pattern.

Table D-3. MULTIPAT Patterns

Pattern Name	Bit Pattern[1]
ALL ONES	F 1111
1:7	F 0100 0000
2 IN 8	F 0100 0010
3 IN 24	F 0100 0100 0000 0000 0000 0100
T1-QRSS	2^{20}-1 pseudorandom pattern with 14-zero suppression

1. F = Framing bit, shown in relative position to test pattern.

D.3 LUP OPTION TEST PATTERNS

The following LUP Option test patterns are only available when the option is installed.

- IBM80 (see Table D-4)
- MIN/MAX (see Table D-5)
- T1_2 (see Table D-6)
- T1_3 (see Table D-7)
- T1_4 (see Table D-8)
- T1_5 (see Table D-9)
- T1_6 (see Table D-10)
- T1_DALY (see Table D-11)

Table D-4. IBM80 Test Pattern Sequen c

01	02	03	04	05	06	07	08
F9	FA	FB	FF	FE	AA	AA	AA
09	10	11	12	13	14	15	16

Table D-4. IBM80 Test Pattern Sequence (Continued)

00	00	00	00	00	00	00	00
17	**18**	**19**	**20**	**21**	**22**	**23**	**24**
00	00	33	33	33	33	33	33

Table D-5. MIN/MAX Test Pattern Sequenc e

01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**
80H	80H	80H	80H	01H	00H	01H	01H	01H	03H
1000 0000	1000 0000	1000 0000	1000 0000	0000 0001	0000 0000	0000 0001	0000 0001	0000 0001	0000 0011
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
80H	01H	80H	01H	01H	80H	01H	22H	00H	20H
1000 0000	0000 0001	1000 0000	0000 0001	0000 0001	1000 0000	0000 0001	0010 0010	0000 0000	0010 0000
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
22H	00H	20H	AAH	AAH	AA	AAH	AAH	55H	55H
0010 0010	0000 0000	0010 0000	1010 1010	1010 1010	1010 1010	1010 1010	1010 1010	0101 0101	0101 0101
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
55H	55H	AAH	AAH	AAH	AA	55H	AAH	AAH	55H
0101 0101	0101 0101	1010 1010	1010 1010	1010 1010	1010 1010	0101 0101	1010 1010	1010 1010	0101 0101
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
55H	55H	80H	80H	FFH	FFH	FF	FFH	FFH	FFH
0101 0101	0101 0101	1000 0000	1000 0000	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
FFH	FEH	FFH	FFH	24H	49H	92H	88H	88H	88H
1111 1111	1111 1110	1111 1111	1111 1111	0010 0100	0100 1001	1001 0010	1000 1000	1000 1000	1000 1000
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
10H	42H	08H	21H	84H	20H	08H	82H	40H	20H
0001 0000	0100 0010	0000 1000	0010 0001	1000 0100	0010 0000	0000 1000	1000 0010	0100 0000	0010 0000
71	**72**	**73**							
10H	80H	--							
0001 0000	1000 0000								

Table D-6. T1-2/TRIP Test Pattern Sequence

01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	AAH	AAH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1010 1010	1010 1010
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
AAH	AAH	80H	01H	80H	01H	80H	01H	80H	01H
1010 1010	1010 1010	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
80H	01H	80H	01H	80H	01H	80H	01H	80H	01H

Table D-6. T1-2/TRIP Test Pattern Sequence (Continued)

1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001
71	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
80H	01H	AAH	AAH	AAH	AA	80H	01H	80H	01H
1000 0000	0000 0001	1010 1010	1010 1010	1010 1010	1010 1010	1000 0000	0000 0001	1000 0000	0000 0001
81	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
80H	01H	80H	01H	80H	01H	80H	01H	80H	01H
1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001
91	**92**	**93**	**94**	**95**	**96**				
80H	01H	80H	01H	80H	01H				
1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001				

Table D-7. T1-3 Test Pattern Sequen c

01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**
01H	01H	01H	01H	01H	01H	00H	01H	01H	01H
0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	0000 0000	0000 0001	0000 0001	0000 0001
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
01H	01H	01H	03H	01H	01H	01H	01H	07H	01H
1000 0000	0000 0001	0000 0001	0000 0011	0000 0001	0000 0001	0000 0001	0000 0001	0000 0111	0000 0001
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
01H	01H	01H	55H	55H	55H	55H	AAH	AAH	AAH
0000 0001	0000 0001	0000 0001	0101 0101	0101 0101	0101 0101	0101 0101	1010 1010	1010 1010	1010 1010
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
AAH	01H	01H	01H	01H	01H	01H	FFH	FFH	FFH
1010 1010	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	1111 1111	1111 1111	1111 1111
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
FFH	FFH	FFH	80H	01H	80H	01H	80H	01H	80H
1111 1111	1111 1111	1111 1111	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000
51	**52**	**53**	**54**						
01H	80H	01H	80H						
0000 0001	1000 0000	0000 0001	1000 0000						

Table D-8. T1-4 Test Pattern Sequen c

01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**

Table D-8. T1-4 Test Pattern Sequence (Continued)

FFH	FFH	FFH	FFH	FFH	FFH	FF	FFH	FFH	FFH
1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111
71	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
FFH	FFH	AAH	AAH	AAH	AA	10H	10H	10H	10H
1111 1111	1111 1111	1010 1010	1010 1010	1010 1010	1010 1010	0001 0000	0001 0000	0001 0000	0001 0000
81	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
10H	10H	10H	10H	10H	10H	10H	10H	10H	10H
0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**
10H	10H	10H	10H	10H	10H	AAH	AAH	AAH	AAH
0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	1010 1010	1010 1010	1010 1010	1010 1010
101	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**
10H	10H	10H	10H	10H	10H	10H	10H	10H	10H
0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000
111	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
10H	10H	10H	10H	10H	10H	10H	10H	10H	10H
0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000	0001 0000

Table D-9. T1-5 Test Pattern Sequen c

01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**
80H	01H	80H	01H	80H	01H	80H	01H	80H	01H
1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
80H	01H	80H	01H	80H	01H	80H	01H	80H	01H
1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
80H	01H	80H	01H	80H	01H	80H	01H	80H	01H
1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
01H	AFH	AAH	AFH	01H	01H	01H	01H	FFH	FFH
0000 0001	1010 1111	1010 1010	1010 1111	0000 0001	0000 0001	0000 0001	0000 0001	1111 1111	1111 1111
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
FFH	FFH	01H	01H	01H	01H	FF	FFH	FFH	FFH
1111 1111	1111 1111	0000 0001	0000 0001	0000 0001	0000 0001	1111 1111	1111 1111	1111 1111	1111 1111
51	**52**	**53**							
FFH	FFH	CBH							
1111 1111	1111 1111	1100 1011							

Table D-10. T1-6/55 OCTET Test Pattern Seque n c

01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**
01H	01H	01H	01H	01H	01H	00H	01H	01H	01H
0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	0000 0000	0000 0001	0000 0001	0000 0001
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
01H	01H	01H	03H	01H	01H	01H	01H	07H	01H
0000 0001	0000 0001	0000 0001	0000 0011	0000 0001	0000 0001	0000 0001	0000 0001	0000 0111	0000 0001
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
01H	01H	01H	55H	55H	55H	55H	AAH	AAH	AAH
0000 0001	0000 0001	0000 0001	0101 0101	0101 0101	0101 0101	0101 0101	1010 1010	1010 1010	1010 1010
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
AAH	01H	01H	01H	01H	01H	01H	FFH	FFH	FFH
1010 1010	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	1111 1111	1111 1111	1111 1111
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Table D-10. T1-6/55 OCTET Test Pattern Sequence (Continued)

FFH	FFH	FFH	80H	01H	80H	01H	80H	01H	80H
1111 1111	1111 1111	1111 1111	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000
51	**52**	**53**	**54**	**55**					
01H	80H	01H	80H	01H					
0000 0001	1000 0000	0000 0001	1000 0000	0000 0001					

Table D-11. T1-DALY Test Pattern Sequence

01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**
01H	01H	01H	01H	01H	01H	80H	01H	01H	01H
0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	1000 0000	0000 0001	0000 0001	0000 0001
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
01H	01H	01H	03H	01H	01H	01H	01H	07H	01H
0000 0001	0000 0001	0000 0001	0000 0011	0000 0001	0000 0001	0000 0001	0000 0001	0000 0111	0000 0001
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
01H	01H	01H	55H	55H	55H	55H	AAH	AAH	AAH
0000 0001	0000 0001	0000 0001	0101 0101	0101 0101	0101 0101	0101 0101	1010 1010	1010 1010	1010 1010
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
AAH	01H	01H	01H	01H	01H	01H	FFH	FFH	FFH
1010 1010	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	0000 0001	1111 1111	1111 1111	1111 1111
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
FFH	FFH	FFH	80H	01H	80H	01H	80H	01H	80H
1111 1111	1111 1111	1111 1111	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000	0000 0001	1000 0000
51	**52**	**53**	**54**	**55**					
01H	80H	01H	80H	01H					
0000 0001	1000 0000	0000 0001	1000 0000	0000 0001					

APPENDIX E TIMING SLIPS MEASUREMENT (N51 TM SLIP)

E.1 INTRODUCTION

This appendix describes how the T-BERD 224 measures timing slips between a timing reference clock and a received T1 signal.

E.2 FUNCTIONAL DESCRIPTION

The T-BERD 224 timing slips measurement (n51 TM SLIP) identifies frequency deviations that cause uncontrolled clock slips. When measuring timing slips, a received T1 signal (LINE 1) is compared to a reference T1 clock connected to either the T1 REF input (LINE 2) or to the side panel BNC connector. If a T1 clock reference is attached to the side panel BNC connector, timing slip analysis can be performed for both LINE 1 and LINE 2. The T-BERD 224 compares the T1 test signal(s) with the reference and counts the number of times the clock edge of the received signal moves past the edge of the reference signal, as indicated in Figure E-1.

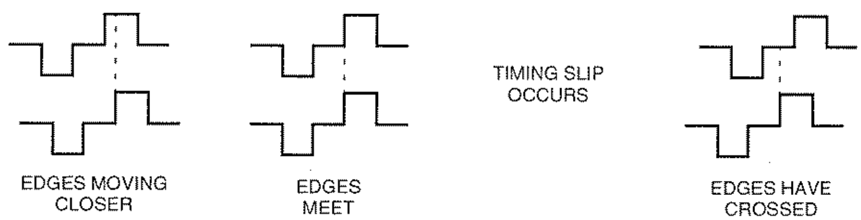


Figure E-1. Timing Slips

The n51 TM SLIP result (available in the SUMMARY and SIGNAL results categories) is displayed in three discrete portions (see Figure E-2):

- A numeric value
- A bar graph
- A moving "wheel"

Figure E-2. Timing Slips Results Display

The numeric value is a range from 0 to 999. This value represents the total number of frame slips that have occurred. One frame slip is equal to 193 bit-slips.

The bar graph represents partial frame slips in increments of one bar for every 16-bit slips (one wheel rotation). Each time the bar moves to the end of the graph, it is reset to the middle position and the frame slip count is incremented.

The wheel is used along with the bar graph to graphically display the direction, rate, and magnitude of timing slips. Figure E-3 shows the values assigned to each position of the bar graph and the wheel.

APPENDIX F DISCUSSION OF CCITT RECOMMENDATION G.821

F.1 INTRODUCTION

This appendix discusses the concept of available time versus unavailable time as specified in CCITT Recommendation G.821. This discussion is provided to familiarize users with the results that may be obtained with the optional Performance Analysis Package.

F.2 FUNCTIONAL DESCRIPTION

CCITT Recommendation G.821 defines available and unavailable time as follows:

> *A period of unavailable time begins when the bit error rate (BER) in each second is worse than 10^{-3} for a period of 10 consecutive seconds. These 10 seconds are considered to be unavailable time. The period of unavailable time terminates when the BER in each second is better than 10^{-3} for a period of 10 consecutive seconds. These 10 seconds are considered to be available time.*

Available and unavailable time are measured in seconds. All test seconds must fall into one of the two categories (total available seconds + total unavailable seconds = total test seconds).

At the beginning of a test, test seconds are considered to be available time; the available seconds begin counting. These seconds continue to be counted until 10 consecutive seconds occur each with a BER worse than 10^{-3}. A sliding window, 10 seconds in length, is used to detect this transition from available to unavailable time and vice versa.

As an example, assume a test begins and continues to run for 25 seconds with each second having a BER better than 10^{-3}. When the test starts, test seconds are considered to be available time, so the available seconds count at this point is 25. In the 26th, 27th, and 28th seconds, the BER becomes worse than 10^{-3}. In the 29th second, the BER drops back to better than 10^{-3}. All 29 seconds are a part of available time and are counted as available seconds.

sec 20 BER <=	sec 21 BER <=	sec 22 BER <=	sec 23 BER <=	sec 24 BER <=	sec 25 BER <=	sec 26 BER >	sec 27 BER >	sec 28 BER >	sec 29 BER <=

**Sliding Window After 29th Test Second
Still in Available Time**

Even though there were 3 consecutive seconds (the 26th, 27th, and 28th) which each had a BER worse than 10^{-3}, 10 such consecutive seconds are required to make the transition to unavailable time. Those 3 individual seconds are still in available time and they are counted as available seconds.

The 3 seconds with a BER worse than 10^{-3} are also included in the count of severely errored seconds. A second in which pattern synchronization is lost is also considered to have a BER worse than 10^{-3}. Therefore, the current test result values for available seconds count = 29; the severely errored seconds (SES) count = 3, and the unavailable seconds count = 0.

The same test continues to run and remains in available time. In the 80th second, the BER for that second i worse than 10^{-3}. The BER for the 81st, 82nd, 83rd, 84th, and 85th seconds is also worse than 10^{-3}. In the 86th, 87th, and 88th seconds, pattern synchronization is lost. We now have 9 consecutive seconds with a BER worse than 10^{-3}. As each of these test seconds occurs, we are still in available time, so they are counted as available seconds and severely errored seconds. The transition has not been made from available time to unavailable time.

sec	sec	sec	sec	sec	sec	sec	sec	sec	sec
79	80	81	82	83	84	85	86	87	88
BER	BER	BER	BER	BER	BER	BER	BER	BER	BER
<=	>	>	>	>	>	>	>	>	>

Sliding Window After 88th Test Second
Still in Available Time

The 89th test second also has a BER worse than 10^{-3}. At this point, the available seconds count = 89, the SES count = 13, and the unavailable seconds count = 0. However, the sliding window now contains 10 consecutive seconds each of which has a BER worse than 10^{-3}. A transition is made to unavailable time.

sec	sec	sec	sec	sec	sec	sec	sec	sec	sec
80	81	82	83	84	85	86	87	88	89
BER	BER	BER	BER	BER	BER	BER	BER	BER	BER
>	>	>	>	>	>	>	>	>	>

Sliding Window After 89th Test Second
Transition to Unavailable Time

Those 10 seconds which had been counted as available seconds are deducted and are added to the unavailable seconds count; the available seconds count becomes 79, and the unavailable seconds count becomes 10. Those same 10 seconds were also included in the SES count. However, SES is limited to only those seconds in available time which have a BER worse than 10^{-3}; therefore, 10 seconds must also be deducted from the SES count (the SES count is updated to 3).

Once the transition occurs from available time to unavailable time, all test seconds are counted as unavailable seconds until 10 consecutive seconds occur each with a BER better than 10^{-3}. As the sample test continues, the 90th through 150th seconds each have a BER worse than 10^{-3}. We are still in unavailable time, so these seconds are counted as unavailable seconds; now the total available seconds count = 79 and the total unavailable seconds count = 71.

Beginning with the 151st second, the BER falls below 10^{-3}. It is still counted as an unavailable second. A BER better than 10^{-3} also occurs for the 152nd through the 160th seconds. Since there are now 10 consecutive seconds with a BER less than 10^{-3}, the transition is made from unavailable time to available time.

sec	sec	sec	sec	sec	sec	sec	sec	sec	sec
151	152	153	154	155	156	157	158	159	160
BER	BER	BER	BER	BER	BER	BER	BER	BER	BER
<	<	<	<	<	<	<	<	<	<

Sliding Window After 160th Test Second
Transition to Available Tim

As each of these faulty 10-second intervals occurred, it was added to the unavailable seconds count (unavailable seconds = 81, available seconds = 79, and SES = 3). Since the last group of seconds has triggered the transition to available time, that group of seconds is deducted from the unavailable second count and added to the available seconds count. The unavailable seconds count = 71 and the available seconds count = 89.

The monitoring of available and unavailable time continues for the duration of the test.

Degraded minutes is an error analysis result that is affected by available and unavailable time. Degraded minutes is a count of the number of minutes during which an average BER worse than 10^{-6}, but better than 10^{-3}, occurs. The 1-minute intervals are derived by removing unavailable seconds and severely errored seconds (SES) from the total test time and then consecutively grouping the remaining seconds into blocks of 60. The average BER is calculated for the block of 60 seconds and, if it is worse than 10^{-6}, the block is counted as a degraded minute.

In the transition from available time to unavailable time, the degraded minutes result is unaffected. This is because a switch to unavailable time requires 10 consecutive seconds each with a BER worse than 10^{3}. Any second in available time with a BER worse than 10^{-3} is considered to be a severely errored second and, therefore, not included in the accumulation of seconds used to calculate degraded minutes.

Moving from unavailable time to available time may affect the degraded minutes count. While in unavailable time, 10 consecutive seconds each with a BER better than 10^{-3} are required for the transition to available time. When this happens, those 10 seconds are subtracted from the unavailable seconds count and are added to the available seconds count. Since these seconds are now considered to be a part of available time and are not severely errored seconds, they are included in the calculation of degraded minutes.

APPENDIX G TRUNK TYPE SUMMARY

STD (E&M)	Tx ON HOOK	A=0	B=0	C=0	D=0
	Tx OFF HOOK	A=1	B=1	C=1	D=1
	Rx ON HOOK	A=0	B=X	C=0	D=X
	Rx OFF HOOK	A=1	B=X	C=1	D=X
FXS (TX) FXO (RX) Ground Start	ON HOOK	A=0	B=1	C=0	D=1
	Ground on ring	A=0	B=0	C=0	D=0
	OFF HOOK (Ground on tip)	A=1	B=1	C=1	D=1
FXS (RX) FXO (TX) Ground Start	ON HOOK (No tip ground)	A=1	B=X	C=1	D=X
	OFF HOOK (Ground on tip)	A=0	B=1	C=0	D=1
	RINGING	A=0	B=0	C=0	D=0
SLC STAT (TX) SLC OFF (RX) Ground Start	ON HOOK	A=0	B=0		
	Ground on ring	A=0	B=1		
	OFF HOOK (Ground on tip)	A=1	B=0		
	ESF, ESFz				
	ON HOOK	A=0	B=0	C=0	D=0
	Ground on ring	A=0	B=1	C=0	D=1
	OFF HOOK (Ground on tip)	A=1	B=0	C=1	D=0
SLC STAT (RX) SLC OFF (TX) Ground Start	ON HOOK	A=0	B=0		
	OFF HOOK (No tip ground)	A=0	B=0/1		
	RINGING	A=1	B=1/0		
	ESF, ESFz				
	ON HOOK	A=0	B=0	C=0	D=0
	OFF HOOK (No tip ground)	A=0	B=1	C=0	D=0
	RINGING	A=1	B=1	C=1	D=0
FXS (TX) FXO (RX) Loop Start	ON HOOK	A=0	B=1	C=0	D=1
	OFF HOOK	A=1	B=1	C=1	D=1
FXS (RX) FXO (TX) Loop Start	IDLE	A=0	B=1	C=0	D=1
	RINGING	A=0	B=0	C=0	D=0
SLC STAT (TX) SLC OFF (RX) Loop Start	IDLE	A=0	B=0		
	RINGING	A=1	B=0		
	ESF, ESFz				
	ON HOOK	A=0	B=0	C=0	D=0
	OFF HOOK	A=1	B=0	C=1	D=0
SLC STAT (RX) SLC OFF (TX) Loop Start	IDLE	A=1	B=1		
	RINGING	A=1	B=1/0		
	ESF, ESFz				
	IDLE	A=1	B=1	C=1	D=1
	RINGING	A=1	B=1	C=1	D=0

APPENDIX H REMOTE CONTROL COMMANDS

H.1 INTRODUCTION

This appendix contains an alphabetical list of the Mainframe remote control commands. Each command is explained and referenced to associated commands, and an example is given.

For information on how to control the T-BERD 224 from a terminal or computer, refer to Section 7 Remote Control.

H.2 488 ADDRESS

488 ADDress **IEEE-488 Address**

488 ADD?

Displays the current IEEE-488 address for the T-BERD 224. **488 ADDress** sets the T-BERD 224 address for the IEEE-488 controller to use when communicating across the bus. The address selected for the T-BERD 224 must be unique to any other device on the bus. This command is part of the AU 09 488MODE function.

488 ADD <xx>

Sets the IEEE-488 address, where xx = 0 to 30.

488 MODe **IEEE-488 Mode**

488 MOD?

Displays the current status for the IEEE-488 mode. **488 MODe** determines the operating mode for the IEEE-488 Interface. This command is part of the AUX 09 488MODE function.

488 MOD TALk

Configures the IEEE-488 Interface to the Talk Only mode.

488 MOD ADDress

Configures the IEEE-488 interface to the addressable mode. In the addressable mode,the T-BERD 224 can both receive commands and return information across the bus.

NOTE

This command is not available from the IEEE-488 remote control.

488 SRQ **IEEE-488 SRQ**

488 SRQ?

Displays the current status for the IEEE-488 SRQ. Sets the IEEE-488 SRQ. This command is part of the AUX 09 488MODE function.

488 SRQ ON

Allows the T-BERD 224 to generate a SRQ when it has data to transmit and asserts Bit 7 dav and Bit 6 rsv of the serial poll status byte.

488 SRQ OFF

A SRQ is not asserted when data is ready to be transmitted, but Bit 7 dav is still asserted.

H.3 ALARMS

ALArms — **Alarms Message Prints**

ALA?

Print the status of the alarms message. **ALArm** enables or disables alarms message prints. When the **PRInt EVEnt** command is OFF, the **ALArms ON** command has no effect because no printouts are enabled.

ALA ON

Alarms messages are printed.

ALA OFF

Disables the alarms messages, preventing alarms and status messages from being printed.

H.4 BACKUP TIMING

BACkup TIMing — **Backup Timing**

BAC TIM ?

Displays the status of the backup timing forLINE 1 and LINE 2. **BACkup TIMing** sets or returns the current backup timing source for the selected line. The backup timing source is used when the clock for the selected line is not recoverable. This command is part of the AUX 06 BACK TM function.

BAC TIM L1 BNC

Set the backup timing for LINE 1 to external BNC CLOCK.

BAC TIM L1 INTernal

Set the backup timing for LINE 1 to INTERNAL.

BAC TIM L1 RECovered

Set the backup timing for LINE 1 to recover the clock fro LINE 2.

BAC TIM L2 BNC

Set the backup timing for LINE 2 to external BNC CLOCK.

BAC TIM L2 INTernal

Set the backup timing for LINE 2 to internal.

BAC TIM L2 RECovered

Set the backup timing for LINE 2 to recover the clock fro LINE 1.

CLEAR FIFO **Clear the Print FIFO**

CLEAR FIFO command clears the print FIFO of all printouts that are waiting to be printed. This command i part of the AUX 01 CL FIFO function.

CLOck **Clock Time**

NOTE

If hours, minutes, and/or seconds are not entered, they are assumed to be "00."

CLO?
Display the clock time (time of day). **CLOck** sets or returns the clock time. The time is entered in 24-hour format. The command is part of the AUX 04 TIME/DAY function.

CLO hh:mm:ss
Set the clock time. The symbol ":" may be replaced by a dah (-), comma (,), period (.), semicolon (;), or slash (/).

CLS **Clear the Terminal Screen**

CLS enables you to output 30 of the selected line terminator sequences (usually CRLF for terminals) to your terminal. This has the effect of clearing the terminal screen of all previous outputs. This command is not available from the IEEE-488 port.

CODe **Select Code Type**

COD?
Display the current status of the **CODE** switch. **CODe** selects or returns the current code type used by the T-BERD 224 when transmitting a T1 signal.

COD AMI
AMI coding is enabled.

COD B8Zs
B8ZS coding is enabled. Note that received B8ZS sequences are always decoded.

COD L1 AMI
Set Line 1 coding to AMI.

COD L1 B8Z
Set Line 1 coding to B8ZS.

COD L2 AMI
Set Line 2 coding to AMI.

COD L2 B8Z
Set Line 2 coding to B8ZS.

COMputer — **Configure the T-BERD 224 for Remote Control Operation**

COMputer configures the T-BERD 224 for computer remote control operation by automatically setting the following:

ECHO OFF — Turns echo off.
PROmpt OFF — Turn command prompts off.
PRI TERm CR — Line terminator set to carriage return and linefeed.
HOLD — Holds printouts.

This command is typically used when responses to queries are desired to be terminated. While in the computer mode, the next command aborts the output of any other command (e.g., LEDS) that have not yet finished. This command is the default for IEEE-488 operation.

CONtrols — **Controls Printout**

CONtrols displays the current status of the T-BERD 224 switches and auxiliary functions. This allows you to initiate a printout of all current T-BERD 224 switch and auxiliary function settings. This command is functionally identical to pressing the CONTROLS position of the **PRINT** switch on theT-BERD 224s front panel. The effect of this command is identical to issuing the **PRInt CONtrols** remote control command.

CUStom — **Custom Results**

CUS?

Displays the status of all of the test results. **CUStom** selects specific test results and Alarm LED conditions available for display and includes them in a results printout. ALL of the results may be selected, NONE of the results may be selected, or specific results may be **ENAbled** or **DISabled**. This command is part of the AUX 35 CUSTOM function.

CUSSTAtus <result>

Displays the status of a selected test results.

CUS <category> ALL

All of the results in the selected category are displayed, included in a results printout, and returned by remote control.

CUS <category> NONE

None of the results in the selected category are displayed, included in a results printout, or returned by remote control.

CUS <category> SELect

The results of the selected category can be disabled or enabled to determine if they are displayed or included in a results printout.

CUS ENAble <result name>

The selected result is available in the display and is included in a results printout.

CUS DISable <result name>

The selected result is not available for display and is not included in a results printout.

Valid entries for **<category>** include:

LOGic	**BPV** & frame
SIGnal	**CHA**nnel
ALArms	**TIMe**
FRAme	

Valid entries **<result names>** for the selected category include the following. **n** = **1** (LINE1) or **2** (LINE 2). The result names from a results printout may also be used for the **<result names>**.

LOGIC

ASY ESn	(Asynchronous Errored Seconds)
%AVLBLn	(%Availability)
BERn	(Bit Error Rate)
BIT ERn	(Bit Errors)
CSESn	(Consecutive Severely Errored Sec)
DEG MNn	(Degrades Minutes)
%DE MNn	(%Degrades Minutes)
EFSn	(Error Free Seconds)
% EFSn	(%Error Free Seconds)
OOS SEn	(Out Of Sync Seconds)
PAT SLn	(Pattern Slips
SESn	(Severely Errored Seconds)
%SESn	(%Severely Errored Seconds)
SYN ESn	(Synchronous Errored Seconds)
UNAK Sn	(Unavailable Seconds)

BPV & FRAME

BPVn	(BPVs)
BPV SECn	(BPV Seconds)
BPV RTn	(BPV Rate)
CRC ERRn	(CRC Errors)
CRC ERTn	(CRC Error Rate)
CRC E Sn	(CRC Errored Seconds)
CRC SESn	(CRC Severely Errored Seconds)
F BPV Sn	(Far BPV Seconds)
F CRC En	(Far CRC Errors)
F F ESn	(Far Frame Error Event Seconds
F F SESn	(Far Frame Severely Errored Sec)
F SLP Sn	(Far Slip Seconds)
FRM E Sn	(Frame Error Seconds)
FRM ERRn	(Frame Errors)
FRM L Sn	(Frame Loss Seconds)
FRM LOSn	(Frame Losses)
FRM SESn	(Frame Severely Errored Seconds)
FRM ERTn	(Frame Error Rate)
HI CRCn	(Far High CRC Errors)
LO CRCn	(Far Low CRC Errors)
MD CRCn	(Far Medium CRC Errors)
MH CRCn	(Far Medium High CRC Errors)
PAY SRCn	(Far Pay Source)
PRM TIMn	(Far PRM Time)
SI CRCn	(Single CRC Errors)
SV CRCn	(Far Severe CRC)

SIGNAL

ALRM LENn	(SLC Alarm Field Format)
DELAYn	(Roundtrip Delay)
RCV DBMn	(Receive Level dBm
RCV DBXn	(Receive Level dBdsx)
RCV FREn	(Receive Frequency)
RCV VPPn	(Receive Vp-p)
SLI SECn	(Timing Slip Seconds)
SPX CRn	(Simplex Current)
TIM SLIn	(Timing Slips)
TRAF ESFn	(Traffic Bits for ESF, ESFz)
TRAFFIC	(A/B Traffic Bits for Display and Results Print)

CHANNEL

C MSGn	(C-Message Noise)
C NCHn	(C-Message Notch Noise)
DC OFFn	(DC Offset)
DDS F En	(DDS Frame Error)
DIG LVL1	(Lower DTMF/MF Tone Frequency and Level)
DIG LVL2	(Upper DTMF/MF Tone Frequency and Level)
ERLn	(Echo Return Loss)
%IN SRVn	(%In Service Bits)
3K FLAn	(3 kHz Flat Noise)
3K NCHn	(3 kHz Notch Noise)
PARn	(Peak To Average Ratio)
PAR LEVn	(Peak To Average Ratio Level)
RCV BYTn	(Receive Byte)
RCV CODn	(Receive Code)
SIG ADDR	(Signal Address)
SIG DEL	(Signal Delay)
SIG DUR	(Signal Duration)
S/Nn	(Signal To Noise)
SRL HIn	(Singing Return Loss High)
SRL LOn	(Singing Return Loss Low)
% UTILn	(% of MSU Utilization)
VF FREn	(VF Frequency)
VF LEVn	(VF Level)

ALARMS (Printer and Remote)

AIS OFF	(Alarm Indication Signal)
AIS ON	(Alarm Indication Signal)
B8ZS DET	(Bipolar 8 Zero Substitution Detected)
1'S DENS	(Ones Density)
EX Z OFF	(Excess Zero Off)
EX Z ON	(Excess Zero On)
NOT B8ZS	(Not Bipolar 8 Zero Substitution)
YEL OFF	(Yellow Alarm Off)
YEL ON	(Yellow Alarm On)

TIME

ALA SECn	(Alarmed Seconds)
DATE	(Calendar Date)
ELA TIMn	(Elapsed Time)

SG LS Sn	(Signal Loss Seconds)
SLC ASn	(SLC Alarm Seconds)
TES END	(Test Ends)
TES LEN	(Test Length)
TIM	(Clock Time)

See also: **PRInt, RESult 1 and 2,** and **RESULTS**

H.6 DATE

DATe **Calendar Date**

DAT?

Display the date. **DATe** determines set the calendar date. This command is part of the AUX 04 TIME/DATE function.

DAT MMM-DD

Sets the calendar date, where MMM (JAN to DEC) is the month and DD (1 to 31) is the day. An invalid date settings generates the error message *ERROR: Parameter is out of range*. The dash (-) symbol may be replaced by a slash (/), period (.), comma (,), or space.

DDIal **Delay Dial**

DDI?

Displays the status of the delay dial. Defines the parameters of the delay dial supervision event that is output during receive sequence transactions. This command is similar to the AUX 28 SPV DEF function.

DDI DELay <xx>

Set the length of time for a delay dial. Valid range for **<xx>**is between 30 ms to 990 ms in 10 ms intervals and 1.0 to 16 seconds in 0.1 second intervals. Enter time in seconds as xx.x.

DDI DURation <xx>

Set the length of the duration of the delay dial. Valid range for **<xx>** is between 30 ms to 990 ms in 10 ms intervals and 1.0 to 16 seconds in 0.1 second intervals. Enter time in seconds as xx.x.

DDS ANAlysis **DDS Channel Analysis**

DDS ANA?

Displays the current DDS channel being analyzed. **DDS ANAlysis** enables the T-BERD 224 to analyze either the DDS secondary or primary channel. This command is part of setting the DDS analysis channel with the AUX 19 DDS CHN, ANALYZE, function.

DDS ANA PRImary

Selects the DDS PRImary channel to be analyzed.

DDS ANA SECondary

Selects the DDS SECondary channel to be analyzed.

NOTE

If the DDS primary channel is being analyzed, the test pattern is selected with the **SOUrce 1** command. If the DDS secondary channel is being analyzed, the test pattern is selected with the **DDS SECondary** command.

See also: **DDS SECondarypat** and **DDS TRAnsmit**

DDS SECondarypat — **Select DDS Secondary Channel Pattern**

DDS SEC?

Displays the current DDS secondary channel test pattern. **DDS SECondarypat** selects the DDS secondary channel test pattern. This command is part of setting the DDS secondary channel test pattern with the AUX 19 DDS CHN, SECCH PAT, function.

DDS SEC 511

Selects the 511 test pattern to be transmitted on the DDS secondary channel.

DDS SEC 2047

Selects the 2047 test pattern to be transmitted on the DDS secondary channel.

See also: **DDS ANAlysis** and **DDS TRAnsmit**

DDS TRAnsmit — **Select Transmitted DDS Channel**

DDS TRA?

Displays the currently transmitted DDS channel. **DDS TRAnsmit** enables the T-BERD 224 to analyze either the DDS secondary or primary channel. This command is part of setting the DDS transmit channel with the AUX 19 DDS CHN, TRANSMIT, function.

DDS TRA PRImary

Selects the DDS primary channel to be transmitted.

DDS TRA SECondary

Selects the DDS secondary channel to be transmitted.

DDS TRA BOTh

Selects both DDS channels to be transmitted.

See also: **DDS ANAlysis** and **DDS SECondarypat**

DEVICE CLEAR — **Reinitialize Device**

DEVICE CLEAR clears the T-BERD 224 by executing the power-up procedure. The entire instrument is reinitialized - hardware and RAM. NOVRAM is not cleared. Executing this command causes a test restart.

NOTE

When specified, this command returns control of the T-BERD 224 to the front-panel of the instrument. Remote control mode must be reestablished.

DIAl SEQuence DEFine **Dial Sequence Definition**

DIA SEQ DEF <##>?

Display the digit sequences for the selected dial sequence. The sequence number **<##>** ranges from 1 to 10. **DIAl SEQuence DEFine** allows the user to program and store up to ten different digit sequences. The digit sequence is transmitted when the T-BERD 224 is configured for Signaling or SWI-56 testing and the Source Configuration I is set to DIAL SEQ. This command is part of the AUX 26 DIAL SEQ.

DIA SEQ DEF <##> <digits>

Program and store up to ten different digit sequences. The sequence number **<##>** ranges from 1 to 10. The sequence digits **<digits>** can consist of up to 80 characters. Valid characters include:

0 to 9	^D	H	ST
*	^H	O	STP
#	^O	P	ST2P
A	^W	R	ST3P
B	{DTMF}	KP	{DP}
C	{MF}		
D			

NOTE

^ indicates lowercase, which represents terminating events.

Programming Notes

Program the address type of a number preceding the number with the appropriate address type: **{DP}**, **{DTMF}**, or **{MF}**. If the number is not preceded by an address type the address type DTMF is assigned to that number

A, **B**, **C**, **D**, **#**, and ***** will be ignored if they appear with a DP or MF address type.

If any of the following characters, A,B,C,D,#, and *, appear in a DP or MF dialing sequence, the entire sequence is rejected.

DIAl SEQuence DEFine defines **KP**, **ST**, **STP**, **ST2P**, and **ST3P** as only one character each with regard to the 80 character sequence length limit. They must be defined as {MF} to be valid.

Brackets **{ }** and the characters inside them will not be counted in the 80 character sequence length limit.

DIGit **Digit**

DIG?

Display all of the current settings of the dial sequence digits. **DIGit** defines the characteristics of the transmitted DTMF, MF, and DP digits for the dial sequence transactions. These commands are identical to setting the AUX 25 DIG MAR function.

DIG %BReak?

Display the current setting of **%BReak.**

DIG %BReak <xx>

Set the % make/break value. Valid range for **<xx>** is between 40 to 68%.

DIG DURation?

Display the current setting of **DURation.**

DIG DURation <xx>

Set the length of the duration for MF/DTMF digit ON time. Valid range for **<xx>** is between 13 to 250ms.

DIG INT DURation?

Display the current setting of **INT DURation.**

DIG INT DURation <xx>

Set the length of the duration for MF/DTMF digit OFF time. Valid range for **<xx>** is between 13 and 250ms.

DIG PPS?

Display the current setting of **PPS.**

DIG PPS <xx>

Set the value for pulse per second. Valid range for **<xx>** is between 7 and 21.

DISplay — **Front-Panel Display Mode**

DIS?

View current mode of display control. **DISplay** determines if the **RESULTS I** and **RESULTS II Blank** and **Arrowed** switches are active when the T-BERD 224 is under remote control. Note that all other switches are always inactive while in remote control.

DIS LOCAL

Activates the **RESULT** switches.

DIS REMOTE

Disables the **RESULT** switches.

DISplay HOLd — **Freeze the Results Displays**

DIS HOL?

Display the current status of **DISPLAY HOLD** switch. **DISplay HOLd** controls the front panel results displays. This command is identical in function to the **DISPLAY HOLD** switch on the front panel ofthe T-BERD 224.

DIS HOL ON

Freezes the results displays. Note that when **DIS HOL ON** is enabled during a test, the T-BERD 224 continues to accumulate test results.

DIS HOL OFF

Disables the display hold function.

DROp **Drop Channel**

DRO?

Display the status of the **DROP CHANNEL** switch. **DROp** returns or selects from which T1 signal a channel(s) is to be dropped for testing. Modifying this command causes a test restart.

DRO L1

Selects LINE 1 as the source from which the data is dropped.

DRO L2

Selects LINE 2 as the source from which the data is dropped.

DRO BOTh

Selects LINE 1 and LINE 2 as the source from which the data is dropped.

DS0 ERRor CORrection **DS0A Error Correction**

DS0 ERR COR?

Displays the current status of the DS0A error correction. **DS0 ERRor CORrection** determines if majority-rule error correction is performed on the subrate DS0A data. This command is part of AUX 12 ERR COR.

DS0 ERR COR ON

Causes access to data verified using majority-rule error correction.

DS0 ERR COR OFF

Disables majority-rule error correction.

DS0 INTerface TIMing **DS0 Interface Timing**

DS0 INT TIM?

Display the status of the DS0 interface timing. **DS0 INTerface TIMing** controls the selection of the DS0 interface transmit and receive clocks. This command is part of the AUX 07 DS0 TM function. Modifying this command causes a test restart if the **CHANNEL FORMAT** switch is set to DS0.

DS0 INT TIM SEParate

Selects separate clocks for drop and insert.

DS0 INT TIM COMmon

Selects a single clock for both drop and insert.

DSU ANAlysis CHAnnel **DDS Channel Analysis**

DSU ANA CHA?

Displays the current DSU analysis channel.**DSU ANAlysis CHAnnel** selects or returns the current DD channel analyzed for performance results. Modifying this command causes a test restart if the **CHANNEL FORMAT** switch is set to a DS0A or DS0B rate. This command is identical to the AUX II ANL CHA function.

DSU ANA CHA PRImary

Selects the primary DS0A or DS0B channel for analysis. Set bit 8 with the **DSUDp Bit8** command.

DSU ANA CHA SECondary

Selects the secondary DS0A or DS0B channel for analysis.

NOTE

If the DDS primary channel is being analyzed, the test pattern is selected with the **SOUrce 1** command. If the DDS secondary channel is being analyzed, the test pattern is selected with the **DDS SECondary** command.

See also: **DSUDp Bit8**

DSUDp Bit8 **DSU-DP Primary Channel Bit 8 Setting**

DSUD B ?

Displays the current DDS primary channel bit 8 setting. **DSUDp Bit8** sets the DSU-DP primary channel. This command sets bit 8 when the DSU ANAlysis CHAnnel command is set to PRImary. This command is identical to the AUX 11 ANL CHA, PRIMARY CTRL BIT function.

DSUD B Thru

Select to allow bit 8 to pass through the T-BERD 224 unaffected.

DSUD B Rts Insert

Select to insert bit 8 with RTS.

See also: **DSU ANAlysis CHAnnel**

H.7 ECHO

ECHo **Echo Mode**

ECHo ?

Displays the echo status. **ECHo** determines whether characters entered form the remote control unit are displayed.

ECHo ON

Enables all characters entered from the remote control unit to be displayed.

ECHo OFF

Inhibits the printing of characters entered from the remote control unit. ECHO is not available from the IEEE-488 port.

ERRor INSert BPV **Initiate BPV Error Insertion**

ERR INS BPV?

Displays current BPV error insertion status. **ERRor INSert BPV** controls the insertion of BPVs into the data stream. This command is identical to pressing the **BPV ERROR INSERT** switch. The command cannot be set when the **INSert** command is set to **NONe**.

ERR INS BPV RATe

Inserts continuous BPVs into the data stream. The error rate is controlled through the **ERRor RATe** command.

ERR INS BPV BURst

Inserts a single burst of BPVs. The burst error rate and burst length are controlled through the **ERRor RATe** and **BURst LENgth** commands.

ERR INS BPV SINgle

Inserts a single BPV. It can also turn off continuous error insertion.

ERR INS BPV OFF

Stops continuous BPV error insertion.

See also: **ERRor RATe and BURst LENgth**

ERRor INSert FRAme **Initiate Consecutive Frame Error Insertion**

ERR INS FRA?

Displays current consecutive frame error insertion status. **ERRor INSert FRAme** controls the insertion of consecutive frame errors into the framing bits of the data stream. This command is identical to pressing the **FRAME ERROR INSERT** switch. The command cannot be set when the **INSer** command is set to **NONe**.

ERR INS FRA CONtinuous

Inserts continuous single or multiple consecutive frame errors (2 to 6) into the framing bits. The number of frame errors is controlled through the **FRM ERRor LENgth** command.

ERR INS FRA SINgle

Inserts a single frame error into the framing bits. It can also turn off continuous error insertion.

ERR INS FRA OFF

Stops continuous frame error insertion.

See also: **FRM ERRor LENgth**

ERRor INSert LOGic — **Initiate Logic Error Insertion**

ERR INS LOG?

Displays current logic error insertion status. **ERRor INSert LOGic** controls the insertion of logic errors into the data stream. This command is identical to pressing the **LOGIC ERROR INSERT** switch. The command cannot be set when the **INSert** command is set to **NONe.**

ERR INS LOGRATe

Inserts continuous logic errors into the data stream. The error rate is controlled through the **ERRor RATe** command.

ERR INS LOG BURst

Inserts a single burst of logic errors. The burst error rate and burst length are controlled through the **ERRor RATe** and **BURst LENgth** commands.

ERR INS LOG SINgle

Inserts a single logic error. It can also turn off continuous error insertion.

ERR INS LOG OFF

Stops continuous logic error insertion.

See also: **ERRor RATe** and **BURst LENgth**

ERRor INSert YELlow — **Yellow Alarm Insertion**

ERR INS YEL?

Displays current yellow alarm insertion status. **ERRor INSert YELlow** controls the insertion of a continuous yellow alarm into the data stream. This command is identical to pressing the **YELLOW INSERT** switch. The command cannot be set when the **INSer** command is set to **NONe**.

ERR INS YEL ON

Inserts continuous yellow alarms into the data stream.

ERR INS YEL OFF

Stops continuous yellow alarm into the data stream.

ERRor NUMber — **Error Number**

ERRor NUMber? prints the code number of the most recent remote control command error. Refer to Section C for the list of error message numbers and explanations.

ERRor RATe — **Set BPV and Logic Error Insertion Rate**

ERRRAT?

Displays current BPV and logic error insertion rate. **ERRor RATe** controls the burst and continuous BPV and logic error insertion rates. This command is part of setting the error rate with the AUX 13 ERR RT, ERROR RATE, function. The maximum error rate can be set to 1.0 E-2 and the minimum error rate can be set to 1.0 E-9.

ERRRAT <X.X,Y>

Sets new BPV and logic error insertion rate **<X.X,Y>**. The **X.X,Y** format represents the valid error rates from 1.0 E-2 to 1.0 E-9. **X.X** equals the whole number (1.0 to 9.9) and **Y** equals the negative exponent (2 to 9). For example, 3.0,6 equals 3.0 E-6.

See also: **ERRor INSert BPV** and **ERRor INSert LOGic**

H.8 FAR END LOOP

FAR END LOOp — **Far-End Loopback Status**

FAR END LOO ?

Displays the status of the shelf and protection line far-end loopbacks. **FAR END LOOP** command reports the status of the shelf and protection line far-end loopbacks of the selected line.

FAR END LOO L1?

Displays the status of the shelf and protection line far-end loopbacks for Line 1.

FAR END LOO L2?

Displays the status of the shelf and protection line far-end loopbacks for Line 2.

Possible status reports include:

SHELF A, B, C, or D — Shelf A, B, C, or D is in far-end loop.

PROTECTION — The protection line is in far-end loop.

UNAVAIL — The datalink is not being received, e.g., frame synchronization is not established or the line receiver is not connected to the span.

N/A — Command is not applicable to current configuration.

NONE — None of the DS1 lines is looped back.

See also: See also: **CHAnnel FORmat, PRInt, RESult 1/2, SIGnal INSert, SLC ALArm, SLC MAINTenance, SOUrce 1,** and **SOUrce 2**

FIRST Power Up — **First Power-Up**

FIRST Power Up reloads factory settings into non-volatile memory (NOVRAM) locations and executes the power-up procedure. The instrument is reinitialized - hardware, RAM, and NOVRAM. Executing this command causes a test restart.

NOTE

The unit is no longer in remote control mode after executing this command.

FREquency SWEep **Set VF Frequency Sweep**

FRE SWE ?

Display the current frequency sweep parameters. **FREquency SWEep** sets the frequency sweep parameters. This command is identical in function to the AUX 21 SWEEP function.

NOTE

Enter a **?** in place of the <parameter> in the following commands to display the current parameter.

FRE SWE STArt FREquency <parameter>

Set the start frequencies for the frequency band to be monitored in a sweep. The valid parameter for START range from 20 Hz to 3904 Hz.

FRE SWE STOp FREquency <parameter>

Set the VF Frequency Sweep STOP frequency to the <parameter> value. The valid parameters for STOP range from 20 Hz to 3904 Hz.

FRE SWE STEp INTerval <parameter>

Set the time interval spent at each frequency during a sweep to the <parameter> value. The valid parameters for STEP-INTVL range from 1.5 seconds to 9.9 seconds.

FRE SWE STEp SIZe <parameter>

Set the step size between each frequency during a sweep to the <parameter> value. The valid parameters for STEP-SIZE range from 10 Hz to 1000 Hz.

FRE SWE SKIp HIGh <parameter>

Set the high end of the skip frequency during a sweep to the <parameter> value. The valid parameters for SKIP-HI range from 20 Hz to 3904 Hz.

FRE SWE SKip LOW <parameter>

Set the low end of the skip frequency during a sweep to the <parameter> value. The valid parameters for SKIP-LO range from 20 Hz to 3904 Hz.

NOTE

A restart must be performed to activate NEW FRE SWE parameters.

FRM ERRor LENgth **Set Consecutive Frame Error Length**

FRM ERR LEN?

Displays current number of consecutive frame errors being inserted. **FRM ERRor LENgth** controls the number of framing bits that are consecutively errored in the framing pattern. This command is identical to setting the frame errors with the AUX 14 FRM ERR function.

FRM ERR LEN <x>

Sets the number of consecutive framing bits to be errored in the framing pattern. <x> can be set from 1 to 6.

See also: See also: **ERRor INSert FRAme**

H.9 GTL

GTL **IEEE-488 Go To Local**

GTL

Enter local mode from remote control. **GTL** (**Go To Local**) is an IEEE-488 bus command that returns the T-BERD 224 to Local mode from remote control. In Local mode, all of the T-BERD 224 front-panel switches are active. The T-BERD 224 remains in Local mode until the user-specifies any valid remote control command.

See also: See also: **488 ADD, 488 MOD, 488 SRQ,** and **LOCAl**

H.10 HELLO

HELLO **Display the T-BERD 224 Software Revision Level**

HELLO? displays the T-BERD 224 hardware and software revision levels and any options that are included in the instrument as well as any self-test errors, such as *NOVRAM LOST.*

HELP **On-Line Help Function**

HELP offers summary on-line help information and provides access to the T-BERD 224s on-line help facility. **HELP** or **HELP 1** provides an index to the various types of help information. **HELP** l lists all validT-BERD 224 remote control commands. **HELP <number>** displays a specific page of help information. **HELP <command-name>** defines and displays the command syntax for any specified remote control command. The following conventions apply:

1. Command parameters are presented in a single column.
2. Command and parameter summaries are preceded by three dashes (- - -).
3. Command parameters are presented as upper case character strings with optional characters in lower case characters.

The following help commands are available to view specific groupings of remote commands.

HELP 1	:Displays an index to all help information.
HELP 2	:Displays help information for special characters.
HELP 3	:Displays help information for printer commands.
HELP 4	:Displays help information for control commands.
HELP 5	:Displays help information for auxiliary function commands.
HELP 6	:Displays help information for remote only commands.
HELP 7|8	:Displays help information for switches.
HELP 9	:Displays help information for VF Option auxiliary functions.
HELP 10	:Displays help information for BERT Option auxiliary functions.
HELP 11	:Displays help information for DDS Option auxiliary functions.
HELP 14	:Displays help information for Signaling Option auxiliary functions.
HELP 15	:Displays help information for Caller ID Option auxiliary functions.

HELP 16	:Displays help information for Smart Loopback/Command Codes Option auxiliary functions.
HELP!	:Displays a list of all valid commands.

HIStory RESet — **Reset Alarm History LED Indicators**

HIStory RESet clears all alarm history LED indicators for both lines.

HOLd — **Hold All Printer Outputs**

HOLd temporarily holds printer outputs (in the print buffer) until a **RELease** command is specified. Note that while the **HOLd** command is enabled, the prompt character changes from the standard (>) or user-specified prompt to a (+) to indicate that the printer output is being held. Printouts held include result printouts, control printouts, alarm messages, and status messages. However, responses to queries are returned as before.

See also: **RELease**

H.11 INSERT

INSer — **Insert**

INS?
Displays the status of the INSERT switch. **INSer** requests the line on which T1 signal data and errors are inserted.

INS L1
Selects LINE 1 for channel insertion.

INS L2
Selects LINE 2 for channel insertion.

INS NONe
Selects neither line for channel insertion.

H.12 L1 CHANNEL

L1 CHAnnel — **LINE 1 Channel Selection**

L1 CHA?
Display the selected channel. **L1 CHAnnel** selects or returns LINE 1 channel to be monitored or tested. Modifying this command causes a test restart.

L1 CHA nn

Selects the channel number (where nn is the channel number 1 - 24) for testing and analysis.

L1 CHA ALL

Selects the all channels for testing and analysis.

NOTE

Valid channel selections are determined by the current setup. This command is valid in the VF and DS0 channel formats.

L2 CHAnnel — LINE 2 Channel Selection

L2 CHA ?

Display the selected channel. **L2 CHAnnel** selects or returns LINE 2s channel to be monitored or tested. Modifying this command causes a test restart.

L2 CHA nn

Selects the channel number (where nn is the channel number 1 - 24) for testing and analysis.

L2 CHA ALL

Selects all channels for testing and analysis.

NOTE

Valid channel selections are determined by the current setup. This command is valid in the VF and DS0 channel formats.

L1 LBO — LINE 1 Line Build-Out

L1 LBO?

Displays the status of the line build-out for LINE 1.**L1 LBO** controls the current transmit output setting for LINE 1, allows the user to select emulation of three different cable losses for T1 rates. This command is identical to the AUX 05 LBO function.

L1 LBO [0 | -7.5 | -15]

Selectable line build-out includes 0, -7.5, and -15.

L2 LBO — LINE 2 Line Build-Out

L2 LBO?

Displays the status of the line build-out for LINE 2.**L2 LBO** controls the current transmit output setting for LINE 2. This command is identical to the AUX 05 LBO function.

L2 LBO [0 | -7.5 | -15]

Selects LINE 2 build-out setting. Selectable line build-out includes 0, -7.5, and -15.

L1 RECeive INPut — LINE 1 Receive Input Termination

L1 REC INP ?

Display the status of the current receive input termination fo r LINE1. **L1 RECeive INPut** selects input impedance and signal conditioning for the LINE 1 RECEIVE connector. Modifying this command causes a test restart.

L1 REC INP BRIdge

Sets the LINE 1 RECEIVE connector to bridge.

L1 REC INP TERminate

Sets the LINE 1 RECEIVE connector to terminate.

L1 REC INP DSX

Sets the LINE 1 RECEIVE connector to DSX-monitor.

L2 RECeive INPut — LINE 2 Receive Input Termination

L2 REC INP ?

Display the status of the current receive input termination for LINE 2. **L2 RECeive INPut** selects input impedance and signal conditioning. Modifying this command causes a test restart.

L2 REC INP BRIdge

Sets the LINE 2 RECEIVE connector to bridge.

L2 REC INP TERminate

Sets the LINE 2 RECEIVE connector to terminate.

L2 REC INP DSX

Sets the LINE 2 RECEIVE connector to DSX-monitor.

L1 RECeive SIGnal — LINE 1 Receive Signal Status

L1 RECeive SIGnal? displays the logical state of the signaling bits on the channel received on LINE 1. The signaling bits are returned in the format XXXX which corresponds to ABCD; where X = 1, the logic state is active (ON) and where X = 0, the logic state is inactive (OFF).

NOTE

For this response to be returned, the selected CHANNEL FORMAT must be set to VF or VF THRU. The number of signaling bits is determined by the current MODE setting. The ABCD signaling status LEDs correspond to the indicators located below the associated line.

L2 RECeive SIGnal — LINE 2 Receive Signal Status

L2 RECeive SIGnal? displays the logical state of the signaling bits received on the selected channel received on LINE 2. The signaling bits are returned in the format XXXX which corresponds to ABCD; where X = 1, the logic state is active (ON) and where X = 0, the logic state is inactive (OFF).

NOTE

For this response to be returned, the selected CHANNEL FORMAT must be set to VF or VF THRU. The number of signaling bits is determined by the current MODE setting. The ABCD signaling status LEDs correspond to the indicators located below the associated line.

LED — LED Status

LED?

Display the state of the T-BERD 224s alarm and status LED indicators. When specified, this command displays the LED indicators as they appear on the front panel.

LED L1 ?

Display the state of the T-BERD 224s alarm and status LED indicators on Line 1. When specified, this command displays the LED indicators as they appear on the front panel.

LED L2 ?

Display the state of the T-BERD 224s alarm and status LED indicators on Line 2. When specified, this command displays the LED indicators as they appear on the front panel.

LOCAl — Return the TBERD 224 to Local Mode

LOCAl

Enter Local (front panel) mode. **LOCAl** returns the T-BERD 224 to Local mode from remote control. In Local mode, all of the T-BERD 224 front-panel switches are active. The T-BERD 224 remains in Local mode until the user specifies any valid remote control command from the remote control unit.

/

Alternate form of the LOCAl command.

See also: **DiSplay, REMote, TERminal, COMputer,** and **GTL**

LOOp CODe — Set Loop Code Type and Pattern

LOO COD?

Display current T1 loop code type (T1, DDS alternating, and DDS latching) and selection.**LOOp CODe** sets the loop-up and loop-down codes that are transmitted when either **LOOp Up ON** or **LOOp Down ON** commands are initiated. The T-BERD 224 can also respond to a selected T1 loop code when the **RESPonse AUTo** command is initiated. This command is identical to setting the loop code type and equipment selections with the AUX 17 LOOP CD function. The loop code configuration are described below:

DDS Alternating

LOO COD DDS_A CHAN+1R	:Selects DDS alternating CHANNEL loop code with one repeater.
LOO COD DDS_A CHAN+2R	:Selects DDS alternating CHANNEL loop code with two repeaters.
LOO COD DDS_A 1ST RPTR	:Selects DDS alternating first repeater loop code.
LOO COD DDS_A 2ND RPT	:Selects DDS alternating second repeater loop code.
LOO COD DDS_A CHANN	:Selects DDS alternating CHANNEL loop code.
LOO COD DDS_A DSU	:Selects DDS alternating DSU loop code.
LOO COD DDS_A HL96	:Selects DDS alternating HL96NY loop code.
LOO COD DDS_A OCU	:Selects DDS alternating OCU loop code.
LOO COD DDS_A OCU+	:Selects DDS alternating OCU loop code with HL96NY.

DDS Latching

LOO COD DDS_L CHA	:Selects DDS latching channel loop code.
LOO COD DDS_L DS0-DP [x]	:Selects DDS latching DS0-DP loop code and location. **[x]** equals 1 to 8.
LOO COD DDS_L LSI	:Selects DDS latching LSI loop code.
LOO COD DDS_L OCU	:Selects DDS latching OCU loop code.
LOO COD DDS_L DSU	:Selects DDS latching DSU loop code.
LOO COD DDS_L MJU	:Selects DDS latching MJU loop code.
LOO COD DDS_L NEI/RPTR	:Selects DDS latching NEI loop code.
LOO COD DDS_L V.54	:Selects DDS latching fractional T1 V.54 loop code.

T1

LOO COD T1 CSU	:Selects T1 in-band CSU loop code.
LOO COD T1 ESF-LIN	:Selects T1 ESF out-of-band Line loop code.
LOO COD T1 ESF-NET	:Selects T1 ESF out-of-band Network loop code.
LOO COD T1 ESF-PAY	:Selects T1 ESF out-of-band Payload loop code.
LOO COD T1 FAC1	:Selects T1 in-band 4-bit Facility 1 loop code.
LOO COD T1 FAC2	:Selects T1 in-band 5-bit Facility 2 loop code.
LOO COD T1 FAC3	:Selects T1 in-band 6-bit Facility 3 loop code.
LOO COD T1 PRO	:Selects T1 in-band Programmable loop code pattern. The loop-up and loop-down codes are programmed through the **PGM LPU** and **PGM LPD** commands, respectively.

T1 Intelligent Network Equipment

LOO COD ILR	:Selects intelligent line repeater loop code.
LOO COD IOR	:Selects intelligent office repeater loop code.
LOO COD ILRC	:Selects intelligent line repeater loop code commands.
LOO COD IORC	:Selects intelligent office repeater loop code commands.
LOO COD ILRP	:Selects intelligent line repeater programmable command address.
LOO COD IORP	:Selects intelligent office repeater programmable command address.
LOO COD ILRPC	:Selects intelligent line repeater programmable commands.
LOO COD IORPC	:Selects intelligent office repeater programmable commands.
LOO COD DS1MSW	:Selects DS1MS Switch loop code.
LOO COD DS1MSR	:Selects DS1MS Ramp loop code.
LOO COD DS1MSC	:Selects DS1MS Switch loop code commands.

See also: **LOOp Down, LOOp Up, RESPonse, PGM LPUp,** and **PGM LPDn**

LOOp Down — **Transmit Loop-Down Code**

LOO D?

Display current loop-down code transmission status. **LOOp Down** controls the transmission of the selected loop-down code which is selected with the **LOOp CODe** command. The transmission of the loop-down code continues until it is no longer detected at the receiver or until a **LOOp Down OFF** command is issued. This command is identical to pressing the **LOOP DOWN** switch.

LOO D ON

Enables the loop-down code transmission for loopbacks requiring a loop-down code to release the terminal loopback.

LOO D OFF

Disables the loop-down code transmission.

See also: **LOOp CODe, LOOp Up, RESPonse, PGM LPUp,** and **PGM LPDn**

LOOp Up — **Transmit Loop-Up Code**

LOO U ?

Display current loop-up code status transmission. **LOOp Up** controls the transmission of the selected loop-up code which is selected with the **LOOp CODe** command. The transmission of the loop-up code continues until it is detected for 250 ms at the receiver or until a **LOOp Up OFF** command is issued. This command is identical to pressing the **LOOP UP** switch.

LOO U ON

Enables the loop-up code transmission for loopbacks requiring a loop-up code to initiate the terminal loopback.

LOO U OFF

Disables the loop-up code transmission.

See also: See also: **LOOp CODe, LOOp Down, RESPonse, PGM LPUp,** and **PGM LPDn**

H.13 MESSAGE

MESsage — **Enable or Disable Error Message Printing**

MES?

Display current status of error message printing. **MESsage** controls the printing of error messages at your remote control unit.

MES O

Enables the printing of error messages when appropriate conditions exist.

MES OFF

Disables the printing of error messages under such conditions.

See also: **ERR NUM**

MJU BRAnch — MJU Branch

MJU BRAnch?

Display the currently selected MJU branch. **MJU BRAnch** selects the MJU branch for the designated MJU operation. This command is similar to the AUX MJU 30 function.

MJU BRAnch [1 - 4]

Selects an MJU branch for the MJU SELECT operation.

MJU HUB — MJU Hub Id

MJU HUB? display the hub id of the currently selected MJU branch. This command is similar to the AUX MJU 30 function.

MJU OPEration — MJU Operation

MJU OPE ?

Display the current MJU operation. **MJU OPEration** selects the operation to be performed on the selected MJU branch. This command is similar to the AUX MJU 30 function.

MJU OPE BLOck

Blocks the selected branch from transmitting or receiving data.

MJU OPE RELease

Releases all branches to normal operation.

MJU OPE REStore

Deletes the last SELECT/BLOCK or SELECT/UNBLOCK sequence.

MJU OPE SELect

Accesses the selected branch.

MJU OPE UNBlock

Unblocks the selected branch previously blocked.

MJU SENd — MJU Send

MJU SEN?

Display the status of the MJU operation. **MJU SENd** initiates the MJU operation setup with the **MJU OPEration** command. This command is similar to the AUX MJU 30 function. This command is not valid when the **INSERT** switch is set to NONE.

MJU SEN

Initiates the selected MJU operation.

MODe **Transmit and Receive Mode**

MOD ?

Display current mode. **MODe** sets or returns the current transmit and receive line rate and data format. This command is identical in function to the **MODE** switch on the T-BERD 224s front-panel. Modifying this command causes a test restart and may change the current setup.

MOD (mode)

Selects a mode. The selected **(mode)** can be one of the following.

T1	:Unframed T1
T1D1D	:T1 rate with D1D framing
T1D2	:T1 rate with D2 framing
T1D4	:T1 rate with D4 framing
T1ESF	:T1 rate with ESF framing
T1ESFZ	:T1 rate with ESFz framing and ZBTSI (optional)
T1SLC	:T1 rate with SLC-96 framing
T1TLB	:T1 rate in Test Loopback mode
T1LLB	:T1 rate in Line Loopback mode
SLCD1D	:Mode I SLC-96 systems
SLC-M2	:Mode II SLC-96 systems
SMRT	:SMARTNIU mode
AUTO	:Automatic configuration mode

H.14 NON CONTIGUOUS

NON CONtiguous **Non-Contiguous Channel Selection**

NON CON ?

Display current non-contiguous channel selection. **NON CON** allows the user to select which non-contiguous channel numbers are to be tested from each line. The channel numbers range from 1 to 24. The number of channels must be the same for each line and they must be in ascending order. Modifying this command causes a test restart if **SOURCE CONFIGURATION II** switch is set to NON CONTIG. This command is identical to the AUX 10 N-CONTG function.

NON CON L1

Selects the channel numbers (nn) for LINE 1 and LINE 2. Separate channel numbers with commas.

H.15 OFF HOOK

OFF HOOK **Off Hook**

OFF HOOK sends the OFF HOOK signaling status for the A, B, C, and D signaling bits of the selected trunk. The trunk type is defined in the **TRUnk TYPe** command. This command is valid when the T-BERD 224 is configured for SIGNLNG or SWI-56 except when **SOURCE CONFIGURATION I** switch is set MONITOR or SCAN.

ON HOOK **On Hook**

ON HOOK sends the ON HOOK signaling status for the A, B, C, and D signaling bits of the selected trunk. The trunk type is defined in the **TRUnk TYPe** command. This command is valid when the T-BERD 224 is configured for SIGNLNG or SWI-56 except when **SCI** switch is set to MONITOR or SCAN.

H.16 PGM LPDOWN

PGM LPDown **Set Programmable Loop-Down Code**

PGM LPDown?

Display current in-band programmable loop-down code. **PGM LPDown** enables a 3- to 8-bit user programmable in-band loop-down code to be entered. The programmable loop-down code is selected through the **LOOp CODe T1 PROgram** command and transmitted when the **LOOp Down ON** command is initiated. **PGM LPDown** also determines which loop code the T-BERD 224 responds to (see **RESP** command) when the **LOOp CODe T1 PROgram** command is set. This command is identical to setting the in-band programmable loop-down code with the AUX 16 PGM LP, DOWN, function.

PGM LPDown <bb...bb>

Sets in-band programmable loop-down code. <bb...bb> equals 3- to 8-bit binary code. The left-most bit is transmitted first.

See also: **LOOp CODe, LOOp Down, LOOp Up, RESPonse,** and **PGM LPUp**

PGM LPUp **Set Programmable Loop-Up Code**

PGM LPUp?

Display current in-band programmable loop-up code. **PGM LPUp** enables a 3- to 8-bit user programmable in-band loop-up code to be entered. The programmable loop-up code is selected through the **LOOp CODe** command and transmitted when the **LOO Up ON** command is initiated. **PGM LPUp** also determines which loop code the T-BERD 224 responds to (see **RESPonse** command) when the **LOOp CODe T1 PROgram** command is set. This command is identical to setting the in-band programmable loop-up code with the AUX 16 PGM LP, UP, function.

PGM LPUp <bb...bb>

Sets in-band programmable loop-up code. <bb...bb> equals 3- to 8-bit binary code. The left-most bit is transmitted first.

See also: **LOOp CODe, LOOp Down, LOOp Up, RESPonse,** and **PGM LPDn**

PRInt **Initiate Printout**

PRI CONtrols

Initiates a controls printout. **PRInt** enables you to initiate a result or controls print. The **PRInt CONtrols** and **PRInt RESults** commands generate controls and results printouts respectively.

PRI RESults

Initiates a results printout.

PRI <result name>?

Initiates a results printout of the selected <result name>.

NOTE

Refer to the **CUSTOM** command for the list of valid **<result names>**. **n** = **1** (LINE 1) or **2** (LINE 2). The result names from a results printout may also be used for the **<result names>**.

See also: **CONTROLS, RESULTS, and CUSTO**

PRInt EVEnt — Print Event

PRInt EVEnt?

Display the print event setting. **PRInt EVEnt** allows you to determine when (if at all) theT-BERD 224 generates automatic test results prints and alarm/status messages.

PRInt EVEnt <event>

Selects print event. The **<event>** choices are as follows:

OFF	:Halt automatic results prints.
TES END	:Print at end of timed test.
ERR SEC	:Print on the occurrence of BPV, frame error or CRCerror.
TIM H:MM:SS	:Print results at the time interval specified.

Any setting other than **PRInt EVEnt OFF** enables automatic results printouts when one or more alar conditions change. When specifying **TIMe H:MM:SS**, the symbol ":" may be replaced by a dash (-), comma (,), period (.), or slash (/). The valid range for H (hours) is 0-5. The valid range for MM (minutes) is 0-59. The valid range for the optional second SS is 0-45 in 15 second increments. Valid range for hours is 0-6, maximum time allowable is 6:00:00. If the minutes and/or seconds are not entered, they are assumed to be zero.

See also: **TIMe PRInt EVEnt**

PRInt SIGnal — Print Signaling Sequence Results

PRInt SIGnal

Prints the last received signaling sequence when the channel format is configured for either SIGNLNG of SWI-56.

EXAMPLE:

```
>PRI SIG

SIGNALING PRINT  15:18:30  APR21
  Originating Line: 2
  Channel:          21
```

```
H {DTMF} 5551212122 0

EVENT  DEL   DUR  FRQ1  LVL1  FRQ2  LVL2
       ms    ms   Hz    dBm   Hz    dBm
  H    N/A   N/A  N/A   N/A   N/A   N/A
  5    40    68   1336  -7.0  770   -7.2
  5    70    70   1336  -7.1  770   -7.2
  5    70    70   1336  -7.1  770   -7.2
  1    70    70   1209  -7.3  697   -7.2
  2    70    70   1336  -7.2  697   -7.1
  1    70    70   1209  -7.2  697   -7.1
  2    70    70   1336  -7.2  697   -7.2
  2    70    70   1336  -7.2  697   -7.2
  2    1210  70   1336  -7.2  697   -7.2
  0    138   N/A  N/A   N/A   N/A   N/A
```

PRInt SWEep — Set Frequency Printout ON or OFF

PRI SWE ?

Display current status of the Frequency printout function. **PRInt SWEep** sets the status of the Frequency Sweep printout to ON or OFF. The Frequency Sweep printout is generated a frequency vs. is identical to pressing the **SOURCE CONFIGURATION II** switch while in AUX 23 PRT OPT.

PRI SWE ON

Enables the frequency printout.

PRI SWE OFF

Disables the frequency printout.

PRInt SWEep PARameters — List the Frequency Sweep Parameters

PRInt SWEep PARameters?

Displays the current status of the Frequency Sweep parameters and is identical to cycling the **SOURCE CONFIGURATION I** switch through the three parameter screens, ENDPOINT, STEP, and SKIP while in AUX 21 SWEEP.

PRInt TERminator — Printer Terminator

PRInt TERminator?

Display the current printer line terminator. **PRInt TERminator** controls the line termination for a printer or remote control device. This command is identical to the AUX 08 RS 232 function.

PRI TER CR

Each printed line is followed by a carriage return (CR) character.

PRI TER CRLF

Each printed line is followed by a carriage return (CR) and a linefeed (LF) character.

PRI TER LF

Each printed line is followed by a line feed.

PRM TRAnsmit — PRM Transmit Control

PRM TRA ?

Display current PRM transmission capability. **PRM TRAnsmit** determines whether and how PRMs are transmitted. This command is identical to the AUX 20 PRM TX, PRM TRANS function. Set the PRM emulation with the **L1 PRM EMUlation** or **L2 PRM EMUlation** command.

PRM TRA ON

Enables PRM transmission capability.

PRM TRA OFF

Disables PRM transmission capability.

PRM TRA AUTo

Configures automatic PRM transmission capability.

See also: **L1 PRM EMUlation** and **L2 PRM EMUlation**

PROmpt — Remote Control Prompt

PRO ?

Display status of prompt. **PROmpt** controls the prompt symbol at the remote control unit. This command is not valid when using IEEE-488 Remote Control.

PRO ON

Enables the display of a ">" as the prompt symbol when the T-BERD 224 is ready to receive a command.

PRO OFF

Turns off the prompt symbol.

PRO STRING <string>

Allows the user to define a prompt symbol (or prompt string) of 100 characters. This custom prompt i not stored in NOVRAM.

NOTE

The T-BERD 224 changes any current prompt symbol to (+) when the **HOLd** command is specified.

H.17 RECEIVE SEQUENCE DEFINE

RECeive SEQuence DEFine — **Receive Sequence Definition**

REC SEQ DEF <##>?

Display the digit sequences for the selected receive sequence. The sequence number <##> ranges from 1 to 10. **RECeive SEQuence DEFine** allows the user to program and store up to ten different digit sequences. The digit sequence is received when the T-BERD 224 is configured for Signaling or SWI-56 testing and the **SOURCE CONFIGURATION I** switch is set to REC SEQ.

REC SEQ DEF <##> <digits>

Programs and stores up to ten different digit sequences. The sequence number <##> ranges from 1 to 10. The sequence digits <digits> can consist up to 32 character/16 events. Valid characters include:

0 to 9	R
O	^O
H	^H
^W	^D
{DTMF}	{DP}
{AUTO}	{MF}

NOTE

^ indicates lowercase terminating events.

Programming Notes

Program the address type of a number preceding the number with the appropriate address type: **{DP}**, **{DTMF}**, **{MF}**, or **{AUTO}**. If the number is not preceded by an address type the address type AUTO is assigned to that number. Address type is maintained until another type is detected.

Numbers greater than 99 are rounded down to 99. The digits (0-9) are entered in pairs. A space between digit pairs is required. If a single digit is entered, it will be converted to 0X (X is the digit).

Brackets **{ }** and the characters inside them will not be counted in the 32 character/16 event sequence length limit.

RELease — **Printer Hold Release**

RELease

Releases all output in the print buffer from HOLD status. When the **RELease** command is specified, the prompt character changes from the (+) to the standard (**>** or user-specified prompt) to indicate that printer output is no longer held.

See also: **HOLD**

REMote — Remote Control Entr

REMote

Places the T-BERD 224 in Remote Control mode. In Remote Control mode, all front-panel switches are inactive with the exception of the **RESULTS I** and **RESULTS II Blank** and **Arrowed** switches. Unlike the **TERminal** command, the **REMote** command does not turn prompts, echo, and messages on.

See also: **LOCAl, TERminal, COMputer,** and **DISpla**

RESPonse — Set Automatic T1 Loop Code Response

RESP?

Display current T1 loop code response status. **RESPonse** controls how the T-BERD 224 responds to T1 loop codes selected through the **LOOp CODe T1** command. If five seconds of T1 in-band loop-up code are received, the T-BERD 224 automatically enters the AUTO LLB mode; the instrument repeats all transmitted data until a valid loop-down code is received. After receiving a loop-down code, the T-BERD 224 exits AUTO LLB mode and reenters the previously selected operating mode indicated by the current setting of the **MODE** switch (or **MODe** command). This command is identical to setting the automatic loop code response with the AUX 18 AUT RES function.

RESP A

Enables the automatic T1 loop code response.

RESP NO

Disables the automatic T1 loop code response.

See also: **LOOp Down, LOOp Up, LOOp CODe, PGM LPUp,** and **PGM LPDn**

RESTART — Test Restart

RESTART

Restarts the T-BERD 224 test by clearing all accumulated results to zero.

RESult 1 and 2 — Result Display Control

RES [1 | 2]?

Prints the displayed result in the Results I or II display. **RESults** controls the displayed results in the Results I and II displays. Unlike the **PRINT** command, the **RESult** command calls up the specified results in the Results displays. The specified result is not displayed at the remote control unit, unless **RESults [1 | 2]?** is used. Refer to the **CUStom** command for the list of valid <result names>. **n = 1** (LINE 1) or **2** (LINE 2). The result names from a results printout may also be used for the **<result names>**. **UNAVAIL** appears as the result when frame synchronization is not established. **N/A** appears a the result before establishing frame synchronization or command is not applicable to current configuration.

RES 1 <result name>

Displays the indicated <result name> in Results I display. n= LINE 1 or LINE 2.

RES 2 <result name>
Displays the indicated <result name> in Results II display.

See also: **CUStom, PRint,** and **RESULTS**.

RESULTS — Results Printout

RESULTS
Causes a printout of the current result values.

RS232 — RS-232 Parameters

RS232?
Displays the current status of the RS232 parameters. **RS232** only displays the current status of the RS232 interface baud rate, parity, and data bits, set in the AUX 08 RS232 function with exception of the line termination character (see **PRInt TERminator**).

RS232 Baud?
Displays the current baud rate of the RS232 parameters.

RS232 Parity?
Displays the current parity of the RS232 parameters.

RS232 Data Bits?
Displays the current data bits of the RS232 parameters.

See also: **PRInt TERminator**

H.18 SETUP

SETup — Setup Summary

SETup?
Displays the current T-BERD 224 test setup for: MODE, CHANNELFORMAT, and both SOURCE CONFIGURATION I and II switches.

SCAn — Signaling Scan Set

SCA ?
Displays current channels being scanned and the timeouts. **SCAn** sets or returns the DS0 channels that are being scanned for signaling activity. It also sets or returns the disconnect and off hook timeouts that control the scanning. This command is only functional when **CHAnnel FORmat SIGnaling** and **SOUrce 1 SCAn** are set. This command is identical to the AUX 29 SCANSET function.

SCA CHAnnels <channels>

Set channel numbers to be scanned. Enter <channels> in numerical order and separate by commas (,). Example: 2,4,6,7,10.

SCA CHAnnels ALL

Set all channel numbers to be scanned.

SCA DISconnect <timeout>

Set disconnect <timeout> from 1 to 15 seconds in 1 second steps.

SCA OFF hook <timeout>

Set off hook <timeout> from 5 to 55 seconds in 5 second steps, or 1 to 5 minutes in 1 minute steps.

SCA OFF hook NONe

Set to resume scanning only after a disconnect or test restart occurs.

SCA CHAnnels ?

Display current channels being scanned.

SCA DISconnect ?

Display current disconnect timeout.

SCA OFF hook ?

Display current off hook timeout.

See also: **CHAnnel FORmat SIGnaling** and **SOUrce 1 SCAn**.

SIGnal INSert — Channel Signaling Bit Insert

NOTE

The **INSERT** switch must not be set to NONE and the insert line's channel number must not be — (none). CHANNEL FORMAT must be set to VF and for signaling bits C and D, the **MODE** switch must be set to ESF or ESFz.

SIG INS ?

Displays all the currently inserted signaling bit states. **SIGnal INSert** sets or returns the logic state of signaling bit A to be transmitted for a selected channel. A logic 1 (ON) or 0 (OFF) may be transmitted for the signaling bit. Signaling bits C and D are only set when the **MODE** switch is set to ESF or ESFz. When ALL is selected, all signaling bits (2 or 4) must be inserted for the selected MODE.

SIG INS A [?|OFF|ON|TOG]

Sets the logical state for the inserted signaling bit A. Enter the ? to display the currently inserted signaling bit A state.

SIG INS B [?|OFF|ON|TOG]

Sets the logical state for the inserted signaling bit B. Enter the ? to display the currently inserted signaling bit B state.

SIG INS C [?|OFF|ON]

Sets the logical state for the inserted signaling bit C. Enter the? to display the currently inserted signaling bit C state.

SIG INS D [?|OFF|ON]

Sets the logical state for the inserted signaling bit D. Enter the ? to display the currently inserted signaling bit D state.

SIG INS ALL [?|<ab>|<abcd>]

Sets the logical state for the currently inserted signaling bit states. Enter the **?** to display the currently inserted signaling bit states. Set the **<ab>** signaling bit states to 0, 1, or T for the D1D, D2, D4, SLC-D1D, or T1SLC96 framing modes. Set the **<abcd>** signaling bit states to 0 or 1 for T1-ESF or T1-ESFz framing modes.

Perform the following steps before initiating the channel signaling bit insert function:

1. Set the **INSert** command to either **L1** or **L2**.
2. Set the **L1/2 CHAnnel** command to either the desired channel number (**1** to **24**) or **ALL**.
3. Set the **CHAnnel FORmat** command to **VF**.

Requesting the status of the **SIGNALING INSERT** switches can be performed at any time.

See also: **CHAnnel FORmat, MODe, PRInt, RESult 1/2,** and **SOUrce 2**

SLC ALArm — SLC Alarm Status

SLC AL ?

Display the current SLC alarm conditions on both lines. **SLC ALAr** reports the current SLC alarm condition for the selected line.

SLC AL L1 ?

Display the current SLC alarm conditions on Line 1.

SLC AL L2 ?

Display the current SLC alarm conditions on Line 2.

These alarms also appear in the SUMMARY category. The following alarm conditions are reported:

SHELF A, B, C, or **D** — A shelf alarm occurred.

MAJOR — A major alarm occurred.

MINO A minor alarm occurred.

POWER MISC. — A power/miscellaneous alarm occurred.

A, B, C, or **D ON PROT.** — The indicated shelf switched to the protection Line.

FE LOOP SHELF A, B, C, or **D** — The indicated shelf is in a far-end loop.

FE LOOP PROTECTION — The protection line is in a far-end loop.

UNAVAIL — The T1 SLC96 mode is selected, but the datalink frame synchronization is not established.

N/A — The T1 SLC96 mode is not selected.

NONE — Appears when no alarms are reported.

See also: **CHAnnel FORmat, FAR END LOOp, MODe, PRInt, RESult 1/2, SIGnal INSert, SLC MAINTe-nance, SOUrce 1,** and **SOUrce 2**

SLC MAIntenance — SLC Maintenance Message Status

SLC MAI ?

Reports on the status of the datalink maintenance messages for both lines. **SLC MAIntenance** reports on the status of the datalink maintenance messages for the selected line.

SLC MAI L1 ?

Reports on the status of the datalink maintenance messages for Line 1.

SLC MAI L2 ?

Reports on the status of the datalink maintenance messages for Line 2.

This command is only valid when the T1SLC96 mode and the DATLINK channel format are selected and frame synchronization is established. These messages also appear in the SUMMARY category. The following reports appear by line number:

HOOK/SEIZE — On-Hook/Seize RC/CR message received.

PROCEED Proceed RC/CR message received.

TEST ALARM — Test alarm message received.

UNAVAIL — The T1 SLC96 mode is selected, but datalink frame synchronization is not established.

N/A — The T1 SLC96 mode is not selected.

NONE — None of the maintenance messages is reported.

See also: **CHAnnel FORmat, FAR END LOOp, MODe, PRInt, RESult 1/2, SIGnal INSert, SLC ALArm, SOUrce 1,** and **SOUrce 2**

SMArtniu CLEar — Clear Smart NIU/Performance Monitor Results

SMArtniu CLEar

Initiates the Clear NIU feature, which clears all stored T1 circuit performance data from the Smart NIU/Performance Monitor memory. In response to the command, one of the following messages appears on the remote terminal's display:

NIU CLEARED — Smart NIU/Performance Monitor T1 circuit performance data was successfully cleared from memory.

CLEAR NIU FAILED — Smart NIU/Performance Monitor T1 circuit performance data was not cleared due to a communication problem.

SMArtniu CLOck — Set Smart NIU/Performance Monitor Date and Time

SMArtniu CLOck

Initiates the Set Clock feature to set the Smart NIU/Performance Monitor to match theT-BERD 224 date and time. In response to the command, one of the following messages appears on the remote terminal's display:

CLOCK SET — Smart NIU/Performance Monitor date and time successfully changed to match the T-BERD 224 date and time.

SET CLOCK FAILED — Smart NIU/Performance Monitor date and time were not changed due to a communication problem.

SMArt NET — Intelligent Network Equipment Selection

SMA NET IOR <manufacturer & model>

Identifies intelligent office repeater type. **SMArt NET** enables the user to identify the intelligent network equipment type and model, so the T-BERD 224 transmits the appropriate loop codes.

SMA NET ILR <manufacturer & model>

Identifies intelligent line repeater type.

SMA NET MS <manufacturer & model>

Identifies DS1 Maintenance Switch type.

SOUrce 1 — Source Configuration I

SOU 1?

Displays the current selection for the**SOURCE CONFIGURATION I** switch. **SOUrce 1** selects or returns the drop and insert source which is to be used when analyzing the selected channel(s). Modifying this command causes a test restart and may change the current setup.

SOU 1 <parameter>

Selects the setting for the **SOURCE CONFIGURATION I** switch.

The following **<parameters>** are available with the mainframe:

1004	:1004 Hz tone
VF INT	:Voice Frequency Interface
DS0 INT	:DS0 Interface
DRO CHA	:Drop Channel

The following **<parameters>** are available with the DSU-DP Option:

DSU-DP	Selects DSU-DP configuration

The following **<parameters>** are available with the VF Option:

2713	2713 Hz Tone
3 TON SLO	3 Tone Slope
FRE	VF Signal Frequency
ERL	Echo Return Loss
LEV	VF Signal Level
PAR	Peak-to-Average Ratio (P/AR)
QUI	Quiet Termination
SRL HIG	Singing Return Loss - High
SRL LOW	Singing Return Loss - Low
SWE	Frequency SWEEP

NOTE

These functions can also set the Source 2 parameter being selected. If no entry beyond the 3 character Source 1 parameter is made, then Source 2 will not be affected.

The following **<parameters>** are available with the Signaling Option:

DIAL SEQ	Dial Sequence
REC SEQ	Receive Sequence
SCA	Scan
MON	Monitor

The following **<parameters>** are available with the BERT Option:

1:7	A One and Seven Zeros Pattern
2^15-1	32,767-Bit Pseudorandom Pattern
2^15-1 INV	Inverted 32,767-Bit Pseudorandom Pattern
2^20-1	1,048,575-Bit Pseudorandom Pattern
2^23-1	8,388,607-Bit Pseudorandom Pattern
2 IN 8	Two Ones In 8-Bits Pattern
3 IN 24	Three Ones In 24-Bits Pattern
63	63-Bit Pseudorandom Pattern
511	511-Bit Pseudorandom Pattern
2047	2047-Bit Pseudorandom Pattern
ALL ONE	All Ones Pattern
ALL ZER	All Zeros Pattern
AUTO	Automatic Pattern Search
BRI	Bridgtap
DDS1	DDS 1 Stress Pattern
DDS2	DDS 2 Stress Pattern
DDS3	DDS 3 Stress Pattern
DDS4	DDS 4 Stress Pattern
DDS5	DDS 5 Stress Pattern
DDS6	DDS 6 Stress Pattern
QRS	Quasi-Random Signal Source Pattern

MIN/	Minimum/Maximum Density Stress Pattern
MUL	Multipat
T1-2/TRIP	96-octet HEX pattern
T1-3	54-octet HEX pattern
T1-4	120-octet HEX pattern
T1-5	53-octet HEX pattern
T1-6/55OCT	Unframed 55-octet HEX pattern
T1-DALY	Framed 55-octet HEX pattern
USE	User Programmable Bit Pattern

The following **<parameters>** are available with the SLC Option:

FAR END LOO	:Far-end loop command to the selected shelf or Protection line
IDLe	:Idle signal
MAInt	:Automated maintenance test sequence
MAJ ALA	:Major alarm to the selected shelf
MINO ALA	:Minor alar
POW	:Power/miscellaneous alarm
SW PROt	:Switch to protection line

The following **<parameters>** are available with the Caller ID Option:

MONitor	:Selects CID MON configuration

The following **<parameters>** are available with the Level 2 Protocol Monitor Option:

SS7 MONitor	:Monitor SS7 level 2 protocol
ISDn MONitor	:Monitor ISDN level 2 protocol

NOTE

Changing the source configuration causes a test restart and changes the current front panel configuration to the previous configuration of the selected channel format. A warning is printed indicating the new set up.

SOUrce 2 — Source Configuration II

SOU 2?

Displays the current status for the **SOURCE CONFIGURATION II** switch selection. **SOUrce 2** augments the **SOURCE CONFIGURATION I** switch selection. **SOUrce 2** selects or returns the drop and insert source which is to be used when analyzing the selected channel(s).

SOU 2 <parameter>

Selects the setting for the **SOURCE CONFIGURATION II** switch.

The following **<parameters>** are available for the DSU-DP Option:

CHAN <x>	:Displays the subrate channel number of a DS0B-formatted channel (where x = 1 to 20, 1 to 10, or 1 to 5).
N = <x>	:Selects the number of channels of a Fractional T1 signal (where x = 1 to 24).

NON CON	:Selects non-contiguous channels for a Fractional T1 signal (The non-contiguous channels are defined by AUX 10 N-CONTG or NO NCONtiguous remote command).

The following **<parameters>** are available with the VF Option:

ON/OFF	When 2713 Hz is the **SOURCE CONFIGURATION I** switch setting.
404/1004/2804 Hz	When 3-TONE SLOPE is the **SOURCE CONFIGURATION I** switch setting.

The following **<parameters>** are available with the Signaling Option:

SEQuence 1 to 10	Sequence 1 to 10.
ORG L1	Originating Line 1.
ORG L2	Originating Line 2.
ORG AUTO	Originating AUTO.

NOTE

Manual dialing is not available in remote control.

The following **<parameters>** are available with the Enhanced ESF/SLC Option:

CHAnnel <x>	Selects the DS0B channel format subrate channel number [x]. [x] = 1 to 20 for DS0B2.4, 1 to 10 for DS0B4.8, or 1 to 5 for DS0B9.6. This is only valid for **CHAnnel FORmat** command parameters DS0B2.4, DS0B4.8, and DS0B9.6.
SHElf [A | B | C | D]	Selects the shelf which either the **SOUrce1 FAR END LOOp** or **SOUrce 1 MAJ ALArm** selection indicates.
PROtection	Selects the **PROtection** line which the **SOUrce1 FAR END LOOp** selection indicates.

The following **<parameters>** are available with the Caller ID Option:

SWI=L1	:Selects LINE 1 as the line from the switch.
SWI=L2	:Selects LINE 2 as the line from the switch.

NOTE

Changing the source configuration causes a test restart and changes the current front panel configuration to the previous configuration of the selected channel format. A warning is printed indicating the new set up.

SUMmary — Summary Results Print

SUMmary

Requests a results print for the results and messages in the Summary category.

H.19 TERMINAL

TERminal **Configure theT-BERD 224 for Remote Control Operation**

TER

Selects the Terminal control mode. **TERminal** is typically used as a log-in sequence when entering Remote Control mode from a dumb terminal. Typing a period (.), followed by a carriage return, places the T-BERD 224 in Terminal mode and provides a default prompt (>) printed on the screen. When the **TER** command is specified, all front-panel switches (except the **RESULT** switches) are inactive. This command is not available when using IEEE-488 Remote Control.

. (period)

Alternate form of the TER command.

The **TERminal** command automatically sets up the following:

ECHO ON	Turn echo on.
PROMPT ON	Turn command prompts on.
TERM CRLF	Line terminator of carriage return and line feed.
MESSAGES ON	Causes error messages to be printed.

See also: **LOCAl, REMote, COMputer,** and **DISplay**

TESt **Test Results Accumulation**

TES ?

Displays the current test type. **TESt** enables you to specify the duration of a test.

TES TIMe

The T-BERD 224 conducts a timed test of the duration specified in the **TESt LENgth** command.

TES TIMe HHH:MM:SS

Sets the T-BERD 224 to timed test and sets the duration (see TESt LENgth).

TES CONtinuous

The T-BERD 224 accumulates test results continuously.

NOTE

Changing from continuous to timed causes a test restart.

See also: **TESt LENgth**

TESt LENgth — Test Length

TES LEN ?

Displays the current test length setting. **TESt LENgth** sets the length of a timed test. This command is identical to the AUX 03 TES LEN function.

TES LEN HHH:MM:SS

Sets new test length in hours, minutes, and seconds. in hours, minutes, and seconds in hours, minutes, and seconds. When setting a new test length, the symbol ":" may be replaced by a dash (-), comma (,), period (.), semicolon (;), or slash (/). The valid ranges for each time value are:

HHH: 0 - 200 hours
MM: 0 - 59 minutes
SS: 0 - 45 seconds (in 15 second intervals)

NOTE

The test length may also be set using the **TES TIM** command. If there is no entry for hours minutes and/or seconds, it is assumed to be zero.

See also: **TESt**

TIMed PRInt EVEnt — Time Print Event

TIM PRI EVE ?

Display the current time interval for results printouts. **TIMed PRInt EVEnt** sets the length of time interval for results printouts. This command is identical to the AUX 02 TIM PRI function.

TIM PRI EVE H:MM:SS

Set the time interval for results printouts in hours, minutes, and seconds, respectively; each can be specified separately (H, MM, or SS). When setting a new test length, the symbol ":" may be replaced by a dash (-), comma (,), period (.), semicolon (;), or slash (/). The valid ranges for each time value are:

H: 0-6 hours
MM: 0-59 minutes
SS: 0-45 seconds (in 15 second intervals)

NOTE

The print event time may also be set using the **PRInt EVEnt TIMed** command. The print event must be set to TIMED to have timed printouts generated. Maximum time allowable is 6:00:00. If the hours, minutes and/or seconds are not entered, they are assumed to be zero (see TES LEN example).

See also: **PRInt EVEnt**

TRUnk TYPe **Trunk Type**

TRU TYP ?

Displays the current trunk type. **TRUnk TYPe** defines the trunk type emulation (ground start or loop start) and on- and off-hook signaling generated bythe T-BERD 224. This command is identical to the AUX 24 TRK DEF function.

TRU TYP DEFine OFFhook <abcd>

Enables the user defined off-hook signaling. Valid signaling bits **<abcd>** include: **0**= off, **1**= on, **T**= toggle, **X**= don't care, and **?**. Enter a signaling bit in each position, e.g., **01xx** or **1t10**. Enter **?** once to display the currently defined signaling bits.

TRU TYP DEFine ONhook <abcd>

Enables the user defined off-hook signaling. Valid signaling bits **<abcd>** include: **0**= off, **1**= on, **T**= toggle, **X**= don't care, and **?**. Enter a signaling bit in each position, e.g., **01xx** or **1t10**. Enter **?** once to display the currently defined signaling bits.

TRU TYP GROund STart <parameter>

Enables the T-BERD 224 to emulate a ground start circuit. Valid **<parameters>** are: **FXO**, **FXS**, **SLC OFFice**, **SLC STAtion**, and **?**. Enter **?** once to display the currently defined signaling bits.

TRU TYP LOOp STart <parameter>

Enables the T-BERD 224 to emulate a loop start circuit Valid **<parameters>** are: **FXO**, **FXS**, **SLC OFFice**, **SLC STAtion**, and **?**. Enter **?** once to display the currently defined signaling bits.

TRU TYP STD

Enables the T-BERD 224 to emulate the standard E&M signaling used between switches in the public switched telephone network.

H.20 USER

USEr **Set User Programmable Test Pattern**

USEr?

Displays current user programmable data pattern. **USEr** enables a 3- to 24-bit user programmable test pattern to be entered. The test pattern is selected using the **SOURCE CONFIGURATION I** switch. This command is identical to setting the user programmable pattern with the AUX 15 USER function.

USEr <bb...bb>

Sets the user programmable data pattern. **<bb...bb>** equals 3- to 24-bit binary code. The left-most bit i transmitted first.

See also: **SOUrce 1 USEr**

H.21 VOLUME

VOLume **Loudspeaker Control**

VOL ?

Displays the current status of the T-BERD 224 **VOLUME** switch. **VOL** enables or disables the audio speaker of the T-BERD 224 internal loud speaker. When set to **ON**, the actual audio level is controlled by the position of the front panel VOLUME slide control and the dropped channel(s) contents are output to the side panel loudspeaker. **VOL OFF** turns off the loudspeaker.

VOL ON

Turns the speaker ON.

VOL OFF

Turns the speaker OFF.

NOTE

Each time the unit power is turned off and then on again, the status of this control is always set to ON.

H.22 WINK

WINk **Wink**

WIN?

Displays the current wink settings (1000 ms). **WIN** determines how the T-BERD 224 transmits the wink supervision event during the receive sequence. This command is identical to the wink control of the AUX 28 SPV DEF function.

WIN DELay <length>

Set the wink delay to a length between 50 ms and 1000 ms. Enter ? to display current wink delay.

WIN DURation <length>

Set the wink duration to a length between 30 ms and 600 ms. Enter ? to display current wink duration.

See also: **DDial**

H.23 YEAR

YEAr **Calendar Year Selection**

YEA ?

Displays current year setting (2 digits) from AUX 04 TIM/DAY.

YEA xx

Set last two digits of the year, where xx can be any number from 00 to 99.

APPENDIX I ACRONYMS

A, B, C, D	Signaling bits for robbed bit signaling with ESF; only A and B are available with other framing.
ACU	Alarm Control Unit
AIS	Alarm Indication Signal
ALBO	Automatic Line Build-Out
AMI	Alternate Mark Inversion
B8ZS	Bipolar 8-Zero Substitution
BER	Bit Error Rate
BERT	Bit Error Rate Test(er)
BOP	Bit Oriented Protocol
BPV	Bipolar Violation
CCC	Clear Channel Capability
CCITT	Consultative Committee of International Telegraph and Telephone
CMI	Common Management Information
CP	Customer Premises
CPE	Customer Premises Equipment
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CSU	Channel Service Unit
D3	Third Generation Channel Bank; 24 channels on one T1
D4	Fourth Generation Digital Channel Bank; up to 48 channels on two T1s or one T1C
D/A	Digital to Analog
dBm	Decibel Level referenced to 1 mV
DCS	Digital Cross-connect System
DCE	Digital Communications Equipment
DDS	Digital Data System
DID	Direct Inward Dial
D/I	Drop and Insert
DP	Dial Puls
DS0	Digital Signal Level 0 (zero)
DS0A	Digital Signal Level 0 with a single rate adapted channel
DS0B	Digital Signal Level 0 with multiple channels for sub-rate multiplexed in DDS format
DS0 DP	Digital Signal Level 0 Data Port
DS1	Digital Signal Level 1: 1.544 Mb/s
DS3	Digital Signal Level 3: (45 Mb/s) Seven DS2 signals digitally multiplexed
DS1C	Two T1s used mostly by Telcos internally
DSL	Digital Subscriber Line
DSP	Data Signal Processing
DSU	Data Service Unit
DSU-DP	Data Service Unit - Data Port
DSX-1	Digital Signal Cross-connect (Switch Panel)
DTE	Data Terminal Equipment
DTM	Distributed Test Manager
DTMF	Dual Tone Multi-Frequency
E&M	Ear and Mouth Signaling
ERL	Echo Return Loss
ESF	Extended Superframe
FB	Framing Bit
FSK	Frequency Shift Key
FT1	Fractional T1
FX	Foreign Exchange
FXO	Foreign Exchange Office
FXS	Foreign Exchange Station
ILR	Intelligent Line Repeater
IOR	Intelligent Office Repeater
ISDN	Integrated Signal Digital Network
LBO	Line Build-Out
LED	Light Emitting Diode
LIU	Line Interface Unit
LLB	Line Loop Back
LSU	Line Switch Unit
M1	SLC-96 Mode I Formatting
M2	SLC-96 Mode II Formatting

M3	SLC-96 Mode III Formatting
MF	Multi-Frequency
MJU	Multipoint Junction Unit
MON	Monitor
MOP	Message Oriented Protocol
MUX	Multiplexer
NOTE	Network Office Terminating Equipment
OCU	Office Channel Unit
OCUDP	Office Channel Unit Data Port
PAR	Peak-to-Average Ratio
PBX	Private Branch Exchange
PCM	Pulse Code Modulation
PLB	Payload Loopback
POP	Point of Presence
PRI	Primary Rate Interface. ISDN; 1.544 Mb/s
PRM	Performance Report Message
QRSS	Quasi-Random Signal
RT	Remote Terminal
RTS	Request to Send
S/N	Signal to Noise
SLC	Subscriber Loop Carrier
SONET	Synchronous Optical Network.
SRL-HI	Signal Return Loss - High
SRL-LO	Signal Return Loss- Low
SRQ	Service Request
SS7	Signaling System 7 (Also known as CCS7)
SSU	Special Service Unit
T1	Transmission at DS1; 1.544 Mb/s
TAD	Test Access digroup
TAU	Time Alignment Unit
TELCO	Telephone Company
TLB	Test Loopback
TRU	Transmit Receive Unit
VF	Voice Frequency
ZBTSI	Zero Byte Time Slot Interchange

INDEX

— A —

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— V —

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