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Rev. G

T-BERD 209*OSP*
T-CARRIER ANALYZER

REFERENCE MANUAL

JULY 1995

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GENERAL INFORMATION

This manual provides information about the physical features, functional operation, and specifications of the Telecommunications Techniques Corporation (TTC) T-BERD 209*OSP* T-Carrier Analyzer. In addition to this manual, a *T-BERD 209OSP User's Guide* provides information on setting up and operating the T-BERD 209*OSP* in a number of outside plant applications.

1.1 INSTRUMENT OVERVIEW

The T-BERD 209*OSP* is a portable test instrument that comprehensively analyzes T1 transmission systems. Designed for outside plant testing, the T-BERD 209*OSP* may be used during circuit installation, acceptance testing, and fault isolation.

Weather-resistant construction permits the T-BERD 209*OSP* to operate in harsh environments. A membrane-switch front panel and a seamless, molded plastic case protects the T-BERD 209*OSP* against the entry of water and debris. All connections, where water or dirt might be introduced, are isolated from the mainframe electronics by a water-resistant barrier.

AUTOTEST™ feature performs a sequence of automated tests on a T1 circuit. These tests include: BRIDGTAP automated pattern sequence, Repeater test, optional DC measurements tests, and optional TDR test. This feature requires the T-BERD T1 Repeater Adaptor accessory.

Automated BRIDGTAP™ pattern sequence detects bridge taps on a T1 span by automatically generating 21 test patterns and monitoring the returned signal for errors.

Automated MULTIPAT™ pattern sequence generates five standard test patterns in 15 minutes. This feature eliminates the need to perform separate tests with each pattern.

D1D, D4, ESF, SLC-96, and unframed framing patterns offer compatibility with a variety of framing formats.

Two front panel displays provide verification of instrument configuration and test results.

Repeater test verifies each side of a repeater with PASS/FAIL results. This feature requires the T-BERD T1 Repeater Adaptor accessory.

Logic error, bipolar violation, and frame error analysis are performed simultaneously.

Complete signal analysis includes signal level, timing slips, received clock frequency, and simplex current measurements.

In-band and out-of-band ESF loopback codes enable the instrument to loopback or emulate devices that accept either in-band or out-of-band datalink loop codes.

Bit-Patterned Message (BPM) recognition enables the T-BERD 209*OSP* to identify and display BPMs from the ESF datalink in accordance with ANSI T1.403. In addition, the T-BERD 209*OSP* can generate BPMs.

SUMMARY category displays either *ALL RESULTS OK* or any out-of-specification or non-zero results, eliminating the need to search through long lists of test results.

AUTO mode automatically configures the T-BERD 209*OSP* to synchronize to the received T1 signal. No setup is required when monitoring live circuits.

Logic error and bipolar violation (BPV) insertion enables the T-BERD 209*OSP* to simulate errors.

Line build-out (LBO) selections add troubleshooting capability to uncover marginal problems such as cable crosstalk and bridge taps.

Print capability generates instrument setup, test results, and TDR trace printouts.

Rechargeable lead-acid battery provides eight to ten hours of continuous cord-free operation.

1.2 OPTIONS

DC Measurements Option (209*OSP*-1)

DC voltage measurements verify voltage potentials between the selected pair of cables in the office, at the repeater inputs, and across the repeater.

Simplex current measurement gives a breakdown of tip current, ring current, and summary (simplex) current for the selected cable pair.

Resistance measurements verify the tip-ring (loop) resistance, tip-ground resistance, and ring-ground resistance.

T-BERD T1 Repeater Adaptor enables mid-span DC repeater testing using the AUTOTEST function.

TDR Measurements Option (209*OSP*-2)

Time Domain Reflectometer (TDR) feature identifies cable pair faults (shorts, opens, and bridge taps) and indicates the distance to the fault. Up to four cable pair faults can be identified per test.

Graphic display of the TDR trace provides visual verification of the fault type and location. A zoom in/out feature allows the user to magnify selected sections of the TDR trace.

Reference trace storage allows a comparison between the reference and present TDR traces.

Pre-programmed or user-programmable cable parameters are available for TDR setup based on the cable gauge and type.

TDR trace and test setup printouts are available using the TTC PR-40A (or compatible) Thermal Printer.

Channel Monitor Option (209*OSP*-3)

Signaling bits for all 24 DS0 channels can be displayed in the character display.

Data bits for a user-selected DS0 channel are displayed on the character and graphic displays.

Selected channel's signaling bits and number can be displayed on a graphic display for easy verification.

VF CHAN selection enables the T-BERD 209*OSP* to drop a single channel's VF output to the speaker.

Advanced Stress Patterns Option (209*OSP*-4)

T1 DALY, T1-2/96, T1-3/54, T1-4/120, T1-5/53, 55 OCTET, and MIN/MAX patterns stress the circuitry of the T1 span equipment, including line repeaters and T1 multiplexers.

Enhanced ESF Option (209*OSP*-5)

Monitors and reports on the received ESF datalink ANSI T1.403 Performance Report Message (PRM).

Adds PRM results to the ERRORS and SUMMARY categories.

Generates and transmits PRMs on the T1 signal.

Adds a SMARTNIU mode that enables the T-BERD 209*OSP* to query, retrieve, store, and clear T1 circuit statistics obtained by the performance monitor feature of the Westell NIU/ Performance Monitor.

Smart Loopback/Command Codes Option (209*OSP*-6)

Adds intelligent network equipment loop codes that enable the T-BERD 209*OSP* to control additional Teltrend, Wescom, Westell, or equivalent intelligent network equipment.

Adds maintenance switch commands that enable the T-BERD 209*OSP* to activate maintenance switch ramp and switch functions.

Fractional T1 Option (209*OSP*-7)

Fractional T1 (FT1) modes provide contiguous and noncontiguous fractional T1 testing capabilities (56KxN and 64KxN) in D4 and ESF framing formats.

Adds three FT1 patterns (63, 511, and 2047) for testing DDS and fractional T1 circuits.

Adds VF tones that can be transmitted on a user-selected DS0 channel.

HDS /ISDN/DDS Measurements Option (209*OSP*-8)

Adds an HDSL mode that enables the T-BERD 209*OSP* to test local loop's HDSL compatibility.

Adds a WB TONES mode that enables the T-BERD 209*OSP* to measure loss for Basic Rate ISDN and 56 Kb/s DDS networks. The transmitted tones are 40 KHz for Basic Rate ISDN and 28 KHz for 56 Kb/s DDS service.

Adds loop length measurement test that can determine the total loop capacitance and total loop length, including bridge taps.

Transmits a 163 KHz, 196 KHz, or 392 KHz signal and measures the loop loss.

Measures signal power on HDSL circuits.

Adds HDSL loop codes that enable the T-BERD 209*OSP* to control PAIRGAIN or equivalent HDSL circuit repeaters.

DLC Analyzer Option (209*OSP*-96)

Report on and generate SLC-96 datalink major, minor, and power/miscellaneous alarms. SLC-96 datalink and T1 channel information can be dropped and inserted.

Establish far-end loopbacks over a given shelf or protection line. The selected shelf is automatically switched to the protection line when placed in loopback.

Initiate switch to protection line for a given shelf.

Generate on-hook, off-hook, and ringing conditions from dedicated switches.

Monitor A, B, C, and D channel signaling bits on all channels or timeslots simultaneously.

Provides request format for SLC-96 Mode 2 timeslot channel assignments and displays the results on the front panel.

Initiate Automated maintenance test procedure from the DLC Analyzer Option.

Measure VF signal level and frequency for individual DS0 channels or timeslots.

Insert 404, 1004, and 2804 Hz tones into individual DS0 channels or timeslots.

Insert a PBX wink signal on the selected channel when an on-hook state to off-hook state transition is detected and display a count of the transmitted wink signals since the last test restart.

Decodes DTMF dialing sequences and displays the dialed number of the received signal.

Two-wire VF input/output enables two-way testing over a selected DS0 channel or timeslot. VF outputs enable DS0 channels or timeslots to be analyzed by external TIMS test sets or listened to over a built-in speaker.

ISDN/DDS Analyzer Option (209*OSP*-9)

Adds capability to qualify Basic Rate ISDN and DDS local loops between the main distribution frame and the demarcation point.

Perform testing with BERT patterns and special network controls over either 4 wire DDS local loop or a 2 wire basic rate ISDN interface between the network and the customer premise.

1.3 ACCESSORIES

T-BERD T1 Repeater Adaptor (Model #41754)

The T-BERD T1 Repeater Adaptor is a circuit card extender that allows the T-BERD 209*OSP* to connect to a repeater housing and perform T1 circuit testing. The special cable from the T-BERD T1 Repeater Adaptor to the T-BERD 209*OSP* allows the T-BERD 209*OSP* to receive and transmit T1 signals at repeater inputs and outputs without having to reconfigure cable connections.

The AUTOTEST feature is enabled with the T-BERD T1 Repeater Adaptor. This automatic test sequence includes sending loop codes as appropriate to perform loopback tests and changing the test locations so that all four cable pairs are tested.

T-BERD Repeater Power Supply (Model #41084)

The T-BERD Repeater Power Supply delivers a constant current source of 60 mA, 100 mA, or 140 mA, which enables outside plant technicians to test the completion of the span by powering the T1 circuit from the distribution frame in the central office. The output voltage varies up to 260 VDC, depending on the number of repeaters powered, span length, and cable gauge.

Repeater Power Supply Multiplexer (Model #43141)

The Repeater Power Supply Multiplexer is an accessory for the T-BERD Repeater Power Supply that supplies transmit and receive power jacks for six T1 lines, which enable the T-BERD Repeater Power Supply to power up to six T1 circuits from the distribution frame in the central office.

PR-40A Thermal Printer

The PR-40A is a thermal, 40-column/80-column, graphics printer. This printer connects to the AUXILIARY PORT (RS-232 printer interface) connector.

Cables (see Table 1-1)

Table 1-1
T-BERD 209*OSP* Accessory Cables

Model	Description
30758	Printer cable — 8-pin DIN to 25-pin D
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')
30697	WECO 310 plug to mini-test clips (6')
10599	WECO 310 plug to bantam plug (4')
10559	WECO 310 plug to bantam plug (10')
40606	15-pin D to 8-pin modular RJ48 (10')
42047	RJ48 to RJ48 (6')
42048	T-BERD Repeater Power Supply Adaptor — Dual-WECO 310 plug to 15-pin D
41645	Dual-bantam plug to 8-pin modular RJ48
11350	Dual WECO 310 to WECO 303

INSTRUMENT CHECKOUT AND SERVICE

2.1 UNPACKING

The T-BERD 209*OSP* shipping container should be inspected for damage when it is received. If the shipping container or shipping 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 209*OSP* does not pass the Instrument Checkout, notify TTC at 800-638-2049. If the shipping container is damaged, notify the carrier as well as TTC, and keep the shipping container and materials for the carrier's inspection.

2.2 EQUIPMENT INCLUDED

The following equipment should be present when the T-BERD 209*OSP* shipment is unpacked.

- T-BERD 209*OSP* T-Carrier Analyzer
- AC power cord
- Printer cable (8-pin DIN to 25-pin D)
- Reference Manual and User's Guide

Check the purchase order against the option label(s) on the bottom of the T-BERD 209*OSP* to verify that the option(s) ordered are installed.

2.3 WARNINGS AND CAUTIONS

The following warnings and cautions must be observed 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's bottom cover while power is applied to the unit.

DO NOT OPERATE IN AN AMBIENT TEMPERATURE ABOVE 50°C

Do not operate this unit in ambient temperatures that exceed 50°C (122°F). Operating this unit in temperatures above 50°C (122°F) can cause damage.

TURN OFF POWER WHEN CONNECTING TO T1 REPEATER PORT

The T-BERD 209*OSP* must be turned off prior to connecting the T1 Repeater Adaptor cable to the T1 REPEATER PORT. Connecting the cable to the T1 REPEATER PORT with the T-BERD 209*OSP* turned on can damage the T-BERD 209*OSP*.

ALWAYS USE CORRECT FUSE SIZE

The T-BERD 209*OSP* should be operated with a 1A, 250V, Slo-Blo fuse (Littlefuse #218001 or equivalent). See Section 2.7 for fuse replacement instructions.

2.4 INSTRUMENT SELF-TEST

At power-up, the T-BERD 209*OSP* performs a self-test, which momentarily illuminates all LEDs and restores the previous settings selected before the last power-down. The Charge LED does not illuminate at power-up if AC power is not connected. If any changes are found in the nonvolatile random access memory (NOVRAM) data, the message *NOVRAM LOST* appears, the test set reloads the factory default settings (see Appendix A), and displays the message *RELOAD NOVRAM*. If the message *RAM FAILURE* or *ROM FAILURE* is displayed, call TTC for service at 800-638-2049.

Restoring Factory Default Settings

1. RESTART switch

Press and hold down the **RESTART** switch. Press the **Power** switch to ON. Hold down the **RESTART** switch until the message *SYSTEM RESET* is displayed.

2. LED indicators

Verify all the LEDs illuminate, the message *RELOAD NOVRAM* appears, and the message *calibrating...* is displayed.

NOTE: If the message calibration failed appears, the T-BERD 209*OSP* may require service. Contact the TTC Customer Service Department at 800-638-2049.

2.5 INSTRUMENT CHECKOUT

1. Open the T-BERD 209*OSP* cover

2. Connect AC power to the T-BERD 209*OSP*

Connect the AC power cord from the T-BERD 209*OSP* to an AC power source.

3. Press the Power switch

Verify the T-BERD 209*OSP* completes start-up and self test.

4. Configure the T-BERD 209*OSP* switches

MODE	T1 (T1 unframed)
PATTERN	ALL ONES
RCV'D	INTERNAL (LED OFF)
RECEIVE INPUT	TERM
LBO dB(DSX)	0
RESULTS I Category	SUMMARY

5. Connect the TRANSMIT/TDR jack to the RECEIVE jack

Use a WECO 310 to WECO 310 cable to connect the TRANSMIT/TDR jack to the RECEIVE jack.

6. Signal verification

Verify that the T1 Pulses and Pattern Sync LEDs illuminate.

NOTE: If the Low Battery LED is illuminated or illuminates at any time during this procedure, continue the instrument checkout. When the instrument checkout is complete, turn OFF the T-BERD 209OSP, but leave the AC power cord attached. Recharge the battery for a minimum of eight hours before operating from the battery.

7. Select the RX LEVEL result

Use the **RESULTS I Category** and **Results** switches to select the SIGNAL category RX LEVEL result. The value should equal 0 dBdsx ±1 dB.

8. Set LBO to 7.5 dBdsx

Set the **LBO dB(DSX)** switch to 7.5 and confirm the RX LEVEL result changes to -7.5 dBdsx ±1 dB.

9. Set LBO to 15 dBdsx

Set the **LBO dB(DSX)** switch to 15 and confirm the RX LEVEL result changes to -15 dBdsx ±2 dB.

10. Set LBO to 22.5 dBdsx

Set the **LBO dB(DSX)** switch to 22.5 and confirm the RX LEVEL result changes to -22.5 dBdsx ±3 dB.

11. Select the RX FREQ result

Use the **RESULTS I Results** switch to select the RX FREQ result. The value should be 1,544,000 Hz ±1 Hz.

12. Remove the cable between the TRANSMIT/TDR and RECEIVE jacks

Remove the WECO 310 to WECO 310 cable connecting the TRANSMIT/TDR jack to the RECEIVE jack.

13. Configure the T-BERD 209*OSP* switches

MODE	SELFTST
PATTERN	ALL ONES
RESULTS I Category	SUMMARY
RESULTS II Category	SUMMARY

14. Press and release the RESTART switch

15. Signal verification

Verify the message ALL RESULTS OK appears in both displays.

16. RESULTS I Category and Results switches

Select the ERRORS category BIT ERRORS result. The value should equal 0.

17. RESULTS II switches

Select the ERRORS category VIOLATIONS result. The value should equal 0.

18. ERR INS switch

Press and release the **ERR INS** switch several times. Verify the BIT ERRORS result increments by one each time the switch is pressed. Verify the VIOLATIONS test result increments by one each time the switch is pressed.

19. Power switch

If an Option is installed, perform the appropriateOption Checkout Procedure.

If no Options are installed, press the **Power** switch to OFF. Leave the AC power cord connected to the instrument and recharge the battery for a minimum of eight hours before operating the test set from the battery. A fully charged battery typically provides five to seven hours of continuous operation.

DC Measurements Option Checkout Procedure

1. MODE switch

Verify the DC TEST mode is available.

2. PATTERN switch

While in DC TEST mode, press the **PATTERN** switch to verify the OHMS, VOLTS, and AMPS tests are available.

3. Proceed to next option checkout procedure

If there are additional options to be verified, proceed to the next applicable option checkout procedure. If this is the last option to be verified, press the **Power** switch to OFF.

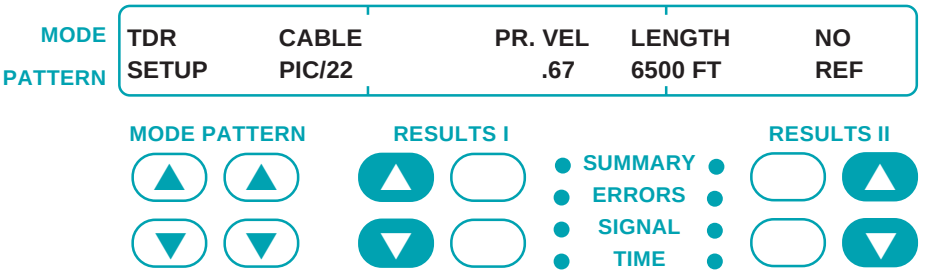
TDR Measurements Option Checkout Procedure

1. MODE switch

Verify the TDR mode is available.

2. PATTERN switch

Select the TDR SETUP menu.



3. **RESULTS I and II switches**
   Verify the CABLE and LENGTH parameters can be changed.

4. **Proceed to next option checkout procedure**
   If there are additional options to be verified, proceed to the next applicable option checkout procedure. If this is the last option to be verified, press the **Power** switch to OFF.

Advanced Stress Patterns Option Checkout Procedure

1. **MODE switch**
   Select T1 D4.

2. **PATTERN switch**
   Press the **PATTERN** switch to verify the T1 DALY, T1-2/96, T1-3/54, T1-4/120, T1-5/53, 55 OCTET, and MIN/MAX long stress patterns are available.

3. **Proceed to next option checkout procedure**
   If there are additional options to be verified, proceed to the next applicable option checkout procedure. If this is the last option to be verified, press the **Power** switch to OFF.

Enhanced ESF Option Checkout Procedure

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX DATALINK function.

2. RESULTS I Results switch

Press either the up or down arrow to scroll through the selections (PRM TRANSMIT, PRM RECEIVE, BPM RECEIVE, USER BPM).

3. RESULTS II Results switch

Press either the up or down arrow to verify the PRM RECEIVE and PRM TRANSMIT can be toggled between OFF and ON.

4. AUX switch

Press the **AUX** switch to return to the operating mode.

5. RESULTS I Category and Results switches

Select SUMMARY category. Verify ESF datalink far-end PRM results are available.

6. MODE switch

Press the **MODE** switch to verify the SMARTNIU mode is available.

7. PATTERN switch

Press the **PATTERN** switch to verify the RESULTS and SETUP functions are available.

8. Proceed to next option checkout procedure

If there are additional options to be verified, proceed to the next applicable option checkout procedure. If this is the last option to be verified, press the **Power** switch to OFF.

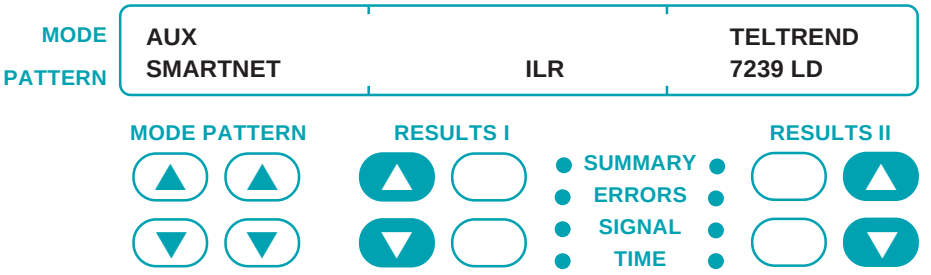
Smart Loopback/Command Codes Option Checkout Procedure

1. AUX and PATTERN switch

Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to verify the AUX SMARTNET function is available.

2. RESULTS switches

Press the **RESULTS I Results** switch to select ILR (intelligent line repeaters). Press the **RESULTS II Category** switch to select an ILR manufacturer (e.g., TELTREND). Press the **RESULTS II Results** switch to select the model (e.g., 7239 LD). Refer to Section 4.2 Auxiliary Functions for additional information on available intelligent repeaters.

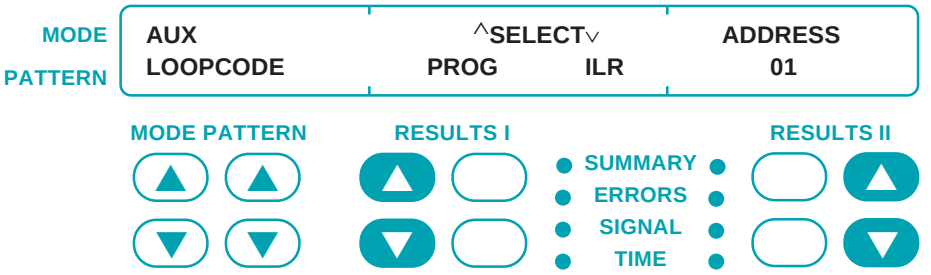


3. LOOP CODES switch

Select the PROG position (PROG LED illuminated).

4. PATTERN, CATEGORY, and RESULTS switches

Press the **PATTERN** switch to select the AUX LOOPCODE function. Press the **RESULTS I Category** switch to verify the ILR selection and address is available with the appropriate digits for the ILR address. Press the **RESULTS II Results** switch to verify the address can be programmed. Refer to Section 4.2 Auxiliary Functions for additional information on allowable address ranges for various intelligent repeaters.



5. AUX switch

Press the **AUX** switch to exit the auxiliary functions.

6. Proceed to next option checkout procedure

If there are additional options to be verified, proceed to the next applicable option checkout procedure. If this is the last option to be verified, press the **Power** switch to OFF.

Fractional T1 Option Checkout Procedure

1. MODE switch

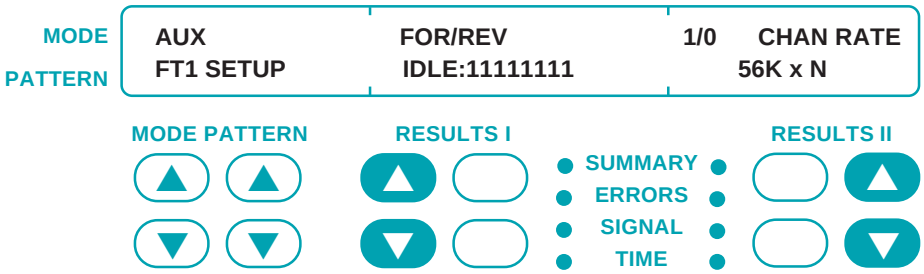
Verify the FT1 D4 and FT1 ESF modes are available. Select FT1 D4.

2. PATTERN switch

Press the **PATTERN** switch to verify the 63, 511, and 2047 patterns and one of the tones (404Hz, 1004Hz, 2804 Hz, and 2713 Hz) are available.

3. AUX and PATTERN switch

Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to verify the AUX FT1 CHAN, AUX FT1 SETUP, and AUX VF TONE functions are available.



4. Proceed to next option checkout procedure

If there are additional options to be verified, proceed to the next applicable option checkout procedure. If this is the last option to be verified, press the **Power** switch to OFF.

HDSL / ISDN / DDS Measurements Option Checkout Procedure

1. Test setup

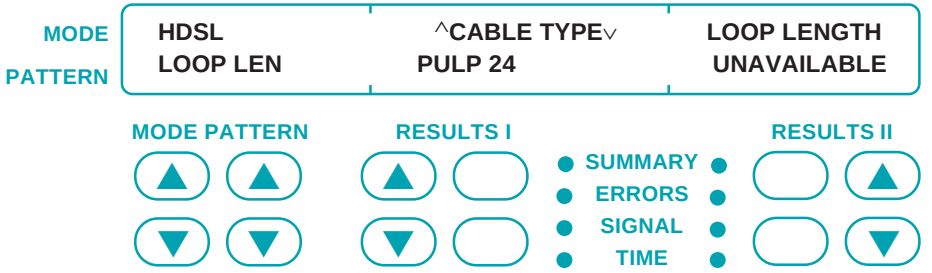
Prepare the T-BERD 209OSP for testing in accordance with the Instrument Checkout Basic Setup procedure.

2. MODE switch

Verify the HDSL mode is available.

3. PATTERN switch

Press the **PATTERN** switch to verify the LOOP LEN, 163KHz, 196KHz, 392 KHz, and POWER selections are available.



4. Proceed to next option checkout procedure

If there are additional options to be verified, proceed to the next applicable option checkout procedure. If this is the last option to be verified, press the **Power** switch to OFF.

DLC Analyzer Option Checkout Procedure

1. **T-BERD DLC Analyzer Option cable**

With AC power still supplied to the T-BERD 209*OSP*, connect the DLC Analyzer Option cable to the T-BERD 209*OSP* AUXILIARY PORT connector.

2. **T-BERD DLC Analyzer Option power-up sequence**

When the instrument is powered up, an automatic self-test is initiated testing the following:

- Illuminates all front-panel and switch LEDs.
- Checks the position of all switches. If a switch is stuck, the message *STUCK SWITCH DETECTED* appears in the display.
- The nonvolatile RAM (NOVRAM) is checked and the front-panel switches are restored to the previous settings selected before the last power-down. If any changes are found, the factory default settings are reloaded and the message *RELOADING NOVRAM* is displayed.
- If it becomes necessary to restore all switch settings to the factory defaults, turn the power off, then press and hold the **RESTART** switch while power is turned on. The display and all the LEDs illuminate and the message *RELOADING NOVRAM* appears in the display. The T-BERD DLC Analyzer Option remains fully functional even though the switch settings may not be saved during the power cycle. While the instrument may be used, contact the TTC Customer Service Department at (800) 638-2049.

- The instrument RAM, EPROM, and microprocessor are also checked during the self-test. If any error is found, the messages *RAM FAILURE 186, ROM FAILURE 186, RAM FAILURE 188,* and *ROM FAILURE 188* appear. In such instances, contact the TTC Customer Service Department at (800) 638-2049. There are no user-serviceable parts within the T-BERD DLC Analyzer Option.

3. AUX switch

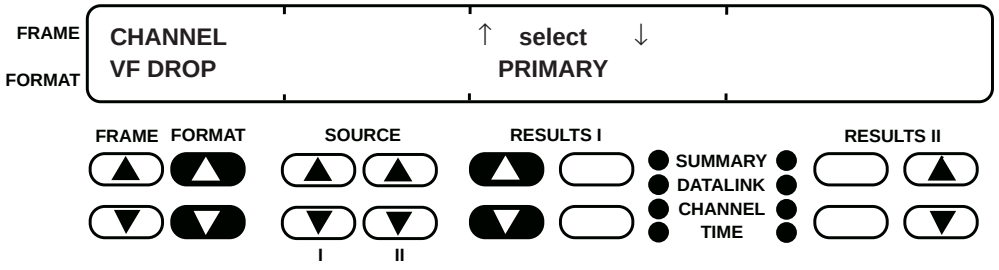
Press this switch to select the auxiliary functions.

4. FRAME switch

Press this switch to select the CHANNEL auxiliary group.

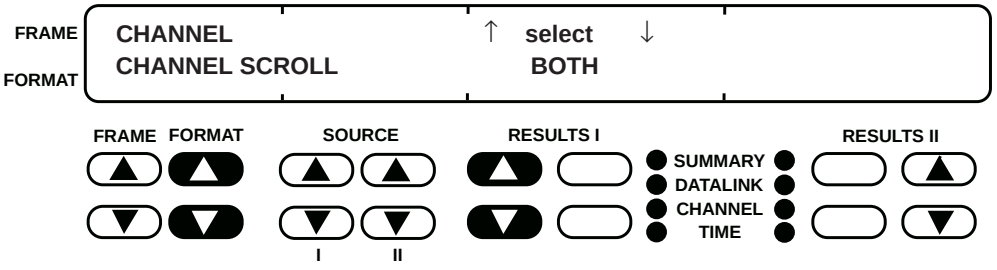
5. FORMAT switch

Press this switch to select the CHANNEL/VF DROP auxiliary function and press the **RESULTS I Results** switch to set which T1 line the DS0 channel is dropped from. Set the auxiliary function for PRIMARY to drop the DS0 channel from the PRIMARY RECEIVE T1 signal.



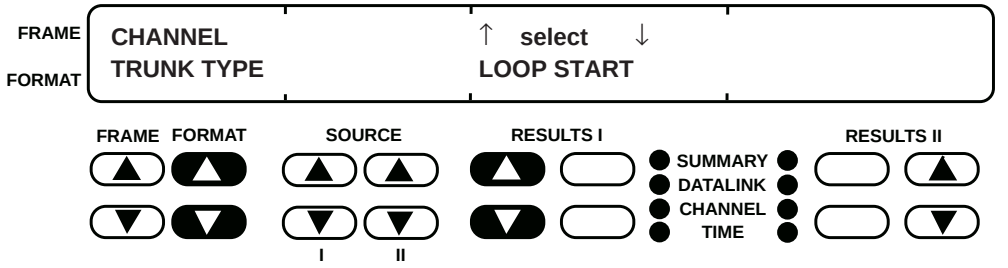
6. FORMAT switch

Press this switch to select the CHANNEL/CHANNEL SCROLL auxiliary function and press the **RESULTS I Results** switch to set the **PRIMARY** and **SECONDARY CHANNEL** switch control to BOTH.



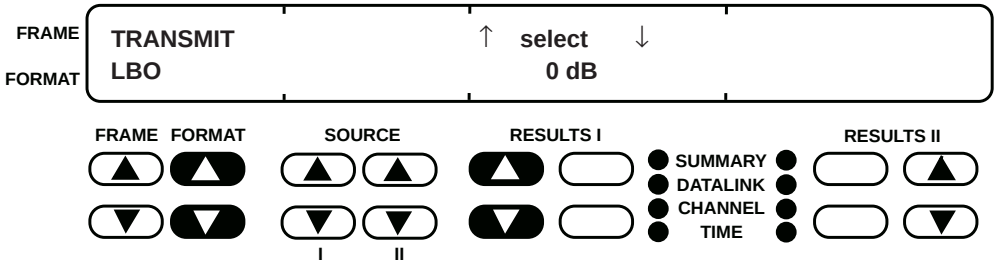
7. FORMAT switch

Press this switch to select the CHANNEL/TRUNK TYPE auxiliary function and press the **RESULTS I Results** switch to set the signaling protocol to either LOOP START or GND START.



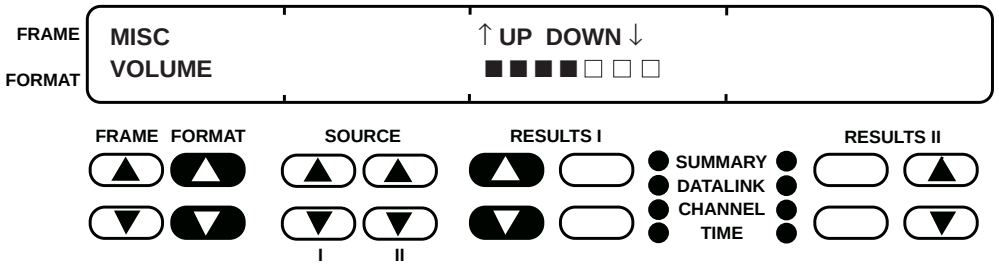
8. **FRAME switch**

Press this switch to select the TRANSMIT/LBO auxiliary function. Press the **RESULTS I Results** switch to set the LBO level to 0.0 dB.



9. FRAME and FORMAT switches

Press the **FRAME** switch to select the MISC auxiliary functions. Press the **FORMAT** switch to select the MISC/VOLUME auxiliary function. Press the **RESULTS I** Results switch to set the volume to mid-range (half the boxes filled).



10. AUX switch

Press this switch to exit the auxiliary functions.

11. CODE switch

Press this switch to select the appropriate line coding, either AMI or B8ZS.

12. FRAME switch

Press this switch to select the SLC-M1 mode.

13. FORMAT switch

Press this switch to select the DATLINK format.

14. SOURCE I switch

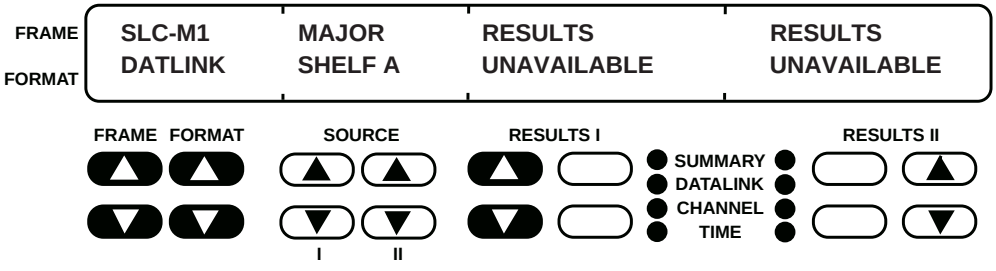
Press this switch to select MAJOR.

15. SOURCE II switch

Press this switch to select SHELF A.

16. RESULTS I and II Category switches

Press these switches to select the SUMMARY category. The yellow LED labeled SUMMARY next to the switch illuminates when the SUMMARY category is selected.



17. RECEIVE INPUT switch

Press this switch to select the TERM receive input level. This switch sets the input level for both RECEIVE input jacks.

18. TRANSMIT and PRIMARY RECEIVE jacks

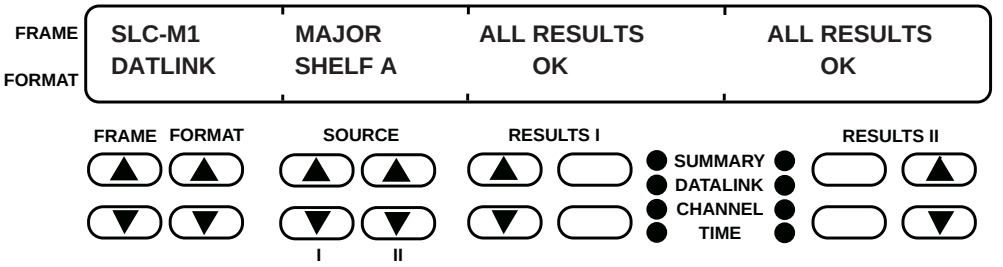
Connect a cable between these two jacks. Press the **RESTART** switch.

19. PRI T1 Pulses and Frame Sync LEDs

The green LEDs should be illuminated. If these LEDs do not illuminate, verify that the cable is properly connected between the TRANSMIT jack and the PRIMARY RECEIVE jack.

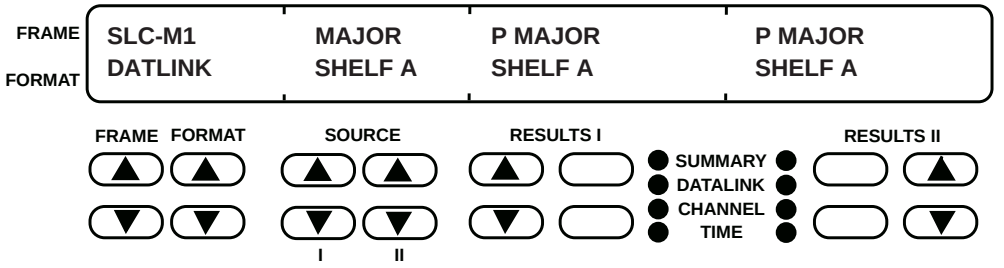
20. RESULTS I and II SUMMARY category test results

When the cable is connected in the previous step, the displayed result message should change to the following.



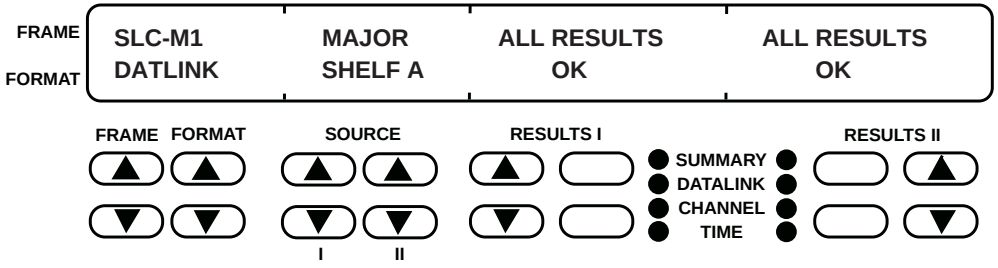
21. INSERT switch

Press this switch. The internal switch LED flashes for three seconds then illuminates. When the switch illuminates, the following message should appear in the RESULTS I and II displays.



22. INSERT switch

Press this switch. The internal switch LED goes out. When the switch is not illuminated, the following message should appear in the display.



23. FORMAT switch

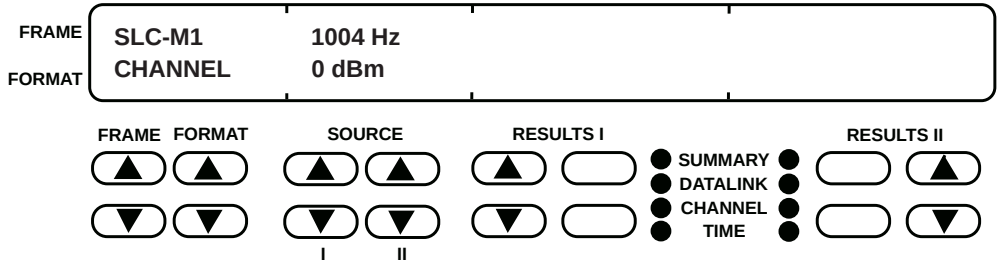
Press this switch to select the CHANNEL format.

24. SOURCE I switch

Press this switch to select 1004 Hz.

25. SOURCE II switch

Press this switch to select 0.0 dBm.



26. PRIMARY CHANNEL switch

Press this switch to change the display from "— —" to "01". The channel number appears in both CHANNEL switch displays.

27. INSERT switch

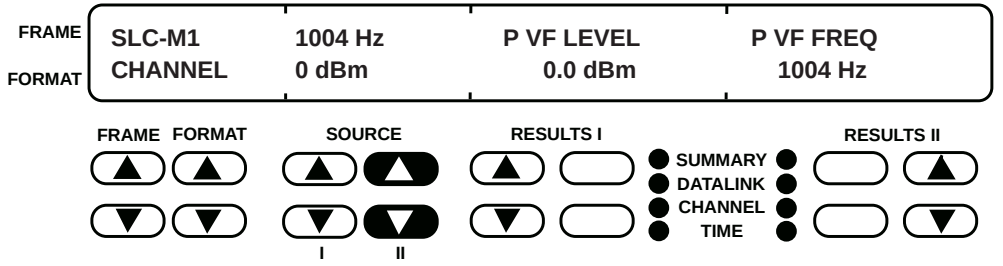
Press this switch. The internal switch LED flashes for three seconds then illuminates. When the switch illuminates, the 1004 Hz tone should be heard through the speaker.

28. RESULTS I and II Category switches

Press these switches to select the CHANNEL category. The yellow LED labeled CHANNEL next to the switch illuminates when the CHANNEL category is selected.

29. RESULTS I and II Results switches

Press these switches to select the P VF LEVEL and P VF FREQ test results. The VF level should be 0.0 dBm ±0.1 dB. The VF frequency should be 1004 Hz ±1 Hz.



30. Power switch

Press the T-BERD 209*OSP* **Power** switch to OFF. Disconnect the DLC Analyzer Option cable from the AUXILIARY PORT connector. Leave the AC power cord connected to the instrument and recharge the battery for a minimum of eight hours before operating the test set from the battery. A fully charged battery typically provides five to seven hours of continuous operation.

ISDN/DDS Analyzer Option Checkout Procedure

1. T-BERD ISDN/DDS Analyzer Option cables

With power applied to the T-BERD 209*OSP*, connect the ISDN/DDS Analyzer Option DC power cable to the T-BERD 209*OSP* AUXILIARY PORT connector.

NOTE: ISDN/DDS Analyzer Option can be powered with the DC power cable or the AC power cable ***but not both*** at the same time.

In standalone mode, connect the ISDN/DDS Analyzer Option AC power cable to the AC input connector and then to an AC source. Press the Power switch to power up the ISDN/DDS Analyzer.

2. T-BERD ISDN/DDS Analyzer Option power-up sequence

When the instrument is powered up, an automatic self-test is initiated testing the following:

- Illuminates all front-panel and switch LEDs.

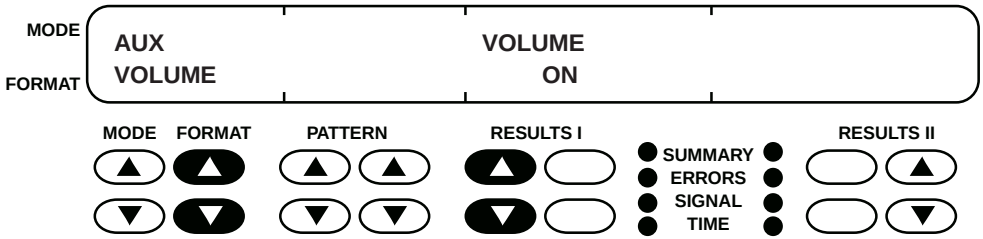
- Checks the position of all switches. If a switch is stuck, the message *STUCK SWITCH DETECTED* appears in the display.
- The nonvolatile RAM (NOVRAM) is checked and the front-panel switches are restored to the previous settings selected before the last power-down.
- If it becomes necessary to restore all switch settings to the factory defaults, turn the power off, then press and hold the **RESTART** switch while power is turned on. The display and all the LEDs illuminate and the message *RELOADING NOVRAM* appears in the display.

3. AUX switch

Press this switch to select the auxiliary functions.

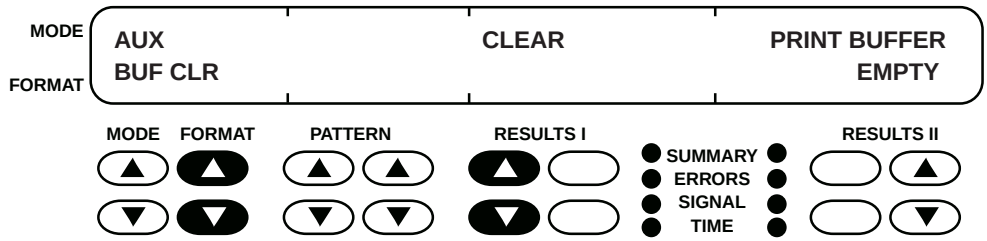
4. FORMAT switch

Press this switch to select the VOLUME auxiliary function and press the **RESULTS I Results** switch to toggle the speaker control ON/OFF.



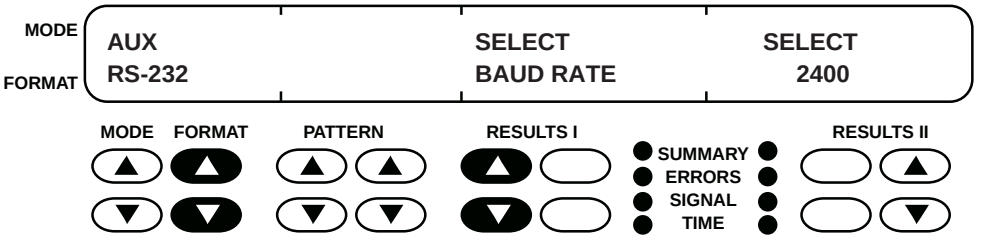
5. FORMAT switch

Press this switch to select the BUF CLR (Buffer Clear) auxiliary function and press the **RESULTS I Results** switch to clear the print buffer..



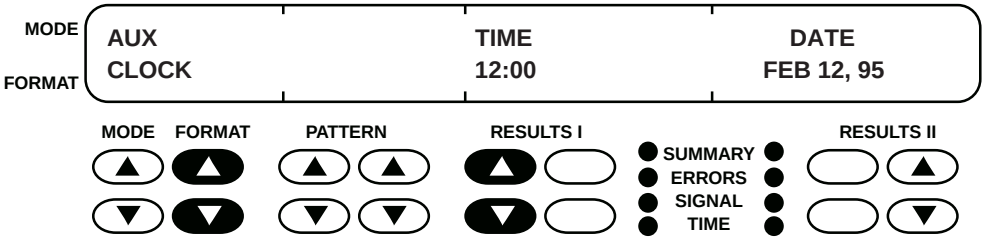
6. FORMAT switch

Press this switch to select the RS-232 (RS-232 AUX Port Configuration) auxiliary function, press the RESULTS I Results switch to select between the BAUD RATE, PARITY, and TERM 232 functions. The **RESULTS II Results** switch is used to select the individual parameters of each function.



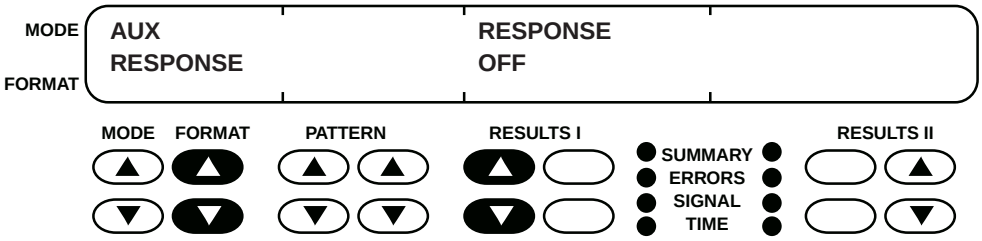
7. FORMAT switch

Press this switch to select the CLOCK auxiliary function, press the **CATEGORY I Category** switch to select between hours and minutes. Press the **RESULTS I Results** switch to set the time. Press the **CATEGORY II Category** switch to select between month, day, and year. Press the **RESULTS II Results** switch to set the date.



8. FORMAT switch

Press this switch to select the RESPONSE auxiliary function, press the **RESULTS I Results** switch to set the loopback response function either ON or OFF..

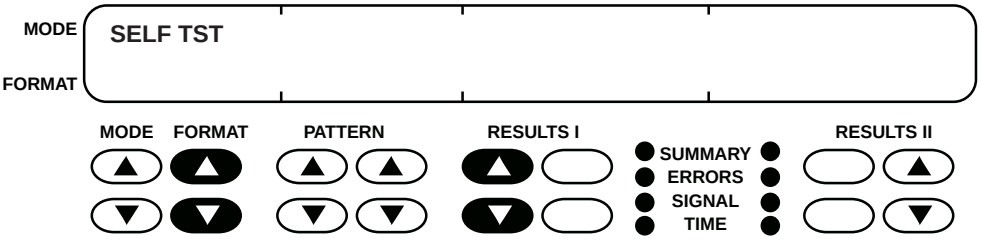


9. AUX switch

Press this switch to exit the auxiliary functions.

10. MODE switch

Press this switch to select SELF TST mode.

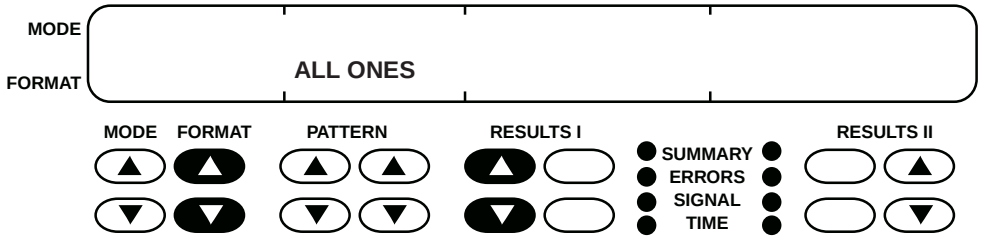


11. FORMAT switch

Press this switch to select 56 kB/s as the rate for the data to be transmitted.

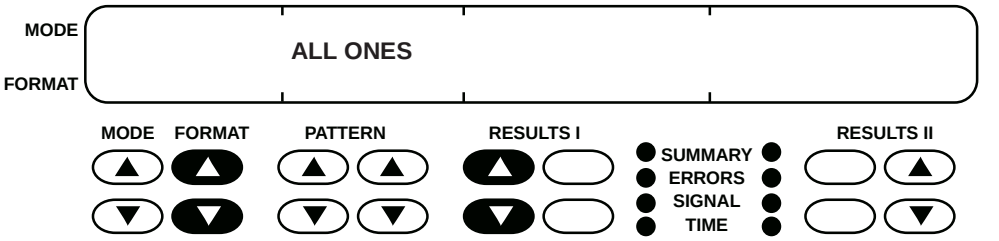
12. PRI PATTERN switch

Press this switch to select the primary data pattern.



13. SEC PATTERN switch

Press this switch to select the secondary data pattern (DDS mode only).

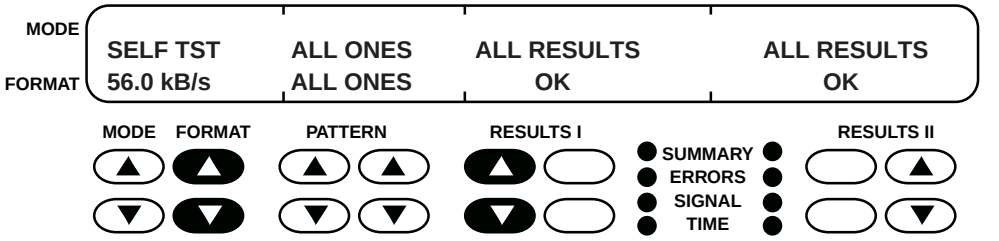


14. RESULTS I Category switch

Press this switch to select the SUMMARY category for the RESULTS I display. The yellow LED next to the selected category illuminates..

15. RESULTS II Category switch

Press this switch to select the SUMMARY category for the RESULTS II display. The yellow LED next to the selected category illuminates..



16. Power switch

Press the T-BERD 209OSP **Power** switch to OFF. Disconnect the ISDN/DDS Analyzer Option cable from the AUXILIARY PORT connector. In standalone mode, press the **Power** switch to OFF on the ISDN/DDS Analyzer and disconnect the ISDN/DDS Analyzer Option AC power cable.

2.6 MAINTENANCE

If the T-BERD 209*OSP* fails to operate and no front panel indicators are illuminated:

- Check the AC power cord to ensure it is securely connected to the T-BERD 209*OSP*.
- Make sure the power supply is uninterrupted by plugging another electrical device into the electrical outlet used by the T-BERD 209*OSP*.
- Verify that a proper, working AC line fuse is installed (see Section 2.7).

If the T-BERD 209*OSP* still fails to operate, contact the TTC Customer Service Department at 800-638-2049. If front-panel indicators are illuminated, but the instrument does not operate properly:

- Use the Instrument Checkout procedure in Section 2.5 to localize the problem.
- Note those areas in which the Instrument Checkout fails, then contact TTC for assistance.

2.7 AC FUSE REPLACEMENT

The T-BERD 209*OSP* AC line fuse is stored in the AC fuse receptacle on the underside of the connector panel (see Figure 2-1). If faulty, replace the fuse with a 1A 250-volt, Slo-Blo fuse (Littlefuse #218001 or equivalent). Always use the correct fuse size.

1. **Turn off the unit and disconnect the AC power cord**
2. **Tilt back the test set to rest on the back of the case**
3. **Locate AC fuse holder (see Figure 2-1)**
4. **Remove AC fuse**
   Using a flat-head screwdriver, twist the fuse cap in a counter-clockwise rotation until loose. Then, pull the fuse cap straight out. The fuse should come out with the cap.
5. **Replace AC fuse with new fuse**
   Remove the old fuse from the cap and install the new fuse in the cap.
6. **Reinstall AC fuse in test set**
   Replace the fuse and fuse cap and tighten with a clockwise rotation until secure.

2.8 BATTERY REPLACEMENT

The T-BERD 209*OSP* contains a user replaceable, rechargeable battery. To order a replacement battery contact TTC Customer Service Department at 800-638-2049. To replace the battery, perform the following steps:

NOTE: Once the battery is disconnected, you have 15 minutes to connect the battery wire plugs to the new battery. If battery replacement takes longer than 15 minutes, the NOVRAM memory is lost (including print buffers) and the instrument will start up with the factory default settings.

1. **Turn off the unit and disconnect the AC power cord**

2. **Tilt back the test set to rest on the back of the case**

3. **Remove and retain four screws on the bottom panel (see Figure 2-1)**

4. **Pull the bottom panel off**

5. **Disconnect the battery's wire plug from the connector in the test set**

   NOTE: The disposal of lead-acid batteries is controlled by state or local government regulations. Dispose of the removed battery in accordance with state or local regulations.

6. **Remove the old battery and set it aside for proper disposal**

7. **Install replacement battery**

   Line up the replacement battery with the battery compartment. Connect the battery wire plug to the connector in the battery compartment. Slide the replacement battery into the unit being careful not to pinch the battery wire.

8. **Replace and secure bottom panel**

   Insert the excess battery wire into the opening along the right edge of the battery compartment. Replace the bottom panel being careful not to pinch the battery wire between the bottom panel and the battery. Secure the bottom panel with the four Phillips head screws removed earlier.

9. **Return test set to upright position**

10. **Connect AC power and charge the new battery for 8 hours**

2.9 WARRANTY

All equipment manufactured by 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.

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 or operated other than in accordance with instructions contained in TTC literature and operating manuals.

No other warranty is expressed or implied. TTC is not liable for consequential damages.

2.10 SERVICE

In-Warranty Service

Equipment in warranty must be returned to the factory with shipping prepaid. The equipment should be packed and shipped in accordance with instructions in Section 2.11. 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.

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.

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 repair charge.

The customer will be billed for parts plus standard labor rates in effect at the time of the 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.

2.11 EQUIPMENT RETURN INSTRUCTIONS

To all equipment returned for repair, attach a tag that includes the following information.

- 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.

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; when needed, appropriate packing materials can be obtained by contacting TTC's Repair Department. 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.

INSTRUMENT DESCRIPTION

3.1 OVERVIEW

Use this section as a reference during testing and as a guide to understanding the functions of the T-BERD 209*OSP* (see Figure 3-1). The controls, indicators, and connectors are discussed in the following order.

- Mainframe
- DC Measurements Option
- TDR Measurements Option
- Channel Monitor Option
- Advanced Stress Patterns Option
- Enhanced ESF Option
- Smart Loopback/Command Codes Option
- Fractional T1 Option
- HDSL/ISD/DDS Measurements Option
- DLC Analyzer Option
- ISDN/DDS Analyzer Option

The controls, indicators, and connectors are presented in the following functional areas:

Test Setup — Describes the front panel controls that configure the instrument.

Test Connections — Discusses the three types of T1 circuit connectors, as well as the associated switches and displays.

Test Results — Presents how a test is started and details the methods used to display test results.

Troubleshooting Controls — Describes the front panel switches that provide access to additional test data or help perform troubleshooting on the span.

Print Controls — Explains how to generate printouts of the test results and test setup.

NOTE: Throughout this section, a circled number appears after each identified switch, indicator, and connector. These numbers match the callout numbers in the applicable figure.

3.28 SMART LOOPBACK/COMMAND CODES OPTION — INTRODUCTION

The Smart Loopback/Command Codes Option enables the T-BERD 209*OSP* to loop up and loop down intelligent network equipment.

NOTE: Unless indicated, the capabilities of the mainframe are applicable to the Intelligent Network Support Option.

3.29 SMART LOOPBACK/COMMAND CODES OPTION — TEST SETUP

AUX Switch

The Smart Loopback/Command Codes Option adds the AUX SMARTNET function, which allows you to select specific intelligent repeater types by manufacturer and model. It also adds a number of intelligent network equipment loop codes to the selections of the AUX LOOPCODE function. For more information, refer to Section 4.2 Auxiliary Functions.

The following auxiliary functions are affected by or have an affect on the Smart Loopback/ Command Codes Option (see Section 4).

AUX LOOPCODE — When intelligent network equipment is selected in the AUX SMARTNET function, the loop code type and address (if applicable) are selected from the AUX LOOPCODE function.

3.30 SMART LOOPBACK/COMMAND CODES OPTION — TROUBLESHOOTING

LOOP CODES Switch

In the PROG position, this switch enables you to send user-programmable loop codes to loop up or loop down intelligent repeaters. The loop code is determined by the AUX LOOPCODE and AUX SMARTNET functions. For more information, refer to Section 4.2 Mainframe — Auxiliary Functions.

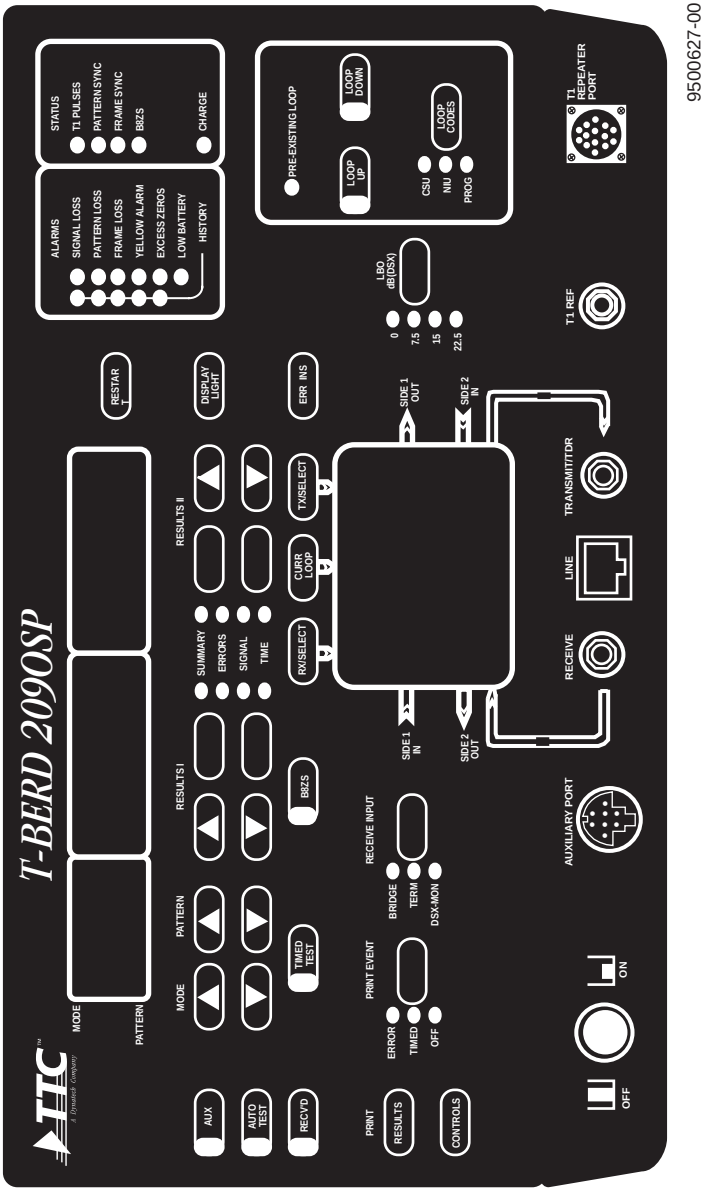


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Figure 3-1
T-BERD 209*OSP* Front Panel

3.2 MAINFRAME — TEST SETUP

The following controls and indicators (see Figure 3-2) are described in the order that they are used:

- Help card
- Character display (1)
- **MODE** switch (2)
- **PATTERN** switch (3)
- **B8ZS** switch (4)
- **TIMED TEST** switch (5)
- **RECV'D** switch (6)
- **AUTOTEST** switch (7)
- **AUX** switch (8)

Help Card

The T-BERD 209*OSP* features a help card in the lid of the instrument. It provides a quick reference of:

- Available mode and pattern selections
- Auxiliary functions
- Available results, grouped by category
- T-BERD T1 Repeater Adaptor accessory operation
- TDR Measurements Option operation
- Loop code operation

Character Display (1)

The character display, an alphanumeric Liquid Crystal Display (LCD), shows instrument setup, test results, and auxiliary functions parameters. The display is divided into three windows with two lines of text in each window. All three windows of the character display are used when the auxiliary functions are activated.

The first window's top line indicates the current operating mode (MODE display), and the bottom line indicates the test pattern (PATTERN display). Pressing the **MODE** or **PATTERN** switch changes the test configuration and the respective display.

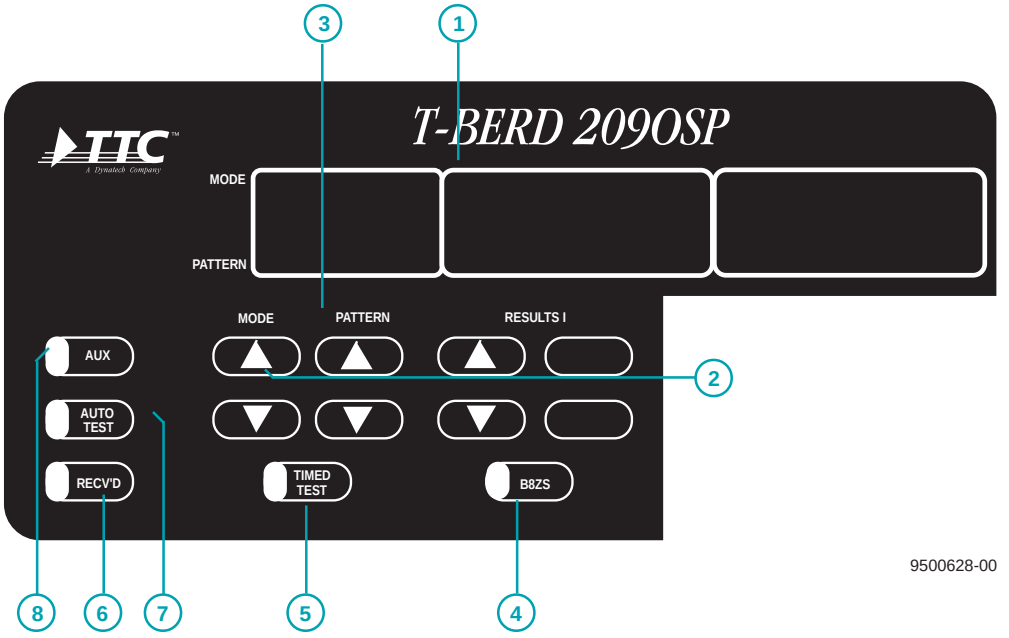


Figure 3-2
Character Display and Setup Switches

The second and third windows display the test results, auxiliary function parameters, and the operating mode status messages. The **RESULTS I** switches control the RESULTS I display (second window), and the **RESULTS II** switches control the RESULTS II display (third window).

MODE Switch (2)

Pressing the **MODE** switch (up arrow or down arrow) scrolls the operating mode selections in the MODE display. Releasing the **MODE** switch on a displayed mode selects that mode. When a mode is selected the T-BERD 209*OSP* is configured for that mode.

Changing the **MODE** switch position clears all test results and causes a test restart. The following operating modes are listed in factory default order.

SELF TST — Configures the T-BERD 209*OSP* in a self-test mode which loops back the transmit output to the receive input. ESF framing is selected, and the **RECV'D** switch is set to internal timing. When leaving self-test mode, the **RECV'D** switch reverts to its previous position. Any test pattern can be selected. The *ALL ONES* pattern is the unit's default setting upon initial power up or after clearing NOVRAM.

BERT modes configure the T-BERD 209*OSP* as a Bit Error Rate Test (BERT) set. These operating modes include the following **MODE** switch selections:

AUTO — Automatic configure mode enables the T-BERD 209*OSP* to automatically configure itself to the received framing format when monitoring live data. When monitoring test patterns, the AUTO mode configures the T-BERD 209*OSP* to the received framing format and pattern.

While automatically configuring to the received signal's framing and pattern, the T-BERD 209*OSP* displays *AUTO* in the MODE display and *scanning* in the PATTERN display. When auto-configuration is successful, both the received framing mode and pattern are displayed in lowercase letters in the MODE and PATTERN displays. When the received signal is not recognized as a pattern, the word *live* appears in the PATTERN display, and the instrument performs as in T1 LLB mode.

T1 — T1 unframed mode configures the T-BERD 209*OSP* to transmit and receive unframed T1 data for testing unframed T1 circuits or T1 circuits with proprietary framing formats.

T1 D4 — T1 D4 superframe mode configures the T-BERD 209*OSP* to transmit and receive D4-framed T1 data for testing D4 framed circuits. The T1 D4 mode is compatible with all superframe framing formats including: D1D, D2, and D3.

T1 ESF — T1 extended superframe mode configures the T-BERD 209*OSP* to transmit and receive ESF-framed T1 data for testing ESF framed circuits.

T1 SLC — T1 subscriber loop carrier mode configures the T-BERD 209*OSP* to transmit and receive SLC-framed T1 data when testing SLC-96 framed circuits. The instrument ignores the SLC datalink (F) bits in the received signal. The SLC datalink bits are set to all zeros in the transmitted test pattern.

T1 D1D — T1 D1D superframe mode configures the T-BERD 209*OSP* to transmit and receive D1D-framed T1 data for testing D1D framed circuits.

T1 TLB — T1 test loopback mode configures the T-BERD 209*OSP* to echo the received data. This mode allows the T-BERD 209*OSP* to emulate a CSU in loopback. The T-BERD 209*OSP* configures itself to the received framing (or unframed) mode. If the received data pattern matches the selected test pattern (i.e., QRSS), pattern synchronization is declared; the Pattern Sync LED illuminates. BPVs *are removed* from the received signal. If B8ZS coding is selected, the B8ZS clear channel codes are converted back to zeros prior to removing the BPVs. However, BPVs, logic errors, and B8ZS line code *can be* inserted into the retransmitted data stream using the **ERR INS** switch and the **B8ZS** switch, respectively. To obtain logic error test results, the T-BERD 209*OSP* test pattern must be set to the received test pattern.

In the T1 TLB mode, the **LOOP CODES, LOOP UP,** and **LOOP DOWN** switches are disabled, and the **RECV'D** switch automatically defaults to recovered timing (LED illuminated).

T1 LLB — T1 line loopback mode configures the T-BERD 209*OSP* in a T1 Line Loopback (LLB) mode in which all received data is echoed by the transmitter. This mode allows the T-BERD 209*OSP* to emulate a repeater. The T-BERD 209*OSP* configures itself to the received framing (or unframed) mode. If the received data pattern matches the selected test pattern (i.e., QRSS), pattern synchronization is declared; the Pattern Sync LED illuminates. BPVs *are not removed* from the received signal. The **ERR INS** switch is disabled in this mode. Line coding is not selectable. To obtain logic error test results, the T-BERD 209*OSP* test pattern must match the received test pattern.

In the T1 LLB mode, the **LOOP CODES, LOOP UP,** and **LOOP DOWN** switches are disabled, and the **RECV'D** switch automatically defaults to recovered timing (LED illuminated).

REPEATER — Configures the unit to verify the operation of each side of a repeater installed in the T-BERD T1 Repeater Adaptor. First, Side 1 is tested with an ALL ONES pattern for five seconds. If there are no bit errors, a 3 IN 24 pattern is used. Regardless of the results of the Side 1 test, the same test is performed on Side 2 of the repeater. The Side 1 test result appears in the RESULTS I display, then the Side 2 test result appears in the RESULTS II display.

Possible test results are:

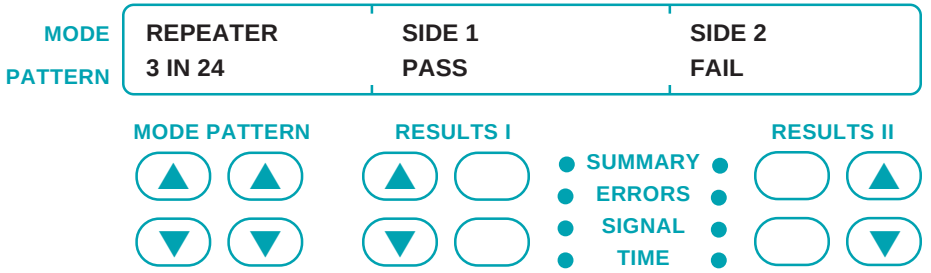
TESTING — The test is in progress, no results yet.

PASS — No bit errors occurred during the test on this side.

FAIL — One or more bit errors occurred during the test on this side.

UNAVAILABLE — Test has not begun on this side yet.

Selecting the REPEATER mode starts the test. When the repeater test is started, the current pattern appears in the PATTERN display, *TESTING* appears in the RESULTS I display, and *UNAVAILABLE* appears in the RESULTS II display. As each pattern is completed, the results appear in the RESULTS I and II displays.



AUTO LLB — Automatically responds to a received loop-up code. AUTO LLB is not selectable by the **MODE** switch. The AUX RESPONSE function must be set to *AUTO RESPONSE*, for the test set to respond to a received loop code. Even then, the T-BERD 209*OSP* only responds to a loop code that matches the loop code type selected in the AUX LPUP, AUX LPDN, and AUX LOOPCODE functions and on the **LOOP CODES** switch. In AUTO LLB mode, the T-BERD 209*OSP* functions the same as the T1 LLB operating mode. The T-BERD 209*OSP* does not emulate an addressable loopable repeater, and it will not respond to intelligent repeater loop codes.

AUTO LLB mode is enabled after receiving either five seconds of an in-band loop-up code or 250 ms of an ESF out-of-band loop-up code. If the T-BERD 209*OSP* is set to T1 LLB or T1 TLB mode, it will not respond to the received loop codes. The AUTO LLB mode is exited by receiving an in-band or an ESF out-of-band loop-down code or by powering down the instrument. When the loopback is disabled, the instrument returns to the previously selected operating mode.

Additional operating modes are introduced by the DC Measurements, TDR Measurements, and Enhanced ESF Options. Refer to Section 3.8 and Section 3.15 for details.

PATTERN Switch (3)

Pressing the **PATTERN** switch (up or down arrow) scrolls through the available selections. Release the switch when the desired selection appears in the PATTERN display. Changing the **PATTERN** switch position clears all test results and causes a test restart.

The **PATTERN** switch performs different functions in each operating mode. In REPEATER mode, the **PATTERN** switch is disabled, since the patterns are preset. In BERT mode, the **PATTERN** switch selects the transmitted test pattern and configures the receiver for the selected test pattern.

The **PATTERN** switch selections include:

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

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

1:7 — This fixed test pattern (F0100 0000) is used to stress the minimum ones density requirement for AMI-encoded T1 circuits. The pattern is aligned with the framing (F) bits as indicated.

2 IN 8 — This fixed test pattern (F0100 0010) is used to stress the minimum ones density for B8ZS-encoded T1 circuits. The pattern is aligned with the framing (F) bits as indicated.

3 IN 24 — This fixed test pattern (F0100 0100 0000 0000 0000 0100) provides the minimum ones density and the maximum excess zeros (15) requirements to stress T1 circuits. The pattern is aligned with the framing (F) bits as indicated. When the pattern is framed, it violates the minimum ones density requirements.

QRSS — The Quasi-Random Signal Source (QRSS) pattern simulates live data for T1 applications. T1 QRSS is a modified 2^{20}-1 pseudorandom pattern which allows a maximum of 14 sequential zeros and 20 sequential ones.

BRIDGTAP — This selection determines if bridge taps are connected to a T1 span by sequentially testing the span with 21 test patterns that have a variety of ones and zeros densities. The T-BERD 209*OSP* monitors the received test pattern for bit errors, BPVs, and frame errors. If signal errors are not detected, the span does not have a bridge tap connected to it. However, if signal errors are detected, the span may have one or more bridge taps connected to it and further sectionalization is required.

When BRIDGTAP is selected, the 21 test patterns are transmitted continuously in the order shown in Table 3-1. The word BRIDGTAP alternates with the lowercase name of the test pattern being transmitted (e.g., ALL ONES = *all ones*). Once the receiver is synchronized with each test pattern (Pattern Sync LED illuminated), the test pattern is analyzed for 23 seconds. One complete BRIDGTAP pattern sequence takes approximately 10 minutes and 30 seconds to transmit.

Use AMI coding when BRIDGTAP is selected. Using B8ZS coding redistributes the test pattern energy making it less effective in detecting bridge taps.

Table 3-1
BRIDGTAP Patterns

Pattern Name	Bit Pattern (F = Framing bit)
ALL ONES	F 1111
1:1	F 1010
1:3	F 0100
1:5	F 0100 00
1:6	F 0100 000
1:7	F 0100 0000
2:8	F 1100 0000 00
2:9	F 1100 0000 000
2:10	F 1100 0000 0000
2:11	F 1100 0000 0000 0
2:12	F 1100 0000 0000 00
2:13	F 1100 0000 0000 000
2:14	F 1100 0000 0000 0000
3 IN 18	F 1101 0000 0000 0000 00
3 IN 19	F 1100 1000 0000 0000 000
3 IN 20	F 1100 0100 0000 0000 0000
3 IN 21	F 0100 0100 0000 0000 0000 1
3 IN 22	F 0100 0100 0000 0000 0000 10
3 IN 23	F 0100 0100 0000 0000 0000 100
3 IN 24	F 0100 0100 0000 0000 0000 0100
QRSS	2^{20}-1 pseudorandom pattern with 14-zero suppression

MULTIPAT — This selection consists of five commonly used test patterns that allow the T-BERD 209*OSP* to test a T1 span without having to select each test pattern individually. The T-BERD 209*OSP* monitors the received test patterns for bit errors, BPVs, and frame errors.

When MULTIPAT is selected, the five test patterns are transmitted continuously in the order shown in Table 3-2. The word MULTIPAT alternates with the lowercase name of the test pattern being transmitted (e.g., ALL ONES = *all ones*). The AUX MULTIPAT function controls the duration of each selected MULTIPAT test pattern from 0 to 15 minutes. The default value for each pattern is three minutes.

Table 3-2
MULTIPAT Patterns

Pattern Name	Bit Pattern (F = Framing bit)
ALL ONES	F 1111
1:7	F 0100 0000
2 IN 8	F 0100 0010
3 IN 24	F 0100 0100 0000 0000 0000 0100
QRSS	2^{20}-1 pseudorandom pattern with 14-zero suppression

PGM PAT1, PGM PAT2, PGM PAT3 — These three user-programmable 3- to 24-bit patterns test circuit sensitivity to a particular pattern. The pattern is entered in binary form through the AUX PGM PAT1, AUX PGM PAT2, and AUX PGM PAT3 functions. The pattern is transmitted starting from left to right.

ALL ZERO — This pattern tests T1 circuits for spans that are not properly configured for B8ZS clear channel capability or incompatible with B8ZS encoding. The pattern can be transmitted framed or unframed, and should always be transmitted with B8ZS coding selected. The T-BERD 209*OSP* monitors the received signal for the normal B8ZS sequence, 000V 10V1 (where V is a bipolar violation). However, if the T-BERD 209*OSP* receives the B8ZS sequence in an Alternate Mark Inversion (AMI) format (0001 1011) instead of all zeros (0000 0000) after decoding, the T-BERD 209*OSP* reports the sequence as an error and displays the message *NOT B8ZS COMPATIBLE* in the SUMMARY category. The failure of the network to maintain the B8ZS sequence in the received ALL ZERO pattern can occur at a multiplexer or DCS with a coding option set for AMI instead of B8ZS.

Additional patterns or **PATTERN** switch positions are introduced by the TDR Measurements, Advanced Stress Patterns, and Fractional T1 Options. Refer to Section 3.8 and Section 3.23 for details.

B8ZS Switch (4)

This LED switch determines whether the T-BERD 209*OSP* transmits data with AMI coding or B8ZS coding. The LED within the switch illuminates when B8ZS coding is selected and is extinguished when AMI coding is selected.

The B8ZS status LED illuminates when zero substitution codes are detected in the received data. The Excess Zeros LED illuminates when there are 16 or more consecutive zeros in the AMI position or when there are eight or more consecutive zeros in the B8ZS position.

The message *B8ZS DETECTED* is displayed in the SUMMARY results category when B8ZS coding is detected and the **B8ZS** switch is set to the AMI position. If the instrument receives the sequence 0001 1011 with the **B8ZS** switch set to the B8ZS position and the ALL ZERO pattern selected, the message *NOT B8ZS COMPATIBLE* is displayed. This message indicates a non-B8ZS compatible piece of equipment regenerated the transmitted signal.

TIMED TEST Switch (5)

This LED switch selects either timed or continuous testing. The LED within the switch illuminates when timed testing is selected and is extinguished when continuous testing is selected. Changing from continuous to timed testing clears the test results and causes a test restart. However, changing from timed to continuous testing during a timed test allows the test to continue (i.e., test results continue to accumulate).

A timed test can be conducted for up to 200 hours and 59 minutes. The test length is set by the AUX TEST LEN function.

RECV'D Switch (6)

This LED switch sets the transmit timing source to either recovered or internal. The LED within the switch illuminates when recovered timing is selected and is extinguished when internal timing is selected. If recovered timing is selected but there is no signal, the switch LED blinks, and internal timing is automatically provided until a signal is received.

In internal timing, the transmit data is generated with a fixed internal crystal oscillator. In recovered timing, the transmit timing source is taken from the received signal's clock. In T1 LLB or T1 TLB modes, the T-BERD 209*OSP* is automatically set to recovered timing.

AUTOTEST Switch (7)

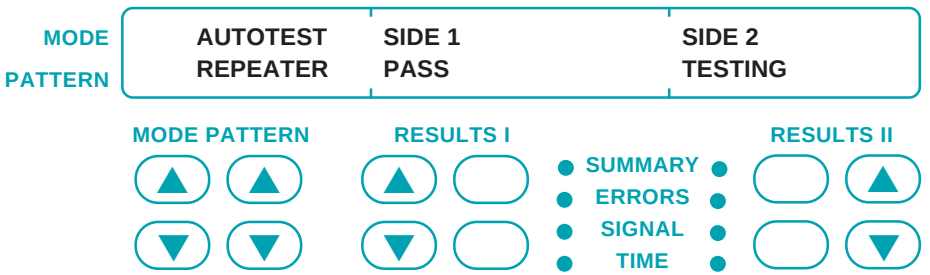
This LED switch initiates an automated series of tests on the T1 circuit. The sequence of the tests is pre-programmed, but individual tests may be excluded by using the AUX AUTOTEST function. The LED within the switch illuminates when AUTOTEST is in progress and is extinguished when AUTOTEST is not activated.

With the T-BERD T1 Repeater Adaptor connected to the T1 circuit, press the **AUTOTEST** switch to activate the automated series of tests. No further action is required. The PATTERN display shows the name of the automated test in progress, while the word *TESTING* appears in the RESULTS I display. In addition, the graphic display shows the configuration of the automated test in progress. All front panel switches, except **RESTART, PRINT RESULTS,** and **DISPLAY LIGHT** are disabled during AUTOTEST.

The results for all completed tests are available by pressing the **PATTERN** switch to scroll through the tests and pressing the **RESULTS I Results** switch to scroll through the results for each test.

To stop an automated test, press the **AUTOTEST** switch. The message *TERMINATED* appears in the RESULTS I display. The results for all completed tests, up to the one in progress, are available by pressing the **PATTERN** switch and the **RESULTS I Results** switch. Pressing the **AUTOTEST** switch again displays the message *RECONFIGURING* in the RESULTS I display, and returns the instrument to the previous test configuration.

The AUTOTEST results are displayed with either a PASS/FAIL message or with a measurement message.



When AUTOTEST is activated, the tests selected by the AUX AUTOTEST function are performed in the following order:

- VOLTS (optional) — DC voltages are measured at the repeater *side 1 in* to *side 2 out* and *side 1 out* to *side 2 in*.
- OHMS (optional) — Resistances are measured for tip-ring, tip-ground, and ring-ground for each of the four cable pairs.
- TDR (optional) — The TDR test is performed for each of the four cable pairs.

- REPEATER — A BERT test is performed on both sides of the repeater to reveal marginal or faulty repeaters.
- AMPS (optional) — Simplex current is measured for each of the four twisted-wire pairs.
- BRIDGTAP — The BRIDGTAP pattern sequence is performed to determine if there are any bridge taps or marginal repeater problems along the span.

AUX Switch (8)

This LED switch allows 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 available in the display. The auxiliary functions require use of the entire display and corresponding switches. Refer to Section 4.2 for more information.

3.3 MAINFRAME — TEST CONNECTIONS

The following connections and switches (see Figure 3-3) provide access to the circuit being tested.

- **RECEIVE INPUT** switch (9)
- **LBO dB(DSX)** switch (10)
- RECEIVE jack (11)
- TRANSMIT/TDR jack (12)
- T1 REF jack (13)
- LINE (RJ48) jack (14)
- T1 REPEATER PORT (15)
- Graphic display (16)
- **RX/SELECT** switch (17)
- **TX/SELECT** switch (18)
- **CURR LOOP** switch (19)

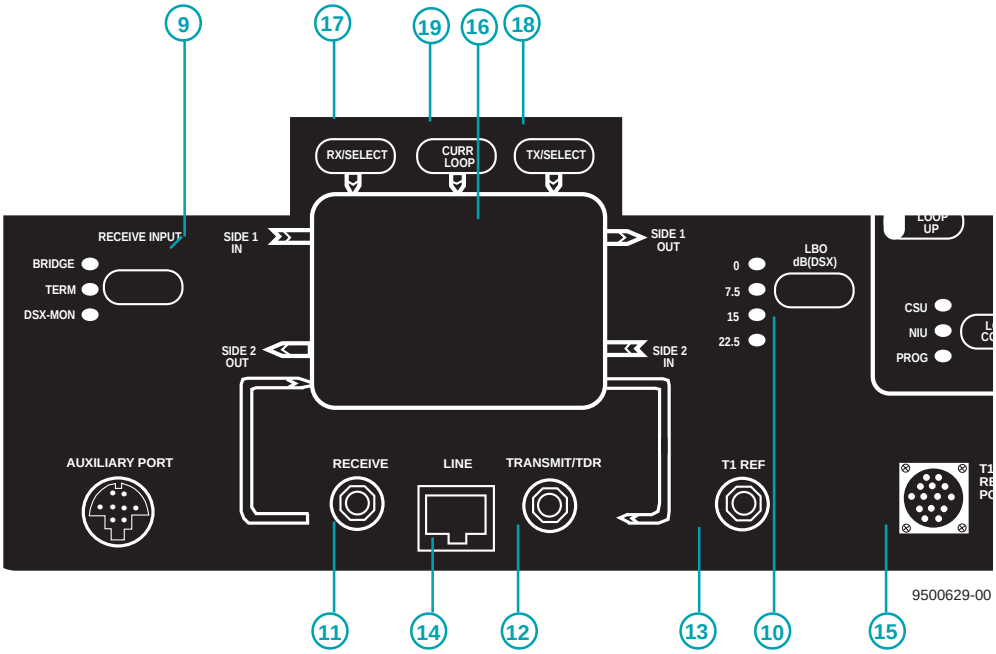


Figure 3-3
Test Connections and Related Switches

RECEIVE INPUT Switch (9)

This three-position switch selects the input impedance and signal conditioning (BRIDGE, TERM, and DSX-MON). Selecting an input impedance allows the T-BERD 209*OSP* to accommodate signals attenuated by cable loss or resistive circuits. With the T-BERD T1 Repeater Adaptor connected to the T-BERD 209*OSP*, the valid **RECEIVE INPUT** switch positions are TERM and BRIDGE, and the switch position automatically changes to BRIDGE if the position was DSX-MON. The **RECEIVE INPUT** switch returns to the previous position when the T-BERD T1 Repeater Adaptor is disconnected. Changing the **RECEIVE INPUT** switch position causes a test restart.

BRIDGE — Provides an input impedance greater than 1000 Ω for bridging lines that are already terminated. The BRIDGE setting provides compensation for cable losses of up to 35 dB. This position is useful for bridging across repeater cable pair input and outputs.

TERM — Provides a nominal input impedance of 100 Ω. The TERM setting provides compensation for cable losses of up to 35 dB for T1 lines. This position is useful for terminating a circuit with the T-BERD 209*OSP*.

DSX-MON — Provides a nominal 100 Ω of input impedance and compensates for resistive loss. The DSX-MON setting is useful for monitoring T1 lines at DSX monitor points which are resistor-isolated. This setting is not applicable when the T-BERD T1 Repeater Adaptor is providing access to the T1 circuit.

LBO dB(DSX) Switch (10)

This four-position switch provides Line Build-Out (LBO) values of 0, -7.5, -15, and -22.5 dB. The selected cable loss affects the transmit signal only.

If transmitting directly into the span at the Network Interface Unit (NIU), select the appropriate LBO setting to avoid sending too strong a signal into the first repeater. The LBO value plus the receive level (dBdsx measurement) should range between -15 and -22.5 dB. For example, if the receive level is -10 dBdsx, the LBO should be set to -7.5 dB (-10 + -7.5 = -17.5 dB). If replacing an NIU, the LBO should be set to the same level as the replaced NIU.

RECEIVE Jack (11)

This WECO 310 jack receives the input signal. The **RECEIVE INPUT** switch determines how the input is terminated before being processed by the T-BERD 209*OSP* receiver.

TRANSMIT/TDR Jack (12)

This WECO 310 jack connects the T-BERD 209*OSP* transmit output to the circuit under test and provides the simplex current path to the RECEIVE jack. The **LBO dB(DSX)** switch inserts artificial line build-out with either 0 dB, -7.5 dB, -15 dB, or -22.5 dB of cable loss at 772 kHz.

T1 REF Jack (13)

This WECO 310 jack provides a connection for a T1 reference clock input to use in timing slips measurements. It provides a nominal 1000 Ω termination and accepts resistively attenuated signals over the range +6 to -24 dBdsx.

LINE Jack (14)

This RJ48 phone jack allows the T-BERD 209*OSP* to connect to the customer side of the NIU or to the local loop. It may be used in lieu of the TRANSMIT/TDR and RECEIVE jacks.

WARNING: When using the LINE jack, any voltage present on the circuit under test appears at the RECEIVE and TRANSMIT/TDR jacks.

T1 REPEATER PORT (15)

This 14-pin military-type connector allows the T-BERD 209*OSP* to connect to the T-BERD T1 Repeater Adaptor for easy test access to T1 signals at span repeater housings. The connection between the T1 REPEATER PORT and T-BERD T1 Repeater Adaptor is made by a six-foot cable which contains seven individually shielded twisted pairs. The pin configuration for the T1 REPEATER PORT is provided in Section 6.1.

CAUTION: Turn off the T-BERD 209*OSP* before connecting the T1 Repeater Adaptor cable to the T1 REPEATER PORT. Connecting the cable to the T1 REPEATER PORT with the T-BERD 209*OSP* turned on can damage the T-BERD 209*OSP*.

Graphic Display (16)

The graphic display shows the current test configuration for the T1 circuit, including the repeater, the four cable pairs attached to the repeater (*side 1 in*, *side 1 out*, *side 2 in*, and *side 2 out*), and the T-BERD 209*OSP* transmitter and receiver connections. The T-BERD 209*OSP* automatically updates the graphic display whenever the test configuration is changed.

If the T-BERD T1 Repeater Adaptor is not used, the graphic display uses two solid lines to indicate the receiver is connected to the RECEIVE jack and the transmitter is connected to the TRANSMIT/TDR jack. The **RX/SELECT**, **TX/SELECT**, and **CURR LOOP** switches have no effect on the test configuration when the T-BERD T1 Repeater Adaptor is not used.

NOTE: If the Channel Monitor Option is installed, the graphic display shows the signaling bits and selected channel's data bits. If the T-BERD T1 Repeater Adaptor is not used, the **RX/SELECT** and **TX/SELECT** switches lower and raise the channel number, respectively.

RX/SELECT Switch (17)

This five-position switch (*side 1 in*, *side 1 out*, *side 2 in*, *side 2 out*, and not connected) represents the location of the receiver in relation to the repeater inputs and outputs. When the **RX/SELECT** switch is pressed, the T-BERD T1 Repeater Adaptor moves the receiver connection to the selected location and the T-BERD 209*OSP* restarts the test. The graphic display configuration changes to show the new receiver location.

Additional **RX/SELECT** switch functions are introduced by the TDR Measurements and Channel Monitor Options. Refer to Section 3.9 and Section 3.23 for details.

TX/SELECT Switch (18)

This five-position switch (*side 1 in*, *side 1 out*, *side 2 in*, *side 2 out*, and not connected) represents the location of the transmitter in relation to the repeater inputs and outputs. When the **TX/SELECT** switch is pressed, the T-BERD T1 Repeater Adaptor moves the transmitter connection to the selected location and the T-BERD 209*OSP* restarts the test. The graphic display configuration changes to show the new transmitter location.

Additional **TX/SELECT** switch functions are introduced by the TDR Measurements and Channel Monitor Options. Refer to Section 3.9, Section 3.14, and Section 3.23 for details.

CURR LOOP Switch (19)

This switch determines the simplex current path. The graphic display shows the simplex current path as a dashed line between the tip and ring lines. When the **CURR LOOP** switch is not activated, the T-BERD T1 Repeater Adaptor passes the simplex current through each half of the repeater. When the **CURR LOOP** switch is enabled, the simplex current is looped back toward the central office (*side 1 out* connected to *side 2 out*), and the dashed line changes to show the new simplex current path. The **CURR LOOP** switch does not disrupt the signal path.

Additional **CURR LOOP** switch functions are introduced by the DC Measurements and TDR Measurements Options. Refer to Section 3.9 and Section 3.15 for details.

3.4 MAINFRAME — TEST RESULTS

Once you have configured and connected the T-BERD 209*OSP* for the desired test, use the following switches and indicators (see Figure 3-4) to initiate the test and collect test results.

- **RESTART** switch (20)
- **DISPLAY LIGHT** switch (21)
- **RESULTS** switches (22)
- Status Indicators (23)
- Alarms Indicators (24)
- Collecting test results

RESTART Switch (20)

This switch causes a test restart that affects all functions related to the test in progress. Pressing and holding this switch during power-up clears non-volatile RAM (NOVRAM), which sets all the parameters to their factory default settings (see Appendix A).

The following actions will also cause a test restart:

- Pressing any major switch: **PATTERN, MODE, RESTART, Power, RECV'D, TX/SELECT, RX/SELECT**, and **RECEIVE INPUT** switches.

- Changing the **TIMED TEST** switch from continuous to timed testing.

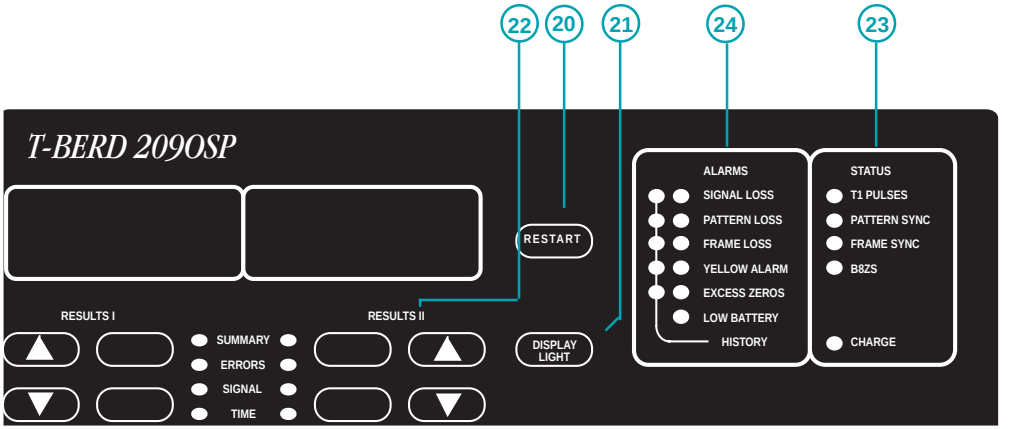


Figure 3-4
Test Results Switches and Indicators

9500630-00

DISPLAY LIGHT Switch (21)

This switch illuminates both the character and graphic displays for better visibility in low light conditions. When pressed once, the displays are illuminated for 30 seconds. When pressed twice within 30 seconds, the displays illuminate and remain illuminated until the switch is pressed a third time.

RESULTS Switches (22)

The **RESULTS I** and **RESULTS II Category** switches select the results category to be displayed. These switches are adjacent to a column of four category LEDs labeled SUMMARY, ERRORS, SIGNAL, and TIME. Pressing the **RESULTS I** or **RESULTS II Results** switch (up arrow or down arrow) scrolls through and displays individual test results within the selected category. Refer to Section 5 for additional test results information.

Collecting Test Results

During a test, the available results and signal measurements are continuously updated. The results are divided into the following six categories.

SUMMARY Category

BIT ERRORS	Bit Errors
VIOLATIONS	Bipolar Violation Count (BPVs)
FRM ERRORS	Frame Errors
CRC ERRORS	Cyclic Redundancy Check (CRC) Errors
RX FREQ Hz	Receive Frequency in Hz
TIMING SLIP	Timing Slips

ERRORS Category

BIT ERRORS	Bit Errors
BIT ERR SEC	Bit Errored Seconds
BIT ERR RATE	Bit Error Rate
VIOLATIONS	Bipolar Violations (BPVs)
BPV SECONDS	BPV Seconds
BPV RATE	BPV Rate
FRM ERRORS	Frame Errors
FRM ERR SEC	Frame Errored Seconds
FRM ERR RATE	Frame Error Rate

CRC ERRORS	Cyclic Redundancy Check (CRC) Errors
CRC ERR SEC	CRC Errored Seconds
CRC ERR RATE	CRC Error Rate

SIGNAL Category

RX FREQ, HZ	Receive Frequency in Hz
RX LEVEL (dBdsx)	Receive Signal Level in dBdsx
RX LEVEL (Vp-p)	Receive Signal Level in Volts (Vp-p)
SPX CURRENT	Simplex Current
TIMING SLIP	Timing Slips

TIME Category

SIG LOS SEC	Signal Loss Seconds
TEST LENGTH	Length of a Timed Test
ELAPSED TIME	Elapsed Time
TEST END IN	Time Remaining in Timed Test
CLOCK TIME	Clock Time of Day
DATE	Date
BATTERY CHARGE	Battery Charge

STATUS Indicators (23)

If the received signal is correct with no accompanying errors, the green Status LEDs provide quick identification of pattern and framing synchronization. The Status LEDs function as follows:

T1 Pulses — Illuminates when a valid T1 signal is detected at the RECEIVE jack.

Pattern Sync — Illuminates when pattern synchronization is achieved. Synchronization to a fixed pattern is declared when 30 consecutive error-free bits are received. Synchronization to the pseudorandom pattern (QRSS) is declared upon the reception of 50 consecutive error-free bits.

Frame Sync — Illuminates when the T-BERD 209*OSP* achieves synchronization to the selected framing pattern within the T1 data stream. The selected framing pattern is based on the currently selected mode. In T1 TLB and T1 LLB modes, the T-BERD 209*OSP* automatically determines the framing type and configures itself to accept either unframed data, D4-framed data, ESF-framed data, or SLC-framed data.

B8ZS — Illuminates when B8ZS clear channel coding is detected in the received T1 signal. If the **B8ZS** switch is set to AMI coding and B8ZS coding is detected, the message *B8ZS DETECTED* is displayed in the SUMMARY category.

Charge — Illuminates when AC power is supplied and the battery is being charged.

ALARM Indicators (24)

The Alarm LEDs provide visual indication of current and historical alarm conditions related to the received signal or instrument low battery. An Alarm LED illuminates when a detected condition occurs and extinguishes when the condition is no longer present. A History LED illuminates after a detected condition is no longer present. Pressing the **RESTART** switch or otherwise causing a test restart clears the illuminated History LEDs.

The current and history Alarm LEDs allow the following four conditions to be indicated:

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

Only current LED on — The corresponding condition is occurring.

History LED on with current LED off — The corresponding condition did occur, but it is not occurring now.

Both History and current LED on — The corresponding condition is occurring and has also occurred in the past.

The Alarm LEDs function as follows:

Signal Loss — Illuminates when no pulses are detected for 150 ms after initial signal detect.

Pattern Loss — Illuminates when 250 bit errors are detected in 1000 or fewer bits in a pseudorandom pattern, or if 100 bit errors are detected in 1000 or fewer bits for a fixed pattern. After a loss of pattern synchronization, bit errors and errored seconds are halted.

Frame Loss — Illuminates when two out of five F_t bits are detected in error for T1 D4, T1 D1D, or T1 SLC-96 framing, or when two out of five frame bits are detected in error for T1 ESF framing.

Yellow Alarm — Illuminates when bit 2 is set to zero for 255 consecutive channels for D4, D1D, and SLC-96 framing, or when the yellow alarm pattern (0000 0000 1111 1111) is detected in the ESF datalink. This alarm condition only applies to framed T1 signals after frame synchronization has been acquired.

Excess Zeros — Illuminates when 16 or more consecutive zeros are detected in AMI coding. When using B8ZS coding, this LED illuminates when eight or more consecutive zeros are detected.

Low Battery — Illuminates approximately 15 minutes before the battery is completely drained of power. The battery is recharged as necessary anytime AC power is applied.

3.5 MAINFRAME — TROUBLESHOOTING CONTROLS

The following switches and indicators (see Figure 3-5) help sectionalize the T1 circuit.

- **LOOP CODES** switch (25)
- **LOOP UP** switch (26)
- **LOOP DOWN** switch (27)
- Pre-Existing Loop LED (28)
- **ERR INS** switch (29)

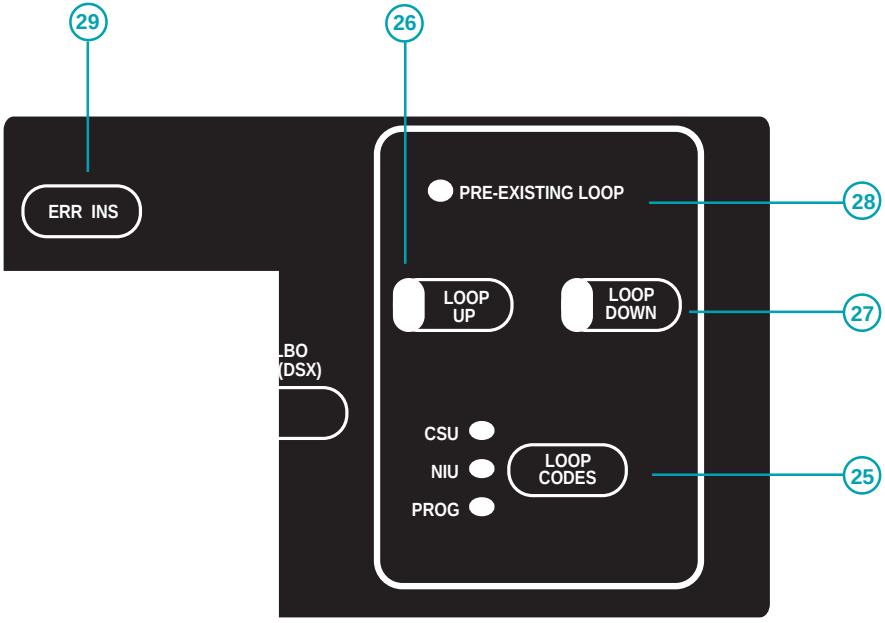


Figure 3-5
Troubleshooting Controls and Indicators

LOOP CODES Switch (25)

This switch selects the type of loop code transmitted: CSU, NIU, or PROG. Table 3-3 shows the factory default settings for each position of the **LOOP CODES** switch. Transmitted loop codes can be sent framed or unframed. When framed is selected, in-band loop codes do not overwrite the framing bit.

Table 3-3
Loop Code Types and Default Settings

LOOP CODE	LOOP UP	LOOP DOWN
In-Band		
CSU NIU (FAC2) PROG (FAC1)	10000 11000 3 to 8 bit (1100)	100 11100 3 to 8 bit (1110)
Out-of-Band		
CSU (line) CSU (payload)* NIU PROG (6 bits)	1111 1111 0111 0000 1111 1111 0010 1000 1111 1111 0100 1000 1111 1111 0xxx xxx0	1111 1111 0001 1100 1111 1111 0100 1100 1111 1111 0010 0100 1111 1111 0xxx xxx0

* The T-BERD 209*OSP* can transmit but not respond to a CSU payload loop code.

LOOP UP Switch (26)

This LED switch controls the transmission of the loop-up code. The LED within the **LOOP UP** switch illuminates for the duration of loop-code transmission. The switch is disabled in T1 TLB and T1 LLB modes.

To verify the looping of the circuit, observe the Status LEDs for indications of synchronization to the transmitted signal, insert a single error in the transmit signal, and observe the received signal. If the inserted error does not appear on the received signal, the circuit failed to loop up properly.

When the **LOOP UP** switch is pressed, the following occurs:

- The loop code is continuously transmitted until an appropriate response is detected at the T-BERD 209*OSP* receiver, a pre-existing loop is detected, a pre-determined timeout interval of three seconds (out-of-band payload only) is exceeded, any major switch is pressed, or the **LOOP UP** switch is pressed again.

- If an in-band loop code is selected, the transmitted loop code overwrites the selected data pattern. *LOOP UP* appears in the PATTERN display. If an ESF out-of-band loop code is selected, the loop code is transmitted in the datalink and does not overwrite the test pattern.

- The switch LED illuminates while transmitting the loop code.

LOOP DOWN Switch (27)

This LED switch controls the transmission of the loop-down code. The LED within the **LOOP DOWN** switch illuminates for the duration of loop-code transmission. The switch is disabled in T1 TLB and T1 LLB modes.

When the **LOOP DOWN** switch is pressed, the following occurs:

- The loop code is continuously transmitted until an appropriate response is detected at the T-BERD 209*OSP* receiver, a pre-determined timeout interval (three seconds for out-of-band payload, no timeout for out-of-band line) is exceeded, any major switch is pressed, or the **LOOP DOWN** switch is pressed again.

- If an in-band loop code is selected, the transmitted loop code overwrites the selected data pattern. *LOOP DN* appears in the PATTERN display. If an ESF out-of-band loop code is selected, the loop code is transmitted in the datalink and does not overwrite the test pattern.

- The switch LED illuminates while transmitting the loop code.

Pre-Existing Loop LED (28)

This LED warns the operator that a loop is already established. It illuminates and remains illuminated for five seconds during a loop-up attempt when an in-band loop-up code is detected within one and a half seconds from the start of loop-up code transmission. When a pre-existing loop is detected, the transmission of the in-band loop-up code is immediately halted, and the **LOOP UP** switch LED is extinguished.

The following auxiliary functions allow you to program special loop-up and loop-down codes and determine how the T-BERD 209*OSP* transmits and responds to a loop code.

- AUX PGM LPUP function
- AUX PGM LPDN function
- AUX ESF LOOP function
- AUX RESPONSE function

ERR INS Switch (29)

This switch inserts a single bit error and a single BPV into the transmitted data stream each time it is pressed. When performing out-of-service tests, use the **ERR INS** switch to ensure continuity of the system.

Bit and BPV errors can be inserted in all operating modes, except T1 LLB. Bit errors and BPVs are inserted without regard to B8ZS coding sequences. This may cause the same error multiplication (one inserted error causing multiple errors) that occurs on a repeatered span. Errors are randomly inserted on data bits (99.48% probability) and frame bits (0.52% probability). If the inserted error overwrites a data bit while in T1 ESF, it causes CRC errors.

3.6 MAINFRAME — PRINT CONTROLS

The printer control switches (see Figure 3-6) generate printouts manually (**PRINT** switches) or automatically (**PRINT EVENT** switch) to the AUXILIARY PORT, which provides the connection to a printer. For additional information on printer operation, refer to Section 6.

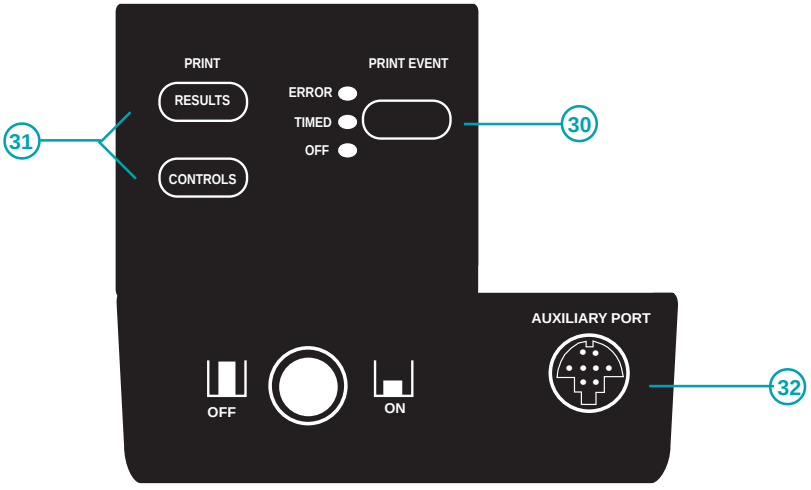


Figure 3-6
Print Controls

PRINT EVENT Switch (30)

This three-position switch determines the events that automatically initiate a results printout. When enabled, alarm messages are printed as they occur.

ERROR — Results are printed once each second when a bit error, CRC error, frame error, or BPV is detected.

TIMED — Results are printed after the specified time interval defined by the AUX PRNT INT function is completed.

OFF — This selection prevents automatic results print generation, but it does not affect the **PRINT** switches or the AUTOTEST printout.

PRINT Switches (31)

These switches manually generate either a test results printout or a front-panel controls printout. Pressing the **RESULTS** switch generates a date- and time-stamped printout of the current test results. Pressing the **CONTROLS** switch generates a date- and time-stamped printout of the current T-BERD 209*OSP* configuration.

AUXILIARY PORT Connector (32)

This female, 8-pin DIN-type connector provides connection to the PR-40A or compatible printer.

3.7 DC MEASUREMENTS OPTION — INTRODUCTION

The DC Measurements Option allows you to operate the T-BERD 209*OSP* as a digital multimeter. As a digital multimeter, the T-BERD 209*OSP* can perform DC measurements, such as resistance, voltage, and simplex current.

3.8 DC MEASUREMENTS OPTION — TEST SETUP

MODE Switch

DC TEST — Configures the instrument to perform DC measurements, such as resistance, voltage, and simplex current. The DC tests of voltage, resistance, and simplex current enable the T-BERD 209*OSP* to identify grounds, opens, shorts, and other DC related problems that affect T1 circuit performance.

PATTERN Switch

In DC TEST mode, the **PATTERN** switch selects one of the following DC tests:

OHMS — OHMS initiates the three resistance measurements of tip-ring, tip-ground, and ring-ground.

VOLTS — VOLTS initiates the DC voltage measurement.

AMPS — AMPS initiates the simplex current measurement.

3.9 DC MEASUREMENTS OPTION — TEST CONNECTIONS

T-BERD T1 Repeater Adaptor

If you are performing the DC tests at a mid-span repeater with the T-BERD T1 Repeater Adaptor providing T1 circuit access, use the following controls to establish the test connections:

- **RX/SELECT** switch
- **TX/SELECT** switch
- **CURR LOOP** switch

RX/SELECT Switch

This switch produces different results depending on the DC test being performed. Changing the **RX/SELECT** switch position restarts the test.

OHMS TEST — Press the **RX/SELECT** switch to select one of the four test sites. The graphic display configuration changes to show the new test location.

VOLTS TEST — Press the **RX/SELECT** switch and the **TX/SELECT** switch to select the receiver and transmitter test access points, respectively. The voltage between the two points is measured and provided in the RESULTS display. The graphic display illustrates the receiver and transmitter locations. Test points are usually selected across either side one or side two of the repeater.

AMPS TEST — Press the **RX/SELECT** switch to select the test location to measure the simplex current at one of the four cable pairs. The graphic display shows the current measurement switching from one cable to the other cable. This switching illustrates the T-BERD 209*OSP* measuring each cable's current separately. The T-BERD 209*OSP* adds the two currents together to obtain a total simplex current for the circuit.

TX/SELECT Switch

This switch only functions when the T-BERD T1 Repeater Adaptor provides access to the T1 circuit and VOLTS is selected. The **TX/SELECT** switch works in conjunction with the **RX/SELECT** switch to select the voltage test points. *INVALID RESULT* is displayed if the transmitter and receiver are at the same location, since the voltage must be measured across a potential difference. The graphic display configuration changes to show the transmitter location and the T-BERD 209*OSP* restarts the test.

CURR LOOP Switch

This switch determines the path of the simplex current. The graphic display shows the simplex current path as a dashed line between the tip and ring lines. When the **CURR LOOP** switch is not activated, the T-BERD T1 Repeater Adaptor passes the simplex current through each half of the repeater in accordance with normal operation. When the **CURR LOOP** switch is enabled, the simplex current is looped back toward the central office (*side 1 out* connected to *side 2 out*), and the dashed line changes to show the new simplex current path. The **CURR LOOP** switch does not disrupt the signal path.

3.10 DC MEASUREMENTS OPTION — TEST RESULTS

The DC test results may be compared to expected levels and can indicate opens, shorts, and other cable faults.

RESULTS I and II Results Switches

The **RESULTS I** and **II Results** switches produce different results depending on the DC test being performed.

VOLTS — The DC voltage potential between the transmitter and receiver test access points. The **RESULTS I** and **II Results** switches have no effect.

OHMS — The **RESULTS I** and **II Results** switches are used to toggle between the three resistance measurements. Resistance values vary with different cable types and distances. The key indicators are that TIP-GND resistance equals the RING-GND resistance and TIP-RING resistance equals the sum of the TIP-GND and RING-GND values.

TIP-GND — A measure of the resistance between the tip lead and ground. Approximately 100 ohms for 3000 feet of cable and 200 ohms for 6000 feet of cable.

RING-GND — A measure of the resistance between the ring lead and ground. Approximately 100 ohms for 3000 feet of cable and 200 ohms for 6000 feet of cable.

TIP-RING — A measure of the resistance between the tip and ring leads. Approximately 200 ohms for 3000 feet of cable and 400 ohms for 6000 feet of cable.

AMPS — A measure of the simplex current as a sum of the tip and ring currents on the selected cable pair. The **RESULTS I** and **II Results** switches have no effect.

3.11 TDR MEASUREMENTS OPTION — INTRODUCTION

The TDR Measurements Option allows you to operate the T-BERD 209*OSP* as a Time Domain Reflectometer (TDR). As a TDR, it tests a cable pair for faults, indicates the fault in plain English (i.e., short, open, etc.), and gives the distance to the identified fault(s).

3.12 TDR FUNCTIONAL DESCRIPTION

The cable type (dielectric, if known), wire gauge, and propagation velocity (Vp) are the only parameters necessary to test a cable pair as a TDR.

Selecting the cable type and wire gauge configures the T-BERD 209*OSP* to compensate for wire resistivity and dielectric characteristics that affect signal transmission. The wire gauge determines the resistive characteristics of the wire; the smaller the wire size (higher the wire gauge), the higher the resistivity. The dielectric characteristics determine the speed of the signal through the wire which is known as the propagation velocity (Vp).

The cable length determines the pulse width that is transmitted. As the distance to be measured becomes shorter, the transmitted pulse width becomes more narrow.

When TDR mode is activated, pulses are sent down the attached cable pair. Between each pulse the TDR monitors the span for reflections caused by a change in impedance on the cable pair. This change in impedance can be caused by bridge taps, coils, shorts, opens, or other impairments in the cable. The T-BERD 209*OSP* measures the time taken for the reflection to return to the T-BERD 209*OSP* and calculates the distance from the T-BERD 209*OSP* to the suspected fault.

If the T-BERD 209*OSP* is being used on an active T1 circuit with all repeaters installed, the TDR trace will see a short at the next repeater. If the T-BERD 209*OSP* is being used as part of installation testing and/or the repeaters are not installed, the TDR trace will show an open at the next repeater location.

The T-BERD 209*OSP* also analyzes the reflected signal for strength, polarity, and shape, which combine to form a distinctive signature for the fault. The magnitude of the reflected pulse is an indication of the severity of the fault and the polarity of the reflection is indicative of the type of fault. A positive (upward) reflection indicates a high resistance or open circuit. A negative (downward) reflection indicates a shunt or short circuit. Once the reflection's signature is identified, the T-BERD 209*OSP* displays the fault type and the distance to the fault in the character display.

3.13 TYPICAL TDR-IDENTIFIED FAULTS

If the fault cannot be identified, compare the actual TDR trace with idealized versions of typical fault traces (Figures 3-7 and 3-8).

Open Conductor — The reflection from an open conductor is a positive or upward pulse. If only one conductor is open on the pair, the reflection will be smaller than with a full open across both conductors. A full open across both conductors absorbs all the TDR signal energy. Therefore, the cable beyond the fault is not tested.

Shorted Conductors — The reflection from a shorted pair is a negative or downward pulse. A complete short across both conductors shunts all the TDR signal energy. Therefore, the cable beyond the fault is not tested.

High Resistance Joint/Splice — A splice produces an S-shaped reflection and a high resistance splice produces a positive pulse that is similar to an open conductor. The amplitude of the reflection depends on the effective resistance.

Build-out Capacitor — A build-out capacitor presents a low shunt impedance to the transmitted pulse and produces a negative reflection followed by a small positive overshoot.

Loading Coils — A loading coil represents a high series impedance to the transmitted pulse and produces a positive reflection. A loading coil absorbs all the TDR signal energy. Therefore, the cable beyond the fault is not tested.

Wet Section — Capacitive coupling from one pair to another pair, often caused by water, is frequency sensitive. This means that higher frequencies in the transmit pulse are affected much more than the low frequencies. For this reason, wet faults exhibit a characteristic distortion of the reflected pulse that is easily recognized.

Bridge Tap — A bridge tap appears as a negative pulse immediately followed by a positive overshoot. Because of multiple reflections it is difficult to troubleshoot a circuit that contains several bridge taps. In addition, a short bridge tap may produce multiple reflections that look like ringing and obscure any reflections from the main cable.

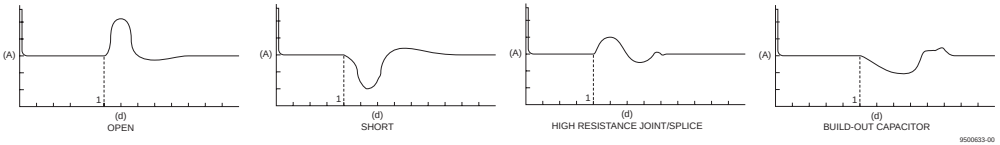


Figure 3-7
Typical TDR Traces

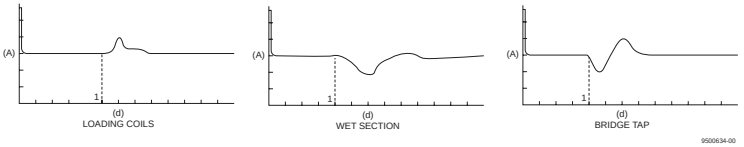
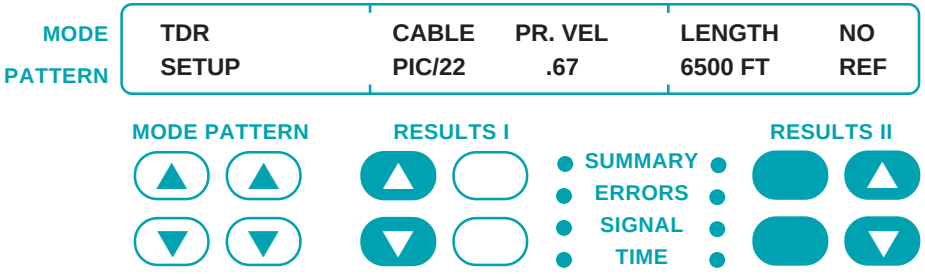


Figure 3-8
Additional Typical TDR Traces

3.14 TDR MEASUREMENTS OPTION — TEST SETUP

MODE Switch

TDR — Displays TDR test parameters.



PATTERN Switch

Press the **PATTERN** switch to select the TDR SETUP menu. If this is the first TDR test, the TDR SETUP menu is automatically displayed.

RESULTS Switches

In the TDR SETUP menu, the **RESULTS** switches perform the following functions:

RESULTS I Results Switch — Press this switch to select the CABLE type and associated wire gauge. USER/22, USER/24, or USER/26 is selected when the cable type is not listed under CABLE or the propagation velocity specified by the cable manufacturer is different than the T-BERD 209*OSP* default value.

Match the CABLE selection with the type of cable being tested. If they do not match, inaccurate distances can occur and faults can be misinterpreted.

RESULTS I Category Switch — If USER/22, USER/24, or USER/26 is selected, press this switch to select the PR. VEL. The PR. VEL can be set from 0.40 to 0.99 in 0.01 steps. Table 3-4 lists the selections for cable type.

Table 3-4
Selectable Cable Types

Cable Type	Propagation Velocity	Description
PIC/22 PIC/24 PIC/26	.67 .66 .65	22 to 26 gauge PIC (polyethylene insulated cable) wire.
JELL/22 JELL/24 JELL/26	.62 .61 .60	22 to 26 gauge jelly-filled insulated wire.
PULP/22 PULP/24 PULP/26	.71 .70 .68	22 to 26 gauge paper-pulp insulated wire.
USER/22 USER/24 USER/26	.40 - .99	When the wire gauge and Vp are known for a cable type not listed, select the wire gauge with the **RESULTS I Results** switch and the PR. VEL in 0.01 steps with the **RESULTS I Category** switch.
DEFAULT	.66	If PR. VEL and CABLE are unknown, select DEFAULT to set the Vp at 0.66. This introduces an error of less than 5% at 77°F (25°C) when testing 24 gauge PIC.

RESULTS II Category Switch — Press this switch to select the cable distance (LENGTH) tested. The LENGTH can be set to 1000 feet, 3000 feet, or 6500 feet.

RESULTS II Results Switch — If the TDR SETUP menu is displayed after a TDR test has been performed, press either the up or down arrow to toggle between NO REF and REF STORED.

NO REF indicates the reference buffer is empty. Pressing the **RESULTS II Results** switch saves the current trace in memory as the reference trace, and REF STORED is displayed.

REF STORED indicates the buffer has a stored reference trace. Dual trace results are available if a TDR test is performed after a reference trace is stored. Pressing the **RESULTS II Results** switch or changing the TDR SETUP menu erases the reference trace from memory, and NO REF is displayed.

NOTE: If this is the first TDR test performed at this connection, pressing this switch has no effect on the display.

3.15 TDR MEASUREMENTS OPTION — TEST CONNECTIONS

TRANSMIT/TDR Jack

This WECO 310 jack connects the T-BERD 209*OSP* to the circuit under test in lieu of the T-BERD T1 Repeater Adaptor when performing a TDR test.

WARNING: When testing T1 spans, remove simplex current before connecting the TRANSMIT/TDR jack to the cable pair to prevent electrical shock.

T1 REPEATER PORT

This 14-pin military-type connector allows the T-BERD 209*OSP* to connect to the T-BERD T1 Repeater Adaptor for easy test access to cable pairs at span repeater housings. When the TDR mode is selected, the T-BERD T1 Repeater Adaptor internally isolates the repeater from the cable pair to ensure valid readings can be obtained without removing the repeater from the T-BERD T1 Repeater Adaptor.

Graphic Display

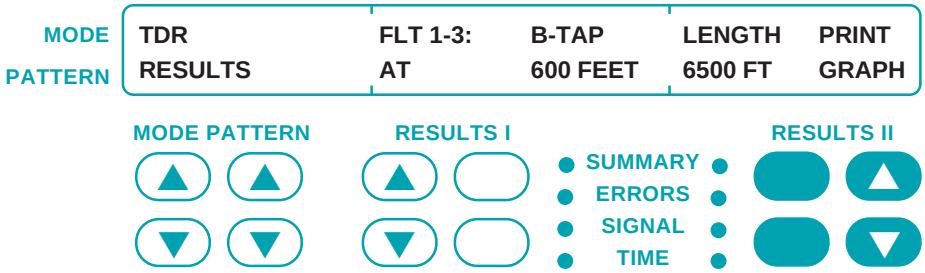
If the T-BERD T1 Repeater Adaptor is used to access the T1 circuit, the graphic display illustrates the current TDR test configuration (SETUP). The tested cable pair is indicated by a line coming down from the **TX/SELECT** switch.

TX/SELECT Switch

When the T-BERD T1 Repeater Adaptor provides access to the T1 circuit pairs, the **TX/SELECT** switch selects which of the four cable pairs at the repeater are to be tested. The graphic display illustrates which of the four repeater pairs the TDR will test.

3.16 TDR MEASUREMENTS OPTION — TEST RESULTS

Once the TDR SETUP menu is configured for the TDR test, pressing the **RESTART** switch starts the test. While the TDR test is in progress, *TESTING* appears in the PATTERN display and *RESULTS NOT AVAILABLE* appears in the RESULTS I display and the graphic display. When the test is complete, the TDR RESULTS menu appears in the character display.



RESULTS Switches

The **RESULTS** switches perform the following functions in the TDR RESULTS menu:

RESULTS I Category Switch — Press the top switch to simultaneously change the character display and graphic display to the next fault. The graphic display moves the point of view further down the trace and slightly expands the details as the distance covered decreases. Up to four faults can be detected and reported in the RESULTS I display during one test. Press the bottom switch to simultaneously select the previous fault and move the point of view towards the start of the trace. If there is only one fault or no faults, this switch has no effect. The following messages and faults can appear in the RESULTS I display:

FAULT: NONE — No faults were detected within the selected cable length. Either the cable pair is longer than the selected cable length or it is terminated with no impedance change.

FLT 1-1: OPEN/AT #### FEET — An open in the cable pair is detected at #### feet. If the distance to the open is less than the known cable length, the open must be repaired and the cable pair retested. If the distance to the open is equal to the known cable pair length, then the cable pair is good.

FLT 1-1: SHORT/AT #### FEET — A short in the cable pair is detected at #### feet. If the distance to the short is less than the known cable length, the short must be repaired and the cable pair retested. If the distance to the short is equal to the known cable pair length, then the cable pair is good.

FLT 1-1: B-TAP/AT #### FEET — A bridge tap is detected at #### feet. The bridge tap should be removed and the cable pair retested.

FLT 1-1: UNREC/AT #### FEET — An unrecognized fault is detected at #### feet. Further investigation is required. Look at the graphic display's TDR trace and compare it to the known fault traces. Check your SETUP menu entries to ensure that they are correct, or print the results for later comparison and analysis.

FLT 1-#: XXXXX/AT #### FEET — A fault is detected at #### feet and another fault(s) are detected at a further distance. The **RESULTS I Category** switch should be used to scroll through the detected faults.

RESULTS II Results Switch — Press this switch below the label PRINT GRAPH to print the TDR trace. The printout will be identical to the graphic display. If NO REF was displayed in the TDR SETUP menu, a single trace is printed from the current test results. If REF STORED was displayed in the TDR SETUP menu, the current and reference traces are printed as dual traces on the same graph.

Graphic Display

The graphic display (see Figure 3-9) identifies each fault by a vertical dotted line and a number that corresponds to the fault number in the RESULTS I display. The fault location is the point where the trace amplitude first starts to deviate from the base line of zero volts. If a reference trace is stored, the TDR test will produce dual trace results on the graphic display.

RX/SELECT Switch

This switch activates the graphic display cursor line that replaces the numbered fault line(s) with a single vertical cursor line. The **RX/SELECT** switch moves the cursor from right to left along the TDR trace. As you scroll along the trace, the scale and proportion changes to compensate for the signal strength. The location of the cursor (in feet) is displayed in the upper right corner of the graphic display. Pressing the **RESULTS I Category** switch at any time restores the fault location indicator(s) and erases the cursor line.

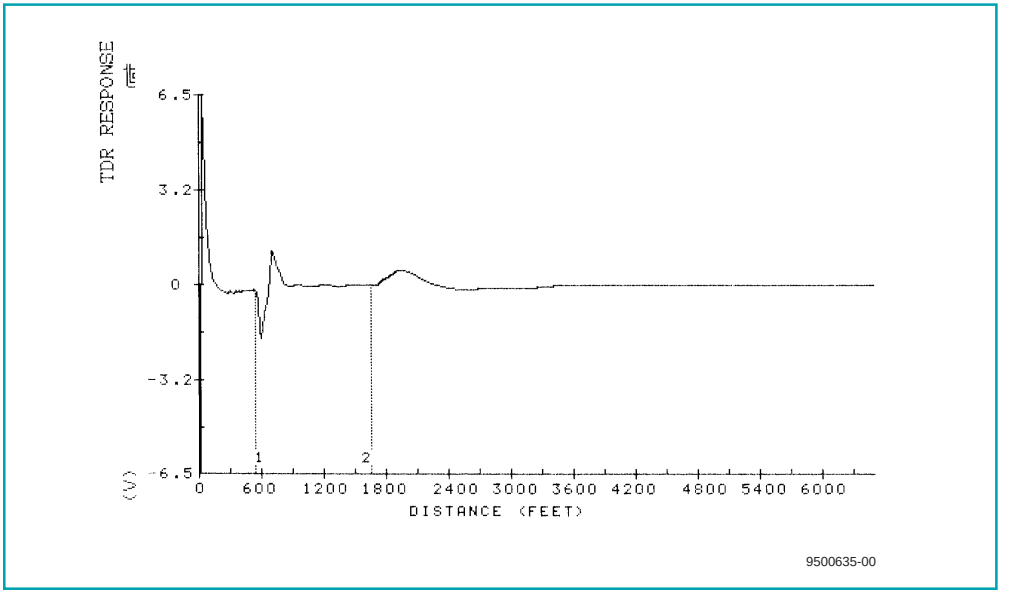


Figure 3-9
TDR Graphic Display Trace

TX/SELECT Switch

This switch activates the cursor line, which replaces the numbered fault line(s) with a single vertical cursor line. The **TX/SELECT** switch moves the cursor from left to right along the TDR trace. As you scroll along the trace, the scale and proportion changes to compensate for the signal strength. The location of the cursor (in feet) is displayed in the upper right corner of the graphic display. Pressing the **RESULTS I Category** switch at any time restores the fault location indicator(s) and erases the cursor line.

CURR LOOP Switch

This switch activates the ZOOM IN feature, which magnifies the trace at the cursor line. Press the **CURR LOOP** switch once to zoom in on the area selected by the cursor line. Press the **CURR LOOP** switch again to zoom out to the original scale. Pressing the **RESULTS I Category** switch at any time restores the fault location indicator(s) and erases the cursor line.

PATTERN Switch

Press this switch (up or down arrow) to return to the TDR SETUP menu.

NOTE: Changing CABLE, PR. VEL, or LENGTH in the SETUP menu clears the TDR results and erases the TDR reference trace.

3.17 TDR MEASUREMENTS OPTION — PRINT CONTROLS

Use the following controls and connectors to generate or store TDR printouts. Refer to Section 6 for additional information.

PRINT Switches

Pressing the **RESULTS** switch generates a date- and time-stamped printout of the current test results. Pressing the **CONTROLS** switch generates a date- and time-stamped printout of the current T-BERD 209*OSP* configuration.

AUXILIARY PORT Connector

This female, 8-pin DIN-type connector provides connection to the PR-40A or compatible printer.

NOTE: Ensure that the AUX PARITY function is set to NONE and the AUX TERM 232 function is set to CR before initiating a TDR trace printout, because graphics printers require eight data bits.

RESULTS II Results Switch

See the **RESULTS II Results** switch paragraphs under the TDR RESULTS menu discussion.

3.18 CHANNEL MONITOR OPTION — INTRODUCTION

The Channel Monitor Option enables the T-BERD 209*OSP* to drop one of the 24 DS0 channels to the speaker, the RESULTS displays, and the graphic display. It also adds four VF tones (404, 1004, 2804 Hz at a user-selectable output level and 2713 Hz at 0.0 dBm) for transmission on single DS0 channels within the DS1 signal.

NOTE: Unless indicated, the capabilities of the mainframe are applicable to the Channel Monitor Option.

3.19 CHANNEL MONITOR OPTION — TEST SETUP

AUX Switch

In addition to the standard mainframe auxiliary functions, the following auxiliary functions are added to the T-BERD 209*OSP* (see Section 4).

AUX VF CHAN — The Voice Frequency Channel Selection auxiliary function selects the DS0 channel to be dropped to the speaker, the RESULTS displays, and the graphic display.

RX/SELECT Switch

If the T-BERD T1 Repeater Adaptor is not connected to the T1 REPEATER PORT, the **RX/SELECT** switch can be used to lower the selected channel number down to a minimum of NONE.

TX/SELECT Switch

If the T-BERD T1 Repeater Adaptor is not connected to the T1 REPEATER PORT, the **TX/SELECT** switch can be used to raise the selected channel number from 1 through 24.

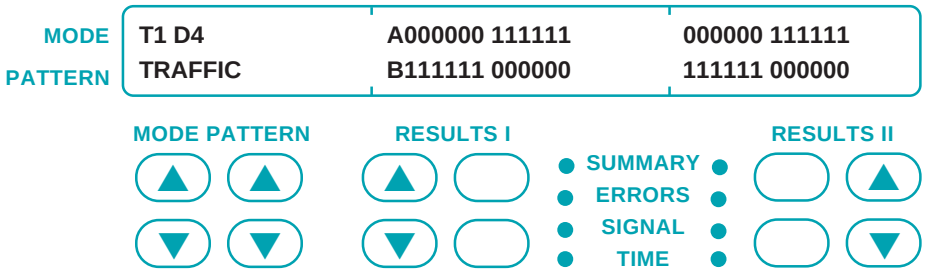
3.20 CHANNEL MONITOR OPTION — TEST RESULTS

Character Display

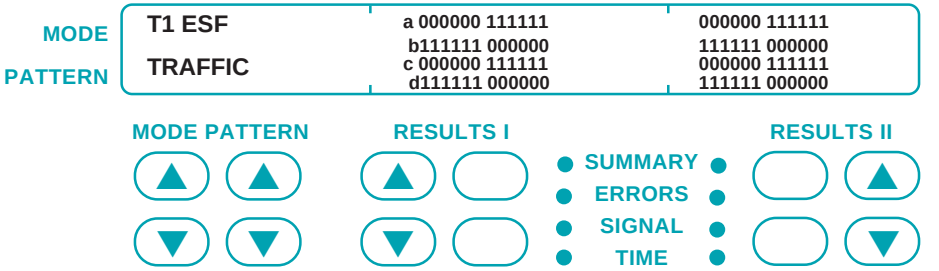
The Channel Monitor Option adds the TRAFFIC and DATA BITS results to the SIGNAL category.

NOTE: Since the TRAFFIC result requires the entire display, only the **RESULTS I** or **II Results** switch that selected the TRAFFIC result works.

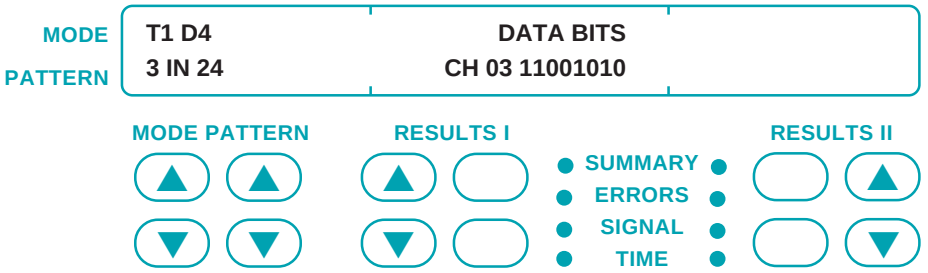
TRAFFIC — For T1 D4, T1 D1D, and T1 SLC framing, the RESULTS I and II displays show the A and B signaling bits for all 24 DS0 channels (see below).



For T1 ESF framing, the RESULTS I and II displays show the A, B, C, and D signaling bits for all 24 DS0 channels.

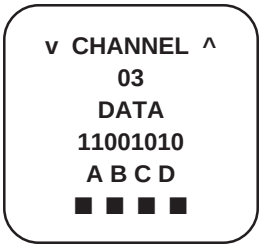


DATA BITS — This result displays the data bits for the selected channel.



Graphic Display

The graphic display provides the selected channel's signaling and data bits.



3.21 CHANNEL MONITOR OPTION — PRINT CONTROLS

The signaling bits of the 24 DS0 channels and the data bits of a single DS0 channel can be printed out by generating a results printout.

3.22 ADVANCED STRESS PATTERNS OPTION — INTRODUCTION

The Advanced Stress Patterns Option provides fixed long patterns that stress test the repeaters in the T1 span.

NOTE: Unless indicated, the capabilities of the mainframe are applicable to the Advanced Stress Patterns Option.

3.23 ADVANCED STRESS PATTERNS OPTION — TEST SETUP

MODE Switch

The following operating mode is affected by the Advanced Stress Patterns Option:

REPEATER — Automatically tests both sides of a repeater installed in the T-BERD T1 Repeater Adaptor. First, Side 1 is tested for bit errors with an ALL ONES pattern followed by a 3 IN 24 pattern. If no bit errors are detected, the T1 DALY pattern is used. Regardless of the results of the Side 1 test, the same test is performed on Side 2 of the repeater. The Side 1 test result appears in the RESULTS I display, while the Side 2 test result appears in the RESULTS II display. The T-BERD T1 Repeater Adaptor supplies 60 mA of simplex current to power the repeater for the test.

PATTERN Switch

The Advanced Stress Patterns Option provides the following additional patterns (refer to Appendix C for hexadecimal pattern descriptions):

T1 DALY — This 55-octet pattern stresses the timing recovery circuitry of line cards and the preamplifier and equalization circuits of repeaters utilizing discrete component ALBOs. The T1 DALY pattern may be sent in unframed T1 or framed T1. When sent framed, the frame bit shall be inserted at octet boundaries. The T1 DALY pattern meets the ones density and excess zeros criteria, and it has only one byte different than the 55 OCTET pattern.

T1-2/96 — This 96-octet pattern allows the T-BERD 209*OSP* to stress M12 cards in DS3 equipment. This pattern may be sent unframed or framed, but it should not be used with T1 D4 framing because of possible synchronization problems inherent in the pattern. The maximum number of zeros when framed is 15, and the pattern meets the ones density criteria.

T1-3/54 — This 54-octet pattern is used to test repeater pre-amplification, equalization, and automatic line build-out (ALBO) circuitry. Because the framing bit rotates through the pattern sequence, the pattern violates the excess zeros criteria by creating 16 consecutive zeros. This pattern should only be transmitted across a repeatered span, not across a public T1 network.

T1-4/120 — This 120-octet pattern allows the T-BERD 209*OSP* to stress the equalization circuits between T1 multiplexers. This pattern can be transmitted framed or unframed. The maximum number of zeros when framed is 7, and it meets the ones density criteria.

T1-5/53 — This 53-octet pattern stresses the automatic line build-out (ALBO) and equalization circuits of repeaters. Because the framing bit rotates through the pattern sequence, the pattern violates the 8(n+1) ones density criteria. This pattern should only be transmitted across a repeatered span, not across a public T1 network.

55 OCTET — This 55-byte pattern allows the T-BERD 209*OSP* to stress the timing recovery circuitry of line cards and the preamplifier and equalization circuits of repeaters utilizing discrete component ALBOs. Because the framing bit rotates through the pattern sequence, the pattern violates the excess zeros criteria by creating 16 consecutive zeros. The 55 OCTET pattern requires unframed T1 framing to meet ones density and excess zeros criteria.

MIN/MAX — This 55-octet pattern allows the T-BERD 209*OSP* to stress T1 circuit repeaters. This pattern is useful for stressing the timing recovery circuitry of line cards and the preamplifier and equalization circuits of repeaters utilizing discrete component ALBOs. The MIN/MAX pattern can be sent framed or unframed without violating the minimum ones density requirements.

3.24 ENHANCED ESF OPTION — INTRODUCTION

The Enhanced ESF Option provides the comprehensive and advanced test capabilities required for installing and maintaining ANSI T1.403 ESF circuits. This option provides monitor and emulation capabilities of the one-second broadcast of Performance Report Message (PRM), per the ANSI T1.403 specification.

The Enhanced ESF Option also adds the SMARTNIU operating mode, which provides access to the T1 span performance statistics recorded by the Westell 3114 NIU/Performance Monitor. This operating mode also supports the Clear Results and Set Clock features of the NIU/Performance Monitor.

NOTE: Unless indicated, the capabilities of the mainframe are applicable to the Enhanced ESF Option.

3.25 ENHANCED ESF OPTION — TEST SETUP

MODE Switch

In addition to the standard mainframe operating modes, the following modes are added to the switch selections:

SMARTNIU — Smart NIU/Performance Monitor mode configures the T-BERD 209*OSP* to query the Performance Monitor portion of the Westell combined NIU/Performance Monitor equipment for the T1 span statistics it recorded. When this mode is enabled, all unrelated functions are disabled, framing is set to T1 ESF, and the transmitted pattern is set to 1:1. The SMARTNIU mode enables three functions; Query, Clear Results, and Set Clock.

PATTERN Switch

When the SMARTNIU mode is enabled, the following switch selections are available:

RESULTS — The RESULTS position activates the Query function of the SMARTNIU mode, which queries, retrieves, and stores the performance monitor statistics. When RESULTS is selected, the **RCVD**, **LOOP CODES**, **LOOP UP**, **LOOP DOWN**, and **ERR INS** switches are disabled. One complete set of performance monitor statistics can be stored at a time, so previously stored statistics are cleared from the T-BERD 209*OSP* by the next query.

SETUP — The SETUP position allows the T-BERD 209*OSP* to activate the Set Clock function and the Clear Results function. The Set Clock function (SET CLOCK) sets the NIU/Performance Monitor time and date to match the T-BERD 209*OSP*'s time and date. NIU/Performance Monitor time and date are maintained internally and recorded with each alarm and error message. The Clear Results function (CLEAR NIU) clears recorded statistics from the NIU/Performance Monitor, which is usually performed after the results are retrieved.

AUX Switch

The following auxiliary functions are affected by or have an affect on the Enhanced ESF Option (see Section 4).

AUX DATALINK — When the Enhanced ESF Option is installed, this auxiliary function is used to select the PRM transmit emulation mode and to determine whether or not the T-BERD 209*OSP* will display PRMs, as well as to determine whether or not the T-BERD 209*OSP* will display BPMs and to program eight-bit BPM commands.

3.26 ENHANCED ESF OPTION — TEST RESULTS

RESTART Switch

When the T-BERD 209*OSP* is in the SMARTNIU mode, pressing the **RESTART** switch automatically selects the RESULTS position and activates the Query function, which retrieves the T1 span performance statistics from the NIU/Performance Monitor. The T-BERD 209*OSP* displays the following message.

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

When the Query function stops, the T-BERD 209*OSP* displays one of the following messages to indicate the results:

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

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

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

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

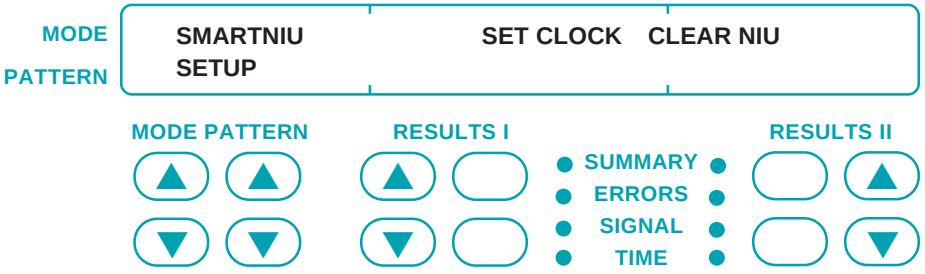
QUERY FAILURE/ERRORS DETECTED — indicates the Query function failed with some messages retrieved. The retrieved data included error messages. Query failure was caused by loss of signal, loss of frame, excessive re-transmission of a message, timeout of a response to a query message, or loss of power.

RESULTS Switches

When the T-BERD 209*OSP* is in the SMARTNIU mode with the SETUP position selected, pressing the **RESULTS I Results** switch activates the Set Clock function. The message *SET CLOCK IN PROGRESS* is displayed in the RESULTS I display for approximately ten seconds, which indicates the Clear Results function is activated. The T-BERD 209*OSP* displays one of the following messages to indicate the results.

SET CLOCK FAILED — indicates the Set Clock function failed to set the time and date to match the T-BERD 209*OSP*'s time and date. This could be the result of poor connections. Check the T1 circuit connections and try again.

SET CLOCK COMPLETE — indicates the Set Clock function has set the NIU/Performance Monitor time and date to match the T-BERD 209*OSP*'s time and date.



When the T-BERD 209*OSP* is in the SMARTNIU mode with the SETUP position selected, pressing the **RESULTS II Results** switch activates the Clear Results function. The message *CLEAR NIU IN PROGRESS* is displayed in the RESULTS II display for approximately ten seconds, which indicates the Clear Results function is activated. When the Clear Results function stops, the T-BERD 209*OSP* displays one of the following messages to indicate the results.

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

CLEAR NIU COMPLETE — indicates all results are cleared from the NIU/Performance Monitor.

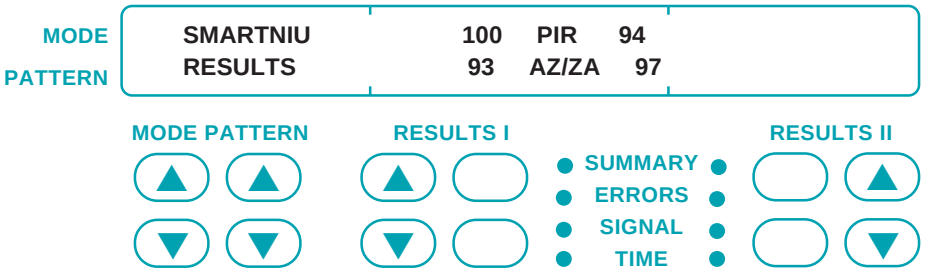
Collecting Test Results

The ESF datalink far-end PRM results enable the T-BERD 209*OSP* to monitor and report on the status of the ESF datalink PRM as described in the ANSI T1.403-1989 standard. The far-end PRM results appear in the ERRORS and SUMMARY categories and include:

FAR FRM ES	Far-End Frame Error Seconds
FAR FRM SES	Far-End Severely Errored Framing Seconds
FAR BPV SEC	Far-End BPV Seconds
FAR SLP SEC	Far-End Controlled Slip Seconds
FAR PRM TIME	Far-End Performance Report Time
FAR CRC ERR	Far-End CRC Error Events
FCRC 1	Far-End CRC Bin 1
FCRC 2-5	Far-End CRC Bin 2 to 5
FCRC 6-10	Far-End CRC Bin 6 to 10
FCRC 11-100	Far-End CRC Bin 11 to 100
FCRC 101-319	Far-End CRC Bin 101 to 319
FCRC >319	Far-End CRC Bin 319 to 333
PAY SRC	Far-End Payload Source/Loopback

The far-end PRM results are available when the ESF operating mode is selected and the AUX DATALINK function PRM RECEIVE is ON. The far-end PRM results are also available in the AUTO LLB and T1 LLB modes.

In the SMARTNIU mode, the NIU/Performance Monitor stored statistics can be retrieved, but they can not be displayed in the RESULTS display. Only the Performance Indication Ratios are displayed as percentage values representing the overall performance of the circuit in each direction.



The retrieved performance data is only available as a Smart NIU Results printout. The T1 circuit is monitored in both directions, and the results are stored as either AZ (CO to NIU) or ZA (Customer Premises to NIU). The statistics are recorded and identified as follows:

CVL — Line Coding Violations is a count of bipolar violations that are not part of a B8ZS sequence.

ESL — Line Errored Seconds is a count of seconds in which at least one CVL has occurred.

SESL — Line Severely Errored Seconds is a count of seconds in which 1544 or more CVLs have occurred (corresponds to a BPV rate of 10E-3).

UASL — Line Unavailable Seconds is a count of seconds that a line was unavailable. A line is unavailable when ten or more consecutive SESLs occur.

CVP — Path Coding Violation is a count of CRC-6 errors or frame errors.

ESP — Path Errored Seconds is a count of seconds in which at least one CVP has occurred.

SESP — Path Severely Errored Seconds is a count of seconds in which 330 or more CRC-6 or eight or more frame errors have occurred.

UASP — Path Unavailable Seconds is a count of seconds that a line was unavailable. A line is unavailable when ten or more consecutive SESPs occur.

PDVS — Pulse Density Violation Seconds is a count of seconds in which 16 consecutive zeros have occurred (8 consecutive zeros for B8ZS encoding).

B8ZS — B8ZS Violation Seconds is a count of seconds in which a B8ZS code is detected on a non-B8ZS circuit. This parameter is not valid on B8ZS circuits.

MSEC — Monitored Seconds is a count of seconds in which valid performance information is recorded.

STAT — Status Register is an eight-bit register with the following bits: Bit 1 - Loopback Request, Bit 2 - Data Incomplete Indicator, Bit 3 - Loss of Signal Indicator, Bit 5 - Loss of Power, Bit 6 - Alarm Indication Signal (AIS), Bit 7 - Yellow Alarm, and Bit 8 - Out-of-Frame.

PIR — Performance Indication Ratio is a percentage providing a "quick glance" indication of the performance of the span. The closer the number is to one-hundred, the better the performance.

3.27 ENHANCED ESF OPTION — PRINT CONTROLS

PRINT Switch

When in SMARTNIU mode, press the **PRINT** switch RESULTS position to generate a SMART NIU results printout. The printout lists the statistics retrieved from the NIU/Performance Monitor at the end of a standard results printout. A complete SMART NIU results printout will

list recorded results for the current hour (CURRENT HOUR), each of the previous 23 hours (HISTORY HOUR 01 through HISTORY HOUR 23), the current day (CURRENT DAY), and the previous week (HISTORY DAY 01 through HISTORY DAY 07) in the following format:

```
SMART NIU RESULTS DATA COLLECTED AT:
  1       08-27-93

Key for STAT res.
- - - - - - - - - -
2 = Looped Back
3 = Data Incomplet
4 = Loss of Signal
5 = Unused
6 = Power Loss
7 = AIS
8 = Yellow Alarm
9 = Out of Frame

AZ-PIR EFS:    100%   AZ-PIR STAT:   <=91%
ZA-PIR EFS:    100%   ZA-PIR STAT:   <=91%

CURRENT HOUR          13:00   08-27-93
AZ-CVL :    1372261   AZ-ESL :      14
AZ-SESL:          0   AZ-UASL:       0
AZ-CVP :    1372261   AZ-ESP :      14
AZ-SESP:          0   AZ-UASP:       0
AZ-PDVS:          0   AZ-B8ZS:       0
AZ-MSEC:          0   AZ-STAT:      21


ZA-CVL :     358367   ZA-ESL :    3518
ZA-SESL:         NA   ZA-UASL:      NA
ZA-CVP :     356959   ZA-ESP :       0
ZA-SESP:         NA   ZA-UASP:      NA
ZA-PDVS:         NA   ZA-B8ZS:      NA
ZA-MSEC:         NA   ZA-STAT:      NA

HISTORY HOUR 01       12:00   08-27-93
AZ-CVL :          0   AZ-ESL :      08
•
•
•
```

3.31 FRACTIONAL T1 OPTION — INTRODUCTION

The Fractional T1 Option also provides fractional T1 (FT1) modes for contiguous and noncontiguous FT1 (56KxN and 64KxN) testing capabilities in D4 and ESF framing formats. In conjunction with the FT1 modes, it adds three FT1 stress patterns (63, 511, and 2047) for testing DDS and fractional T1 circuits.

NOTE: Unless indicated, the capabilities of the mainframe are applicable to the Fractional T1 Option.

3.32 FRACTIONAL T1 OPTION — TEST SETUP

MODE Switch

In addition to the mainframe operating modes, the following FT1 operating modes are also available:

FT1 D4 — D4 Superframe Fractional T1 mode configures the T-BERD 209*OSP* to transmit and receive D4 framed FT1 data. The FT1 D4 mode is compatible with D3 and D4 superframe formats.

FT1 ESF — Extended Superframe Fractional T1 mode configures the T-BERD 209*OSP* to transmit and receive ESF framed FT1 data.

PATTERN Switch

The Fractional T1 Option provides the following additional patterns when an FT1 mode is enabled:

63 — A 63-bit (2^6-1) pseudorandom pattern that generates a maximum of five sequential zeros and six sequential ones.

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

2047 — A 2047-bit (2^{11}-1) pseudorandom pattern that generates a maximum of ten sequential zeros and eleven sequential ones. This pattern is generally used to test DDS and other circuits operating between 9.6 and 56 kb/s.

<tone> — The tone frequency selected in the AUX VF TONE function is displayed as a pattern selection. The selection is 404 Hz, 1004 Hz, or 2804 Hz at a user-selected output level or 2713 Hz at 0.0 dBm.

When an FT1 mode is enabled, the following stress patterns are affected:

VF Tones — VF tones should not be used when the 56KxN data rate is selected.

BRIDGTAP & MULTIPAT — BRIDGTAP and MULTIPAT are designed to function with full T1 and should not be used for FT1 circuit testing.

AUX Switch

In addition to the standard mainframe auxiliary functions, the following auxiliary functions are added to the T-BERD 209*OSP* (see Section 4).

AUX FT1 CHAN — The Fractional T1 Channel Bandwidth auxiliary function selects the FT1 channel bandwidth being tested in FT1 circuits.

AUX FT1 SETUP — The Fractional T1 Setup auxiliary function sets the FT1 idle code and selects the FT1 channel rate.

AUX VF TONE — The Voice Frequency Tone Selection auxiliary function selects the VF frequency and level of the transmitted VF tone. The VF tone is transmitted on only a single channel, which is the channel selected by the AUX VF CHAN function.

The following auxiliary functions are affected by or have an affect on the Fractional T1 Option (see Section 4).

AUX RESPONSE — When operating in the FT1 modes and AUTO RESPONSE is enabled, the T-BERD 209*OSP* responds to in-band loop codes if they are present on the full T1 bandwidth. However, the T-BERD 209*OSP* does respond to ESF out-of-band loop codes when configured for FT1 ESF operation. The AUTO RESPONSE mode also establishes a full bandwidth loopback and bit error rate test.

AUX LOOPCODE — When FT1 modes are selected, the T-BERD 209*OSP* sends in-band loop codes only within the selected FT1 channel bandwidth. However, the T-BERD 209*OSP* responds to in-band loop codes if they are present on the full T1 bandwidth. Out-of-band loop codes are not affected by the Fractional T1 Option.

3.33 HDSL/ISDN/DDS MEASUREMENTS OPTION — INTRODUCTION

The HDSL/ISDN/DDS Measurements Option provides the capabilities to measure the circuit loss, HDSL signal power, total loop length, and total loop capacitance of HDSL circuits. It also enables the T-BERD 209*OSP* to perform insertion loss testing of Basic Rate ISDN and 56 Kb/s DDS circuits.

NOTE: Unless indicated in the following descriptions, the capabilities of the mainframe are applicable to the HDSL Measurements Option.

3.34 HDSL/ISDN/DDS MEASUREMENTS OPTION — TEST SETUP

MODE Switch

In addition to the standard mainframe operating modes, the following modes are added to the switch selections:

HDSL — High-bit-rate Digital Subscriber Line (HDSL) mode configures the T-BERD 209*OSP* to test HDSL circuits.

WB TONES — WideBand Tones (WB TONES) mode configures the T-BERD 209*OSP* to test either Basic Rate ISDN or 56 Kb/s DDS circuits.

PATTERN Switch

When the HDSL mode is enabled, the following switch selections are available:

LOOP LEN — The LOOP LEN position measures the total capacitance of the loop and displays the total loop length, including all bridge taps.

163KHz — The 163KHz position enables the T-BERD 209*OSP* to transmit a 163 KHz signal. The 209*OSP* automatically displays the LOSS result for the received 163 KHz signal.

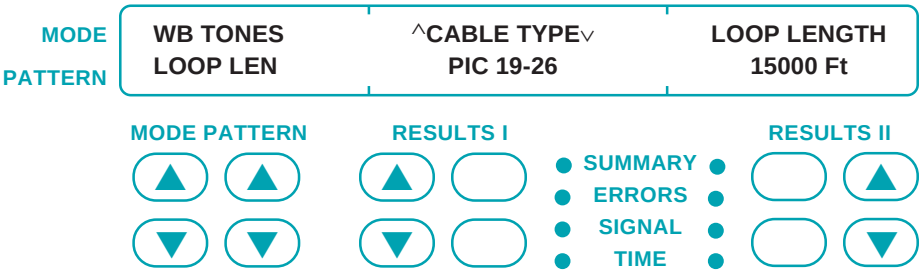
196KHz — The 196KHz position enables the T-BERD 209*OSP* to transmit a 196 KHz signal. The 209*OSP* automatically displays the LOSS result for the received 196 KHz signal.

392KHz — The 392KHz position enables the T-BERD 209*OSP* to transmit a 392 KHz signal. The 209*OSP* automatically displays the LOSS result for the received 392 KHz signal.

POWER — The POWER position allows the 209*OSP* to measure HDSL 2B1Q signal power and crosstalk.

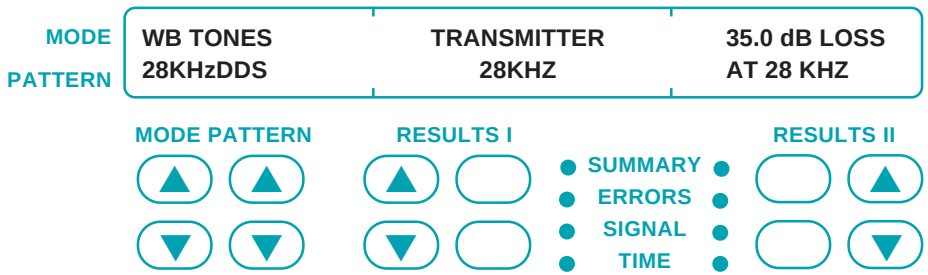
When the WB TONES mode is enabled, the following switch selections are available:

LOOP LEN — The LOOP LEN position measures the total capacitance of the loop and displays the total loop length, including all bridge taps.



40KHzBRI — The 40KHzBRI position enables the T-BERD 209*OSP* to transmit a 40 KHz signal to test Basic Rate ISDN circuits. The 209*OSP* automatically displays the LOSS result for the received 40 KHz signal. Pressing the **RESULTS I** and **II** switches have no effect on the display.

28KHzDDS — The 28KHzDDS position enables the T-BERD 209*OSP* to transmit a 28 KHz signal to test 56 Kb/s DDS circuits. The 209*OSP* automatically displays the LOSS result for the received 40 KHz signal. Pressing the **RESULTS I** and **II** switches have no effect on the display.



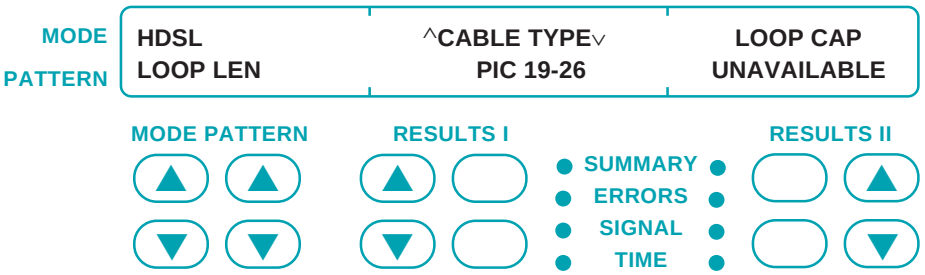
Switch Indicators

When the T-BERD 209*OSP* is in the HDSL mode, the **RECV'D**, **TIMED TEST**, **B8ZS**, **RX/SELECT**, **TX/SELECT**, **CURR LOOP**, **LBO**, **LOOP CODES**, **LOOP UP**, **LOOP DOWN**, **ERR INS**, **AUTO TEST**, and **RESULTS I and II Category** switches and LEDs are disabled.

RESULTS Switches

When the HDSL or WB TONES mode is enabled with the LOOP LEN test selected, the **RESULTS** switches perform the following functions:

RESULTS I Results switch — Press this switch to select the CABLE TYPE. Press either the up or down arrow to scroll through the selections: PIC 19-26, PULP 19, PULP 22, PULP 24, PULP 26, and DEFAULT. Select DEFAULT when the cable type or cable gauge is unknown or mixed.



3.35 HDSL/ISDN/DDS MEASUREMENTS OPTION — TEST CONNECTIONS

T1 REPEATER PORT

The HDSL and WB TONES modes are not operational when the T-BERD T1 Repeater Adaptor is connected to the T1 REPEATER PORT. The message *HDSL TESTING UNAVAILABLE DISCONNECT RPTR ADAPTER* is displayed in the RESULTS I and II displays when the T-BERD T1 Repeater Adaptor is attached to the T-BERD 209*OSP* and the HDSL mode is selected. The message *WB TONES TEST UNAVAILABLE DISCONNECT RPTR ADAPTER* is displayed in the RESULTS I and II displays when the T-BERD T1 Repeater Adaptor is attached to the T-BERD 209*OSP* and the WB TONES mode is selected.

3.36 HDSL/ISDN/DDS MEASUREMENTS OPTION — TEST RESULTS

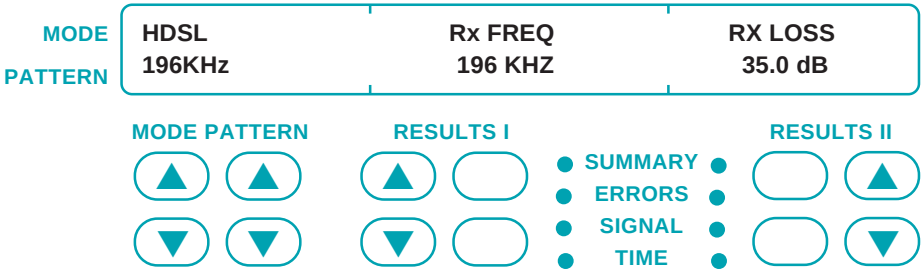
STATUS AND ALARM INDICATORS

When the T-BERD 209*OSP* is in the HDSL mode, all the status and alarm LEDs do not function.

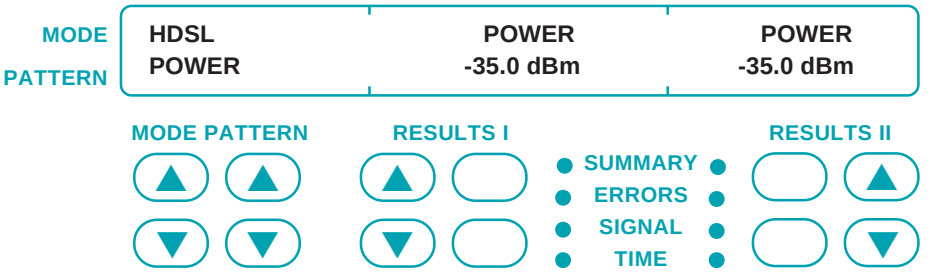
RESULTS I and II Switches

The **RESULTS I** and **II** switches produce different results depending on the HDSL test being performed.

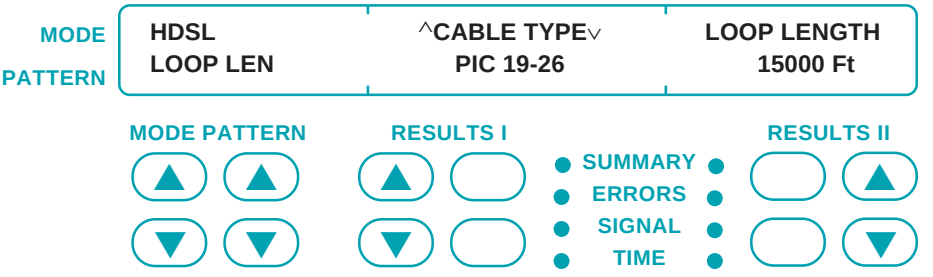
163KHz, 196KHz, 392KHz — This test transmits a sine wave signal at the selected frequency from one unit and measures the received signal level on a second unit at the other end. The received frequency from the second test set is displayed in the RESULTS I display. The received frequency and the selected frequency should match. If they do not agree, check the circuit type (Basic Rate ISDN or 56 Kb/s DDS) and set both test sets to the correct frequency. The RX LOSS result is displayed in the RESULTS II display and is updated continuously or when the **RESTART** switch is pressed.

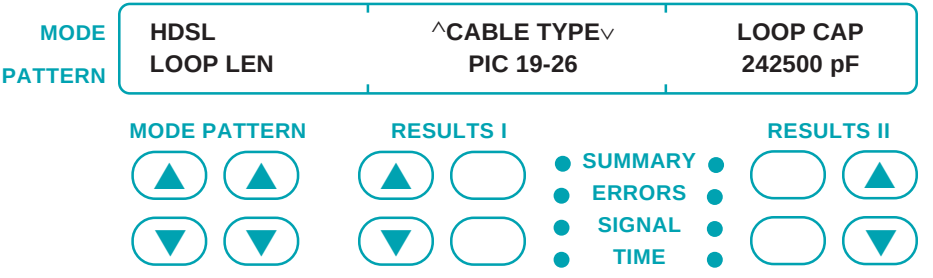


POWER — This test measures the RMS power of a live HDSL signal. The POWER result is displayed in the RESULTS I display and is updated continuously or when the **RESTART** switch is pressed. The valid results range is +13.0 to -40.0 dBm. If the result is greater than +13.0 dBm, *>+13.0 dBm* is displayed. If the result is less than -40.0 dBm, *<40.0 dBm* is displayed.



LOOP LEN — This test measures the total capacitance and total length of the cable. The total loop length and total capacitance results are displayed in the RESULTS II display. Both results are measured once, then frozen in the display until the **RESTART** switch is pressed. The valid loop length range is from 100 to 20,000 feet. The valid loop capacitance range is from 1500 to 323,500 picofarads (pF). The **RESULTS II Results** switch is used to toggle between the two results, LOOP LENGTH and LOOP CAP.

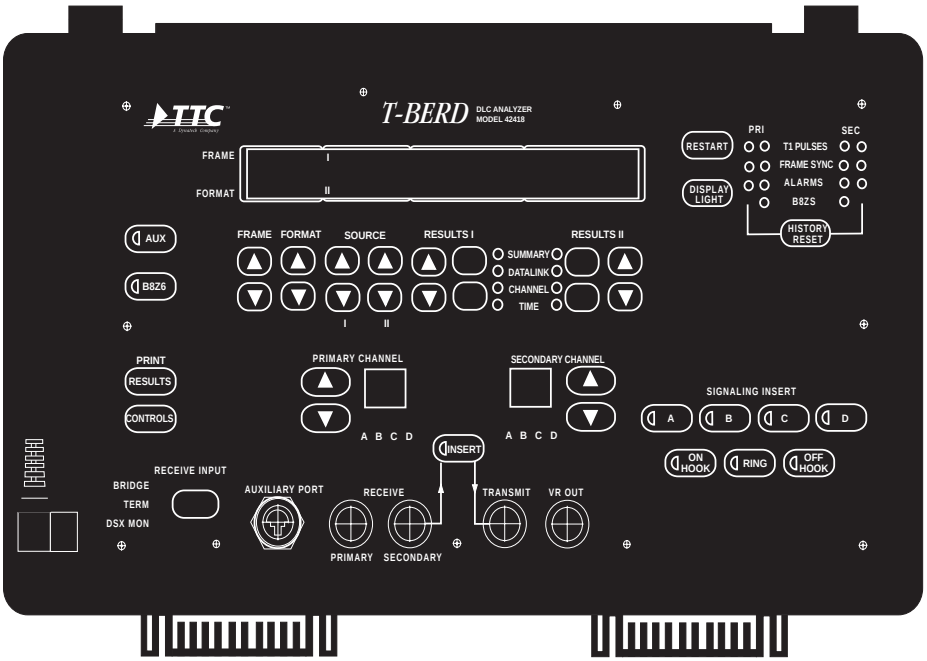




3.37 DLC ANALYZER OPTION — INTRODUCTION

The DLC Analyzer Option (209*OSP*-96) provides the T-BERD 209*OSP* with the ability to test Digital Loop Carrier (DLC) systems during circuit installation, acceptance testing, and troubleshooting applications. It can monitor and generate alarms, far-end loops, switch to protection events, and maintenance test sequences over the DLC datalink. The DLC Analyzer Option also has the capability to monitor the channel signaling of all 24 DS0 channels and test the channel signaling of individual DS0 channels.

The DLC Analyzer Option (see Figure 3-10) can generate and report on the status of datalink alarm, far-end loopback, maintenance, and switch to protection line messages. Alarm messages indicate various system conditions that cause failures in signal quality, loss, or line backup capabilities. Far-end loopback messages indicate which DS1 line is looped back (Shelf A, B, C, D, or protection line). The maintenance messages indicate the messages being transmitted when the maintenance test procedure is performed. Protection line switch messages indicate which of the primary DS1 lines has been switched to the protection line.



9500636-00

Figure 3-10
DLC Analyzer Option

3.38 DLC ANALYZER OPTION — TEST SETUP

The DLC Analyzer Option cable attaches to the T-BERD 209*OSP* AUXILIARY PORT connector. The DLC Analyzer Option receives power through this cable. This cable can also be used to send printouts from the mainframe to a printer attached to the DLC Analyzer Option AUXILIARY PORT.

The following DLC Analyzer Option controls and indicators are described in the order that you would normally use them to test a circuit from a DSX-1 access point (see Figure 3-11).

- Front-panel display (1)
- **DISPLAY LIGHT** switch (2)
- **AUX** switch (3)
- **B8ZS** switch (4)
- **FRAME** switch (5)
- **FORMAT** switch (6)
- **SOURCE I** and **II** switches (7)
- **PRIMARY CHANNEL** switch (8)
- **SECONDARY CHANNEL** switch (9)

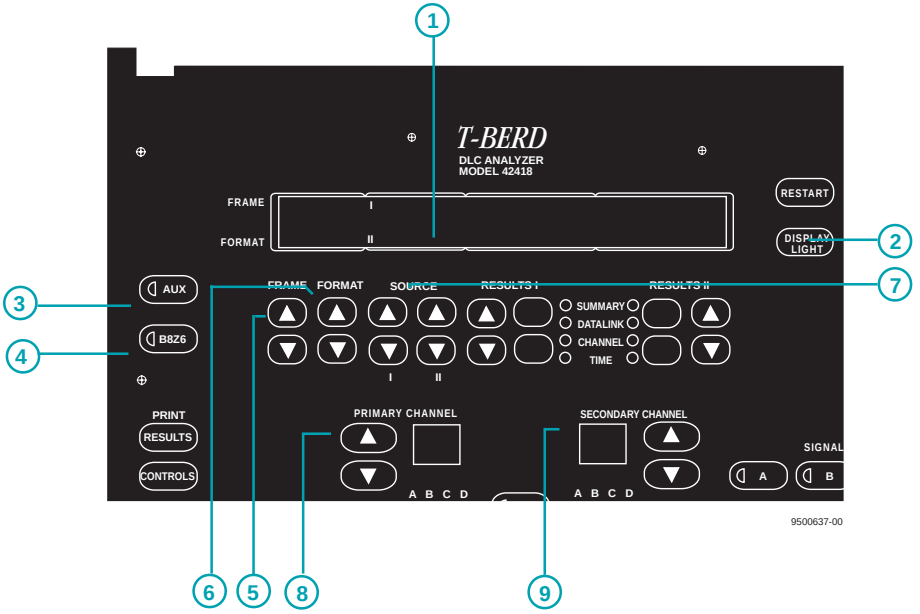


Figure 3-11
DLC Analyzer Option Display and Setup Switches

Front-Panel Display (1)

Operating modes, test results, test patterns, and auxiliary functions are displayed in the four window, two-line, Liquid Crystal Display (LCD). The display is also backlighted for easier viewing in subdued lighting.

FRAME/FORMAT window — The first window indicates the current framing mode and format of the instrument. The displayed information is selected by pressing the **FRAME** and **FORMAT** switches.

SOURCE window — The second window indicates the current source test signal for the selected framing and format modes. The SOURCE I line is controlled with the **SOURCE I** switch, and the SOURCE II line is controlled with the **SOURCE II** switch.

RESULTS I and II windows — The third and fourth windows display test results, auxiliary function selections, and status messages. These windows are controlled by the two switches located just below each window.

DISPLAY LIGHT Switch (2)

Press this switch to backlight the display in low light conditions. Press once to backlight the display for 30 seconds. Press the switch again during the 30 seconds, and the display remains illuminated. Press a third time to turn the illumination off.

AUX Switch (3)

Press this LED switch to access the DLC Analyzer Option auxiliary functions. These auxiliary functions allow access to parameters that are less frequently used and do not have dedicated switches. For detailed information on the auxiliary functions, refer to Section 4.4.

B8ZS Switch (4)

This switch sets the transmitted coding for either AMI-encoded data or B8ZS clear-channel encoded data. The LED within the switch illuminates when B8ZS coding is selected and is extinguished when AMI coding is selected. B8ZS decoding is performed automatically at the receiver.

Switch Configurations

The **FRAME, FORMAT, SOURCE I,** and **SOURCE II** switches are interrelated. They configure the DLC Analyzer Option to the circuit framing mode and select a signal for insertion into either the selected DS0 channel or SLC-96 datalink. Table 3-5 lists the available switch selections to test a Mode 1 SLC-96 (SLC-M1) circuit from the Shelf A datalink. Table 3-6 lists the available switch selections to test a Mode 2 SLC-96 (SLC-M2) circuit from either the Shelf A or C datalink. Table 3-7 lists the available tones and levels, as well as a 2-wire interface, that can be used to test a DS0 channel.

Table 3-5
Mode 1 SLC-96 Datalink Source Test Signals

Switch	Configuration			
FRAME	SLC-M1			
FORMAT	DATLINK			
SOURCE I	MAJOR	FE LOOP	SW PROT	MINOR, PWR/MISC, MAINT, and IDLE
SOURCE II	SHELF A SHELF B SHELF C SHELF D NO SHELF	SHELF A SHELF B SHELF C SHELF D PROTECT	SHELF A SHELF B SHELF C SHELF D	

Table 3-6
Mode 2 SLC-96 Datalink Source Test Signals

Switch	Configuration			
FRAME	SLC-M2			
FORMAT	DATLINK			
SOURCE I	MAJOR	FE LOOP	SW PROT	MINOR, PWR/ MISC, and IDLE
SOURCE II	SHELF A SHELF B SHELF C SHELF D NO SHELF	SHELF A SHELF C PROTECT	SHELF A SHELF C	

Table 3-7
DS0 Channel Test Signals

Switch	Configuration				
FRAME	SLC-M1, SLC-M2, T1 D1D, T1 D4, and T1 ESF				
FORMAT	CHANNEL				
SOURCE I	404 Hz	1004 Hz	2804 Hz	PBX WINK*	VF INTF
SOURCE II	-16 dBm -10 dBm -3 dBm 0 dBm +3 dBm	-16 dBm -10 dBm -3 dBm 0 dBm +3 dBm	-16 dBm -10 dBm -3 dBm 0 dBm +3 dBm	AUTO SINGLE	

* PBX WINK is only available in T1 D4 and T1 ESF.

FRAME Switch (5)

Pressing the **FORMAT** switch selects the transmitted framing mode, configures both receivers for that framing mode, and initiates a test restart. The following framing modes are listed in factory default order.

SLC-M1 — Configures the DLC Analyzer Option to transmit and receive a SLC-96 (Mode 1) signal.

SLC-M2 — Configures the DLC Analyzer Option to transmit and receive a SLC-96 (Mode 2) signal.

T1 D1D — Configures the DLC Analyzer Option to transmit and receive a D1D framed T1 signal.

T1 D4 — Configures the DLC Analyzer Option to transmit and receive a D4 framed T1 signal.

T1 ESF — Configures the DLC Analyzer Option to transmit and receive an ESF framed T1 signal.

AUTO — Automatically configures the DLC Analyzer Option to match a received SLC-96 (Mode 1), T1 D1D, or T1 ESF framed signal. When the DLC Analyzer Option searches for the framing format, the message *scan…* appears in the FORMAT window. When the framing is detected, the framing mode name appears in the FRAME window in lowercase characters.

FORMAT Switch (6)

Pressing this switch selects the bandwidth available for test signal insertion. The source test signal (see **SOURCE** switches) is inserted into one of the following bandwidths:

CHANNEL — Enables access to the DS0 channels or timeslots. An internally generated tone, externally generated signal, and/or channel signaling can be inserted into the selected DS0 channel or timeslot. The **SIGNALING INSERT** switches are active only in this format.

DATLINK — Enables access to the SLC-96 datalink. This allows alarm, maintenance, far-end loop, switch to protection line, and idle messages to be sent to the remote terminal, switch, or central office terminal. DATLINK is only available in the SLC-M1 and SLC-M2 framing modes. If DATLINK is selected, and the framing is changed to a non-SLC mode, the format defaults to CHANNEL. If the framing mode is changed to AUTO and the DLC Analyzer Option gains frame synchronization with a non-SLC mode, the format is changed to CHANNEL.

The **FORMAT** switch is disabled whenever *scan…* appears in the FORMAT window (AUTO configure framing mode).

Source Test Signal Switches (7)

The **SOURCE I** and **SOURCE II** switches work in conjunction with the **FRAME** and **FORMAT** switches to select source test signals (tones, levels, alarms, or circuit requests) that can be inserted into either a DS0 channel/timeslot or the SLC-96 datalink when the **INSERT** switch is illuminated. The selected source test signal is inserted into the T1 signal that passes through the DLC Analyzer Option from the SECONDARY RECEIVE input to the TRANSMIT output. The inserted source test signal overwrites the information in the selected DS0 channel or datalink field.

SOURCE I Switch

Press this switch to scroll through and select the source test signals displayed in the SOURCE I line. The source test signals are dependent on the selected format (CHANNEL or DATLINK) and framing mode.

When the **FORMAT** switch is set to CHANNEL, the DLC Analyzer Option can be configured to insert one of three tones at five different levels or the input from a 2-wire interface into the selected DS0 channel or timeslot when the **INSERT** switch LED is illuminated. The DS0 channel or timeslot is selected with the **SECONDARY CHANNEL** switch. Another selection allows the T-BERD DLC Analyzer Option to transmit a PBX wink signal when an on-hook/off-hook cycle is detected on the selected channel or timeslot. The source test signals include:

404 Hz, 1004 Hz, or 2804 Hz — Select one of the internally generated tones to insert on the selected DS0 channel or timeslot. The output level is selected with the **SOURCE II** switch.

VF INTF — Select the external 2-wire interface to insert an externally generated signal (e.g., voice, tones, etc.) on the selected DS0 channel or timeslot. When the CHANNEL format is selected, the DLC Analyzer Option overwrites any signaling information from the VF INTF. When the DATLINK format is selected, the signaling passes through the DLC Analyzer Option from the SECONDARY RECEIVE input.

PBX WINK — Select the PBX wink signal test mode, which is only applicable for T1 D4 or T1 ESF circuits. The test mode (SINGLE or AUTO) is selected with the **SOURCE II** switch. For PBX WINK, the WINK START trunk is automatically used regardless of the CHANNEL TRUNK auxiliary function setting.

When PBX WINK is selected and the **INSERT** switch is ON, the T-BERD DLC Analyzer Option monitors the selected channel for an on-hook to off-hook transition, then responds by transmitting a wink signal. A count of the wink transmissions is stored until test restart. The T-BERD DLC Analyzer Option determines which line to monitor for the on-hook to off-hook transition by monitoring the Primary line for a signal after the test restart. If the Primary line has a signal, the Primary line is monitored and WINK CNT is preceded by a P. If the Primary line does not have a signal after test restart, the Secondary line is monitored and WINK CNT is preceded by an S.

When the **FORMAT** switch is set to DATLINK, the DLC Analyzer Option can be configured to insert alarms, far-end loop, switch to protection line, maintenance test, or idle messages into the SLC-96 datalink when the **INSERT** switch LED is illuminated. To test from the datalink, the DLC Analyzer Option should be connected to either Shelf A in a Mode 1 SLC-96 circuit or Shelf A or C in a Mode 2 SLC-96 circuit. If the DLC Analyzer Option has SLC frame synchronization but no datalink synchronization, all datalink information is passed through the DLC Analyzer Option. The source test signals include:

MAJOR — Sends a major alarm with or without an accompanying shelf alarm. Select the shelf or no shelf with the **SOURCE II** switch.

MINOR — Sends a minor alarm message.

PWR/MISC — Sends a power/miscellaneous alarm message.

FE LOOP — Sends the far-end loop command to loop back the selected shelf. A minor alarm message is also transmitted. Select the shelf or protection line with the **SOURCE II** switch. The selected shelf is automatically switched to the protection line to prevent customer service interruption.

SW PROT — Sends the switch to protection line command to switch the selected shelf to the protection line. Select the shelf with the **SOURCE II** switch. If the switch to the protection line is successful, the message *P/S SHELF x ON PROT* appears in the SUMMARY and DATALINK categories. If the switch to the protection line fails, the message *SW PROT FAILED* flashes in the SUMMARY category. If another line is already on the protection line when the command is sent, the DLC Analyzer Option flashes the message *SW PROT FAILED* in the SUMMARY category and waits until the protection line is cleared to switch the selected shelf to the protection line.

MAINT — Sends the automated maintenance test sequence. This emulates central office equipment performing an automated maintenance test. The test sequence is displayed in the SOURCE II line. It is assumed that the DLC Analyzer Option is connected to Shelf A. Responses to the test sequence can be monitored in the SUMMARY and DATALINK categories. Select the DS0 channel to be tested with the **SECONDARY CHANNEL** switch.

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.

SOURCE II Switch

Press this switch to scroll through and select the source test signals displayed in the SOURCE II line. The source test signals are dependent on the SOURCE I selection. In some cases, a SOURCE I selection does not have a SOURCE II selection and the **SOURCE II** switch is disabled.

When the **FORMAT** switch is set to CHANNEL, the **SOURCE II** switch selects the output level for the selected tone shown in the SOURCE I line or the PBX wink test mode. These selections include:

-16 dBm, -10 dBm, -3 dBm, 0 dBm, and +3 dBm — Select the desired output level for the selected tone.

SINGLE or AUTO — If the **SOURCE I** switch is set to PBX WINK, these selections become available. In SINGLE PBX wink test mode, the DLC Analyzer Option only monitors the selected channel for the transition from on hook to off hook, then transmits a wink signal on the selected channel. The T-BERD DLC Analyzer Option automatically determines which line to monitor based on whether or not the Primary line has signal present at test restart.

In AUTO PBX wink test mode, the T-BERD DLC Analyzer Option performs exactly the same, but automatically increments to the next channel or timeslot when a successful wink cycle is observed on the current channel. If any channel does not change from on-hook state to the off-hook state, the T-BERD DLC Analyzer Option does not increment to the next channel. The CHANNEL displays show the first channel that failed the wink test. The technician can repair the identified channel, but the technician must repeat the test until all channels pass the test.

When the **FORMAT** switch is set to DATLINK, the **SOURCE II** switch selects the shelf or line that an alarm, far-end loop, or switch to protection line message is assigned. These selections include:

SHELF A, SHELF B, SHELF C, SHELF D, or NO SHELF — When MAJOR alarm is selected with the **SOURCE I** switch, select the desired shelf or no shelf to identify the major alarm.

SHELF A, SHELF B, SHELF C, SHELF D, or PROTECT — When FE LOOP is selected with the **SOURCE I** switch, select the desired shelf or protection line to loop back. When a shelf is looped back, the shelf automatically switches to the protection line. In SLC-M2 mode only SHELF A, SHELF C, and PROTECT are available.

SHELF A, SHELF B, SHELF C, or SHELF D — When SW PROT is selected with the **SOURCE I** switch, select the shelf that is going to be switched to the protection line. In SLC-M2 mode only SHELF A, SHELF C, and PROTECT are available.

MAINT Messages — During the automated maintenance test, the transmitted maintenance test sequence messages appear in lowercase characters in the SOURCE II line.

PRIMARY CHANNEL Switch (8)

Press this switch to select the DS0 channel or timeslot to be dropped from the T1 signal that is received at the PRIMARY RECEIVE jack. This enables the DLC Analyzer Option to monitor the selected DS0 channel or timeslot through the internal speaker, measure the VF level and frequency, and monitor the channel data bits and DTMF dialed telephone numbers. Changing the channel number clears the CHANNEL category primary results.

For all the framing modes, except SLC-M2, the number displayed in the Primary Channel display indicates the selected channel from 1 to 96. In SLC-M2 framing, the Primary Channel display indicates the selected timeslot from 1 to 48. A double dash (— —) indicates that a channel or timeslot is not selected. Table 3- 8 identifies the shelves and the associated channel numbers for a typical SLC-96 channel numbering scheme.

The **PRIMARY CHANNEL** switch and **SECONDARY CHANNEL** switch can select channels or timeslots separately or simultaneously through the CHANNEL/CHANNEL SCROLL auxiliary function. Set the CHANNEL/VF DROP auxiliary function to either PRIMARY or BOTH to analyze the selected primary T1 signal DS0 channel or timeslot.

Table 3-8
SLC-96 Channel Numbering Scheme

Shelf	Plug-in Circuit Channel Numbers											
D	73|74	75|76	77|78	79|80	81|82	83|84	85|86	87|88	89*|90	91*|9	93*|94	95*|96
C	49|50	51|52	53|54	55|56	57|58	59|60	61|62	63|64	65*|66	67*|68	69*|70	71*|72
B	25|26	27|28	29|30	31|32	33|34	35|36	37|38	39|40	41*|42	43*|44	45*|46	47*|48
A	1|2	3|4	5|6	7|8	9|10	11|12	13|14	15|16	17*|18	19*|20	21*|22	23*|24

* In Mode 2 operation where single circuit plug-ins are used, the asterisk indicates the channel number that is assigned to the timeslot.

PRIMARY CHANNEL ABCD Signaling LEDs

These four LEDs indicate the status of the signaling bits for the selected channel received on the PRIMARY RECEIVE jack.

SECONDARY CHANNEL Switch (9)

Pressing this switch performs the following three functions:

- Selects the DS0 channel or timeslot to be dropped from the secondary T1 signal received at the SECONDARY RECEIVE jack. This enables the DLC Analyzer Option to monitor the selected DS0 channel or timeslot through the internal speaker, measure the VF level and frequency, and monitor the channel data bits and DTMF dialed telephone numbers. Changing the channel number clears the CHANNEL category secondary results.

- Selects the DS0 channel or timeslot that a source test signal and channel signaling bits can be inserted into when the **INSERT** switch is illuminated and the **FORMAT** switch is set to CHANNEL.

- Selects the DS0 channel or timeslot that is placed on the bypass pair when the maintenance test sequence is performed from the DLC Analyzer Option when the **INSERT** switch is illuminated and the **FORMAT** switch is set to DATLINK.

For all the framing modes, except SLC-M2, the number displayed in the Secondary Channel display indicates the selected channel from 1 to 96. In SLC-M2 framing, the Secondary Channel display indicates the selected timeslot from 1 to 48. A double dash (— —) indicates that a channel or timeslot is not selected. Select the desired channel or timeslot before plugging into a shelf. Table 3-8 identifies the shelves and the associated channel numbers for a typical SLC-96 channel numbering scheme.

The **PRIMARY CHANNEL** switch and the **SECONDARY CHANNEL** switch can select channels or timeslots separately or simultaneously through the CHANNEL/CHANNEL SCROLL auxiliary function. Set the CHANNEL/VF DROP auxiliary function to SECONDARY or BOTH to analyze the selected secondary T1 signal DS0 channel or timeslot.

SECONDARY CHANNEL ABCD Signaling LEDs

These four LEDs indicate the status of the signaling bits for the selected channel received on the SECONDARY RECEIVE jack.

3.39 DLC ANALYZER OPTION — TEST CONNECTIONS

The front-panel connections (see Figure 3-12) allow the DLC Analyzer Option to receive two T1 signals simultaneously and transmit one T1 signal. Additional connections allow for VF inputs and outputs.

- PRIMARY RECEIVE jack (10)
- SECONDARY RECEIVE jack (11)
- **RECEIVE INPUT** switch (12)
- TRANSMIT jack (13)
- **INSERT** switch (14)
- VF OUT jack (15)
- 2-Wire VF posts (16)

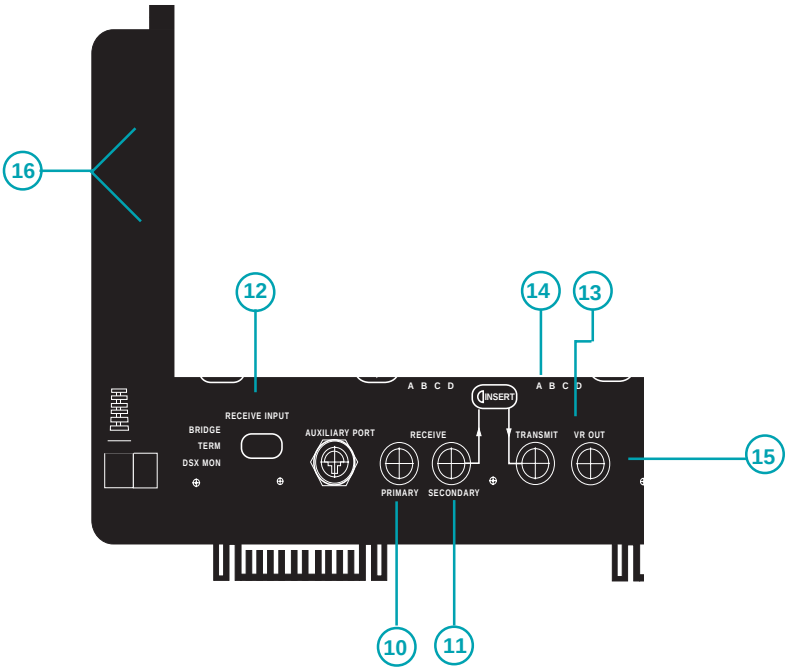


Figure 3-12
DLC Analyzer Option Circuit Connections

PRIMARY RECEIVE Jack (10)

This WECO 310 jack accepts a T1 signal to be monitored and analyzed by the DLC Analyzer Option. The input impedance and signal conditioning are controlled through the **RECEIVE INPUT** switch.

SECONDARY RECEIVE Jack (11)

This WECO 310 jack accepts a T1 signal to be monitored and analyzed by the DLC Analyzer Option. The received T1 signal is also retransmitted through the TRANSMIT jack, which enables a source test signal to be inserted into one of the DS0 channels, timeslots, or SLC-96 datalink. The received secondary T1 signal provides recovered timing for the transmitted signal at the TRANSMIT jack. The input impedance and signal conditioning are controlled through the **RECEIVE INPUT** switch.

RECEIVE INPUT Switch (12)

The **RECEIVE INPUT** switch sets the input impedance and signal conditioning for the PRIMARY RECEIVE and SECONDARY RECEIVE jacks. The selections include:

BRIDGE — provides an impedance of greater than 1000 ohms to connect across a terminated line.

TERM — provides an impedance of 100 ohms to terminate a connection.

DSX-MON — provides an impedance of 100 ohms and amplification to monitor a T1 signal from a DSX-1 monitor point.

TRANSMIT Jack (13)

This WECO 310 jack provides the T1 output for the DLC Analyzer Option. The output can be transmitted in one of the following forms:

- The unaffected T1 signal from the SECONDARY RECEIVE jack when the **INSERT** switch is not illuminated.
- The T1 signal from the SECONDARY RECEIVE jack with a source test signal inserted into a selected DS0 channel or timeslot when the **INSERT** switch is illuminated and the CHANNEL format is selected. The datalink passes through unaffected.
- The T1 signal from the SECONDARY RECEIVE jack with a datalink signal inserted into the SLC-96 datalink when the **INSERT** switch is illuminated and the DATLINK format is selected. The DS0 channels or timeslots (data and signaling) pass through unaffected.

The output level is controlled through the TRANSMIT/LBO auxiliary function and terminated into 100 ohms. The transmitted output timing is taken from the recovered clock of the SECONDARY RECEIVE input, or from an internal clock when the T1 signal is not connected to the SECONDARY RECEIVE input. Before connecting the TRANSMIT output to a shelf, disable the **INSERT** switch (not illuminated) to prevent inadvertent source test signal insertion from the DLC Analyzer Option.

INSERT Switch (14)

This switch controls the insertion of the source test signal (channel tones, channel signaling bits, and datalink messages) into the T1 signal transmitted from the TRANSMIT output jack. When the switch LED is illuminated, the source test signal is inserted into the transmitted T1 signal. When the switch LED is not illuminated, the inserted source test signal is suspended and the Secondary Receive T1 signal passes through the DLC Analyzer Option unaffected. The insert mode is functional only when the DLC Analyzer Option has frame synchronization.

The following conditions cause the **INSERT** switch to flash for three seconds, which indicates that the DLC Analyzer Option is being reconfigured.

- Pressing the **INSERT** switch when it is not illuminated.
- Changing the **FORMAT** switch selection.
- Changing either the **SOURCE I** or **SOURCE II** switch when the **FORMAT** switch is set to DATLINK.
- Changing the **SECONDARY CHANNEL** switch when the **FORMAT** switch is set to DATLINK and the maintenance test is being performed.
- Changing the **SECONDARY CHANNEL** switch when the **FORMAT** switch is set to CHANNEL.

During the three seconds, the inserted source test signal is temporarily inhibited, the instrument is reconfigured, and the T1 signal from the SECONDARY RECEIVE input is passed on to the TRANSMIT output unaffected. When the **INSERT** switch LED stops flashing and illuminates, the new source test signal is inserted into the T1 signal.

VF OUT Jack (15)

This WECO 310 jack provides a 4-wire, 600 ohm termination, to drop a DS0 channel to an external device such as a TIMS test set. The output source is determined by the CHANNEL/VF DROP auxiliary function and the **SECONDARY CHANNEL** switch.

2-Wire VF Posts (16)

The 2-wire interface is located in the left-side inset of the DLC Analyzer Option. The two posts allow a butt-set to be connected to the DLC Analyzer Option for two-way access and control over the selected DS0 channel. The posts provide a 600 ohm termination. Select the 2-wire interface by setting the **SOURCE I** switch to VF INTF. The input and output source is determined by the CHANNEL/VF DROP auxiliary function, the **SECONDARY CHANNEL** switch, and the **INSERT** switch.

3.40 DLC ANALYZER OPTION — SIGNAL VERIFICATION

The following controls, indicators, and results verify that the DLC Analyzer Option properly acquires the received DS1 signal from both receiver inputs (see Figure 3-13).

- Primary and Secondary Status LEDs (17)
- **HISTORY RESET** switch (18)
- SUMMARY category messages

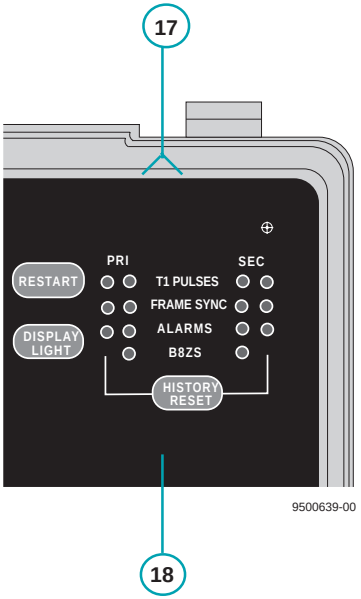


Figure 3-13
Signal Verification Controls and Indicators

Primary and Secondary Status LEDs (17)

Four columns of LEDs, two columns for the PRIMARY RECEIVE input and two columns for the SECONDARY RECEIVE input, indicate the current and history status of the received signal. The two inside columns provide the current status of the incoming T1 signal, and the two outside columns indicate the history status. Green LEDs indicate a positive condition (e.g., signal present), and red LEDs indicate history, alarm, or failure conditions (e.g., frame loss).

T1 Pulses — This green LED illuminates when valid T1 pulses are detected. The red history LED illuminates when T1 pulses are no longer detected after initial signal detection.

Frame Sync — This green LED illuminates when the DLC Analyzer Option achieves frame synchronization with the selected framing pattern. The red history LED illuminates when frame synchronization is lost, after initial frame synchronization.

Alarms — The current red LED illuminates when any of the following conditions is detected in the SLC datalink.

- Major alarms
- Minor alarms
- Power/miscellaneous alarms
- Shelf alarms
- Far-end loop event
- Switch to protection line event
- Automated maintenance test event

If the current LED is illuminated, check the SUMMARY and DATALINK categories for the current alarms and messages. If the history LED is illuminated, check the DATALINK category for the previously received alarms and messages.

B8ZS — The current green status LED illuminates when B8ZS clear channel encoding is detected in the received signal.

HISTORY RESET Switch (18)

Pressing the **HISTORY RESET** switch clears the illuminated history LEDs and all non-current alarm messages in the DATALINK category.

SUMMARY Category Messages

The SUMMARY category provides a convenient way to monitor specific non-zero results, messages, and measurements without having to search through the other categories. The SUMMARY category is selected by pressing either the **RESULTS I Category** switch or the **RESULTS II Category** switch. When the category is selected, the appropriate yellow LED illuminates.

During initial signal acquisition, display the SUMMARY category and watch for one of the following messages:

ALL RESULTS OK — appears after initial signal presence is detected on one input and no errors or alarms are detected.

ALL RESULTS UNAVAILABLE — appears at test restart when the instrument has not synchronized with the received signal or no signal is attached.

For more information on the SUMMARY category results, refer to Section 5.

3.41 DLC ANALYZER OPTION — TEST RESULTS

Once the DLC Analyzer Option is configured and connected to the circuit, use the following switches and indicators (see Figure 3-14) to initiate the test and collect test results.

- **RESTART** switch (19)
- **RESULTS** switches (20)
- Test results display

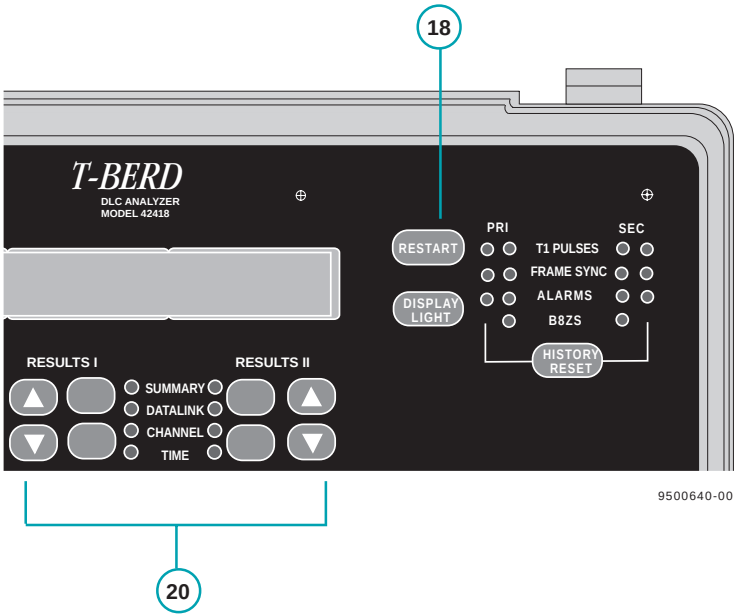


Figure 3-14
DLC Analyzer Option Test Results Switches and Indicators

RESTART Switch (19)

This pushbutton switch restarts the test in progress and clears all test results and status LEDs. A test is also restarted when the **FRAME** switch or **RECEIVE INPUT** switch is pressed.

RESULTS Switches (20)

RESULTS I Category Switch or RESULTS II Category Switch — Selects the category of results to be displayed. The labeled LEDs illuminate to indicate the selected category. Holding down the switch automatically scrolls the categories.

RESULTS I Results Switch or RESULTS II Results Switch — Selects the individual results from the indicated category. Pressing this switch for more than one second automatically scrolls the entire list.

Test Results Display

During a test, the available results and alarm messages are continuously updated. The results are divided into four categories. During the test, the SUMMARY category displays key non-zero or alarm message results. Refer to Section 5 for more information on the test results.

SUMMARY Category — When an error or alarm is detected, the appropriate result appears in the SUMMARY category window. Each result is preceded with either a "P" (Primary) or "S" (Secondary) to indicate the input source. The SUMMARY category results are divided into four types of results: flashing messages, alarm messages, maintenance test messages, and T1 signal errors. The "x" in some of the results indicates a shelf or line designation, A, B, C, D, or PROTECT.

Flashing Messages
P/S DATALINK SYNC LOSS
P/S SIGNAL LOSS
SW PROT FAILED
OPTION NOT INSTALLED

Maintenance Messages
P/S MAINT HOOK/SEIZE
P/S MAINT PROCEED
P/S MAINT TEST ALARM

Current Alarm Messages
P/S ALARM SHELF x
P/S FE LOOP PROTECT
P/S FE LOOP SHELF x™
P/S MAJOR ALM
P/S MAJOR SHELF x
P/S MINOR ALM
P/S PWR/MISC
P/S SHELF x ON PROT

T1 Signal Errors
P/S VIOLATION
P/S FRM ERROR
P/S CRC ERROR (ESF framing only)

PBX WINK
P/S WINK CNT

DATALINK Category — Lists SLC datalink related results, current and history alarms, and maintenance test messages.

Alarm Messages
P/S MAJOR SHELF x
P/S MAJOR ALM
P/S ALARM SHELF x
P/S SHELF x ON PROT
P/S FE LOOP PROTECT
P/S FE LOOP SHELF x
P/S MINOR ALM
P/S PWR/MISC

Maintenance Messages
P/S MAINT HOOK/SEIZE
P/S MAINT PROCEED
P/S MAINT TEST ALARM

Datalink Results
P/S SLC A SEC
P/S DL BITS
P/S ALM FIELD

CHANNEL Category — Lists results for timeslot or channel signaling bits, data bits, channel assignments, and measurements.

Channel Signaling
P/S TRAFFIC CHANNEL AB
P/S TRAFFIC CHANNEL ABCD
P/S TRAFFIC TIMESLOT AB
P/S TS CHAN

VF Results
P/S VF LEVEL
P/S VF FREQ
P/S DATA BITS
DTMF SEQ

PBX WINK
P/S WINK CNT

TIME Category — Lists results for time of day, date, and signal loss seconds.

TIME
DATE
P/S SIG L SEC

3.42 DLC ANALYZER OPTION — TROUBLESHOOTING CONTROLS

The following **SIGNALING INSERT** switches (see Figure 3-15) control channel signaling bit status of individual channels.

- **ABCD** switches (21)
- **ON HOOK** switch (22)
- **RING** switch (23)
- **OFF HOOK** switch (24)

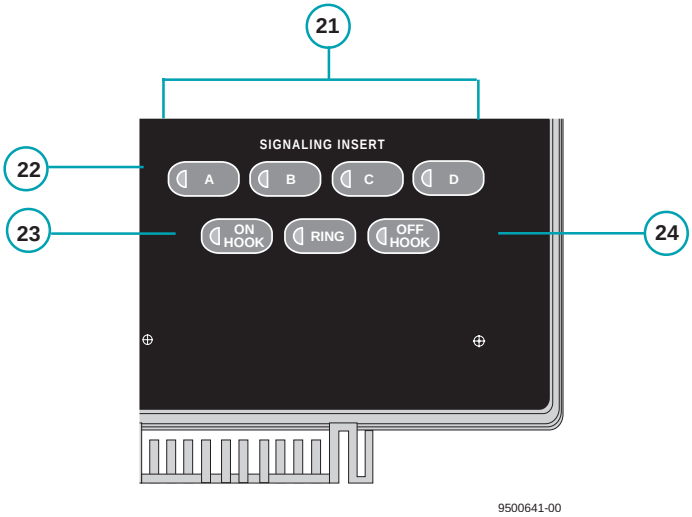


Figure 3-15
DLC Analyzer Option Signaling Insert Controls

SIGNALING INSERT Switches

Seven switches insert signaling information into the selected channel or timeslot. The selected channel or timeslot appears in the SECONDARY CHANNEL window. When the CHANNEL format is selected with the **INSERT** switch LED illuminated, the signaling bits are inserted over the signaling bits being received on the selected DS0 channel. Table 3-9 provides the signaling bit patterns that control D4, D1D, and SLC channel banks. Table 3-10 provides the signaling bit patterns that control T1 ESF channel banks. When the secondary channel number is changed with the **INSERT** switch LED illuminated, the **SIGNALING INSERT** switches are temporarily inhibited until the **INSERT** switch stops flashing.

When the CHANNEL format is selected with the **INSERT** switch LED illuminated and the **SOURCE I** switch set to PBX WINK, these switches have no effect. However, the appropriate switches illuminate during wink start testing. Normally, the **ON HOOK** switch illuminates to indicate the T-BERD DLC Analyzer Option is transmitting an on-hook state and monitoring for an off-hook signal. When an off-hook signal is detected, the T-BERD DLC Analyzer Option transmits a wink signal.

The DLC Analyzer Option generates on- and off-hook signaling states that emulate the station end of the circuit and assumes the far end is sending office supervision. The ringing signaling state emulates the office signaling.

When the format is toggled between CHANNEL and DATALINK, the **SIGNALING INSERT** switch settings are stored in memory. When the **FORMAT** switch is set to DATLINK, the signaling is passed through the DLC Analyzer Option unaffected. The **AB** switches are functional in all frame modes. The **CD** switches are only functional in the T1 ESF mode. The **ON HOOK**, **OFF HOOK**, and **RING** switches are not functional in the SLC-M2 mode.

Table 3-9
D4, D1D, and SLC Framed Signaling States

Signaling State	A	B
On-hook	0	0
Off-hook	1	0
Ringing	1	1/0

Table 3-10
T1 ESF Signaling States

Direction	Signaling State	A	B	C	D
Ground Start Signaling					
Transmit	On-hook	0	0	0	0
	Ringing	1	1	1	0
	Off-hook	1	0	1	0
Receive	On-hook	0	0	0	0
	Off-hook	0	1	0	0
Loop Start Signaling					
Transmit	On-hook	0	0	0	0
	Off-hook	1	0	1	0
Receive	On-hook	1	1	1	1
	Ringing	1	1	1	0
	Off-hook	1	1	1	1

ABCD Switches (21)

The **ABCD** switches set the individual signaling bits. The signaling bits can be set to a logic 0, 1, or toggled 0/1 in the following manner.

- To insert a logic 1, press the switch for less than one second; the switch LED illuminates, and the logic 1 is inserted into the appropriate bit location when the **INSERT** switch is illuminated.
- To insert a logic 0, press the switch for less than one second; the switch LED is extinguished, and the logic 0 is inserted into the appropriate bit location when the **INSERT** switch is illuminated.
- To toggle the bit location between a logic 1 and 0, press the switch for more than one second; the switch LED flashes, and the toggled bits are inserted into the appropriate bit location when the **INSERT** switch is illuminated. The toggling state is stopped by pressing the switch again.

ON HOOK Switch (22)

Press the **ON HOOK** switch to send an on-hook state. The transmitted bit pattern is determined by the CHANNEL/TRUNK TYPE auxiliary function and the framing. When the **ON HOOK** switch is pressed, the **ABCD** switches are updated to reflect the on-hook state.

RING Switch (23)

Press the **RING** switch to send a ringing state. The transmitted bit pattern is determined by the CHANNEL/TRUNK TYPE auxiliary function and the framing. When the **RING** switch is pressed, the **ABCD** switches are updated to reflect the ringing state.

OFF HOOK Switch (24)

Press the **OFF HOOK** switch to send an off-hook state. The transmitted bit pattern is determined by the CHANNEL/TRUNK TYPE auxiliary function and the framing. When the **OFF HOOK** switch is pressed, the **ABCD** switches are updated to reflect the off-hook state.

3.43 DLC ANALYZER OPTION — PRINT CONTROLS

Refer to Figure 3-16 for the following controls:

- **PRINT** switches (25)
- AUXILIARY PORT connector (26)

Refer to Section 6 for additional information on results and controls printouts.

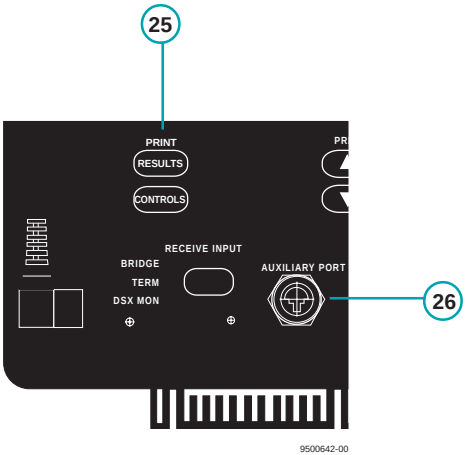


Figure 3-16
DLC Analyzer Option Print Controls

PRINT Switches (25)

These switches are used to manually generate a printout of the current screen. Pressing the **RESULTS** switch generates a date- and time-stamped printout of the current test results. Pressing the **CONTROLS** switch generates a date- and time-stamped printout of the current DLC Analyzer Option configuration.

AUXILIARY PORT Connector (26)

This female, 8-pin DIN-type connector provides connection to the PR-40A or compatible printer.

3.44 ISDN/DDS ANALYZER OPTION — INTRODUCTION

The ISDN/DDS Analyzer Option (209*OSP*-9) provides the T-BERD 209*OSP* with the ability to test 4-wire Digital Data System Local Loops and 2-wire Basic Rate ISDN Local Loops between the main distribution frame and the customer demarcation point. Two technicians are required, each equipped with a T-BERD 209*OSP* with the ISDN/DDS Analyzer Option installed. If a repeater is present, the ISDN/DDS Analyzer at the distribution frame will provide span power (the ISDN/DDS Analyzer must be powered from an AC source, not the T-BERD 209*OSP* AUX connector, to provide span power).

The ISDN/DDS Analyzer Option (see Figure 3-17) can generate various BERT patterns and special network controls over either the 4-wire DDS local loop or a 2-wire Basic Rate ISDN interface.

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Figure 3-17
ISDN/DDS Analyzer Option

3.45 ISDN/DDS ANALYZER OPTION — TEST SETUP

The ISDN/DDS Analyzer Option cable attaches to the T-BERD 209*OSP* AUXILIARY PORT connector. The ISDN/DDS Analyzer Option receives DC power through this cable. If in standalone mode, the ISDN/DDS Analyzer Option must be powered from an AC source using the AC Input Connector, **not** from the T-BERD 209*OSP* AUXILIARY PORT connector.

A separate cable is used to connect the ISDN/DDS Analyzer Option AUX port to a printer for hard copy printouts of results or control setups.

The following ISDN/DDS Analyzer Option controls and indicators are described in the order that you would normally use them to test a circuit (see Figure 3-18).

- Front-panel display (1)
- **DISPLAY LIGHT** switch (2)
- **AUX** switch (3)
- **RECVD** switch (4)
- **MODE** switch (5)
- **FORMAT** switch (6)
- **PRI and SEC PATTERN** switches (7)
- **RECEIVE INPUT** switch (8)
- **LBO (dB)** switch (9)
- **SPAN CURR** switch (10)

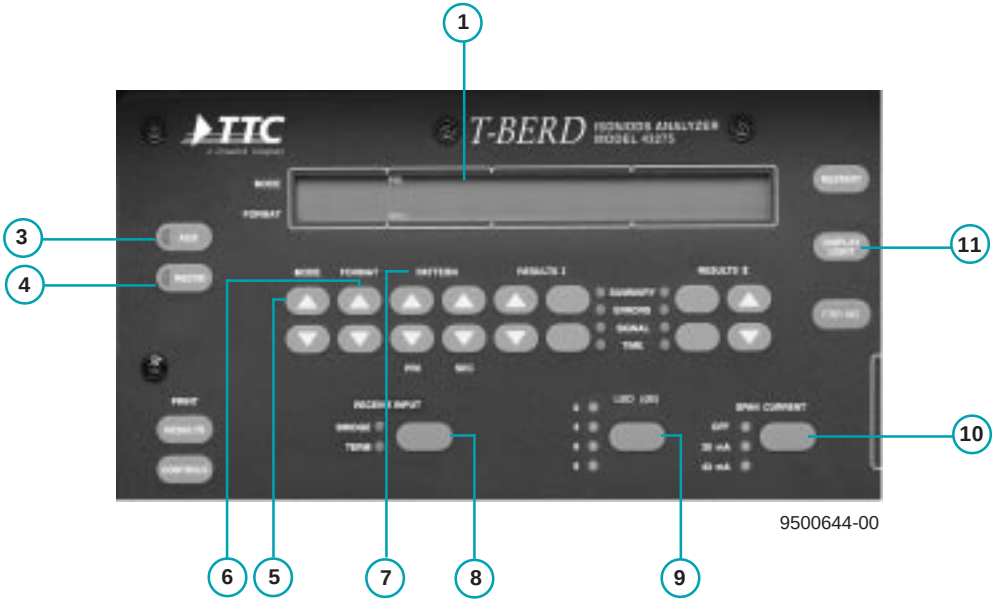

Figure 3-18
ISDN/DDS Analyzer Option Display and Setup Switches

Front-Panel Display (1)

Operating modes, test results, test patterns, and auxiliary functions are displayed in the four window, two-line, Liquid Crystal Display (LCD). The display is also backlighted for easier viewing in subdued lighting.

MODE/FORMAT window — The first window indicates the current mode and format of the instrument. The displayed information is selected by pressing the **MODE** and **FORMAT** switches.

PRI/SEC PATTERN window — The second window indicates the current transmit data pattern for the Primary Channel and the Secondary Channel (DDS mode only) for the selected operating mode and format. The Primary Channel line is controlled with the **PRI PATTERN** switch, and the Secondary Channel line is controlled with the **SEC PATTERN** switch.

RESULTS I and II windows — The third and fourth windows display test results and auxiliary function selections. These windows are controlled by the two switches located just below each window.

DISPLAY LIGHT Switch (2)

Press this switch to backlight the display in low light conditions. Press once to backlight the display for 30 seconds. Press the switch again during the 30 seconds, and the display remains illuminated. Press a third time to turn the illumination off.

AUX Switch (3)

Press this LED switch to access the ISDN/DDS Analyzer Option auxiliary functions. These auxiliary functions allow access to parameters that are less frequently used and do not have dedicated switches. For detailed information on the auxiliary functions, refer to Section 4.4.

RECVD Switch (4)

This switch sets the transmit timing source. The LED within the switch illuminates when timing is recovered from the received signal, and is extinguished when timing is generated from an internal crystal. If the ISDN/DDS Analyzer Option is in recovered timing (LED is ON) and signal is lost, the LED flashes until either a signal is detected or the **RECVD** switch is pressed. If loop timed and the input signal is lost. the RECVD LED flashes and the transmit clock reverts to internal timing until signal presence is detected.

If auto loopback is enabled and a loopback request is detected, the ISDN/DDS Analyzer Option automatically selects recovered timing.

Switch Configurations

The **MODE, FORMAT, PRI PATTERN,** and **SEC PATTERN** switches are interrelated. These switches configure the ISDN/DDS Analyzer Option to the required operating mode, select the rate/format of the data, and the pattern of the data transmitted. Table 3-11 lists the available switch selections to test a DDS local loop. Table 3-12 lists the available switch selections to test an ISDN Basic Rate Interface.

Table 3-11
DDS Local Loop Test Signals

Switch	Configuration
MODE	DDS
FORMAT	AUTO, 2.4 kB/s, 4.8 kB/s, 9.6 kB/s, 19.2 kB/s, 56.0 kB/s, or 64.0 kB/s
PRI PATTERN	ALL ONES, 63, 511, 2047, DDS1, DDS2, DDS3, DDS4, or DDS5
SEC PATTERN	none, ALL ONES, 63, 511, or 2047

Table 3-12
ISDN Basic Rate Interface Test Signals

Switch	Configuration
MODE	ISDN
FORMAT	160 kB/s
PRI PATTERN	ALL ONES, 63, 511, or 2047

MODE Switch (5)

Press the **MODE** switch to scroll through and select the transmit and receive data mode. Changing the mode switch position clears all test results and initiates a test restart. The following operating modes are listed in factory default order.

SELF TST — Performs a built in self test of the ISDN/DDS Analyzer Option. In this mode, DDS Output is looped to DDS Input and the signal is tested using the currently selected FORMAT, PRI PATTERN and SEC PATTERN.

DDS — Configures the ISDN/DDS Analyzer Option to transmit and receive a DDS Local Loop signal.

ISDN — Configures the ISDN/DDS Analyzer Option to transmit and receive a Basic Rate ISDN U Interface signal.

FORMAT Switch (6)

Press this switch to scroll through and select the rate/format of the data to be transmitted and informs the receiver as to which data format to expect.

In ISDN Mode the **FORMAT** switch is disabled, and 160 kB/s is displayed in the format display position.

In DDS Mode the **FORMAT** switched is used to select the operating format. The selected operating format remains in effect until another operating format is selected. Changing the **FORMAT** switch position clears all test results and causes a test restart.

OPERATING FORMATS — Auto, 2.4 kB/s 4.8 kB/s, 9.6 kB/s, 19.2 kB/s, 56.0 kB/s, and 64.0 kB/s.

AUTO FORMAT — The ISDN/DDS Analyzer Option automatically configures to the received DDS signal format and pattern. While identifying the format and pattern of the incoming signal, the ISDN/DDS Analyzer Option displays "AUTO" in the FORMAT display and "scanning" in the PATTERN display and transmits a signal with the previously selected FORMAT and PATTERN characteristics. Once auto-configuration is successful, the received FORMAT and PATTERN are displayed in lowercase letters in the FORMAT and PATTERN displays respectively.

If a signal is detected but no synchronization is achieved, the AUTO Format process continues until either the **MODE, FORMAT**, or **RESTART** switch is pressed.

PRI and SEC PATTERN Switches (7)

The **PRI PATTERN** and **SEC PATTERN** switches work in conjunction with the **MODE** and **FORMAT** switches to select the actual data transmitted and informs the receiver as to which data pattern to expect.

PRI PATTERN Switch — Press this switch to scroll through and select the data pattern for the Primary Channel. The selected data pattern remains in effect until another data pattern is selected. Changing the **PRI PATTERN** switch position clears all test results and causes a test restart. The Primary Channel data patterns are as follows: ALL ONES, 63, 511, 2047, DDS1, DDS2, DDS3, DDS4, and DDS5. In ISDN mode DDS1, DDS2, DDS3, DDS4, and DDS5 are not available.

SEC PATTERN Switch — Press this switch to scroll through and select the data pattern for the Secondary Channel (DDS mode only). The selected data pattern remains in effect until another data pattern is selected. Changing the **SEC PATTERN** switch position clears all test results and causes a test restart. The Secondary Channel data patterns are as follows: none, ALL ONES, 63, 511, 2047.

If none is selected, the secondary channel is deactivated (i.e. DDS framing and control bits are not inserted).

If 63, 511, or 2047 is selected, the secondary channel is activated with the selected pattern.

If ISDN or DDS 64 kB/s mode is selected, the **SEC PATTERN** switch is disabled and the secondary pattern display position is blank.

RECEIVE INPUT Switch (8)

Press this switch to select the input impedance and signal conditioning. This switch toggles between two yellow LEDs labeled BRIDGE and TERM. The illuminated LED indicates the selected input impedance and signal conditioning.

In ISDN mode, this switch is locked in the TERM position.

LBO (dB) Switch (9)

Press this switch to select the transmit level. This switch toggles between four yellow LEDs labeled 0, -3, -6, and -9. The illuminated LED indicates the selected transmit level.

In ISDN mode, this switch is locked in the 0 dB position.

SPAN CURR Switch (10)

Press this switch to enable the span current source. This switch toggles between three yellow LEDs labeled OFF, 20mA, and 43mA. The illuminated LED indicates the selected span current source. Span current must be set to 43 mA to loopback a DDS repeater. Span current must be set to 20 mA or 43 mA to loopback a DDS CSU. In addition, span current may be set to 43 mA to power an ISDN or DDS repeater if they are present in the system. If current is detected on the connected cable, the **SPAN CURR** switch is locked in the OFF position.

3.46 ISDN/DDS ANALYZER OPTION — TEST CONNECTIONS

The front-panel connections (see Figure 3-19) enable the ISDN/DDS Analyzer Option to receive DDS and ISDN signals. In addition an AC input connector is provided for standalone operation.

- RECEIVE jack (11)
- LINE jack (12)
- TRANSMIT/ISDN jack (13)
- **AC POWER** switch (14)
- AC Input connector (15)
- DC Input Cord

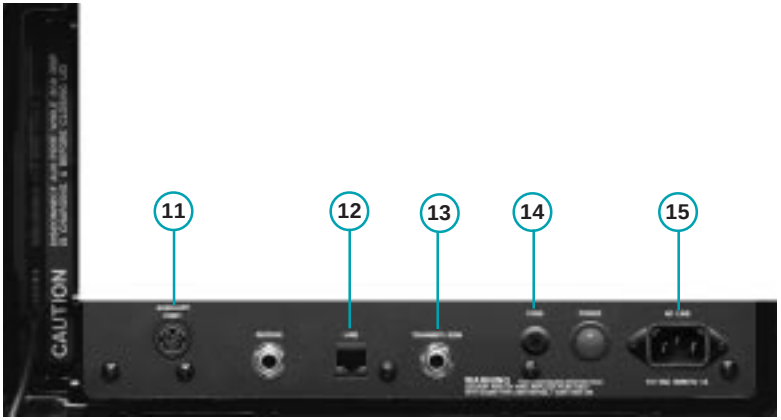

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Figure 3-19
ISDN/DDS Analyzer Option Circuit Connections

RECEIVE Jack (11)

This WECO 310 jack accepts a DDS signal to be monitored and analyzed by the ISDN/DDS Analyzer Option. The input impedance and signal conditioning are controlled through the **RECEIVE INPUT** switch.

LINE Jack (12)

This RJ45 connector receives/transmits both DDS and ISDN signals. The received signals are monitored and analyzed by the ISDN/DDS Analyzer Option. The input impedance and signal conditioning are controlled through the **RECEIVE INPUT** switch. This connector is keyed, and compatible with both RJ45 and RJ48S modular plugs. The connector pinout corresponds to standard ISDN and DDS conventions.

TRANSMIT/ISDN Jack (13)

This WECO 310 jack provides both DDS and 2-wire ISDN output for the ISDN/DDS Analyzer Option. The output level is controlled through the **LBO (dB)** switch (in ISDN mode the output level is locked at 0 dB).

AC POWER Switch (14)

This switch is used to apply AC power to the ISDN/DDS Analyzer Option when used in standalone mode.

AC POWER Connector (15)

This connector is used to supply AC power to the Analyzer Option when used in standalone mode.

CAUTION: The ISDN/DDS Analyzer Option must be powered from either the AC line **or** the T-BERD 209*OSP* AUX port **but not both simultaneously**.

DC INPUT Cord

This cord is used to connect to a T-BERD 209*OSP* AUX port to obtain DC power.

3.47 ISDN/DDS ANALYZER OPTION — SIGNAL VERIFICATION

The following controls, indicators, and results verify that the ISDN/DDS Analyzer Option properly acquires the received DDS or Basic Rate ISDN signal from the receiver inputs (see Figure 3-20).

- Status LEDs (16)
- **HISTORY RESET** switch (17)
- SUMMARY category messages

Figure 3-20
Signal Verification Controls and Indicators

Status LEDs (18)

Two columns of LEDs, indicate the current and history status of the received signal. The lefthand column indicates the current status of the incoming signal, and the righthand column indicates the history status. Green LEDs indicate a positive condition (e.g., signal present), and red LEDs indicate history, alarm, or failure conditions (e.g., signal loss).

Pulses — This green LED illuminates when the presence of a valid signal is detected. The red history LED illuminates when pulses were lost, then recovered after initial signal detection.

PRI PATTERN — This green LED illuminates when ISDN pattern or DDS primary pattern synchronization has been achieved. The red history LED illuminates when ISDN pattern or DDS primary pattern synchronization was lost, then recovered after initial pattern synchronization had been achieved.

SEC PATTERN — This green LED illuminates when pattern synchronization is achieved on the DDS secondary channel (this LED is held OFF in ISDN mode). The red history LED illuminates when DDS secondary channel pattern synchronization was lost, then recovered after initial pattern synchronization had been achieved.

ERROR —The red LED illuminates upon detection of a bit error, bipolar violation, or an ISDN or DDS frame synchronization loss. The red history LED illuminates when a bit error, bipolar violation, or an ISDN or DDS frame synchronization loss was detected and then recovered during a test.

HISTORY RESET Switch (19)

Pressing the **HISTORY RESET** switch clears the illuminated history LEDs.

SUMMARY Category Messages

The SUMMARY category provides a convenient way to monitor specific non-zero results, and out-of specification test results without having to search through the other categories. The SUMMARY category is selected by pressing either the **RESULTS I Category** switch or the **RESULTS II Category** switch. When the category is selected, the appropriate yellow LED illuminates.

During initial signal acquisition, display the SUMMARY category and watch for the following message:

ALL RESULTS OK — appears after initial signal presence is detected and no errors or alarms are detected, otherwise the RESULTS I display autoscrolls the out-of-specification results until the **RESULTS I** switch is pressed.

For more information on the SUMMARY category results, refer to Section 5.

3.48 ISDN/DDS ANALYZER OPTION — LOOP CONTROLS AND INDICATORS

The following controls and indicators, are listed in the order that they would normally be used to test a circuit (see Figure 3-21).

- **LOOP** switch (18)
- **LOOP UP** switch (19)
- **LOOP DOWN** switch (20)
- **AUTO LLB** mode

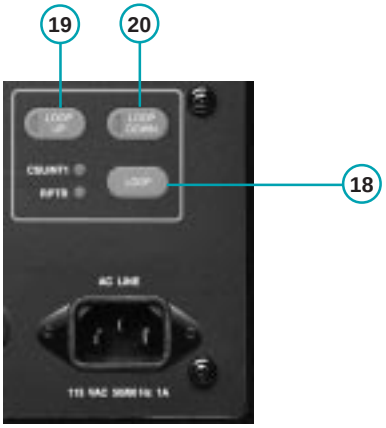


Figure 3-21
ISDN/DDS Analyzer Option Loop Controls and Indicators

LOOP Switch (18)

Press the **LOOP** switch to select the device to be looped. This switch toggles between two yellow LEDs labeled CSU/NT1 (DDS Channel Service Unit or ISDN Network Terminal) and RPTR (DDS or ISDN repeater). If in ISDN mode, NT1 loopbacks are activated. If in DDS mode, CSU loopbacks are activated. The illuminated LED indicates the selected device. If a loop-up or loop-down sequence is in progress when this switch is pressed, the loop-up or loop-down sequence is restarted for the new loopback device.

LOOP UP Switch (19)

Press the **LOOP UP** switch to request a loop-up sequence in either ISDN or DDS mode.

In ISDN mode — pressing the **LOOP UP** switch initiates the "2B+D Loopback" command. When the **LOOP UP** switch is pressed the associated LED is illuminated. If pattern synchronization is achieved, the LOOP UP LED is turned OFF. Once loopback has been confirmed, testing is restarted automatically.

In DDS mode — pressing the **LOOP UP** switch causes the ISDN/DDS Analyzer Option to reverse sealing or simplex current. If CSU loopback is selected and 20 or 43 mA sealing or simplex current has not been selected (with the **SPAN CURRENT** switch) an error message is displayed. The error message informs the user that span current is required to loop up a DDS CSU. If RPTR loopback is selected and 43 mA simplex current has not been selected (with the **SPAN CURRENT** switch) an error message is also displayed. The error message informs the user that span current is required to loop a DDS repeater. When the **LOOP UP** switch is pressed the associated LED is illuminated. If pattern synchronization is achieved, the LOOP UP LED is turned OFF.

LOOP DOWN Switch (20)

Press the **LOOP DOWN** switch to request a loop-down sequence in either ISDN or DDS mode.

In ISDN mode — pressing the **LOOP DOWN** switch initiates the "Return to Normal" command. When the **LOOP DOWN** switch is pressed the associated LED is illuminated and the "Return to Normal" command is transmitted.

In DDS mode — pressing the **LOOP DOWN** switch returns current reversal to normal polarity and illuminates the LOOP DOWN LED for one second.

AUTO LLB Mode

The AUTO LLB (Line Loop Back) mode is not user selectable with the **MODE** switch, but rather is entered automatically when Auto-Response is turned on (via the AUX function) and a DDS loopback command (current reversal) is received. Only DDS CSU and DDS loopback commands are recognized. The ISDN/DDS Analyzer Option automatically exits the AUTO LLB mode when received current is returned to normal polarity, or the unit is powered down. After exiting the AUTO LLB mode, the ISDN/DDS Analyzer Option returns to the previously selected operating mode.

NOTE: When AUTO LLB is enabled the following switches are disabled: **MODE, FORMAT, RECVD, LOOP UP, LOOP DOWN, SPAN CURR,** and **ERR INS**. In addition, when AUTO LLB is active, AUTO RESPONSE cannot be disabled.

3.49 ISDN/DDS ANALYZER OPTION — TEST RESULTS

Once the ISDN/DDS Analyzer Option is configured and connected to the circuit, use the following switches and indicators (see Figure 3-22) to initiate the test, insert errors if required and collect test results.

- **RESTART** switch (21)
- **ERR INS** switch (22)
- **RESULTS** switches (23)
- Test results display

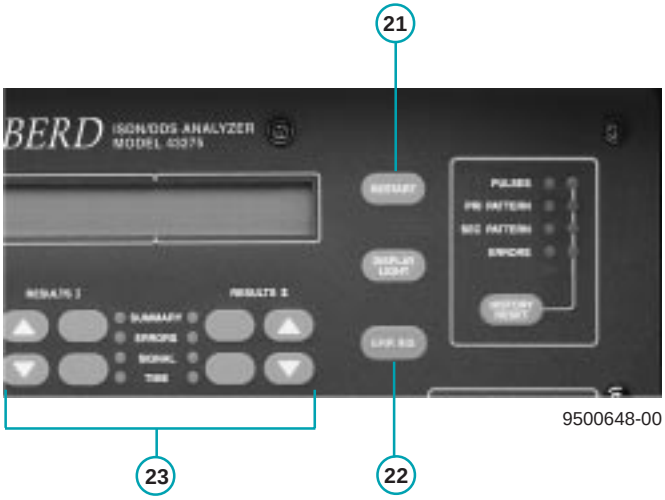


Figure 3-22
ISDN/DDS Analyzer Option Test Results Switches and Indicators

RESTART Switch (21)

This pushbutton switch restarts the test in progress and clears all test results and status LEDs. A test is also restarted when the **MODE** switch or **FORMAT** switch is pressed.

ERR INS Switch (22)

This switch is used to insert errors into the transmitted DDS primary or ISDN pattern. Errors cannot be inserted when the AUTO LLB mode is active. In DDS mode, pressing this switch inserts 6 errors; in ISDN mode, single errors are inserted.

RESULTS Switches (23)

RESULTS I Category Switch or RESULTS II Category Switch — Selects the category of results to be displayed. The labeled LEDs illuminate to indicate the selected category. Holding down the switch automatically scrolls the categories. The available categories are: SUMMARY, ERRORS, SIGNAL, and TIME.

RESULTS I Results Switch or RESULTS II Results Switch — Selects the individual results from the indicated category. Pressing this switch for more than one second automatically scrolls the entire list.

Test Results Display

During a test, the available results and alarm messages are continuously updated. The results are divided into four categories. During the test, the SUMMARY category displays key non-zero or out-of specification results. Refer to Section 5 for more information on the test results.

SUMMARY Category — When an error or out-of-specification result is detected, the appropriate result appears in the SUMMARY category window. In DDS mode, each result is preceded with either a "P" (Primary) or "S" (Secondary) to indicate the input source. The SUMMARY category results are as follows:

pERRORS, sERRORS, BPVs, RX FREQ, and CURRENT REVERSED.

ERRORS Category — Bit errors and bipolar pulse violation (BPV) results appears in the ERRORS category. Each result is preceded with either a "P" (Primary) or "S" (Secondary) to indicate the input source. The ERRORS category results are as follows:

pERRORS, pBER, pERR SECS, p%EFS sERRORS, sBER, sERR SECS, s%EFS, BPVs, BPV RATE, and BPV SECS.

When an error occurs an audible alarm sounds, if AUX VOLUME is ON.

SIGNAL Category —Signal level, frequency, span current, and received data byte appear in the SIGNAL category. The SIGNAL category results are as follows:

RX LVL (Volts), RX LVL (dB), RX FREQ, SPAN CURR, and RX BYTE.

TIME Category — Lists results for time of day, date, and the elapsed time since the last test restart. The TIME category results are as follows:

TIME, DATE, ELAPSED TIME

3.50 ISDN/DDS ANALYZER OPTION — PRINT CONTROLS

The ISDN/DDS Analyzer Option print controls (see Figure 3-23) are as follows:

- **PRINT** switches (24)
- AUXILIARY PORT connector (25)

Figure 3-23
ISDN/DDS Analyzer Option Print Controls

PRINT Switches (26)

These switches are used to manually generate a printout of the current results or setup. Pressing the **RESULTS** switch generates a date- and time-stamped printout (see Figures 3-24 and 3-25) of the current test results. Pressing the **CONTROLS** switch generates a date- and time-stamped printout (see Figure 3-26) of the current ISDN/DDS Analyzer Option configuration.

RESULTS PRINT 12:34:34 JAN 5 DDS 2.4 kB/s 511

pBIT ERR	nnnnnnnn	BPV	nnnnnnnn
pBER	n.nnE-nn	BPV RATE	n.nnE-nn
pBER SECS	nnnnnnnn	BPV SECS	nnnnnnnn
p%EFS	nn.nnn%	RX LVL	n.nnn Vpp
sBIT ERR	nnnnnnnn	RX LVL	-nn.n dB
sBER	n.nnE-nn	RX FREQ	nnn.n kHz
sERR SEC	nnnnnnnn	SPAN CURR	nn mA
s%EFS	nn.nnn%	RX BYTE	bbbbbbbb

Figure 3-24
ISDN/DDS Analyzer Option DDS Results Printout

RESULTS PRINT 12:34:34 JAN 5 ISDN 160 kB/s 511

BIT ERR	nnnnnnnn	RX LVL	n.nnn Vpp
BER	n.nnE-nn	RX LVL	-nn.n dB
ERR SEC	nnnnnnnn	RX FREQ	nnn.n kHz
%EFS	nn.nnn%	SPAN CURR	nn mA

Figure 3-25
ISDN/DDS Analyzer Option ISDN Results Printout

CONTROLS PRINT 12:34:34 JAN 5

MODE	DDS	LBO	-3 dB
FORMAT	2.4 kB/s	RX INPUT	TERM
PRI PATTERN	511	RECVD	RECOV
SEC PATTERN	N/A	SPAN CUR	OFF
		LOOP	CSU

Figure 3-26
ISDN/DDS Analyzer Option Controls Printout

AUXILIARY PORT Connector (25)

This female, 8-pin DIN-type connector provides connection to the PR-40A or compatible printer (see Table 3-13 for connector pinout).

Table 3-13
ISDN/DDS Analyzer Option AUX Port Pinout

Pin	Name	Direction/Description
1	N/C	Reserved. Leave unconnected.
2	GND	Ground
3	GND	Ground
4	TXD	Input; Transmit data received from 209*OSP*; [Transmit Data]
5	N/C	Reserved. Leave unconnected
6	DTR	Input; DTE Ready to Receive; [Data Terminal Ready]
7	RXD	Output; Send Data to DTE; [Receive Data]
8	DSR	Output; DCE Ready to Receive; [Data Set Ready]

AUXILIARY FUNCTIONS

4.1 INTRODUCTION

Auxiliary functions allow access to parameters that are less frequently used and do not have dedicated switches.

The descriptions of the auxiliary functions available with the T-BERD 209*OSP* have been divided into separate categories.

Mainframe — Auxiliary Functions — Describes each of the auxiliary functions for the mainframe T-BERD 209*OSP*.

DLC Analyzer Option — Auxiliary Functions — Describes each of the auxiliary functions for the DLC Analyzer Option.

4.2 MAINFRAME — AUXILIARY FUNCTIONS

When the **AUX** switch is pressed, the LED within the switch illuminates and the character display changes as follows:

- *AUX* appears in the MODE display.
- The last selected auxiliary function appears in the PATTERN display.
- The auxiliary function's parameters appear in the RESULTS I and II displays. If there is only one parameter selection, the RESULTS I display is used, and the RESULTS II display is cleared.

Once the auxiliary functions are disabled, all the displays return to the previous values.

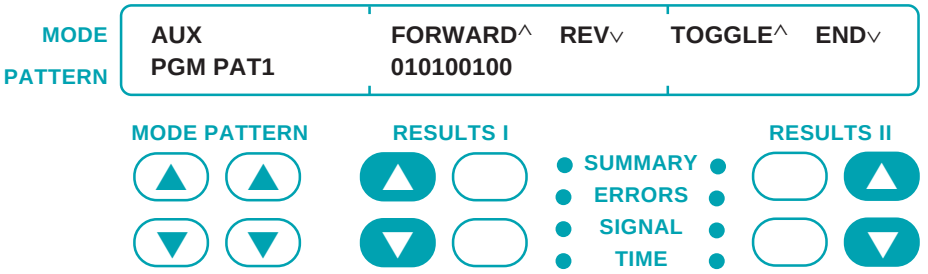
Table 4-1 lists all the available mainframe auxiliary functions and indicates whether or not an option is required for specific auxiliary functions.

Table 4-1
Auxiliary Functions

Auxiliary Function	Description
AUX PGM PAT1	Programmable Pattern 1
AUX PGM PAT2	Programmable Pattern 2
AUX PGM PAT3	Programmable Pattern 3
AUX MULTIPAT	MULTIPAT Pattern Selection and Duration Control
AUX AUTOTEST	AUTOTEST Test Selections
AUX RESPONSE	Loop Code Response
AUX PGM LPUP	Programmable Loop-Up Code
AUX PGM LPDN	Programmable Loop-Down Code
AUX LOOPCODE	Loop Code Select
AUX SMARTNET	Intelligent Network Equipment Select*
AUX DATALINK	ESF Datalink Features Select
AUX FT1 CHAN	Fractional T1 Channel Select**
AUX FT1 SETUP	Fractional T1 Idle Code and Data Rate Select**
AUX VF TONE	Voice Frequency Tone**
AUX VF CHAN	VF Channel Selection***
AUX VOLUME	Volume
AUX TEST LEN	Test Length
AUX BUF CLR	Buffer Clear
AUX PRNT INT	Print Interval
AUX PRNTPORT	Printer Interface Setup
AUX CLOCK	Time and Date

* Smart Loopback/Command Codes Option required.
** Fractional T1 Option required.
*** Channel Monitor Option required.

AUX PGM PAT 1, PGM PAT 2, and PGM PAT 3 — Programmable Test Patterns



The AUX PGM PAT1, AUX PGM PAT2, and AUX PGM PAT3 functions allow three user-defined 3- to 24-bit patterns to be programmed. These patterns are transmitted in a BERT operating mode when PGM PAT1, PGM PAT2, or PGM PAT3 is selected with the **PATTERN** switch. Each pattern is transmitted from left to right as it is displayed. The factory default settings are 010100100 for pattern 1, 001101110 for pattern 2, and 110001110 for pattern 3. The RESULTS I display shows the present pattern settings.

Use the following procedure to change the pattern setting.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX PGM PAT1 function, AUX PGM PAT2 function, or AUX PGM PAT3 function.

2. **RESULTS I Results switch**
   Press the up or down arrow to select the bit (blinking zero or one) to be toggled. The up arrow moves FORWARD from left to right. The down arrow moves in the REVerse direction from right to left.

3. **RESULTS II Results switch**
   Press the up arrow to TOGGLE the selected bit (blinking digit) between “1” and “0”.

4. **RESULTS I and RESULTS II Results switches**
   Repeat Steps 2 and 3 until the desired bit pattern is complete. Move to the last bit of the pattern.

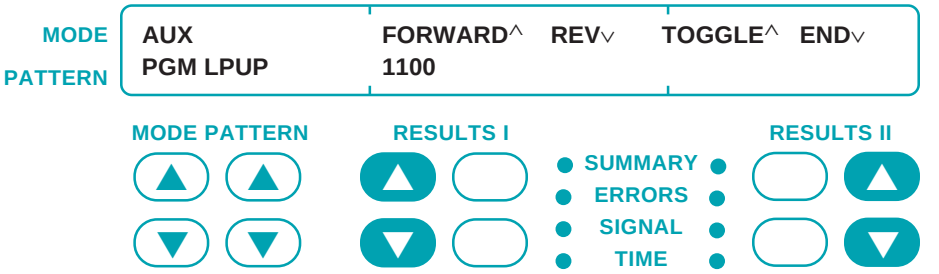
5. RESULTS II Results switch

Press the down arrow to END the pattern at the current bit (blinking digit). Any bits displayed to the right of this bit are deleted.

6. AUX switch

Press the **AUX** switch to return to the operating mode.

AUX PGM LPUP — Programmable Loop-up Code



The AUX PGM LPUP function enables you to program a 3- to 8-bit user-defined, in-band, loop-up code (3- to 6-bit out-of-band loop code). This allows the T-BERD 209*OSP* to transmit and respond to non-standard loop codes. The loop code is transmitted from left to right as displayed. The programmed loop-up code is transmitted when the **LOOP CODES** switch is set to PROG and the **LOOP UP** switch is pressed. The default setting for this code is the FAC1 loop-up code.

When the T1, T1 D4, T1 D1D, or T1 SLC mode is selected, the loop code is transmitted as an in-band loop code. When the T1 ESF mode is selected, the loop code can be transmitted in-band or out-of-band depending on the AUX ESF LOOP function setting. The RESULTS I display shows the present programmed loop-up code.

Use the following procedure to program the loop code.

1. AUX and PATTERN switch

Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX PGM LPUP function.

2. RESULTS I Results switch

Press the up or down arrow to select the bit (blinking one or zero) to be toggled. The up arrow moves FORWARD from left to right. The down arrow moves in the REVerse direction from right to left.

3. **RESULTS II Results switch**
   Press the up arrow to TOGGLE the selected bit (blinking digit) between “1” and “0”.

4. **RESULTS I and RESULTS II Results switches**
   Repeat Steps 2 and 3 until the desired loop code is complete. Move to the end of the programmed loop code.

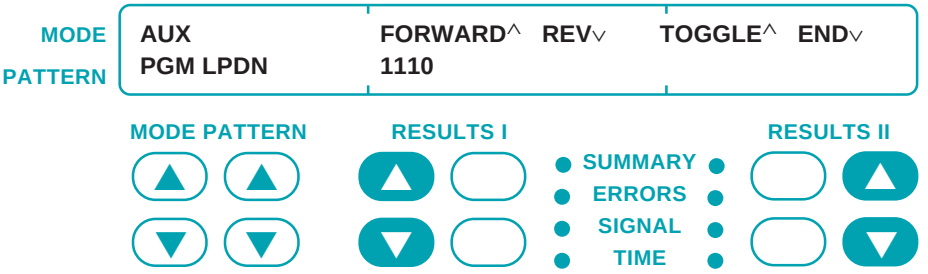
5. **RESULTS II Results switch**
   Press the down arrow to END the loop code at the current bit (blinking digit), thereby setting the loop code’s length.

6. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following functions and modes when changing the AUX PGM LPUP function:

- Loop codes controls
- AUX PGM LPDN function
- AUX RESPONSE function
- AUX PROGLOOP function

AUX PGM LPDN — Programmable Loop-Down Code



The AUX PGM LPDN function enables you to program a 3- to 8-bit user-defined, in-band, loop-down code (3- to 6-bit out-of-band loop code). This allows the T-BERD 209*OSP* to transmit and respond to non-standard loop codes. The loop code is transmitted from left to right as displayed. The programmed loop-down code is transmitted when the **LOOP CODES** switch is set to PROG and the **LOOP DOWN** switch is pressed. The default setting for this code is the FAC1 loop-down code.

When the T1, T1 D4, T1 D1D, or T1 SLC mode is selected, the loop code is transmitted as an in-band loop code. When the T1 ESF mode is selected, the loop code can be transmitted in-band or out-of-band depending on the AUX ESF LOOP function setting. The RESULTS I display shows the present programmed loop-down code.

Use the following procedure to program the loop code.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX PGM LPDN function.

2. **RESULTS I Results switch**
   Press the up or down arrow to select the bit (blinking one or zero) to be toggled. The up arrow moves FORWARD from left to right. The down arrow moves in the REVerse direction from right to left.

3. **RESULTS II Results switch**
   Press the up arrow to TOGGLE the selected bit (blinking digit) between “1” and “0”.

4. **RESULTS I and RESULTS II Results switches**
   Repeat Steps 2 and 3 until the desired loop code is complete. Move to the end of the programmed loop code.

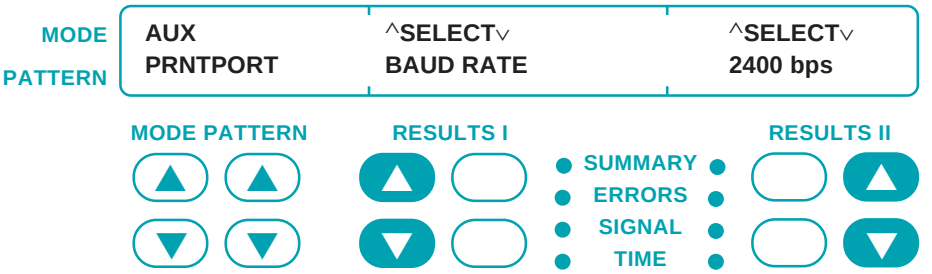
5. **RESULTS II Results switch**
   Press the down arrow to END the loop code at the current bit (blinking digit), thereby setting the loop code’s length. Any bits displayed after this last bit are ignored.

6. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following functions and modes when changing the AUX PGM LPDN function:

- Loop codes controls
- AUX PGM LPUP function
- AUX RESPONSE function
- AUX PROGLOOP function

AUX PRNTPORT — Printer Interface Setup



The AUX PRNTPORT function selects the baud rate, parity, and termination character for the RS-232 AUXILIARY PORT connector. The baud rate selections are 300, 1200, 2400, 4800, and 9600 b/s. The parity selections are described as: NONE, ODD, and EVEN. The termination character selections are CR (Carriage Return) and CRLF (Carriage Return Linefeed). The RESULTS I display shows the parameter and the RESULTS I display shows the current value.

BAUD RATE — Selects the baud rate for the RS-232 AUXILIARY PORT connector. The baud rate selections are 300, 1200, 2400, 4800, and 9600 b/s.

PARITY — Selects the parity for the RS-232 AUXILIARY PORT connector. PARITY selections include:

NONE — Disables parity and configures the data output for eight data bits.

EVEN — Enables even parity and configures the data output for seven data bits.

ODD — Enables odd parity and configures the data output for seven data bits.

TERM 232 — Selects the termination character for the RS-232 AUXILIARY PORT connector. TERM 232 selections include:

CR — Carriage Return.

CRLF — Carriage Return-Linefeed .

Use the following procedure to set the RS-232 printer interface parameters.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX PRNTPORT function.

2. **RESULTS I Results switch**
   Press to select the printer interface parameter; BAUD RATE, PARITY, or TERM 232.

3. **RESULTS II Results switch**
   Press to select the parameter value.

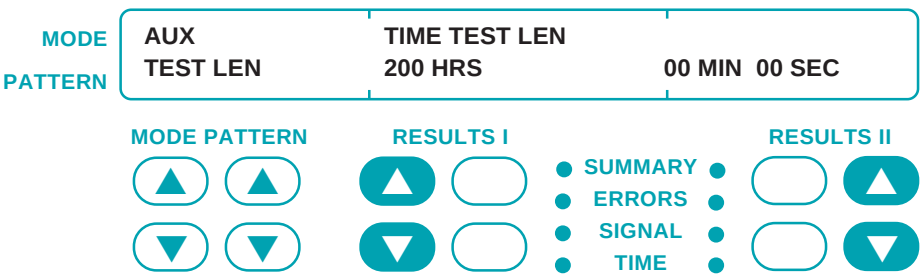
4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following when changing the AUX BAUD function:

- RS-232 printer interface
- Printer operation

For further information, refer to Section 6, Printer Operation.

AUX TEST LEN — Timed Test Length Duration



The AUX TEST LEN function sets the length of a timed test. The maximum test length setting is 200 HRS 59 MIN 00 SEC, and the minimum is 0 HRS 0 MIN 15 SEC. The default setting is 200 HRS 00 MIN 00 SEC. The RESULTS I and RESULTS II displays show the present test length setting.

Use the following procedure to set the test length.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX TEST LEN function.

2. **RESULTS I Results switch**
   Press the up arrow (increase) or down arrow (decrease) to set the hours in one hour increments.

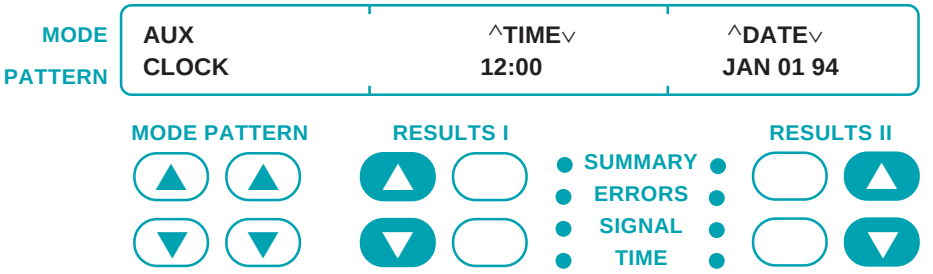
3. **RESULTS II Results switch**
   Press the up arrow (increase) or down arrow (decrease) to set the minutes and seconds. Seconds are only available when HRS = 00 and MIN = 00. When available, seconds are set in 15-second increments.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following functions and TIME category results when changing the AUX TEST LEN function:

- **TIMED TEST** switch
- **RESTART** switch
- TEST LENGTH result
- ELAPSED TIME result
- TEST END IN result
- AUX PRNT INT function

AUX CLOCK — Time and Date Setup



The AUX CLOCK function sets the time (in 24-hour format) for the battery-backed real-time clock and the date (in MMM DD YY format). The clock time appears on all printouts generated by the T-BERD 209*OSP*. The current time is displayed in the TIME category, CLOCK TIME result. The AUX DATE function sets the month, day, and year for the battery-backed real-time clock. The month and day appear on all printouts generated by the T-BERD 209*OSP*. The month, day, and year appear on the SMART NIU results printout. The current month and day are displayed in the TIME category, DATE result.

Use the following procedure to set the time and date.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX CLOCK function.

2. **RESULTS I switches**
   Press the **RESULTS I Category** switch to toggle between the hour and minute parameters. Press the **RESULTS I Results** switch up arrow (increase) or down arrow (decrease) to change the time parameter.

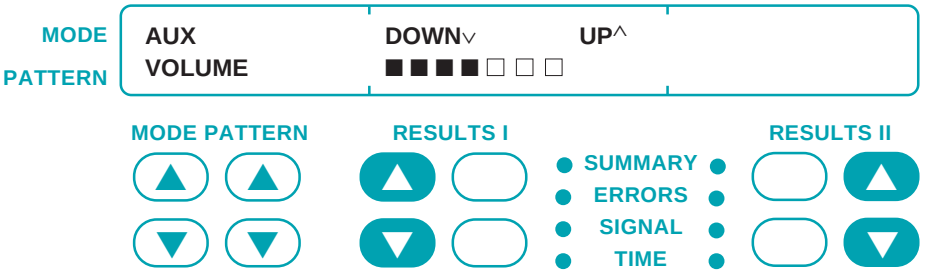
3. **RESULTS II switches**
   Press the **RESULTS II Category** switch to highlight the parameter to be changed; MMM (month), DD (day), or YY (year). Press the **RESULTS II Results** switch up arrow (increase) or the down arrow (decrease) to change the current setting.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following when changing the AUX CLOCK function:

- Printer operation

AUX VOLUME — Speaker Volume



The AUX VOLUME function sets the audible output level for the speaker, which also controls the volume of the VF output if the Channel Monitor Option is installed. A seven-box, bar-graph in the RESULTS I display shows the relative volume by filling in the boxes. The boxes are filled from left to right. If none of the boxes are filled, the speaker is turned off. If all boxes are filled, the volume is at maximum.

Use the following procedure to change the volume setting.

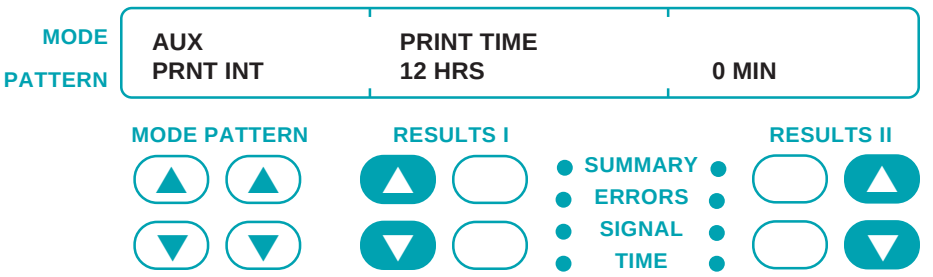
1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX VOLUME function.

2. **RESULTS I Results switch**
   Press the up arrow (increase) or the down arrow (decrease) to change the volume of the speaker. An audible beep occurs each time the volume is adjusted.

3. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

The T-BERD 209*OSP* provides an audible beep each second when one or more bit errors, BPVs, frame errors, CRC errors, or timing slips occur.

AUX PRNT INT — Print Interval Time



The AUX PRNT INT function sets the print interval time that determines how often a results printout is generated. It is valid when the **PRINT EVENT** switch is set to the TIMED position. This function operates independent of the **TIMED TEST** switch. The RESULTS I and RESULTS II displays show the present print interval setting.

Use the following procedure to change the print interval setting.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX PRNT INT function.

2. **RESULTS I Results switch**
   Press the up arrow (increase) or the down arrow (decrease) to change the print interval hour setting from 0 HRS to 23 HRS.

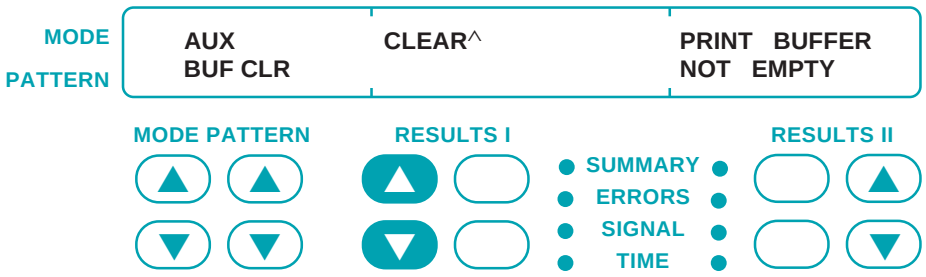
3. **RESULTS II Results switch**
   Press the up arrow (increase) or the down arrow (decrease) to change the print interval minutes from 0 MIN to 59 MIN.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following functions when changing the AUX PRNT INT function:

- **PRINT EVENT** switch
- Printer operation
- **TIMED TEST** switch

AUX BUF CLR — Clear Print Buffer



The AUX BUF CLR function clears the print buffer. When selected and the print buffer contains stored results, the message *PRINT BUFFER NOT EMPTY* appears in the RESULTS II display. When the print buffer is clear, the message *PRINT BUFFER EMPTY* appears in the RESULTS II display.

Use the following procedure to clear the print buffer.

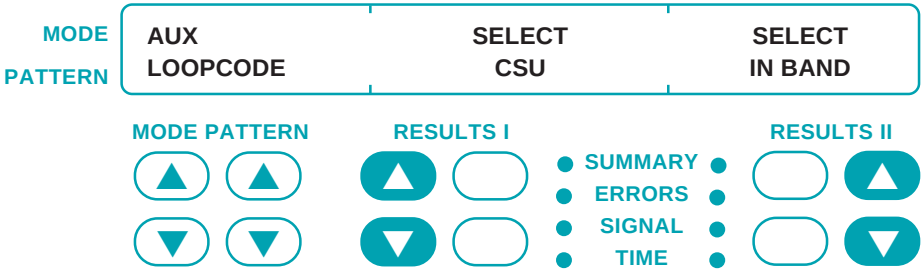
1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX BUF CLR function.

2. **RESULTS I Results switch**
   Press either the up or down arrow to clear the print buffer. The message *PRINT BUFFER EMPTY* appears in the RESULTS II display when the print buffer is clear.

3. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

When using the AUX BUF CLR function consider printer operation.

AUX LOOPCODE — Loop Codes Select



The AUX LOOPCODE function selects the transmitted loop code for the CSU, NIU, and PROG positions of the **LOOP CODES** switch. These selections also determine which loop code causes the T-BERD 209*OSP* to establish the AUTO LLB mode. The loop codes are transmitted when the **LOOP UP** or **LOOP DOWN** switch is pressed. The appropriate loop code is transmitted from left to right.

Either the **LOOP CODES** switch or the **RESULTS I Results** switch can be used to select the equipment type (CSU, NIU, or PROG). Pressing the **RESULTS I Results** switch changes the AUX LOOPCODE equipment type and forces the **LOOP CODES** switch to the same equipment type (matching switch LED illuminates). If CSU is the selected equipment, the **RESULTS II Results** switch is used to select one of the following loop code types:

IN BAND — The CSU in-band loop codes are transmitted or responded to in place of the data or test pattern. The in-band loop-up code is 10000. The in-band loop-down code is 100.

ESF LINE — Out-of-band line loop codes are transmitted in the ESF datalink or responded to when received in the ESF datalink. They do not overwrite the data or test pattern. The out-of-band line loop code allows the T-BERD 209*OSP* to establish a loopback with a compatible terminal. The loopback affects all data and framing bits. The out-of-band line loop-up code is 1111 1111 0111 0000. The out-of-band line loop-down code is 1111 1111 0001 1100. If the operating mode is not an ESF mode, the IN BAND loop code is automatically substituted for transmissions.

ESF PAYLOAD — Out-of-band payload loop codes are transmitted in the ESF datalink. The T-BERD 209*OSP* does not respond to an out-of-band payload loop code. The loopback affects only data bits; framing bits are not affected. The out-of-band payload loop-up code is 1111 1111 0010 1000 The out-of-band payload loop-down code is 1111 1111 0100 1100. If the operating mode is not an ESF mode, the CSU IN BAND loop code is automatically substituted for transmissions.

If NIU is the selected equipment, the **RESULTS II Results** switch is used to select one of the following loop code types:

FAC1 — The 4-bit facility or network (smart jack) loop codes allow the T-BERD 209*OSP* to establish a loopback with a compatible facility interface or respond to a facility loop code. The facility 1 (FAC1) loop-up code is 1100. The facility 1 (FAC1) loop-down code is 1110.

FAC2 — The 5-bit facility or network (smart jack) loop codes allow the T-BERD 209*OSP* to establish a loopback with a compatible facility interface or respond to a facility loop code. The facility 2 (FAC2) loop-up code is 11000. The facility 2 (FAC2) loop-down code is 11100.

FAC3 — These facility or network (smart jack) loop codes allow the T-BERD 209*OSP* to establish a loopback with a compatible facility interface or respond to a facility loop code. The facility 3 (FAC3) loop-up code is 100000. The facility 3 (FAC3) loop-down code is 100.

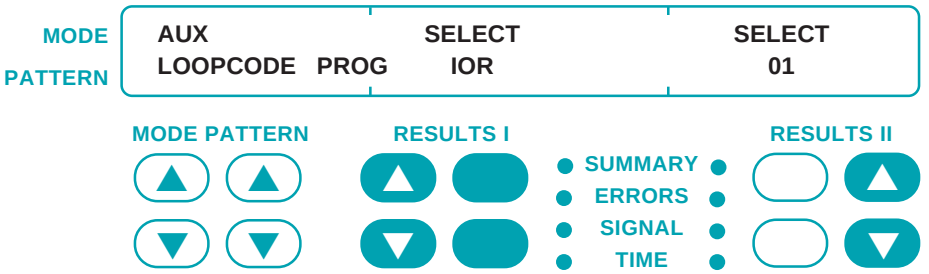
ESF NET — The ESF out-of-band network loop codes allow the T-BERD 209*OSP* to establish a loopback with a compatible terminal or respond to a network loop code. The ESF out-of-band network loop-up code is 1111 1111 0100 1000. The ESF out-of-band network loop-down code is 1111 1111 0010 0100. If the operating mode is not an ESF mode, the FAC2 loop code is automatically substituted for transmissions.

If PROG is the selected equipment, the **RESULTS I Category** switch is used to select USER, one of the intelligent network equipment types (Smart Loopback/Command Codes Option required), ESF DL, or one of the HDSL loop codes (HDSL/ISDN/DOS Measurements Option required). The TBERD 209*OSP* does not respond to intelligent network equipment loop codes.

The availability of intelligent network equipment loop codes is determined by the AUX SMARTNET function (Smart Loopback/Command Codes Option required). If the intelligent network equipment is not selected or is set to NONE in the AUX SMARTNET function, the selection does not appear in the AUX LOOPCODE function. Refer to Appendix D for tables that list the intelligent network equipment, available addresses, and commands. The USER, intelligent network equipment type, and ESF DL selections are described as follows:

USER — The in-band, 3- to 8-bit programmable, loop code settings of the AUX PGM LPUP and AUX PGM LPDN functions are transmitted or responded to by the T-BERD 209*OSP*.

IOR — The intelligent office repeater loop codes allow the T-BERD 209*OSP* to establish a loopback of an intelligent office repeater. If the intelligent repeater type has office repeaters that are addressable, the **RESULTS II Results** switch is used to program the address (refer to Appendix D).



ILR — The intelligent line repeater loop codes allow th T-Berd 209*OSP* to establish a loopback of an intelligent line repeater. The **RESULTS II** switches are used as follows:

ADDRESS — The intelligent line repeater address is used to identify a specific line repeater on the span. The abailable address sigits change to match the intelligent line repeater type (refer to Appendix D). The **RESULTS II Results** switch is used to program the address.

EXCH:LOC — The intelligent line repeater exchange and location codes are used to allow the T-BERD 20posp to extablish a loopback of an XEL model 7853-000 inteligent line repeater. The **RESULTS II Category** switch is used to program the exchange code (refer to Appendix D). The **RESULTS II Results** switch is used to program the location code (refer to Appendix D). This selection only appears if the AUX SMARTNET function is set to XEL.

IOR CMD or ILR CMD — The intelligent repeater commands allow the T-BERD 209*OSP* to activate specific functions of intelligent office and line repeaters. The availability of commands is determined by the type of repeater (see AUX SMARTNET function). The **RESULTS II Results** switch is used to select the command from among the following available commands:

AIS Disable — Disables the automatic AIS transmission for the repeater currently in loopback. Press either the **LOOP UP** or **LOOP DOWN** switch to send the AIS disable code.

Arm/Disarm — Selects the arming/disarming code. An arming code (**LOOP UP** switch) is transmitted down the intelligent repeater span to loop up the NIU and to prepare the intelligent repeaters to loop up or loop down upon receipt of the appropriately addressed loop codes. A disarming code (**LOOP DOWN** switch) loops down the NIU and all the intelligent repeaters on the span.

Auto Learn — Enables the T-BERD 209*OSP* to reassign addresses to line repeaters (Teltrend models 7239LS and 7239LW). Pressing the **LOOP UP** or **LOOP DOWN** switch transmits the Auto Learn loop code, which clears all current addresses from the span repeaters. Then, each repeater is automatically assigned a new address based on its position on the span. The first repeater is assigned address 01, the second one is assigned address 02, etc. Each repeater acknowledges its new address by returning an address or address code (bit errors). The process continues until all the repeaters on the span have been assigned a new address (no more address or address codes are received).

Auto Query — Enables the T-BERD 209*OSP* to query each line repeater on the span for its address (Teltrend models 7239LS and 7239LW). Pressing the **LOOP UP** or **LOOP DOWN** switch transmits the Auto Query loop code, which sequentially queries each line repeater for its address. The first line repeater responds with its address or an address code (bit errors). If an address code of 555 is displayed, the repeater has no assigned address. The RESULTS display is blanked for approximately five seconds. Then, the second line repeater responds with its address. The address and blank display cycle continues until each line repeater has responded with its address. If the process is interrupted for any reason, the Auto Query loop code must be transmitted again, and the process begins again with the first repeater on the span.

Clear FT1 — If the Teltrend 7231E, or equivalent, office repeater is set for FT1 mode (rotary switch on office repeater in positions 1 through 6) and is already armed, this code temporarily sets the office repeater to Full T1 mode. Either the **LOOP UP** switch or **LOOP DOWN** switch can be used to transmit the Clear FT1 loop code.

CPE Arm — Selects the CPE arming/disarming code. A CPE arming code (**LOOP UP** switch) is transmitted on the intelligent repeater span when testing from the NIU toward the Central Office (CO) to prepare the intelligent repeaters to loop up or loop down upon receipt of the appropriately addressed loop codes. A disarming code (**LOOP DOWN** switch) loops down all the intelligent repeaters on the span.

Dual LPBK — After a Teltrend 7231E, or equivalent, T1 office repeater has been programmed for the NIU mode (rotary switch on office repeater in position 7) and has been looped up from the DSX-1 side, this command is transmitted from the DSX-1 to create a second loopback of the farend side of the office repeater. The office repeater is placed in dual loopback mode with a loopback toward the CO (DSX-1) and a loopback toward the Customer Premises. Pressing the **LOOP UP** switch transmits the Dual Loopback code. Pressing the **LOOP DOWN** switch transmits the loop-down code that loops down the office repeater.

Far-End NIU Activate — Unblocks an already armed near-end Teltrend 7231E, or equivalent, T1 office repeater to allow the appropriate NIU loop code to pass through. Pressing the **LOOP UP** or **LOOP DOWN** switch transmits the unblock code, which allows standard NIU loop up and loop down codes to pass through the office repeater to loop the far-end NIU.

Manual Learn — Enables the T-BERD 209*OSP* to reassign addresses to line repeaters (Teltrend models 7239LS and 7239LW). Pressing the **LOOP UP** switch transmits the Manual Learn loop code, which clears all current addresses from the span repeaters, loops back each repeater in the span, and prepares each repeater to receive a new address assignment. Select the ILR command and program an address for the first repeater in the span, then press the **LOOP UP** switch to transmit the loop code. The first repeater accepts the loop code, reprograms itself to the new address, and loops itself down, so that the second repeater in the span is ready to receive its new address. Program addresses for all the repeaters on the span before exiting this function.

Near-end Arm — Selects the near-end arming/disarming code. A near-end arming code (**LOOP UP** switch) is transmitted on the intelligent repeater span when testing from the NIU toward the Central Office (CO) to prepare the intelligent repeaters to loop up or loop down upon receipt of the appropriately addressed loop codes. A disarming code (**LOOP DOWN** switch) loops down all the intelligent repeaters on the span.

Option Query — Queries for the option status of an intelligent repeater in loopback mode. Press the **LOOP UP** switch to send the option query code. The repeater in loopback first returns its address or an address code, which the TBERD 209*OSP* displays. Then, it returns the status for the repeater options as follows:

Framing Mode — Auto, Dual, or ESF
Loopback Code Detection — Synchronous or Asynchronous
AIS — Enabled or Disabled
CPE Arming Code Block — Enabled or Disabled
Automatic Loopback Timeout — Enabled or Disabled
Repeater Status — Programmed or Original Settings

Power Down — Removes the power from the line past the office receiver while the loop code is being transmitted plus an additional five seconds after the loop code transmission is stopped. Press either the **LOOP UP** or **LOOP DOWN** switch to send the power down code.

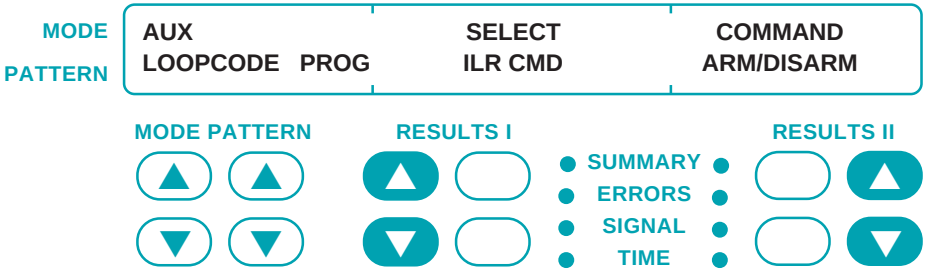
Power Loop/Power Query — Queries for and loops up the line repeater that is currently looping back the power. Press the **LOOP UP** switch to send the power loop-up code. Press the **LOOP DOWN** switch to loop down the first repeater on the span that is looped up.

Power Thru — Forces the line repeater that initiated the power loop to return to thru power mode, but it can only be activated from the DSX-1 side of the repeater. Press either the **LOOP UP** or **LOOP DOWN** switch to send the power thru code.

Query — Reveals which line repeater is in loopback mode. Press either the **LOOP UP** or **LOOP DOWN** switch to send the query code. The repeater in loopback returns its address or an address code, which the TBERD 209*OSP* displays. If the address code 555 is displayed, the repeater in loopback does not have an assigned address.

Sequential Loopback — Loops up the T1 line repeaters on the span in sequence starting with the repeater nearest the T-BERD 209*OSP* and proceeding down the span, regardless of the repeater's address. Pressing the **LOOP UP** switch transmits the Sequential Loopback code. The first time a repeater receives the sequential loop code, it loops up and returns its address or an address loop code to the TBERD 209*OSP*. The second time the sequential loop code is sent, the repeater loops down. Alternatively, the **LOOP DOWN** switch can be used to transmit the loop down code, which loops down the repeater. Regardless of which method is used to loop down the repeater, it ignores all subsequent sequential loop code transmissions until it is disarmed and re-armed.

Time-out Disable/Extend — Disables/extends the automatic loopback timeout function of the repeater. Establish the line repeater loopback first, then send the timeout disable function. The timeout function is reset when the loopback is deactivated remotely.



IOR PGM, ILR PGM — The remote programming commands allow the T-BERD 209*OSP* to activate specific functions of intelligent office repeaters and intelligent line repeaters. Remote programming can only be done from the DSX side while the repeater is in loopback. Pressing the **LOOP UP** switch transmits the selected programming command to the repeater. The **RESULTS II Category** switch is used to select the command type from among the following available commands:

ACK — Enables the T-BERD 209*OSP* to select the acknowledgement type the repeater in loopback uses, the error acknowledgement scheme or the inverted first four bits acknowledgement scheme. Press the **RESULTS II Results** switch to select the ERROR or INVERSE acknowledgement type.

ADDR — Selects the address change command, which allows the T-BERD 209*OSP* to assign an address for the intelligent repeater. The local address assignment is limited to the range from 0 to 99. Press the **RESULTS II Results** switch to assign the address in the range from 0 to 1999.

ARM CDE — Enables the T-BERD 209*OSP* to select the arming code the repeater in loopback recognizes. Press the **RESULTS II Results** switch to select the NIU or CPE arming codes.

ARM FRM — Enables the T-BERD 209*OSP* to select the framing mode the repeater recognizes. Press the **RESULTS II Results** switch to select AUTO, DUAL, or ESF framing mode.

In Auto Framing mode, the repeater automatically recognizes whether the received framing is ESF or SF framing. When SF framing is detected, the repeater only arms to the in-band arming code. When ESF framing is detected, the repeater only arms to the datalink (out-of-band) arming code.

In Dual Framing mode, the repeater arms to an in-band arming code in both SF and ESF modes. If ESF framing is detected, the repeater also arms to the datalink (out-of-band) arming code.

In ESF mode, the repeater only arms to the datalink (out-of-band) arming code.

AIS — Allows the T-BERD 209*OSP* to set the Alarm Indication Signal (AIS) to either enabled or disabled. When AIS is enabled, the repeater sends an all ones AIS toward the Customer Premises Equipment (CPE) indicating the repeater is in loopback. Press the **RESULTS II Results** switch to select ENABLE or DISABLE.

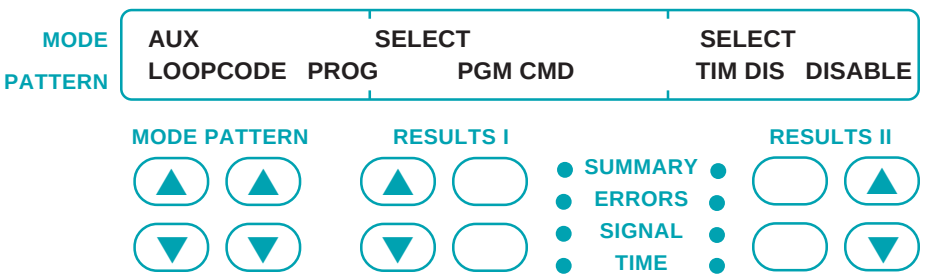
BLK CPE — Enables the T-BERD 209*OSP* to enable or disable the CPE arming code block, which prevents further arming of the span and its elements from the CPE side when the repeater is in loopback. Press the **RESULTS II Results** switch to select ENABLE or DISABLE.

CODE RX — Enables the T-BERD 209*OSP* to set the code detection, which determines if the repeater responds to asynchronous or synchronous loop codes. Press the **RESULTS II Results** switch to select ASYNC or SYNC.

NOTE: The T-BERD 209*OSP* always transmits synchronous loop codes.

RESET — Allows the T-BERD 209*OSP* to reset the programmable features to either the factory default settings or the settings prior to the current loopback session. Press the **RESULTS II Results** switch to select MASTER (default settings) or SESSION (prior settings).

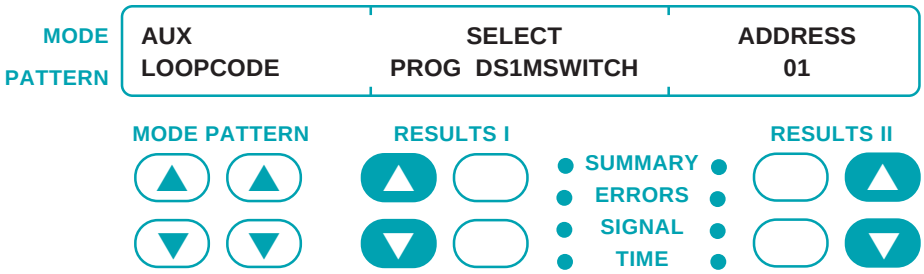
TIMEOUT — Disables or enables the automatic loopback timeout function of the repeater. Press the **RESULTS II Results** switch to select ENABLE or DISABLE.



DS1MSW — The DS1 maintenance switch commands allow the T-BERD 209*OSP* to activate specific functions of the Westell and Teltrend DS1 maintenance switches. The **RESULTS II Category** switch is used to select the function:

SWITCH — The maintenance switch code is used to allow the T-BERD 209*OSP* to establish a loopback. The **RESULTS II Results** switch is used to program the address, if applicable.

RAMP — The ramp code is used to allow the T-BERD 209*OSP* to connect to the NIU/ Performance Monitor on a maintenance switching system without taking the desired DS1 out of service. The **RESULTS II Results** switch is used to program the address, if applicable.



DS1MS CMD — The DS1 maintenance switch commands are used to allow the T-BERD 209*OSP* to change the configuration. The **RESULTS II Results** switch is used to select the DS1 maintenance switch command. .i.DS1 Maintenance Switch:Maintenance Switch Commands;

Arm/Disarm — Selects the maintenance switch arming/disarming code. An arming code (**LOOP UP** switch) is transmitted down the repeater span to prepare the maintenance switch to loop up or switch a channel upon receipt of the appropriately addressed code.

Query — Reveals if the maintenance switch is in loopback mode. If it is in loopback mode, the switch returns a bit error count equal to the address times 10 plus 1000. If it is not looped, the switch returns a bit error count of 1350. Press either the **LOOP UP** or **LOOP DOWN** switch to send the query code.

Restore — Loops down the maintenance switch and restores normal operations. Press either the **LOOP UP** or **LOOP DOWN** switch to send the restore code.

Time-out Disable — Disables the automatic timeout function of the maintenance switch. Establish the maintenance switch loopback first, then send the timeout disable function. The timeout function is reset when the loopback is deactivated remotely.

HDSL — The HDSL loop codes are used to establish a loopback at either the central office or the customer premises. The **RESULTS** switch is used to select between HTU-C (Central office) and HTUR (Remote - customer premises).

ESF DL — The ESF datalink codes determine which ESF BPMs the T-BERD 209*OSP* transmits. Pressing the **LOOP UP** or **LOOP DOWN** switch transmits the selected BPM. When a BPM is being transmitted, its name appears while transmitting in the PATTERN display.

The Smart Loopback/Command Codes Option currently supports the following intelligent network equipment:

- ADTRAN HTU-C and HTU-R HDSL End Equipment
- PAIRGAIN HLU-231 and HRU-412 HDSL End Equipment
- Tellabs HTU-C and HTU-R HDSL End Equipment
- Teltrend Model IOR7231/ILR7239 Intelligent Repeaters
- Teltrend Model IOR7231E Intelligent Repeaters
- Teltrend Model IOR7231LC/ILR7239LC Intelligent Repeaters
- Teltrend Model IOR7231LD/ILR7239LD Intelligent Repeaters
- Teltrend Model IOR7231LP/ILR7239LP Intelligent Repeaters
- Teltrend Model IOR7231LS/ILR7239LS Intelligent Repeaters
- Teltrend Model IOR7231LW/ILR7239LW Intelligent Repeaters
- Teltrend DS1 Maintenance Switch System
- TxPORT Model 231-OR/239-SR Intelligent Repeaters
- Wescom Smart Span T1 Span Line System with Addressable Bi-Directional Loopback (F-Series)
- Westell 3130-56 T1 Office Repeater with Addressable Loopback Plus
- Westell 3150-56 T1 Line Repeater with Addressable Loopback Plus
- Westell 3151-56 T1 Line Repeater with Addressable Loopback Plus
- Westell 3130-70 T1 Office Repeater with Addressable Loopback Plus
- Westell 3150-70 T1 Line Repeater with Addressable Loopback Plus

- Westell 3130-80 T1 Office Repeater with Addressable Loopback Plus
- Westell 3150-80 T1 Line Repeater with Addressable Loopback Plus
- Westell 3140-80 T1 Office Repeater with Addressable Loopback Plus
- Westell 3150-81 T1 Line Repeater with Addressable Loopback Plus
- Westell 3150-CO T1 Line Repeater with Addressable Loopback Plus
- Westell 3171 T1 Network Interface and Maintenance System-20 (NIMS - 12 bit)
- Westell 3171 T1 Network Interface and Maintenance System-28 (NIMS - 12 bit)
- Westell 3171 T1 Network Interface and Maintenance System-60 (NIMS - 16 bit)
- Westell 3222-40/41 HDSL Remote Terminal Unit (HTU-R)
- Westell 3224-40/41 HDSL Central Office Terminal Unit (HTU-C)
- XEL 7853-000 Mini T1 Line Repeater
- XEL 7854-008 Mini T1 Line Repeater

Use the following procedure to select the intelligent network equipment codes.

1. **LOOP CODES switch**
   Select the PROG position (LED illuminates).

2. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the **AUX LOOPCODE** function.

3. **RESULTS I Results switch**
   Press to select PROG.

4. **RESULTS I Category switch**
   Press to select the equipment type (IOR, ILR, DS1 MSW, etc.).

5. **RESULTS II switches**
   Press the **RESULTS II Category** switch to select the EXCHange code for XEL model 7853-000 intelligent line repeaters. Press the **RESULTS II Results** switch to select the LOCation code for XEL model 7853-000 intelligent line repeaters or the address, commands, etc. for the intelligent network equipment, if applicable.

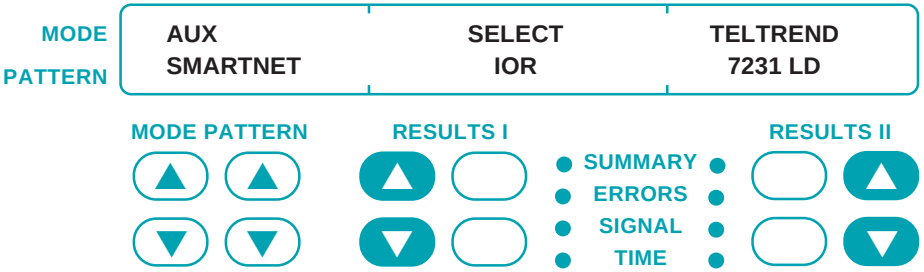
6. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following functions and modes when sending and receiving loop codes:

- AUX PGM LPUP function
- AUX PGM LPDN function
- AUX RESPONSE function
- AUX SMARTNET function
- LOOP CODES switch
- LOOP UP switch
- LOOP DOWN switch

AUX SMARTNET — Intelligent Network Equipment Select

Smart Loopback/Command Codes Option Required



The AUX SMARTNET function selects the intelligent network equipment type by manufacturer and model number, as appropriate. These selections determine what loop codes and commands are available in the AUX LOOPCODE function. This auxiliary function requires the Smart Loopback/Command Codes Option.

When the AUX SMARTNET function is displayed, the **RESULTS I Results** switch is used to select the intelligent network equipment type. The **RESULTS II Category** switch is used to select the manufacturer, while the **RESULTS II Results** switch is used to scroll through the available models supported for the selected manufacturer. All equipment types have a NONE selection for manufacturer/model to indicate that type of equipment is not installed in the network being tested. Refer to Appendix D for tables that list the intelligent network equipment, available addresses, and commands.

Use the following procedure to select the intelligent network equipment type.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX SMARTNET function.

2. **RESULTS I Results switch**
   Press either the up or down arrow to select the appropriate intelligent network equipment type (IOR, ILR, etc.).

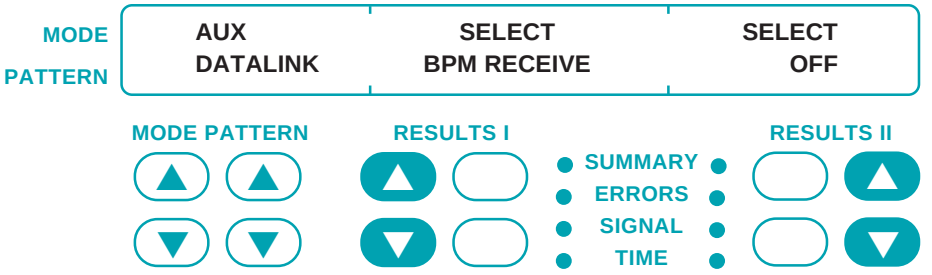
3. **RESULTS II switches**
   Press the **RESULTS II Category** switch to select the specific manufacturer or NONE. Press the **RESULTS II Results** switch to select the model, if applicable.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following functions and modes when selecting an intelligent network equipment type:

- AUX LOOPCODE function
- **LOOP CODES** switch
- **LOOP UP** switch
- **LOOP DOWN** switch

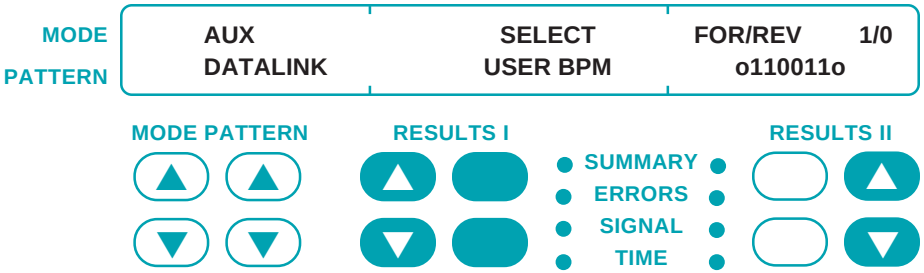
AUX DATALINK — ESF Datalink Features Select



The AUX DATALINK function selects whether or not Bit-Patterned Messages (BPMs) are displayed and accumulated. The AUX DATALINK function also allows the user to program an eight-bit BPM for reception and transmission. This auxiliary function is only available when T1 ESF mode is selected. Press the **RESULTS I Results** switch to select one of the following:

BPM RECEIVE — Press the **RESULTS II Results** switch to toggle the BPM receiver on or off. When the BPM receiver is on, the T-BERD 209*OSP* decodes the BPM, displays the message in the RESULTS display, and adds the BPM results to the Alarms printout. If the BPM receiver is off, the results are not available for display or printout.

USER BPM — The USER BPM position displays an eight-bit number string in the RESULTS II display. The six inner bits can be changed, but the two end bits are always zeros. Press the **RESULTS II Category** switch to highlight the desired bit. Press the **RESULTS II Results** switch up or down arrow, which changes the highlighted bit to a one or a zero, respectively, and automatically advances one bit to the right.



If the Enhanced ESF Option is installed, the AUX DATALINK function is used to select how or if Performance Report Messages (PRMs) are transmitted and whether PRM results are accumulated. Press the **RESULTS I Results** switch to select one of the following:

PRM TRANSMIT — Press the **RESULTS II Results** switch to select one of the following methods of transmitting the PRM.

EMUL CARRIER — Emulates the carrier PRM. This selection sets the PRM C/R bit to one.

EMUL CUSTOMER — Emulates the customer PRM. This selection sets the PRM C/R bit to zero.

OFF — Disables the PRM transmitter.

PRM RECEIVE — Press the **RESULTS II Results** switch to toggle the PRM receiver on or off. When the PRM receiver is on, the T-BERD 209*OSP* reports on the PRM status in the RESULTS display, and the PRM results appear in the Results printout. If the PRM receiver is off, the results are not available for display or printout.

Use the following procedure to select the DATALINK emulation and results availability.

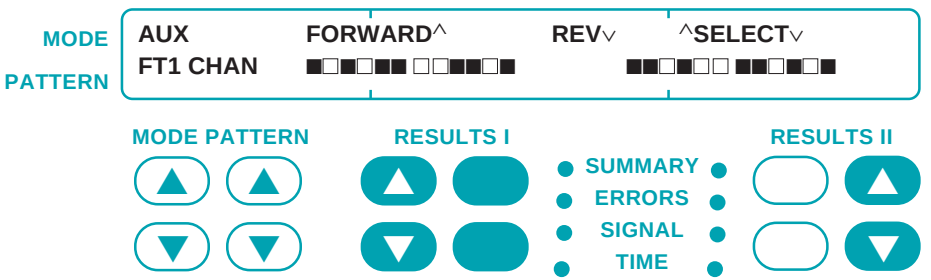
1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX DATALINK function.

2. **RESULTS I Results switch**
   Press either the up or down arrow to scroll through the selections (PRM TRANSMIT, PRM RECEIVE, BPM RECEIVE, USER BPM). Release the switch when the desired selection is displayed.

3. **RESULTS II switches**
   Press the appropriate switch(es) to select and set the parameters.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

AUX FT1 CHAN — Fractional T1 Channel Bandwidth



The AUX FT1 CHAN function selects the FT1 channel bandwidth being tested in FT1 circuits testing. This auxiliary function is only active in the FT1 operating modes (FT1 D4 and FT1 ESF).

Use the following procedure to select the FT1 channels.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX FT1 CHAN function.

2. **RESULTS I Results switch**
   Pressing the **RESULTS I Results** switch up arrow moves from left to right. Pressing the **RESULTS I Results** switch down arrow moves the cursor from right to left. Pressing either arrow after it has reached the end of its range wraps around to the beginning.

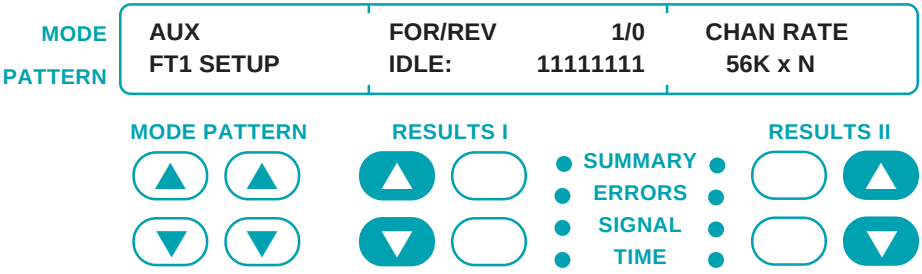
3. **RESULTS II Results switch**
   Pressing the **RESULTS II Results** switch up arrow selects the flashing channel and advances the cursor one channel to the right. Pressing the **RESULTS II Results** switch down arrow deselects the flashing channel and moves the cursor one channel to the right.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following function when setting the FT1 channel bandwidth:

- AUX FT1 SETUP function

AUX FT1 SETUP — Fractional T1 Idle Code and Data Rate Selection



The AUX FT1 SETUP function sets the idle channel code to be transmitted on idle channels and the FT1 channel rate.

The AUX FT1 SETUP selections are:

IDLE — The idle code is always eight bits. One of the bits flashes to indicate that it is in edit mode. To select a different bit to be edited, press the **RESULTS I Results** switch up arrow to move to the right or down arrow to move to the left, or press the **RESULTS I Category** switch up or down arrow, which changes the bit to a one or zero, respectively, and automatically advances one bit to the right.

CHAN RATE — The FT1 channel rate is controlled by the **RESULTS II Results** switch. Press the **RESULTS II Results** switch up or down arrow to toggle between the 56KxN and 64KxN channel rates.

Use the following procedure to set the idle code and FT1 channel rate.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX FTI SETUP function.

2. **RESULTS I Results switch**
   Press the up arrow to move from left to right. Press the down arrow to move from right to left. Pressing either arrow after it has reached the end of its range wraps around to the other end.

3. **RESULTS I Category switch**
   Pressing the up arrow sets the flashing bit to a one and advances one bit to the right. Pressing the down arrow sets the flashing bit to a zero and moves the cursor one bit to the right.

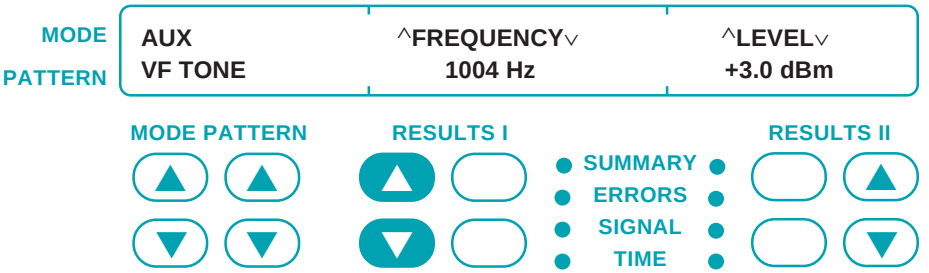
4. **RESULTS II Results switch**
   Press the up or down arrow to toggle the FT1 channel rate.

5. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following function when setting the FT1 setup:

- AUX FT1 CHAN function

AUX VF TONE — VF Tone Select



The AUX VF TONE function sets the transmitted VF tone frequency and level for the selected channel.

When a VF tone is transmitted on an active FT1 channel, an all ones pattern is inserted in the remaining active FT1 channels (if any), and the FT1 Idle Code is inserted in each of the inactive channels. If the channel selected by the AUX VF CHAN function is not an active FT1 channel; the VF tone setting is ignored, an all ones pattern is inserted in all the active FT1 bandwidth channels, and the FT1 Idle Code is inserted in each of the inactive channels.

NOTE: VF tones are available in non-FT1 modes, but the tone is only inserted in the selected DS0 channel (see AUX VF CHAN function).

Use the following procedure to set the VF tone frequency and level.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX VF TONE function.

2. **RESULTS I Results switch**
   Press the up arrow to increase the VF tone frequency. Press the down arrow to decrease the VF tone frequency. The VF tone frequencies are 404 Hz, 1004 Hz, and 2804 Hz at user-selectable tone levels (in dBm) and 2713 Hz at 0.0 dBm only.

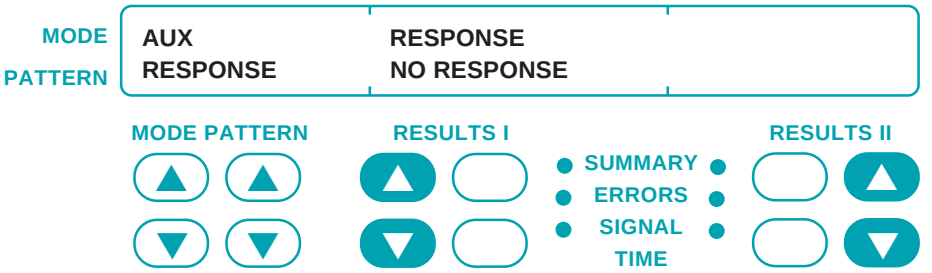
3. **RESULTS II Results switch**
   Press to scroll through and select one of the available VF tone levels: -13.0 dBm, -3.0 dBm, 0.0 dBm, or +3.0 dBm.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following function when setting the VF tone frequency and level:

- AUX VF CHAN function

AUX RESPONSE — Loop Code Response



The AUX RESPONSE function determines whether or not the T-BERD 209*OSP* enters or leaves automatic line loopback mode (AUTO LLB) in response to received loop codes. Press the **RESULTS I Results** switch to select one of the following:

NO RESPONSE — T-BERD 209*OSP* does not respond to received loop codes.

AUTO RESPONSE — T-BERD 209*OSP* automatically responds to received loop codes by enabling or disabling the AUTO LLB mode. The instrument only responds to loop codes matching the loop code selected from the AUX ESF LOOP function. If the T-BERD 209*OSP* is set to T1 TLB or T1 LLB mode, the instrument does not respond to the received loop codes.

In AUTO RESPONSE mode, the T-BERD 209*OSP* enables AUTO LLB after receiving five seconds of in-band loop-up code or after receiving 250 ms of ESF out-of-band loop-up code. AUTO LLB is disabled after receiving the in-band or ESF out-of-band loop-down code. When AUTO LLB is disabled, the instrument returns to the previously selected operating mode. AUTO LLB functions the same as the T1 LLB operating mode which is entered manually from the front panel.

Use the following procedure to select a loop code response mode.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX RESPONSE function.

2. RESULTS I Results switch

Press either the down arrow to select NO RESPONSE or the up arrow to select AUTO RESPONSE.

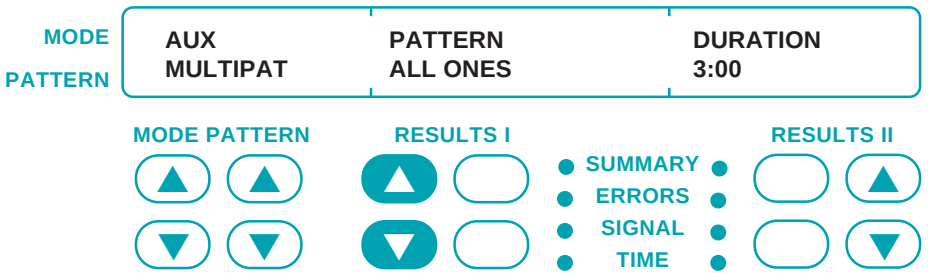
3. AUX switch

Press the **AUX** switch to return to the operating mode.

Consider the following functions when changing AUX RESPONSE:

- AUX LP CODE function
- AUX ESF LOOP function

AUX MULTIPAT — MULTIPAT Pattern Selection and Duration Control



The AUX MULTIPAT function controls the duration of each test pattern of the MULTIPAT test pattern sequence. The test patterns are transmitted when the **PATTERN** switch is set to MULTIPAT.

PATTERN — Press the **RESULTS I Results** switch to select each of the test patterns: ALL ONES, 1:7, 2 IN 8, 3 IN 24, and QRSS.

DURATION — Press the **RESULTS II Results** switch to set the duration of the selected test pattern. The setting 0:00 turns the selected pattern off. For the range 0:00 to 1:00, the duration is set in 15 second steps. For the range of 1:00 to 15:00, the duration is set in one minute steps.

The MULTIPAT pattern can be used in a loopback configuration, or in an end-to-end configuration if the other test set is configured with the same MULTIPAT patterns and durations.

Use the following procedure to change MULTIPAT test pattern duration.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch (up arrow or down arrow) to select the AUX MULTIPAT function.

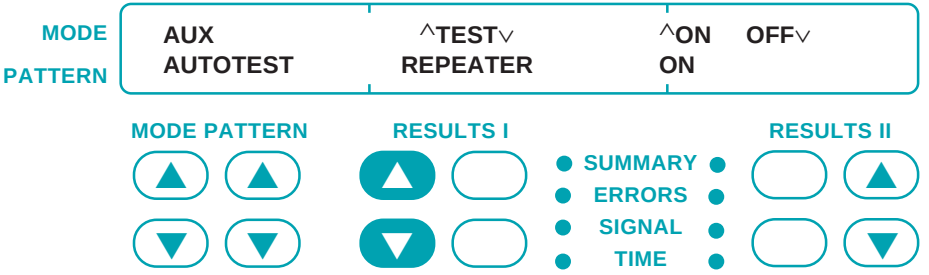
2. **RESULTS I Results switch**
   Press the up or down arrow to scroll through and select the pattern to be changed.

3. **RESULTS II Results switch**
   Press the up arrow to increase the duration or press the down arrow to decrease the duration.

4. **RESULTS I and RESULTS II Results switches**
   Repeat Steps 2 and 3 until all the patterns are set to the desired duration.

5. **AUX switch**
   Press the **AUX** switch to return to the operating mode (**AUX** switch LED extinguished).

AUX AUTOTEST — AUTOTEST Test Selections



The AUX AUTOTEST function allows the operator to select which test(s) are performed when the **AUTOTEST** switch is pressed. The operator can select any or all of the available tests. When each test name appears in the RESULTS I display, the corresponding *ON* or *OFF* condition is shown in the RESULTS II display. The AUX AUTOTEST function selections are:

^TEST∨ — Available tests are VOLTS, OHMS, TDR, REPEATER, AMPS, or BRIDGTAP. VOLTS, OHMS, and AMPS are only available if the DC Measurements Option is installed. TDR is only available if the TDR Measurement Option is installed.

^ON OFF∨ — The default setting for all available tests is ON.

Use the following procedure to set the loopable repeater parameters.

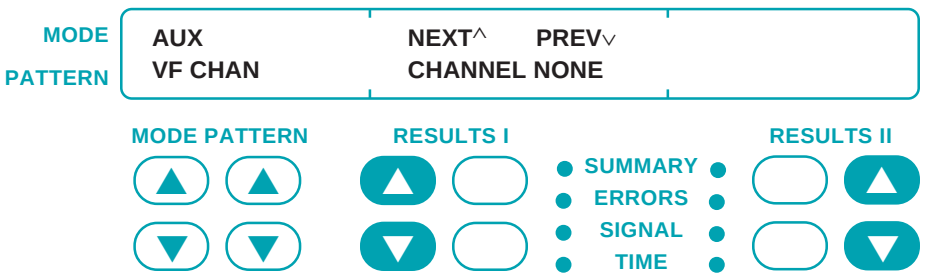
1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX AUTOTEST function.

2. **RESULTS I Results switch**
   Press either the up or down arrow to scroll through the list of available tests. Release the switch to select the displayed test.

3. **RESULTS II Results switch**
   Press the up arrow to add the displayed test to the ones performed when the **AUTOTEST** switch is pressed. Press the down arrow to remove the displayed test from the ones performed when the **AUTOTEST** switch is pressed.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

AUX VF CHAN — Voice Frequency Channel Selection



The AUX VF CHAN function allows you to select which of the 24 DS0 channels can be accessed. When the AUX VF CHAN function is selected, the previously selected channel appears in the RESULTS display. The channel selections are described as follows:

NONE — No DS0 channel will be accessed.

CHANNEL nn — Indicates the channel number (nn is a number from 01 to 24) that will be accessed and available at the RESULTS display and the speaker, as well as the channel into which tones can be inserted.

Use the following procedure to select a DS0 channel to be accessed.

1. **AUX and PATTERN switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **PATTERN** switch to select the AUX VF CHAN function.

2. **RESULTS I Results switch**
   Press either the up or down arrow to scroll through the choices from NONE to 24. Release the switch to select the channel to be accessed.

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode.

Consider the following auxiliary functions and switch when changing the AUX VF CHAN function:

- AUX VOLUME function
- AUX VF TONE function (if Fractional T1 Option is installed)
- **PATTERN** switch

4.3 DLC ANALYZER OPTION — AUXILIARY FUNCTIONS

The DLC Analyzer Option adds the auxiliary functions listed in Table 4-2.

Table 4-2
DLC Analyzer Option Auxiliary Functions

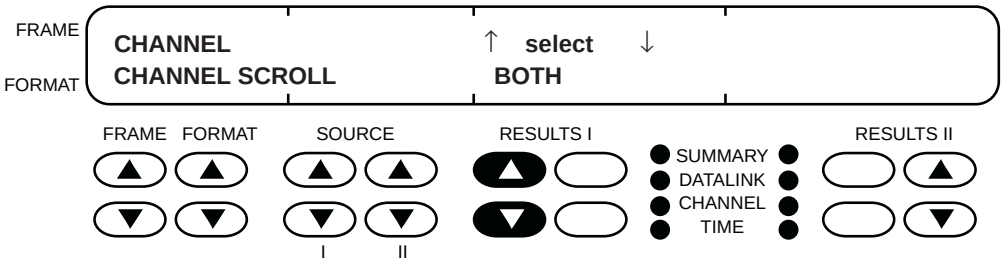
Category	Name	Description
CHANNEL	CHANNEL SCROLL	Channel Scroll Switch Synchronization
CHANNEL	TRUNK TYPE	Type of Switched Trunk
CHANNEL	VF DROP	T1 Source for Channel VF Drop
TRANSMIT	LBO	T1 Transmitter Line Build-Out
TIME	SET TIME	Set the Time of Day
TIME	SET DATE	Set the Date
MISC	VOLUME	Set Speaker Volume

Auxiliary functions are scrolled through and selected by pressing the **FRAME** switch. When the **AUX** switch is pressed, the LED within the switch illuminates and the character display changes as follows:

- The last selected auxiliary function appears in the FRAME and FORMAT displays. If this is the first use of the auxiliary functions since a NOVRAM reset or the initial power up of the instrument, *CHANNEL* appears in the FRAME display and *CHANNEL SCROLL* appears in the FORMAT display.

- The auxiliary function's parameters appear in the RESULTS I and II displays. If there is only one parameter selection, the RESULTS I display is used, and the RESULTS II display is cleared.

CHANNEL/CHANNEL SCROLL — Channel Scroll Switch Synchronization



The CHANNEL SCROLL auxiliary function determines how the **PRIMARY CHANNEL** and **SECONDARY CHANNEL** switches scroll through the channel or timeslot numbers.

Select — Press the **RESULTS I Results** switch to select one of the following:

BOTH — Pressing either switch changes both channel or timeslot numbers simultaneously.

SEPARATE — The two switches operate independently of each other.

Use the following procedure to change the channel scroll setting.

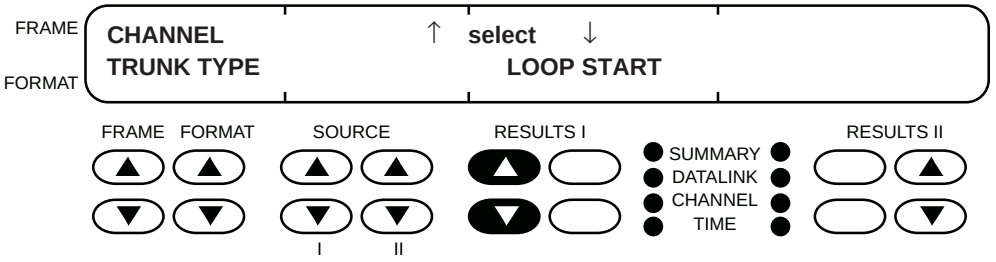
1. **AUX and FRAME switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FRAME** switch to select the CHANNEL auxiliary functions.

2. **FORMAT switch**
   Press the **FORMAT** switch to select the CHANNEL SCROLL auxiliary function.

3. **RESULTS I Results switch**
   Press either the up or down arrow to select LOOP START, GND START, or WINK START.

4. **AUX switch**
   Press the **AUX** switch to return to the previous mode.

CHANNEL/TRUNK TYPE — Type of Switched Trunk



The TRUNK TYPE auxiliary function selects the trunk type signaling generated by the **ON HOOK, OFF HOOK,** and **RING** switches. The DLC Analyzer Option is only configured to simulate the station end of a circuit and assumes the far end is sending office supervision signaling. The **RING** switch transmits office signaling. This auxiliary function is active in all framing modes except SLC-M2.

Select — Press the **RESULTS I Results** switch to select one of the following:

> ***LOOP START*** — Enables the DLC Analyzer Option to emulate or monitor standard signaling between a telephone and switch.
>
> ***GND START*** — Enables the DLC Analyzer Option to emulate or monitor a ground start foreign exchange or a SLC circuit.
>
> ***WINK START*** — Enables the DLC… <see last page "11" of Section 4.2 **PAGEMAKER CHANGES.**

Use the following procedure to change the trunk type setting.

1. **AUX and FRAME switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FRAME** switch to select the CHANNEL auxiliary functions.

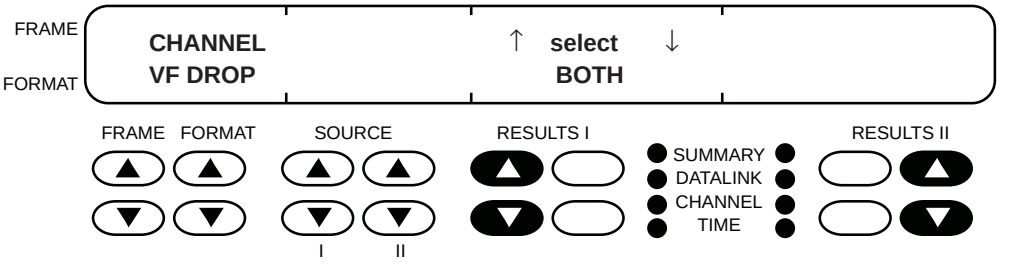
2. **FORMAT switch**
   Press the **FORMAT** switch to select the TRUNK TYPE auxiliary function.

3. **RESULTS I Results switch**
   Press either the up or down arrow to select LOOP START, GND START, or WINK START.

4. AUX switch

Press the **AUX** switch to return to the previous mode.

CHANNEL/VF DROP — T1 Source for Channel VF Drop



The VF DROP auxiliary function selects the T1 input source for the channel dropped to the speaker, VF OUT jack, and 2-WIRE VF interface. The auxiliary function also determines which input source(s) has active DTMF digit decoding and VF measurements.

Press the **RESULTS I Results** switch on the DLC Analyzer Option front panel to select one of the following:

PRIMARY — The DS0 channel is dropped from the PRIMARY RECEIVE input.

SECONDARY — The DS0 channel is dropped from the SECONDARY RECEIVE input.

BOTH — The DS0 channel is dropped from both the PRIMARY and SECONDARY RECEIVE inputs.

The CHANNEL category VF LEVEL, VF FREQ, and DTMF SEQ results measure the VF level and frequency and report the DTMF sequence for the selected line. When BOTH is selected, the VF FREQ result is not applicable.

Use the following procedure to change the VF drop setting.

1. AUX and FRAME switch

Press the **AUX** switch to activate the auxiliary functions. Press the **FRAME** switch to select the CHANNEL auxiliary functions.

2. FORMAT switch

Press the **FORMAT** switch to select the VF DROP auxiliary function.

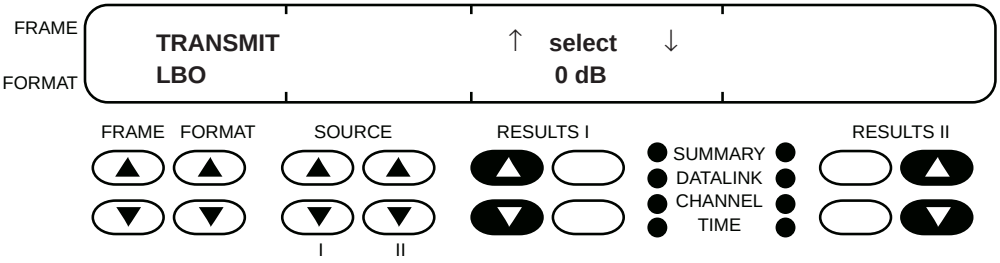
3. RESULTS I Results switch

Press either the up or down arrow to select PRIMARY, SECONDARY, or BOTH.

4. AUX switch

Press the **AUX** switch to return to the previous mode.

TRANSMIT/LBO — T1 Transmitter Line Build-Out



The LBO auxiliary function sets the transmitter LBO. Press the **RESULTS I Results** switch to select 0 dB, -7.5 dB, or -15.0 dB.

Use the following procedure to change the LBO setting.

1. AUX and FRAME switch

Press the **AUX** switch to activate the auxiliary functions. Press the **FRAME** switch to select the TRANSMIT/LBO auxiliary functions.

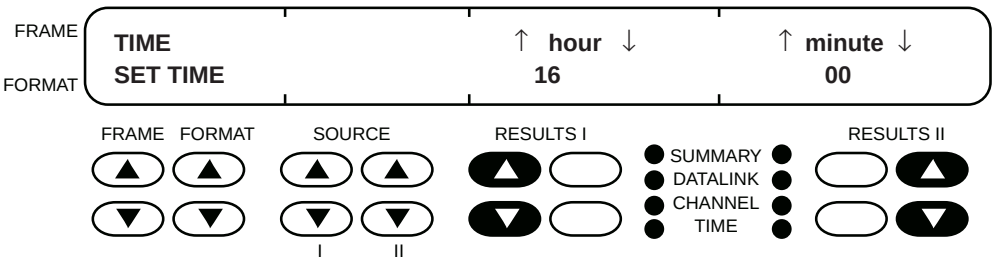
2. RESULTS I Results switch

Press either the up or down arrow to select 0 dB, -7.5 dB, or -15 dB.

3. AUX switch

Press the **AUX** switch to return to the previous mode.

TIME/SET TIME — Set Time of Day



The SET TIME auxiliary function sets the time (in 24-hour format) for the battery-backed clock. The current time appears in the TIME category, TIME result.

Hour — Press the **RESULTS I Results** switch to set the current hour from 0 to 23 hours.

Minute — Press the **RESULTS II Results** switch to set the current minutes from 0 to 59 minutes.

Use the following procedure to change the time.

1. **AUX and FRAME switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FRAME** switch to select the TIME auxiliary functions.

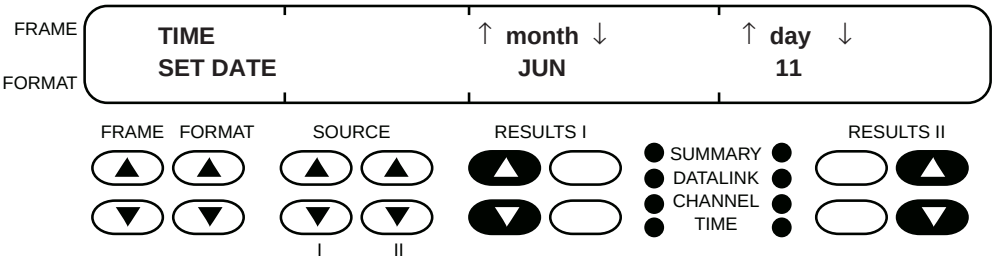
2. **FORMAT switch**
   Press the **FORMAT** switch to select the SET TIME auxiliary function.

3. **RESULTS I Results switch**
   Press either the up or down arrow to set the current hour from 0 to 23 hours.

4. **RESULTS II Results switch**
   Press either the up or down arrow to set the current minute from 0 to 59 minutes.

5. **AUX switch**
   Press the **AUX** switch to return to the previous mode.

TIME/SET DATE — Set Date



The SET DATE auxiliary function sets the month and day for the battery-backed clock. The current month and day appear in the TIME category, DATE result.

Month — Press the **RESULTS I Results** switch to set the current month from JAN to DEC.

Day — Press the **RESULTS II Results** switch to set the current day of the month from 1 to 31.

Use the following procedure to change the date.

1. **AUX and FRAME switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FRAME** switch to select the TIME auxiliary functions.

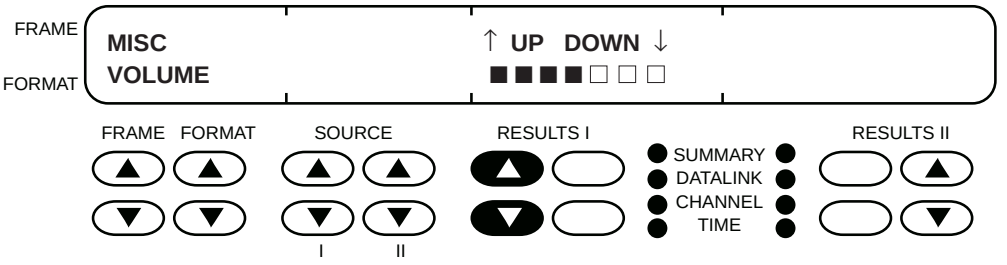
2. **FORMAT switch**
   Press the **FORMAT** switch to select the SET DATE auxiliary function.

3. **RESULTS I Results switch**
   Press either the up or down arrow to set the current month from JAN to DEC.

4. **RESULTS II Results switch**
   Press either the up or down arrow to set the current day from 1 to 31.

5. **AUX switch**
   Press the **AUX** switch to return to the previous mode.

MISC/VOLUME — Set Volume



The VOLUME auxiliary function sets the volume for the internal speaker. A seven-box, bar-graph in the RESULTS I display shows the relative volume by filling in the boxes. The boxes are filled from left to right. If none of the boxes are filled, the speaker is turned off. If all boxes are filled, the volume is at maximum.

Use the following procedure to change the volume.

1. **AUX and FRAME switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FRAME** switch to select the MISC auxiliary functions.

2. **FORMAT switch**
   Press the **FORMAT** switch to select the VOLUME auxiliary function.

3. **RESULTS I Results switch**
   Press the up arrow to increase the volume or the down arrow to decrease the volume.

4. **AUX switch**
   Press the **AUX** switch to return to the previous mode (**AUX** switch LED extinguished).

4.4 ISDN/DDS ANALYZER OPTION — AUXILIARY FUNCTIONS

The ISDN/DDS Analyzer Option adds the auxiliary functions listed in Table 4-3.

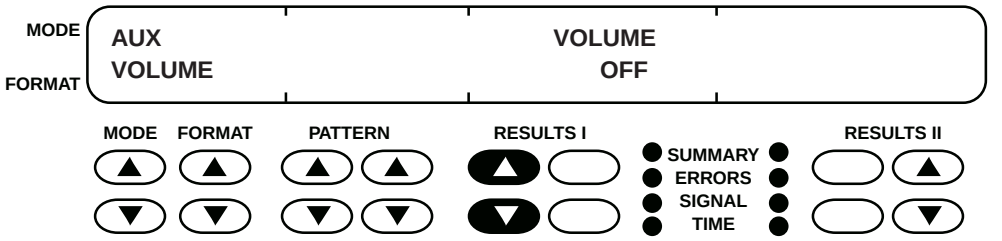
Table 4-3
ISDN/DDS Analyzer Option Auxiliary Functions

Auxiliary Function	Description
VOLUME	Enables/disables speaker
BUF CLR (Buffer Clear)	Clears Print Buffer
RS-232	Sets Baud Rate, Parity, and Termination Character for Printer Output
CLOCK	Sets Time and Date for the Clock/ Calendar
RESPONSE	Enables/Disables Loopback Response

When the **AUX** switch is pressed, the LED within the switch illuminates and the character display changes as follows:

- The last selected auxiliary function appears in the MODE and FORMAT displays.
- The parameters of the auxiliary functions appear in the RESULTS I and II displays. If there is only one parameter selection, the RESULTS I display is used, and the RESULTS II display is cleared.
- Auxiliary functions are scrolled through and selected by pressing the **FORMAT** switch.

VOLUME — Enables/disables speaker



The VOLUME auxiliary function enables or disables the speaker.

Select — Press the **RESULTS I Results** switch to select one of the following:

ON — Turns the speaker On.

OFF — Turns the speaker Off.

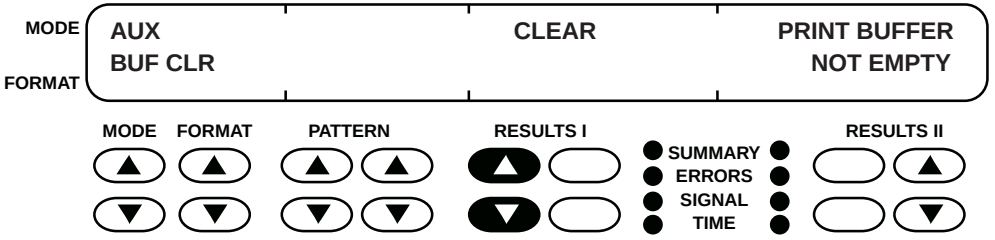
Use the following procedure to change the speaker setting.

1. **AUX and FORMAT switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FORMAT** switch to select the VOLUME auxiliary function.

2. **RESULTS I Results switch**
   Press the up or down arrow to select either ON or OFF. The speaker beeps each time the switch is pressed.

3. **AUX switch**
   Press the **AUX** switch to return to the previous mode.

BUF CLR — Clears Print Buffer



The BUF CLR (Buffer Clear) auxiliary function is used to clear the print buffer. When this function is selected and the buffer contains stored results, the message "PRINT BUFFER NOT EMPTY" is displayed. When the print buffer is empty, the message "PRINT BUFFER EMPTY" is displayed.

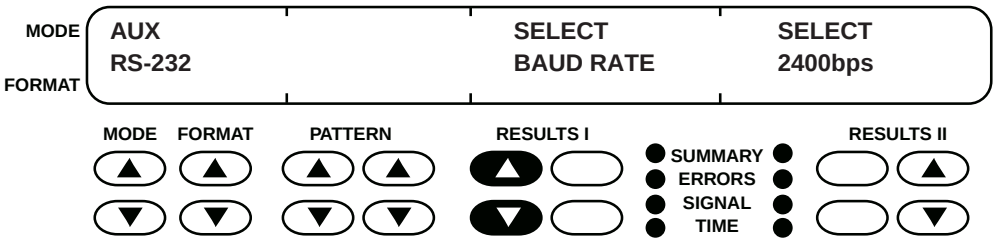
Use the following procedure to change the speaker setting.

1. **AUX and FORMAT switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FORMAT** switch to select the BUF CLR auxiliary function.

2. **RESULTS I Results switch**
   Press the up or down arrow to clear the print buffer.

3. **AUX switch**
   Press the **AUX** switch to return to the previous mode.

RS-232 — Sets Baud Rate, Parity, and Termination Character for Printer Output



The RS-232 (RS-232 AUX Port Configuration) auxiliary function enables the user to select the baud rate, parity, and termination character(s) for the RS-232 printer output. The baud rates available are: 300, 1200, 2400, 4800, and 9600. Parity can be set to NONE, ODD, or EVEN. The termination character selections are CR (Carriage Return), or CRLF (Carriage Return and Line Feed).

Use the following procedure to change the RS-232 settings.

1. **AUX and FORMAT switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FORMAT** switch to select the RS-232 auxiliary functions.

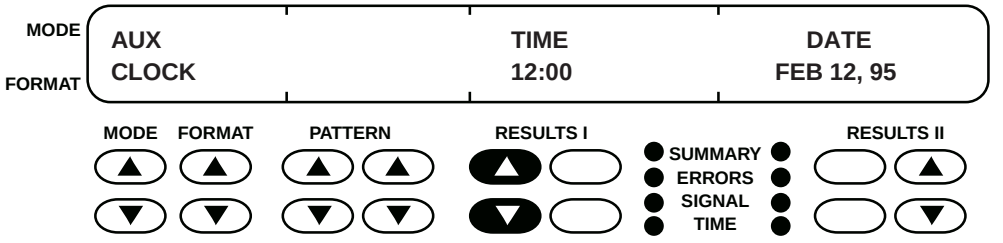
2. **RESULTS I Results switch**
   Press either the up or down arrow to select BAUD RATE, PARITY, or TERM 232 parameter function.

3. **RESULTS II Results switch**
   Press either the up or down arrow to select the desired value for the selected parameter.

NOTE: Repeat steps 2 and 3 until all parameters have been configured.

4. **AUX switch**
   Press the **AUX** switch to return to the previous mode.

CLOCK — Sets Time and Date for Clock/Calendar



The CLOCK auxiliary function sets the time (in 24-hour format) and date for the clock/calendar. The clock/calendar is updated as soon as the user completes making the required entries.

Use the following procedure to change the time.

1. **AUX and FORMAT switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FORMAT** switch to select the TIME auxiliary functions.

2. **CATEGORY I Category switch**
   Press the up or down arrow to select hours.

3. **RESULTS I Results switch**
   Press either the up or down arrow to set the current hour from 0 to 23 hours.

4. **CATEGORY I Category switch**
   Press the up or down arrow to select minutes.

5. **RESULTS I Results switch**
   Press either the up or down arrow to set the current minute from 0 to 59 minutes.

6. **CATEGORY II Category switch**
   Press either the up or down arrow to select month.

7. **RESULTS II Results switch**
   Press either the up or down arrow to set the current month from JAN to DEC.

8. **CATEGORY II Category switch**
   Press either the up or down arrow to select day.

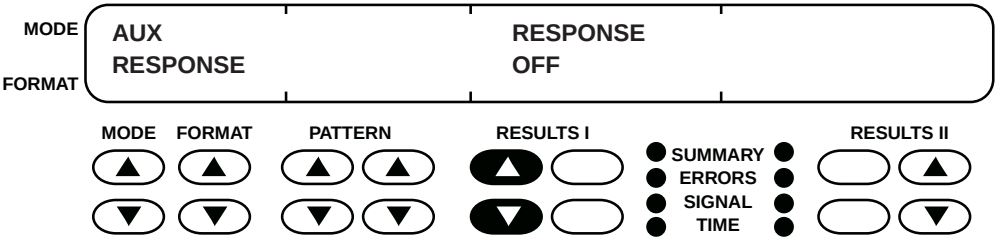
9. **RESULTS II Results switch**
   Press either the up or down arrow to set the current day.

10. **CATEGORY II Category switch**
    Press either the up or down arrow to select year.

11. **RESULTS II Results switch**
    Press either the up or down arrow to set the current year.

12. **AUX switch**
    Press the **AUX** switch to return to the previous mode.

RESPONSE — Enables/Disables Loopback Response (DDS mode only)



The RESPONSE auxiliary function enables or disables loopback response. If the ISDN/DDS Analyzer Option is configured for RESPONSE ON and detects the appropriate DDS loopback command, the unit enters AUTO LLB mode within three seconds.

Use the following procedure to set the response .

1. **AUX and FORMAT switch**
   Press the **AUX** switch to activate the auxiliary functions. Press the **FORMAT** switch to select the RESPONSE auxiliary function.

2. **RESULTS I Results switch**
   Press the up or down arrow to set response either ON or OFF

3. **AUX switch**
   Press the **AUX** switch to return to the previous mode.

TEST RESULTS

5.1 MAINFRAME — TEST RESULTS

The T-BERD 209*OSP* measurements and test results are displayed in the RESULTS I and RESULTS II displays. The two RESULTS displays allow two different results to be shown at the same time.

The categories are selected with the **RESULTS I** and **RESULTS II Category** switches. Pressing the **RESULTS I** or **II Category** switch illuminates a Category LED and displays the previously selected result for that category. The test results in each selected category are displayed by pressing the **RESULTS I** and **II Results** switches.

The four categories and the available results are:

SUMMARY Category

Mainframe	Enhanced ESF Option
BIT ERRORS	FAR FRM ES
VIOLATIONS	FAR FRM SES
FRM ERRORS	FAR BPV SEC
CRC ERRORS	FAR SLP SEC
RX FREQ, Hz	FAR CRC ERR
TIMING SLIP	

ERRORS Category

Mainframe	Enhanced ESF Option
BIT ERRORS	FAR FRM ES
BIT ERR SEC	FAR FRM SES
BIT ERR RATE	FAR BPV SEC
VIOLATIONS	FAR SLP SEC
BPV SECONDS	FAR PRM TIME
BPV RATE	FAR CRC ERR
FRM ERRORS	FCRC 1
FRM ERR SEC	FCRC 2-5
FRM ERR RATE	FCRC 6-10
CRC ERRORS	FCRC11-100
CRC ERR SEC	FCRC101-319
CRC ERR RATE	FCRC>319
	PAY SRC

SIGNAL Category

Mainframe	Channel Monitor Option
RX FREQ, HZ	TRAFFIC
RX LEVEL (dBdsx)	DATA BITS
RX LEVEL (Vp-p)	
SPX CURRENT	
TIMING SLIP	

TIME Category

Mainframe
SIG LOS SEC
TEST LENGTH
ELAPSED TIME
TEST END IN
CLOCK TIME
DATE
BATTERY CHARGE

NON-CATEGORY TEST RESULTS (ALL CATEGORY LEDs OFF)

DC TESTS	TDR
VOLTS	FAULT: NONE
OHMS	FLT 1-1: OPEN/AT #### FEET
TIP-GND	FLT 1-1: SHORT/AT #### FEET
RING-GND	FLT 1-1: B-TAP/AT #### FEET
TIP-RING	FLT 1-1: UNREC/AT #### FEET
AMPS	FLT 1-#: XXXXX/AT #### FEET

5.2 MAINFRAME — SUMMARY CATEGORY

The SUMMARY category displays key non-zero and out-of-specification test results without having to change categories.

When the **RESULTS I Category** switch is set to SUMMARY, the RESULTS I display automatically scrolls through the affected SUMMARY category results. Press either **RESULTS I Results** switch (up arrow or down arrow) to temporarily pause the scrolling. The RESULTS II display does not automatically scroll.

BIT ERRORS

Bit Errors — A count of received bits which have a value opposite that of the corresponding transmitted bits (one or zero) after pattern synchronization is achieved.

VIOLATIONS

Bipolar Violation Count — A count of BPVs detected since the start of the test (excluding intentional violations found within B8ZS coding).

FRM ERRORS

Frame Errors — A count of the frame errors detected since the start of the test and after frame synchronization was achieved. For T1 D1D and T1 D4 framing, frame errors are counted if either an F_t or an F_S frame bit is in error. For T1 SLC framing, frame errors are counted only if an error is found on an F_t bit.

CRC ERRORS

Cyclic Redundancy Check (CRC) Errors — A count of CRC errors detected. CRC errors are counted only when ESF framing is present in the received T1 data.

RX FREQ, HZ

Received Frequency in Hz — The frequency of the clock measured from the received data.

TIMING SLIP

Timing Slips — The number of bit slips and framing slips counted when the RECEIVER input has slipped from the T1 REF input. Timing slips are displayed as the number of framing slips plus the number of bit slips (###FRM ###BIT). Each framing slip equals 193 bit slips.

In addition to test results, the following status messages appear in the SUMMARY category as required.

ALL RESULTS OK — This message is displayed when all summary results are error-free or meet specification boundaries.

SIGNAL LOSS — This message is displayed when the received signal has been lost. The RESULTS I display alternates between the selected test result and *SIGNAL LOSS* until the signal returns.

B8ZS DETECTED — This message is displayed when the **B8ZS** switch is set to the AMI position and B8ZS coding is detected in the received signal.

NOT B8ZS COMPATIBLE — This message is displayed when the **B8ZS** switch is set to the B8ZS position, the selected pattern is ALL ZERO, and the instrument receives the sequence 0001 1011. This sequence occurs if a non-B8ZS compatible piece of equipment regenerates the transmitted signal.

In the ESF operating mode, the following Bit-Patterned Messages (BPMs) appear in the SUMMARY category if BPM RECEIVE is set to ON in the AUX DATALINK function.

NOT FOR SYNC— Do not use for synchronization timing.
SONET— SONET clock traceable.
STRATUM 1 — Stratum 1 traceable.
STRATUM 2 — Stratum 2 traceable.
STRATUM 3 — Stratum 3 traceable.
STRATUM 4 — Stratum 4 traceable.
SYNC UNKNOWN — Synchronization quality unknown.
USER — User-programmable BPM is being received (refers to the eight-bit USER BPM).

The following SUMMARY category PRM test results are received from the ESF datalink. The Enhanced ESF Option is required for these test results. If a "~" (tilde symbol) precedes a far end test result, it indicates the results are an approximate value due to lost PRMs.

FAR FRM ES

Far-End Frame Error Seconds — A count of the seconds in which one or more frame errors occurred in the received signal at the far end. This result reports on the PRM Frame-Synchronization-Bit Error Event Bit (FE = 1) status.

FAR FRM SES

Far-End Severely Errored Framing Seconds — A count of the seconds in which two or more frame errors occurred in less than 3 ms in the received signal at the far end. This result reports on the PRM Severely-Errored Framing Event Bit (SE = 1) status.

FAR BPV SEC

Far-End BPV Seconds — A count of the seconds in which one or more BPVs occurred in the received signal at the far end. This result reports on the PRM Line-Code Violation Event Bit (LV = 1) status.

FAR SLP SEC

Far-End Controlled Slip Seconds — A count of the seconds in which controlled slips occurred in the received signal at the far end. This result reports on the PRM Controlled-Slip Event Bit (SL = 1) status.

FAR CRC ERR

Far-End CRC Error Events — A count of the minimum number of CRC errors reported in the FCRC results. A ">" (greater than) preceding the count indicates that the Bins 2 through 6 are non-zero (see ERRORS Category). This result reports on the PRM CRC Error Event Bits (G1 to G6) status.

FAR PRM TIME

Far-End PRM Time — A count of the seconds, since the last test restart, during which a valid PRM was received. This result is displayed in the format HHH:MM:SS.

5.3 MAINFRAME — ERRORS CATEGORY

The following ERRORS category results are based on a bit error count. These results are updated each time a bit error is detected in the currently selected data pattern. When pattern synchronization is lost, the bit error count is frozen.

BIT ERRORS

Bit Errors — A count of received bits which have a value opposite that of the corresponding transmitted bits (one or zero) after pattern synchronization is achieved.

BIT ERR SEC

Bit Errored Seconds — A count of test seconds where one or more bit errors occurred.

BIT ERR RATE

Bit Error Rate — The ratio of detected bit errors to the number of data bits after pattern synchronization is achieved.

VIOLATIONS

Bipolar Violation Count — A count of BPVs detected since the start of the test (excluding intentional violations found within B8ZS coding).

BPV SECONDS

BPV Seconds — A count of the seconds within which one or more BPVs occurred.

BPV RATE

BPV Rate — The ratio of BPVs to the number of data bits received.

FRM ERRORS

Frame Errors — A count of the frame errors detected since the start of the test and after frame synchronization was achieved. For T1 D1D and T1 D4 framing, frame errors are counted if either an F_t or an F_s frame bit is in error. For T1 SLC framing, frame errors are counted only if an error is found on an F_t bit.

FRM ERR SEC

Frame Errored Seconds — A count of the seconds during which one or more frame errors occurred.

FRM ERR RATE

Frame Error Rate — The ratio of frame errors to the number of analyzed framing bits.

CRC ERRORS

Cyclic Redundancy Check (CRC) Errors — A count of CRC errors detected. CRC errors are counted only when ESF framing is present in the received T1 data.

CRC ERR SEC

CRC Errored Seconds — A count of seconds within which one or more CRC errors are detected.

CRC ERR RATE

CRC Error Rate — A count of CRC errors divided by the total number of ESF superframes analyzed.

In the ESF operating mode, the following BPM results are available if BPM RECEIVE is set to ON in the AUX DATALINK function.

NOT FOR SYNC

Not for Synchronization — A received BPM message stating timing source is not suitable for synchronization.

SONET

SONET Clock Traceable — A received BPM message stating timing is recognized as a SONET clock.

STRATUM 1

Stratum 1 Clock Traceable — A received BPM message stating timing is recognized as a Stratum 1 clock.

STRATUM 2

Stratum 2 Clock Traceable — A received BPM message stating timing is recognized as a Stratum 2 clock.

STRATUM 3

Stratum 3 Clock Traceable — A received BPM message stating timing is recognized as a Stratum 3 clock.

STRATUM 4

Stratum 4 Clock Traceable — A received BPM message stating timing is recognized as a Stratum 4 clock.

SYNC UNKNOWN

Synchronization Quality Unknown — A received BPM message stating the synchronization timing is either unknown, or the signal is asynchronous.

USER

User BPM Detected — A received BPM message stating timing is recognized as an eight-bit user-programmable BPM.

If the Enhanced ESF Option is installed, the following PRM test results are available when an ESF mode is selected.

FAR FRM ES

Far-End Frame Error Seconds — A count of the seconds in which one or more frame errors occurred in the received signal at the far end. This result reports on the PRM Frame-Synchronization-Bit Error Event Bit (FE = 1) status.

FAR FRM SES

Far-End Severely Errored Framing Seconds — A count of the seconds in which two or more frame errors occurred in less than 3 ms in the received signal at the far end. This result reports on the PRM Severely-Errored Framing Event Bit (SE = 1) status.

FAR BPV SEC

Far-End BPV Seconds — A count of the seconds in which one or more BPVs occurred in the received signal at the far end. This result reports on the PRM Line-Code Violation Event Bit (LV = 1) status.

FAR SLP SEC

Far-End Controlled Slip Seconds — A count of the seconds in which controlled slips occurred in the received signal at the far end. This result reports on the PRM Controlled-Slip Event Bit (SL = 1) status.

FAR CRC ERR

Far-End CRC Error Events — A count of the minimum number of CRC errors reported in the FCRC results. A “>” (greater than) preceding the count indicates that the Bins 2 through 6 are non-zero. This result reports on the PRM CRC Error Event Bits (G1 to G6) status.

FCRC 1

Far-End CRC 1 Bin — A count of the seconds with only one CRC error reported in the received signal at the far end. This result reports on the first PRM CRC Error Event Bit (G1 = 1) status.

FCRC 2-5

Far-End CRC 2 to 5 Bin — A count of the seconds with two to five CRC errors reported in the received signal at the far end. This result reports on the second PRM CRC Error Event Bit (G2 = 1) status.

FCRC 6-10

Far-End CRC 6 to 10 Bin — A count of the seconds with six to ten CRC errors reported in the received signal at the far end. This result reports on the third PRM CRC Error Event Bit (G3 = 1) status.

FCRC 11-100

Far-End CRC 11 to 100 Bin — A count of the seconds with 10 to 100 CRC errors reported in the received signal at the far end. This result reports on the fourth PRM CRC Error Event Bit (G4 = 1) status.

FCRC 101-319

Far-End CRC 1 Bin — A count of the seconds with 101 to 319 CRC errors reported in the received signal at the far end. This result reports on the fifth PRM CRC Error Event Bit (G5 = 1) status.

FCRC >319

Far-End CRC 320 to 333 Bin — A count of the seconds with 320 to 333 CRC errors reported in the received signal at the far end. This result reports on the sixth PRM CRC Error Event Bit (G6 = 1) status.

PAY 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 payload loopback applications, the customer generated PRM in indicated as CUST LOOP (C/R = 0 and LB = 1) when the customer is looped back and the carrier generated PRM is indicated as CARR LOOP (C/R = 1 and LB = 1) when the carrier is looped back.

FAR PRM TIME

Far-End PRM Time — A count of the seconds, since the last test restart, during which a valid PRM was received. This result is displayed in the format HHH:MM:SS.

5.4 MAINFRAME — SIGNAL CATEGORY

The following SIGNAL category results analyze the characteristics of the input signal.

RX FREQ, HZ

Received Frequency in Hz — The frequency of the clock measured from the received data.

RX LEVEL

Received Signal Level in dBdsx — The level of the received signal in dB relative to a standard 6-volt peak-to-peak signal (dBdsx).

RX LEVEL

Received Signal Level in Volts — The level of the received signal in peak-to-peak volts. The signal level is displayed as Vp-p or mVp-p when it is higher or lower than one volt, respectively.

SPX CURRENT

Simplex Current — The magnitude of the simplex current flowing between the transmit output tip and ring and the receive input tip and ring. Simplex current is displayed as the sum of tip current and ring current. The simplex current measurement is not available when the T-BERD T1 Repeater Adaptor is used.

TIMING SLIP

Timing Slips — The number of bit slips and framing slips counted when the RECEIVER input has slipped from the T1 REF input. Timing slips are displayed as the number of framing slips plus the number of bit slips (###FRM ###BIT). Each framing slip equals 193 bit slips.

5.5 MAINFRAME — TIME CATEGORY

The following TIME category results offer time-related measurements.

SIG LOS SEC

Signal Loss Seconds — A count of test seconds during which the signal was not present or during which one or more signal losses occurred.

TEST LENGTH

Test Length — The current test length for a timed test, in HHH:MM:SS format.

ELAPSED TIME

Elapsed Time — The number of hours, minutes, and seconds in HHH:MM:SS format (1) since a valid frequency and level has been detected or (2) since the last major switch change.

TEST END IN

Test End In — Time remaining in a timed test, in HHH:MM:SS format.

CLOCK TIME

Clock Time — The time of day in HH:MM:SS format.

DATE

Date — The date in MMM DD format.

BATTERY CHARGE

Battery Charge — Relative level of battery power remaining. This value is displayed using six boxes. The far left is marked by an *E* for empty, and the far right is marked by an *F* for fully charged. The level of battery power is the number of filled boxes from left to right. This result is only valid when the T-BERD 209*OSP* is operating on battery power.

5.6 DLC ANALYZER OPTION — TEST RESULTS

The DLC Analyzer Option performs a variety of measurements and provides a number of channel and datalink results. The measurements and test results are displayed in the RESULTS windows. This allows two different results to be displayed at the same time.

The categories are selected with the **RESULTS I** and **RESULTS II Category** switches. Pressing the **RESULTS I** or **II Category** switch illuminates a Category LED and displays the previously selected result for that category. The test results in each selected category are displayed by pressing the **RESULTS I** and **II Results** switches.

Most results are preceded with either a “P” or an “S” to indicate the input source, PRIMARY RECEIVE or SECONDARY RECEIVE.

SUMMARY Category

Flashing Messages
P/S DATALINK SYNC LOSS
P/S SIGNAL LOSS
SW PROT FAILED
OPTION NOT INSTALLED

Maintenance Messages
P/S MAINT HOOK/SEIZE
P/S MAINT PROCEED
P/S MAINT TEST ALARM

Current Alarm Messages
P/S ALARM SHELF x
P/S FE LOOP PROTECT
P/S FE LOOP SHELF x
P/S MAJOR ALM
P/S MAJOR SHELF x
P/S MINOR ALM
P/S PWR/MISC
P/S SHELF x ON PROT

T1 Signal Errors
P/S VIOLATION
P/S FRM ERROR
P/S CRC ERROR (ESF framing only)

PBX WINK
P/S WINK CNT

DATALINK Category

Alarm Messages
P/S MAJOR SHELF x
P/S MAJOR ALM
P/S ALARM SHELF x
P/S SHELF x ON PROT
P/S FE LOOP PROTECT
P/S FE LOOP SHELF x
P/S MINOR ALM
P/S PWR/MISC

Maintenance Messages
P/S MAINT HOOK/SEIZE
P/S MAINT PROCEED
P/S MAINT TEST ALARM

Datalink Results
P/S SLC A SEC
P/S DL BITS
P/S ALM FIELD

CHANNEL Category

Channel Signaling
P/S TRAFFIC CHANNEL AB
P/S TRAFFIC CHANNEL ABCD
P/S TRAFFIC TIMESLOT AB
P/S TS CHAN

PBX WINK
P/S WINK CNT

VF Results
P/S VF LEVEL
P/S VF FREQ
P/S DATA BITS
DTMF SEQ

TIME Category

TIME
DATE
P/S SIG L SEC

5.7 DLC ANALYZER OPTION — SUMMARY CATEGORY

During the test, the SUMMARY category displays key non-zero or alarm message results. When an error or alarm is detected, the appropriate result appears in the SUMMARY category window. The SUMMARY category results are divided into four types of results: flashing messages, alarm messages, maintenance test messages, and T1 signal errors. The "x" in some of the results indicates a shelf or line designation, A, B, C, D, or PROTECT.

Flashing Messages

Flashing messages appear in the RESULTS I window indicating a signal loss, switching failure, or an option not installed. When a full-screen result appears, the flashing messages are not displayed. Depending on the message, some flash in the display once, while others flash until the condition is resolved.

P/S SIGNAL LOSS

Signal Loss — This message indicates the T1 signal has been lost after initial signal presence on the indicated receiver. The message flashes until the signal returns (T1 Pulses LED illuminated).

P/S DATALINK SYNC LOSS

Datalink Synchronization Loss — This message indicates that datalink synchronization has been lost after initial datalink synchronization. The message flashes until datalink synchronization is regained.

SW PROT FAILED

Switch to Protection Line Failed — This message indicates a switch to protect request cannot be completed. The message flashes once with each occurrence.

OPTION NOT INSTALLED

Option Not Installed — An option is not currently installed or available. The message flashes once with each attempt.

Alarm Messages

Alarm messages only appear in the SUMMARY category as they occur. The following alarm messages also appear in the DATALINK category as a current and historical record. The alarms are listed in a prioritized order. Higher priority messages supersede the lower priority messages.

P/S MAJOR SHELF x

Major Alarm on Shelf x — This message indicates a system state that is characterized by a loss of service to the subscribers served by a shelf or shelf group (x = A, B, C, or D).

P/S MAJOR ALM

Major Alarm — This message indicates a system state that is characterized by a loss of service to the subscribers with no associated shelf alarm.

P/S ALARM SHELF x

Shelf Alarm on Shelf x — This message indicates a system state that is characterized by a loss of service to the subscribers served by the indicated shelf (x = A, B, C, or D).

P/S SHELF x ON PROT

Shelf x on Protection Line — This message indicates that one of the shelves has switched to the protection line (x = A, B, C, or D).

P/S FE LOOP SHELF x

Far-End Loop on Shelf x — This message indicates that a request is being sent to the far end to loop one of the four shelves (x = A, B, C, or D).

P/S FE LOOP PROTECT

Far-End Loop on Protection Line — This message indicates that a request is being sent to the far end to loop the protection line.

P/S MINOR ALM

Minor Alarm — This message indicates a system state that is characterized by a non-service affecting fault.

P/S PWR/MISC

Power/Miscellaneous Alarm — This message can indicate a power loss or other predefined conditions like high temperature, smoke, high water, or open door.

Maintenance Test Messages

These messages indicate a maintenance test is being performed. They appear in the DATALINK category as a historical record of the test.

P/S MAINT HOOK/SEIZE

On-Hook/Seize Maintenance Message — This message appears when either the on-hook or seize message is received.

P/S MAINT PROCEED

Proceed Maintenance Message — The maintenance bypass procedure continues or has succeeded.

P/S MAINT TEST ALARM

Test Alarm Maintenance Message — The maintenance bypass procedure has failed.

T1 Signal Errors

These signal errors only appear in the SUMMARY category when one or more errors are detected. These results remain in the SUMMARY category until a test restart occurs.

P/S VIOLATION

Bipolar Violation Count — A count of BPVs detected since the start of the test (excluding intentional violations found within B8ZS encoding).

P/S CRC ERROR

CRC Errors — A count of CRC errors detected. CRC errors are counted only when ESF framing is present in the received T1 data.

P/S FRM ERROR

Frame Errors — A count of the frame errors detected since the start of the test. For D4 or D1D framing, frame errors are counted if either an F_t or an F_s frame bit is in error. For ESF framing, frame errors are counted on FPS bits. For SLC-M1 or SLC-M2 framing, frame errors are counted only if an error is found on an F_t bit.

PBX Wink Results

The PBX wink results only appear in the SUMMARY category when one or more wink signals are transmitted while testing a WINK START trunk. These results remain in the SUMMARY category until a test restart occurs.

P/S WINK CNT

Transmitted Wink Signals — A measurement of the number of wink signals transmitted since the last test restart. If the T-BERD DLC Analyzer Option detects a signal on the Primary line after a test restart, the Primary line is monitored and WINK CNT is preceded by a P. If the Primary line does not have a signal after a test restart, the Secondary line is monitored and WINK CNT is preceded by an S.

5.8 DLC ANALYZER OPTION — DATALINK CATEGORY

The DATALINK category results act as a current and historical record of the alarm and maintenance messages that are received from the SLC datalink. The messages are cleared when the **HISTORY RESET** switch is pressed or a test restart occurs. This category is only available when the **FRAME** switch is set to SLC-M1 or SLC-M2, and initial frame and datalink synchronization have occurred.

Alarm Messages

The datalink alarm field identifies conditions that cause disruptions in customer service, changes in signal quality, changes in signal path, and mechanical integrity of the system. Major alarms indicate system failures that cause disruptions in customer service. These failures include excessive BPVs, frame loss, and continuous signal loss. Minor alarms indicate system conditions that occur to prevent a major alarm or identify a far-end loop. The following alarm messages also appear in the SUMMARY category.

P/S MAJOR SHELF x

Major Alarm on Shelf x — This message indicates a system state that is characterized by a loss of service to the subscribers served by a shelf or shelf group (x = A, B, C, or D).

P/S MAJOR ALM

Major Alarm — This message indicates a system state that is characterized by a loss of service to the subscribers with no associated shelf alarm.

P/S ALARM SHELF x

Shelf Alarm on Shelf x — This message indicates a system state that is characterized by a loss of service to the subscribers served by the indicated shelf (x = A, B, C, or D).

P/S SHELF x ON PROT

Shelf x on Protection Line — This message indicates that one of the shelves has switched to the protection line (x = A, B, C, or D).

P/S FE LOOP SHELF x

Far-End Loop on Shelf x — This message indicates that a request is being sent to the far end to loop one of the four shelves (x = A, B, C, or D).

P/S FE LOOP PROTECT

Far-End Loop on Protection Line — This message indicates that a request is being sent to the far end to loop the protection line.

P/S MINOR ALM

Minor Alarm — This message indicates a system state that is characterized by a non-service affecting fault.

P/S PWR/MISC

Power/Miscellaneous Alarm — This message can indicate a power loss or other predefined conditions like high temperature, smoke, high water, or open door.

Maintenance Test Messages

The datalink maintenance field controls customer maintenance testing between the central office and remote terminal (RT). The maintenance test lasts approximately two seconds. The following messages only occur when the maintenance test is being performed.

P/S MAINT HOOK/SEIZE

On-Hook/Seize Maintenance Message — This message appears when either the on-hook or seize message is received.

P/S MAINT PROCEED

Proceed Maintenance Message — The maintenance bypass procedure continues or has succeeded.

P/S MAINT TEST ALARM

Test Alarm Maintenance Message — The maintenance bypass procedure has failed.

Datalink Status Results

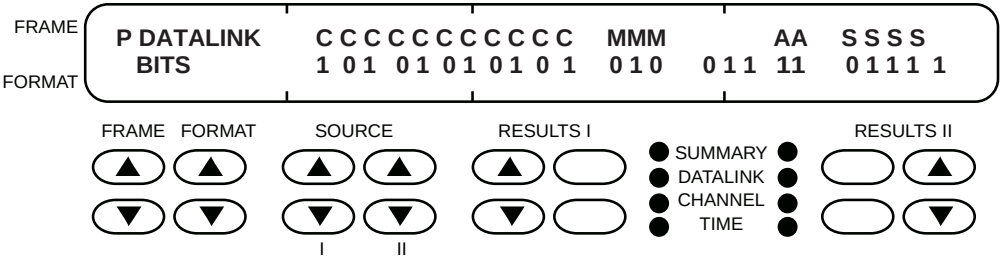
The following datalink status results indicate the number of seconds that alarms are detected, the datalink bit stream, and the alarm field format.

P/S SLC A SEC

SLC Alarmed Seconds — The number of test seconds during which datalink alarms, maintenance tests, or switch to protection line messages were detected.

P/S DATALINK BITS

SLC Datalink Bits — This result displays the individual datalink bits. The display indicates the concentrator (CCCCCCCCCCC), maintenance (MMM), alarm (AA), and protection line switch (SSSS) fields. This result is only available when the DLC Analyzer Option is frame synchronized in the SLC-M1 or SLC-M2 mode. The spoiler bits are shown without characters above them.



P/S ALM FIELD

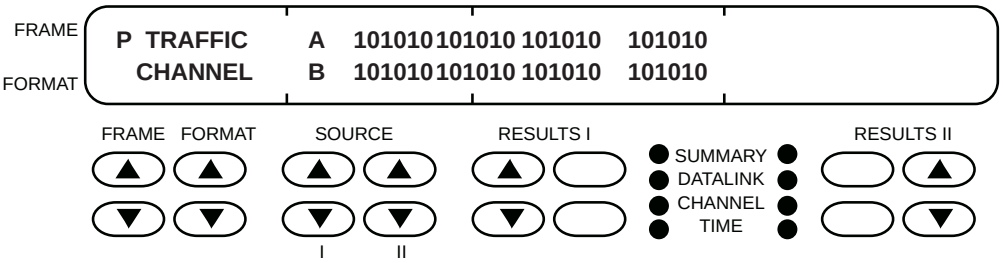
Alarm Field Format — Identifies the received datalink alarm field format as either 13 bit or 16 bit.

5.9 DLC ANALYZER OPTION — CHANNEL CATEGORY

The CHANNEL category displays results for all 24 DS0 timeslot or channel signaling bits, data bits, and channel assignments for both primary and secondary receiver inputs. The results are only available after initial frame synchronization is achieved.

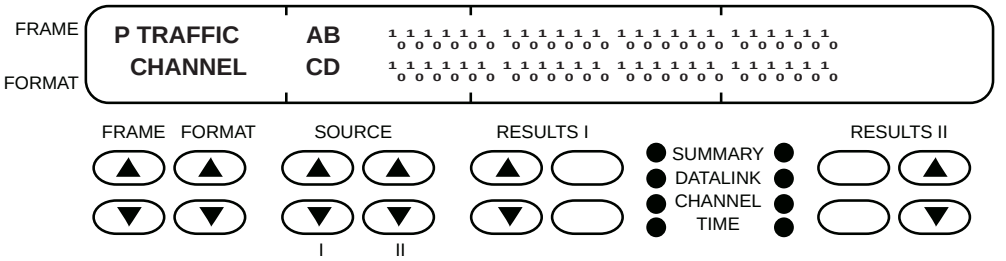
P/S TRAFFIC CHANNEL

AB Traffic Channel Signaling Bits — This result displays the A and B signaling bits in all 24 channels. This result is available in the SLC-M1, T1 D1D, T1 D4, and AUTO frame modes, but not SLC-M2 or T1 ESF.



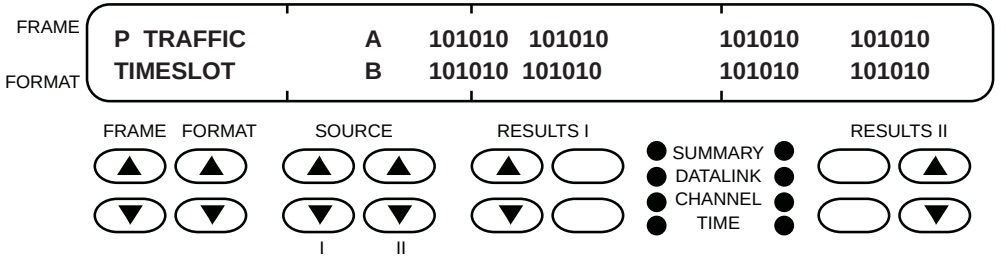
P/S TRAFFIC CHANNEL

ABCD Traffic Channel Signaling Bits — This result displays the A, B, C, and D signaling bits in all 24 channels. This result is only available in the T1 ESF frame mode.



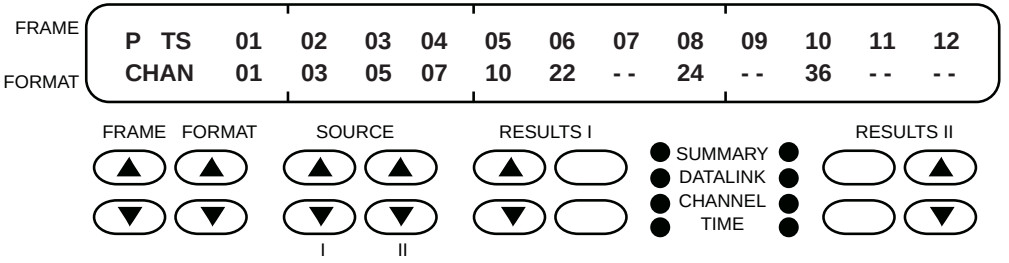
P/S TRAFFIC TIMESLOT

Traffic Signaling Bits for SLC-M2 Timeslots — This result displays the A and B signaling bits in all timeslots from a single receiver input. This is only available in the SLC-M2 frame mode.



P/S TS CHAN

SLC-M2 Timeslot Channel Assignments — This result displays the timeslot channel assignments of a Mode 2 SLC-96 circuit. An unassigned timeslot is indicated by two dashes (— —). An unknown timeslot assignment is left blank. This result is only available in the SLC-M2 frame mode and when the signal is received from the LDS.



P/S VF LEVEL

Received VF Signal Level in dBm — A measurement of signal power in the currently selected DS0 channel.

P/S VF FREQ

Received VF Frequency — The VF frequency, measured in Hertz, of the received VF data in the currently selected DS0 channel.

P/S DATA BITS

DS0 Channel Data Bits — Displays the binary values of the selected DS0 channel.

DTMF SEQ

Dual-Tone Multi-Frequency Sequence — Displays 11 digits of the received telephone number in the currently selected DS0 channel.

PBX Wink Results

The PBX wink results only appear in the CHANNEL category when one or more wink signals are transmitted while testing a WINK START trunk. These results remain in the CHANNEL category until a test restart occurs.

P/S WINK CNT

Transmitted Wink Signals — A measurement of the number of wink signals transmitted since the last test restart. If the T-BERD DLC Analyzer Option detects a signal on the Primary line after a test restart, the Primary line is monitored and WINK CNT is preceded by a P. If the Primary line does not have a signal after a test restart, the Secondary line is monitored and WINK CNT is preceded by an S.

5.10 DLC ANALYZER OPTION — TIME CATEGORY

TIME

Time of Day — The current time of day in HH:MM:SS format. This is set with the SET TIME auxiliary function.

DATE

Date — The current date in MMM DD format. This is set with the SET DATE auxiliary function.

P/S SIG L SEC

Signal Loss Seconds — A count of test seconds during which the signal was not present or during which one or more signal losses occurred after the initial signal detection.

5.11 ISDN ANALYZER OPTION — TEST RESULTS

The ISDN/DDS Analyzer Option performs a variety of measurements and provides a number of test results. The measurements and test results are displayed in the RESULTS windows. This allows two different results to be displayed at the same time.

The categories are selected with the **RESULTS I** and **RESULTS II Category** switches. Pressing the **RESULTS I** or **II Category** switch illuminates a Category LED and displays the previously selected result for that category. The test results in each selected category are displayed by pressing the **RESULTS I** and **II Results** switches.

Most DDS results are preceded with either a “p” or an “s” to indicate the, PRIMARY CHANNEL or SECONDARY CHANNEL.

SUMMARY Category

pERRORS
sERRORS
BPVs
RX FREQ
CURRENT REVERSED

ERRORS Category

pERRORS
pBER
pERR SECS
p%EFS
sERRORS
sBER
sERR SECS
s%EFS
BPVs
BPV RATE
BPV SECS

SIGNAL Category

RX LVL (Volts)
RX LVL (dB)
RX FREQ
SPAN CURR
RX BYTE

TIME Category

TIME
DATE
ELAPSED TIME

5.12 ISDN/DDS ANALYZER OPTION — SUMMARY CATEGORY

The SUMMARY category displays key non-zero and out-of-specification test results without having to change categories.

When the **RESULTS I Category** switch is set to SUMMARY, the RESULTS I display automatically scrolls through the affected SUMMARY category results. Press either **RESULTS I Results** switch (up arrow or down arrow) to temporarily pause the scrolling.

pERRORS

pERRORS — This message indicates the number of bit errors detected in the primary channel of data transmission. The result is displayed as an eight digit integer. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate.

sERRORS

sERRORS — This message indicates the number of bit errors detected in the secondary channel of data transmission. The result is displayed as an eight digit integer. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate.

BPVS

BPVS (Bipolar Violations) — This message indicates the number of bipolar violations present on the received signal. The result is displayed as an eight digit integer. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate.

RX FREQ

RX FREQ (Receive Frequency) — This message displays the bit rate of the received signal in Hertz. If the result of outside of the displayable range, the message "OUT RANGE" is displayed.

> **NOTE:** Line, Bit, and Pattern Data rates are not necessarily the same; when DDS framing is present, bit rate (= line rate) and exceeds the pattern data rate. The ISDN data rate is 144 kbps, but the bit rate is 160 kbps, and the line rate is 80 kbps.

CURRENT REVERSED

CURRENT REVERSED — This message indicates that ISDN/DDS Analyzer Option current is reversed.

5.13 ISDN/DDS ANALYZER OPTION — ERRORS CATEGORY

The following ERRORS category results are based on a bit error count. These results are updated each time a bit error is detected in the currently selected data pattern. When pattern synchronization is lost, the bit error count is frozen.

pERRORS

pERRORS — This message indicates the number of bit errors detected in the primary channel of data transmission. The result is displayed as an eight digit integer. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate.

pBER

pBER (Bit Error Rate) — This message indicates the bit error rate on the primary channel of data transmission. The result is displayed with either one, two, or three significant digits and an exponent. If no bit errors are detected, the result "0 E-XX" (XX depends on the number of bits received) is displayed.

pERR SEC

pERR SEC (Errored Seconds) — This message indicates the number of errored seconds detected in the primary channel of data transmission since the last test restart. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate.

p%EFS

p%EFS (% Error Free Seconds) — This message indicates the percent of errored seconds versus total seconds on the primary channel of data transmission since the last test restart. The result is displayed in the form nnn.nn%, leading zeros are blanked.

sERRORS

sERRORS — This message indicates the number of bit errors detected in the secondary channel of data transmission. The result is displayed as an eight digit integer. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate. If no secondary channel is present, this display position will remain blank.

sBER

sBER (Bit Error Rate) — This message indicates the bit error rate on the secondary channel of data transmission. The result is displayed with either one, two, or three significant digits and an exponent. If no bit errors are detected, the result "0 E-XX" (XX depends on the number of bit s received) is displayed. If no secondary channel is present, this display position will remain blank. If no secondary channel is present, this display position will remain blank.

sERR SEC

sERR SEC (Errored Seconds) — This message indicates the number of errored seconds detected in the secondary channel of data transmission since the last test restart. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate. If no secondary channel is present, this display position will remain blank.

s%EFS

s%EFS (% Error Free Seconds) — This message indicates the percent of errored seconds versus total seconds on the secondary channel of data transmission since the last test restart. The result is displayed in the form nnn.nn%, leading zeros are blanked. If no secondary channel is present, this display position will remain blank.

BPVS

BPVS (Bipolar Violations) — This message indicates the number of bipolar violations present on the received signal. The result is displayed as an eight digit integer. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate. If ISDN mode is selected, BPVs are not counted and this result is not available.

BPV RATE

BPV RATE (Bipolar Violation Rate) — This message indicates the bipolar violation rate on the received signal. The result is displayed with either one, two, or three significant digits and an exponent. If no bit errors are detected, the result "0 E-XX" (XX depends on the number of bit s received) is displayed. This result is not available when ISDN mode is selected.

BPV SECS

BPV SECS (Bipolar Violation Seconds) — This message indicates the number of errored seconds on the received signal since the last test restart. The result is displayed as an eight digit integer. If the count exceeds the maximum displayable value, the result is preceded with a ">" and the displayed digits remain accurate. This result is not available when ISDN mode is selected.

5.14 ISDN/DDS ANALYZER OPTION — SIGNAL CATEGORY

The following SIGNAL category results analyze the characteristics of the input signal.

RX LVL(VOLTS)

RX LVL (Volts) — This message displays the received signal level in volts peak-to-peak. The result is displayed as "x.xx V" in the range from 1.00 to 9.99 Vpp, and xxx mV in the range from 15 to 999 mVpp. If the result is greater than 10 Vpp or less than 15 mVpp, the results are displayed as > 10Vpp or < 15 mVpp respectively.

RX LVL (dB)

RX LVL (dB)) — This message displays the received signal level in dB. The result is displayed as "±xx.x dB" in the range from +6.00 dB to -42.0 dB. A value greater than +6.0 dB causes the message "Too High" to be displayed, while a value less than -39.0 dB for DDS or -42.0 dB for ISDN causes the message "Too Low" to be displayed.

RX FREQ

RX FREQ (Receive Frequency) — This message displays the bit rate of the received signal in Hertz. If the result of outside of the displayable range, the message "OUT RANGE" is displayed.

NOTE: Line, Bit, and Pattern Data rates are not necessarily the same; when DDS framing is present, bit rate (= line rate) and exceeds the pattern data rate. The ISDN data rate is 144 kbps, but the bit rate is 160 kbps, and the line rate is 80 kbps.

SPAN CURR

SPAN CURR (Span Current) — This message displays the span current between the transmit output tip and ring and the receive input tip and ring. Span current is displayed as ± xx mA. If the result is greater than ± 60 mA or less than ±4 mA, the results are displayed as > 60 mA or < 4 mA respectively.

RX BYTE

RX BYTE (Receive Byte) — This message displays the binary equivalent of the received DDS data byte (bits received over the local loop in a 6, 7, 8, or 9 bit serial binary stream). The result is displayed as a 6 to 9 bit binary number, from left to right. The display includes pattern and overhead bits, if present. If ISDN mode is selected, the RX BYTE is blank.

5.15 ISDN/DDS ANALYZER OPTION — TIME CATEGORY

DATE

Date — The current date is displayed in MMM DD format.

TIME

Time of Day — The current time of day is displayed in HH:MM:SS format.

ELPSD TIME

ELPSD TIME (Elapsed Time) — This message displays the time elapsed since the last test restart in HH:MM:SS format; with the HH value between 0 and 99, the MM and SS values between 0 and 59. Pressing the **RESTART, MODE**, or **FORMAT** switches restarts the timer.

PRINTER OPERATION

6.1 INTERFACE DESCRIPTION

The AUXILIARY PORT is a circular, 8-pin, DIN-type connector configured to function as Data Communications Equipment (DCE), which allows it to be directly connected to Data Terminal Equipment (DTE). Connection to another DCE is possible with the use of an adaptor cable. Table 6-1 shows the AUXILIARY PORT pin configuration.

Table 6-1
AUXILIARY PORT Pin Configuration

Pin	Designation	Description
1	VBAT	Voltage battery — Connected to battery terminal.
2	GND	Ground — Connected to signal ground.
3	CGND	Chassis ground — connected to chassis ground.
4	TD	Transmit data — The T-BERD 209*OSP* receives data on this lead.
5	+5V	+5 VDC.
6	DTR	Data terminal ready — Data is only output from the T-BERD 209*OSP* when this line is held in the ON condition by the receiving device.
7	RD	Receive data — Data is transmitted by the T-BERD 209*OSP* on this lead.
8	DSR	Data set ready — This lead is driven to the ON state by the T-BERD 209*OSP* whenever it has power applied and is ready to receive data.

6.2 PRINTER OPERATION

Standard RS-232 graphics compatible dot-matrix printers, like the PR-40A Thermal Printer, can be connected to the T-BERD 209*OSP* to provide printouts of the test results, front-panel setup, and TDR (optional) traces. If a printer is not attached to the AUXILIARY PORT, the T-BERD 209*OSP* stores the printouts in nonvolatile memory (NOVRAM) until a printer is available.

Auxiliary functions (see Table 6-2) are used to select the interface parameters of baud rate, parity, and line terminator. Column length is preset to 80 characters. The default auxiliary function settings match the PR-40A Thermal Printer parameters.

Table 6-2
AUXILIARY PORT Printer Interface Parameters

Auxiliary Function Default	Definition	Selections
AUX PRNTPORT Function 2400 BAUD	Baud Rate Select	300, 1200, 2400, 4800 BAUD
AUX PRNTPORT Function NONE	Parity Select*	EVEN, ODD, or NONE
AUX PRNTPORT Function CR	Line Terminator	CR or CRLF

* Word length is controlled by the parity selection, seven bits for odd or even parity and eight bits for no parity.

6.3 CONNECTING THE PRINTER

Perform the following procedure to connect the TTC PR-40A Thermal Printer to the T-BERD 209*OSP*.

1. Printer interface parameters verification

Before connecting the printer to the T-BERD 209*OSP* verify that the AUXILIARY PORT printer interface parameters (see Table 6-2) match the interface parameters of the printer. The T-BERD 209*OSP* default parameters match the PR-40A default parameters. Once the interface parameters are verified, turn the power off on both instruments.

2. Printer connection to the T-BERD 209*OSP*

Connect the printer to the T-BERD 209*OSP* AUXILIARY PORT connector using a circular 8-pin DIN-type to 25-pin D-type connector cable (Model #30758) with the pin assignments described in Table 6-1.

3. Apply power to the T-BERD 209*OSP* and printer

Turn the T-BERD 209*OSP* on first, then the PR-40A. If this step is reversed, the first printout can be garbled.

NOTE: When connecting a compatible printer other than the PR-40A to the T-BERD 209*OSP*, connect the printer to the T-BERD 209*OSP*, turn the printer power on first, and place the printer OFF LINE before turning the T-BERD 209*OSP* ON.

4. Place the printer ON LINE

The PR-40A must be placed ON LINE manually (see the *PR-40A Thermal Printer Operating Manual*).

NOTE: When the printer is placed ON LINE the T-BERD 209*OSP* immediately sends any printouts stored in memory.

6.4 GENERATING A PRINTOUT

Printout generation is controlled by the front-panel **PRINT** and **PRINT EVENT** switches. All printouts are date- and time-stamped.

PRINT Switches — The two **PRINT** switches specify the type of printout to be generated. Pressing either switch generates the desired printout immediately.

RESULTS Switch — Press this switch to generate a printout of current test results. Results printouts are fully described in Section 6.5.

CONTROLS Switch — Press this switch to generate a printout of the T-BERD 209*OSP* current switch settings. Controls printouts are fully described in Section 6.5.

PRINT EVENT Switch — The **PRINT EVENT** switch has three positions that establish when a results printout is generated. The labeled LEDs adjacent to the switch illuminate to reflect the current position of the switch.

OFF — Prevents data from being sent to the RS-232 printer interface. Note that results and controls prints are still available using the **PRINT** switches.

TIMED — Initiates a results print at the end of each time interval as set by the AUX PRNT INT function.

ERROR — Initiates a results print for each second that a logical bit error, CRC error, frame error, or bipolar violation occurs.

NOTE: The **PRINT EVENT** switch is disabled during TDR or DC testing.

6.5 PRINTOUTS

The T-BERD 209*OSP* can generate four types of printouts: controls, results, automated test, and messages. If the Cable Qualification Option is installed, a TDR trace printout is available. Each printout is identified by a header and is time- and date-stamped.

The T-BERD 209*OSP* can store up to 10 results printouts, 10 controls printouts, one AUTOTEST printout, 10 TDR traces (optional), 10 TDR results/controls printouts (optional), and 75 alarm messages if a printer is not connected to the unit at the time the printouts are generated.

If the operator attempts to store a printout when the print buffer for that type of printout is full, the printout does not overwrite a previous printout, the data is not stored, but the request is counted against the total number of possible print requests (equals the total number of available print buffers). The print buffer can be cleared using the AUX BUF CLR function or by connecting the instrument to a compatible serial printer like the PR-40A.

Results Printout

The results printout (see Figure 6-1) is a hard-copy listing of the current test results. The format includes all available results and any alarm LEDs that are illuminated at the time the printout is initiated.

A results printout is automatically initiated when a result counter overflows. Labeled OVERFLOW PRINT (see Figure 6-2), the printout contains the same results as a standard results printout with a double asterisk (**) by the result that overflowed. The double asterisk (**) indicates an immediate overflow condition (i.e., the results counter overflowed during the last second). Subsequent printouts of the overflowed result are preceded by a single asterisk (*) to indicate a previous overflow condition. All asterisks are cleared at test restart.

Controls Printout

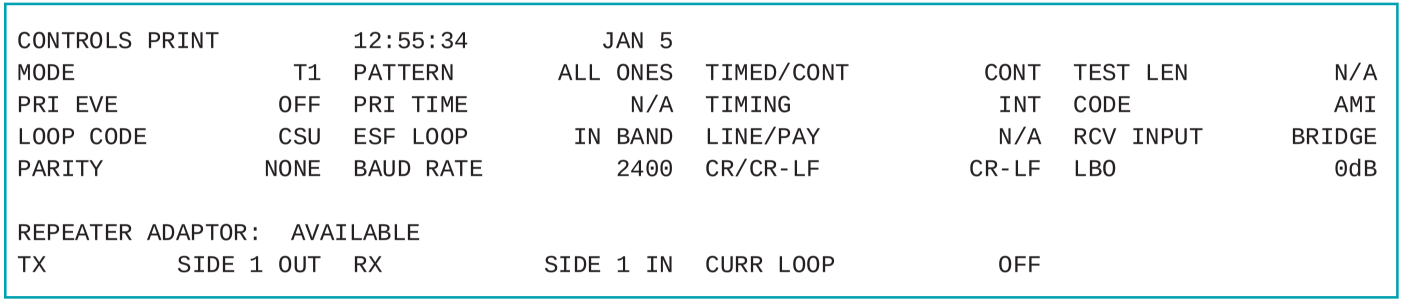
The controls printout (see Figure 6-3) lists the current setting of all front-panel switches and auxiliary functions.

```
RESULTS PRINT            12:56:16        JAN  5  T1 ESF             1:7
BIT ERR          119405  ASYN E SEC          29  BER          1.71 E-03  SLIPSUNAVAIL
BPV ERR               0  BPV ER SEC           0  BPV RATE        0 E-07  FRA ER SEC N/A
FRA ERR             N/A  F E RATE           N/A  CRC ERR           2591  CRC ER SEC 29
CRC E RT       1.59E-01  FREQ Hz        1543990  RX LEVEL    +5.5 dBdsx  RX LVL     11.27 Vp-p
SPX CUR          UNAVAIL  SIG LS SC            0  TEST LEN          CONT  ELAPS TIM  00:00:45
TEST END            ****

ALARM/STATUS
EX ZERO HIST          ON  T1                  ON  PATTERN SYNC        ON  FRAME SYNC ON
```

Figure 6-1
Results Printout

```
OVERFLOW PRINT           12:58:16        JAN  5  T1 ESF             1:7
BIT ERR       **00014365  ASYN E SEC        6516  BER          9.98 E-03  SLIPS               9
BPV ERR               0  BPV ER SEC           0  BPV RATE        0 E-10  FRA ER SEC        N/A
FRA ERR             N/A  F E RATE           N/A  CRC ERR         2148206  CRC ER SEC       6515
CRC E RT       9.81 E-01  FREQ HZ        1543991  RX LEVEL    +5.7 dBdsx  RX LVL     11.61 Vp-p
SPX CUR             0 mA  SIG LS SC            0  TEST LEN          CONT  ELAPS TIM    01:48:57
TEST END            ****

ALARM/STATUS
EX ZERO HIST          ON  T1                  ON  PATTERN SYNC        ON  FRAME SYNC          ON
```

Figure 6-2
Overflow Results Printout



```
CONTROLS PRINT          12:55:34          JAN 5
MODE                 T1 PATTERN        ALL ONES  TIMED/CONT          CONT  TEST LEN          N/A
PRI EVE             OFF PRI TIME            N/A  TIMING               INT  CODE              AMI
LOOP CODE           CSU ESF LOOP         IN BAND  LINE/PAY             N/A  RCV INPUT      BRIDGE
PARITY             NONE BAUD RATE           2400  CR/CR-LF          CR-LF  LBO               0dB

REPEATER ADAPTOR:  AVAILABLE
TX          SIDE 1 OUT  RX            SIDE 1 IN  CURR LOOP            OFF
```

Figure 6-3
Controls Printout

MULTIPAT Results Printout

The MULTIPAT results printout (see Figure 6-4) provides results for each of the five test patterns. The SYNC SEC result indicates the number of seconds the synchronized pattern was received and monitored. The BIT ERR result equals the sum of the MULTIPAT BIT ERR results. The ASYN E SEC result equals the sum of the MULTIPAT ERR SEC results. If pattern synchronization is lost, SYNC SEC is not counted.

```
RESULTS PRINT 18:04:50    JAN 1
BIT ERR            1340   ASYN E SEC        802
BER          **3.91E-06   SLIPS               9
BPV ERR            2411   BPV ER SEC         *7
BPV RATE         17E-05   FRA ER SEC          5
FRA ERR              22   F E RATE       12E-05
CRC ERR              99   CRC ER SEC          7
CRC E RT           2E-04  FREQ Hz       1544010
RX LVL        -19 dBdsx   RX LVL      2.33 Vp-p
SPX CUR            57 mA  SIG LS SC           5
TEST LEN           CONTI  ELAPS TIM    00:22:14
TEST END           *****

MULTIPAT RESULTS
PATTERN          BIT ERR  ERR SEC      SYNC SEC
ALL ONES             260  168                175
1:7                  271  175                175
2 IN 8               270  167                175
3 IN 24              269  158                175
QRSS                 270  134                175

ALARM STATUS
SIGNAL LOSS           ON  PATTERN LOSS       ON
FRAME LOSS            ON
```

Figure 6-4
Multipattern Results Printout

BRIDGTAP Results Printout

The BRIDGTAP results printout (see Figure 6-5) provides results for each of the 21 test patterns. The SYNC SEC result indicates the number of seconds the synchronized pattern was received and monitored. The ASYN E SEC result equals the sum of the BRIDGTAP ERR SEC results. When pattern synchronization is lost, SYNC SECs are not counted. Each pattern is monitored for 23 seconds.

AUTOTEST Printout

The AUTOTEST printout (see Figure 6-6) is generated automatically after the AUTOTEST sequence is complete (Test Complete printout), after the AUTOTEST sequence is terminated because of an errored test result (Errors in current test printout), or after the AUTOTEST sequence is terminated by operator intervention (Terminated by request printout). Results are separated into type of test and side of the repeater tested. Only one AUTOTEST printout can be stored in the print buffer at one time. The most recent AUTOTEST printout will overwrite the previous AUTOTEST printout in the print buffer.

```
RESULTS PRINT 18:04:50   JAN 1
BIT ERR          225423  ASYN E SEC        74
BER         **3.91E-06   SLIPS              9
BPV ERR            2411  BPV ER SEC        *7
BPV RATE         17E-05  FRA ER SEC         5
FRA ERR              22  F E RATE      12E-05
CRC ERR              99  CRC ER SEC         7
CRC E RT           2E-04 FREQ Hz       1544010
RX LVL       -19 dBdsx   RX LVL     2.33 Vp-p
SPX CUR           57 mA  SIG LS SC          5
TEST LEN          CONTI  ELAPS TIM   00:22:14
TEST END          *****

BRIDGTAP  RESULTS
PATTERN         BIT ERR  ERR SEC     SYNC SEC
ALL ONES              0   0                46
1:1                   0   0                46
1:3                   0   0                46
1:5                   0   0                46
1:6               16123   6                46
1:7               16124   5                46
2:8                   0   0                46
2:9                   0   0                46
2:10                  0   0                46
2:11                  0   0                24
2:12                  0   0                23
2:13                  0   0                23
2:14                  0   0                23
3 IN 18           54600   18               23
3 IN 19           27903   10               23
3 IN 20           44112   14               23
3 IN 21           49785   16               23
3 IN 22               0   0                23
3 IN 23           16776   5                23
3 IN 24               0   0                23
QRSS                  0   0                23

ALARM STATUS
SIG LOS              ON   PATTERN LOSS      ON
FRAME LOSS           ON
```

Figure 6-5
BRIDGTAP Results Printout

```
AUTO TEST RESULTS          15:16:20        JAN  1
Voltage Results:
Side 1 in to Side 2 out    Side 2 in to Side 1 out
     No Voltage                                        No Voltage
Resistance Results:
         Side 1 In              Side 1 Out              Side 2 In              Side 2 Out
Tip to Rng:            0  Tip to Rng:          0  Tip to Rng:       15  Tip to Rng:           0
Tip to Gnd:        499 K  Tip to Gnd:      499 K  Tip to Gnd:     499 K  Tip to Gnd:       499 K
Rng to Gnd:        499 K  Rng to Gnd:      500 K  Rng to Gnd:     499 K  Rng to Gnd:       500 K
TDR Results
          Side 1 In              Side 1 Out              Side 2 In              Side 2 Out
          No Problem           Bridgetap in Span       Open in Line           No Problem
                                    50 Feet                 50 Feet
Repeater Results:
   Side 1: PASS                                         Side 2: FAIL
Simplex Current Results:
        Side 1 In              Side 1 Out              Side 2 In              Side 2 Out
Tip:     0 mA                     0 mA                    0 mA                   0 mA
Rng:     0 mA                     0 mA                    0 mA                   0 mA
Spx:     0 mA                     0 mA                    0 mA                   0 mA
Bridgetap Results:
Side 2 Out to Side 1 In:
 ONES        0            1:1          0          1:3          0          1:5          0
 1:6         0            1:7          0          2:8          0          2:9          0
 2:10        0            2:11         0          2:12         0          2:13         0
 2:14        0            3N18         0          3N19         0          3N20         0
 3N21        0            3N22         0          3N23         0          3N24         0
 QRSS        0
Side 1 Out to Side 2 In:
No Loop
```

Figure 6-6
AUTOTEST Printout

DC Test Results Printouts

When a DC results printout is requested, the voltage, simplex current, and resistance measurements that were performed for the present location (e.g., *side 1 in*) are printed or stored as a set of readings (see Figure 6-7). The technician must select each test and allow time for the measurement(s) to be performed before proceeding to the next test to enable the results to appear on the printout. Results printout values that are *UNAVAILABLE* represent tests that were not performed.

For any test location for which you desire a hard copy printout of the test configuration and results, you must press both the **PRINT** switches (**CONTROLS** and **RESULTS)** prior to changing any major switch, except the **PATTERN** switch.

```
RESULTS PRINT      15:16:20   JAN  1   DC TEST
OHMS RESISTANCE:   TIP-RNG   24 Ohms   TIP-GND  >10 MOhm   RNG-GND>10 MOhm
SIMPLEX CURRENT:   TIP-SPX     30 mA   RNG-SPX     30 mA   SPX CUR   60 mA
VOLTAGE:           VOLTS      7.4VDC
```

Figure 6-7
DC Results Printout

TDR Trace Printouts

A TDR trace printout is a hard copy of the TDR trace in the graphic display. Up to ten traces can be stored in memory at one time if a printer is not connected to the unit when the traces are generated (dual traces count as two printouts). To obtain a printout of the TDR trace, use an RS-232 graphics compatible printer like the TTC PR-40A.

With a TDR trace in the graphic display, press the **RESULTS II Results** switch labeled *PRINT GRAPH* to print the TDR trace. If *NO REF* was displayed in the TDR SETUP menu, a single trace is printed from the current test results. If *REF STORED* was displayed in the TDR SETUP menu, the current and reference traces are printed as a dual trace on the same graph.

NOTE: To properly initiate a graphic printout, the T-BERD 209*OSP* AUXILIARY PORT connector must be set for eight data bits — set the AUX PARITY function to NONE.

The single TDR trace in Figure 6-8 shows the reflection signature of a bridge tap and an open. The traces are charted as reflected signal amplitude versus distance. The type of fault (if known), distance, and the TDR setup parameters are also indicated on the printout. The numbered vertical lines in the graph indicate the position of each fault available in the RESULTS I display. The dual trace graph in Figure 6-9 identifies the reference trace as the dotted line and the current trace as the solid line. The numbered vertical line indicates the fault on the current trace (solid line).

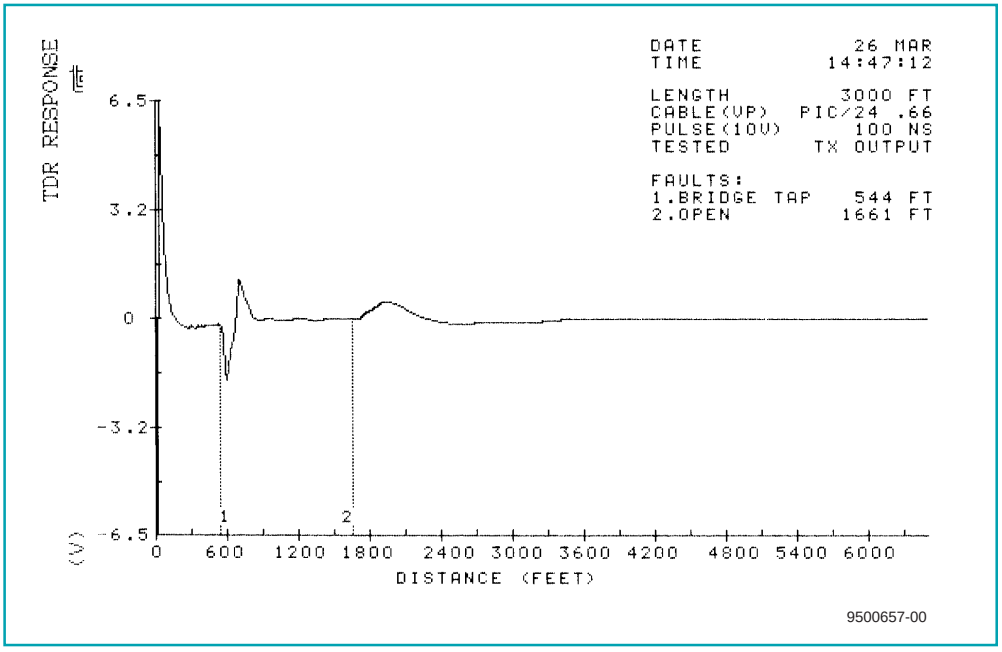


Figure 6-8
Single Trace TDR Printout

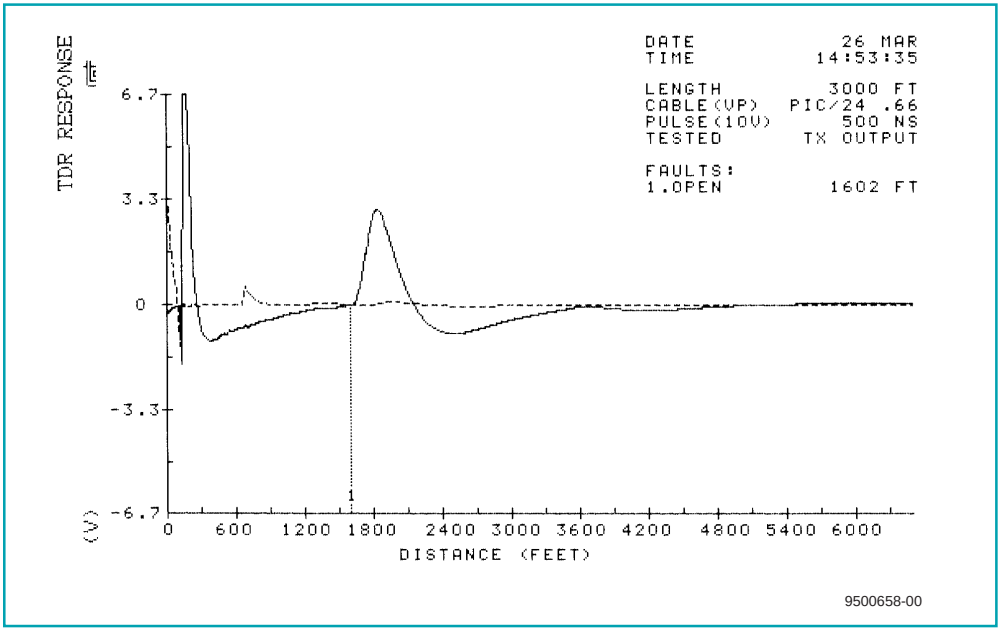


Figure 6-9
Dual Trace TDR Printout

When more than one fault is detected and reported in the RESULTS I display, each fault after the first one can be selected, magnified, and printed individually.

To print an individual fault after the first fault, press the **RESULTS I Category** switch to select the desired fault in the RESULTS I display. The selected fault is enlarged and the distance scale adjusted on the graphic display. After the fault is selected, press the **RESULTS II Results** switch to print the enlarged section of the trace.

To print a magnified trace of any individual fault, note the distance for each fault. Press the**RX/SELECT**, **TX/SELECT**, or **CURR LOOP** switch to activate the cursor. When the cursor is activated, the fault locator lines disappear from the graphic display trace, and a cursor line appears at the last selected fault location. While observing the graphic display trace, use the **RX/SELECT** or **TX/SELECT** switch to move the cursor line to the desired location. Press the **CURR LOOP** switch to zoom in on the selected section of the trace. Press the **RESULTS II Results** switch to print the magnified section of the trace.

Figure 6-10 illustrates how the TDR trace would appear after the initial test of the cable pair. The trace indicates a bridge tap at 544 feet (Fault 1) and an OPEN fault at 1661 feet (Fault 2). By selecting Fault 2 from the TDR RESULTS menu and pressing *PRINT GRAPH* again, the magnified trace of Fault 2 (see Figure 6-11) can be more clearly viewed. To verify Fault 2, remove the bridge tap (Fault 1) and repeat the TDR test. Figure 6-12 clearly identifies Fault 2 as an open; and with the bridge tap removed, the open becomes the first fault on the cable pair.

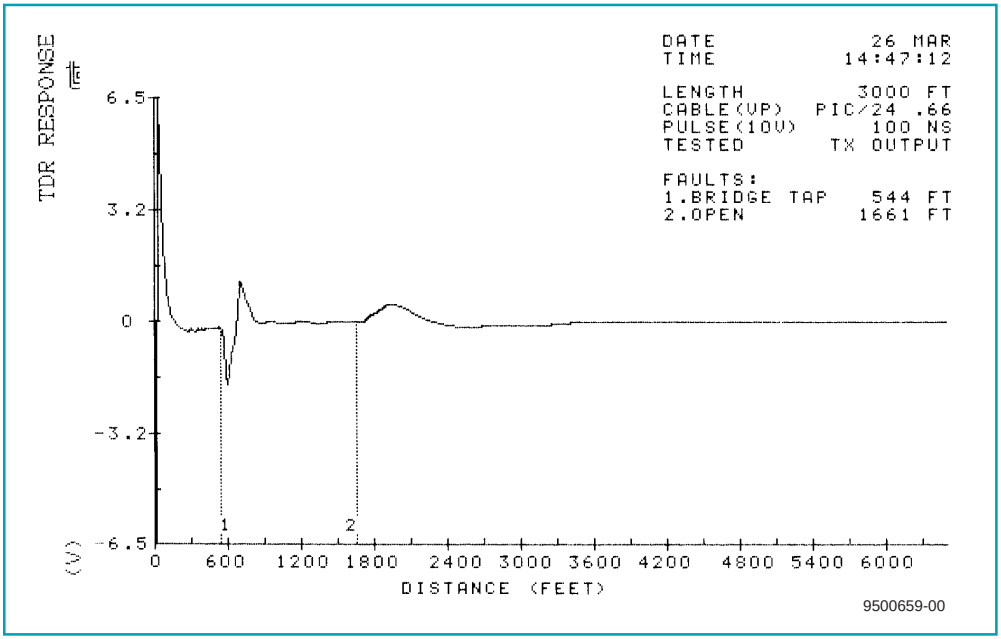


Figure 6-10
Initial TDR Test Result Printout

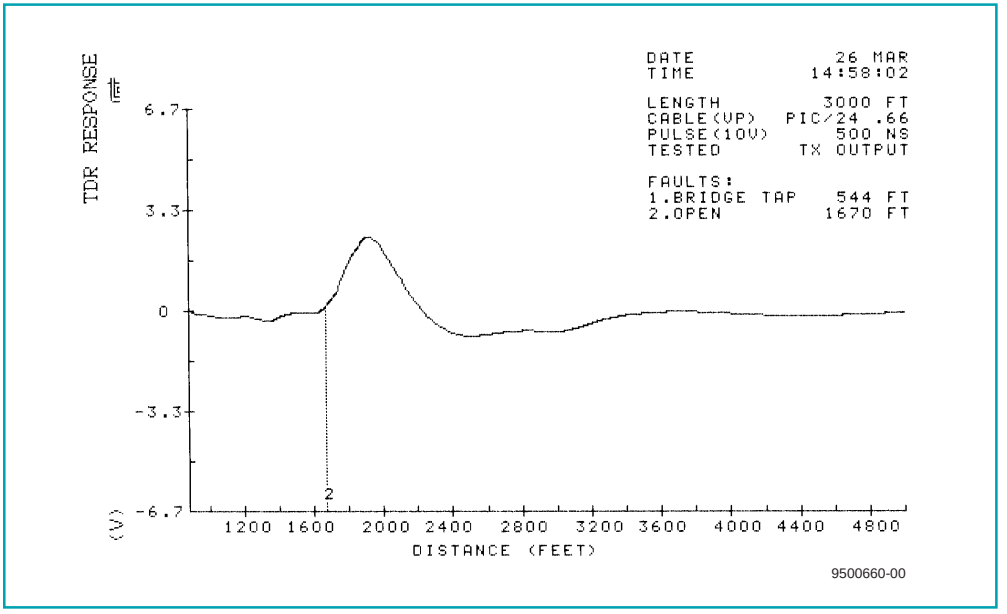


Figure 6-11
Magnified TDR Printout

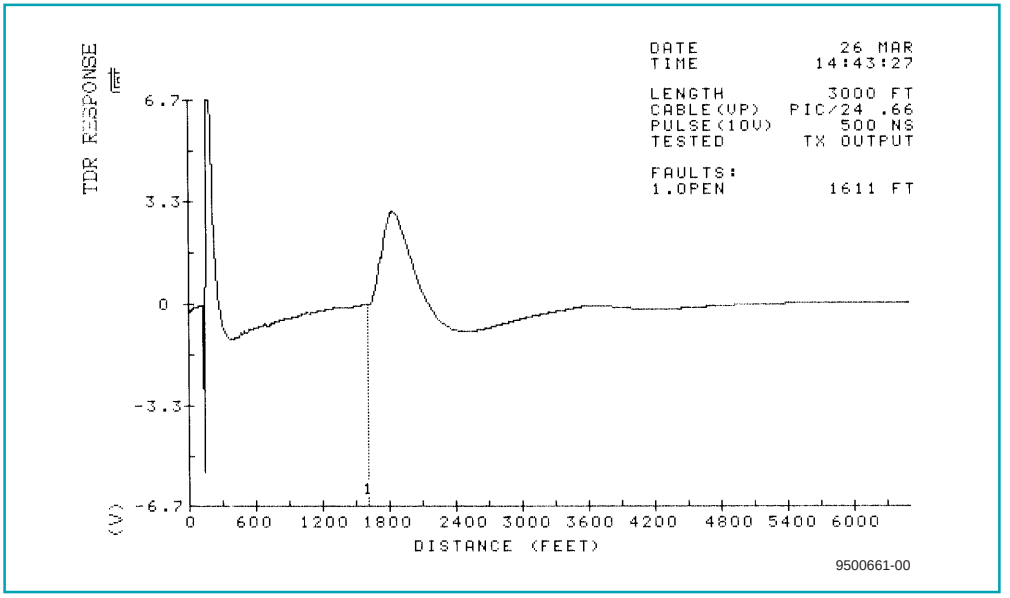


Figure 6-12
Verifying the Second Cable Pair Fault

Printer Squelch Feature

When 20 or more printouts are generated in 60 seconds, the printer squelch is turned on to temporarily halt the printouts. The squelched printouts include alarm and errored second condition that occur during a test. With the twentieth printout the message *PRINTER SQUELCH ON* is printed. When the printouts drop to five or less in 60 seconds, the message *PRINTER SQUELCH OFF* is printed and a squelch summary results print (SQUELCH OFF PRINT) is generated. The squelch summary printout provides the cumulative results when the squelch was activated. The printer squelch does not affect messages indicating the squelch state, timed print requests, manual print requests, or the *TEST COMPLETE* message. The printer squelch is reset when a restart occurs.

Messages

When the **PRINT EVENT** switch is set to either the ERROR or TIMED position, alarm and status messages are initiated automatically to inform you of any important developments related to your ongoing test. To turn off the messages feature, set the **PRINT EVENT** switch to OFF. The format for an alarm message is:

HH:MM:SS MM:DD alarm message

Possible messages are:

Alarm Messages

SIGNAL LOSS XX — Valid T1 pulses are no longer present on the line. Where XX = a running count of signal losses since the start of the test.

FRAME LOSS XX — The framing pattern is no longer present on the line. Where XX = a running count of frame synchronization losses since the start of the test.

PATT LOSS XX — The test pattern is no longer present on the line. Where XX = a running count of pattern losses since the start of the test.

YELLOW ALARM ON — A yellow alarm condition is present.

YELLOW ALARM OFF — A yellow alarm condition is no longer present.

EXCESS ZEROS ON — More than 15 consecutive zeros have been received when **B8ZS** switch is set to AMI, or more than seven consecutive zeros have been detected when **B8ZS** switch is set to B8ZS.

EXCESS ZEROS OFF — Less than 16 consecutive zeros have been received when an excess zeros condition had been previously detected.

Status Messages

SIGNAL DETECT — T1 pulses of valid frequency and level are present.

FRM SYNC ACQUIRED — The framing pattern has been detected and synchronization is acquired.

PATT SYNC ACQUIRED — The test pattern has been detected and synchronization is acquired.

B8ZS DETECTED — B8ZS line code is received.

NOT B8ZS COMPATIBLE — When the switch is set to the B8ZS position and the selected pattern is ALL ZERO, this message is displayed whenever the instrument receives the sequence 0001 1011, which occurs if a non-B8ZS compatible piece of equipment regenerates the transmitted signal.

BUFFER FULL — The internal print buffers have overflowed. At least one printout has been lost (discarded). This is the only message that is not date- and time-stamped.

NOTE: Print buffer overflow may result in lost information.

PRINTER 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.

PRINTER 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. This message applies only when in timed test mode.

TEST RESTART — A test restart occurred as a result of pressing the **RESTART** switch or any other major switch.

NOTE: The term major switch applies to the **PATTERN**, **MODE**, **RESTART**, **Power**, **RCV'D**, **TX/SELECT**, **RX/SELECT**, and **RECEIVE INPUT** switches.

NEW CONFIGURATION — The test configuration has been modified.

ADAPTOR CONFIG — The T-BERD T1 Repeater Adaptor configuration has been modified.

NO CABLE ATTACHED — The TDR test cannot be performed, because a cable pair is not attached to the TRANSMIT/TDR jack and the T-BERD T1 Repeater Adaptor is not providing access at a mid-span repeater. This message is only available if the Cable Qualification Option is installed.

SPECIFICATIONS

7.1 MAINFRAME — GENERAL SPECIFICATIONS

Physical

Size:	7.0"H x 13.6"W x 7.8"D (17.8 cm x 34.5 cm x 19.8 cm).
Weight:	12.4 pounds (5.6 kg).

Operational

Operating Temperature	
Battery Operation:	-4°F to 122°F (-20°C to 50°C).
AC Power Operation:	-4°F to 104°F (-20°C to 40°C).
Storage Temperature:	-4°F to 140°F (-20°C to 60°C).
Power:	115 VAC ±10%, 50/60 Hz.
Fuse:	1A, 250V Slo-Blo (Littlefuse #218001 or equivalent).

7.2 MAINFRAME — INPUT SPECIFICATIONS

Receive Input

Input Connectors:	WECO 310, RJ48 (see Table 7-1 for pinouts). T1 REPEATER PORT connector.
Input Frequency:	1,544,000 Hz ±5000 Hz.
Input Impedance:	BRIDGE — 1000 Ω or greater (with ALBO). TERM — 100 Ω ±5% (with ALBO). DSX-MON — 100 Ω ±5% (with AGC).

Table 7-1
LINE Jack (RJ48) Pinouts

Pin	Designation
1	RECEIVE TIP (Blue)
2	RECEIVE RING (Orange)
3	Not used
4	TRANSMIT TIP (Red)
5	TRANSMIT RING (Green)
6	Not used
7	Not used
8	Not used

Operating Range: BRIDGE — +6 dB to -35 dB.
TERM — +6 dB to -35 dB.
DSX-MON — +6 dBdsx to -24 dBdsx.

T1 Reference Input

Input Connector: WECO 310 jack.

Input Frequency: 1,544,000 Hz ±1000 Hz.

Input Impedance: 1000 Ω (nominal).

Operating Range: +6 dBdsx to -24 dBdsx resistive loss.

7.3 MAINFRAME — OUTPUT SPECIFICATIONS

Output Connectors:	Selectable line build-out (LBO) of 0, -7.5, -15.0, and -22.5 dB is provided on WECO 310, RJ48, and 14-pin T1 REPEATER PORT connectors.
Output LBO Tolerance:	±1 dB at 772 kHz.
Internal Oscillator Accuracy:	±5 ppm.
Line Codes:	AMI or B8ZS.
Error Insert:	Single logic and BPV error insertion.
Pulse Shape:	With output terminated in 100 Ω resistive load and 0 dB line build-out selected, the T-BERD 209*OSP* meets CCITT Recommendation G.703; AT&T Publications CB113, CB119, CB132, CB143, and PUB62508; and AT&T PUB62411 pulse shape specifications.

163 KHz, 196KHz, 392KHz Outputs (HDSL Option only)

Frequency	
163 KHz:	163 KHz, sine wave.
196 KHz:	196 KHz, sine wave.
392 KHz:	392 KHz, sine wave.
Signal Level:	0.0 dBm ±0.2 dB.
Termination:	135 Ohms ±1%.

WB TONES (HDSL Option only)

Frequency	
28 KHz:	28 KHz, sine wave.
40 KHz:	40 KHz, sine wave.
Signal Level:	0.0 dBm ±0.2 dB.
Termination:	135 Ohms ±1%.

7.4 MAINFRAME — MEASUREMENTS

Frequency

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

Level

The designation dBdsx is a voltage measurement; a 3-volt base-to-peak signal is defined as 0 dBdsx.

dBdsx Level Range:	+6 dBdsx to -40 dBdsx.
dBdsx Level Accuracy:	±1 dB between +6 dBdsx and -10 dBdsx. ±2 dB between -10 dBdsx and -20 dBdsx. ±3 dB between -20 dBdsx and -40 dBdsx.
dBdsx Resolution:	0.1 dB between +6 dBdsx and -6 dBdsx. 0.5 dB between -6 dBdsx and -40 dBdsx.
Vp-p Range:	60 mV to 12.0 V.

Simplex Current

Range:	0 mA to 200 mA.
Resolution:	1 mA.
Accuracy:	±(5% +1 mA).
Simplex Voltage Drop:	9.5 volts (nominal) at 60 mA.

Timing Slips

Range:	0 bit slips to 999 frame slips and 192 bit slips.
Resolution:	1 bit slip.

Volts DC (Optional)

Range:	0.5 VDC to 400 VDC.
Resolution:	0.1 VDC.
Accuracy:	±5%.

Resistance (Optional)

Range:	10 Ω to 10 MΩ.
Resolution:	10 Ω to 99 Ω — 2 significant digits. 100 Ω to 10 MΩ — 3 significant digits.
Accuracy:	±(5% +10 Ω) from 10 Ω to 1 MΩ. ±10% from 1 MΩ to 10 MΩ.

Time Domain Reflectometer (Optional)

Connection:	Jack type - WECO 310 or T1 Repeater Port connector. Isolation Voltage Protection - 1000 Vmax.
Pulse Repetition Rate:	11.718 kHz, nominal.
Pulse Amplitude:	10 Vp-p, nominal.
Vertical Dynamic Range:	60 dB, minimum.
Time Base Accuracy:	0.05%.

Test Range:	50 to 1000/3000/6500 ft. for fixed length tests on the character display. 50 to 10,500 ft. for AUTO length test on the character display.
Acquisition Time:	15 to 45 seconds depending upon the selected cable length and the location of the faults.
Data Presentation:	Character display and graphic display or printer.

Channel Monitor (Optional)

Channel:	1 to 24, NONE.
Signaling:	T1 D1D, T1 D4, or T1 SLC — A and B signaling bits. T1 ESF — A, B, C, and D signaling bits.
Data Presentation	
Character Display:	Signaling bits for all 24 channels. Data bits for selected channel.
Graphic Display:	Signaling bits, data bits, and channel number for selected channel.

HDSL (Optional)

LOSS Accuracy:	±0.5 dB.
LOSS Resolution:	0.1 dB.
LOSS Range (@ 0.0 dBm)	
28 KHz (56 Kb/s DDS):	0.0 dB to 45.0 dB.
40 KHz (Basic Rate ISDN):	0.0 dB to 45.0 dB.
163 KHz and 196 KHz:	0.0 dB to 45.0 dB.
392 KHz:	0.0 dB to 35.0 dB.
Power Detector:	RMS.
Power Accuracy:	±0.5 dB.
Power Resolution:	0.1 dBm.

Power Range:	-40.0 to +13.0 dBm.
Loop Length Range:	100 to 20,000 feet.
Loop Capacitance Range:	1500 to 323,500 pF.
Loop Length Resolution:	1%.
Loop Capacitance Resolution:	1%.
Loop Length Accuracy:	±2%.
Loop Capacitance Accuracy:	±2%.
Measurement Time:	<5 seconds.

7.5 MAINFRAME — ALARM CRITERIA

Signal Loss:	150 ms without input pulses after valid frequency and level are detected.
Pattern Loss:	QRSS — 250 errors detected in 1000 or fewer bits. 1:1, 1:7, ALL ONES, 2 IN 8, and 3 IN 24 — 100 errors in 1000 or fewer bits.
Frame Loss:	D1D - 2 out of 5 F_t bits in error. D4 - 2 out of 5 F_t bits in error. ESF - 2 out of 5 frame bits in error. SLC - 2 out of 5 F_t bits in error.
Yellow Alarm:	D1D - Bit 2 is a 0 for 255 consecutive channels. D4 - Bit 2 is a 0 for 255 consecutive channels. ESF - 256 bits ±16 bits of a repetitive (1111 1111 0000 0000) pattern received in the 4 kb/s datalink. SLC - Bit 2 is a 0 for 255 consecutive channels.
Excess Zeros:	AMI - 16 consecutive zeros. B8ZS - 8 consecutive zeros.
Low Battery:	Battery has approximately 15 minutes of power remaining.

7.6 MAINFRAME — LOOP CODES

Generation and Detection Patterns

CSU Loop Codes

In-Band:	Loop up: 10000; loop down: 100.
ESF LINE:	Loop up: 1111 1111 0111 0000. Loop down: 1111 1111 0001 1100.
ESF PAYLOAD:	Loop up: 1111 1111 0010 1000. Loop down: 1111 1111 0100 1100.

NIU Loop Codes

FAC1:	Loop up: 1100; loop down: 1110.
FAC2:	Loop up: 11000; loop down: 11100.
FAC3:	Loop up: 100000; loop down: 100.
ESF NET:	Loop up: 1111 1111 0100 1000. Loop down: 1111 1111 0010 0100.

PROG Loop Codes

USER:	3- to 8-bit programmable repeating code independently selectable for loop-up and loop-down codes.
IOR (Optional):	See the manufacturer's specifications.
IOR CMD (Optional):	See the manufacturer's specifications.
IOR PGM (Optional):	See the manufacturer's specifications.
ILR (Optional):	See the manufacturer's specifications.
ILR CMD (Optional):	See the manufacturer's specifications.
ILR PGM (Optional):	See the manufacturer's specifications.
DS1MSWITCH (Optional):	See the manufacturer's specifications.
DS1MSRAMP (Optional):	See the manufacturer's specifications.

DS1MSCMD (Optional):	See the manufacturer's specifications.
HDSL (Optional):	See the manufacturer's specifications.
ESF DL:	NOT FOR SYNC, SONET, STRATUM 1, STRATUM 2, STRATUM 3, STRATUM 4, SYNC UNKNOWN, and USER.

7.7 DLC ANALYZER OPTION — GENERAL SPECIFICATIONS

Physical

Size:	7.8"H x 13.7"W x 4.4"D (19.8 cm x 34.8 cm x 11.2 cm).
Weight:	4.5 pounds (2.0 kg).

Operational

Operating Temperature:	32°F to 122°F (0°C to 50°C).
Storage Temperature:	-4°F to 122°F (-20°C to 50°C).
Power:	8 watts, maximum (power supplied by T-BERD 209*OSP*).

7.8 DLC ANALYZER OPTION — INPUT SPECIFICATIONS

Input Connectors:	WECO 310 jacks for primary and secondary receivers.
Input Frequency:	1,544,000 Hz ±4000 Hz.
Input Impedance:	BRIDGE — 1000 Ω or greater. TERM — 100 Ω ±5%. DSX-MON — 100 Ω ±5%.

Input Signal Range:	BRIDGE — +6 dBdsx to -35 dBdsx (with ALBO). TERM — +6 dBdsx to -35 dBdsx (with ALBO). DSX-MON — +6 dBdsx to -24 dBdsx (with AGC resistive loss compensation).
Framing Formats:	SLC Mode 1, SLC Mode 2, T1 D1D, T1 D4, T1 ESF, and Auto framing.

7.9 DLC ANALYZER OPTION — OUTPUT SPECIFICATIONS

Transmit Output

Output Connectors:	WECO 310 jack.
Output LBO Tolerance:	0 dB, -7.5 dB, and -15 dB.
Line Codes:	AMI or B8ZS selectable.
Pulse Shape:	With output terminated in 100 Ω resistive load and 0 dB line build-out selected, the T-BERD DLC Analyzer Option meets ANSI T1.403 pulse shape specifications.

VF Output

Connector:	VF OUT (WECO 310) jack.
Driver:	600 ohms with a minimum 28 dB return loss from 300 Hz to 3400 Hz.
Frequency Response:	±0.25 dB (300 Hz to 3000 Hz). +0.25 dB to -1.5 dB (3000 Hz to 3400 Hz).
Tracking Distortion:	±0.3 dB between +3 dBm0 and -40 dBm0 (relative to 1004 Hz at -10.0 dBm0).

2-Wire VF Posts

Connector:	2-Wire VF posts.
Loop Current:	25 mA (typical).
Return Loss:	>20 dB at 1 kHz.

7.10 DLC ANALYZER OPTION — FUNCTIONS

VF Drop

VF Drop Sources:	Primary receiver, secondary receiver, or both receivers.
VF Drop Interfaces:	Built-in speaker, 2-terminal 2-wire VF interface, and WECO 310 4-wire VF interface.

VF Level

Range:	-40.0 dBm0 to +3.0 dBm0.
Accuracy:	±1.5 dB (300 Hz to 3000 Hz).
Resolution:	0.1 dBm0.

VF Frequency

Range:	60 Hz to 3500 Hz.
Accuracy:	±2 Hz.
Resolution:	1 Hz.

VF Insert

VF Insert Sources:	Internally generated tones — 404 Hz, 1004 Hz, and 2804 Hz.
	External input — 2-terminal 2-wire interface.
VF Tone Levels:	-16 dBm, -10 dBm, -3 dBm, 0 dBm, and +3 dBm.

Trunk Control

SLC Trunk Type:	Ground start, loop start, and wink start.
Signal Controls:	A, B, C, and D signaling, and on-hook, off-hook, and ringing signaling.

SLC Transmitted Messages

SLC Alarms:	Major, Minor, Power/Misc, Far-End Loop, Switch to Protection, and Shelf Alarm.
SLC Maintenance:	Maintenance Proceed, Maintenance Hook/Seize, and Maintenance Test Alarm.

7.11 ISDN/DDS ANALYZER OPTION — GENERAL SPECIFICATIONS

Physical

Size:	7.8"H x 13.7"W x 4.4"D (19.8 cm x 34.8 cm x 11.2 cm).
Weight:	6 pounds (2.7 kg).

Operational

Operating Temperature:	32°F to 122°F (0°C to 50°C).
Storage Temperature:	-4°F to 122°F (-20°C to 50°C).
Power:	
DC	6 watts, maximum (power supplied by T-BERD 209*OSP*).
AC	≤ 20 watts (power supplied by AC line in standalone mode).

7.12 ISDN/DDS ANALYZER OPTION — INPUT SPECIFICATIONS

Input Connectors:	WECO 310 jack or RJ-45 connector, pinouts corresponds to standard ISDN and DDS conventions.
Input Frequency:	2.4 to 72 kB/s (DDS). 160 kB/s (ISDN)
Input Impedance:	BRIDGE — 1500 Ω or greater (DDS mode only). TERM — 135 Ω ±5%.
Input Signal Range:	DDS Mode — +6 dB to -39dB. ISDN Mode — +6 dB to -42dB.

7.13 ISDN/DDS ANALYZER OPTION — OUTPUT SPECIFICATIONS

Transmit Output

Output Connectors:	WECO 310 jack or RJ-45 connector, pinouts corresponds to standard ISDN and DDS conventions..
Output LBO Levels:	0 dB, -3 dB, -6 dB, and -9 dB (DDS mode only).
Line Codes:	AMI (DDS mode) or 2B1Q (ISDN mode).
Pulse Shape:	DDS Mode — the T-BERD ISDN/DDS Analyzer Option meets ANSI T1.401 pulse shape specifications. ISDN Mode — the T-BERD ISDN/DDS Analyzer Option meets ANSI T1.601 pulse shape specifications

7.14 GROUNDING

WECO 310 jack sleeves connected to chassis ground.

Power cord center pin connected to chassis ground.

RS-232 8-pin DIN Connector:	Pin 3 to chassis ground. Pin 2 to signal ground.
14-pin T1 REPEATER PORT Connector:	Pins 8 and 14 to signal ground. Pin 9 to chassis ground.

7.15 BATTERY

Type:	12 V, 3 A, jelled lead-acid electrolyte.
Operating Period:	
No DLC or ISDN/DDS Analyzer Option:	Five to seven hours of continuous operation on a full charge.
With DLC or ISDN/DDS Analyzer Option:	At least 1.5 hours if both units are operating. At least 3.5 hours if only the T-BERD DLC or ISDN/DDS Analyzer Option is operating.
Storage Period:	@ 68°F, holds 85% of charge after six months. Requires recharging every six months.
Recharging Period:	Eight hours from full discharge.

FACTORY DEFAULT SETTINGS

A.1 MAINFRAME — DEFAULT SETTINGS

The T-BERD 209*OSP* factory default settings (see Table A-1) are stored in mainframe nonvolatile RAM (NOVRAM). The T-BERD 209*OSP* controls can be forced to their default settings by momentarily pressing the **RESTART** switch while the unit is being powered-up. As soon as the message *SYSTEM RESET* is visible in the display window, release the **RESTART** switch.

Table A-1
Factory Default Settings

Parameter	Default
AUTOTEST	LED OFF
B8ZS	LED OFF (AMI coding)
DISPLAY LIGHT	OFF
LBO dB(DSX)	0
LOOP CODES	CSU
MODE	SELF TST
PATTERN	ALL ONES
PRINT EVENT	OFF
RECEIVE INPUT	BRIDGE
RECV'D	LED OFF (internal timing)
RESULTS I & II Category	SUMMARY
TIMED TEST	LED OFF (continuous testing)
AUX PGM PAT1	010100100
AUX PGM PAT2	001101110
AUX PGM PAT3	110001110
AUX PGM LPUP	1100 (FAC1)
AUX PGM LPDN	1110 (FAC1)
AUX PRNTPORT	
BAUD RATE	2400
PARITY	NONE
TERM 232	CR
AUX TEST LEN	200 HRS 00 MIN 00 SEC
AUX CLOCK	
TIME	N/A
DATE	N/A

Table A-1
Factory Default Settings (Continued)

Parameter	Default
AUX VOLUME	OFF
AUX TIME PRN	12 HRS 0 MIN
AUX BUF CLR	EMPTY
AUX LOOPCODE	
CSU	IN BAND
NIU	FAC2
PROG	USER
AUX SMARTNET	
IOR	TELTREND 7231
ILR	TELTREND 7239
DS1 MSW	NIMS-60
HDSL	PAIRGAIN
AUX DATALINK	
BPM RECEIVE	ON
USER BPM	01100110
PRM TRANSMIT	OFF
PRM RECEIVE	ON
AUX FT1 CHAN	1
AUX FT1 SETUP	
IDLE	11111111
RATE	64KxN
AUX VF TONE	
FREQUENCY	1004Hz
LEVEL	0.0 dBm
AUX VF CHAN	NONE
AUX RESPONSE	NO RESPONSE
AUX AUTOTEST	
VOLTS	ON
OHMS	ON
TDR	ON
REPEATER	ON
AMPS	ON
BRIDGTAP	ON
AUX MULTIPAT	
PATTERN	ALL ONES
MIN: SEC	3:00 (all patterns)

A.2 DLC ANALYZER OPTION — DEFAULT SETTINGS

The DLC Analyzer Option factory default settings (see Table A-2) are stored in the DLC Analyzer nonvolatile RAM (NOVRAM). The DLC Analyzer Option controls can be configured with their factory default settings by momentarily pressing the **RESTART** switch while the unit is being powered-up. Release the **RESTART** switch after power is applied. When the message *LOAD NOVRAM* appears, press the **RESTART** switch again.

Table A-2
DLC Analyzer Option Factory Default Settings

Parameter	Default
B8ZS	AMI
FRAME	SLC-M1
FORMAT	CHANNEL
SOURCE I	1004 Hz
SOURCE II	0 dB
RESULTS I and II	SUMMARY
RESTART	N/A
DISPLAY LIGHT	OFF
PRINT	OFF
RECEIVE INPUTS	DSX-MON
PRIMARY CHANNEL	— —
SECONDARY CHANNEL	— —
INSERT	OFF
SIGNALING INSERT	All OFF
CHANNEL/VF DROP	BOTH
CHANNEL/CHANNEL SCROLL	BOTH
CHANNEL/TRUNK TYPE	LOOP START
TRANSMIT/LBO	0 dB
TIME/SET TIME	(Time of software release)
TIME/SET DATE	(Date of software release)
MISC/VOLUME	OFF

A.3 ISDN/DDS ANALYZER OPTION — DEFAULT SETTINGS

The ISDN/DDS Analyzer Option factory default settings (see Table A-3) are stored in the ISDN/DDS Analyzer RAM (NOVRAM). The ISDN/DDS Analyzer Option controls can be configured with their factory default settings by momentarily pressing the **RESTART** switch while the unit is being powered-up. Release the **RESTART** switch after power is applied.

Table A-3
ISDN/DDS Analyzer Factory Default Settings

Parameter	Default
MODE	DDS
FORMAT	56 kB/s
PRI PATTERN	2047
SEC PATTERN	none
RESULTS I	SUMMARY
RESULTS II	SUMMARY
RECEIVE INPUT	TERM
RECVD	LED off
LBO	0 dB
SPAN CURRENT	OFF
AUX VOLUME	ON
AUX BAUD	2400
AUX PARITY	NONE
AUX TERM	CR
AUX RESPONSE	NO RESPONSE
LOOP	CSU/NT1 (Inactive)

CHANNEL TIME SLOT ASSIGNMENTS

The channel time slot assignments determine which channel is actually dropped from a framed signal when a particular time slot is selected. Since the Advanced Services Support Option selects the dropped channel based on the primary usage of D4 and ESF framing, the time slots for other D1D and SLC framing drop different data channels than the user may expect. Use Table B-1 to determine the correspondence between the selected channel number and the actual channel that is displayed.

Table B-1
Channel Time Slot Assignments

Channel Time Slot	D1D Channel Number	D4 & ESF Channel Number	SLC Channel Number
1	1	1	1
2	13	2	13
3	2	3	2
4	14	4	14
5	3	5	3
6	15	6	15
7	4	7	4
8	16	8	16
9	5	9	5
10	17	10	17
11	6	11	6
12	18	12	18
13	7	13	7
14	19	14	19
15	8	15	8
16	20	16	20
17	9	17	9
18	21	18	21
19	10	19	10
20	22	20	22
21	11	21	11
22	23	22	23
23	12	23	12
24	24	24	24

STRESS PATTERNS

A hexadecimal-to-binary conversion table appears below. The following test pattern bit patterns and hexadecimal equivalents are indicated in this appendix.

- MIN/MAX
- T1-2/96
- T1-3/54
- T1-4/120
- T1-5/53
- 55 OCTET
- T1 DALY

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	

Min/Max Stress Pattern

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								

T1-2/96 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 80H 1000 0000	72 01H 0000 0001	73 AAH 1010 1010	74 AAH 1010 1010	75 AAH 1010 1010	76 AAH 1010 1010	77 80H 1000 0000	78 01H 0000 0001	79 80H 1000 0000	80 01H 0000 0001
81 80H 1000 0000	82 01H 0000 0001	83 80H 1000 0000	84 01H 0000 0001	85 80H 1000 0000	86 01H 0000 0001	87 80H 1000 0000	88 01H 0000 0001	89 80H 1000 0000	90 01H 0000 0001
91 80H 1000 0000	92 01H 0000 0001	93 80H 1000 0000	94 01H 0000 0001	95 80H 1000 0000	96 01H 0000 0001				

T1-3/54 Stress Pattern

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

T1-4/120 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 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

T1-4/120 Stress Pattern (Continued)

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

T1-5/53 Stress Pattern

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

55 OCTET Stress Pattern

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

T1-DALY Stress Pattern

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

INTELLIGENT NETWORK EQUIPMENT

INTRODUCTION

This appendix shows the intelligent network equipment addresses (see Table D-1) and available commands (see Table D-2) currently supported by the T-BERD 209*OSP*.

Table D-1
Intelligent Network Equipment Loop Code Addresses

Equip. Manuf.	Model	IOR Addresse	ILR Addresses	Maint Switch/ Ramp Address
ADTRAN	HDSL equipment. No Model Number	None	1 to 2	N/A
Pair Gain	HDSL equipment. No Model Number	None	1 to 2	N/A
Tellabs	HDSL equipment. No Model Number	None	1 to 2	N/A
Teltrend	7231/7239 or 7231/7239 LC or 7231/7239 LD or 7231/7239 LP or 7231/7239LS or 7231/7239LW	None	1 to 20	N/A
	7231E	1 to 3	N/A	N/A
	DS1 Maintenance Switch	N/A	N/A	1 to 16
TxPORT	231/239	1 to 26	1 to 26	N/A
Wescom	F-Series Office or F-Series Field (CS270F/3192-7F/ 3423-7F)	A to H, J to M, 0 to 2, and AA to AH, AJ to AM, A0 to A2	A to H, J to M, 0 to 2, and AA to AH, AJ to AM, A0 to A2	N/A N/A

Table D-1 (Continued)
Intelligent Network Equipment Loop Code Addresses

Equip. Manuf.	Model	IOR Addresses	ILR Addresses	Maint Switch/ Ramp Address
Westell	3150-C0	N/A	1 to 99	N/A
	3130-56/3150-56	1 to 2	1 to 20	N/A
	3151-56	N/A	1 to 20	N/A
	3130-70/3150-70	1 to 2	N/A	N/A
	3130-80/3150-80	1 to 1999	0 to 1999	N/A
	3140-80	0 to 1999	N/A	N/A
	3150-81	N/A	0 to 1999	N/A
	NIMS-20 NIMS-28 NIMS-60	N/A	N/A	1 to 28
	3222/3224-40(41) (HDSL equipment)	None	None	N/A
XEL	7853-000	N/A	Exchange Code: 1 to 999 Location Code: 1 to 9999	N/A
	7854-008	N/A	1 to 63	N/A

NOTE: N/A indicates there is no equipment of that type associated with the given model of equipment.

Table D-2
Intelligent Network Equipment Commands

Equip. Manuf.	Model	Equipment Command	Program Command	Command Selections
ADTRAN	HDSL equipment. No Model Number	Arm/Disarm Time-out Disable	N/A	N/A
Pair Gain	HDSL equipment. No Model Number Time-out Disable Power Down	Arm/Disarm Query	N/A	N/A
Tellabs	HDSL equipment. No Model Number	Arm/Disarm Time-out Disable	N/A	N/A
Teltrend	7231/7239 or 7231/7239 LC or 7231/7239 LD or 7231/7239 LP	Arm/Disarm Near-end Arm Query Time-out Disable Power Loop Power Down Power Thru	N/A	N/A
	7231E	Arm/Disarm Near-end Arm Query Time-out Disable Power Down Far-end NIU Activate Clear FT1 Dual Loop back	N/A	N/A

Table D-2 (Continued)
Intelligent Network Equipment Commands

Equip. Manuf.	Model	Equipment Command	Program Commands	Command Selections
Teltrend	7231/7239LS or 7231/7239LW	Arm/Disarm Near-end Arm Query Time-out Disable Power Loop Power Down Power Thru Auto Query Auto Learn Manual Learn	N/A	N/A
	DS1 Maintenance Switch	Arm/Disarm Restore Query Time-out Disable	N/A	N/A
TxPORT		231/239	N/A	N/A N/A
Wescom	(CS270F/3192-7F/3423-7F)	F-Series Office or F-Series Field Power Query	Time-Out Disable Power Loop	
Westell	3150-C0	Arm/Disarm Query Time-out Disable Sequential Loop Back	N/A	N/A
	3130-56/3150-56	Arm/Disarm Query Time-out Disable Sequential Loopback Power Query	N/A	N/A
	3151-56	Arm/Disarm Query Time-out Disable Sequential Loop Back Power Query AIS Disable	N/A	N/A

Table D-2 (Continued)
Intelligent Network Equipment Commands

Equip. Manuf.	Model	Equipment Command	Program Command	Command Selections
Westell	3130-70	Arm/Disarm CPE Arm Query Time-out Disable Sequential Loop Back Enable, Disable Power Down Invert Entry AIS Disable Option Query	Address Arm Frame AIS Timeout Block CPE Arm Acknowledge Power Query Arm Code Reset	1 to 2 Auto, Dual, ESF Enable, Disable Enable, Disable Error, Invert CPE, NIU Master, Session
	3150-70	Arm/Disarm Cpe Arm Query Time-out Disable Sequential Loopback Power Down Power Query AIS Disable Option Query	Address Arm Frame Ais Timeout Block CPE Arm	1-20 Auto, Dual, ESF Enable, Disable Enable, Disable Enable, Disable
	3130-80/3150-80 or 3140-80 or 3150-81	Arm/Disarm Query Time-out Disable Sequential Loop Back Disable Power Query Power Down AIS Disable Option Query	Address Arm Frame Code Detection AIS Timeout Block CPE Arm Reset	0/1 to 1999 Auto, Dual, ESF Sync Async, Enable, Enable, Disable Enable, Disable Master, Session
	NIMS-20 NIMS-28 NIMS-60	N/A	N/A	N/A
	3222/3224-40(41) (HDSL equipment)	Arm/Disarm Time-out Disable	N/A	N/A
XEL	7853-000 7854-008	Time-out Extend N/A	N/A N/A	N/A N/A

NOTE: Some commands are only valid for the office repeaters, and some commands are only valid for the line repeaters.