ML11086-02
Rev. A

T-BERD 107
T-CARRIER ANALYZER
OPERATING MANUAL

SEPTEMBER 1990

20410 Observation Drive
Germantown, MD 20876
(301) 353-1550 or (800) 638-2049
Fax. (301) 353-0731

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE **PAGE**

FIGURES

SECTION 1

GENERAL INFORMATION

1.1 INTRODUCTION

This manual is issued to provide information on the physical and functional features and operation of Telecommunications Techniques Corporation's T-BERD 107 T-Carrier Analyzer.

1.2 INSTRUMENT OVERVIEW

The T-BERD 107 T-Carrier Analyzer is a hand-held, battery- or AC-operated test set for T1 and T1C circuits. Packaged in a compact case, the T-BERD 107's operating panel features test mode selection switches, alarm and signal status LED indicators, and a liquid crystal display with backlighting capability. The T-BERD 107 also contains a printer port for providing hard copy test results.

Two T-BERD 107 options are available: a T1 Channel Monitor Option and a T1/T1C Transmitter Option. The T1 Channel Monitor Option provides audio and data monitoring of a user-selected channel. The T1/T1C Transmitter Option provides the ability to transmit framed and unframed test patterns, as well as loop smart jacks and CSUs. Both options are field-installable in the T-BERD 107 lid. The T1 Channel Monitor Option and the T1/T1C Transmitter Option are discussed in detail in Appendices A and B, respectively.

The T-BERD 107 is designed for use at any T-Carrier access point, whether at a central office, DSX patch bay, customer service unit, or a repeater. It monitors T1 or T1C circuits, verifies error and alarm conditions, measures signal quality, and identifies equipment failures. The T-BERD 107 can perform both in-service and out-of-service testing, and can be set for either continuous or timed tests.

1.3 SUMMARY OF KEY FEATURES

The T-BERD 107 offers these key features and characteristics:

- Automatic synchronization to D4, ESF, and SLC*-96 framing patterns.
- Automatic recognition of and synchronization to the quasi-random signal source (QRSS), the 3 IN 24, 1:7, and ALL ONES patterns.
- Extended Receiver Range that allows testing of T1 signals at any point along a span line, including low-level signals (down to -35 dB) at repeater inputs.
- An optional T1/T1C Transmitter for performing out-of-service testing.
- Printer port and buffer for storing and printing hard copy test results.
- An optional T1 Channel Monitor to test individual DS0 channels within the T1 frame.
- Signal analysis with signal level and recovered clock frequency measurements.

* SLC is a registered trademark of AT&T Technologies, Inc.

SECTION 2

PHYSICAL DESCRIPTION

2.1 INTRODUCTION

This section contains a physical description of the T-BERD 107 T-Carrier Analyzer.

2.2 DESCRIPTION

The T-BERD 107 T-Carrier Analyzer is housed in a rugged, shock-resistant, rectangular case, measures 3.25" deep x 4.25" wide x 8.5"high, and weighs 3.4 pounds. A metal clasp allows the two panels of the instrument to be closed for carrying or storing; when unlatched, the two panels hinge open and lie flat. The carrying case holds the T-BERD 107, T-BERD Repeater Extender, AC adaptor, operating manual, and cables. (See Section 8 for information on accessories.)

The T-BERD 107 right panel contains alarm LED indicators, alarm history LED indicators, status LED indicators, pattern LED indicators, the liquid crystal display (LCD), the **DISPLAY** backlight switch, the **CATEGORY** switch, the **RESULTS (TIME SET)** switch, the **HALT/RUN/RESTART** switch, the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch, the **BRIDGE/TERM/DSX-MON** switch, the **T1/T1C** switch, the printer LED indicators, the **PRINTER** switch, and the **POWER** switch.

The T-BERD 107 Help Panel is located on the lid. This lid is also used to house the T1 Channel Monitor Option or T1/T1C Transmitter Option. See Appendices A and B for information on the T1 Channel Monitor Option and T1/T1C Transmitter Option, respectively.

2.3 POWER SUPPLY

The T-BERD 107 is powered by a replaceable, sealed lead acid battery or by the AC adaptor plugged into a 120-volt outlet. When the AC adaptor is plugged in it will both power the instrument and charge the battery. (See Section 6 for detailed information on battery-powered operation.)

SECTION 3

FUNCTIONAL DESCRIPTION

3.1 INTRODUCTION

This section describes the T-BERD 107 measurement capabilities. Included are descriptions of the operating modes, switches, indicators, and results display. Information on the printer port, print buffer, and user Help Panel is included at the end of this section.

3.2 OPERATING MODES

The T-BERD 107 provides monitoring capabilities for T1 and T1C circuits. T1C mode monitors **Unframed** data only. T1 modes monitor:

- **Unframed** for compatibility with existing test equipment or circuits where framing is not required.
- **Framed** for monitoring circuits which include multiplexers and Digital Access and Cross-Connect Switches (DCS) through which only framed data can pass. T1 framing modes include D4, ESF, and SLC-96.

The T-BERD 107 performs a self-test on power up. A complete description of the self-test is provided in Section 4.

3.3 INSTRUMENT PANEL

This section describes the T-BERD 107 switches and indicators. Figure 3-1 depicts the T-BERD 107 Mainframe. The numbers for each item in Figure 3-1 correspond to the bracketed number appearing in the following descriptions.

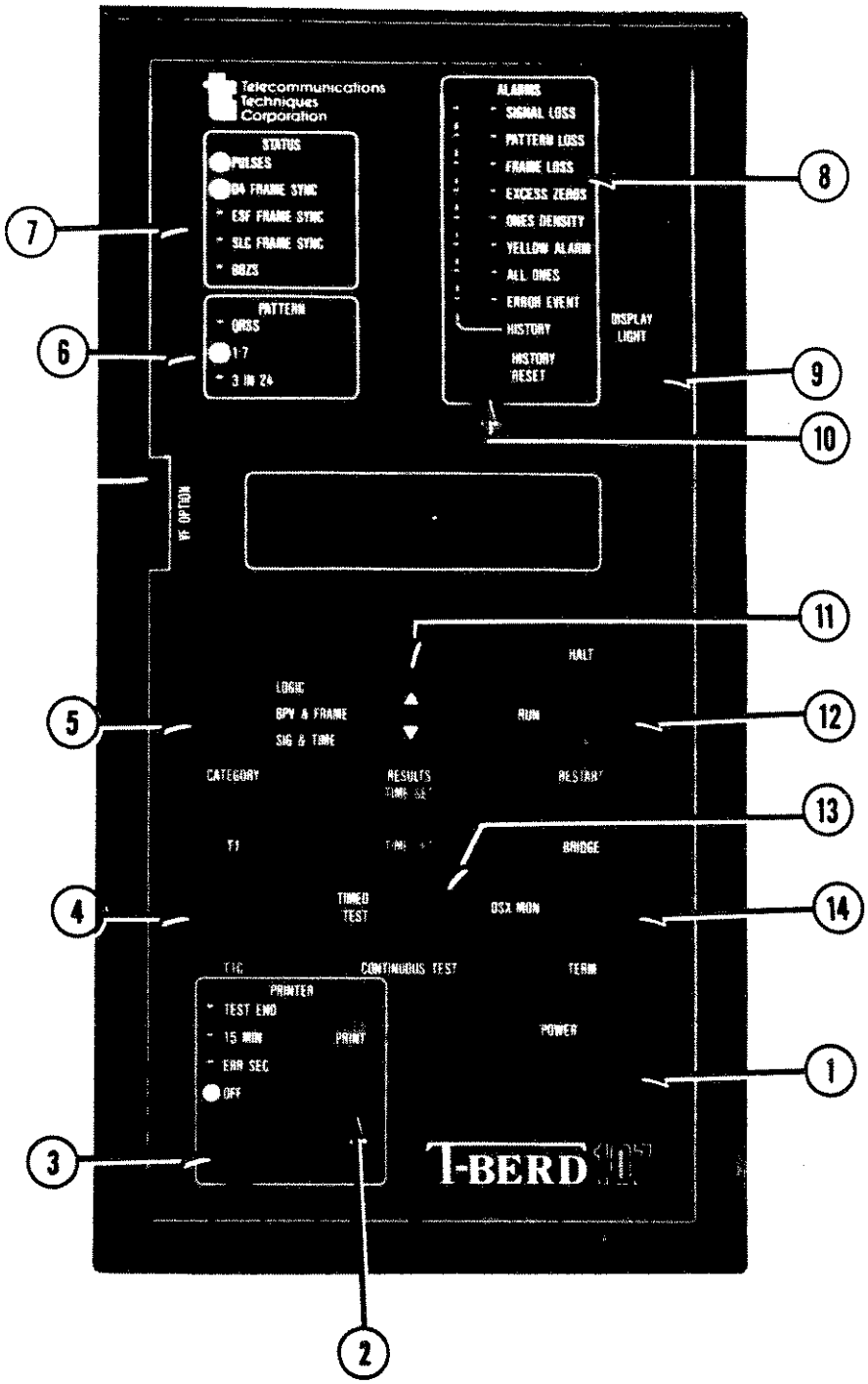

Figure 3-1
T-BERD 107 Right Panel

3.3.1 Switches

The T-BERD 107 has two types of switches: multiposition rocker switches and pushbutton switches. The T-BERD 107 switches are described in the following paragraphs:

POWER Switch [1]

This pushbutton switch applies power to (ON) and removes power from (OFF) the instrument.

PRINT Switch [2]

This pushbutton switch sends all test results to the results buffer or directly to the an attached printer each time it is pushed.

PRINTER SELECT Switch [3]

This pushbutton switch selects when the T-BERD 107 will output its test results to the results buffer or directly to an attached printer. The TEST END position sends test results after a timed test is complete. The 15 MIN position sends the test results every 15 minutes during the test interval. The ERR SEC (Errored Seconds) position sends a set of test results every time an errored second occurs. The OFF position prevents any test results from being automatically sent to the buffer.

NOTE: See Section 3.5 for detailed description of printing functions.

T1/T1C Switch [4]

This two-position rocker switch configures the receiver for either T1 (1.544 Mb/s signal) or T1C (3.152 Mb/s signal).

CATEGORY Switch [5]

The **CATEGORY** switch controls the selection of results categories for display. The categories are LOGIC, BPV & FRAME, and SIG & TIME. Note that all results are accumulated simultaneously regardless of which category is displayed. The category selection may be changed during a test without causing a test restart.

DISPLAY LIGHT Switch [9]

This pushbutton switch lights the display for use in dark environments. The switch is pressed once to light the display. The light will automatically be turned off after 30 seconds to conserve battery life. If the switch is pressed a second time before the 30 seconds expire, the light will remain on until the switch is pressed a third time, when it will turn off.

HISTORY RESET Switch [10]

This pushbutton switch turns off all of the HISTORY LEDs.

RESULTS (TIME SET) Switch [11]

The **RESULTS (TIME SET)** switch is a rocker switch with an up arrow position and a down arrow position, as well as a neutral position. The **RESULTS (TIME SET)** switch works in conjunction with the **CATEGORY** switch to determine which result is displayed in the Liquid Crystal Display (LCD). The up and down arrows represent the direction of movement through the results in the selected category. Each time an arrow position on the switch is pressed the next result is scrolled into the display. If the arrow is held down for more than 1 second, the instrument automatically scrolls through the list of available results.

The **RESULTS (TIME SET)** switch also works in conjunction with the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to set the TIMED TEST interval. The TIME SET position of the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch is used to select the hours, minutes, or seconds portion of the TIMED TEST interval. The **RESULTS (TIME SET)** switch up and down arrows increase or decrease the selected time increment of the TIMED TEST interval.

NOTE: The **RESULTS (TIME SET)** switch and the **CATEGORY** switch SIG & TIME position are used to set the CLOCK and DATE. Select Result 65-CLOCK or Result 66-DATE and use the **TIME SET/TIMED TEST/ CONTINUOUS TEST** switch TIME SET position and the **RESULTS (TIME SET)** switch to set the correct time and date.

HALT/RUN/RESTART Switch [12]

This three-position rocker switch has one momentary and two fixed positions. RESTART is the momentary position that clears all test results and LEDs and starts a new test. The two fixed positions are HALT and RUN. HALT causes the test to stop and freezes all LEDs and displayable results. HALT also stops printer activity. The RUN position allows the test to proceed.

If the user switches from HALT to RUN, the test in progress continues, the displayed results and LEDs begin accumulating and adding new values to the totals from before the test was halted, and the printer continues its operation.

TIME SET/TIMED TEST/CONTINUOUS TEST Switch [13]

This rocker switch has one momentary position, TIME SET. The other two fixed positions, CONTINUOUS TEST and TIMED TEST, determine the type of test performed while the unit is operating.

(a) **TIME SET** - This momentary position is used to sequentially set the hours, minutes, and seconds portions of the TIMED TEST test interval. Pushing the TIME SET position once displays the time interval on the LCD and causes the hours (HHH) to blink. A second push causes the minutes (MM) to blink. A third push causes the seconds (SS) to blink. As each portion is blinking, the **RESULTS (TIME SET)** switch increases or decreases the value within its limits.

(b) **CONTINUOUS TEST** - This position allows tests of unlimited duration. To restart a continuous test or to clear results, press any of the following switches/switch settings:

T1/T1C
RESTART
POWER
BRIDGE/DSX-MON/TERM

(c) **TIMED TEST** - Changing the switch setting from CONTINUOUS TEST to TIMED TEST mode clears all of the results and begins a timed test. The TIMED TEST position

causes the test to begin and continue for the duration of the preset time interval. In the TIMED TEST mode, pressing any one of the **T1/T1C, RESTART, POWER**, or **BRIDGE/ DSX-MON/TERM** switches/switch settings will begin a new timed test. Changing the switch setting from TIMED TEST to CONTINUOUS TEST mode does not clear accumulated results; new results are added to the already accumulated ones.

BRIDGE/DSX-MON/TERM Switch [14]

This three-position rocker switch selects the input impedance and signal conditioning. The BRIDGE position provides greater than 1000 ohms input impedance with automatic line build-out (ALBO) for monitoring lines that are already terminated. The DSX-MON position provides 100 ohms input impedance with automatic gain control (AGC) for testing at resistor isolated DSX-MON jacks. The TERM position provides 100 ohms input impedance with ALBO for terminating lines with the T-BERD 107.

3.3.2 Status Indicators

The five STATUS indicators and the three PATTERN indicators located on the T-BERD 107 Mainframe provide information about the received signal. Each green LED is illuminated for at least 0.1 second when the status or pattern it represents is detected.

The T-BERD 107 indicators are described in the following paragraphs:

STATUS [7]

(a) **PULSES** - The presence of a valid T1 or T1C signal illuminates this green LED.

(b) **D4 FRAME SYNC** - When the T-BERD 107 achieves synchronization to a D4 framing mode in the received T1 data stream, this green LED illuminates.

(c) **ESF FRAME SYNC** - When the T-BERD 107 achieves synchronization to an ESF framing mode in the received T1 data stream, this green LED illuminates.

(d) **SLC FRAME SYNC** - When the T-BERD 107 achieves synchronization to an SLC framing mode in the received T1 data stream, this green LED illuminates.

NOTE: If frame synchronization is lost, the applicable FRAME SYNC LED turns off.

(e) **B8ZS** - Detection of B8ZS clear channel codes in the received T1 or T1C signal illuminates this green LED.

PATTERN [6]

The three pattern status indicators located on the T-BERD 107 Mainframe indicate the presence of one of three test patterns.

(a) **QRSS** - When the T-BERD 107 achieves synchronization to a QRSS pattern, this green LED illuminates.

(b) **1:7** - When the T-BERD 107 achieves synchronization to a 1:7 pattern, this green LED illuminates.

(c) **3 IN 24** - When the T-BERD 107 achieves synchronization to a 3 IN 24 pattern, this green LED illuminates.

NOTE: If pattern synchronization is lost, the applicable pattern LED turns off.

3.3.3 Alarm Indicators

Alarm indicators are illuminated on the occurrence of specific alarm conditions, and remain illuminated for at least 100 ms. The alarm indicators alert the user to problems within the incoming signal, and are divided into two functional categories, CURRENT (real-time) indicators and HISTORY indicators as described below.

CURRENT AND HISTORY ALARM INDICATORS [8]

During any test interval, the occurrence of an alarm is instantly identified by the illumination of a corresponding red LED. If the alarm condition clears, the HISTORY alarm indicator that corresponds to the previous alarm is illuminated. At the end of a timed test all alarm indicators are frozen.

Current Alarm Indicators - These red LEDs provide information about alarm conditions currently detected. (A 0.1 second minimum "on" state allows the user to observe transient events.)

History Indicators - These red LEDs provide information about alarm conditions detected at a previous point during a test. During a continuous test or while a timed test is in progress the HISTORY LEDs are not illuminated until the detected alarm condition is no longer present. This permits the two alarm indicators for each alarm to convey four possible states (see Table 3-1).

Table 3-1
Alarm Indicator Conditions

Alarm State	LED Condition
No alarms, past or present	Current LED off History LED off
First occurrence of alarm condition	Current LED on History LED off
Past occurrence of alarm condition with no alarm detected at present	Current LED off History LED on
Re-occurrence of alarm condition	Current LED on History LED on

At any time during a test the **HISTORY RESET** switch can be used to clear the history alarm indicators. This switch affects only the history LEDs and does not affect the displayed results or restart a test. At the end of a timed test all alarm indicators are frozen.

The following is a description of each alarm indicator:

SIGNAL LOSS - - Loss of incoming signal is declared when no pulse is detected for 150 ms.

PATTERN LOSS - - Loss of synchronization to the designated pattern is declared after pattern synchronization has been achieved and 250 errors are detected in 1000 or fewer bits. After a loss of pattern synchronization, bit errors and errored seconds counts are halted. Pattern synchronization is reacquired after 50 (for QRSS) or 30 (for 1:7 or 3 IN 24) consecutive error-free bits have been received.

FRAME LOSS - - Loss of synchronization to the incoming T1 framing pattern is indicated by the FRAME LOSS current and history LEDs. For D4, ESF, and SLC-96 framing, frame synchronization loss is declared upon the occurrence of 2 out of 5 Ft bits in error.

Upon the occurrence of frame synchronization loss, no CRC or frame errors are counted, and the frame error rate, CRC error rate, frame errored seconds, CRC errored seconds, frame percent EFS, and CRC percent ESF results are frozen until synchronization is reacquired. The frame loss seconds count is incremented during the loss of synchronization.

EXCESS ZEROS - - Excess zeros detection is declared if 16 or more consecutive zeros are received in T1 or if 34 or more consecutive zeros are received in T1C.

ONES DENSITY - - This indicator is illuminated upon the occurrence of a ones density less than 12.5%.

YELLOW ALARM - - The yellow alarm indicator is provided to indicate the reception of yellow alarm signals embedded in framed T1 data. Neither the current nor the history yellow alarm LED will be illuminated for T1C signals or when T1 frame synchronization has not been acquired.

- For D4 framed data, yellow alarm is declared when Bit 2 is a zero for 255 consecutive channels.

- For ESF framed data, yellow alarm is declared when 256 ±16 bits of a repetitive "1111111100000000" pattern are received in the data link.

- For SLC-96, yellow alarm is declared when Bit 2 is a zero for 255 consecutive channels.

ALL ONES - - 1024 consecutive ones in unframed T1 or T1C signals; 128 consecutive DS0 channels with all ones for T1 framed modes.

ERROR EVENT - - The error event indicator is illuminated upon the occurrence of a bit error, BPV, frame error, or CRC error.

3.3.4 Connectors

The T-BERD 107 features several connectors located on top of the case and described below.

PRINTER CONNECTOR - - The printer port is a standard RS-232 serial port. A printer cable is supplied with each unit. The DB-25 end plugs into the printer, and the HIROSE HR-12 8-pin connector plugs into the T-BERD 107.

INPUT CONNECTOR - - Two receive input connectors allow either a WECO 310 or bantam jack to be used to access the receive input signal. The **BRIDGE/DSX-MON/TERM** switch determines whether automatic line build-out or automatic gain control circuits are used to accommodate signals attenuated by either cable or resistive circuits.

NOTE: Only one of these connectors should be used as the receive input at one time.

AC ADAPTOR - - The AC adaptor accommodates a 9-volt DC input with positive outer conductor and negative inner conductor.

3.4 MEASUREMENTS

Measurement results are divided into three categories, LOGIC, BPV & FRAME, and SIGNAL & TIME. These categories are described briefly in the following paragraphs and the results are listed in Tables 3-2 through 3-4.

A 2-line, 16-digit LCD is used for the results display. Not all results are available simultaneously, because some results depend on framing type, pattern synchronization, etc. When a result is unavailable, the message "UNAVAILABLE" appears in the display. Result counts overflowing will cause the "greater than" symbol (>) to be displayed. Results which are not applicable to the current test will display "N/A" in place of the result.

3.4.1 LOGIC Category

The LOGIC category results (Table 3-2) are based on a bit error count and are simultaneously updated each time bit errors are detected in the selected data pattern. When pattern synchronization is lost, the bit error count halts until pattern synchronization is reacquired.

3.4.2 BPV & FRAME Category

The BPV & FRAME category results (Table 3-3) are designed for in-service monitoring of T-Carrier spans. In this category, all results are taken from bipolar violation (BPV) counts and frame error counts. The BPV count increases each time successive T1 or T1C pulses of the same polarity are detected (except when part of a B8ZS substitution code). The BPV count is also the basis for calculating BPV seconds and BPV rate.

When counting frame errors, the T-BERD 107 analyzes the frame information embedded within a T1 signal. Frame errors detected in D4, ESF, or SLC-96 signals are used as the basis for calculating framing error rate and frame losses. The T-BERD 107 also displays the number of frame synchronization losses along with the number of seconds that frame synchronization was actually lost.

3.4.3 SIG & TIME Category

The SIG & TIME category (Table 3-4) contains results that analyze the characteristics of the input signal and results that offer time-related measurements.

Table 3-2
Displayed Results LOGIC Category

Result Number	Result Name	Description
00	BIT ERRORS	A count of received bits having a value opposite that of the corresponding transmitted bits (Mark or Space) after pattern synchronization is achieved.
01	ASYN ERR SEC	A count of test seconds during which one or more bit errors were counted.
02	BIT ERR RT	The ratio of bit errors to the number of data bits received.
06	%EFS	The ratio, expressed as a percentage, of error-free seconds to the total number of seconds during which pattern synchronization was present.
10	SEV ERR SEC	A count of seconds during which the bit error ratio was worse than 1×10^{-3}.
18	PAT LOS SEC	A count of the number of seconds during which the data received was not synchronized to the incoming data pattern for the entire second.

Table 3-3
Displayed Results BPV & FRAME Category

Result Number	Result Name	Description
24	BPV %EFS	The percentage of test seconds without bipolar violations (BPVs).
25	VIOLATIONS	A count of BPVs detected since the start of the test.
26	BPV SECONDS	A count of the seconds within which one or more BPVs occurred.
27	BPV RATE	The ratio of BPVs to the number of data bits received.
28	FRM ERR SEC	A count of the seconds during which one or more frame errors occurred. This result is only valid with D4 or SLC framing present.
29	FRAME SES	A count of the seconds during which the TOTAL number of frame errors equaled 12 or more. This result is only valid with D4 or SLC framing present.
30	FRM ERRORS	A count of the frame errors detected since the start of the test. For D4-compatible framing, frame errors are counted if either an Ft or an Fs frame bit is in error. In T1 SLC mode, frame errors are counted only if an error is found in an Ft bit. This result is only valid with D4 or SLC framing present.
31	FRM ERR RT	The ratio of frame errors to the number of analyzed framing bits. This result is only valid with D4 or SLC framing present.

Table 3-3
Displayed Results BPV & FRAME Category
(Continued)

Result Number	Result Name	Description
32	CRC ERRORS	A count of CRC errors detected. CRC errors are counted only when ESF framing is present in the received T1 data.
33	CRC ERR SEC	A count of seconds within which one or more CRC errors are detected. This result is only valid with ESF framing present.
34	FRAME %EFS	The percentage of test seconds without frame errors. This result is only valid with D4 or SLC framing present.
35	FRM LOS SEC	A count of seconds since initial frame synchronization during which one or more frame synchronization losses occurred, or during which frame synchronization could not be achieved.
36	CRC SES	A count of seconds during which the total number of CRC errors and frame synchronization losses equaled 320 or more. This result is only valid with ESF framing present.
37	CRC ERR RATE	A count of CRC errors divided by the total number of EFSs analyzed. This result is only valid with ESF framing present.
38	CRC %EFS	The percentage of test seconds without CRC errors. This result is only valid with ESF framing present.

Table 3-4
Displayed Results SIGNAL & TIME Category

Result Number	Result Name	Description
40	RX FREQ, Hz	The frequency of the received signal.
41	RX LVL,	The level of the received signal in dB relative to a standard 3-volt base-to-peak signal (DSX level).
42	RX LVL, dBm	The power level of an all ones signal (applicable only when all ones is detected).
43	RX LVL, Vp-p	The level of the received signal in peak-to-peak volts. The signal level is displayed as V or mV when it is higher or lower than 1 volt, respectively.
60	SIG LOS SEC	A count of test seconds during which the signal was not present, or during which one or more signal losses occurred.
61	ALARMED SEC	A count of test seconds during which a Yellow, All Ones, Excess Zeros, or Ones Density alarm was detected.
62	TEST LENGTH	The currently set test length for a timed test in HHH:MM:SS format.
63	ELAPSED TIME	The number of hours, minutes, and seconds since a proper frequency and level has been detected, or since the last major switch change.
64	TEST ENDS IN	Time remaining in a timed test, in HHH:MM:SS format
65	CLOCK TIME	The time of day in HH:MM:SS format.
66	DATE XXX:XX	The date in MMM:DD format.

Three types of receive level measurements are obtainable. The first measures peak voltage level and is expressed in dB relative to a standard 3-volt, base-to-peak signal (dsx level). This measurement is displayed in dBdsx (Result 41) and is valid for any T1 or T1C signal. The second measurement is displayed in dBm (Result 42) and may be performed only on an all-ones signal. The third measurement displays the signal level in peak-to-peak volts (Result 43).

3.5 PRINTER PORT AND BUFFER

The T-BERD 107 is equipped with an RS-232 printer port, as well as a printer buffer which saves results during testing. The buffer stores 18 printouts in first in/first out order.

When the T-BERD 107 is operated without a printer attached, generated results prints and alarm messages are stored in NOVRAM and the contents of the printer buffer are maintained during power down. If a printer is connected and on-line at T-BERD 107 power-up, the contents of the printer buffer are sent to the RS-232 port. If battery voltage is low, the contents of the printer buffer will be lost during power down and the message "NOVRAM LOST" will be printed. While testing, select PRINT EVENT OFF, if test results are not needed, to avoid having the buffer filled by unwanted results.

The different print events (see Figure 3-1) are selected by pressing the **PRINTER SELECT** switch located below the LEDs. Pressing the **PRINT** switch selects the type of test print to be stored in the buffer.

NOTE: Scrolling through the LEDs to the OFF position will clear the print buffer.

The results printout contains all results available at the time the printout is initiated and can be initiated manually by pressing the **PRINT** switch or automatically by selecting the TEST END, 15 MIN, or ERR SEC positions. A results printout will also be generated by a result count overflow. All results prints are labeled with the reason that they occurred, time- and date-stamped, and output in a 40-column format. Each results

print contains non-zero results and related calculations, an indication of no errors, and alarm LED statuses. Each time a result count overflows it is preceded by a double asterisk "**" to indicate a "just now overflowed" condition. All asterisks are cleared with a test restart. Figure 3-2 is a sample results printout.

```
MANUAL PRINT
12:58:39     MAY 31

LOGIC:
BIT ERR          339     ASYN E SEC          2
BER         3.22E-06     %EFS           98.53%
SES                1     PAT L SEC          13

BPV:
BPV %EFS      98.80%     BPV ERR             1
BPV E SEC          1     BPV RATE    8. E-09

CRC:
FRA L SEC          0     CRC ERR             1
CRC E SEC          1     CRC SES             0
CRC E RT    4. E-05      CRC %EFS      98.80%

SIGNAL:
FREQ Hz   OUT/RANGE      Rx LVL   +4.3 dBdsx
Rx LVL       UNAVAIL     Rx LVL   9.8  V p-p
SIG L SEC          0     ALARM SEC          81
TEST LEN 200:00:00       ELAPS TIM 00:01:23
TEST END 199:58:37

ALARM STATUS:
ONES DEN          ON     PAT LOSS HIST      ON
ONES DEN HIST     ON     ALL ONES HIST      ON
ERROR EV HIST     ON     PULSES             ON
ESF FRAME SYNC    ON     3 IN 24            ON
```

Figure 3-2
Sample Results Print

Alarm messages are generated automatically to inform the user of an important development in the ongoing test. These messages are printed when an alarm condition changes and only when the print event is not set to OFF. Alarm messages will be printed only once during the test second in which the alarm condition occurs. The format of an alarm message is shown below with XX:XX:XX representing time in HH:MM:SS format and XXX XX representing date in MMM DD format:

PATT SYN ACQUIRED
XX:XX:XX XXX XX

SIG LOSS
XX:XX:XX XXX XX

Other alarm messages include:

ALL ONES (ON/OFF)
EXCESS ZEROS (ON/OFF)
YELLOW ALARM (ON/OFF)
PAT SYN LS (XXXX)
FRA SYN LS (XXXX)
SIG LOSS (XXXX)
FRAME SYN ACQUIRED
PAT SYN ACQUIRED
TEST COMPLETE
TEST RESTART
SIGNAL DETECT
BUFFER FULL
ONES DENSITY FAIL

The T-BERD 107 will work with any serial text printer and connects using the supplied cable. TTC's PR-40A printer is compatible with the T-BERD 107. The printer should be configured as follows:

Baud	2400
Stop Bits	2 bits
Parity	none
Data Bits	8 bits

This information appears in the LCD upon power-up.

3.6 HELP PANEL

The T-BERD 107 features a user Help Panel located on the left panel. It supplies the user with step-by-step instructions to perform a test; to set test length, the clock, and the date; and lists all test results. When the T1 Channel Monitor is installed in the lid, the Help Panel supplies the user with step-by-step instructions to perform a test; to set test length, the clock, and the date; and user instructions for the T1 Channel Monitor. When the T1/T1C Transmitter is installed in the lid, the Help Panel supplies step-by-step instructions to perform a transmit/receive test, as well as loopback tests.

SECTION 4

PREPARATION FOR USE

4.1 INTRODUCTION

This section provides information on preparing the T-BERD 107 for use. Specifically included are: instructions for unpacking and inspecting the instrument, a list of the equipment that should be contained in the shipment, and the instrument checkout procedure.

4.2 UNPACKING

The T-BERD 107 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. Procedures for checking the electrical performance of the instrument are given in Section 4.4, Instrument Checkout. If the contents are incomplete, or if the T-BERD 107 does not pass performance tests, the customer should notify TTC. 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.

4.3 EQUIPMENT SUPPLIED

The following is a list of the equipment that should be present when the T-BERD 107 is received and unpacked.

T-BERD 107 T-Carrier Analyzer
Carrying Case
AC Adaptor
Operating Manuals
Printer Cable

4.4 INSTRUMENT CHECKOUT

As recommended in Section 4.2, the T-BERD 107 should be checked upon unpacking. To verify proper electrical operation, observe the T-BERD 107 as it goes through the instrument self-test. Then complete the instrument checkout procedures.

4.4.1 T-BERD 107 Self-Test

(1) Press the **POWER** switch to turn the T-BERD 107 on. All of the LEDs should be illuminated and the display should show the software revision level and the date. Baud rate, stop bits, parity, and data bits configuration information for the printer will also be displayed.

(2) If these instrument responses are not obtained, the battery may be discharged and the AC adaptor should be used to power the instrument and charge the battery. Set the **POWER** switch to the OFF position. Plug in the AC adaptor and wait 10 seconds. Repeat step (1).

Note: If the unit doesn't power up, the battery leads may be dislodged. Refer to Section 6 for instructions on connecting the battery.

4.4.2 Instrument Checkout Procedures

To perform the instrument checkout procedure, set the switches on the T-BERD 107 Mainframe as specified in the following instructions:

(1) Set the **T1/T1C** switch to the T1 position.

(2) Set the **BRIDGE/DSX-MON/TERM** switch to the TERM position.

(3) Set the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to the CONTINUOUS TEST position.

(4) Connect the T-BERD 107 to a known good T1 source. TTC's T-BERD 209A, T-BERD 211, and the T-BERD 107 T1/T1C Transmitter Option are examples of such signal sources.

(5) Press **RESTART**.

(6) The PULSES LED should be illuminated.

(7) If the signal contains D4, ESF, or SLC-96 framing, the appropriate FRAME SYNC LED should be illuminated.

(8) If a QRSS, 1:7, or 3 IN 24 pattern is present, the corresponding PATTERN LED should be illuminated.

(9) No red alarm LEDs should be illuminated.

(10) Set the **CATEGORY** switch to SIG & TIME and press the **RESULTS (TIME SET)** switch until 40 - RX FREQ is displayed. The frequency shown should be between 1,543,950 Hz and 1,544,050 Hz.

(11) Press the **RESULTS (TIME SET)** switch until 41 - RX LVL dBdsx is displayed. Verify that the received signal level is between +1 dBdsx and -1 dBdsx when a 3-volt base-to-peak signal is used as a source.

SECTION 5

OPERATION

5.1 INTRODUCTION

This section contains step-by-step instructions for operating and collecting test results with the T-BERD 107 T-Carrier Monitor.

5.2 PERFORMING A TEST AT THE REPEATER

Figure 5-1 shows a T-BERD 107 connected to a repeater input. A T-BERD 209A or similar instrument transmits a signal down the span line and the signal is looped back at the CSU.

Table 5-1 contains step-by-step instructions to set up a test at a T1 repeater.

Upon successfully setting up the basic T1 repeater test, follow the procedures outlined in Table 5-2 to collect test results.

NOTE: The T-BERD 107 T1/T1C Transmitter Option in conjunction with the T-BERD Repeater Extender can transmit a signal from any span line repeater. See Section 5.7 for Out-of-Service Loopback Test procedure.

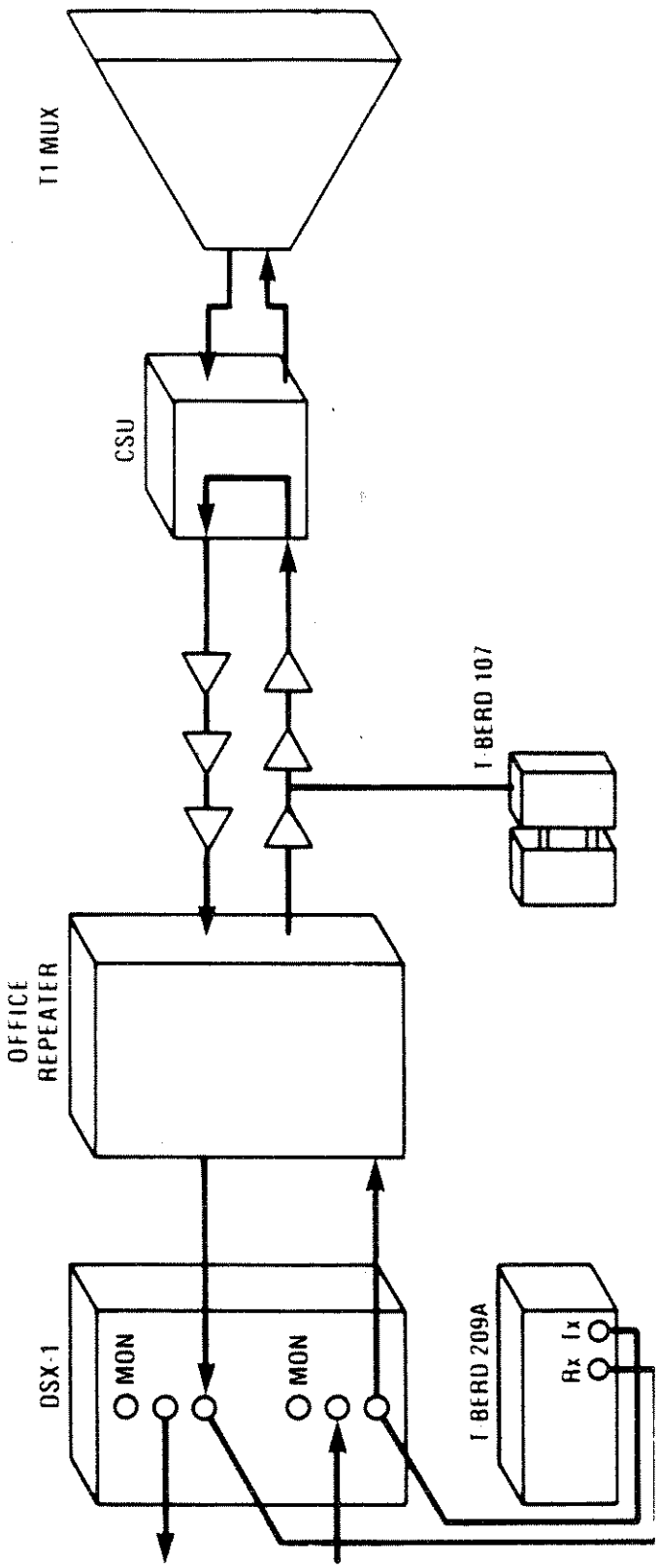

Figure 5-1
Repeater Test Diagram

Table 5-1
Basic T1 Repeater Test Set-Up

Step	Activity
1.	Press the **POWER** switch to apply power to the T-BERD 107.
2.	Set the **T1/T1C** switch to T1.
3.	Set the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to CONTINUOUS TEST.
4.	Set the **BRIDGE/DSX-MON/TERM** switch to BRIDGE.
5.	Connect a cable (Model 30697 - WECO 310 plug to mini-test clips) between the T-BERD 107 and the repeater pins. **CAUTION: HIGH VOLTAGE MAY BE ENCOUNTERED.**
6.	Press the **RESTART** switch to begin the test. Verify that: (a) The PULSES LED is illuminated if a T1 signal is present. (b) The appropriate FRAME SYNC LED is illuminated if the signal contains D4, ESF, or SLC framing. (c) The appropriate PATTERN LED (QRSS, 1:7, 3 IN 24) is illuminated if one of these patterns is received. (d) The B8ZS LED indicator is illuminated if the circuit is using clear channel (B8ZS) line coding.

Table 5-2
Collecting Basic T1 Repeater Test Results

Step	Activity
1.	If no red alarm LEDs are illuminated, the signal is good and the test is complete.
2.	If the ERROR EVENT LED is illuminated, the signal contains errors. (a) Set the **CATEGORY** switch to BPV & FRAME and use the **RESULTS (TIME SET)** switch to scroll to Result 25 - VIOLATIONS. Check for bipolar violations. (b) Use the **RESULTS (TIME SET)** switch to scroll to Result 30 - FRM ERRORS (or 32 - CRC ERRORS if ESF framing is present). Check for frame or CRC errors. (c) If a PATTERN LED is illuminated, set the **CATEGORY** switch to LOGIC and use the **RESULTS (TIME SET)** switch to scroll to Result 00 - BIT ERRORS. Check for bit errors on the line. (d) Set the **CATEGORY** switch to SIG & TIME and use the **RESULTS (TIME SET)** switch to scroll to Result 41 - RX LVL dBdsx. Verify that the receive signal level is within line specifications. (Receive signal level should be greater than -35 dBdsx at repeater inputs and between -3 dBdsx and +3 dBdsx at repeater outputs.)
3.	Interpret the results. (a) If violations, frame/CRC errors, and bit errors are all present, it is likely that problems exist on the near-end span.

Table 5-2
Collecting Basic T1 Repeater Test Results (Continued)

Step	Activity
3. cont.	(b) If bit errors are detected but the violations and frame/CRC error counts remain at 0, it is likely that errors are not being induced in the near-end repeatered span. Further sectionalization is required. (c) If no BIT ERRORS or BPVs are present at the repeater input, but BIT ERRORS and BPVs occur at the repeater output, replace the repeater with a new unit.

5.3 PERFORMING A 15-MINUTE TIMED TEST

Table 5-3 contains step-by-step instructions to set up a 15-minute timed test on a T1 circuit.

Table 5-3
15-Minute Timed Test Set-up

Step	Activity
1.	Press the **POWER** switch to apply power to the T-BERD 107.
2.	Set the **T1/T1C** switch to T1.
3.	Set the TEST LENGTH.
	(a) Press the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to TIME SET.
	(b) Use the **RESULTS (TIME SET)** switch to change hours to 00.
	(c) Press the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to TIME SET.
	(d) Use the **RESULTS (TIME SET)** switch to change minutes to 15.

Table 5-3
15-Minute Timed Test Set-up (Continued)

Step	Activity
3. cont.	(e) Press the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to TIME SET. (f) Use the **RESULTS (TIME SET)** switch to change seconds to 00. (g) Press the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to TIME SET to exit SET mode.
4.	Set the **BRIDGE/DSX-MON/TERM** switch to DSX-MON if monitoring at resistor-isolated DSX patch bays. If the T-BERD 107 is terminating the line, set this switch to TERM.
5.	Connect the T-BERD 107 to the circuit.
6.	Press **RESTART** switch to begin the test. Verify that: (a) The PULSES LED is illuminated if a T1 signal is present. (b) The appropriate FRAME SYNC LED is illuminated if the signal contains D4, ESF, or SLC framing. (c) The appropriate PATTERN LED (QRSS, 1:7, 3 IN 24) is illuminated if one of these patterns is received. (d) The B8ZS LED is illuminated if the circuit is using clear channel (B8ZS) line coding. **NOTE:** The message "TIMED TEST COMPLETE" will flash in the display at the end of the timed test. All results accumulation is halted.

Figure 5-2 shows the T-BERD 107 connected to a DSX monitor port in a central office.

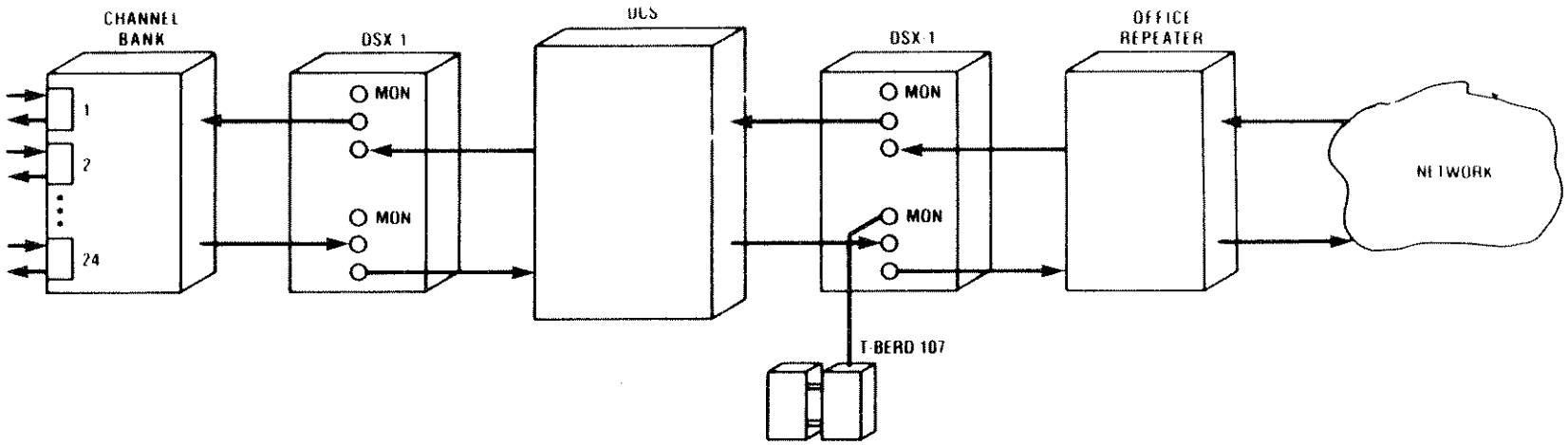

Figure 5-2
15-Minute Timed Test Diagram

Upon successfully setting up the 15-minute timed test, follow the procedures outlined in Table 5-4 to collect test results.

Table 5-4
Collecting 15-Minute Timed Test Results

Step	Activity
1.	If no red alarm LEDs are illuminated at the completion of the test, the line is completely clean and passes performance requirements.
2.	If the ERROR EVENT history LED is illuminated, errors occurred during the test. Using the **RESULTS (TIME SET)** switch, scroll through the various results categories to determine if the line passed required performance levels. (a) If a pattern is detected on the line, examine the bit errors and the associated error rate, errored seconds, percent error-free seconds, and severely errored seconds. (b) If no patterns were present on the line but D4 or SLC-96 framing was detected, examine the frame errors, frame error rate, and frame percent error-free seconds to obtain an approximation of the actual bit error rate. (c) If ESF framing was detected, examine the CRC errors and the associated CRC error rate, CRC errored seconds, and CRC percent error-free seconds to check actual line performance.

5.4 PERFORMING A SIGNAL LEVEL MEASUREMENT TEST

The T-BERD 107 can measure input and output signal levels at any in-service monitoring point. Table 5-5 contains step-by-step instructions to set up a signal level measurement test at a CSU.

Table 5-5
Signal Level Measurement Test Set-Up

Step	Activity
1.	Press the **POWER** switch to apply power to the T-BERD 107.
2.	Set the **T1/T1C** switch to T1.
3.	Set the **BRIDGE/DSX-MON/TERM** switch to BRIDGE.
4.	Set the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to CONTINUOUS TEST.
5.	Connect the T-BERD 107 to the receive line terminals (from the central office).
6.	Observe that the PULSES LED indicator is illuminated.
7.	Press the **RESTART** switch to begin the test.

Upon succussfully setting up the signal level measurement test, follow the procedures outlined in Table 5-6 to collect test results.

Table 5-6
Collecting Signal Level Measurement Test Results

Step	Activity
1.	Set the **CATEGORY** switch to SIG & TIME.
2.	Using the **RESULTS (TIME SET)** switch, scroll to Result 41 - RX LVL, dBdsx.
3.	Verify that the RX level is between 0 dBdsx and -22 dBdsx, per AT&T Technical Reference PUB 62411. **DANGER: HIGH VOLTAGE MAY BE ENCOUNTERED.**
4.	Connect the T-BERD 107 to the transmit line terminals (toward the central office).
5.	Verify that the CSU's line build-out (LBO) is properly set as follows: (a) If the RX level is -15 dBdsx and below, the TX level of the CSU should be 0 dBdsx. (b) If the RX level is -14 to -8 dBdsx, the TX level of the CSU should be -7.5 dBdsx. (c) If the RX level is -7.5 dBdsx and above, the TX level of the CSU should be -15 dBdsx.

5.5 PERFORMING A T1C TEST

Table 5-7 contains step-by-step instructions to set up a T1C test.

Table 5-7
T1C Test Set-Up

Step	Activity
1.	Press the **POWER** switch to apply power to the T-BERD 107.
2.	Set the **T1/T1C** switch to T1C.
3.	Set the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to CONTINUOUS TEST.
4.	Set the **BRIDGE/DSX-MON/TERM** switch to DSX-MON.
5.	Connect the T-BERD 107 to the MON output of the patch panel.
6.	Press **RESTART** switch to begin the test. Verify that: (a) The PULSES LED is illuminated if a T1C signal is present. (b) The appropriate PATTERN LED is illuminated if a pattern is present. (c) The B8ZS LED is illuminated if the circuit is using clear channel (B8ZS) line coding.

Upon successfully setting up the T1C test, follow the procedures outlined in Table 5-8 to collect test results.

Table 5-8
Collecting T1C Test Results

Step	Activity
1.	If no red alarm LEDs are illuminated, the signal is good and the test is complete.
2.	If the ERROR EVENT LED is illuminated, the signal contains errors. (a) Set the **CATEGORY** switch to BPV & FRAME and use the **RESULTS (TIME SET)** switch to scroll to Result 25 - VIOLATIONS. Check for bipolar violations. (b) If a PATTERN LED is illuminated, set the **CATEGORY** switch to LOGIC and use the **RESULTS (TIME SET)** switch to scroll to Result 00 - BIT ERRORS. Check for bit errors on the line. (c) Set the **CATEGORY** switch to SIG & TIME and use the **RESULTS (TIME SET)** switch to scroll to Result 41 - RX LVL dBdsx. Verify that the receive signal level is between -18 and -24 dBdsx. (The resistor-isolated monitor ports drop the signal approximately 20 dB.
3.	Interpret the results. (a) If violations are detected, it is likely that errors are being induced in the near-end repeatered span. (b) If bit errors are detected without violations, it is likely that errors are not being induced in the near-end repeatered span. Further sectionalization is required.

5.6 TESTING INDIVIDUAL DS0 CHANNELS

NOTE: The T1 Channel Monitor Option must be installed to perform this test.

Table 5-9 contains step-by-step instructions to set up basic in-service monitoring of individual channels within the T1 bit stream.

Table 5-9
Individual T1 Channel Monitoring Set-up

Step	Activity
	Configure the T-BERD 107 as follows
1.	Press the **POWER** switch to apply power to the T-BERD 107.
2.	Set the **T1/T1C** switch to T1.
3.	Set the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to CONTINUOUS TEST.
4.	Set the **BRIDGE/DSX-MON/TERM** switch to DSX-MON if operating at a DSX patch bay. If you are connecting to the bare wires of a repeater or CSU, set this switch to BRIDGE.
5.	Connect a cable between the T-BERD 107 and the circuit. **CAUTION: HIGH VOLTAGE MAY BE ENCOUNTERED IF OPERATED AT A REPEATER OR CSU.**
6.	Press the **RESTART** switch to begin the test. Verify that: (a) The PULSES LED is illuminated if a T1 signal is present.

Table 5-9
Individual T1 Channel Monitoring Set-up
(Continued)

Step	Activity
6. cont.	(b) The appropriate FRAME SYNC LED is illuminated if the signal contains D4, ESF, or SLC framing. (c) The B8ZS LED is illuminated if the circuit is using clear channel (B8ZS) line coding.
	Configure the T1 Channel Monitor as follows
1.	Press the **POWER** switch to apply power to the T1 Channel Monitor.
2.	Select the proper framing format (D1D, D2, D3/D4, ESF, or SLC-96).
3.	Use the **CHANNEL SELECT** switch to scroll to the desired test channel.
4.	Examine the A, B, C, and D signaling bits for ON HOOK/OFF HOOK status.
5.	Adjust the speaker volume output with the **VOLUME** switch.
6.	Examine the DATA BITS to determine if any fixed channel codes exist on the line.

Figure 5-3 shows the T-BERD 107 connected to a DSX monitor port. The T1 Channel Monitor Option is used to test the individual channel cards of the channel bank.

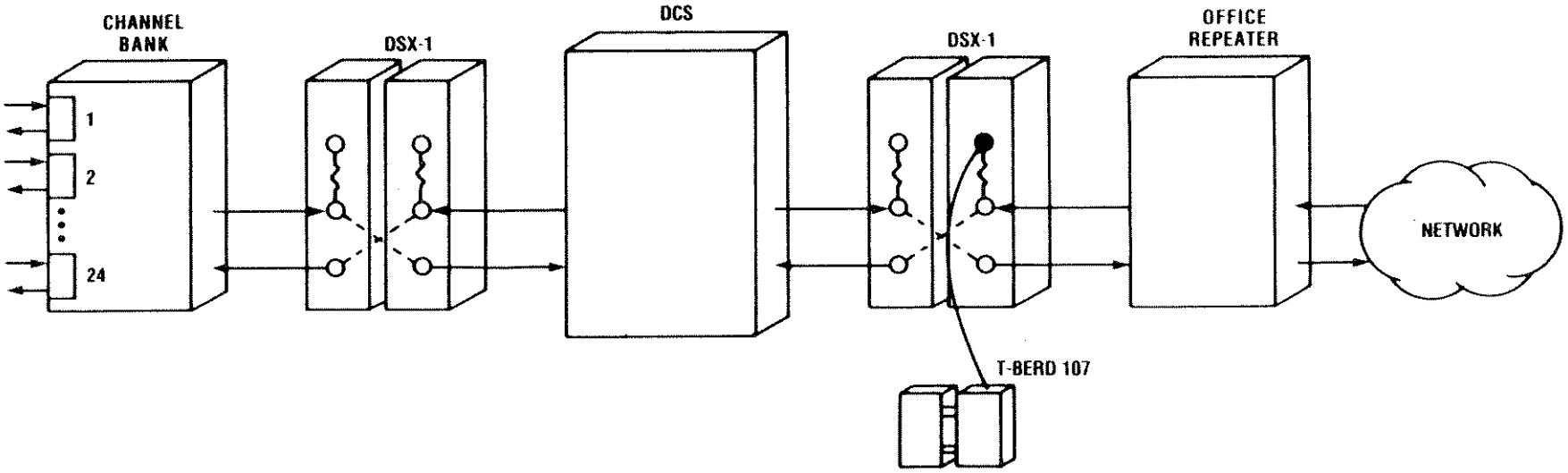

Figure 5-3
Testing Individual DS0 Channels

5.7 PERFORMING AN OUT-OF-SERVICE LOOPBACK TEST ON A T1 CIRCUIT

NOTE: The T1/T1C Transmitter must be installed to perform this test.

Figure 5-4 shows the test setup. The T-BERD 107's INPUT is connected to the DSX patch panel OUT jack. The T1/T1C Transmitter OUTPUT jack is connected to the DSX patch panel IN jack.

Table 5-10 contains step-by-step instructions for performing an out-of-service test with the T-BERD 107.

Table 5-10
Out-of-Service Loopback Test Set-up

Step	Activity
	Configure the T-BERD 107 Mainframe as follows
1.	Press the T-BERD 107 Mainframe **POWER** switch to apply power to the T-BERD 107.
2.	Set the **T1/T1C** switch to T1.
3.	Set the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to CONTINUOUS TEST.
4.	Set the **BRIDGE/DSX-MON/TERM** switch to TERM.
5.	Connect a cable between the T-BERD 107's RECEIVE INPUT and the DSX patch panel OUT jack of the circuit to be tested.

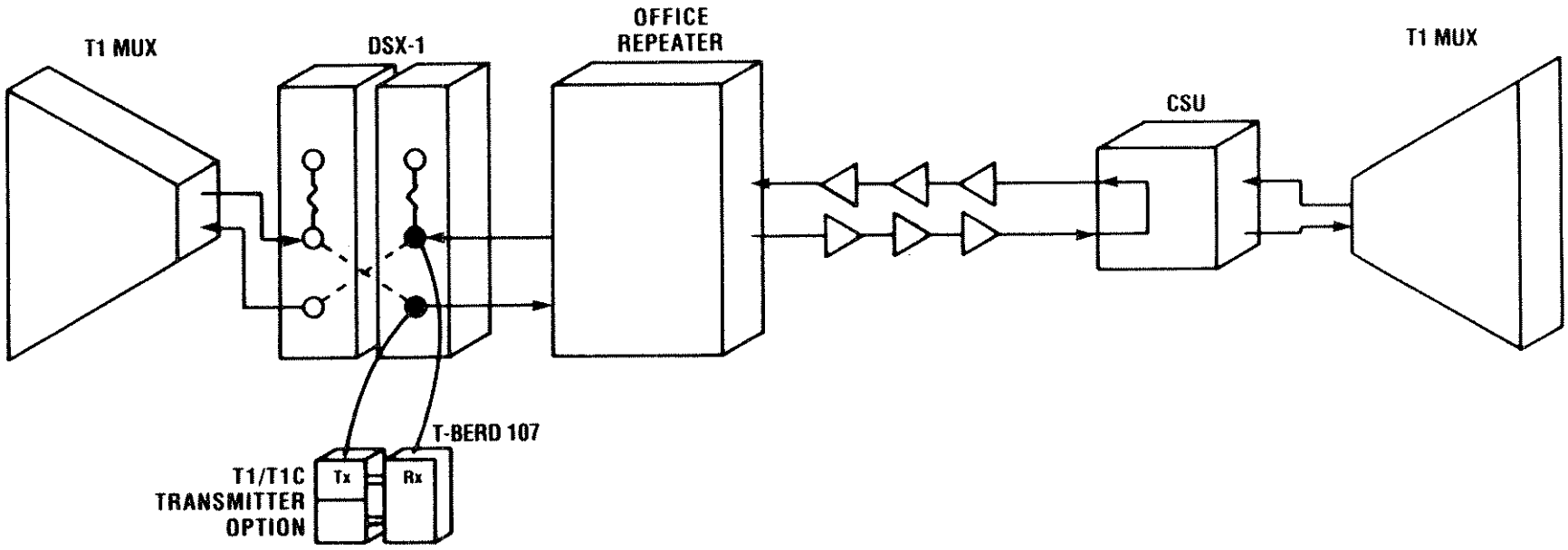

Figure 5-4
Loopback Test Diagram

Table 5-10
Out-of-Service Loopback Test Set-up (Continued)

Step	Activity
6.	Set the **CATEGORY** switch to the LOGIC position and select the 00-BIT ERRORS result with the **RESULTS (TIME SET)** switch.
	Configure the T1/T1C Transmitter as follows
1.	Press the T1/T1C Transmitter **POWER** switch to apply power.
2.	Set the **MODE** switch to T1, D4, or ESF, as required.
3.	Set the **PATTERN** switch to QRSS, 1:7, 3 IN 24, or ALL ONES, as required.
4.	Set the **TIMING** switch to the INT position to clock the transmitted data from the T-BERD 107 Mainframe's internal crystal oscillator. **NOTE:** If testing is performed through a Digital Cross-Connect, set the **TIMING** switch to the RECOV/(LOOP) position.
5.	Set the **CODE** switch to either the B8ZS or AMI position, as appropriate.
6.	Set the LBO level to 0.0 dB.
7.	Set the **LOOP CODE** switch to CSU or FAC, as appropriate to loop CSUs or smart jacks, respectively. **NOTE:** The factory set Facility loop code is 11000 for loop up and 11100 for loop down. Consult Appendix B for instructions for changing the facility loop codes.
8.	Connect a cable between the T1/T1C Transmitter's OUTPUT jack and the DSX patch panel IN jack of the circuit to be tested (See Figure 5.4).

Table 5-10
Out-of-Service Loopback Test Set-up (Continued)

Step	Activity
9.	Press and hold the **LOOP UP** switch for approximately 5 seconds to send the selected loop up code. Release the **LOOP UP** switch to stop sending the loop up code. The circuit should now be looped. To verify the loop, insert BPVs and logic errors with the **ERROR INSERT** switch and monitor for bit errors. If you do not see the bit errors on the T-BERD 107, the circuit is not looped. Verify that: (a) The PULSES LED illuminates. (b) The appropriate FRAME SYNC LED illuminates. (c) The B8ZS LED illuminates if the circuit is using B8ZS clear channel line coding. (d) The appropriate PATTERN LED (QRSS, 1:7, 3 IN 24) illuminates.
10.	Press the T-BERD 107 Mainframe **RESTART** switch to begin the test.

Operation

Upon successfully configuring the T-BERD 107 and T1/T1C Transmitter for the test, follow the procedures shown in Table 5-11 to collect test results.

NOTE: All results are gathered by the T-BERD 107 Mainframe.

Table 5-11
Collecting T1 Out-of-Service Test Results

Step	Activity
1.	If no red alarm LEDs are illuminated, the signal is good. You may wish to continue testing to verify that no dribbling or transient errors occur.
2.	If the ERROR EVENT LED is illuminated, the signal contains errors. (a) Set the **CATEGORY** switch to BPV & FRAME and use the **RESULTS (TIME SET)** switch to scroll to Result 25-VIOLATIONS. Check for bipolar violations. (b) Use the **RESULTS (TIME SET)** switch to scroll to Result 30-FRM ERRORS (or 32-CRC ERRORS if ESF framing is present). Check for frame or CRC errors. (c) Set the **CATEGORY** switch to LOGIC and use the **RESULTS (TIME SET)** switch to scroll to Result 00-BIT ERRORS. Check for bit errors on the line. (d) Set the **CATEGORY** switch to SIG & TIME and use the **RESULTS (TIME SET)** switch to scroll to Result 41-RXLVL dBdsx. Verify that the receive signal level is within line specifications. Receive signal level should be between -2 dBdsx and +2 dBdsx at the DSX patch panel.

Table 5-11
Collecting T1 Out-of-Service Test Results
(Continued)

Step	Activity
3.	Interpret the results. (a) If violations, frame/CRC errors, and bit errors are all present, it is likely that problems exist on the near-end span. (b) If bit errors are detected but the violations and frame/CRC error counts remain at 0, it is likely that errors are not being induced in the near-end repeatered span. Further sectionalization is required. (c) If violations and frame/CRC errors occur on some patterns but not on others, then it is likely that there is a marginal repeater or pattern-dependent problem such as a bridge tap on the line. See Section 5.2 for instructions for troubleshooting T1 signals at span repeaters.

5.8 PERFORMING AN SLC-96 OUT-OF-SERVICE TEST

NOTE: The T1/T1C Transmitter must be installed to perform this test.

To set up a basic out-of-service test of an SLC-96 T1 span, perform the steps shown in Table 5-12.

Table 5-12
SLC-96 Out-of-Service Test Set-up

Step	Activity
1.	Determine if the protection T1 span is in use by examining the LEDs of each Line Interface Unit (LIU) for shelves A, B, C, and D. The LED labeled LINE ON PROT on the LIUs illuminates when an error threshold in the corresponding T1 span is exceeded and the T1 span is placed out-of-service. This span should be tested and repaired prior to testing another span: otherwise, service may be interrupted. Note that if none of the LIUs are switched to protect, then any of them can be tested.
2.	Install a pin plug into the LIU pin jack labeled F END LP of the line to be tested.
3.	Connect an LIU Test Cord (a 15-pin D-to-edge connector cable) from the LIU to the JACK PANEL.
	Configure the T-BERD 107 Mainframe as follows
1.	Press the **POWER** switch to apply power to the T-BERD 107.
2.	Set the **T1/T1C** switch to T1.
3.	Set the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to CONTINUOUS TEST.
4.	Set the **BRIDGE/DSX-MON/TERM** switch to TERM.
5.	Connect a cable between the T-BERD 107 RECEIVE INPUT and the DSX patch panel OUT jack.
6.	Set **CATEGORY** switch to the LOGIC position and select the 00-BIT ERRORS result with the **RESULTS (TIME SET)** switch.

Table 5-12
SLC-96 Out-of-Service Test Set-up (Continued)

Step	Activity
	Configure the T1/T1C Transmitter as follows
1.	Press the **POWER** switch to apply power.
2.	Set the **MODE** switch to SLC.
3.	Set the **PATTERN** switch to QRSS, 1:7, 3 IN 24, or ALL ONES, as appropriate.
4.	Set the **TIMING** switch to the INT position to supply timing from the internal crystal oscillator.
5.	Set the **CODE** switch to either the B8ZS or AMI position, as appropriate.
6.	Set the LBO level to 0.0 dB.
7.	Connect a cable between the T1/T1C Transmitter OUTPUT jack and the DSX patch panel IN jack. Verify that: (a) The PULSES LED illuminates. (b) The SLC FRAME SYNC LED illuminates. (c) The B8ZS LED illuminates if the circuit is using clear channel (B8ZS) line coding. (d) The appropriate PATTERN LED illuminates. (e) Errors inserted with the T1/T1C Transmitter **ERROR INSERT** switch are received by the T-BERD 107 Mainframe.
8.	Press the T-BERD 107 Mainframe **RESTART** switch to begin the test.

Upon successfully setting up the basic SLC-96 Out-of-Service test, follow the procedures outlined in Table 5-13 to collect test results.

Table 5-13
Collecting SLC-96 Out-of-Service Test RESULTS (TIME SET)

Step	Activity
1.	If no red alarm LEDs are illuminated, the signal is good. You may wish to continue testing to verify that no dribbling or transient errors occur.
2.	If the ERROR EVENT LED is illuminated, the signal contains errors. (a) Set the **CATEGORY** switch to BPV & FRAME and use the **RESULTS (TIME SET)** switch to scroll to Result 25-VIOLATIONS. Check for bipolar violations. (b) Use the **RESULTS (TIME SET)** switch to scroll to Result 30-FRM ERRORS. Check for frame errors. (c) If a PATTERN LED is illuminated, set the **CATEGORY** switch to LOGIC and use the RESULTS (TIME SET) switch to scroll to Result 00-BIT ERRORS. Check for bit errors on the line. (d) Set the **CATEGORY** switch to SIG & TIME and use **RESULTS (TIME SET)** switch to scroll to Result 41-RX LVL dBdsx. Verify that the receive signal level is within line specifications. Receive signal level should be between -2 dBdsx and +2 dBdsx at the DSX frame.

Table 5-13
Collecting SLC-96 Out-of-Service Test RESULTS (TIME SET) (Continued)

Step	Activity
3.	Interpret the results. (a) If violations and frame errors are detected, perform an end-to-end test using either a second T-BERD 107 with T1/T1C Transmitter Option or a T-BERD 209A at the far end of the span. To perform an end-to-end test, remove the pin plug from the F END LP position and insert it into the SW TO PROT position.

5.9 PERFORMING A LOSS TEST ON A NEW T1 CABLE SECTION

NOTE: The T1/T1C Transmitter must be installed to perform this test.

The first test performed on a new T1 circuit is usually a cable test to verify the copper span segments can carry T1 signals. This test involves inserting a T1 signal on one end of the copper section and measuring the loss on the other end. If the loss varies significantly from engineering design records, a fault (bridge tap, load coil, etc.) exists along the span line.

Figure 5-5 shows a T-BERD 107 with T1/T1C Transmitter connected to each end of a T1 cable section.

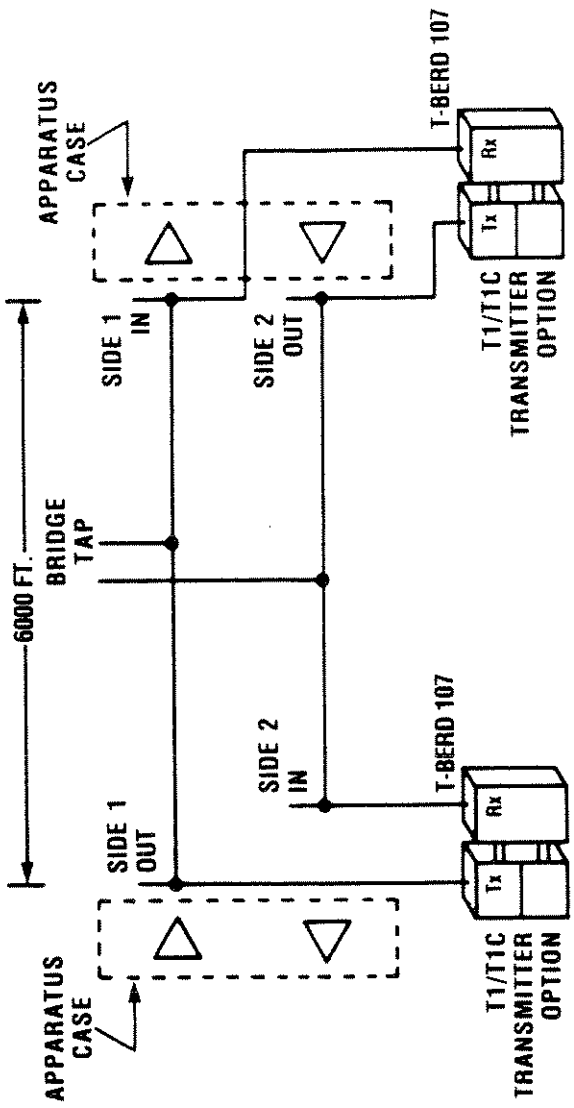

Figure 5-5
Cable Loss Test Diagram

To set up a loss test on a new T1 cable section, perform the steps shown in Table 5-14.

NOTE: Two T-BERD 107 units or a T-BERD 107 and a T-BERD 209A are required for this test.

Table 5-14
T1 Cable Loss Test Set-up

Step	Activity
	Configure the T-BERD 107 Mainframe as follows
1.	Press the **POWER** switch to apply power to the T-BERD 107 Mainframe.
2.	Set the **T1/T1C** switch to T1.
3.	Set the **TIME SET/TIMED TEST/CONTINUOUS TEST** switch to CONTINUOUS TEST.
4.	Set the **BRIDGE/DSX-MON/TERM** switch to TERM.
5.	Connect a cable from the T-BERD 107 INPUT jack to the cable pair which would be connected to the input of the T1 repeater (either SIDE 1 IN or SIDE 2 IN on the TTC T1 Repeater Extender, Model 41157).
	Configure the T1/T1C Transmitter as follows
1.	Press the **POWER** switch to apply power to the T1/T1C Transmitter.
2.	Set the **MODE** switch to T1 (UNFRAMED).
3.	Set the **PATTERN** switch to ALL ONES. (You may subsequently select QRSS, 1:7, or 3 IN 24 patterns for more complete testing.)

Table 5-14
T1 Cable Loss Test Set-up (Continued)

Step	Activity
4.	Set the **TIMING** switch to the INT position to supply timing from the internal crystal oscillator.
5.	Set the **CODE** switch to the AMI position.
6.	Set the LBO level to 0.0 dB for the initial test.
7.	Connect the OUTPUT jack to the repeater output cable pair (either SIDE 1 OUT or SIDE 2 OUT on the TTC T1 Repeater Extender, Model 41157). Verify that: (a) The PULSES LED illuminates. (b) The ALL ONES LED illuminates.
8.	Press the T-BERD 107 Mainframe **RESTART** switch to begin the test.

Upon successfully setting up the T1 cable loss test, follow the procedures outlined in Table 5-15 to collect test results.

Table 5-15
Collecting Cable Loss Test Results

Step	Activity
1.	If the red ERROR EVENT LED is not illuminated, the signal is being received error free.
2.	Set the **CATEGORY** switch to SIG & TIME. Use the **RESULTS (TIME SET)** switch to scroll to result 41-RX

Table 5-15
Collecting Cable Loss Test Results (Continued)

Step	Activity
2. cont.	LVL dBdsx. The RX LVL should be within engineering design specifications or comparable to other cable pairs in the same cable bundle. Record this reading as the measured cable loss.
3.	Select the 3 IN 24 PATTERN on the T1/T1C Transmitter and verify the appropriate green PATTERN LED illuminates on the far-end test set.
4.	Press the **RESTART** switch on the T-BERD 107 Mainframe and verify that the signal is still being received error free (ERROR EVENT LED remains off).
5.	Observe Result 41-RX LVL and record the reading.
6.	Repeat steps 3 through 5 for both 1:7 and QRSS patterns.
7.	If all of the above patterns operate error free, stress the circuit to test for cable crosstalk or other marginal problems by increasing the LBO setting on the T1/T1C Transmitter until the RX LVL (Result 41) of the far-end test set reads -32dBdsx.
8.	Interpret the results. (a) For the 0.0 dB LBO results, compare the 3 IN 24, 1:7, and QRSS pattern RX LVLs to the ALL ONES pattern RX LVL. All three RX LVLs should be 2 to 4 dB greater than the ALL ONES pattern RX LVL. If any pattern RX LVL is less than the ALL ONES pattern RX LVL, the line probably contains an unremoved bridge tap. (b) For the -32 dBdsx portion, if the signals are transmitted error free on all patterns down to -32 dBdsx, you can be confident the cable section will carry live T1 traffic error free.

SECTION 6

MAINTENANCE AND SERVICE

6.1 INTRODUCTION

This section provides information on maintenance and service for the T-BERD 107 T-Carrier Analyzer. It also contains TTC's warranty policies and repair procedures.

6.2 MAINTENANCE

6.2.1 In Case of Difficulty

If the unit fails to operate and no LEDs are illuminated, check the following:

- Sealed Lead Acid Battery
- AC adaptor/charger and AC supply

Follow the self-test procedures in Section 4 of this operating manual as an aid in localizing the problem. If the unit continues to be inoperative, refer to the following paragraphs for service information or call the TTC Customer Service Department for assistance.

6.2.2 Battery Maintenance

The T-BERD 107 is powered by one sealed lead acid rechargeable battery. This battery should provide 5 hours of operation between charges (3 hours when used with the T1 Channel Monitor Option or T1/T1C Transmitter Option). When the battery needs to be recharged, the display will show "LOW BATTERY". The AC adaptor will both power the T-BERD 107 and continuously charge the batteries while it is plugged in. If the battery is deeply discharged, charge the battery with the POWER switch in the OFF position for 30 minutes before use. Operation using the AC adaptor is always allowed; overcharging will not damage the batteries.

Instructions for battery replacement are listed below. You will need:

- Small Phillips head screwdriver
- Replacement Panasonic Battery, LCR6V1.3P (6v, 1.3Ah)

1. Remove power from the T-BERD 107; either disconnect the AC adaptor from the power source or, if battery-operated, turn off the **POWER** switch on the T-BERD 107.

2. Disconnect all cables (AC adaptor, printer cable) from the T-BERD 107.

3. Using a Phillips head screwdriver, remove and retain the four (4) screws from the back of the unit.

4. Open the case, and hold your hand over the T-BERD 107's front panel while releasing the unit assembly by tipping it out gently into your hand. When the unit assembly has been released, position your hand at the bottom end of the assembly and pull it out of the case at an angle away from the top of the case (see Figure 6-1). Then gently slide the unit assembly toward the bottom of the case, and lift it only enough to set the unit assembly on the edge of the case.

   NOTE: The wires connecting the battery to the unit assembly are very short and will not allow the unit assembly to be moved completely out of the case. Be careful not to dislodge or break the two wires connecting the unit assembly to the battery.

5. Disconnect the battery wires from the unit assembly by pulling gently on the plug (see Figure 6-2).

6. Remove the velcro straps from the battery. Remove the connecting wires from the battery by unclipping the clips, and remove the battery.

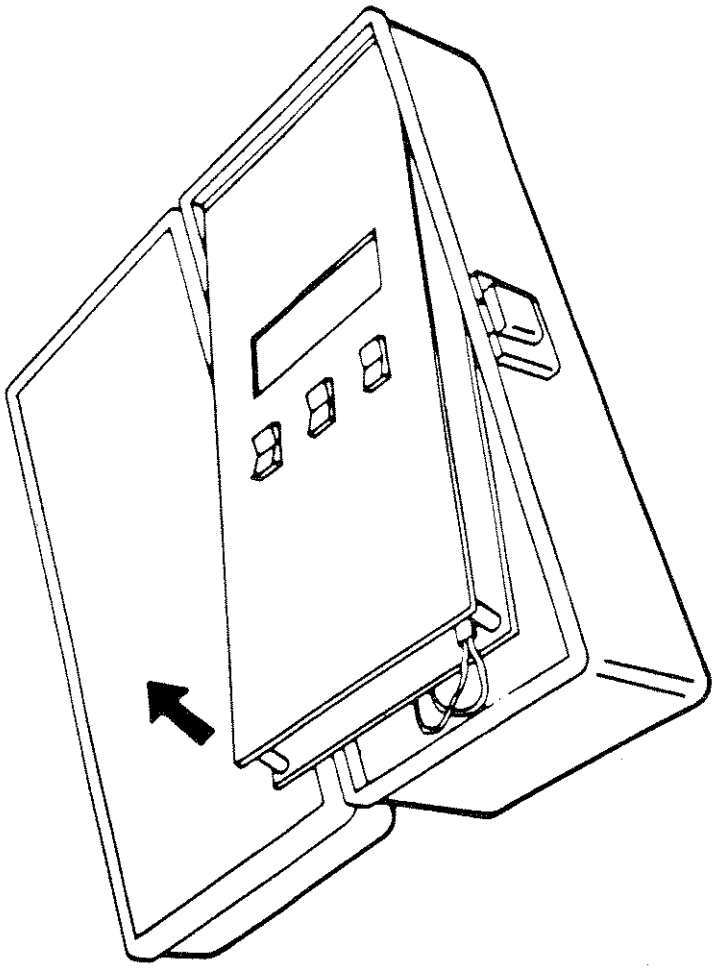

Figure 6-1
Unit Assembly Removal

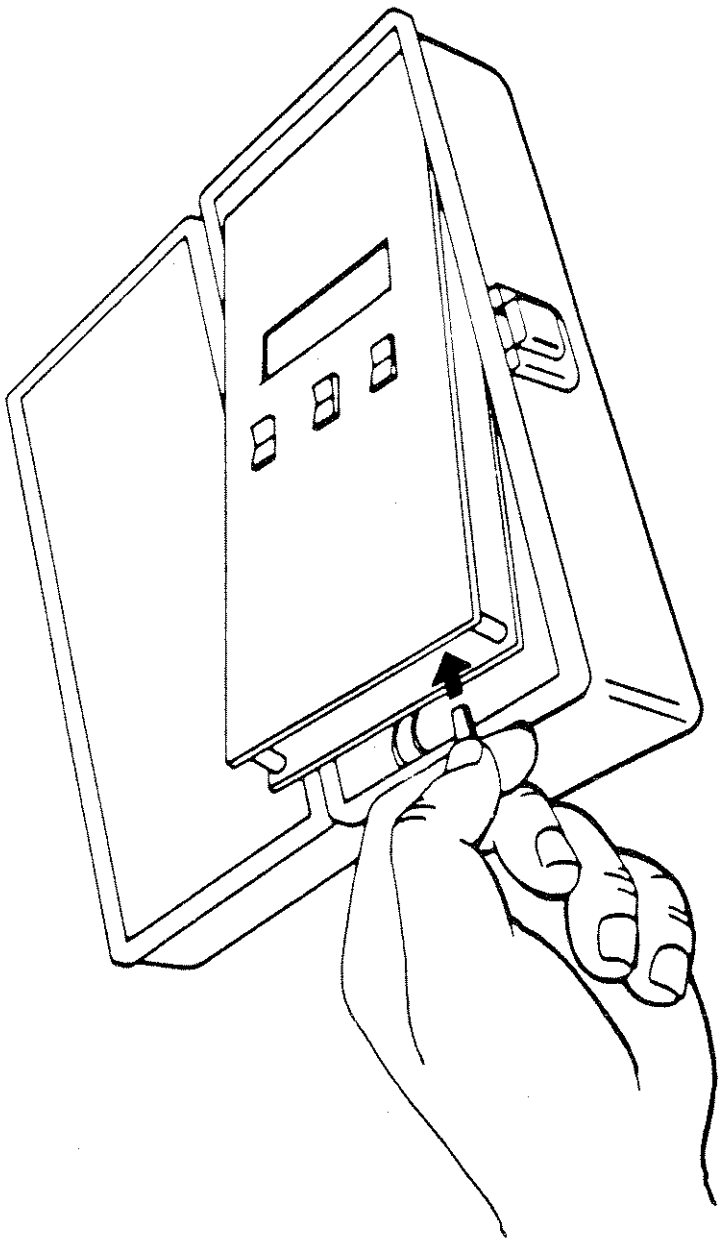

Figure 6-2
Battery Wire Disconnection

7. Clip the connecting wires onto the new battery.

   CAUTION: The red wire must be connected to the positive (+) side of the battery, and the black wire must be connected to the negative (-) side of the battery.

8. Put the new battery into place, with the lettering face up, the positive (+) side to the right, and the negative (-) side to the left. Replace the velcro straps over the battery.

9. Reconnect the battery wire into the unit assembly, making sure that the red wire is connected to the positive (+) pin and that the black wire is connected to the negative (-) pin.

10. Gently place the unit assembly back into the case. Angle the unit assembly the same way as was done in removal, with the top of the assembly unit going in first.

    NOTE: Be sure that the battery connecting wires do not get hung up on the case or the unit assembly when replacing the unit assembly into the case.

11. Gently drop the bottom of the unit assembly into the case.

12. Replace the four screws in the back of the T-BERD 107's case.

6.3 SERVICE

6.3.1 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

The T-BERD 107 T-Carrier Monitor will be repaired or replaced (at our option) at no charge for a period of three years for the mainframe and one year for any options after shipment to the customer. Liability under this warranty extends only to the replacement value of the equipment. The warranty is void under the following conditions:

1. Equipment has been altered or repaired without specific authorization from TTC.

2. Equipment is installed 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.

6.3.2 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 this section of the manual. 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.

6.3.3 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still in warranty. However, there is a minimum charge applied to each request for out-

of-warranty service. The minimum charge guarantees the customer an estimate of the repair costs and is used as credit against actual materials and labor costs should the equipment be repaired. Contact the TTC Repair Department for specific information on the minimum out-of-warranty repair charge.

The customer will be billed for parts plus standard labor rates in effect at the time of repair. The customer will also be required to furnish a purchase order number before repair work can be started, and a hard copy of the purchase order must be received by TTC before the repaired equipment may be shipped to the customer. A description of the labor and materials used will be provided in the Equipment Repair Report.

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

6.3.4 Equipment Return Instructions

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

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

If a mainframe is being returned, it is recommended that all switches be left in the positions they were in when the problem occurred.

If possible, the customer should return the equipment using the original shipping container and material. If the original

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

SECTION 7

SPECIFICATIONS

7.1 INTRODUCTION

This section contains specifications for the T-BERD 107 T-Carrier Analyzer.

7.2 PHYSICAL CHARACTERISTICS

- Size: 8.5"H x 4.25"W x 3.25"D (8.26 cm x 10.78 cm x 21.59 cm).
- Weight: 3.4 lbs. (1.5 kg).

7.3 OPERATIONAL REQUIREMENTS

- Operating Temperature Range: 0°C to +45°C (32°F to 113°F).
- Storage Temperature Range: -40°C to +70°C (-40°F to 158°F).
- AC Adaptor: 120 VAC to 9 VDC.
- Batteries: Sealed Lead Acid.
- Battery Life: 5.0 hours nominal (3.0 hours with T1 Channel Monitor or T1/T1C Transmitter Option).
- Battery Recharge Time: 12 hours.

7.4 INPUT SPECIFICATIONS

- Input Connection: WECO jack or bantam jack.
- Input Frequency: T1 - 1,544,00 Hz ± 4,000 Hz.
  T1C - 3,152,000 Hz ± 8,000 Hz.

- Input Impedance: BRIDGE (ALBO): 1000 ohms or greater
  TERM (ALBO): 100 ohms
  DSX-MON: 100 ohms with automatic gain control (AGC).

- Operating Range: BRIDGE/TERM: +7 to -35 dBdsx at T1, +7 to -5 dBdsx at T1C. Automatic line build-out compensates for cable loss characteristics.

- Operating Range: DSX-MON: -16 to -28 dBdsx at T1 and T1C.

7.5 FREQUENCY MEASUREMENT

- Accuracy: ± 5 ppm.

- Resolution: ± 1 Hz.

- T1 Range: 1.544 Mb/s ± 4 kb/s.

- T1C Range: 3.152 Mb/s ± 8 kb/s.

7.6 LEVEL MEASUREMENT

The level measurement capability of the T-BERD 107 is described below. The designation dBdsx is a voltage measurement; a 3.0 volt base-to-peak signal is defined as 0 dBdsx. Measurements for dBm are available only when ALL ONES is detected.

- dBdsx Level Range: +7.0 to -40.0 dBdsx.

- dBdsx Level Accuracy: ± 1 dB between +7 dBdsx and -10 dBdsx
  ± 2 dB between -10 dBdsx and -20 dBdsx
  ± 3 dB between -20 dBdsx and -40 dBdsx.

- dBdsx Resolution: 0.1 dBdsx between +7 dBdsx and -6 dBdsx
  0.5 dBdsx between -6 dBdsx and -40 dBdsx.

- dBm Level Range: +22.0 to -23.0 dBm.

- dBm Level Accuracy: ± 5%.

- dBm Resolution: 1 dBm.

7.7 SWITCHES

- **CATEGORY**: LOGIC, BPV & FRAME, SIGNAL & TIME

- **RESULTS**: LOGIC — Bit errors, asynchronous errored seconds, bit error rate, percent error-free seconds, severely errored seconds, and pattern loss seconds.

  BPV & FRAME — BPV percent error-free seconds, violations, BPV seconds, BPV rate, frame error second, frame severely errored seconds, frame errors, frame error rate, CRC errors, CRC errored seconds, frame percent error-free seconds, frame loss seconds, CRC severely errored seconds, CRC error rate, and CRC percent error-free seconds.

  SIGNAL & TIME — Receive frequency Hz, receive level dBdsx, receive level dBm, receive level Vp-p, signal loss seconds, alarmed seconds, test length, elapsed time, test ends in, clock time, and date.

- **TEST LENGTHS**: Timed or continuous.

- **TIMED TEST LENGTH**: 15 seconds to 200 hours, 59 minutes, 45 seconds. Factory setting is 200 hours.

- **BRIDGE/TERM/DSX-MON**: Sets the input impedance on the T-BERD 107.

- **HALT/RUN/RESTART**: Stops and restarts tests.

- **TI/T1C**: Configures the receiver for either T1 (1.544 Mb/s signal) or T1C (3.152 Mb/s signal).

- **PRINT**: Manually generates a results print.

7.8 INDICATORS

- Status: Signal present, D4 framing synchronization, ESF framing synchronization, SLC-96 framing synchronization, B8ZS detection.

- Pattern: QRSS detect, 1:7 detect, 3 in 24 detect.

- Alarm: Present and history indicators for Signal Loss, Pattern Loss, Frame Loss, Excess Zeros, Ones Density, Yellow Alarm, All Ones, Error Event.

7.9 ALARM CRITERIA

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

- Pattern Loss: 250 errors detected in 1000 or fewer bits.

- Frame Sync Loss: D4 - 2 out of 5 Ft bits in error
  ESF - 2 out of 5 Ft bits in error
  SLC - 2 out of 5 Ft bits in error.

- Excess Zeros: 16 or more consecutive zeros in T1; 34 or more consecutive zeros in T1C.

- Ones Density: Less than 12.5% ones density during measurement interval per compatibility bulletin 119, or per AT&T Technical Reference PUB62411. This indicator is disabled when receiving a T1-QRSS pattern or any T1C signal.

- Yellow Alarm: D4 - bit 2 is a 0 for 255 consecutive channels.
  ESF - 256 bits ± 16 bits of a repetitive "1111111100000000" pattern received in the 4 kb/s data link.
  SLC - Bit 2 is a 0 for 255 consecutive channels.

- All Ones: 1024 consecutive ones in unframed T1 or T1C signals; 128 consecutive DS0 channels with all ones for T1 framed modes.

- Error Event: Upon the occurrence of a bit error, BPV, frame error, or CRC error.

7.10 PRINTER AND PRINTER CABLE SPECIFICATIONS

The printer port on the T-BERD 107 is compatible with any serial RS-232 printer. The T-BERD 107 acts as a DCE and the printer is configured as DTE. The port is configured as follows:

- Baud Rate: 2400.

- Data Bits: 8.

- Parity: None.

- Stop Bits: 2.

- Line Terminator: CR LF.

Consult the factory if this configuration is incompatible with your printer.

Table 7-1 outlines the printer cable connections.

Table 7-1
Printer Cable Connections

Signal Name	Pin Number (DB 25)	Pin Number (HIROSE)	Status at T-BERD 107
Protective Ground	1	3	
Transmitted Data	2	3	N/A
Received Data	3	7	OUTPUT
Data Set Ready (DSR)	6	8	N/A
Signal Ground	7	2	GROUND
Data Terminal Ready (DTR)	20	6	INPUT

SECTION 8

OPTIONS AND ACCESSORIES

8.1 INTRODUCTION

This section provides a list of the options and accessories available for use with the T-BERD 107 T-Carrier Analyzer.

8.2 OPTIONS

The T1 Channel Monitor Option adds data and audible voice monitoring to the T-BERD 107. The T1 Channel Monitor is housed in the lid of the T-BERD 107, and is user-installable. Appendix A provides a complete description of the T1 Channel Monitor Option.

The T1/T1C Transmitter Option adds the ability to transmit test patterns for out-of-service testing. The T1/T1C Transmitter Option is housed in the lid of the T-BERD 107, and is user-installable. Appendix B provides a complete description of the T1/T1C Transmitter Option.

NOTE: All T-BERD 107 units with serial numbers prior to 1577 must be returned to the factory for installation of the T1/T1C Transmitter Option.

8.3 ACCESSORIES

The T-BERD 107 comes with a carrying case, an AC adaptor, a printer cable, and an operating manual which fits in the carrying case. Replacements may be purchased using the following model numbers.

Model 11078	AC Adaptor/Charger
Model 41170	Soft Carrying Case
Model 30758	Printer Cable
ML11086	Operating Manuals

Options and Accessories

The following is a list, including model numbers, of accessory cables, equipment, and options available from TTC for use with the T-BERD 107.

Model	Item
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')
10615	Bantam plug to bantam plug (10')
10648	Bantam plug to alligator clips (10')
PR-40A	Thermal 40-column graphic printer with carrying case (battery or AC operation)
10966	Thermal printer paper
11235	Cigarette lighter charger
30804	Shoulder Harness
40981	T1 Channel Monitor
11449	T1/T1C Transmitter

T-BERD 107 CLEI Code: T1TUSUHFAA
T-BERD 107 CPR Code: 377044

T1 Channel Monitor CLEI Number: T1TUSROFAA
T1 Channel Monitor CPR Number: 377043

APPENDIX A

T1 CHANNEL MONITOR OPTION

A.1 INTRODUCTION

Appendix A fully describes the T1 Channel Monitor Option.

A.2 OVERVIEW

The T1 Channel Monitor Option allows audio monitoring of a user-selected channel using the built-in speaker, and data monitoring of a user-selected channel using the eight LEDs mounted on the front panel. The T1 Channel Monitor is compatible with D1D, D2, D3/D4, SLC-96, or ESF framing, both AMI and B8ZS coding, and has full-span capabilities.

The T1 Channel Monitor Option is housed in the lid of the T-BERD 107 It measures 3.81" wide x 7.94" long x 0.75" deep, weighs 8.7 oz., and is enclosed in pressure-formed plastic. The T1 Channel Monitor is powered by the same sealed lead acid battery that powers the T-BERD 107. It can also be powered using the AC adaptor.

A.3 SUMMARY OF KEY FEATURES

- Byte decoder displays the logic state of the individual data bits within the dropped channel.
- A, B, C, and D LEDs display the logic state of the selected channel's signaling bits.
- Speaker provides audio output of the selected channel to enable verification of new circuit operation.
- Framing synchronization to ESF, SLC, D3/D4, D2, and D1D format.

A.4 INSTRUMENT DESCRIPTION

Figure A-1 shows the T1 Channel Monitor Option for the T-BERD 107. The numbers for each item in Figure A-1 correspond to the bracketed numbers appearing in the following descriptions of switches and indicators.

POWER SWITCH [1] –This pushbutton switch powers the T1 Channel Monitor on or off.

NOTE: The T1 Channel Monitor should remain off when not in use to conserve battery life.

DATA BITS DISPLAY [2] – Eight LEDs mounted on the T1 Channel Monitor display bits 1 through 8 of the user-selected channel. The LEDs are either off (if the data bit is a zero) or on (if the data bit is a one).

CHANNEL SELECT SWITCH [3] – A rocker switch with up (↑) and down (↓) arrows allows the user to select and scroll through channels 1 through 24.

CHANNEL NUMBER DISPLAY [4] – The selected channel number is displayed. The default is channel 24.

SIGNALING DISPLAY [5] – Four signaling LEDs, labeled A, B, C, and D, are used to display the signaling status for the selected channel. All four LEDs are active when monitoring a signal with Extended Super Frame (ESF) format; only A and B signaling indicators are active when monitoring other framing formats. This display is updated at the signaling rate.

FRAME SELECTION [6] – The framing select pushbutton switch allows the user to select and scroll through the desired framing formats. The formats are ESF, SLC, D3/D4, D2, and D1D.

FRAME SYNC LOSS INDICATOR [7] – The red FRAME SYNC LOSS indicator is illuminated if no frame sync is achieved or if frame sync is lost.

VOICE MONITOR [8] – The selected channel is decoded and the resulting audio may be monitored with the built-in speaker.

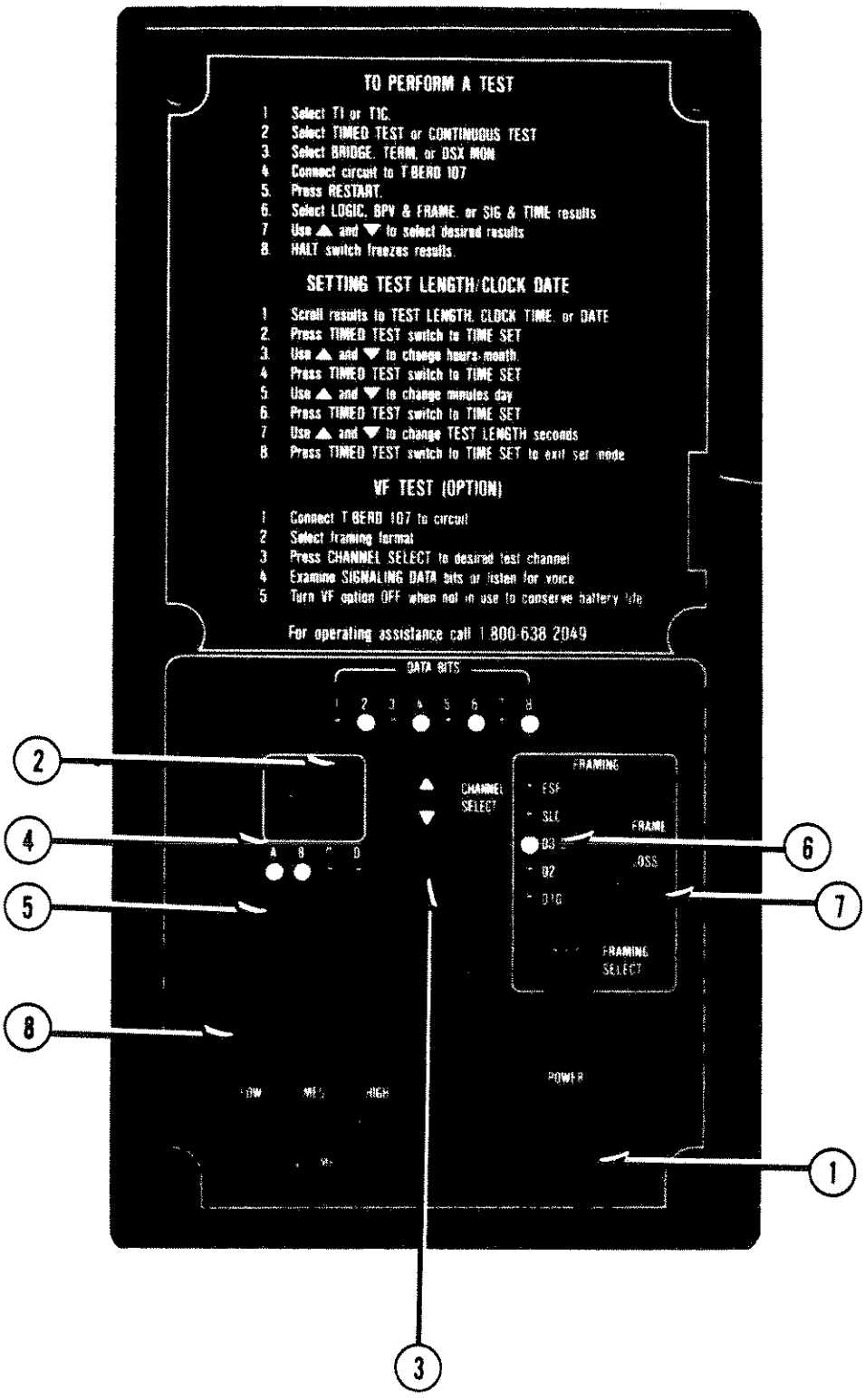

Figure A-1
T1 Channel Monitor Option

The user may set the desired volume level using the **VOLUME SELECT** switch labeled LOW, MED, and HIGH.

A.5 SPECIFICATIONS

This section contains the specifications for the T1 Channel Monitor Option for the T-BERD 107.

Physical Characteristics

- Size: 3.81"W x 7.94"L x 0.75"D (9.68 cm x 20.17 cm x 1.91 cm).
- Weight: 8.7 oz (0.247 kg).

A.6 OPERATIONAL REQUIREMENTS

- Operating Temperature Range: 0°C to +45°C (32°F to 113°F).
- Storage Temperature Range: -40°C to +70°C (-40°F to 158°F).

APPENDIX B

T1/T1C TRANSMITTER OPTION

B.1 INTRODUCTION

Appendix B describes the T1/T1C Transmitter Option key features, controls, indicators, and connectors.

B.2 OVERVIEW

The T1/T1C Transmitter Option transmits T1 and T1C test patterns enabling technicians to perform complete out-of-service testing on T-Carrier circuits. The T1/T1C Transmitter Option transmits standard framing, line coding, and data patterns for complete compatibility with existing network equipment.

The T1/T1C Transmitter Option is housed in the T-BERD 107 lid. It measures 3.81" wide x 7.94" long x 0.75" deep, and weighs 10.6 oz. The T1/T1C Transmitter Option is powered by the same lead acid battery that powers the T-BERD 107 Mainframe. It can also be powered using the AC adapter.

B.3 SUMMARY OF KEY FEATURES

- Operates in T1 & T1C (unframed), D4, ESF, and SLC framing modes and a THRU (Loop signal through unit) mode.
- Transmits standard T1 and T1C test patterns; QRSS, 3 in 24, 1:7, and ALL ONES.
- Sends both in-band and T1.403 compatible ESF Datalink (ESF only) CSU and programmable Facility (smart jack) loop codes.

- Enables selection of Line Build-Out level from 0 to -22.5 dB in 1.5 dB increments for identifying marginal performance which can lead to crosstalk problems.
- Transmits either AMI or B8ZS line code.
- Provides internal crystal oscillator timing and recovered (Loop) timing.
- Indicates if simplex current is between 52 mA and 70 mA or greater than 70 mA.
- Loops signals through the test set in the THRU mode.
- Inserts single BPV and logic errors into data stream. Errors can be inserted into data stream in the THRU mode.

B.4 INSTRUMENT DESCRIPTION

Figure B-1 shows the T-BERD 107 T1/T1C Transmitter Option. The numbers for each item in Figure B-1 correspond to the bracketed number appearing in the following descriptions.

NOTE: The T1/T1C Transmitter Option operates independently from the T-BERD 107 Mainframe.

POWER Switch [1] —This pushbutton switch turns the T1/T1C Transmitter Option on or off.

NOTE: The T1/T1C Transmitter Option should remain off when not in use to conserve battery life.

SIMPLEX CURRENT LED [2] —This three-state LED indicates the presence of simplex current on the span line. For current under 52 milliamps+(mA), the LED will be OFF. For currents between 52 mA and 70 mA, the LED will be green. For

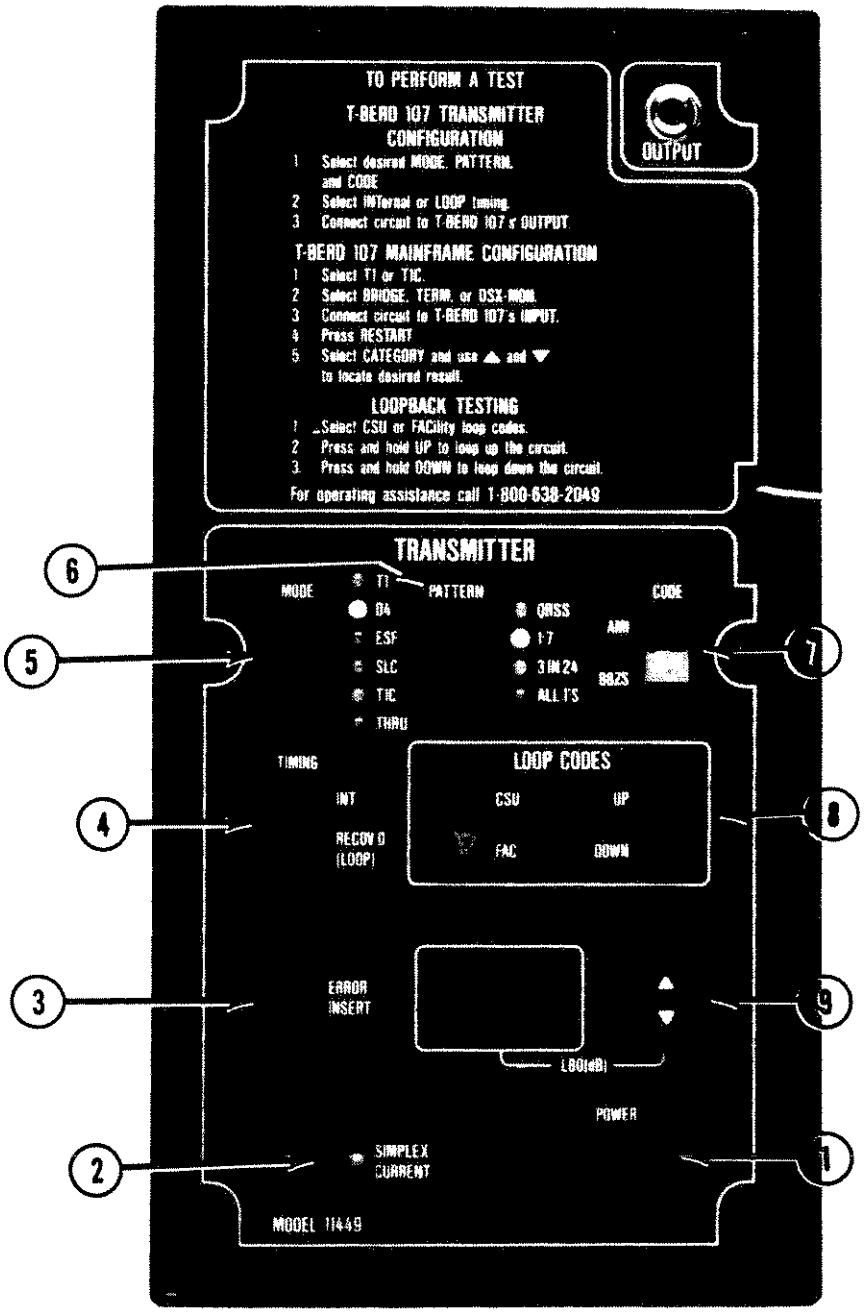

Figure B-1
T1/T1C Transmitter Panel

currents greater than 70 mA, the LED will be red. This LED is only lit when the T-BERD 107 is in THRU mode.

ERROR INSERT Switch [3] — This pushbutton switch inserts both a single logic error and a single bipolar violation (BPV) into the T1 bit stream. In the THRU mode, pressing this switch will error any one bit (data, framing, CRC, or datalink) in the stream.

NOTE: CRC and datalink bits are only present in ESF framing.

TIMING Switch [4] — The **TIMING** switch selects either internal (INT) crystal oscillator controlled timing or recovered/loop (RECOV) timing. In the RECOV (LOOP) position, the T1/T1C Transmitter uses the recovered clock from the T-BERD 107 Mainframe received signal to transmit its data patterns.

MODE Switch [5] — The **MODE** switch selects the desired framing format. An LED illuminates next to the selected framing mode. The framing choices are described as follows:

(a) T1 - In this position, the T1/T1C Transmitter sends UN-FRAMED T1 data patterns.

(b) D4 - Sends D4 FRAMED T1 data patterns.

(c) ESF - Sends ESF FRAMED T1 data patterns.

(d) SLC - Sends SLC FRAMED T1 data patterns.

(e) T1C - Sends T1C UNFRAMED data patterns.

(f) THRU - In THRU mode, the T1/T1C Transmitter Option regenerates and transmits the received data from the T-BERD 107. All BPVs are stripped, the pattern LEDs are turned OFF, and the loop timing is selected automatically.

PATTERN Switch [6] — The **PATTERN** switch selects the appropriate test pattern. An LED illuminates next to the selected pattern. The pattern choices are ALL ONES, 1:7, 3 IN 24, and QRSS.

NOTE: All patterns are synchronized to the framing pattern to prevent the generation of network yellow alarms.

CODE Switch [7] — The **CODE** switch selects the appropriate line coding, AMI or B8ZS (Clear Channel).

LOOP CODES [8] —The T1/T1C Transmitter enables the user to transmit both in-band and out-of-band (ESF only) CSU and programmable Facility (smart jack) loop codes.

(a) **CSU/FAC** Switch - This two-position rocker switch selects the appropriate CSU or FACility (smart jack) loop code when looping customer premises equipment.

(b) **LOOP CODES UP/DOWN** Switch - This two-position momentary switch transmits the selected loop-up or loop-down code. The loop codes are ONLY transmitted when the switch is pressed. The transmission of the selected data pattern is halted during the transmission of the loop code.

When the **MODE** switch is set for T1, D4, or SLC framing, the **LOOP CODES UP/DOWN** switch sends the standard in-band CSU and FACility loop codes. The CSU loop-up code is a repeating 10000 pattern; the CSU loop-down code is a repeating 100 pattern; the FACility loop-up code is a repeating 11000 pattern; and the FACility loop-down code is a repeating 11100 pattern.

NOTE: The out-of-band FACility loop codes are fixed values. The in-band FACility loop codes may be changed via **DIP** switches located inside the T1/T1C Transmitter Option assembly. See Section B.5 for the procedure for changing the in-band FACility loop codes.

When the **MODE** switch is set to ESF and the **LOOP CODES UP/DOWN** switch is pressed, the T1/T1C Transmitter simultaneously sends out-of-band (datalink) loop codes compatible with ANSI specification T1.403 and the in-band

loop codes. Craftsmen can therefore loop T1.403 compatible smart jacks and CSUs with the T1/T1C Transmitter Option. The datalink loop codes are outlined below:

	Loop-Up	Loop-Down
CSU (line)	0000 1110 1111 1111	0011 1000 1111 1111
FACility	0001 0010 1111 1111	0010 0100 1111 1111

LBO [9] — The T1/T1C Transmitter can attenuate its transmitted signals by adding line build-out (LBO) onto the signal. This LBO reduces the signal level of the transmitted signals in increments of 1.5 dB up to 22.5 dB of reduction.

(a) LBO VALUE DISPLAY - This LED display shows the current LBO value in the range from 0.0 dB to 22.5 dB.

(b) **LBO SELECT** switch - This switch increases or decreases the transmit line build-out (LBO) to simulate different cable lengths. The up and down arrows increase or decrease the amount of line build-out in 1.5 dB increments.

B.5 LOOP CODE SET-UP PROCEDURE

This section presents the procedure for setting the FACility loop up/down code(s) using the **LOOP UP/DOWN DIP** switches and associated code length rotary selection switches (see Table B-1). The **LOOP UP/DOWN DIP** switches and associated code length rotary selection switches are located on the T1/T1C Transmitter Option in the upper left-hand corner (see Figure B-2).

The position of the code length rotary selection switch determines how many bits will be used in the loop code transmit pattern. The **DIP** switch settings determine the values for the bits in the loop code pattern from left to right (most significant

bit to least significant bit). For example, a byte length setting of 4 with associated **DIP** switch positions of 1-1-0-0-0-0-0-0 will result in a loop up code of 4 repeating bits — 1100 1100 1100 ...

Tools Required

- Small Phillips head screwdriver
- Small flathead screwdriver

Table B-1
Setting Loop Code Switches

	Initial Disassembly Procedure
1.	Open the T-BERD 107 and lay it on a flat surface.
2.	Remove power from the T-BERD 107 Mainframe and T1/T1C Transmitter Option; disconnect the AC adaptor from the power source, if connected, and turn OFF the **POWER** switch on the T-BERD 107 Mainframe and T1/T1C Transmitter Option.
3.	Disconnect all cables from the T1/T1C Transmitter Option and T-BERD 107 Mainframe.
	T1/T1C Transmitter Option Removal
1.	Remove and retain the six screws from the T1/T1C Transmitter Option panel.
2.	While holding your hand over the T1/T1C Transmitter Option front panel, release it by tipping it out gently into your hand.

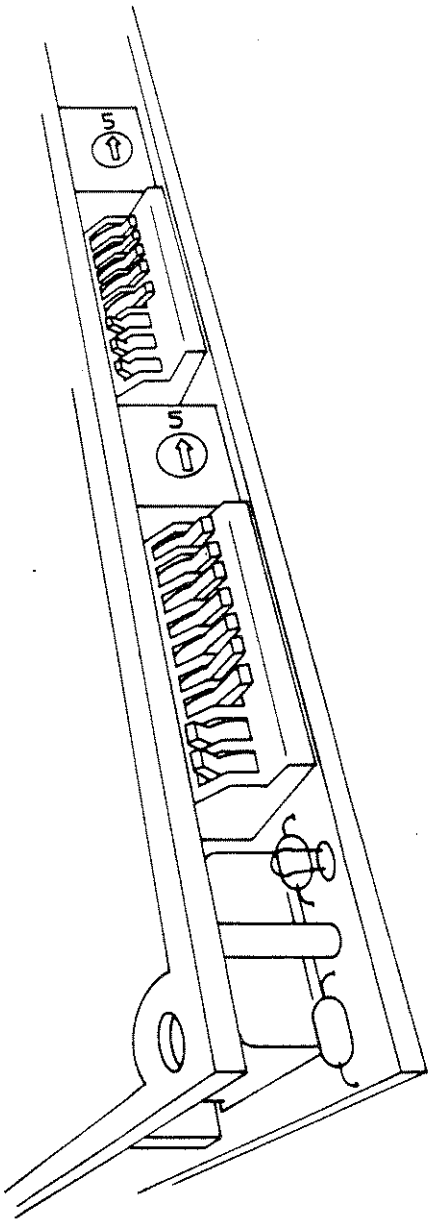

Figure B-2
T1/T1C Transmitter Assembly Side View

Table B-1
Setting Loop Code Switches (Continued)

3.	When the T1/T1C Transmitter Option has been released, grasp it by the sides and lift it out of the case at an angle away from the right side of the case (see Figure B-3).
4.	Gently set the T1/T1C Transmitter Option on the left edge of the case so that the T1/T1C Transmitter Option's right side is still resting within the case. **CAUTION:** Avoid lifting the T1/T1C Transmitter Option more than one inch out of the case, and be careful not to twist or pinch the ribbon cable that connects the T1/T1C Transmitter Option to the T-BERD 107 Mainframe.
	Setting the Loop Codes
1.	Use a small flathead screwdriver to set the **LOOP UP** code length rotary selection switch to the desired code length. This action sets the number of repeating bits in the loop code. **NOTE:** The minimum setting for the byte length rotary selection switch is 3 bits and the maximum setting is 8 bits.
2.	To set the **LOOP UP DIP** switch, start on the left-most toggle switch and position it UP for a logic one or DOWN for a logic zero. Position the remaining toggle switches to the desired logic characters.
3.	Repeat steps (1) and (2) above for the **LOOP DOWN** switches.
4.	Record the new loop code settings in Table B-2.

Table B-1
Setting Loop Code Switches (Continued)

T-BERD 107 Reassembly	
1.	Gently place the T1/T1C Transmitter Assembly back into the lid. Angle the T1/T1C Transmitter Assembly the same way as was done in removal, with the bottom right edge going in first (see Figure B-3).
2.	Replace the six screws on the T-BERD 107 lid, T1/T1C Transmitter Option case.

Table B-2
Loop Code Settings

Date	Loop Up Setting	Loop Down Setting
Factory	11000	11100

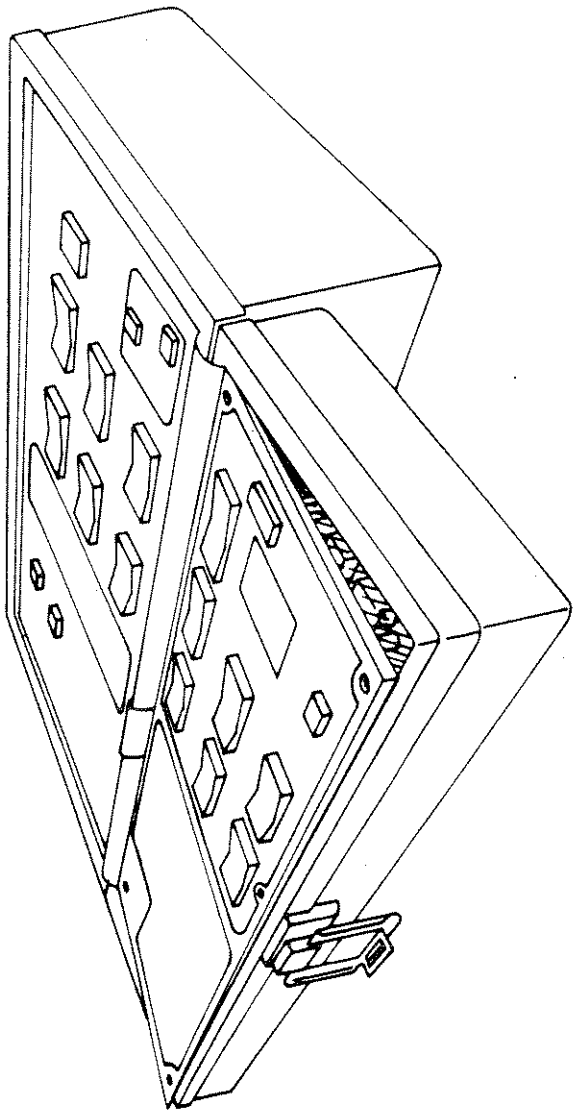

Figure B-3
T1/T1C Transmitter Assembly Removal

B.6 SPECIFICATIONS

This section contains the specifications for the T-BERD 107 T1/T1C Transmitter Option.

Physical Characteristics

- Size: 3.81"W x 7.94"L x 0.75"D (9.68 cm x 20.17 cm x 1.91 cm).
- Weight: 10.6 oz. (0.300 kg).

Output Specifications

- Output Connector: A balanced bipolar signal is output via a BANTAM jack connector.
- Output Line Build-out (LBO) Tolerance: ± 1 dB attenuation at 772 kHz.
- Output Level: 0 dB to -22.5 dB in 1.5 dB increments.
- Internal Oscillator Accuracy: ± 5 ppm.
- Line Codes: AMI or B8ZS (switch-selectable).
- Error Insert: Single BPV and single logic error.
- Pulse Shape: With output terminated in 100 ohm resistive load and 0 dB LBO selected, the T1/T1C Transmitter meets pulse shape specifications given in CCITT Recommendation G.703; Bell Publications CB113, CB119, CB132, CB143, and PUB62508; and PUB62411.

Pattern Definition

- ALL ONES: All Marks.

- 1:7: One Mark and seven Spaces.
- 3 IN 24: 01 0001 0000000000000001 00
- QRSS: QRSS pattern (2^{20}-1 with zero suppression) for T1;
  QRSS pattern (2^{20}-1) for T1C.

Loop Codes

- CSU UP (10000) or (0000111011111111 - FDL)
- CSU DOWN (100) or (0011100011111111 - FDL)
- FAC UP (11000) or (0001001011111111 - FDL)
- FAC DOWN (11100) or (0010010011111111 - FDL)

NOTE: The FACility in-band loop codes are programmable through internal DIP switches. See Section B.5 for the procedure for changing loop codes.

B.7 OPERATIONAL REQUIREMENTS

- Operating Temperature Range: 0°C to +45°C (32°F to 113°F).
- Storage Temperature Range: -40°C to +70°C (-40°F to 158°F).