APPENDIX E
TIME SLIPS MEASUREMENT

50-11387-01
Rev. G

T-BERD® 224
PCM ANALYZER
REFERENCE MANUAL

NOVEMBER 1994

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GENERAL INFORMATION

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, SLC and ESF from virtually any T1 access point. Dual drop capabilities allow users to observe or listen to live voice and data traffic. Bi-directional 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.

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's 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 formats 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.

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

Test T1 circuits with over 15 different test patterns.

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

Automated MULTIPAT testing performs one-step testing with a 15-minute test that includes standard All Ones, 1:7, 2 IN 8, 3 IN 24, and QRSS test patterns.

Automated BRIDGTAP testing evaluates T1 circuits for bridge taps using 21 different test patterns.

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.

Simplex current measurement.

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

Measures the round trip path delay of the T1 circuit.

Fractional T1 Option — Model 13466

T1 BERT Option Required (43016)

Test Fractional T1 circuits with over 20 different test patterns.

Test and loop contiguous and non-contiguous Fractional T1 bandwidths.

Test 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.

DDS Option — Model 13467

T1 BERT Option Required (43016)

Test DDS circuits with over 20 different test patterns.

Alternating and latching DDS loop codes are available 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.

Received byte displays the logic states of bits one through eight of one or both dropped channels.

DDS Primary and Secondary channel testing.

Control 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.

Advanced Stress Patterns Option — Model 12042

T1 BERT Option Required (43016)

Stress DDS and T1 networks with 8 additional test patterns.

CCITT Recommendation G.821 evaluates the long-term performance of your system.

T1.403 Performance Report Messages (PRMs) can be monitored and transmitted on ESF and ESFz framed circuits.

SLC-96 (Mode 1 and 2) circuit alarms (major shelf, minor shelf, and power/miscellaneous) can be sent and monitored.

SLC-96 (Mode 1) automated maintenance test sequences can be sent and monitored.

SLC-96 (Mode 1 and 2) switch to protection line function can be sent and monitored.

SLC-96 (Mode 1 and 2) far-end shelf loopback can be sent and monitored. 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 can be sent and monitored.

Test VF circuits at the T1 access points.

Qualify 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).

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

Perform automated frequency sweeps.

VF THRU Capability

Signaling Option — Model 41934

DSP Option Board Required (42659)

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

Terminate calls by receiving digits from a far-end switch/PBX and sending supervision events.

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

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

Measure wink delay and duration.

Dial and BERT Switched 56 circuits (DDS Option required).

Digit Analysis Option — Model 12078

Signaling Option Required (41934)

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

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

Measure digit on and off time.

Level 2 Protocol Monitor Option — Model 12079

DSP Option Board Required (42659)

Monitors Level 2 Protocol in Signaling System Number 7 (SS7) and Primary Rate Integrated Services Digital Network (PRI ISDN) systems, to isolate and distinguish switch versus facility link problems.

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

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

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

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.

RS-232, RS-449, and V.35 electrically formatted signals are multiplexed/demultiplexed into the T1 bit stream.

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

Test and analyze ZBTSI clear channel encoded T1 lines.

Automated IEEE-488 (HP-113) remote control ability.

Test in engineering and manufacturing environments where multiple test equipment/ peripherals are operated via a master controller.

1.4 ACCESSORIES

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

1.5 CABLES

Part No.	Description
10598	WECO 310 plug to WECO 310 plug (4')
10420	WECO 310 plug to WECO 310 plug (10')
10558	WECO 310 plug to alligator clips (10')
10599	WECO 310 plug to bantam plug (4')
10559	WECO 310 plug to bantam plug (10')
10615	Bantam plug to bantam plug (10')
10648	Bantam plug to alligator clips (10')
10213	RS-232 male-to-male (6')
10418	RS-232 male-to-male (10')
10214	V.35/306 male-to-male (6')
10419	V.35/306 male-to-male (10')
10215	RS-449/MIL-188 37-pin D male-to-male (6')
10417	RS-449/MIL-188 37-pin D male-to-male (10')
30611	9-pin D male to 5-pin audio male (4')
20309	9-pin D male to 9-pin audio male (10')
31141	Dual Drop RS-232 protocol adaptor
31142	Dual Drop RS-449 protocol adaptor
31143	Dual Drop V.35 protocol adaptor
30771	Extender cable for lid printer (8')
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
06154	WECO 310 plug to AT&T 800 Series-type male (12')
06153	Bantam plug to AT&T 800 Series-type male (12')

1.6 ORDERING INFORMATION

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

SECTION 1

2 INSTRUMENT CHECKOUT & SERVICE

SECTION 2
INSTRUMENT CHECKOUT AND SERVICE

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 User's Guide
- Front cover
- Snap-on pouch
- Help cards

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 the customer's 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 224's 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 "I" for the ON position and a "0" for the OFF position.

2.5 INSTRUMENT SELF-TEST/CHECKOUT

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 (I) 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's NOVRAM and set all switch configurations to the factory default settings listed in Appendix A.

   - Checks the instrument's 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.

LINE 1 and LINE 2 CHANNEL switches
Select channel 01.

RESULTS I & II Blank switches
Select SUMMARY category.

DROP (RX) switch
Select LINE 2.

INSERT (TX) switch
Select LINE 1.

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*.

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).

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

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

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

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

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

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 the T-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 the T-BERD 224 still fails to operate, contact TTC's 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. Always use the correct fuse rating.

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.**

2.8 WARRANTY

2.8.1 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted against 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. No other warranty is expressed or implied. TTC is not liable for consequential damages.

Liability under this warranty extends only to the replacement value of the equipment. The warranty is void under the following conditions.

- Equipment has been altered or repaired without specific authorization from TTC.
- Equipment is installed other than in accordance with instructions contained in TTC literature and operating manuals.

2.8.2 In-Warranty Service

Equipment in warranty must be returned to the factory with shipping prepaid. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the TTC Repair Department. The RA number should then appear on all paperwork and be clearly marked on the outside of the shipping container. The equipment should be packed and shipped in accordance with instructions in Section 2.9 of this manual.

After the equipment is repaired by TTC, it will be tested to applicable specifications, burned-in for at least 24 hours, retested, and returned to the customer with shipping prepaid. A brief description of the work performed and the materials used will be provided on the Equipment Repair Report furnished with the returned equipment.

2.8.3 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still in warranty. However, there is a minimum charge applied to each request for out-of-warranty service. The minimum charge guarantees the customer an estimate of the repair costs and is used as credit against actual materials and labor costs should the equipment be repaired. Contact the TTC Repair Department for specific information on the minimum out-of-warranty charge.

The customer will be billed for parts plus standard labor rates in effect at the time of repair. The customer will also 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 description of the labor and materials used will be provided in the Equipment Repair Report.

Once an out-of-warranty repair is made, the repaired part or component is warranted for 90 days. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the 90-day repair warranty.

2.9 EQUIPMENT RETURN INSTRUCTIONS

Attach a tag with the following information to all equipment returned for repair.

- Owner's name and address.
- A list of the equipment being returned and the applicable serial number(s).
- A detailed description of the problem or service requested.
- The name and telephone number of the person to contact regarding questions about the repair.
- The Return Authorization (RA) number.

Leave all switches in the positions they were in when the problem occurred. This is requested so that the TTC repair group can analyze the switch positions along with a detailed description of the problem or of the service requested.

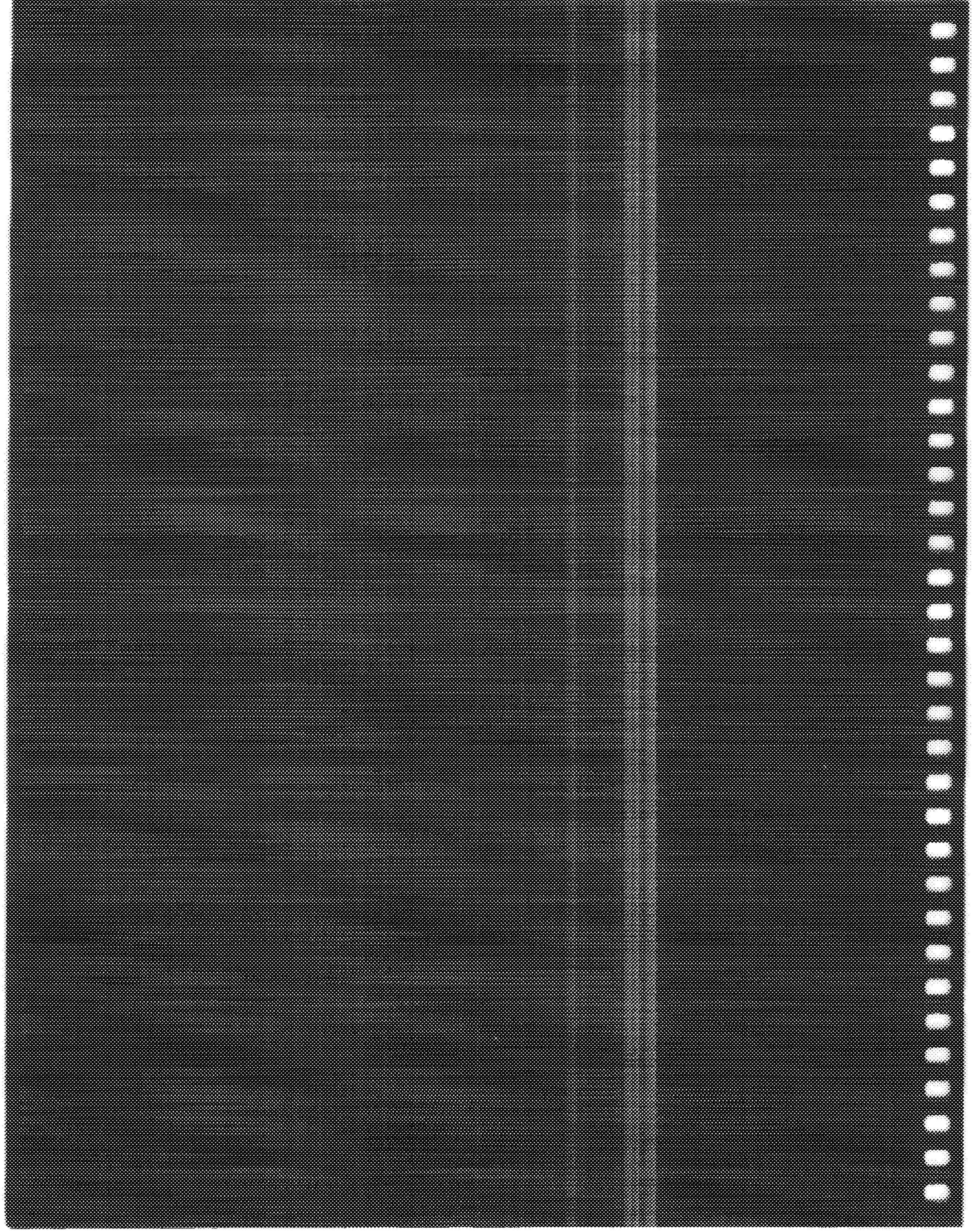
If possible, the customer should return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit. TTC is not liable for any damage that may occur during shipping. The customer should clearly mark the TTC-issued RA number on the outside of the package and ship it prepaid and insured to TTC.

3 INSTRUMENT DESCRIPTION

SECTION 3
INSTRUMENT DESCRIPTION

MAINFRAME AND T1 BERT OPTION

Introduction
Test Setup
Circuit Connections
Results Verification
Troubleshooting Controls
Printer Controls



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):

- Mainframe and T1 BERT Option
- Fractional T1 Option
- DDS Option
- SLC Option
- ESF Option
- VF Option
- Signaling Option
- Level 2 Protocol Monitor 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.

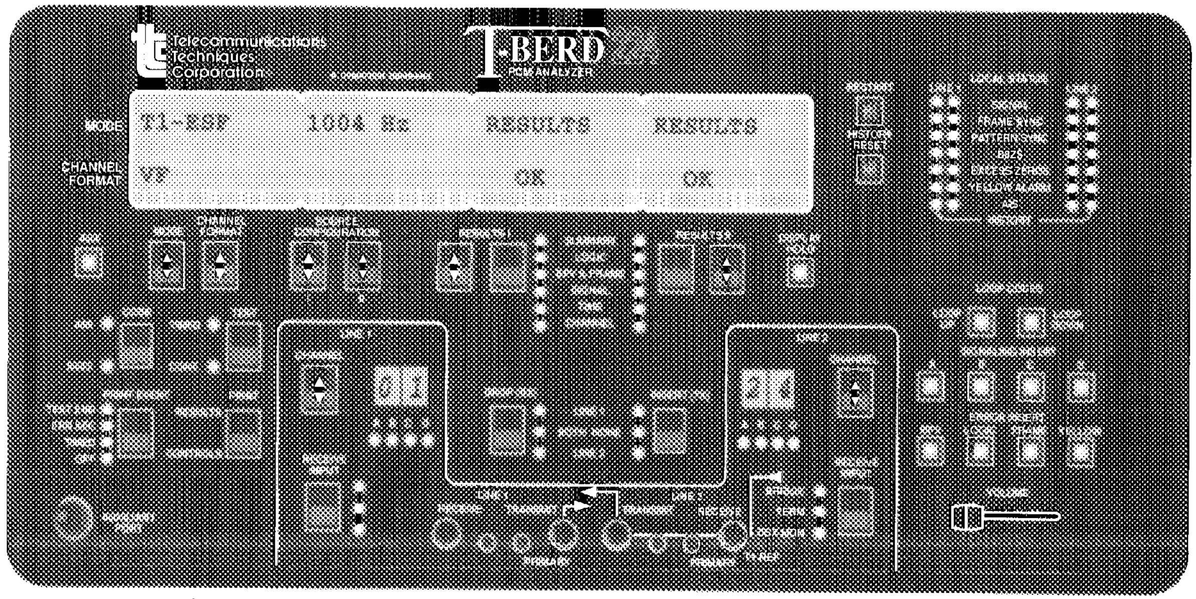
Circuit Connections — Discusses the connections and switches used to provide access to the circuit being tested.

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 circled number appears 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.


Telecommunications
Techniques
Corporation
T-BERD
PCM ANALYZER
MODE
CHANNEL FORMAT
T1-ESF
1004 Hz
RESULTS
RESULTS
VF
OK
OK
HISTORY RESET
LOCAL STATUS
SIGNAL
FRAME SYNC
PATTERN SYNC
B8ZS
EXCESS ZEROS
YELLOW ALARM
AIS
HISTORY
MODE
CHANNEL FORMAT
SOURCE CONFIGURATION
DISPLAY HOLD
LOOP CODES
ERROR INSERT
VOLUME
LINE 1
LINE 2
RECEIVE
TRANSMIT
AUXILIARY PORT

3.2 MAINFRAME AND T1 BERT OPTION — TEST SETUP

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

- Help card
- Front-panel display (1)
- **MODE** switch (2)
- **CHANNEL FORMAT** switch (3)
- **SOURCE CONFIGURATION I** switch (4)
- **CODE** switch (5)
- **TEST** switch (6)
- **AUX** switch (7)

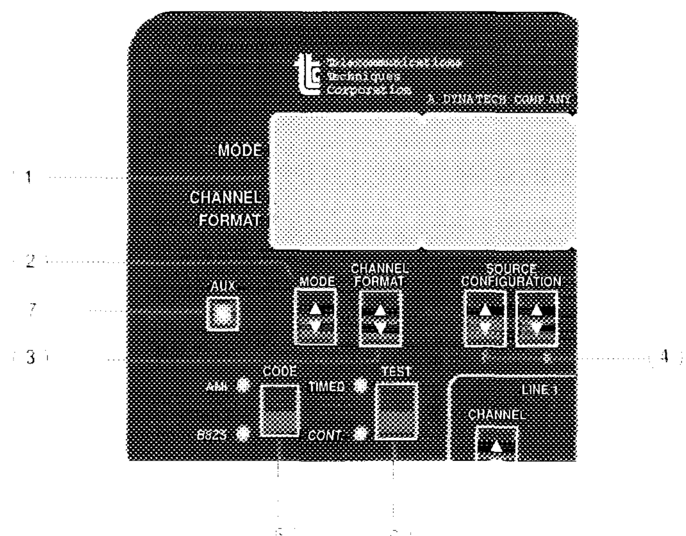


Figure 3-2
Test Setup Controls

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

Switch	Configuration	
MODE	AUTO, T1, T1-D1D, T1-D2, T1-D4, T1-ESF, SLC-D1D, SLC-M2, T1SLC96, T1 TLB, T1 LLB	
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, 1 IN 8, 3 IN 24, 1:7

Help Card

A help card is located under the storage pouch. Use the help card as a quick test reference.

Front-panel Display

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.

MODE Switch

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 LINE 1 or LINE 2

The **MODE** switch selections include:

AUTO — Automatically configures the unit's 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 Selections

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 process 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.

Configure the following framing formats on the T-BERD 224 to evaluate the T1 system:

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 ALARM 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.

T1-TLB (Test Loopback) — Loops data from each line's receiver to the opposite line's 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's receiver to the opposite line's transmitter. Each input is monitored for T1 and channel results, but data is unaffected by the 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.

CHANNEL FORMAT Switch

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

Modifying the **CHANNEL FORMAT** switch selection:

- Causes a test restart
- Disables the insert function for 3 seconds if the **INSERT (TX)** switch is set to LINE 1 or LINE 2
- 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.

SOURCE CONFIGURATION I Switch

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 **CHANNEL FORMAT** 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's 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's 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, the T-BERD 224 is in a through mode allowing data to pass. Once the pattern is recognized, the T-BERD 224 transmits the pattern on the inserted line. Otherwise, the unit remains in the through mode. When testing DDS circuits, the AUTO mode only applies to the primary channel.

MULTIPAT — is an automated test used during the acceptance testing of a new T1 span or while troubleshooting an existing T1 span. MULTIPAT transmits five consecutive test patterns: ALL ONES, 1:7, 2 IN 8, 3 IN 24, and QRSS.

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. MULTIPAT is only available in the FULL T1 channel format.

BRIDGTAP — is an automated test 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 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.

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 —is generally used to stress span repeater current regulator circuits. ALL ONES is a fixed test pattern of AMI pulses. 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 —pattern 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.

When the **CODE** switch is set for B8ZS and the ALL ZEROS test pattern is transmitted, the T-BERD 224 monitors the received signal for the normal B8ZS sequence, 000V 10V1 (where V is a bipolar violation). If the T-BERD 224 receives the B8ZS sequence in an AMI format (0001 1011) instead of all zeros (0000 0000) after decoding, the T-BERD 224 reports the sequence as an error and displays the message *NOT B8ZS COMPATIBLE*. To test circuits for B8ZS compatibility, the T-BERD 224 channel format must be set for either FULL T1, 64 x N, or DS064. The failure can occur at a multiplexer or digital cross-connect with an improperly set equipment coding option: set for AMI instead of B8ZS.

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 —is used to test the ability of repeaters to adjust to rapid changes in ones density. The pattern generates rapid transitions from low ones density octets to high ones density octets.

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 — is generally used to test mis-optioned equipment for B8ZS encoding. 2 IN 8 is a fixed test pattern of F0100 0010 01.... 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 — is generally used to stress 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.

Advanced Stress Pattern Option (see Appendix D for the Bit Pattern)

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

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

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

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

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

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

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.

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.

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.

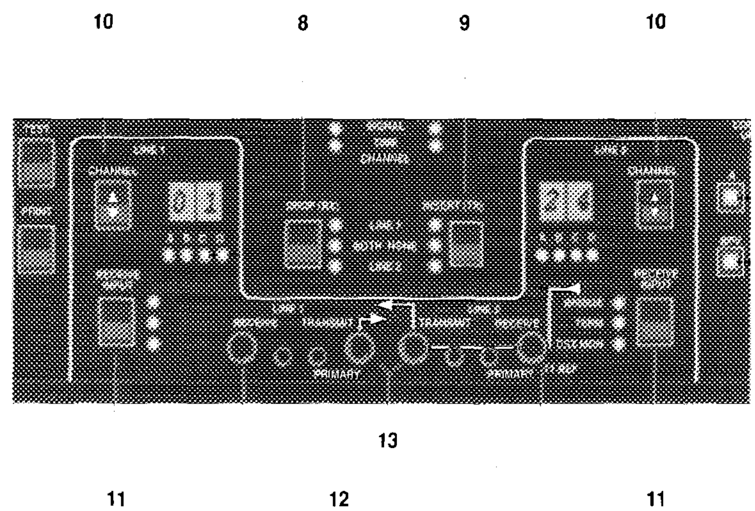
AUX Switch

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 information on the following mainframe and T1 BERT auxiliary functions:

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 Configuration
AUX 13 ERR RT — Error Rate
AUX 14 FRM ERR — Frame Error Insertion
AUX 15 USER — User Programmable Test Pattern
AUX 16 PGM LP — Programmable Loop Codes
AUX 17 LOOP CD — Loop Code Type
AUX 18 AUT RES — Automatic Loop Code Response
AUX 35 CUSTOM — Custom Results

3.3 MAINFRAME AND T1 BERT OPTION — CIRCUIT CONNECTIONS

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



- **DROP (RX)** switch
- **INSERT (TX)** switch
- **LINE 1 & 2 CHANNEL** switches
- LINE 1 & 2 CHANNEL displays
- **LINE 1 & 2 RECEIVE** switches
- LINE 1 & 2 RECEIVE jacks
- LINE 1 & 2 TRANSMIT jacks
- Side-panel connections

DROP (RX) Switch

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.

INSERT (TX) Switch

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.

LINE 1 & 2 CHANNEL Switches (10)

The **LINE 1** and **LINE 2 CHANNEL** switches are available in the **VF CHANNEL FORMAT** 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 "— —".

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 line monitored 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 line monitored 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.

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.

LINE 1 & 2 TRANSMIT Jacks

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.

Side Panel Connections

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

DS0 INTF Jacks

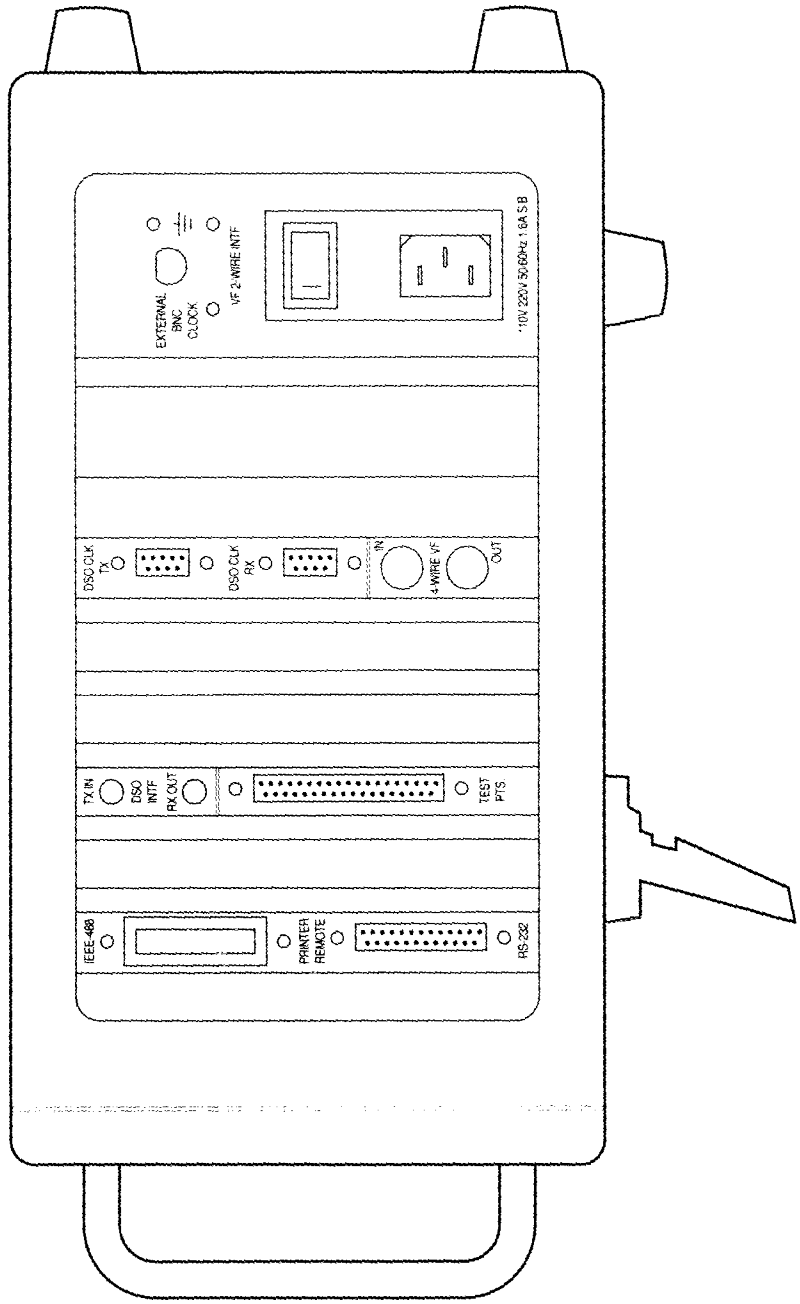
The DS0 INTF jack provides two bantam jacks for external access to bipolar, 64 kb/s, DS0 signals within the T1 bit stream data. The T-BERD 224 requires the DDS Option to use this interface. The TX IN jack is used to insert a 64 kb/s DS0 signal into a channel designated by the front panel **INSERT (TX)** 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.

TEST PTS. Connector

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's pin designations, refer to Section 8.

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.


EXTERNAL BNC CLOCK
VF 2-WIRE INTF
110V 220V 50/60Hz 1.6A S.B
DSO CLK TX
DSO CLK RX
IN
4-WIRE VF
OUT
TX IN
DSO INTF
RX OUT
TEST PTS
IEEE-488
PRINTER REMOTE
RS-232

VF 2-WIRE INTF Terminals

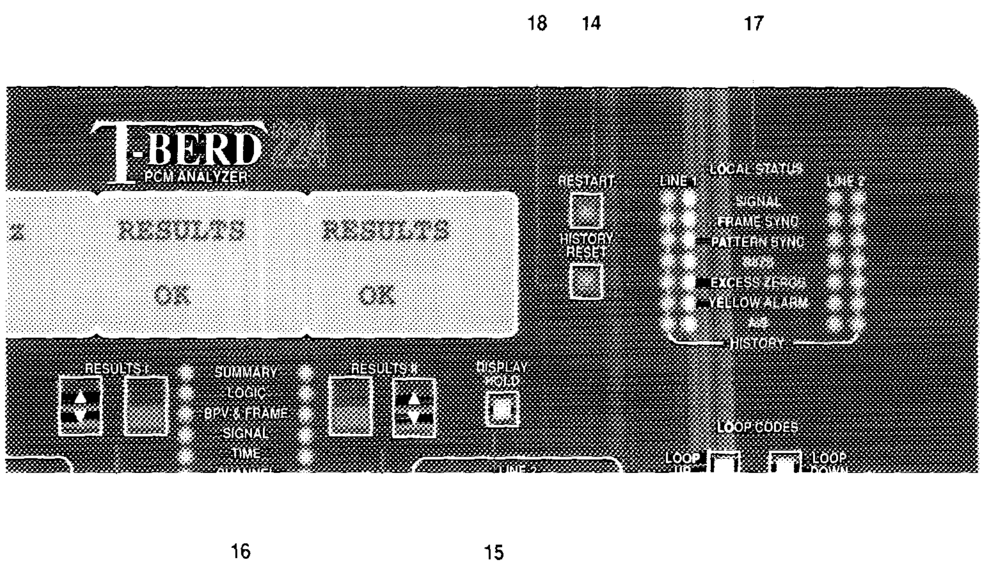
These two turret-type posts provide 2-wire test access to a digitally encoded VF channel. Using an external butt set, users can connect to the interface, dial DTMF digits, and talk to another party.

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 MAINFRAME AND T1 BERT OPTION— 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).



- **RESTART** switch (14)
- **DISPLAY HOLD** switch (15)
- **RESULTS** switches (16)
- Local Status LEDs (17)
- **HISTORY RESET** switch (18)

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**, **CHANNEL FORMAT**, **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

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, a test restart can be performed, and a results printout can be generated to give 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.

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 1 or 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 results 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.

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

Local Status LEDs

Four columns of LEDs, two columns for LINE 1 and two columns for LINE 2, indicate each T1 input's status. 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 the T-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 LINE 2) 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 or LINE 2) 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.

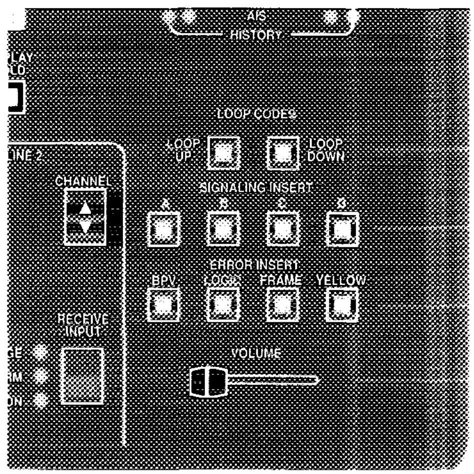
AIS – This red LED illuminates when the T-BERD 224 detects an AIS signal. The LED indicates on which receive input (LINE 1 or LINE 2) the AIS signal is detected. The red History LED illuminates when AIS is no longer detected.

HISTORY RESET Switch

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 MAINFRAME AND T1 BERT OPTION — TROUBLESHOOTING CONTROLS

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



22

LOOP CODES switches
SIGNALING INSERT switches
ERROR INSERT switches
VOLUME control

LOOP CODES Switches

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 timeout 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 timeout 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.

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.

ERROR INSERT Switches

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 AUX 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 syncronization 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 repeatered 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.

VOLUME Control

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 MAINFRAME AND T1 BERT OPTION — 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).

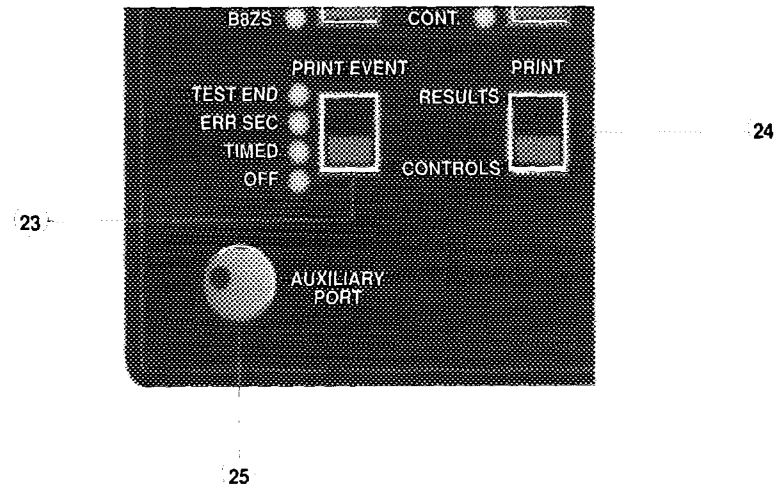


Figure 3-7
Printer Controls

- **PRINT EVENT** switch (23)
- **PRINT** switch (24)
- AUXILIARY PORT (25)
- Printer/Remote RS-232 Connector

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 a BPV, 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.

PRINT Switch

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.

AUXILIARY PORT

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.

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 T-BERD 224 to an external printer, terminal, modem, computer, or other asynchronous communications equipment. The AUX 08 RS 232 function sets up the interface.

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

FRACTIONAL T1 OPTION

Introduction

Test Setup

3.7 FRACTIONAL T1 OPTION — INTRODUCTION
T1 BERT Option Requited

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.

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 FRACTIONAL T1 OPTION — TEST SETUP

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

- **MODE** switch
- **CHANNEL FORMAT** switch
- **SOURCE CONFIGURATION I** switch
- **SOURCE CONFIGURATION II** switch
- **AUX** switch

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, 1 IN 8, 3 IN 24, 1:7, 63, 511, 2047, DDS1, DDS2, DDS3, DDS4
SCII	N = 1-24, NON CONTIG

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.

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.

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. This pattern

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...

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.

SOURCE CONFIGURATION II Switch

When the **CHANNEL FORMAT** 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.

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 DDS OPTION — 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.

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

3.10 DDS OPTION — TEST SETUP

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

- **MODE** switch
- **CHANNEL FORMAT** switch
- **SOURCE CONFIGURATION I** switch
- **SOURCE CONFIGURATION II** switch
- **AUX** switch

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 DS019.2 DS0A56 DS064	DS0B2.4	DS0B4.8	DS0B9.6

CHANNEL FORMAT 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 COR and AUX 19 DDS CHN functions are applicable.

DS019.2 — Use when monitoring or testing DS0A-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 being received, the All Ones pattern is placed in bytes 1, 4, and 5. AUX 19 DDS CHN function is applicable. Subrate frame synchronization must be acquired before the T-BERD 224 will insert test data.

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

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. This pattern

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...

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.

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

DS0 INTF (DS0 Interface) — Enables the side panel's 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.

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 **CHANNEL FORMAT** 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 DDS DS0B channels to analyze. The remaining 4, 9, or 19 DDS DS0B channels are unaffected.

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 DDS OPTION — RESULTS VERIFICATION

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

RESTART Switch

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

3.12 DDS OPTION — TROUBLESHOOTING CONTROLS

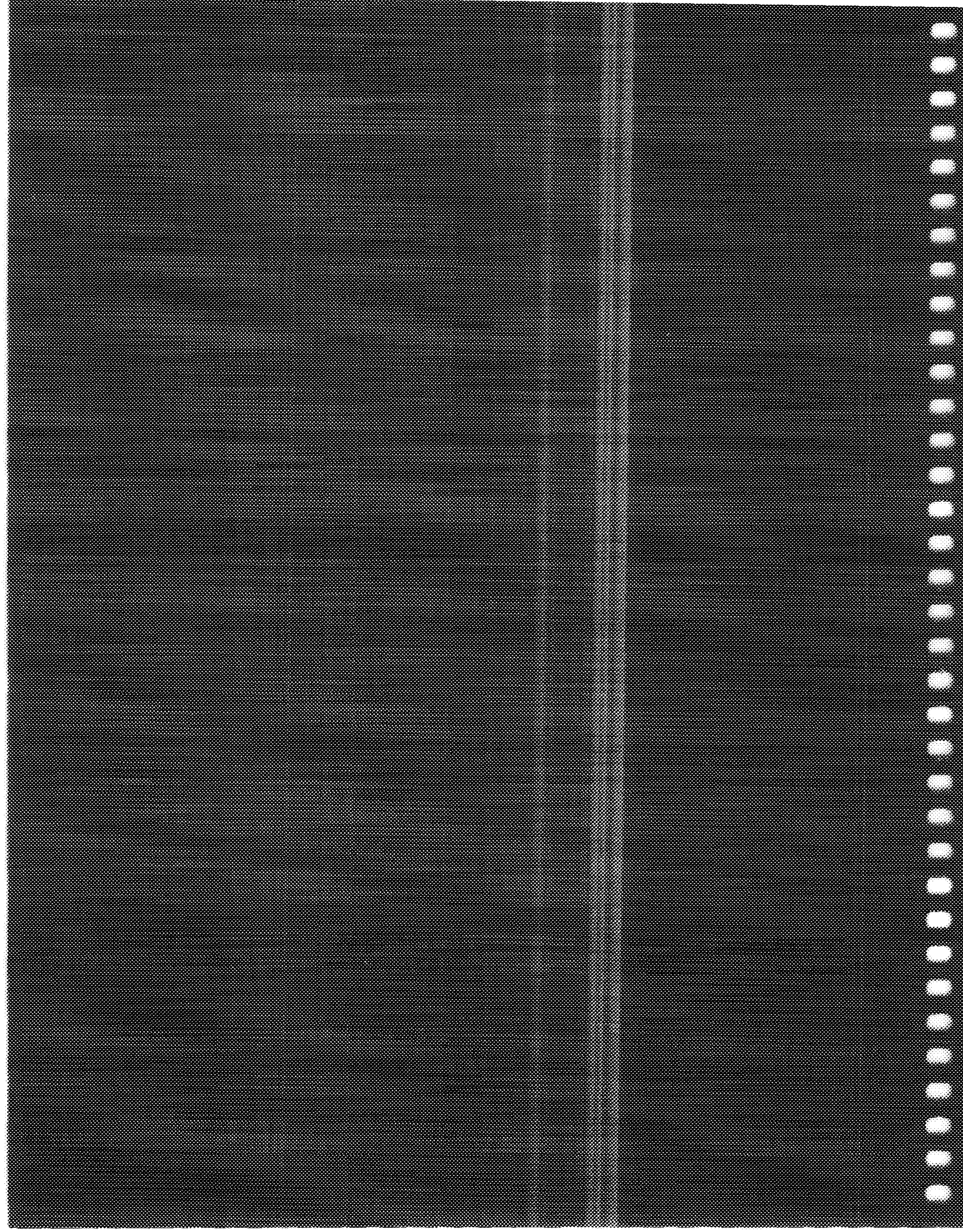
The following troubleshooting control is affected by the DDS Option.

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 errors can be inserted.

SLC OPTION

Introduction
Test Setup
Results Verification
Troubleshooting Controls



3.13 SLC OPTION — 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:

- **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 SLC Option — 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 Office Terminating 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 SLC OPTION — TEST SETUP

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

CHANNEL FORMAT switch
SOURCE CONFIGURATION I switch
SOURCE CONFIGURATION II switch

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[1]
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.

CHANNEL FORMAT Switch

In addition to the mainframe and T1 BERT Option channel formats, the following are 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 the following functions.

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 ALRM — 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).

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 SLC OPTION — RESULTS VERIFICATION

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

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.

Local Status LEDs

Yellow Alarm LED

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

3.16 SLC OPTION — TROUBLESHOOTING CONTROLS

The following troubleshooting controls are affected by the SLC Option.

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

Channel Unit Type	Customer State	Bits Sent To the LDS A	Bits Sent To the LDS B	Bits Sent To the RT A	Bits Sent To the RT B	Channel State
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 Battery	0	0	0	0	Loop Open
	Reverse Battery	1	1	1	1	Loop Closure

ESF OPTION

Introduction

Test Setup

Troubleshooting Controls

3.17 ESF OPTION — 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:

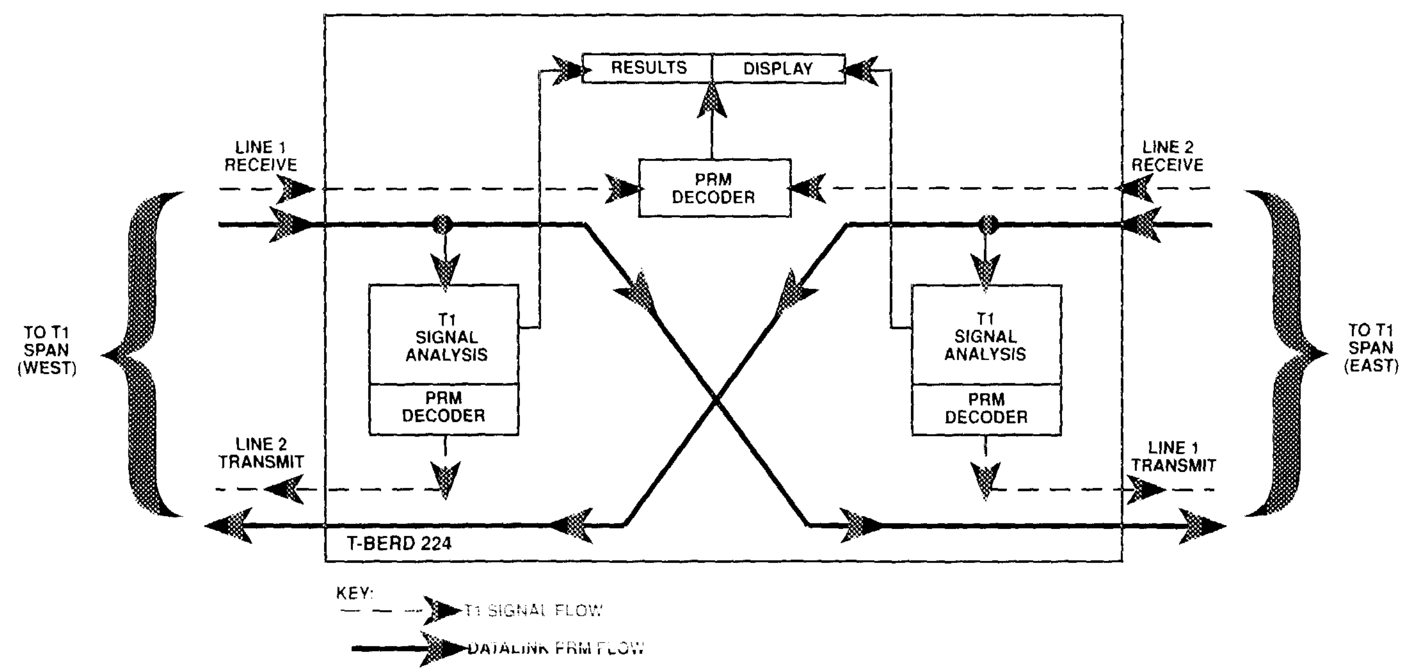
- Displays the ESF (4 kb/s) and ESFz (2 kb/s) datalink ANSI T1.403 PRMs.
- Enables the T-BERD 224 to transmit ESF datalink bit oriented protocol (BOP) command response messages.
- Enables the T-BERD 224 to transmit and respond to out-of-band datalink loop codes if the T1 BERT Option is installed.
- Enables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

3.17.1 ESF Option — Functional Description

When the T-BERD 224 is connected to the ESF datalink and the AUX 20 PRM TX 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 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.


TO T1
SPAN
(WEST)
LINE 1
RECEIVE
LINE 2
TRANSMIT
T1
SIGNAL
ANALYSIS
PRM
DECODER
RESULTS
DISPLAY
PRM
DECODER
T1
SIGNAL
ANALYSIS
PRM
DECODER
LINE 2
RECEIVE
LINE 1
TRANSMIT
TO T1
SPAN
(EAST)
T-BERD 224
KEY:
T1 SIGNAL FLOW
DATALINK PRM 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 ESF OPTION — TEST SETUP

Switch	Configuration
MODE	T1-ESF
CHANNEL FORMAT	DATALINK

MODE Switch

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

CHANNEL FORMAT Switch

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

DATALINK — 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 ESF OPTION — TROUBLESHOOTING CONTROLS

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.

VF OPTION

Introduction

Test Setup

3.20 VF OPTION — INTRODUCTION
DSP Board Required

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.

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

3.21 VF OPTION — TEST SETUP

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

- **CHANNEL FORMAT** switch
- **SOURCE CONFIGURATION I** switch
- **SOURCE CONFIGURATION II** switch
- **AUX** switch

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	

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 circuits without disrupting the channel's 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.

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, VF 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's 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's 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 — Transmits one of three frequencies at an output level set in the LEVEL source configuration. This test obtains a quick measure of a channel's 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.

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

SDS

3.22 SIGNALING OPTION — INTRODUCTION
DSP Board Required

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 Dial Tone Multifrequency (DTMF), Multifrequency (MF), or Dial Pulse (DP) digits to switches/PBXs to test the switching equipment's 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.

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.

3.22.1 Signaling Option — 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.

3.23 SIGNALING OPTION — TEST SETUP

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

CHANNEL FORMAT switch
SOURCE CONFIGURATION I switch
SOURCE CONFIGURATION II switch
TEST switch
AUX switch
Signaling Keypad Lid

CHANNEL FORMAT 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.

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

SIGNLNG

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

MAN DTMF - Manual Dual Tone Multi-Frequency — The T-BERD 224 transmits DTMF digitsfrom 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 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 digits 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 timeout occurs, the T-BERD 224 resumes scanning the selected channels for channel seizure. The AUX 29 SCANSET function selects the timeouts 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 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, the T-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.

SWI-56

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

MAN DTMF - Manual Dual Tone Multi-Frequency — The T-BERD 224 transmits DTMF digitsfrom 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 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 **CHANNEL FORMAT** 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 to ON to disable any echo suppressers present.

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.

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.

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

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

Signaling Keypad Lid

The Signaling Option includes a Keypad Lid. The Keypad Lid is used to edit dial and receive signaling sequences, manually dial, and analyze test result sequences (see Figure 3-9).

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.

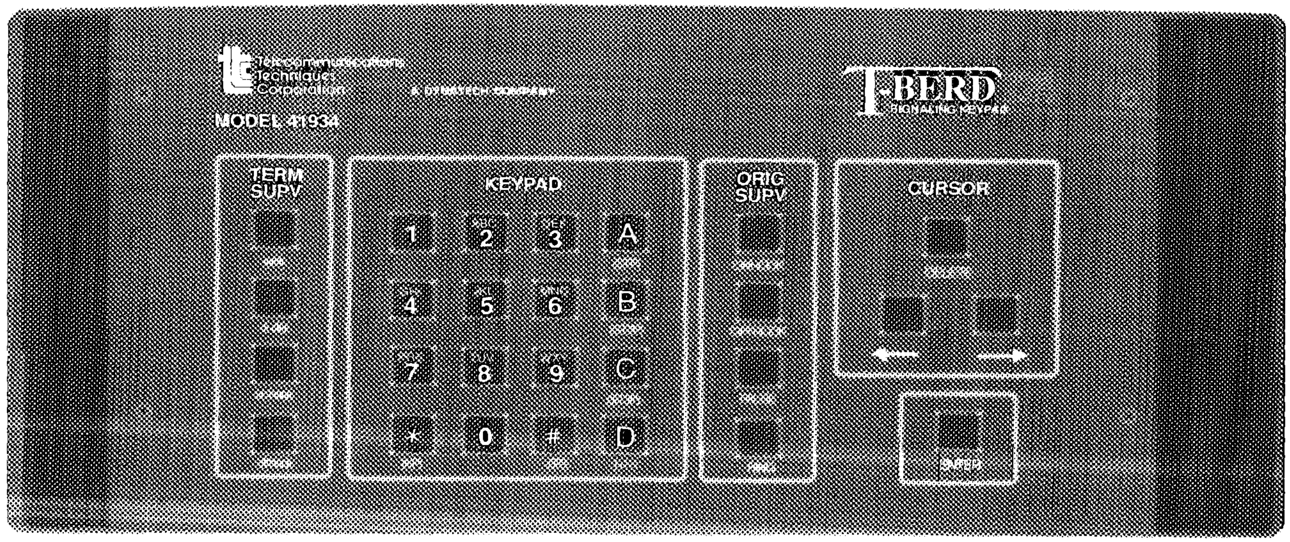


Figure 5-9
Signaling Keypad

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 from 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.

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.

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.

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.

ENTER

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

3.24 SIGNALING OPTION — CIRCUIT CONNECTION

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

DROP (RX) Switch

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

INSERT (TX) Switch

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

CHANNEL Switches

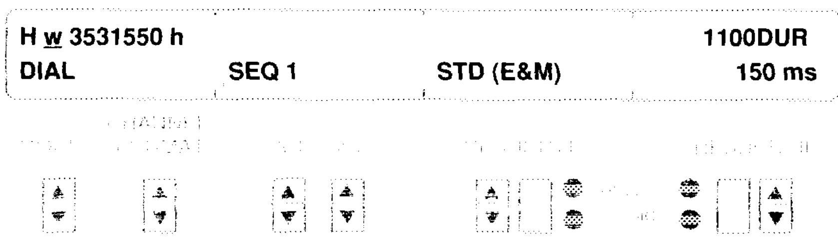
When the T-BERD 224 is configured to SCAN the **CHANNEL** switch number is displayed as "– – —". The T-BERD 224 controls the channel selection. After a channel is seized, the channel number is displayed. The channel number is always the same for LINE 1 and LINE 2.

3.25 SIGNALING OPTION — RESULTS VERIFICATION

The Signaling Option adds five new results to the CHANNEL category: n100 DELAY, n101 DUR, n102 ADDR, n104FQ/LVL, and n105FQ/LVL. The n104FQ/LVL and n105FQ/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



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.

3.26 SIGNALING OPTION — TROUBLESHOOTING CONTROLS

The following troubleshooting controls are affected by the Signaling Option.

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.

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.

ERROR INSERT Switches

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

VOLUME

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

3.27 SIGNALING OPTION — 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.

FTCL

LEVEL 2 PROTOCOL MONITOR OPTION

Introduction

Test Setup

Results Verification

3.28 LEVEL 2 PROTOCOL MONITOR OPTION — INTRODUCTION
DSP Board Required

The T-BERD 224 Level 2 Protocol Monitor Option enables the T-BERD 224 to non-intrusively monitor level 2 protocol signaling packets in Signaling System 7 (SS7) and Primary Rate Integrated Services Digital Network (PRI ISDN) systems. The T-BERD 224 Level 2 Protocol Monitor Option provides the following features and capabilities:

- Accesses the SS7/ISDN facility link from any T1 access point.
- Non-intrusively monitors SS7 and ISDN primary rate links.
- Quickly retrieves and displays link status information.
- Isolates transmission and protocol problems between SSP, STP, and SCP components.
- Sectionalizes transmission problems on the link.

3.28.1 Level 2 Protocol Monitor Option — Functional Description

SS7 and PRI ISDN protocols transmit signaling information using an HDLC packet format. However, each protocol uses a different method for packeting the signaling information; SS7 uses CCITT standard Q.700 and ISDN uses CCITT standard Q.931. 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.

3.29 LEVEL 2 PROTOCOL MONITOR OPTION — TEST SETUP

The following test setup controls are affected by the Level 2 Protocol Monitor Option (see Table 3-11):

CHANNEL FORMAT switch
SOURCE CONFIGURATION I switch

Switches	Configuration	
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1-ESF, T1-SLC96, SLC-D1D, T1-TLB, T1-LLB	
CHANNEL FORMAT	PROTOCOL	
SCI	SS7 MON	ISDN MON

CHANNEL FORMAT Switch

In addition to the mainframe channel format selections, the Level 2 Protocol Monitor Option adds the following:

PROTOCL — Configures the T-BERD 224 to monitor SS7 or ISDN primary rate links. this channel format is available in all framed modes.

SOURCE CONFIGURATION I Switch

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

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

ISDN MON — Monitor primary rate ISDN signaling and messaging link information on a 64 kb/s DDS link.

3.30 LEVEL 2 PROTOCOL MONITOR OPTION — RESULTS VERIFICATION

The Level 2 Protocol Monitor Option adds the following SS7 and ISDN test results to the CHANNEL category.

SS7 Test Results

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 MSUs
Message Signal Units — The count of error free MSU packets detected since test restart. MSUs contain messages and useful information.

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.

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.

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 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 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.

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.

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.

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.

n LSSU Messages — Link Status Signal Unit Messages — Monitors SS7 link status. Messages (e.g., busy, processor outage, out of service, etc.) appear in the SUMMARY category.

ISDN Test Results

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 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 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 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.

The following alarm messages may appear in the SUMMARY category when monitoring SS7 protocol.

n BUSY STATUS	Busy Status Alarm
n EMRGNCY ALIGN STAT	Emergency Alignment Status Alarm
n NORMAL ALIGN STAT	Normal Alignment Status Alarm
n OUT OF ALIGNMENT	Out of Alignment Alarm
n OUT OF SERVICE	Out of Service Alarm
n PROCESR OUTAGE	Processor Outage Alarm

DSU-DP OPTION

3.31 DSU-DP OPTION — 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 224's DSU-DP.

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

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

3.32 DSU-DP OPTION — TEST SETUP

The following controls and indicators are affected by the DSU-DP Option (see Table 3-12).

CHANNEL FORMAT switch
SOURCE CONFIGURATION I switch
SOURCE CONFIGURATION II switch
CHANNEL switches
AUX switch

Switch	Configuration				
MODE	AUTO, T1-D1D, T1-D2, T1-D4, T1 ESF, SLC-D1D, SLC-M2, T1SLC96, T1 TLB, T1 LLB,				
CHANNEL FORMAT	DS0A2.4 DS0A4.8 DS0A9.6 DS019.2 DS0A56 DS064 DATLINK[1]	DS0B2.4	DS0B4.8	DS0B9.6	56xN[2] 64xN[2]
SCI	DSU-DP	DSU-DP	DSU-DP	DSU-DP	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.

CHANNEL FORMAT 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.

DS019.2 — 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 via the DSU-DP Option interfaces. Subrate frame synchronization must be acquired before the T-BERD 224 will insert test data. Data is inserted in bytes 2 and 3, while bytes 1, 4, and 5 pass through unaffected. AUX 11 ANL CHA function 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 a single customer's unformatted data is provided via the DSU-DP Option interfaces. 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 bits 1-7 (56xN) or bits 1-8 (64xN) of any combination of contiguous or non-contiguous 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.

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's DSU-DP Option interfaces (RS-232, V.35, RS-449) as the drop and insert source. Data is transmitted at the rate indicated in the CHANNEL FORMAT display.

SOURCE CONFIGURATION II Switch

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

When the **CHANNEL FORMAT** 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 **CHANNEL FORMAT** 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.

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.

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.

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.

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

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

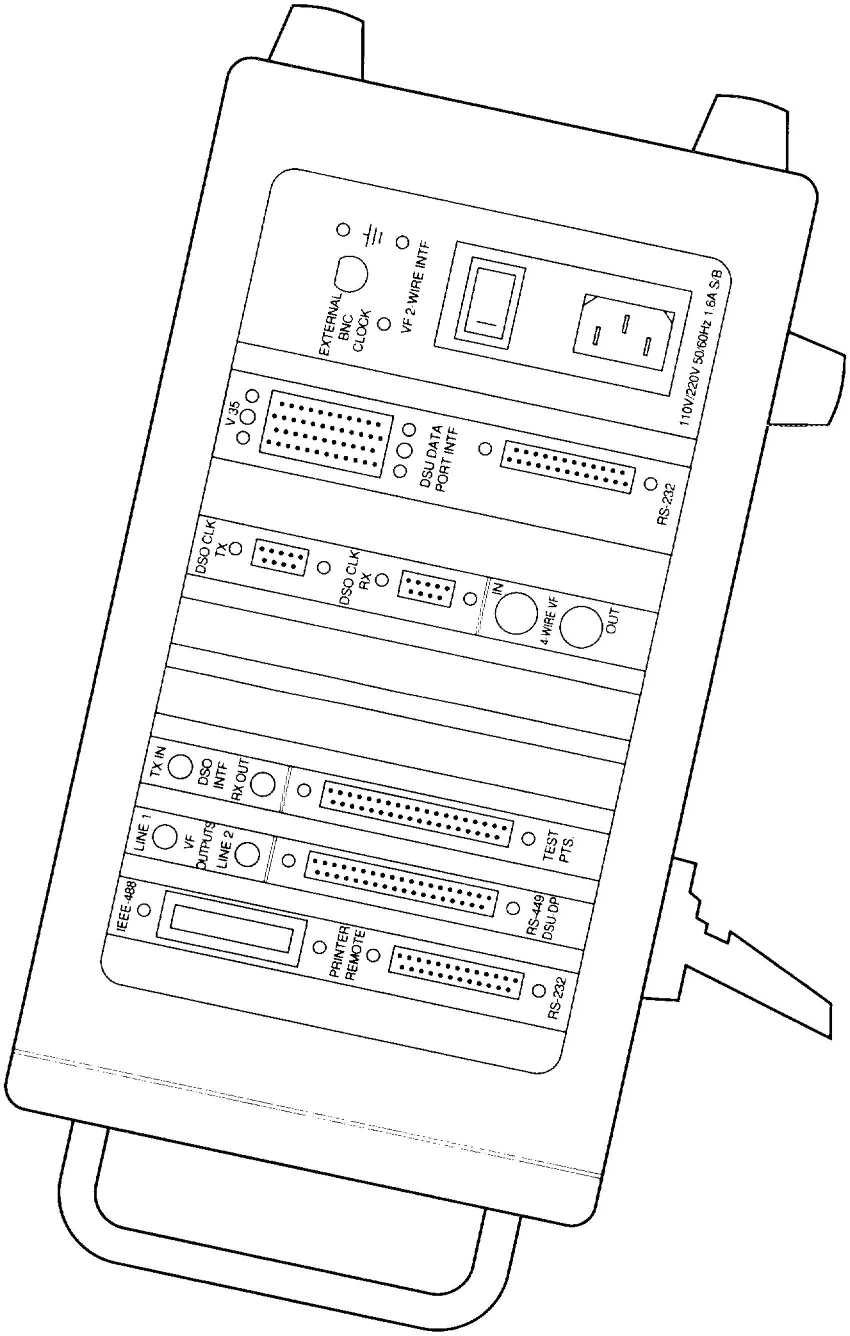


Figure 3-10
Side Panel Connector

3.33 DSU-DP OPTION — CIRCUIT CONNECTIONS

The DSU-DP Option's side panel connections are shown in Figure 3-10. 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.

3.33.1 Connection To A Protocol Analyzer

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 3-13. 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 3-14.

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

Interface	LINE 1 Pin Assignment(s)	LINE 1 Pin Name(s)	LINE 2 Pin Assignment(s)	LINE 2 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

Terminal Emulation On A DDS Circuit

The DSU-DP Option allows the T-BERD 224 to emulate a CSU/DSU/OCU combination. The test set inserts 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.

3.33.2 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.

Tables 3-15 through 3-17 provide detailed pinout assignments for cable connections to an external test set/DTE.

Table 3-15
RS-232 Male-to-Male Adaptor Cable

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

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)

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 OPTION

Introduction
Test Setup
Troubleshooting Controls

3.34 ZBTSI OPTION — 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.

3.34.1 ZBTSI Option — 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 seven-step process:

1. The data is combined with a psuedorandom 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.

3.35 ZBTSI OPTION — TEST SETUP

The following test setup controls are affected by the ZBTSI Option (see Table 3-18).

Switch	Configuration
MODE	T1-ESFz

MODE Switch

T1-ESFz — Configures the T-BERD 224 to transmit and receive ZBTSI encoded ESF framed T1 data. This 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 (**CHANNEL FORMAT** 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.

3.36 ZBTSI OPTION — TROUBLESHOOTING CONTROLS

The following troubleshooting controls are affected by the ZBTSI Option.

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.

4 AUXILIARY FUNCTIONS

SECTION 4
AUXILIARY FUNCTIONS

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 Functions

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 35 CUSTOM	Custom Results
IEEE-488 Option	
AUX 09 488MODE	IEEE-488 Mode and Address
T1 BERT Option	
AUX 09 488MODE	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 Code Type
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

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

VF Option

AUX 21 SWEEP	Sweep Parameters
AUX 22 VFBURST	VF Burst
AUX 23 PRT OPT	Print Option (Frequency Sweep)

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

4.2 AUXILIARY FUNCTIONS

The auxiliary functions are listed in numeric order. An example and description of each auxiliary function is provided.

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 CLEARED* flashes in the display when the print buffer is empty.

AUX 02 TIM PRI — 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 EVENT** 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.

AUX 03 TES LEN — 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.

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.

AUX 04 TIM/DAY — Clock Time and Date

AUX 04	**CLOCK TIME and DATE**		
TIM/DAY	**12 HRS**	**0 MINS**	**JAN 1**

The AUX 04 TIM/DAY function allows the user to set the real time clock and calendar date.

Press the **SOURCE CONFIGURATION II** switch to set the hour and the **RESULTS I Blank** switch set the minutes. The time is based on a 24-hour (military) clock.

Press the **RESULTS II Blank** switch up to set the month and the **RESULTS II Arrowed** switch down to set the day.

AUX 05 LBO — Line Build-Out Level

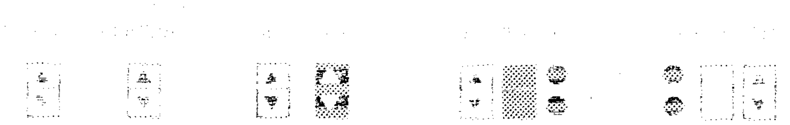
AUX 05	**LINE 1**	**LINE 2**
LBO	**0 dB**	**-15 dB**

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.

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's 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 is not present from the opposite line receiver, then the internal crystal oscillator is used as the transmit timing source.

This auxiliary function does not affect the T1 TLB, T1 LLB, and AUTO modes, where only recovered timing is used.

AUX 07 DS0 TM — DS0 Interface Timing

AUX 07	**DS0 INTERFACE TIMING**
DS0 TM	**COMMON**

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.

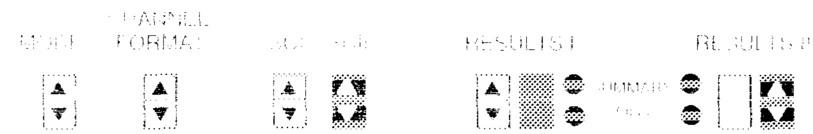
COMMON — Configures the two side panel DS0 clock connectors to provide identically phased clocks. This setting is used when timing slips do not occur between the two T1 inputs.

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.

AUX 08 RS 232 — Printer/Remote RS-232

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's 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.

AUX 09 488MODE — IEEE-488 Mode and Address

AUX 09	**IEEE-488**	**MODE and ADDRESS**	
488MODE	**ADDR:**	**0**	**SRQ: ON**

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.

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.

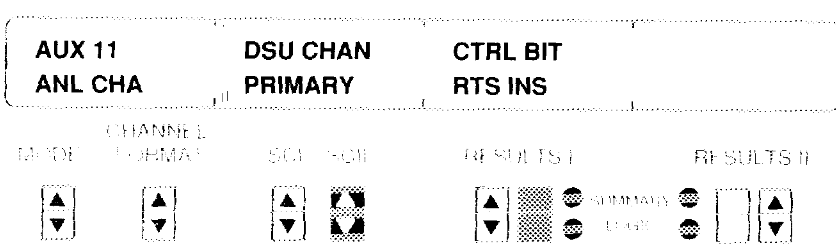
Press the **SOURCE CONFIGURATION II** switch to select the T1 LINE input to be configured for non-contiguous channels, L1 (LINE 1) or L2 (LINE 2).

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 causes a test restart.

AUX 11 ANL CHA — DSU-DP Analysis Channel



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.

PRIMARY — 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.

If the T-BERD 224 is configured to test DS0A2.4, DS0A4.8, DS0A9.6, DS019.2, DS0A56, DS0B2.4, DS0B4.8, or DS0B9.6, changing the auxiliary function causes a test restart.

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.

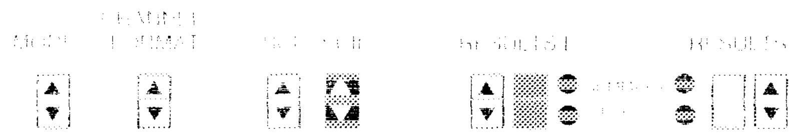
Press the **SOURCE CONFIGURATION II** switch to choose whether DS0A error correction is ON or OFF.

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.

AUX 13 ERR RT — BPV and Logic Error Insert Parameters

AUX 13	**ERROR RATE**	**ERROR TYPE**
ERR RT	**1.0 E-6**	**SINGLE**



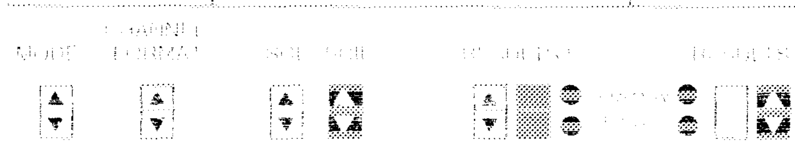
The AUX 13 ERR RT function selects the BPV and logic error insertion, type, rate, and burst length for the **BPV** and **LOGIC ERROR INSERT** switches.

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 ms**



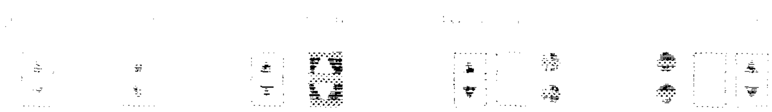
Press the **RESULTS II Arrowed** switch to set the BURST LEN from 20 ms to 5.0 sec. The burst length is incremented as follows:

20 ms to 170 ms in 50 ms steps.
170 ms to 200 ms in 30 ms steps.
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.

AUX 14 FRM ERR — Consecutive Frame Error Insertion

AUX 14	**FRAME ERROR INSERT**
FRM ERR	**SINGLE**



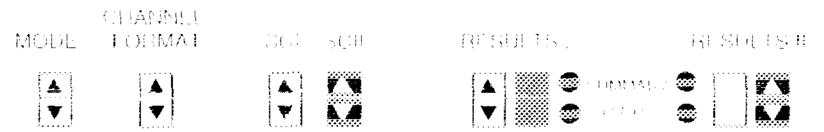
The AUX 14 FRM ERR function selects the number of consecutive frame errors inserted into the T1 framing pattern when the **FRAME ERROR INSERT** switch is pressed. When the **FRAME ERROR INSERT** switch is pressed, the Ft bits in T1-D1D, T1-D2, T1-D4, T1SLC96, and SLC-D1D framing modes and the FPS bits 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.

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 a 3- 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.

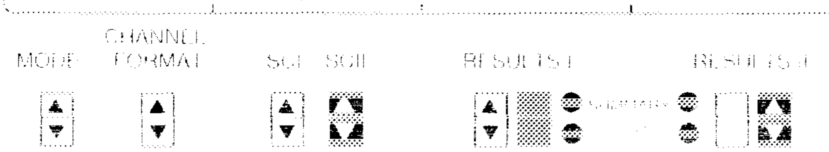
Press the **SOURCE CONFIGURATION II** switch up to change the current bit to a 1 or down to change the current bit to a 0. Changing the value of the bit moves the cursor to the right.

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.

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 **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 **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.

AUX 17 LOOP CD — Loop Code Type

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 and smart jacks, the channel format must be set to FULL T1.

Press the **SOURCE CONFIGURATION II** switch to select either T1, DDS-ALT, or DDS-LAT as the TYPE of loop code transmitted.

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 Codes

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.

AUX 18 AUT RES — Automatic T1 Loop Code Response

AUX 18	**AUTO RESPONSE TO T1 LOOP CODES**
AUT RES	**NO RESP**

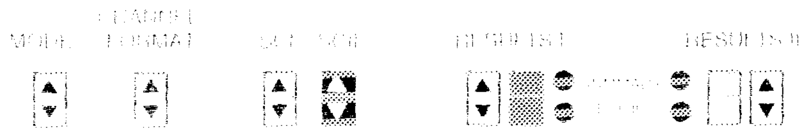
The AUX 18 AUT RES function determines whether the T-BERD 224 enters an automatic line loopback (AUTO LLB) mode in response to a received in-band or out-of-band T1 loop code. The instrument only responds to the T1 loop codes matching the code selected from the AUX 17 LOOP CD function.

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-PAY loop code. The FT1 LLB mode indicates the T-BERD 224 has responded to a loop code (probably V.54) 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, 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.

AUX 19 DDS CHN — DDS Analysis Channel and Secondary Channel Pattern

AUX 19	**TRANSMIT**	**ANALYZE**	
DDS CHN	**PRIMARY**	**PRIMARY**	



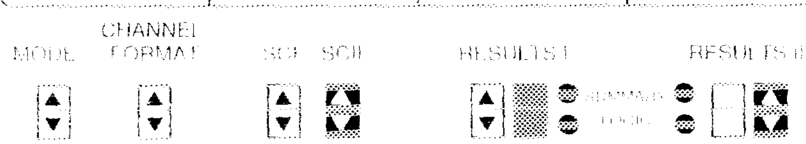
The AUX 19 DDS CHN function determines how the T-BERD 224 tests the DDS primary and secondary channel data.

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 CH PAT (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 4-3 indicates the possible transmit, analysis, and secondary channel pattern configurations.

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.

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.

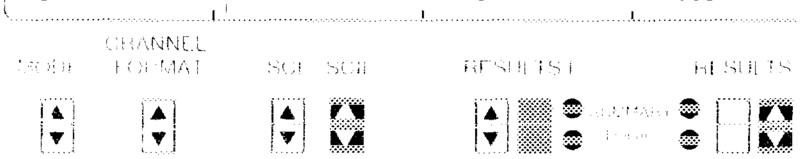
AUTO — The T-BERD 224 automatically determines whether it should transmit PRM. The LINE 1 and LINE 2 datalinks are tested to determine which received datalink is active or inactive. An inactive datalink is defined as idle, e.g., the line receiver is not connected to the circuit, or a Bit-Oriented Protocol (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.

AUX 21 SWEEP — Frequency Sweep Parameters

AUX 21	***END-POINT**	**START**	**STOP**
SWEEP		**100 Hz**	**2500 Hz**



* Indicates this is one of three possible selections.

The AUX 21 SWEEP function allows the user to set the Frequency Sweep parameters.

Press the **SOURCE CONFIGURATION I** switch to selects 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**

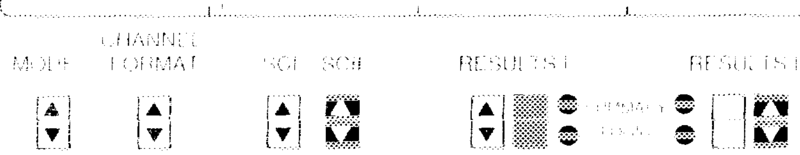
STEP selects the step size and time spent at each frequency (STEP-SIZE and STEP-INTVL). Press the **RESULTS I Blank** switch to modify the STEP-SIZE frequency from 10 Hz to 1000 Hz. Press the **RESULTS II Arrowed** switch to modify the STEP-INTVL (Frequency Step Interval) from 1.5 seconds to 9.9 seconds.

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.

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 the VF 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.

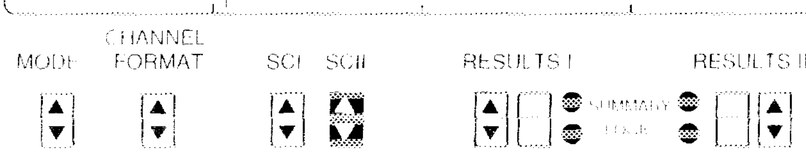
Press the **SOURCE CONFIGURATION II** switch to toggle between burst ON and burst OFF.

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.

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 12
  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

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 SW1-56 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

LOOP START — Enables the T-BERD 224 to emulate or monitor standard signaling between a telephone and a 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).

AUX 25 DIG MAR — Digit Margining (Interdigit Timing)

The AUX 25 DIG MAR function defines the parameters of the DTMF/MF, and DP digits.

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.

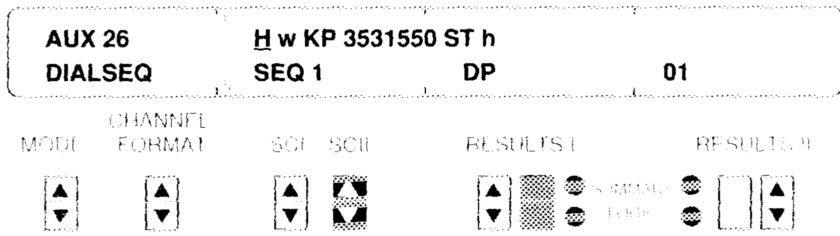
DP - - Dial Pulse

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

AUX 26 DIAL SEQ — Dial Sequence



The AUX 26 DIAL SEQ function, which supports the SIGNLNG and SWI-56 modes, allows users to program and store up to ten different digit sequences. The sequences define the events and digits the T-BERD 224 transmits and the events expected in response. The digit sequences can be 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 selected digits.

Signaling Keypad Lid — Use the Signaling Keypad Lid 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.

AUX 27 REC SEQ — Receive Sequence

AUX 27	H w 07 h		
REC SEQ	SEQ 1	AUTO	01

The AUX 27 REC SEQ function, which supports the SIGNLNG and SWITCH 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 the T-BERD 224 automatically determines the digit type.

Signaling Keypad Lid — Use the Signaling Keypad Lid 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.

AUX 28 SPV DEF — Transmit Supervision

AUX 28	SUP EVENT	DELAY	DURATION
SPV DEF	WINK	70 ms	200 ms

The AUX 28 SPV DEF function 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.

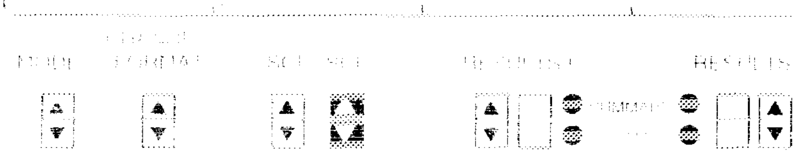
The WINK DELAY ranges between 50 ms and 1 second.
The DELAY DIAL DELAY ranges between 30 ms and 16 seconds.

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.

AUX 29 SCANSET — Channel Signaling Scan Setting

AUX 29	*CHAN 1↑/0↓	FWD↑/REV↓		
SCANSET	110111	100011	100011	111100



* Indicates this is one of two possible selections.

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 only appears when the SIGNLNG channel format and SCAN source configuration are selected (Signaling Option required).

Press the **SOURCE CONFIGURATION I** switch to select either the CHANnel selection display or the TIMEOUT display.

CHAN — Press the following switches to set the flag for the channels to be scanned. The bits or flags (1 or 0) represent the DS0 channels 1 to 24 from left to right in the display.

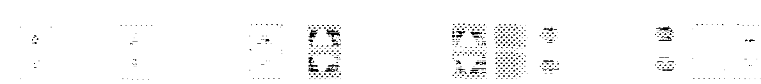
AUX 29	***CHAN 1↑/0↓**	**FWD↑/REV↓**	
SCANSET	**110111**	**100011 100011**	**111100**

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 timeouts.

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.

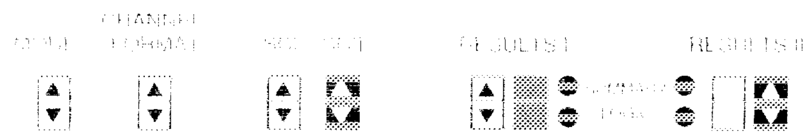
Press the **RESULTS I Blank** switch to select the timeout duration for either timeout function.

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.

AUX 30 MJU — MJU Controls

AUX 30	**OPERATION**	**BRANCH**	**HUB ID**
MJU	**SELECT**	**1**	**SEND?**



AUX 30 MJU allows the user to control DDS MJU's. 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.

AUX 35 CUSTOM — CUSTOM Results

AUX 35	***CHANNEL**
CUSTOM	**ALL**

* Indicates that this is one of six possible selections

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.

Press the **SOURCE CONFIGURATION I** switch to select the category from which the results will be chosen from: **LOGIC**, **BPV/FRAME**, **SIGNAL**, **TIME**, **CHANNEL**, or **ALARMS**.

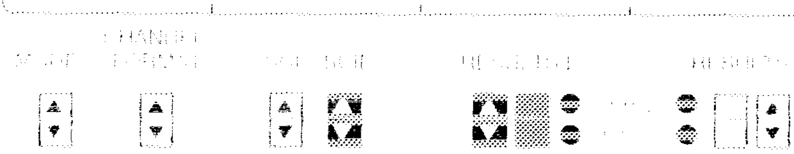
Press the **SOURCE CONFIGURATION II** switch to select the condition of the category.

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.

AUX 35	***CHANNEL**	**180 RCV BYT**
CUSTOM	**SELECT**	**ENABLED**



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

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 .

3 TEST RESULTS

SECTION 5
TEST RESULTS

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.

The following lists the results by category and the option that makes them available.

SUMMARY Category

n00BIT ERR	T1 BERT	n09PAT SLP	T1 BERT
n17F FR ES	Enhanced ESF/SLC	n18F F SES	Enhanced ESF/SLC
n19F BPV S	Enhanced ESF/SLC	n20F SLP S	Enhanced ESF/SLC
n22F CRC E	Enhanced ESF/SLC	n25 BPVS	Mainframe
n30FRM ERR	Mainframe	n32CRC ERR	Mainframe
n34FRM LOS	Mainframe	n40RX FREQ	Mainframe
n51TM SLIP	Mainframe	n96DDS F E	DDS
n ER PKCRC	Level 2 Protocol	n DISC PKTs	Level 2 Protocol
n NACKs	Level 2 Protocol		
RESULTS OK	Mainframe	*RESULTS UNAVAIL*	Mainframe
POWER LOSS	Mainframe	*NOT B8ZS COMPATIBLE*	Mainframe
n 1's DENS VIOLATED	Mainframe	*FAILED PAT xxxxx*	Mainframe
n MAINT HOOK/SEIZE	Enhanced ESF/SLC	*MAINT PROCEED*	Enhanced ESF/SLC
n MAINT TEST ALRM	Enhanced ESF/SLC	*DATLINK SYNC LOSS*	Enhanced ESF/SLC
n FE LOOP PROTECTION	Enhanced ESF/SLC	*n FE LOOP SHELF (x)*	Enhanced ESF/SLC
n SLC ALM (x) ON PROT	Enhanced ESF/SLC	*n SLC ALARM MAJOR*	Enhanced ESF/SLC
n SLC ALARM MINOR	Enhanced ESF/SLC	*n SLC ALM POWER/MISC*	Enhanced ESF/SLC
n SLC ALM SHELF (x)	Enhanced ESF/SLC	*SW PROT FAILED*	Enhanced ESF/SLC
n BUSY STATUS	Level 2 Protocol	*n EMRGNCY ALIGN STAT*	Level 2 Protocol
n NORMAL ALIGN STAT	Level 2 Protocol	*n OUT OF ALIGNMENT*	Level 2 Protocol
n OUT OF SERVICE	Level 2 Protocol	*n PROCESR OUTAGE*	Level 2 Protocol
B8ZS DETECTED	Mainframe		

LOGIC Category

n00BIT ERR	T1 BERT	n01ASYN ES	T1 BERT
n04 BER	T1 BERT	n05 EFS	T1 BERT
n06 % EFS	T1 BERT	n07 SYN ES	T1 BERT
n08OOS SEC	T1 BERT	n09PAT SLP	T1 BERT
n10 SES	G.821 Performance Analysis	n11 % SES	G.821 Performance Analysis
n12 DEG MN	G.821 Performance Analysis	n13 % DEGMN	G.821 Performance Analysis
n14 UNAV S	G.821 Performance Analysis	n15 % AVLBL	G.821 Performance Analysis
n16 CSES	G.821 Performance Analysis		

BPV & FRAME Category

n17F FR ES	Enhanced ESF/SLC	n18F F SES	Enhanced ESF/SLC
n19F BPV S	Enhanced ESF/SLC	n20F SLP S	Enhanced ESF/SLC
n21PRM TIM	Enhanced ESF/SLC	n22F CRC E	Enhanced ESF/SLC
n F SI CRC	Enhanced ESF/SLC	n F LO CRC	Enhanced ESF/SLC
n F MD CRC	Enhanced ESF/SLC	n F MH CRC	Enhanced ESF/SLC
n F HI CRC	Enhanced ESF/SLC	n F SV CRC	Enhanced ESF/SLC
n23PAY SRC	Enhanced ESF/SLC	n25 BPVS	Mainframe
n26BPV SEC	Mainframe	n27 BPV RT	Mainframe
n28 FRM ES	Mainframe	n29FRM SES	Mainframe
n30FRM ERR	Mainframe	n31FRM ERT	Mainframe
n32CRC ERR	Mainframe	n33 CRC ES	Mainframe
n34FRM LOS	Mainframe	n35FR LS S	Mainframe
n36CRC SES	Mainframe	n37CRC ERT	Mainframe

SIGNAL Category

n40RX FREQ	Mainframe	n41 RX LVL	Mainframe
n42 RX LVL	Mainframe	n43 RX LVL	Mainframe
n50SPX CUR	T1 BERT	n51TM SLIP	Mainframe
n52SLP SEC	Mainframe	n53 DELAY	T1 BERT
n55 TRAFFIC	Mainframe	n56 TRAFFIC	Mainframe
n110 ALRM	Mainframe		

TIME Category

n70SG LS S	Mainframe	n71ALM SEC	Mainframe
72TST LEN	Mainframe	n73ELAP TM	Mainframe
74TST END	Mainframe	75 TIME	Mainframe
76 DATE	Mainframe	n79SLC AS	Enhanced ESF/SLC

CHANNEL Category

n80RCV BYT	DDS	n81VF FREQ	Mainframe
n82 VF LVL	Mainframe	n84 3KFLAT	VF Testing
n85 3K NCH	VF Testing	n86 C-MSG	VF Testing
n87 C-NCH	VF Testing	n88 S/N	VF Testing
n89 DC-OFF	VF Testing	n90 P/AR	VF Testing
n91 PAR LV	VF Testing	n92 ERL	VF Testing
n93 SRL-HI	VF Testing	n94 SRL-LO	VF Testing
n95 RCODE	DDS	n96DDS F E	DDS
n98% IN SRV	DDS	n100 DELAY	Signaling
n101 DUR	Signaling	n102 ADDR	Signaling
n104FQ/LVL	Digit Analysis	n105FQ/LVL	Digit Analysis
n PACKETS	Level 2 Protocol Monitor		
n MSUs	Level 2 Protocol Monitor	n FISUs	Level 2 Protocol Monitor
n LSSUs	Level 2 Protocol Monitor	n ER PKCRC	Level 2 Protocol Monitor
n PKT ES	Level 2 Protocol Monitor	n DISC PKTs	Level 2 Protocol Monitor
n PKT ERT	Level 2 Protocol Monitor	n NACKs	Level 2 Protocol Monitor
n ER MSU	Level 2 Protocol Monitor	n %UTIL	Level 2 Protocol Monitor

5.2 SUMMARY CATEGORY

The SUMMARY category allows quick access to key non-zero and out-of-specification results without having to scroll through several categories. The results that appear in the SUMMARY category include:

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 Bits 1 through 6 are non-zero.

n25 BPVS

Bipolar Violations — A count of BPVs since the start of elapsed time (excluding intentional violations found within B8ZS codes).

n30FRM ERR

Frame Errors — A count of frame errors detected since initial frame sync or the last test restart. 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 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 sync 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 sync 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.

n96DDS 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.

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.

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.

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 BRIDG TAP or MULTIPAT pattern fails. **xxxxx** is the failed pattern.

The SLC-96 datalink maintenance and alarm messages are also displayed in the SUMMARY category with the Enhanced SLC and ESF 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 from the 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 two 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 bypass 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.

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 alarm 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 a shelf's 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.

The following messages only apply when the Level 2 Protocol Monitor Option is installed, and the PROTOCL channel format and SS7 MON source configuration are selected.

n BUSY STATUS

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

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.

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.

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

Bipolar violations and frame errors are available when monitoring T-Carrier spans that are transmitting live traffic or 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. 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 non-zero.

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).

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.

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 sync 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 sync 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 sync 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

Signal category results analyze the characteristics of the input signal.

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 V p-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.

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.

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 SEC

Slip Analysis Seconds — A count of test seconds during which Timing Slip Analysis occurred.

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.

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's 24 channels in 4 fields of 6 channels each.

NOTE: 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's 24 channels in 4 fields of 6 channels each.

NOTE: The TRAFFIC result uses the entire display window. To return to the normal display, press the appropriate **RESULTS Blank** or **Arrowed** switch.

The following test result is only available when the Enhanced ESF/SLC Option is installed.

n110ALRM

Alarm Field Format — Identifies the received SLC datalink alarm field format as either 13 bit or 16 bit.

5.6 TIME CATEGORY

Time-related measurements are available in this category.

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 is 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 format.

n79SLC A S

SLC Alarm Seconds — A count of seconds during which a SLC-96 Datalink Alarm was detected.

5.7 CHANNEL CATEGORY

Information on the selected channel is available in this category.

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.

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.

n84 3KFLAT

3 kHz Flat Noise — A measure of the noise (dBm) 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. A 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 PAR LV

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 - Low — The ratio (in dB) of the noise power transmitted for a shaped low frequency band to the power reflected by the terminated circuit.

n95 RCODE

Received DS0 Control Code — Displays the name of the received DS0 code identified in the n80 RCV BYT result.

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 SRV

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.

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.

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). Table 5-2 and 5-3 list the DTMF and MF tone frequencies.

n105FQ/LVL

Upper DTMF/MF Tone Frequency and Level — The upper DTMF/MF tone frequency (Hz) and signal level (dBm). Table 5-2 and 5-3 list the DTMF and MF tone frequencies.

n110 ALRM

Alarm Field Format — Identifies the received SLC datalink alarm field format as either 13 bit or 16 bit.

Table 5-1
Reportable DS0 Control Codes

Code ID	Control Byte	Description
ASC	x001 1110	Abnormal Station Code. Generated by the OCU due to a signal loss from the DSU/CSU or the DSU/CSU isn't attached.
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.
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.

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

Multifrequency Signals

Frequencies (Hz) 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 Operator Released	ST	ST

The following test results are only available when the Level 2 Protocol Monitor 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 or ISDNMON 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 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.

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 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 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 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 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 as 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.

8 PRINTER OPERATION

SECTION 6
PRINTER OPERATION

PRINTER OPERATION

6.1 COMPATIBLE PRINTERS

The T-BERD 224 can generate printouts to either 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.

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 Set-Up and Operation

To set up the lid printer for operation, perform the following steps.

1. **Attach the lid printer to the T-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 the 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 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 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.

AUX switch
Press to access auxiliary functions (LED ON).

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.

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.

PRINTER/REMOTE IEEE-488 Interface
Connect the printer to the T-BERD 224 with an appropriate cable.

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 Printouts

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.

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.

```
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-[illegible]
[illegible] Printout

SIGNALING PRINT 10:34:54 AUG 23

H w {MF} KP3531550ST h

Event	DEL ms	DUR ms	FRQ1 Hz	LVL1 dBm	FRQ2 Hz	LVL2 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 Controls Printouts

The controls printout lists the current setting of all front-panel switches and the auxiliary functions (see Figure 6-3). A controls printout is initiated manually by pressing the **PRINT** switch to the CONTROLS position.

6.6.4 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
```

```
 CONTROLS PRINT      08:22:07     JAN 09
MODE:        T1SLC96  CHAN FOR:         DS0  SOU 1:          BYTE  SOU 2:    00000000
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  DSOA 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:     100000
MJU OP:       SELECT  MJU BRANCH:         1  MJU HUB ID:
L1 N-CONTG:
L2 N-CONTG:
```

Possible messages are:

Alarm Messages

L1|L2 SIGNAL LOSS XX — 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.

Status Messages

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.

7 REMOTE CONTROL

SECTION 7
REMOTE CONTROL

REMOTE CONTROL

7.1 REMOTE CONTROL OPERATION

This section provides information on how to control the T-BERD 224 from a terminal or a computer. These devices can access the T-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 224's right-side panel. The PRINTER/REMOTE RS-232 connector is configured as Data Communication Equipment (DCE); so it can be directly connected to Data Terminal Equipment (DTE). Connection to another DCE is possible with an adaptor cable. Refer to Section 8 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 mode; terminal mode, remote mode, or computer mode.

In terminal mode, the T-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, echos 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

Tto allow the T-BERD 224 to communicate with the remote controller, it must be configured using the auxiliary functions (baud rate and parity).

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 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).

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 CONTROL* 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.

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.

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 identifies the T-BERD 224 that is attached to the terminal. User-defined prompts are not saved when the T-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 by the T-BERD 224, the message *UNDER REMOTE CONTROL* is no longer visible in display window and local control is restored.

7.3 IEEE 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 the T-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.

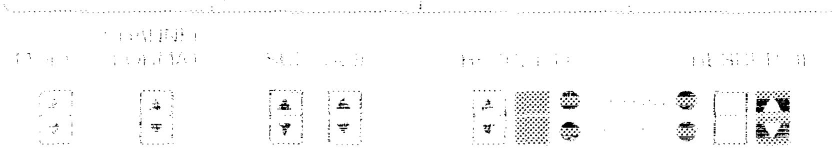
7.3.1 IEEE-488 Set-Up Procedure

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 IEEE-488 Remote Control Commands

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.

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 Sequence

The general format for any remote control command is:

command_name [parameter] or
command_name?

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.

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. For positive numbers, do not add "+" in front of it. The command name parameter string should always be followed by a carriage return or carriage return/line feed sequence.

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, however, that some commands (e.g., **CLS**) are *executable only* and have no current or changeable state.

7.4.2 Switch Commands Format

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 T-BERD 224 front panel and in the display.

Table 7-1 lists the switch commands with their equivalent front-panel switch names. Brackets to the right of the switch name indicate the command's associated parameters. The parameters associated with each command are fully described in Appendix H.

Table 7-1
Switch Commands

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 INSERT
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
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 Commands Format

Auxiliary commands control the functions associated with the T-BERD 224 auxiliary functions. Table 7-2 lists the auxiliary function commands with their equivalent AUX function names. Brackets to the right of the command name indicate the command has associated parameters. The parameters associated with each command are fully described in Appendix H.

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
CLEAR FIFO	AUX 01 CL FIFO
CLOck []	AUX 04 TIM/DAY
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 DS0 TM
DSU ANAlysis CHAnnel []	AUX 11 ANL CHA
DSUDp Bit 8 []	AUX 11 ANA CHA, PRIMARY CONTROL BIT
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

Command	Auxiliary Function
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) Commands Format

Control commands have no front panel or AUX equivalent. These commands are used to obtain information from the T-BERD 224 or to modify the remote control/printer protocol. Table 7-3 lists the control commands. Brackets to the right of the command name indicate the command has associated parameters. The parameters associated with each command are fully described in Appendix H.

Table 7-3
Control Commands

ALArms []	L1 RECeive SIGnal []
BEEp	L2 RECeive SIGnal []
CLS	LED
COMputer	LOCAL (/)
DEVICE CLEAR	MESsage []
DISplay []	PRInt SIGnal
ECHo []	PROmpt []
ERRor NUMber	RELease
FAR END LOOp []	REMote
FIRST Power Up	SETup
GTL	SLC ALArm
HELLO	SLC MAIntenance
HELP []	SUMmary
HOLD	TERminal ([illegible]

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.

SPECIFICATIONS

SECTION 8
SPECIFICATIONS

SPECIFICATIONS

8.1 GENERAL SPECIFICATIONS

8.1.1 Physical

Dimensions	
Without Lid:	6.5" H x 14.0" W x 11.0" D (16.51 cm x 35.56 cm x 29.21 cm).
With Lid:	6.5" H x 14.0" W x 14.2" D (16.51 cm x 35.56 cm x 36.07 cm).
Weight:	16.2 lbs. (7.3 kgs.).

NOTE: These dimensions are only for the base unit. This data should be used for reference purposes only.

8.1.2 Environmental Specifications

Operating Temperature Range:	32°F to 113°F (0°C to 45°C).
Storage Temperature Range:	-40°F to 158°F (-40°C to 70°C).
Operating Humidity:	90% maximum, noncondensing.
Storage Humidity:	5% to 95% noncondensing.
Power:	115/230 VAC ±10%.
Fuse:	1.6A, 250 V, Slo-Blo; (Littlefuse #21801.6, or equivalent).
Shock and Vibration:	Meets IEEE Standard 743 specifications.
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.

8.2 INPUT SPECIFICATIONS

Input Connectors:	2 WECO 310 jacks. 2 bantam jacks.
Input Frequency:	1,544,000 Hz ±5000 Hz.
Input Impedance:	BRIDGE — 1000 ohms or greater. TERM — 100 ohms ±5%. DSX-MON — 100 ohms ±5%.
Input Signal Level:	BRIDGE — +6 dBdsx to -35 dBdsx. ALBO compensates for cable loss characteristics. TERM — +6 dBdsx to -35 dBdsx. ALBO compensates for cable loss characteristics. DSX-MON — +6 dBdsx to -24 dBdsx. No ALBO provided; resistive loss compensation only.

8.3 OUTPUT SPECIFICATIONS

Output Connectors:	2 WECO 310 jacks. 2 bantam jacks.
Output Line Build-Out:	Selectable line build-out of 0 dB, -7.5 dB, or -15 dB is provided.
Pulse Shape:	With the output terminated into a 100 ohm resistive load and 0 dB line build-out selected, the T-BERD 224 meets the pulse shape specifications given in CCITT Recommendation G.703; Bell Publications CB113, CB119, and CB143 and AT&T PUB62508; and AT&T PUB62411.

Internal Oscillator Accuracy: 1.544 MHz, 5 ppm.

Line Codes: Bipolar (pseudoternary). Switch-selectable AMI or B8ZS.

8.4 MEASUREMENTS

8.4.1 T1 Frequency

Accuracy:	±5 ppm.
Resolution:	1 Hz.
T1 Range:	1,544,000 Hz, ±5000 Hz.

8.4.2 T1 Level

The designation dBdsx is a voltage measurement, with a 3-volt base-to-peak signal being defined as 0 dBdsx. Measurements for dBm are only available when unframed all ones (AIS) is detected.

dBdsx

Range:	+6 dBdsx to -40 dBdsx.
Accuracy:	±1 dBdsx from +6 dBdsx to -10 dBdsx.
	±2 dBdsx from -10 dBdsx to -20 dBdsx.
	±3 dBdsx from -20 dBdsx to -40 dBdsx.
Resolution:	0.1 dBdsx.

dBm

Range:	+23 dBm to -23.5 dBm.
Accuracy:	±1 dBm from +23 dBm to +7 dBm.
	±2 dBm from +7 dBm to -13.5 dBm.
	±3 dBm from -13.5 dBm to -23.5 dBm.
Resolution:	0.1 dBm.

V p-p

Range:	12.0 V p-p to 0.05 V p-p.
Resolution:	0.1 V (12.0 Vp-p to 1.0 Vp-p). 1mV (1.0 Vp-p to .05 Vp-p).

8.4.3 T1 Timing Slips

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 (>1,15[illegible] days).

8.4.4 VF Frequency

Range:	20 Hz to 3404 Hz at +3.0 dBm to -40 dBm. 3404 Hz to 3904 Hz at +3.0 dBm to [illegible] dBm.
Accuracy:	±0.5 Hz.
Resolution:	1 Hz.

8.4.5 VF Level

Range:	+3 dBm0 to -55 dBm0.
Accuracy:	+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. (300 Hz to 3000 Hz).
Resolution:	0.1 dBm0.

8.46 VF 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.

8.4.7 VF Transmitter — VF Option Installed

Frequency

Range:	20 Hz to 3904 Hz.
Accuracy:	±0.5 Hz.
Resolution:	1 Hz.

Level

Range:	+3.0 dBm to -40.0 dBm.
Accuracy:	±0.1 dBm.
Resolution:	0.1 dBm.

8.4.8 VF Measurements — VF Option Installed

Signal-to-Noise Ratio

Range (minimum):	0 dB to 45 dB.
Accuracy:	±0.5 dB.
Resolution:	1 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.

8.4.9 Simplex Current — BERT Option Installed

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.

8.4.10 Digit and Dialtone Frequency and Level Measurements

Frequency:	Resolution — 1 Hz. Range — ±3.5%. Accuracy — ±1 Hz or 0.1%.

Level:	Resolution — 0.1 dB. Range — +3.0 to -30.0 dBm. Accuracy — ±0.5 dB.
Twist:	MF Range — ±6.0 dB, high frequency over low frequency. DTMF Range — +4.0 dB to -8 dB, high frequency over low frequency.

8.5 ALARM CRITERIA

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 1's.
Pattern Sync Loss:	250 or more errors detected in 1000 or fewer bits.

8.6 TEST PATTERNS — T1 BERT OPTION INSTALLED

8.6.1 Pattern Definitions

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 Criteria

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 INSTALLED

8.7.1 Loop Code Generation and Detection Patterns

Type	Equip/Loc	Bit Pattern Loop Up	Bit Pattern Loop Down	Description
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.
DDS-ALT	OCU	x010 1010	N/A	Alternating Office Channel Unit loop code.
	OCU+HL96	x010 1010	N/A	Alternating Office Channel Unit loop code behind a HL96NY.
	HL96NY	x010 1010	N/A	Alternating HL96NY Office Channel Unit loop code.
	DSU	x010 1100	N/A	Alternating Data Service Unit loop code.

Type	Equip/Loc	Bit Pattern Loop Up	Loop Down	Description
	CHANNEL	x010 1000	N/A	Alternating Channel Service Unit loop code.
	CHAN+1R	x010 1000	N/A	Alternating Channel Service Unit behind one repeater loop code.
	CHAN+2R	x010 1000	N/A	Alternating Channel Service Unit behind two repeaters loop code.
	1ST RPTR	x010 1000	N/A	Alternating First Local Loop repeater loop code.
	2ND RPTR	x010 1000	N/A	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 to 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.
	NEI	***	***	Latching Network Element Interface and Adtran™ repeater and loop code.
	DSU	**	**	Latching Data Service Unit loop code.

NOTES:

** As described in TR-TSY-000476, Issue 3, April 1987.

*** As decribed in TR-OPT-000489.

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.

8.7.2 Loop Code Detection Criteria

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 INSTALLED

8.8.1 Digit Receiving Templates

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

Wink

Delay:	0 to 16 seconds.
Duration:	70 ms to 600 ms.

Delay Dial

Delay:	0 to 16 seconds.
Duration:	70 ms to 16 seconds.

Off Hook

Delay:	0 to 60 seconds.
Duration:	Greater than 600 ms.

8.9 CONNECTORS

8.9.1 External BNC

Connector Type:	BNC.
Input Impedance:	75 ohms ±5% .
Input Configuration:	AC-coupled differential input. Inner conductor is signal.
Signal Level:	High, greater than 2 V. 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 Connector

Connector Type:	25-pin, D-type.
Connector Configuration:	DCE.
Connector Pin Configuration:	See Table 8-2.
Character Format:	7 or 8 data bits (ASCII coding).

Pin No.	Signal Description	Function
1	Protective Ground	Connected to chassis ground.
2	Transmit Data (TXD)	The T-BERD 224 receives data on this lead.
3	Receive Data (RCVData)	The 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)	The T-BERD 224 drives 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)	The T-BERD 224 drives 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)	The T-BERD 224 drives 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	The T-BERD 224 drives this lead ON (HIGH) whenever data in its FIFO is ready to print.
20	Data Terminal Ready (DTR)	When this lead is driven ON (HIGH) by the receiving device, the T-BERD 224 transmits data.

Parity:	Odd, even, or none.
Stop Bits:	2 transmitted. Accepts 1 or more received stop bits.
Baud Rates:	300, 1200, 2400, 4800 or 9600.
Terminator:	CR, LF, or CRLF.
Print Width:	80-column.

8.9.3 Test Points

Table 8-3 contains descriptions of the T-BERD 224's test points which are available on the side panel's 37-pin, D-type connector. Signals present at these test points are TTL levels.

Table 8-3
T-BERD 224 Test Points

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 1 BPV	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

Table 8-3
T-BERD 224 Test Points (Continued)

Pin No.	Input/ Output	Pin Name	Description
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	N/C		
36	N/C		
37		Signal Ground	

Signaling Inputs

Input Voltage Range: -0.5 V to +25 V.

Logic 0 Input: Closure to ground or -0.5 V to +1.0 V.
(On Hook)

Logic 1 Input: Open circuit or +2.5 V to +25 V.
(Off Hook)

Input Current: -1.5 microamps, maximum at 0 V, +10 microamps, maximum at +3V.

Signaling Outputs

Output Voltage 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.

8.9.4 VF 2-Wire Interface

Connectors: 2 turrets.

Loop Current: 25 mA, typical.

Return Loss at 1 kHz: Greater than 20 dB.

8.9.5 VF 4-Wire Interface

VF 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: Relative to 1004 Hz, -10 dBm0. +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.

VF Input

Connector: WECO 310 jack.

Receiver: 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:	Relative to 1004 Hz, -10 dBm0. ±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). Measured with C-message and with C-message with notch filter.
Idle Channel Noise:	18 dBrnc0, maximum.

8.9.6 DS0 Bipolar Bantam Interface

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).

8.9.7 IEEE-488 Connector

Connector Type:	24-pin, D-type.
Connector Configuration:	Addressable or Talk-Only.
Connector Pin Configuration:	See Table 8-4.
Maximum Transfer Rate:	1200 b/s.
Line Terminator:	CR, LF, or CRLF.

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

8.9.8 DSU-DP Option Interfaces

RS-232 Interface

Connector:	25-pin, D-type, 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 2.667 kb/s.
Data Polarity:	Mark (binary 1) — -3 V to -25 V. Space (binary 0) — +3 V to +25 V.
Drivers: (Output levels into 3000-ohm load)	Low level — -10 V ±1 V, typical. High level — +10 V ±1 V, typical.

* These data rates exceed the data rate limitations recommended for RS-232 and V.24. However, the RS-232 connector can still be used but with result of increased bias distortion and clock data skew.

Slew Rates: (Into 7000-ohm resistive load)	Clock and data — 6 V/microsecond, typical. Signaling — 6 V/microsecond, typical.
Maximum Short-Circuit:	Current — +12 mA.
Receivers:	Input impedance — 3000 to 7000 ohms. Input threshold — +2 V and -1 V.
Maximum Input Voltage:	±25 V.

Pin	Signal Name	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*

*Non-standard pin configuration.

V.35 Interface

Connector: 34-pin, female.

Connector Pin Assignments: See Table 8-6.

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.

Pin	Signal Designation	Signal Status
A	Protective ground	Chassis Ground
B	Signal ground	Signal Ground
C	Request to send	In
D	Clear to send	Out
E	Data set ready	Out
F	Receive line signal detector	Out
P	Send data (A)	In
R	Receive data (A)	Out
S	Send data (B)	In
T	Receive data (B)	Out
V	Serial clock receive (A)	Out
X	Serial clock receive (B)	Out
Y	Serial clock transmit (A)	Out
a	Serial clock transmit (B)	Out
d	Secondary receive data (A)*	Out
f	Secondary receive data (B)*	Out
h	Secondary serial clock receive (A)*	Out
k	Secondary serial clock receive (B)*	Out
l	Secondary receive line signal detector	Out

*Non-standard pin configuration.

Polarity

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 from Short-circuited Terminals to ground:	50 ohms ±15 ohms.
Rise Time:	Less than 40 nanoseconds, into a 100-ohm resistive load.
Maximum Short-Circuit Current:	Less than 100 mA.
Signal Swing:	±0.55 V, into 100 ohms.

Data and Clock Receivers

Input Impedance:	100 ohms ±10 ohms.
Resistance from Short-Circuited Terminals to Ground:	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, typically.

Signaling Receivers

Input Impedance:	3000 to 7000 ohms.
Maximum Input Range:	±25 V.

RS-449 Interface

Connector:	37 pin, D-type, female.
Connector Pin Assignments:	See Table 8-7.
Impedance:	110 ohms, minimum.
Data Rates Primary:	2.4, 4.8, 9.6, 19.2, 56, or 64 kb/s.

Table 8-7

[illegible] RS-449 Channel [illegible]

Pin No.	Signal Designation	Signal Status
1	Shield	Chassis Ground
3	Secondary receive data (A)	Out
4	Send data (A)	In
5	Send timing (A)	Out
6	Receive data (A)	Out
7	Request to send (A)	In
8	Receive timing (A)	Out
9	Clear to send (A)	Out
11	Data mode (A)	Out
13	Receiver ready (A)	Out
16	Secondary receive data (A)*	Out
19	Signal ground	Signal Ground
20	Receive common	Signal Ground
21	Secondary receive data (B)*	Out
22	Send data (B)	In
23	Send timing (B)	Out
24	Receive data (B)	Out
25	Request to send (B)	In
26	Receive timing (B)	Out

Table 8-7
DCU-DP RS-449 Connector Pin Assignment (Continued)

Pin No.	Signal Designation	Signal Status
27	Clear to send (B)	Out
29	Data mode (B)	Out
31	Receiver ready (B)	Out
32	Secondary receiver ready (A)	Out
33	Secondary receive timing (B)*	Out
34	Secondary receiver ready (B)	Out
37	Send common	Signal Ground

*Non-standard pin configuration.

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.
Polarity 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.
Data, Clock, and Signal Driver Source Impedance:	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 — 200 mV. Maximum Input Voltage — ±25 V.

8.10 GROUNDING

Chassis and Signal Grounds:	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.
RS-449 Connector:	Pin 1 connected to chassis ground. Pin 19 connected to signal ground.
4-Wire VF Connector:	Sleeve connected to chassis ground.

APPENDIXES

APPENDIX A
FACTORY DEFAULT SETTINGS

Table A-1 contains the factory default settings that are stored in memory. The T-BERD 224's 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 Settings

Parameter	Default
MODE	T1-D1D
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

Parameter	Default
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
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
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	104 Hz
STOP FREQ	3704 Hz
STEP-SIZE	100 Hz

Table A-1
Factory Default Settings (Continued)

Parameter	Default
AUX 21 SWEEP (CONT.)	
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	
CHAN	ALL ONES
TIMEOUTS	
OFF HOOK	1 Minute
DISCONNECT	5 Seconds
AUX 30 MJU	
OPERATION	SELECT
BRANCH	1
AUX 35 CUSTOM	
LOGIC	ALL
BPV&FRAME	ALL
SIGNAL	ALL
TIME	ALL
CHANNEL	ALL
ALARMS	ALL

APPENDIX B
CHANNEL TIME SLOTS

CHANNEL TIME SLOT ASSIGNMENTS

This appendix contains the T1 time slot assignments for the T1 framing formats supported by the T-BERD 224. Table B-1 lists the T1 time slot numbers and the corresponding channel numbering for the selected framing format.

Table B-1
Channel Time Slot Assignments

Channel Circuit Numbers			
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

OPERATING MESSAGES

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.

T-BERD 224 Operating Messages

The following lists the T-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 LoopStart 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 ALARM — Displayed when the T-BERD 224 is in SLC-M1 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 VF LVL (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 from transmitting or receiving data.

MJU OPERATION FAILED — 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 SELECT FAILED — 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 **CHANNEL FORMAT** 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 TIMED 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 SET SEC PATTERN -- Displayed as a reminder that the DDS secondary channel test pattern is selected from the AUX 19 DDS CHN function. This 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 SET SWEEP 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 SET BURST 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.

SIGNAL LOSS/NO DATA 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 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.

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.

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.

Remote Control Error Messages (Continued)

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: LUP 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.

APPENDIX D
STRESS PATTERNS

STRESS PATTERNS

The stress patterns are represented in a right-to-left format. When the pattern is transmitted in binary form the least significant bit is transmitted first. This requires that the binary representation be turned over for transmission. Example: The binary representation of the hexadecimal value 01 would be 0000 0001.

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

MSB LSB
74H = 0111 0100

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	AAH	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	AAH	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	FFH	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								

T1-2 Stress Pattern

01 FFH 1111 1111	02 FFH 1111 1111	03 FFH 1111 1111	04 FFH 1111 1111	05 FFH 1111 1111	06 FFH 1111 1111	07 FFH 1111 1111	08 FFH 1111 1111	09 FFH 1111 1111	10 FFH 1111 1111
11 FFH 1111 1111	12 FFH 1111 1111	13 FFH 1111 1111	14 FFH 1111 1111	15 FFH 1111 1111	16 FFH 1111 1111	17 FFH 1111 1111	18 FFH 1111 1111	19 FFH 1111 1111	20 FFH 1111 1111
21 FFH 1111 1111	22 FFH 1111 1111	23 FFH 1111 1111	24 FFH 1111 1111	25 FFH 1111 1111	26 FFH 1111 1111	27 FFH 1111 1111	28 FFH 1111 1111	29 FFH 1111 1111	30 FFH 1111 1111
31 FFH 1111 1111	32 FFH 1111 1111	33 FFH 1111 1111	34 FFH 1111 1111	35 FFH 1111 1111	36 FFH 1111 1111	37 FFH 1111 1111	38 FFH 1111 1111	39 FFH 1111 1111	40 FFH 1111 1111
41 FFH 1111 1111	42 FFH 1111 1111	43 FFH 1111 1111	44 FFH 1111 1111	45 FFH 1111 1111	46 FFH 1111 1111	47 FFH 1111 1111	48 FFH 1111 1111	49 AAH 1010 1010	50 AAH 1010 1010
51 AAH 1010 1010	52 AAH 1010 1010	53 80H 1000 0000	54 01H 0000 0001	55 80H 1000 0000	56 01H 0000 0001	57 80H 1000 0000	58 01H 0000 0001	59 80H 1000 0000	60 01H 0000 0001
61 80H 1000 0000	62 01H 0000 0001	63 80H 1000 0000	64 01H 0000 0001	65 80H 1000 0000	66 01H 0000 0001	67 80H 1000 0000	68 01H 0000 0001	69 80H 1000 0000	70 01H 0000 0001

71	72	73	74	75	76	77	78	79	80
80H	01H	AAH	AAH	AAH	AAH	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				

T1 3 Stress Pattern

01 01H 0000 0001	02 01H 0000 0001	03 01H 0000 0001	04 01H 0000 0001	05 01H 0000 0001	06 01H 0000 0001	07 00H 0000 0000	08 01H 0000 0001	09 01H 0000 0001	10 01H 0000 0001
11 01H 1000 0000	12 01H 0000 0001	13 01H 0000 0001	14 03H 0000 0011	15 01H 0000 0001	16 01H 0000 0001	17 01H 0000 0001	18 01H 0000 0001	19 07H 0000 0111	20 01H 0000 0001
21 01H 0000 0001	22 01H 0000 0001	23 01H 0000 0001	24 55H 0101 0101	25 55H 0101 0101	26 55H 0101 0101	27 55H 0101 0101	28 AAH 1010 1010	29 AAH 1010 1010	30 AAH 1010 1010
31 AAH 1010 1010	32 01H 0000 0001	33 01H 0000 0001	34 01H 0000 0001	35 01H 0000 0001	36 01H 0000 0001	37 01H 0000 0001	38 FFH 1111 1111	39 FFH 1111 1111	40 FFH 1111 1111
41 FFH 1111 1111	42 FFH 1111 1111	43 FFH 1111 1111	44 80H 1000 0000	45 01H 0000 0001	46 80H 1000 0000	47 01H 0000 0001	48 80H 1000 0000	49 01H 0000 0001	50 80H 1000 0000
51 01H 0000 0001	52 80H 1000 0000	53 01H 0000 0001	54 80H 1000 0000						

01 FFH 1111 1111	02 FFH 1111 1111	03 FFH 1111 1111	04 FFH 1111 1111	05 FFH 1111 1111	06 FFH 1111 1111	07 FFH 1111 1111	08 FFH 1111 1111	09 FFH 1111 1111	10 FFH 1111 1111
11 FFH 1111 1111	12 FFH 1111 1111	13 FFH 1111 1111	14 FFH 1111 1111	15 FFH 1111 1111	16 FFH 1111 1111	17 FFH 1111 1111	18 FFH 1111 1111	19 FFH 1111 1111	20 FFH 1111 1111
21 FFH 1111 1111	22 FFH 1111 1111	23 FFH 1111 1111	24 FFH 1111 1111	25 FFH 1111 1111	26 FFH 1111 1111	27 FFH 1111 1111	28 FFH 1111 1111	29 FFH 1111 1111	30 FFH 1111 1111
31 FFH 1111 1111	32 FFH 1111 1111	33 FFH 1111 1111	34 FFH 1111 1111	35 FFH 1111 1111	36 FFH 1111 1111	37 FFH 1111 1111	38 FFH 1111 1111	39 FFH 1111 1111	40 FFH 1111 1111
41 FFH 1111 1111	42 FFH 1111 1111	43 FFH 1111 1111	44 FFH 1111 1111	45 FFH 1111 1111	46 FFH 1111 1111	47 FFH 1111 1111	48 FFH 1111 1111	49 FFH 1111 1111	50 FFH 1111 1111
51 FFH 1111 1111	52 FFH 1111 1111	53 FFH 1111 1111	54 FFH 1111 1111	55 FFH 1111 1111	56 FFH 1111 1111	57 FFH 1111 1111	58 FFH 1111 1111	59 FFH 1111 1111	60 FFH 1111 1111
61 FFH 1111 1111	62 FFH 1111 1111	63 FFH 1111 1111	64 FFH 1111 1111	65 FFH 1111 1111	66 FFH 1111 1111	67 FFH 1111 1111	68 FFH 1111 1111	69 FFH 1111 1111	70 FFH 1111 1111
71 FFH 1111 1111	72 FFH 1111 1111	73 AAH 1010 1010	74 AAH 1010 1010	75 AAH 1010 1010	76 AAH 1010 1010	77 10H 0001 0000	78 10H 0001 0000	79 10H 0001 0000	80 10H 0001 0000

T-? Stress Pattern (Continued)

81 10H 0001 0000	82 10H 0001 0000	83 10H 0001 0000	84 10H 0001 0000	85 10H 0001 0000	86 10H 0001 0000	87 10H 0001 0000	88 10H 0001 0000	89 10H 0001 0000	90 10H 0001 0000
91 10H 0001 0000	92 10H 0001 0000	93 10H 0001 0000	94 10H 0001 0000	95 10H 0001 0000	96 10H 0001 0000	97 AAH 1010 1010	98 AAH 1010 1010	99 AAH 1010 1010	100 AAH 1010 1010
101 10H 0001 0000	102 10H 0001 0000	103 10H 0001 0000	104 10H 0001 0000	105 10H 0001 0000	106 10H 0001 0000	107 10H 0001 0000	108 10H 0001 0000	109 10H 0001 0000	110 10H 0001 0000
111 10H 0001 0000	112 10H 0001 0000	113 10H 0001 0000	114 10H 0001 0000	115 10H 0001 0000	116 10H 0001 0000	117 10H 0001 0000	118 10H 0001 0000	119 10H 0001 0000	120 10H 0001 0000

Stress Pattern

01 80H 1000 0000	02 01H 0000 0001	03 80H 1000 0000	04 01H 0000 0001	05 80H 1000 0000	06 01H 0000 0001	07 80H 1000 0000	08 01H 0000 0001	09 80H 1000 0000	10 01H 0000 0001
11 80H 1000 0000	12 01H 0000 0001	13 80H 1000 0000	14 01H 0000 0001	15 80H 1000 0000	16 01H 0000 0001	17 80H 1000 0000	18 01H 0000 0001	19 80H 1000 0000	20 01H 0000 0001
21 80H 1000 0000	22 01H 0000 0001	23 80H 1000 0000	24 01H 0000 0001	25 80H 1000 0000	26 01H 0000 0001	27 80H 1000 0000	28 01H 0000 0001	29 80H 1000 0000	30 01H 0000 0001
31 01H 0000 0001	32 AFH 1010 1111	33 AAH 1010 1010	34 AFH 1010 1111	35 01H 0000 0001	36 01H 0000 0001	37 01H 0000 0001	38 01H 0000 0001	39 FFH 1111 1111	40 FFH 1111 1111
41 FFH 1111 1111	42 FFH 1111 1111	43 01H 0000 0001	44 01H 0000 0001	45 01H 0000 0001	46 01H 0000 0001	47 FFH 1111 1111	48 FFH 1111 1111	49 FFH 1111 1111	50 FFH 1111 1111
51 FFH 1111 1111	52 FFH 1111 1111	53 CBH 1100 1011							

T1-6 Stress Pattern

01 01H 0000 0001	02 01H 0000 0001	03 01H 0000 0001	04 01H 0000 0001	05 01H 0000 0001	06 01H 0000 0001	07 00H 0000 0000	08 01H 0000 0001	09 01H 0000 0001	10 01H 0000 0001
11 01H 0000 0001	12 01H 0000 0001	13 01H 0000 0001	14 03H 0000 0011	15 01H 0000 0001	16 01H 0000 0001	17 01H 0000 0001	18 01H 0000 0001	19 07H 0000 0111	20 01H 0000 0001
21 01H 0000 0001	22 01H 0000 0001	23 01H 0000 0001	24 55H 0101 0101	25 55H 0101 0101	26 55H 0101 0101	27 55H 0101 0101	28 AAH 1010 1010	29 AAH 1010 1010	30 AAH 1010 1010
31 AAH 1010 1010	32 01H 0000 0001	33 01H 0000 0001	34 01H 0000 0001	35 01H 0000 0001	36 01H 0000 0001	37 01H 0000 0001	38 FFH 1111 1111	39 FFH 1111 1111	40 FFH 1111 1111
41 FFH 1111 1111	42 FFH 1111 1111	43 FFH 1111 1111	44 80H 1000 0000	45 01H 0000 0001	46 80H 1000 0000	47 01H 0000 0001	48 80H 1000 0000	49 01H 0000 0001	50 80H 1000 0000
51 01H 0000 0001	52 80H 1000 0000	53 01H 0000 0001	54 80H 1000 0000	55 01H 0000 0001					

01 01H 0000 0001	02 01H 0000 0001	03 01H 0000 0001	04 01H 0000 0001	05 01H 0000 0001	06 01H 0000 0001	07 80H 1000 0000	08 01H 0000 0001	09 01H 0000 0001	10 01H 0000 0001
11 01H 0000 0001	12 01H 0000 0001	13 01H 0000 0001	14 03H 0000 0011	15 01H 0000 0001	16 01H 0000 0001	17 01H 0000 0001	18 01H 0000 0001	19 07H 0000 0111	20 01H 0000 0001
21 01H 0000 0001	22 01H 0000 0001	23 01H 0000 0001	24 55H 0101 0101	25 55H 0101 0101	26 55H 0101 0101	27 55H 0101 0101	28 AAH 1010 1010	29 AAH 1010 1010	30 AAH 1010 1010
31 AAH 1010 1010	32 01H 0000 0001	33 01H 0000 0001	34 01H 0000 0001	35 01H 0000 0001	36 01H 0000 0001	37 01H 0000 0001	38 FFH 1111 1111	39 FFH 1111 1111	40 FFH 1111 1111
41 FFH 1111 1111	42 FFH 1111 1111	43 FFH 1111 1111	44 80H 1000 0000	45 01H 0000 0001	46 80H 1000 0000	47 01H 0000 0001	48 80H 1000 0000	49 01H 0000 0001	50 80H 1000 0000
51 01H 0000 0001	52 80H 1000 0000	53 01H 0000 0001	54 80H 1000 0000	55 01H 0000 0001					

TIMING SLIP MEASUREMENT
(n51 TM SLIP)

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 that the clock edge of the received signal moves past the edge of the reference signal, as indicated in Figure E-1.

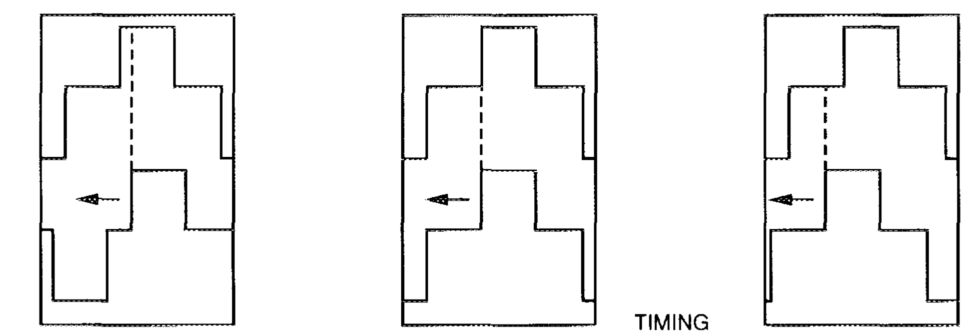


Figure E-1
Timing Slips

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"

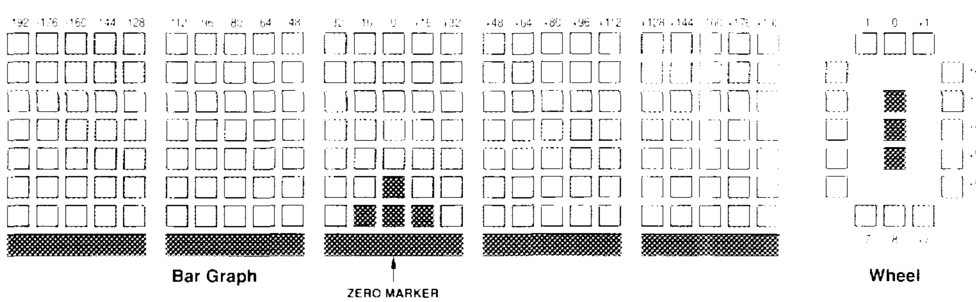
n 52 - TM SLIP

ø __ ⁝ __ ⁝

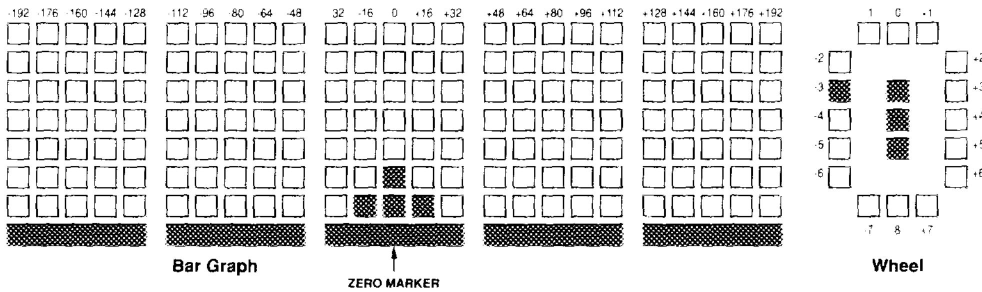
The numeric value is a range from 0 to 999. This value represents the total number of frame slips that have occurred. One frame slip is equal to 193 bit-slips.

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.

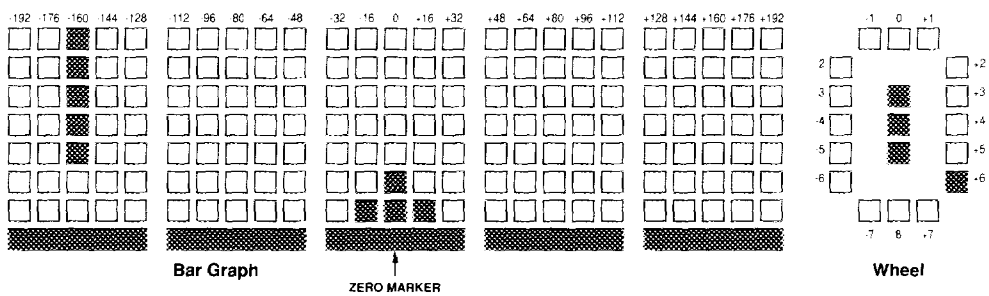
The wheel is used along with the bar graph to graphically display the direction, rate, and magnitude of timing slips. Figure E-3 shows the values assigned to each position of the bar graph and the wheel.



The magnitude of a timing slip is determined by adding the magnitude of the number indicated by the wheel's position to the corresponding bar graph value. The following example indicates how this is accomplished:



The bar graph value is +96 (because it occurs on the plus bar graph side and at a value of 96) and the wheel value is -3. Adding these two values together results in a timing slip of +93 bits. This indicates that 93 more clock cycles have been received at the RECEIVE input than have been received at the T1 REF input, or the RECEIVE input is receiving a higher frequency than the T1 REF input. A second example shows:



The bar graph value is -160 and the wheel value is +6. This results in a timing slip of -154 bits.

The displayed result depends on whether the signal is being received on LINE 1 or LINE 2. Table E-1 describes the different configurations and the corresponding displayed results.

T1 Input	Clock Reference	Displayed Results
L1	L2	L1 vs. L2 (#151)
L1 & L2	BNC	L1 vs. BNC (#151) and L2 vs. BNC (#[illegible]51)
L1	BNC	L1 vs. BNC (#151)
L2	BNC	L2 vs. BNC (#251)

As shown in Table E-1, the T-BERD 224 configuration determines the result displayed. When LINE 1 and LINE 2 are used for measuring timing slips, LINE 2 is considered to be the reference signal and LINE 1 is the signal that is compared to the LINE 2 signal. When a signal is connected to the side panel BNC connector (EXTERNAL BNC CLOCK), the BNC connector is considered to be the reference signal and the signal present at LINE 1 and/or LINE 2 are measured against the reference signal.

Timing slip results vary according to the timing relationship between the EXTERNAL BNC CLOCK and the RECEIVE connector signals, as follows:

If the clock reference and T1 input signals are perfectly synchronized, then the timing slip count remains at 0, the bar graph remains at center, and the wheel remains at top-center.

If the clock reference and T1 input signals are synchronized, but one signal exhibits low-speed wander (e.g., Doppler shifts from satellites), then the timing slip count remains at 0; both the bar graph and the wheel move to the right as the satellite approaches, and to the left after the satellite passes by.

If the clock reference and T1 input signals are unsynchronized, and the T1 input frequency is higher than the clock reference frequency, then the wheel moves clockwise, the bar graph moves to the right, and the timing slip count increments every 193 bit slips. When the frequency difference is more than a few Hertz, the TIMING SLIP count, bar graph, and wheel move very rapidly.

If the clock reference and T1 input signals are unsynchronized, and the T1 input frequency is lower than the clock reference frequency, then the wheel moves counterclockwise, the bar graph moves to the left, and the timing slip count increments every 193 bit slips. When the frequency difference is more than a few Hertz, the TIMING SLIP count, bar graph, and wheel move very rapidly.

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.

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	sec	sec	sec	sec	sec	sec	sec	sec	sec
20	21	22	23	24	25	26	27	28	29
BER	BER	BER	BER	BER	BER	BER	BER	BER	BER
<=	<=	<=	<=	<=	<=	>	>	>	<=

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 is 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
<=	>	>	>	>	>	>	>	>	>

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
>	>	>	>	>	>	>	>	>	>

Window After 89th

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).

APPENDIX G
TRUNK TYPE SUMMARY

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

ON HOOK	A=0	B=0		
OFF HOOK	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

REMOTE CONTROL COMMANDS

This appendix contains an alphabetical list of the remote control commands. Each command is explained, 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.

IEEE-488 Address

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 AUX 09 488MODE function.

488 ADD?	:Displays the current IEEE-488 address for the T-BERD 224.
488 ADD <xx>	:Sets the IEEE-488 address, where xx = 0 to 30.

EXAMPLE:

> 488 ADD?	:Displays the current IEEE-488 address. The current address is 10.
488 ADDress 10	
> 488 ADD 07	:Set the IEEE-488 address to 07.

>

IEEE-488 Mode

488 MODe determines the operating mode for the IEEE-488 Interface. This command is part of the AUX 09 488MODE function.

NOTE: This command is not available from the IEEE-488 remote control.

488 MOD?	:Displays the current status for the IEEE-488 mode.
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.

IEEE-488 SRQ

488 SRQ	:Sets the IEEE-488 SRQ. This command is part of the AUX 09 488MODE function.
488 SRQ?	:Displays the current status for the IEEE-488 SRQ.
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.

Alarms Message Prints

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?	:Print the status of the alarms message.
ALA ON	:Alarms messages are printed.
ALA OFF	:Disables the alarms messages, preventing alarms and status messages from being printed.

Backup Timing

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 ?	:Displays the status of the backup timing for LINE 1 and LINE 2.
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 from 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 from LINE 1.
BAC TIM L1 ?	:Display backup timing for LINE 1.
BAC TIM L2 ?	:Display backup timing for LINE 2.

Sound Remote Control Beeper

BEEp causes the remote control unit to sound a single short beep.

Set VF Burst ON or OFF

BURst controls the transmission of the VF burst, sets the frequency of the VF burst, and sets the level of the VF burst. It is part of the AUX 22 VFBURST function.

BUR?	:Displays the current status of the VF burst function.
BUR ON	:Enables the VF burst.
BUR OFF	:Disables the VF burst.
BUR FREquency <parameter>	:Sets the VF burst frequency to the **<parameter>** value. The valid parameters for VF burst frequency are the frequencies from 20 Hz to 3904 Hz.
BUR LEVel <parameter>	:Sets the VF burst LEVEL to the **<parameter>** value. The valid parameters for VF burst level are the settings from -40.0 dBm to +3.0 dBm.

EXAMPLE:

>BUR?	:Displays the current status of VF burst.
BURst FREq: 2125 Hz	
BURst LEVel: -10.0 dBm	
BURst OFF	
>BUR FRE 2000	:Sets the VF burst frequency to 2000 Hz.
>BUR LEV -13.0	:Sets the VF burst frequency to -13.0 dBm.
>	

Set BPV and Logic Error Burst Length

BURst LENgth controls the BPV and logic error burst length interval. This command is part of setting the burst length with the AUX 13 ERR RT, BURST ERROR TYPE, function.

BUR LEN? :Displays current burst length.

BUR LEN <value> :Sets the burst length **<value>** from 0.020 to 5.0 seconds. Enter **<value>** in milliseconds by entering 20 to 5000. Enter **<value>** in seconds by entering 0.020 to 5.0.

Only the following values are valid burst length periods:

- 20 ms to 170 ms in 50 ms steps.
- 170 ms to 200 ms in a 30 ms steps.
- 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 0.1 sec. steps.
- 1.5 sec. to 5.0 sec. in 0.5 sec. steps.

Values that are not the incremental values are rounded to the nearest lesser value. If a value has a decimal point, the digits after the third fractional position are ignored.

See also: **ERRor RATe**, **ERRor INSert**, and **FRM ERRor LENgth**

EXAMPLE:

>BUR LEN 3.0 :A 3-second burst length is specified

>BUR LEN 3.4 :A 3.4-second burst length is specified

WARNING: The Value has been rounded down.

>

Channel Format

CHAnnel FORmat selects the T-BERD 224 channel format.

CHA FOR?	:Displays the current channel format.
CHA FOR <format>	:Selects the channel **<format>** for the selected operating mode.

The **CHAnnel FORmat <format>** selections include:

56XN	:56xN FT1 data.
64XN	:64xN FT1 data.
DATa LINk	:ESF 4 kb/s, ESFz 2 kb/s, or SLC-96 datalink.
DS0A2.4	:DS0A formatted DDS data at 2.4 kb/s.
DS0A4.8	:DS0A formatted DDS data at 4.8 kb/s.
DS0A9.6	:DS0A formatted DDS data at 9.6 kb/s.
DS0A19.2	:DS0A formatted DDS data at 19.2 kb/s.
DS0A56	:DS0A formatted DDS data at 56 kb/s.
DS0B2.4	:DS0B formatted DDS data at 2.4 kb/s.
DS0B4.8	:DS0B formatted DDS data at 4.8 kb/s.
DS0B9.6	:DS0B formatted DDS data at 9.6 kb/s.
DS064	:Clear channel data at 64 kb/s.
FULl T1	:Full bandwidth channel format.
PROtocol	:SS7 and ISDN Level 2 protocol.
SIGnaling	:Signaling.
SWI-56	:Switched 56.
VF	:Voice Frequency.
VF THRu	:Voice Frequency with Through Signaling.

Changing the channel format causes a test restart and changes the front panel configuration to the configuration of the previously selected channel format.

Channel Format (Continued)

EXAMPLE:

> CHA FOR FUL T1 :Select FULL T1 as the channel format.

WARNING: New Setup:
MODe T1D4
CHAnnel FORmat FULL T1
SOUrce 1 ALL ONES

>

Clear the Print FIFO

CLEAR FIFO command clears the print FIFO of all printouts that are waiting to be printed. This command is part of the AUX 01 CL FIFO function.

EXAMPLE:

> CLEAR FIFO :Clear the print FIFO.

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 the T-BERD 224's front panel. The effect of this command is identical to issuing the **PRInt CONtrols** remote control command.

Custom 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.

CUS?	:Displays the status of all of the test results.
CUS STAtus <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**e
FRAme	

Custom Results (Continued)

CHANNEL (Continued)

%IN SRVn	(%In Service Bits)
3K FLAn	(3 kHz Flat Noise)
3K NCHn	(3 kHz Notch Noise)
LSSUSn	(Link Status Signal Units)
MSUSn	(Message Signal Units)
NACKSn	(Negative Acknowledgments)
PACKETn	(Packets)
PARn	(Peak To Average Ratio)
PAR LEVn	(Peak To Average Ratio Level)
PKT ESn	(Packet CRC Errored Seconds)
PKT ERTn	(Packet CRC Error Rate)
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	(AI)
AIS ON	(A)
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)

Custom Results (Continued)

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**

Calendar Date

DATe determines set the calendar date. This command is part of the AUX 04 TIME/DATE function.

DAT? :Display the date.

DAT MM-DD :Sets the calendar date, where MM (1 to 12) 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.

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?	:Displays the status of the delay dial.
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.

EXAMPLE:

> DDI?	:Display the delay dial settings.
delay dial delay = 200 ms	
delay dial duration = 150 ms	
> DDI DEL 45	:Sets the delay dial delay value to 45ms.
>	

DDS Channel Analysis

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? :Displays the current DDS channel being analyzed.

DDS ANA PRImary :Selects the DDS PRImary channel to be analyzed.

DDS ANA SECondary :Selects the DDS SECondary channel to be analyzed.

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**

Custom Results (Continued)

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)

BPV (Continued)

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)
DIS PKTn	(Discarded Packets)
ERLn	(Echo Return Loss)
E MSUSn	(Errored Message Signal Units)
ERPKCRn	(CRC Errored Packets)
FISUSn	(Fill-In Signal Units)

Clock Time

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.

If hours, minutes, and/or seconds are not entered, they are assumed to be "00."

CLO?	:Display the clock time (time of day).
CLO hh:mm:ss	:Set the clock time. The symbol ":" may be replaced by a dash (-), comma (,), period (.), semicolon (;), or slash (/).

EXAMPLE:

> CLO?	:Print the clock time.
CLOck 15:30:24	:Time is displayed in hours, minutes, and seconds.
> CLO 6:28	:Set clock time to 6:28 a.m.
>	

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.

EXAMPLE:

> CLS	:Clears the terminal screen.
	:30 line terminators transmitted.

Select Code Type

CODe selects or returns the current code type used by the T-BERD 224 when transmitting a T1 signal.

COD?	:Display the current status of the **CODE** switch.
COD AMI	:AMI coding is enabled.
COD B8Zs	:B8ZS coding is enabled. Note that received B8ZS sequences are always decoded.

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.

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
<	<	<	<	<	<	<	<	<	<

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 seconds 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 F

DISCUSSION OF CCITT RECOMMENDATION G.821

Select DDS Secondary Channel 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. SEC CH PAT. function.

DDS SEC?	:Displays the current DDS secondary channel test patten.
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**

Select 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?	:Displays the currently transmitted DDS channel.
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**

EXAMPLE:

> DDS TRA?	:Display current transmitted DDS channel.
DDS TRAnsmit PRImary	
> DDS TRA BOT	:Change transmitted DDS channel to both.
>	

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.

> 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 Definition

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 <##>? :Display the digit sequences for the selected dial sequence. The sequence number **<##>** ranges from 1 to 10.

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 Definition (Continued)

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.

EXAMPLE:

> DIA SEQ DEF 7? :Displays programmed dial sequence number seven.
DIA SEQ DEF 7 H 5551212

Digit

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?	:Display all of the current settings of the dial sequence digits.
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.

EXAMPLE:

> DIG PPS?	:Display the current setting of **PPS.** Pulses Per Second = 10
>DIG DUR 20	:Set the duration to 20 ms.

Front-Panel Display Mode

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?	:View current mode of display control.
DIS LOCAL	:Activates the **RESULT** switches.
DIS REMOTE	:Disables the **RESULT** switches

Freeze the Results Displays

DISplay HOLd controls the front panel results displays. This command is identical in function to the **DISPLAY HOLD** switch on the front panel of the T-BERD 224.

DIS HOL?	:Display the current status of **DISPLAY HOLD** switch.
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

Drop Channel

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?	:Display the status of the **DROP CHANNEL** switch.
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 DS0 ERRor CORrection

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?	:Displays the current status of the DS0A error correction.
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 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?	:Display the status of the DS0 interface timing.
DS0 INT TIM SEParate	:Selects separate clocks for drop and insert.
DS0 INT TIM COMmon	:Selects a single clock for both drop and insert.

DDS Channel Analysis

DSU ANAlysis CHAnnel selects or returns the current DDS 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 11 ANL CHA function.

DSU ANA CHA?	:Displays the current DSU analysis channel.
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.

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 DSUDp Bit8

DSU-DP 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 ? :Displays the current DDS primary channel bit 8 setting.

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**

ECHo ECHo

Echo Mode

ECHo determines whether characters entered form the remote control unit are displayed.

ECHo ? :Displays the echo status.

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.

Initiate BPV Error Insertion

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?	:Displays current BPV error insertion status.
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

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 **INSert** command is set to **NONe**.

ERR INS FRA?	:Displays current consecutive frame error insertion status.
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**

Initiate Logic Error Insertion

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 LOG?	:Displays current logic error insertion status.
ERR INS LOG RATe	: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

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 **INSert** command is set to **NONe**.

ERR INS YEL?	:Displays current yellow alarm insertion status.
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 Appendix C for the list of error message numbers and explanations.

EXAMPLE:

> ERR NUM?	:Prints the number of the last error message.

ERROR NUMber 01
>

Set 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.

ERR RAT?	:Displays current BPV and logic error insertion rate.
ERR RAT <X.X,Y>	:Sets new BPV and logic error insertion rate **<X.X,Y>**. The **X.X,Y** format represents the valid error rate 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**

EXAMPLE:

>ERROR RATE 6.5,5	:Change the error insertion rate to 6.5 E-5.
>ERR RAT?	:Display current error insertion rate.
ERRor RATe 6.5E-5	:The current error insertion rate is now 6.5 E-5.
>	

Far-End Loopback Status

FAR END LOOP command reports the status of the shelf and protection line far-end loopbacks of the selected line.

FAR END LOO ?	:Displays the status of the shelf and protection line far-end loopbacks.
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: **CHAnnel FORmat, PRInt, RESult 1/2, SIGnal INSert, SLC ALArm, SLC MAINTenance, SOUrce 1,** and **SOUrce 2**

EXAMPLE:

> FAR END LOO?	:Display current far-end loop status.
LINE 1 SLC FAR END LOOP:	
SHELF A	:Shelf A is in a far-end loopback.
LINE 2 SLC FAR END LOOP:	
SHELF A	:Shelf A is in a far-end loopback.

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.

The unit is no longer in remote control mode after executing this command.

Frequency Sweep | FREquency SWEep

Set VF Frequency Sweep

FREquency SWEep sets the frequency sweep parameters. This command is identical in function to the AUX 21 SWEEP function.

FRE SWE ? :Display the current frequency sweep parameters.

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.

EXAMPLE:

>FRE SWE?	:Displays the current settings of the VF Frequency Sweep parameters.

SWEep SKIp HIGh: 2750 Hz
SWEep SKIp LOW: 2450 Hz
SWEep STArt FREq: 104 Hz
SWEep STEp INTvl: 2.0 SEC
SWEep STEp SIZe: 100 Hz
SWEep STOp FREq: 3704 Hz

>FRE SWE STA FRE 250	:Sets the VF Frequency Sweep START frequency to 250 Hz.
>	
>FRE SWE STO FRE 3250	:Sets the VF Frequency Sweep STOP frequency to 3250 Hz.
>	
>FRE SWE STE INT 3	:Sets the VF Frequency Sweep STEP-INTVL time to 3 seconds.
>	
>FRE SWE STE SIZ 250	:Sets the VF Frequency Sweep STEP-SIZE frequency to 250 Hz.
>	
>FRE SWE SKI LOW 1750	:Sets the VF Frequency Sweep SKIP-LO frequency to 1750 Hz.
>	
>FRE SWE SKI HIG 2000	:Sets the VF Frequency Sweep SKIP HI frequency to 2000 Hz.
>	

FRM ERRor LENgth

Set Consecutive Frame Error Length

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?	:Displays current number of consecutive frame errors being inserted.
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: **ERRor INSert FRAme**

EXAMPLE:

>FRM ERR LEN?	:Display current number of consecutive frame errors being inserted.
FRM ERR LEN 4	:The current number of consecutive frame errors being inserted is 4.
>FRM ERR LEN 5	:Change the number of consecutive frame errors to 5.

>

IEEE-488 Go To Local

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.

GTL :Enter local mode from remote control

See also: **488 ADD, 488 MOD, 488 SRQ**, and **LOCAL**

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 *NOV RAM LOST*.

EXAMPLE:

> HELLO? :Display the hardware and software revision level.

T-BERD 224, Software Version E, (c) TTC 6/30/90
DSU-DP Option installed
IEEE-488 Option installed
VF Option installed

HELP HELP

On-Line Help Function

HELP offers summary on-line help information and provides access to the T-BERD 224's on-line help facility. **HELP** or **HELP 1** provides an index to the various types of help information. **HELP** ! lists all valid T-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 (see Example 1).
2. Command and parameter summaries are preceded by three dashes (- - -) (See Example 2).
3. Command parameters are presented as upper case character strings with optional characters in lower case characters (see Example 3).

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|11	:Displays help information for BERT Option auxiliary functions.
HELP 14	:Displays help information for Signaling Option auxiliary functions.
HELP!	:Displays a list of all valid commands.

EXAMPLE 1:

> HELP DISPLAY	:Displays the valid T-BERD 224 control settings; LOCAl or REMote.

```
LOCAl
REMote
>
```

On-Line Help Function (Continued)

EXAMPLE 2:

> **HELP CLOCK**	:Displays the valid formats for the **CLOCK** command.
[HH:MM:SS]	
[HH-MM-SS]	
[HH/MM/SS]	
[HH:MM:SS]	
[HH.MM.SS]	
[HH.MM.SS]	
---HH 0 TO 23 HOURS	:Lists the valid parameters for hours, minutes, and seconds.
---MM 0 TO 59 MINUTES	
---SS 0 to 59 SECONDS	
>	

EXAMPLE 3:

> **HELP PRI EVE**	:Displays the possible settings for the **PRINT EVENT** switch.
ERRor SECond	
OFF	
TESt END	
TIMed	
>	

Reset Alarm History LED Indicators

HIStory RESet clears all alarm history LED indicators for both lines.

HOLd 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 results printouts, control printouts, alarm messages, and status messages. However, responses to queries are returned as before.

See also: **RELease**

EXAMPLE:

> HOL	:Hold all printouts for now ...
+CLOCK?	:Requests the clock time.
CLOCK 12:34:56	
+DATE?	:Requests the calendar date.
DATE APR 14	
+CONTROLS?	:Note that nothing is printed.
+REL	:Start printing the controls print.
>	:... and the prompt is changed back to (**>**).

Insert

INSert requests the line on which T1 signal data and errors are inserted.

INS?	:Displays the status of the **INSERT** switch.
INS L1	:Selects LINE 1 for channel insertion.
INS L2	:Selects LINE 2 for channel insertion.
INS NONe	:Selects neither line for channel insertion.

LINE 1 Channel Selection

L1 CHAnnel selects or returns LINE 1's channel to be monitored or tested. Modifying this command causes a test restart.

L1 CHA? :Display the selected channel.

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 DSO channel formats.

LINE 2 Channel Selection

L2 CHAnnel selects or returns LINE 2's channel to be monitored or tested. Modifying this command causes a test restart.

L2 CHA ? :Display the selected channel.

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 DSO channel formats.

L1 LBO L1 LBO

LINE 1 Line Build-Out

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? :Displays the status of the line build-out for LINE 1.

L1 LBO [0 | -7.5 | -15] :Selectable line build-out includes **0**, **-7.5**, and **-15**.

L2 LBO L2 LBO

LINE 2 Line Build-Out

L2 LBO controls the current transmit output setting for LINE 2. This command is identical to the AUX 05 LBO function.

L2 LBO? :Displays the status of the line build-out for LINE 2.

L2 LBO [0 | -7.5 | -15] :Selects LINE 2 build-out setting. Selectable line build-out includes **0**, **-7.5**, and **-15**.

LINE 1 Receive Input Termination

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 ?	:Display the status of the current receive input termination for LINE 1.
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.

LINE 2 Receive Input Termination

L2 RECeive INPut selects input impedance and signal conditioning. Modifying this command causes a test restart.

L2 REC INP ?	:Display the status of the current receive input termination for LINE 2.
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? 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 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 Status

LED? :Display the state of the T-BERD 224's 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 224's 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 224's alarm and status LED indicators on Line 2. When specified, this command displays the LED indicators as they appear on the front panel.

EXAMPLE:

> LED?

```
 LINE 1 LEDS        HIST  CURR
   SIGNAL           :     ON
   FRAME SYNC       :     ON
   PATTERN SYNC     :
   B8ZS             :
   EXCESS ZEROS     :ON
   YELLOW ALARM     :
   AIS              :

   LINE 2 LEDS      HIST  CURR
   SIGNAL           :     ON
   FRAME SYNC       :     ON
   PATTERN SYNC     :
   B8ZS             :
   EXCESS ZEROS     :
   YELLOW ALARM     :ON
   AIS              :
```
>

Return the T-BERD 224 to Local 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.

LOCAl	:Enter Local (front panel) mode.
/	:Alternate form of the **LOCAl** command.

See also: **DISplay, REMote, TERminal, COMputer,** and **GTL**

EXAMPLE:

> LOCAl	:Enter Local (front panel) mode ...
(TERMINAL)	: ... then return to remote control.
Terminal mode initiated.	
Type "HELP" followed by a <RETURN>	
for help.	:Message for Terminal mode.
>/	:Quickly return to Local mode.

Set Loop Code Type and Pattern

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:

LOO COD?	:Display current T1 loop code type (T1, DDS alternating, and DDS latching) and selection.

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 RPTR	: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.

LOOp CODe LOOp CODe

Set Loop Code Type and Pattern (Continued)

<u>**T1**</u>

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.

See also: **LOOp Down, LOOp Up, RESPonse, PGM LPUp,** and **PGM LPDn**

LOOp Down LOOp Down

Transmit Loop-Down Code

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?	:Display current loop-down code transmission status.
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

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 ? :Display current loop-up code status transmission.

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: **LOOp CODe, LOOp Down, RESPonse, PGM LPUp,** and **PGM LPDn**

MESsage

Enable or Disable Error Message Printing

MESsage controls the printing of error messages at your remote control unit.

MES? :Display current status of error message printing.

MES ON :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

MJU BRAnch selects the MJU branch for the designated MJU operation. This command is similar to the AUX MJU 30 function.

MJU BRAnch?	:Display the currently selected MJU branch.
MJU BRAnch [1 - 4]	:Selects an MJU branch for the MJU SELECT operation.

EXAMPLE:

> MJU BRA? :Display current branch.
MJU BRAnch 1
> MJU BRA 4 :Selects MJU branch number four.
>

MJU HUB 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.

EXAMPLE:

> MJU HUB? :Display hub id of the currently selected branch.
Hub ID 47.
>

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 ?	:Display the current MJU operation
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 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?	:Display the status of the MJU operation.
> MJU SEN	:Initiates the selected MJU operation.

EXAMPLE:

> MJU SEN	:Initiates the selected MJU operation.
MJU SEND	
>	
TEST RESTART	09:37:23 FEB 07
>	
L1 SIGNAL DETECT	09:37:23 FEB 07
>	
L1 FRM SYN ACQUIRE	09:37:23 FEB 07
>	
MJU SELECTED	09:37:25 FEB 07
HUB ID 47	
BRANCH NUMBER 2	
>	
NEW CONFIGURATION	09:37:27 FEB 07
>	
TEST RESTART	09:37:27 FEB 07
>	
SIGNAL DETECT	09:37:27 FEB 07
>	
L1 FRM SYN ACQUIRE	09:37:27 FEB 07
>	
L1 PATTERN SYNC GAIN	09:37:29 FEB 07

Transmit and Receive 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 224's front-panel. Modifying this command causes a test restart and may change the current setup.

MOD ?	:Display current mode.
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
AUTO	:Automatic configuration mode

EXAMPLE:

> MOD T1D4 :Sets mode to T1 rate with D4 framing

WARNING: New Setup:
MODe T1D4
CHAnnel FORmat DS0
SOUrce 1 BYTe
SOUrce 2 10101001

>

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 ?	:Display current non-contiguous channel selection.
NON CON L1	:Selects the channel numbers (nn) for LINE 1 and LINE 2. Separate channel numbers with commas.

EXAMPLE:

> NON CON?	:Display the non-contiguous channels selected for LINE 1 and LINE 2.
LINE1: 1,2,3,4,5	
LINE2: 3,4,5,6,7	
> NON CON L1 4,5,6,7,8 L2 5,6,7,8,9	:Selects the non-contiguous channels for LINE 1 (4, 5, 6, 7, and 8) and for LINE 2 (5, 6, 7, 8, and 9).
>	

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 SW1-56 except when **SOURCE CONFIGURATION I** switch is set MONITOR or SCAN.

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.

Set 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?	:Display current in-band programmable loop-down code.
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**

EXAMPLE:

>PGM LPD?	:Display current programmable loop-down code.
PGM LPDn 01001001	
>PGM LPD 100	:Sets programmable loop-down code to 100.
>	

Set 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?	:Display current in-band programmable loop-up code.
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**

EXAMPLE:

>PGM LPU?	:Display current programmable loop-up code.
PGM LPUp 01001001	
>PGM LPU 100	:Sets programmable loop-up code to 100.
>	

Initiate 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 CONtrols	:Initiates a controls printout.
PRI RESults	:Initiates a results printout.
PRI <result name>?	:Initiates a results printout of the selected **<result name>**.

Refer to the **CUSTOM** command for the list of valid **<result names>**. n = **1** (LINE1) or **2** (LINE 2). The result names from a results printout may also be used for the **<result names>**.

See also: **CONTROLS, RESULTS, and CUSTOM**

EXAMPLE:

> PRI BPV1?	:Prints the BPV result for LINE 1.
BPV1 12345	:12345 BPVs are detected on LINE 1.
>	

Print Event

PRInt EVEnt allows you to determine when (if at all) the T-BERD 224 generates automatic test results prints and alarm/status messages.

PRInt EVEnt?	:Display the print event setting.
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 CRC error.
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 alarm 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 Signaling Sequence Results

PRInt SIGnal prints the last received signaling sequence when the channel format is configured for either SIGNLNG or 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	[illegible].2
5	70	70	1336	-7.1	770	[illegible].2
5	70	70	1336	-7.1	770	[illegible].2
1	70	70	1209	-7.3	697	[illegible].2
2	70	70	1336	-7.2	697	[illegible].1
1	70	70	1209	-7.2	697	[illegible].1
2	70	70	1336	-7.2	697	[illegible].2
2	70	70	1336	-7.2	697	[illegible].2
2	1210	70	1336	-7.2	697	[illegible].2
0	138	N/A	N/A	N/A	N/A	N/A

>

PRInt SWEep | PRInt SWEep

Set Frequency Printout ON or OFF

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 ? :Display current status of the Frequency printout function.

PRI SWE ON :Enables the frequency printout.

PRI SWE OFF :Disables the frequency printout.

PRInt SWEep PARameters | 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.

EXAMPLE:

>PRI SWE PAR? :Display the current status of the Frequency Sweep parameters.

SWEep STArt FREq: 100 Hz
SWEep STOp FREq: 2500 Hz
SWEep STEp SIZe: 100 Hz
SWEep STEp INTvl: 2.0 SEC
SWEep SKIp HIGh: 2750 Hz
SWEep SKIp LOW: 2450 Hz

>

Printer 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.

PRInt TERminator?	:Display the current printer line terminator.
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 Control

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 ?	:Display current PRM transmission capability.
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**

Remote Control Prompt

PROmpt controls the prompt symbol at the remote control unit. This command is not valid when using IEEE-488 Remote Control.

PRO ?	:Display status of prompt.
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 is not stored in NOVRAM.

Note that the T-BERD 224 changes any current prompt symbol to (+) when the **HOLd** command is specified.

EXAMPLE:

> PRO?	:Display prompt status.
PROMPT ON	
> PRO S =	:Defines "=" as prompt symbol.
=PRO OFF	:Turns off the "=" prompt.
CLOCK?	:Display the time (no prompt).
CLOCK 10:33:04	
PRO ON	:Turns on the "=" prompt.
=	

Receive Sequence Definition

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 <##>? :Display the digit sequences for the selected receive sequence. The sequence number **<##>** ranges from 1 to 10.

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 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.

EXAMPLE:

> REC SEQ DEF 7? :Display programmed receive sequences number seven.

REC SEQ DEF 7 H07

> REC SEQ DEF 6 H10 :H10 is programmed for receive sequence number six.

 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**

EXAMPLE:

> HOLD	:Hold all printouts for now ...
+CLOCK?	:Requests the clock time.
CLOCK 12:34:56	
+DATE?	:Requests the calendar date.
DATE APR 14	
+CONTROLS	:Note that nothing is printed.
+REL	:Start printing the controls print.
>	:... and the prompt is changed back to (**>**).

Remote Control Entry

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 **DISplay**

Set Automatic T1 Loop Code Response

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?	:Display current T1 loop code response status.
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

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** (LINE1) 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 as the result before establishing frame synchronization or command is not applicable to current configuration.

RES [1 | 2]?	:Prints the displayed result in the Results I or II display.
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 Printout

RESULTS causes a printout of the current result values.

RS-232 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? :Displays the current status of the RS232 parameters.

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**

Setup Summary

SETup? displays the current T-BERD 224 test setup for: **MODE, CHANNEL FORMAT,** and both **SOURCE CONFIGURATION I** and **II** switches.

EXAMPLE:

> SET? :Display current T-BERD 224 setup.

MODe T1D4
CHAnnel FORmat DS0
SOUrce 1 BYTe
SOUrce 2 10101001

Signaling Scan Set

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 ?	:Displays current channels being scanned and the timeouts.
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**.

EXAMPLE:

>SCA?	:Display current channels being scanned and the timeouts.
CHAnnel - 1,2,3,4,5,6,7,8,9	:Channels 1 through 9 are being scanned.
DIScоnnect - 5 Seconds	:Disconnect timeout is 5 seconds.
OFF hook - 5 Minutes	:Off hook timeout is 5 minutes.
>SCA SET CHA 3,5,7,9,10	:Set the channels to be scanned.
>SCA SET DIS 10S	:Set the disconnect timeout for 10 seconds.
>SCA SET OFF 2M	:Set the off hook timeout for 2 minutes.
>	

SIGnal INSert SIGnal INSert

Channel Signaling Bit Insert

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.

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.
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 sinaling 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.

Channel Signaling Bit Insert (Continued)

See also: **CHAnnel FORmat, MODe, PRInt, RESult 1/2**, and **SOUrce 2**

EXAMPLE:

> SIG INS ALL?	:Display the current logical state of all signaling bits.
SIGnal INSert ALL 10	
> SIG INS ALL 1T	:Set signaling bit A to a logic 1 and toggle the B signaling bit B(1/0). The **A SIGNALING INSERT** switch illuminates and the **B SIGNALING INSERT** switch flashes.

SLC Alarm Status

SLC ALArm reports the current SLC alarm condition for the selected line.

SLC AL ?	:Display the current SLC alarm conditions on both lines.
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.

MINOR — 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 MAINTenance, SOUrce 1,** and **SOUrce 2**

SLC Alarm Status (Continued)

EXAMPLE:

> SLC ALA?	:Report on current SLC alarms.
LINE 1 SLC ALARMS:	
SHELF A	
MAJOR	
POWER MISC.	:LINE 1 reports a major alarm on shelf A and a power failure.
LINE 2 SLC ALARMS:	
SHELF A	
MAJOR	
POWER MISC.	
B ON PROT	:LINE 2 reports a major alarm on shelf A and a power failure. Shelf B has switched to the Protection Line.

>

SLC Maintenance Message Status

SLC MAIntenance reports on the status of the datalink maintenance messages for the selected line.

SLC MAI ?	:Reports on the status of the datalink maintenance messages for both lines.
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**

Source Configuration I

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?	:Displays the current selection for the **SOURCE CONFIGURATION I** switch.
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

Source Configuration I (Continued)

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

Source Configuration I (Continued)

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 alarm
POW	:Power/miscellaneous alarm
SW PROt	:Switch to protection line

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.

EXAMPLE:

> SOU 1? :Displays current SOURCE CONFIGURATION I selection.

SOUrce 1 1004

> SOU 1 BYT 10101010 :Select the byte encoder as the new source configuration and set the desired byte contents.

WARNING: New Setup:
MODe T1D4
CHAnnel FORmat DS0
SOUrce 1 BYTe
SOUrce 2 10101010

>

Source Configuration II

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?	:Displays the current status for the **SOURCE CONFIGURATION II** switch selection.
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 NON CONtiguous 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
20 to 3904 Hz	When FREQ is the **SOURCE CONFIGURATION I** switch setting
-40.0 to +3.0 dBm	When LEVEL or SWEEP is the **SOURCE CONFIGURATION I** switch setting. Do not add"+" for positive values
-40.0 to -10.0 dBm	When PAR 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

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 **SOUrce 1 FAR END LOOp** or **SOUrce 1 MAJ ALArm** selection indicates.

PROtection — Selects the **PROtection** line which the **SOUrce 1 FAR END LOOp** selection indicates.

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.

EXAMPLE:

```
> SOU 2?                :Display the current SOURCE CONFIGURATION II selection.
 SOUrce 2 10101001
> SOU 2 10110101        :Change the byte definition to 10110101.
   WARNING: New Setup:
   MODe  T1D4
   CHAnnel FORmat DS0
   SOUrce 1  BYTe
   SOUrce 2  10101010
>
```

Summary Results Print

SUMmary requests a results print for the results and messages in the Summary category.

EXAMPLE:

> SUM :Display current Summary category results and messages.

```
SUMMARY PRINT    15:19:40    FEB 07    BIT ER2:  35320    FAIL PAT: 1 TO 3
FRM ER2: 634
```

Configure the T-BERD 224 for Remote Control Operation

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.

TER :Selects the Terminal control mode.

. (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 enables you to specify the duration of a test.

TES ?	:Displays the current test type.
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.

Changing from continuous to timed causes a test restart.

See also: **TESt LENgth**

Test Length

TESt LENgth sets the length of a timed test. This command is identical to the AUX 03 TES LEN function.

TES LEN ?	:Displays the current test length setting.
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**

EXAMPLE:

> TES LEN?	:Display the current test length setting.
TEST LENGTH 12:35:00	:Current test length is 12 hours, 35 minutes, and 00 seconds.
> TES LEN ; 6 ;	:Test length now is 6 minutes.
>	

Time Print Event

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 ?	:Display the current time interval for results printouts.
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)

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**

EXAMPLE:

> TIM PRI EVE?	:Display the current time interval setting.
TIMed PRInt EVEnt 4:30:00	:Current print event is 4 hours, 35 minutes, and 0 seconds.
> TIM PRI EVE 3:30:00	:Print event now is 3 hours and 30 minutes.
>	

Trunk Type

TRUnk TYPe defines the trunk type emulation (ground start or loop start) and on- and off-hook signaling generated by the T-BERD 224. This command is identical to the AUX 24 TRK DEF function.

TRU TYP ? :Displays the current trunk type.

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.

EXAMPLE:

> TRU TYP? :Display the current trunk type.
GROund STart SLC STAtion

>TRU TYP GRO ST SLC OFF :Enables the T-BERD 224 to emulate a ground start SLC office circuit.

>TRU TYP DEF ONH 01xx :Enables the user defined on-hook signaling as a=0, b=1, c=don't care, and d=don't care.

Set User Programmable Test 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?	:Displays current user programmable data pattern.
USEr <bb...bb>	:Sets the user programmable data pattern. **<bb...bb>** equals 3- to 24-bit binary code. The left-most bit is transmitted first.

See also: **SOUrce 1 USEr**

EXAMPLE:

>USE?	:Display current user pattern.
USEr 10000100	:8-bit test pattern.
>USE 10101110000111010	:Enter new test pattern.
>	

Loudspeaker Control

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 ?	:Displays the current status of the T-BERD 224 **VOLUME** switch.
VOL ON	:Turns the speaker ON.
VOL OFF	:Turns the speaker OFF.

Each time the unit power is turned off and then on again, the status of this control is always set to ON.

Wink

WIN determines how the T-BERD 224 transmits the the wink supervision event during the receive sequence. This command is identical to the wink control of the AUX 28 SEV DEF function.

WIN?	:Displays the current wink settings (1000 ms).
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**

EXAMPLE:

> WIN?	:Displays the current wink setting.
Wink delay = 200	
Wink duration = 150	
> WIN DUR 100	:Set the wink duration to 100 ms.

APPENDIX
ACRONYM LIST

ACRONYM LIST

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 Suppression
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 Pulse
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
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
FT1	Fractional T1
FB	Framing Bit
FX	Foreign Exchange
FXO	Foreign Exchange Office
FXS	Foreign Exchange Station
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
PRM	Performance Report Message
QRSS	Quasi-Random Signal
RT	Remote Terminal
RTS	Request to Send
S/N	Signal to Noise

SLC	Subscriber Loop Carrier
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

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