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# 635/633

## QuickBERT-T1 and QuickCHECK-T1

# Users Manual

PN 1278087

July 1999 Rev.1, 9/99

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## **1-2. Design Highlights**

The QuickBERT-T1 and QuickCHECK-T1 are designed to allow users to easily analyze and correct the common problems arising in T1 networks. Experienced and inexperienced users alike can determine the integrity, configuration parameters, and general performance of a T1 circuit when using these units. Features include the following.

- Is handheld and battery powered
- Transmits all standard T1 bit error rate test (BERT) patterns and loop codes (QuickBERT-T1 only)
- Transmits HDSL loop codes (QuickBERT-T1 only)
- Has the ability to insert logic, BPV, and frame bit errors (QuickBERT-T1 only)
- Performs BERT and Fractional T1 BERT (Nx56 and Nx64)
- Captures and displays DTMF digits
- Measures DS1 frequency, level, and clock slips
- Displays standard T1 alarms
- Displays major T1 performance parameters
- Displays AMI or B8ZS line coding
- Measures DS0 level and frequency
- Monitors voice using internal speaker (or headset)
- Displays DS0 data and signaling bits
- Automatically synchronizes to and displays the T1 framing type, line coding, and BERT pattern

## **1-3. Safety Information**

### **⚠ Warnings and Precautions**

**To avoid possible electric shock or personal injury, and to avoid possible damage to the Test Set or to the equipment under test, follow these guidelines:**

- Before using the Test Set inspect the case. Do not use the Test Set if it is damaged.
- Inspect the test cables for damaged insulation or exposed metal. Check the cables for continuity. Replace damaged test cables, before using the Test Set.
- Do not operate the Test Set around explosive gas, vapor, or dust.
- Do not operate the Test Set with the case (or part of the case) removed.
- Recharge the battery as soon as the low battery indicator appears. With a low battery, the Test Set might produce false readings.
- When servicing the Test Set, use only specified replacement parts.

## **1-4. Software Revision**

To view the software revision number and the date of release, press and hold the **RESTART** key while powering up the unit.

## **1-5. Self Test**

After the startup screen, a self test will activate and the version build date will be displayed. To perform an LED test, press and hold the **RX INPUT** key while powering up the unit.

## 1-6. Supplied Equipment

The QuickBERT-T1 and QuickCHECK-T1 come with the following items.

- Carrying case
- ToolPak™ Accessory Kit
- A/C power adapter
- Two bantam-to-bantam cables
- Users manual
- Trimmer tool (used to adjust display view angle)

The 635-1 version of the QuickBERT-T1 also comes with a cable kit, which includes the following items.

- Two bantam-to-310 cables
- Two bantam-to-alligator clip cables
- One bantam-to-RJ48 cable.

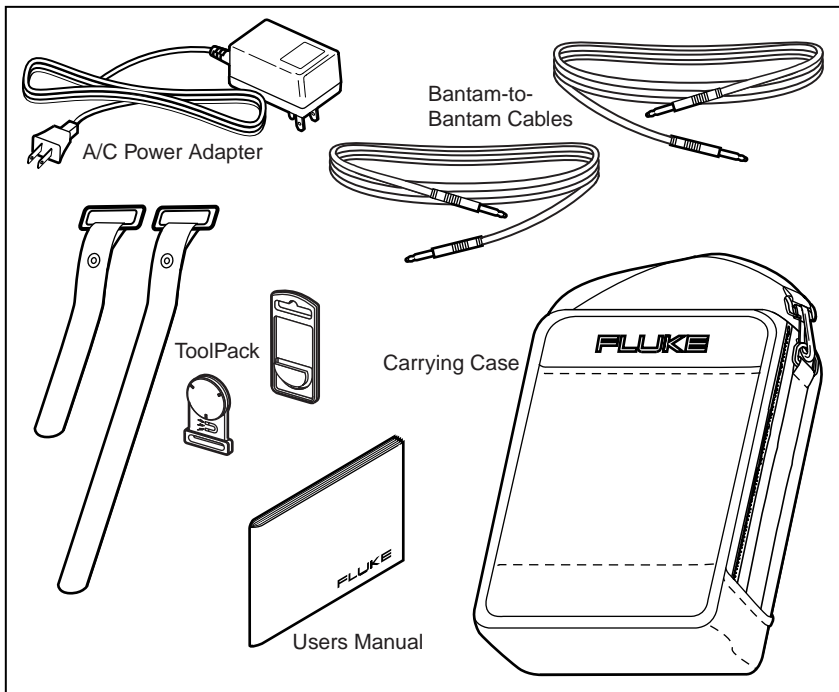


Figure 1-2. Supplied Equipment

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## 1-7. Toolpak Accessory Kit

The QuickBERT-T1 and QuickCHECK-T1 come with a ToolPak accessories kit. This kit includes a universal hanger, hook-and-loop straps, and a magnet. The universal hanger attaches to the unit and can be used by itself on a nail or hook, with a piece of rope or stiff wire. Two hook-and-loop straps are used with the universal hanger and can be wrapped around a pipe or beam. The ToolPak's magnet is used with the universal hanger and is strong enough to securely hold the test set.

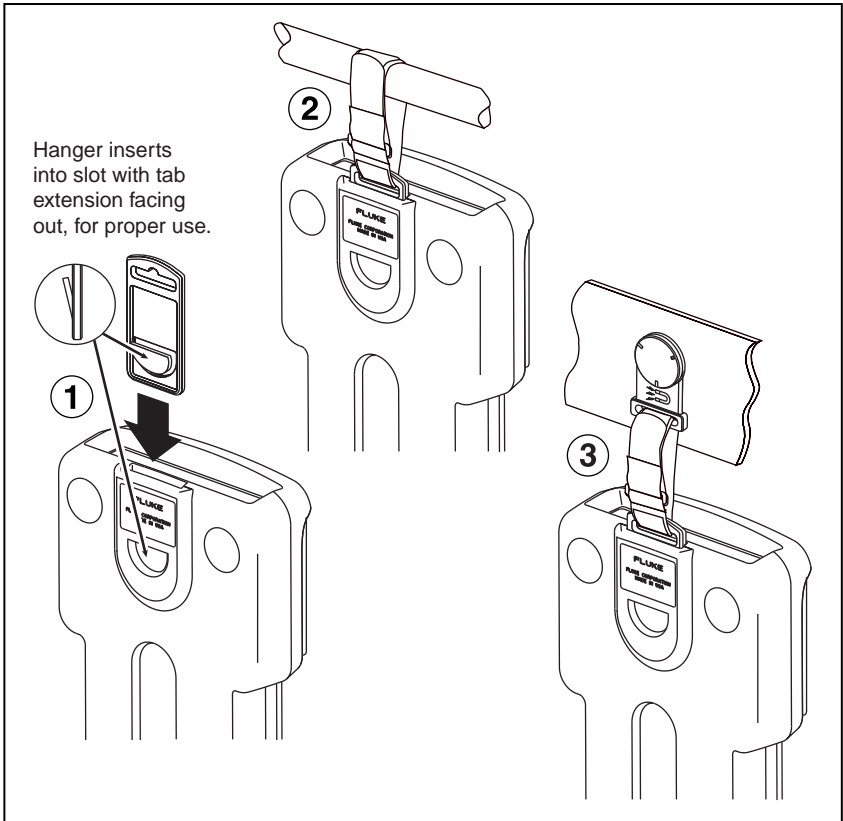


Figure 1-3. ToolPak Accessory Kit

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## **1-8. View Angle Adjustment**

The **VIEW ANGLE** control, located on the top panel of the test set, is a recessed control used to vary the display's view angle.

### *Note*

*In order to prevent damage to the test set, use only an insulated, flat-bladed tool to adjust the display's view angle.*

## **1-9. Accessories**

Additional cables and headsets for use with the QuickBERT-T1 and QuickCHECK-T1 are available from Fluke Corporation. For information, please contact customer service at 888-993-5853.

## **1-10. Cleaning**

When cleaning the display surface, use a soft cloth (such as a gauze) with mild soap and water.

## **1-11. Environmental**

Do not exceed the operating temperature limits of 32° to 122° F. Protect your unit from exposure to direct sunshine or high temperature/humidity for prolonged periods of time. These conditions may cause degradation to the display.

## **1-12. Manual**

This manual is arranged so you can quickly and easily find the information you need. The following is an overview of the contents of this manual.

- Chapter 1, Introduction, familiarizes you with QuickBERT-T1 and QuickCHECK-T1 highlights.
- Chapter 2, Overview, describes the QuickBERT-T1 and QuickCHECK-T1 controls, indicators, and connectors.
- Chapter 3, Operation, provides common test instructions.

- Appendix A, Specifications, provides the specifications of the QuickBERT-T1 and QuickCHECK-T1.

References to front panel keys are designated in upper case bold letters.

# Chapter 2 Overview

## 2-1. Introduction

This chapter of the manual contains information to familiarize you with QuickBERT-T1 and QuickCHECK-T1 controls and indicators. Refer to Appendix A for test set specifications. Figure 2-1 and 2-2 illustrate all control and indicator locations.

## 2-2. Power

The primary power source for the QuickBERT-T1 and QuickCHECK-T1 is a rechargeable, NiMH (nickel metal hydride) battery pack. An auxiliary power connector is available for use with an A/C power adapter (which is provided with the unit). The **ON/OFF** switch is located between the power (9 VDC) jack and the RX bantam jack on the top panel of the unit. During battery operation, the LOW BATTERY LED will illuminate to indicate that the battery pack has nearly exhausted its charge and that the test set should be recharged.

### *Note*

*If the test set is not turned off before the battery is completely exhausted, the unit will shut down to prevent battery damage. If this occurs, the unit will resume normal operation once recharge is performed.*

## 2-3. Primary And Reference T1 Receivers

The QuickBERT-T1 and QuickCHECK-T1 are equipped with two T1 receivers: primary (Rx) and reference (REF). The test set performs analysis on the signal present at the Rx receiver. The REF receiver provides the clock reference for performing clock-slip measurements.

On the QuickBERT-T1, the REF receiver functions as the transmit clock source when external (EXT) clock is selected. For additional information on clock-source selection, see section 2-18.

The **RX INPUT** key is provided for the Rx T1 receiver. Before making a connection from a T1 line to the RX jack, the **RX INPUT** key should be set appropriately. For additional information on the **RX INPUT** key and its settings, see section 2-42.

A bantam jack is provided for the REF T1 receiver. This jack is automatically terminated by the test set.

## **2-4. Controls**

The QuickBERT-T1 is equipped with 19 pushbutton keys and one switch. The **TX PATTERN**, **TX LINE CODE**, and **TX FRAMING** keys are yellow. The **RESTART** key is red. All remaining pushbutton keys are black.

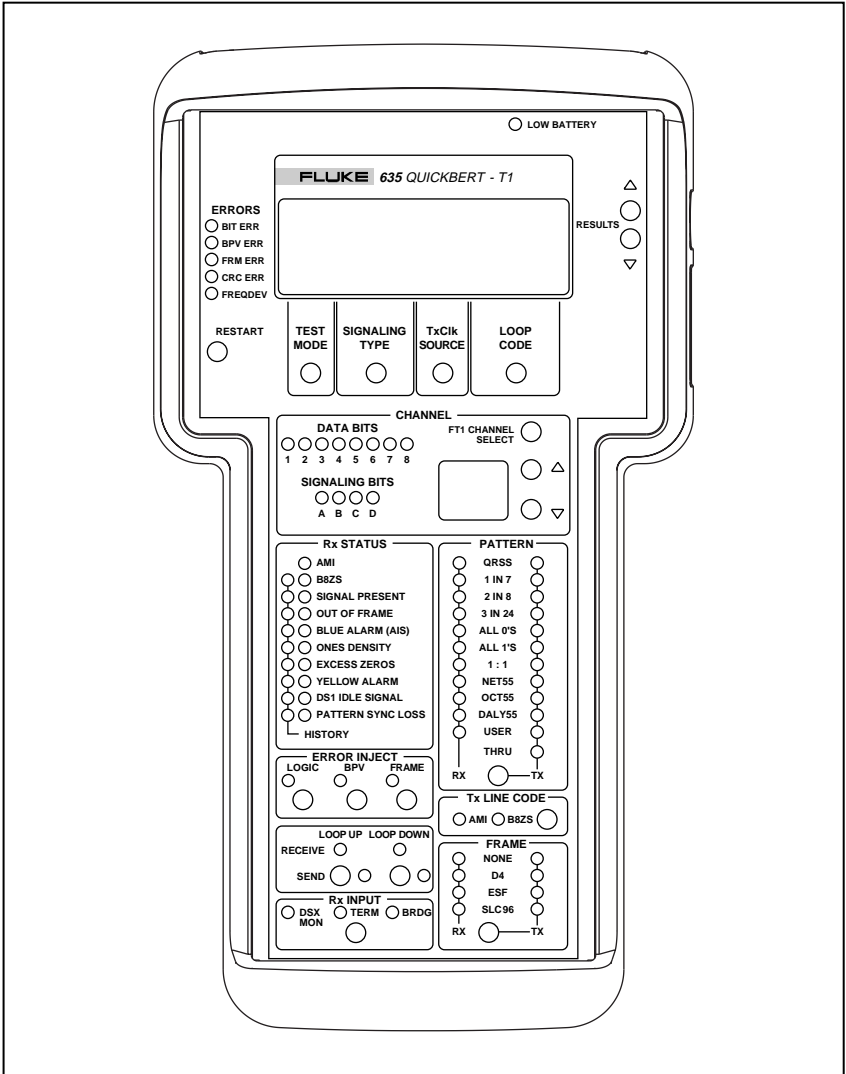
The QuickCHECK-T1 is equipped with 9 pushbutton keys and one switch. The **RESTART** key is red. All remaining pushbutton keys are black.

The following is a list of the controls which are defined in sections 2-5 through 2-58. An asterisk is placed next to those controls that are only applicable to the QuickBERT-T1. The remaining controls are included on both units.

<b>ON/OFF Switch</b>	<b>CHANNEL UP/DOWN Keys</b>
<b>RESULTS Keys</b>	<b>ERROR INJECT Keys*</b>
<b>RESTART Key</b>	<b>SEND LOOP UP/DOWN Keys*</b>
<b>TEST MODE Key</b>	<b>RX INPUT Key</b>
<b>SIGNALING TYPE Key</b>	<b>TX PATTERN Key*</b>
<b>TXCLK SOURCE Key*</b>	<b>TX LINE CODE Key*</b>
<b>LOOP CODE Key*</b>	<b>TX FRAME Key*</b>
<b>FT1 CHANNEL SELECT Key</b>	<b>Volume Control</b>

## **2-5. ON/OFF Switch**

This switch is located on the top panel of the test set and is used to apply and remove power from the unit.



**Figure 2-1. QuickBERT-T1 Front Panel**

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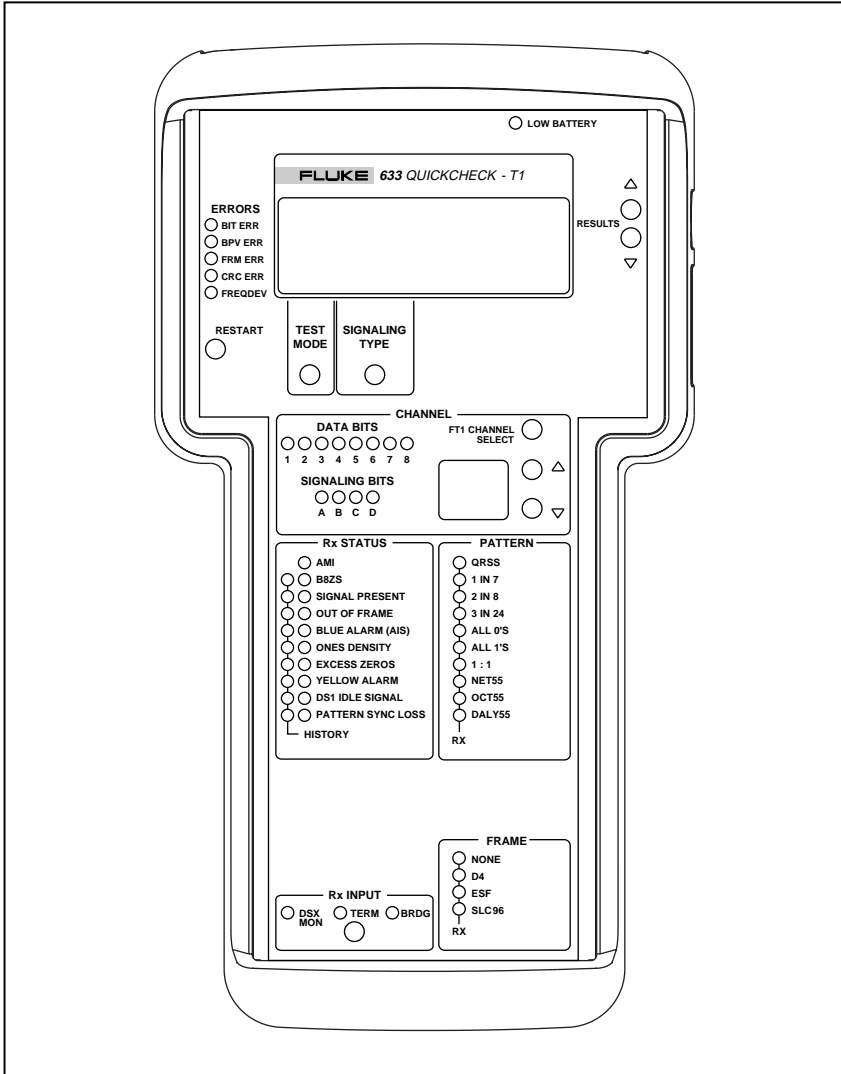


Figure 2-2. QuickCHECK-T1 Front Panel

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## 2-6. RESULTS Keys

These keys are used to scroll through the paired results parameters that appear on the display screen. To go from one pair of results to the next, use the **RESULTS UP/DOWN** keys (located to the right of the display screen).

<b>BPV Error</b>		<b>0</b>	
<b>Frame Err</b>		<b>0</b>	
<b>T1</b>	<b>RB</b>	<b>Int</b>	<b>CSU</b>

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The five Error LEDs will illuminate solid if currently detecting an error and will flash to indicate an error has previously been detected but is not currently being detected (history). Sections 2-7 through 2-14 provide detailed descriptions of the paired parameters.

## 2-7. BPV Error/Frame Err

<b>BPV Error</b>		<b>0</b>	
<b>Frame Err</b>		<b>0</b>	
<b>T1</b>	<b>RB</b>	<b>Int</b>	<b>CSU</b>

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### BPV Error

The test set records a bipolar violation (BPV) if it detects a violation of the alternate mark inversion (AMI) line-coding scheme (that is standard for T1 transmission). BPVs are recorded if the T1 signal is live traffic or a BERT pattern. The red BPV ERR LED will illuminate solid to indicate a BPV error is present and will flash to indicate a history of BPV errors.

### Frame Err

The test set automatically synchronizes with D4, ESF, or SLC'96 framing. When frame synchronization is achieved, the proper green Frame LED will illuminate. The unit will now register any errors that occur in the framing bit sequence (as defined for that particular framing format). Frame errors are recorded if the T1 signal is live traffic or a BERT pattern. The red FRM ERR

LED will illuminate solid to indicate a frame error is present and will flash to indicate a history of frame errors.

## 2-8. CRC Error/Bit Error

<b>BPV Error</b>			<b>0</b>
<b>Frame Err</b>			<b>0</b>
<b>T1</b>	<b>RB</b>	<b>Int</b>	<b>CSU</b>

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### CRC Error

If the test set establishes frame sync with an ESF-framed signal, it will detect and count cyclic redundancy check (CRC) errors. The CRC is a check-sum message that is transmitted in the facility data link (FDL) associated with ESF framing. The red CRC ERR LED will illuminate solid to indicate a CRC error is present and will flash to indicate a history of CRC errors.

### Bit Error

In order to record a bit error, the test set has to be synchronized with a test pattern. Therefore, bit errors are registered only if a BERT pattern is present. Pattern synchronization is indicated by the green Pattern LEDs. Each time the unit detects an errored bit in the pattern it is receiving, one bit error is recorded. The red BIT ERR LED will illuminate solid to indicate a bit error is present and will flash to indicate a history of bit errors.

## 2-9. DS1 Freq/Clk Slips

<b>DS1 Freq</b>		<b>1544000Hz</b>	
<b>Clk Slips</b>		<b>0</b>	
<b>T1</b>	<b>RB</b>	<b>Int</b>	<b>CSU</b>

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### DS1 Freq

When the DS1 frequency result is selected (using the RESULTS keys), the test set displays the frequency (in Hz) of the DS1 signal. If the DS1 frequency deviates from the nominal (1.544 MHz  $\pm$  50 Hz), the red FREQDEV LED illuminates to indicate that a DS1 frequency deviation is occurring. A frequency deviation of greater than  $\pm$  50 Hz indicates that the clock source is becoming unstable and has an unacceptable variation.

### Clk Slips

In order for a T1 circuit to perform properly, the TX clock (from the CPE) must be synchronized with the receive clock (from the central office). If a variation of these clocks exists, errors will result. The clock-slip parameter is used to verify clock synchronization. The test setup for a clock-slip measurement between the Tx and Rx side of a T1 span is described in section 3-10 of this manual.

Timing tests may also be performed to either side of the span when a T1 reference clock (stratum) is used. If a bipolar clock or a T1 signal is present at both the REF and RX receivers, the test set compares the two inputs and declares clock slips (if they are out of phase). If an external reference clock is not available, the unit will automatically compare the receiver clock to the internal, 5-ppm, 1.544-MHz clock source.

Clock slips is a loop-timing parameter that shows the total number of clock counts that the reference and receiver clocks have deviated from since the test began (or from the last restart). A positive number indicates that the reference clock is faster than the receive clock. A negative number indicates that the receive clock is faster than the reference clock.

*Note*

*If no reference clock measurement is being made, remove the plug from the REF jack to extend battery life.*

**2-10. E-Bit Sync**

<b>E-Bit Sync</b>			<b>Yes</b>
<b>T1</b>	<b>E-Bit</b>	<b>Int</b>	<b>CSU</b>

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If E-Bit is the selected signaling type (chosen with the **SIGNALING TYPE** key), the E-Bit Sync results screen will display Yes or No to indicate whether or not the span is in E-Bit sync. If E-Bit is not the selected signaling type, the E-Bit Sync results screen is not accessible.

**2-11. DS1 Level (volts, peak-to-peak)/DS1 Level (dBDSX)**

<b>DS1 Level</b>			<b>6.00vp-p</b>
<b>DS1 Level</b>			<b>0.00dB</b>
<b>T1</b>	<b>RB</b>	<b>Int</b>	<b>CSU</b>

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**DS1 Level (volts, peak-to-peak)**

When monitoring an in-service span, it may be useful to read the level of the T1 signal in volts, peak-to-peak; therefore, the DS1 level may be viewed both in dBDSX and volts, peak-to-peak. See section 3-6.

DS1 Level (dBDSX)

When the DS1 level result is selected (using the **RESULTS** keys), the test set displays the level of the DS1 signal in dBDSX. A DS1 signal is transmitted at a 0 dBDSX level. The reading, therefore, indicates the loss (in dB) from the point of transmission to the point of measurement.

*2-12. DS0 Freq/DS0 Level*

<b>DS0 Freq</b>		<b>1004.0Hz</b>	
<b>DS0 Level</b>		<b>0.0dBm</b>	
<b>T1</b>	<b>RB</b>	<b>Int</b>	<b>CSU</b>

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DS0 Frequency

DS0 frequency is a measurement of the analog frequency for the DS0 that is currently being monitored. For example, a test tone that is being received (in the selected DS0) will be measured and the received frequency will be displayed. The test set demodulates the digitally-encoded signal on the selected channel and presents it through the speaker (and the headset jack). If the DS0 frequency result is selected (using the **RESULTS** keys), the frequency of the analog signal present on the channel is displayed in Hz. (This result display is only available if a channel has been selected for monitoring.)

DS0 Level

DS0 level is a measurement of the analog signal level for the DS0 that is currently being monitored. For example, a test tone that is being received will be measured and the received level (or amplitude) will be displayed. The test set demodulates the digitally-encoded signal on the selected channel and drops the channel to the speaker (and the headset jack). If the DS0 level result is selected (using the **RESULTS** keys), the level of the signal is displayed in dBm. If you know the level at which the tone signal is inserted, the insertion loss of the channel may be determined. (This result display is only available if a channel has been selected for monitoring.)

*Note*

*The test set develops the analog signal level from the decoded digital signal. Therefore, the isolation resistors at a DSX monitor jack do not affect the DSO-level reading. See the note under step 7b in section 3-6.*

**2-13. FT1 (Fractional T1)**

<b>FT1</b>		<b>01</b>	<b>02</b>	<b>03</b>	<b>04</b>	<b>05</b>
<b>06</b>	<b>07</b>	<b>08</b>	<b>09</b>	<b>10</b>	<b>11</b>	<b>12</b>
<b>F64</b>		<b>CCIS</b>		<b>Rx</b>		<b>CSU</b>

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If F64 or F56 is selected as the test mode, you can view the Fractional T1 channels (01-24) on the FT1 results screens. There are two FT1 results screens: one with channels 01-12 and one with channels 13-24. The selected channel(s) will blink. For information on how to select channels for Fractional T1, see section 2-38.

**2-14. DTMF**

<b>DTMF</b>				<b>- - No Digits - -</b>
<b>F64</b>		<b>CCIS</b>		<b>Rx</b>
				<b>CSU</b>

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The DTMF results screen allows you to view DTMF digits for a selected channel. For information on how to capture and display DTMF digits, see section 3-7. (This result display is only available if a channel has been selected for monitoring.)

## 2-15. **RESTART** Key

Bit errors, BPV errors, CRC errors, frame errors, clock slips, and errored seconds are cleared to "0" when the **RESTART** key is pressed. If one of these results is being displayed when the **RESTART** key is pressed, it will continue to be displayed, but "0" will be displayed until an error of that type occurs. Any red Error LEDs that are flashing (to indicate errors of that type) will be turned off when the **RESTART** key is pressed. All Status and History LEDs are cleared when the **RESTART** key is pressed.

### *Note*

*Always press the **RESTART** key after connecting the test set to the line under test. The unit might detect invalid errors when first connected due to receiver sensitivity.*

Pressing the **RESTART** key does not affect the Signaling Bits LEDs, Data Bits LEDs, Signaling Type LEDs, LOW BATTERY LED, or Channel Selection display. In addition, pressing the **RESTART** key causes the test set to enter the auto-evaluate mode (see section 3-2 for additional information on automatic evaluation).

## 2-16. **TEST MODE** Key

The **TEST MODE** key allows you to select one of three test modes: T1, F64 (fractional T1, 64k), or F56 (fractional T1, 56k). When the T1 mode is selected, you can perform a T1 in-service or out-of-service BERT. For both the F64 and F56 test modes, the receiver performs T1 in-service or out-of-service testing on only the active channels and ignores the data on all other channels. When F64 mode is selected, all 8 bits in each active channel are used by the receiver for BERT. When the F56 mode is selected, only the first 7 bits in each active channel are used by the receiver for BERT.

The transmitter (QuickBERT-T1 only) sends the BERT pattern on the active channel(s). The received signal is simply passed through in the inactive channels and if there is not a received signal present, the inactive channels are filled with idle code (FF Hex). (Channels can be selected with the **FT1 CHANNEL SELECT** key.)

## **2-17. SIGNALING TYPE Key**

When the test set is in frame sync, either the D4, ESF, or SLC96 green Framing LED illuminates. For further analysis, the unit provides the ability to view the state of the signaling bits and data bits for a selected DS0 channel. There are four yellow Signaling Bits LEDs provided for this purpose (A, B, C, D). The D4 and SLC96 framing modes make provision for two signaling bits (A, B). The ESF framing mode makes provision for four signaling bits (A, B, C, D). In order to display the state of the signaling bits, the test set must be set up for the proper signaling format (robbed bit, CCIS, or E-Bit) being used on the T1 line under test.

The robbed bit (RB) scheme uses "robbed" data bits to transmit the signaling states. In common channel interoffice signaling (CCIS), a complete channel (DS0) is used to transmit signaling bits, thus leaving the eight data bits available to transmit data (clear channel). The E-Bit selection is provided to define a proprietary common channel signaling scheme.

## **2-18. TX CLK SOURCE Key (QuickBERT-T1 only)**

This key is used to select one of three transmit clock sources: Rx (recovered), Int (internal), and Ext (external). When Rx is selected, the QuickBERT-T1 recovers the clock from the received bit stream and uses the received clock as the timing element for the transmit data. When Int is selected, the 1.544 MHz internal oscillator is used to clock the transmitter. When Ext is selected, the QuickBERT-T1 recovers the bipolar clock from the external clock that is applied to the REF bantam jack and uses this clock as the transmit timing element.

## **2-19. LOOP CODE Key (QuickBERT-T1 only)**

This key is used to select the type of loop code to be transmitted by the QuickBERT-T1. See Table 2-1 for a list of the codes transmitted by the QuickBERT-T1 when the corresponding selections are made and the **SEND LOOP UP** or **SEND LOOP DOWN** key is pressed. The HDSL loop codes are either ADTRAN, Inc. or PairGain Technologies, Inc. loop codes. Sections 2-20 through 2-37 provide detailed descriptions of the loop-code types.

**Table 2-1. Loop Code Types**

<b>Loop Code Type</b>	<b>Loop-Up Code</b>	<b>Loop-Down Code</b>
CSU	10000 (IN-BAND)	100 (IN-BAND)
NIU4	1100 (IN-BAND)	1110 (IN-BAND)
NIU5	11000 (IN-BAND)	11100 (IN-BAND)
NTWRK (ESF)	1111111101001000 (OUT-BAND)	1111111100100100 (OUT-BAND)
LINE (D4)	10000 (IN-BAND)	100 (IN-BAND)
LINE (ESF)	1111111101110000 (OUT-BAND)	1111111100011100 (OUT-BAND)
PYLD (ESF)	1111111100101000 (OUT-BAND)	1111111101001100 (OUT-BAND)
ARM	11000 (IN-BAND)	11100 (IN-BAND)
HTU-R	1100011101000010 (IN-BAND)	1001001110010011 (IN-BAND)
HTU-C	1101001111010011 (IN-BAND)	1001001110010011 (IN-BAND)
HRE1	1100011101000001 (IN-BAND)	1001001110010011 (IN-BAND)
HRE2	1100011101010100 (IN-BAND)	1001001110010011 (IN-BAND)
NREM	1111111100000010 (IN-BAND)	11100 (IN-BAND)
NLOC	1111111100011110 (IN-BAND)	11100 (IN-BAND)
NDU1	1111111100000100 (IN-BAND)	11100 (IN-BAND)
NDU2	1111111100000110 (IN-BAND)	11100 (IN-BAND)
CREM	0011111100011110 (IN-BAND)	11100 (IN-BAND)
CLOC	0011111100000010 (IN-BAND)	11100 (IN-BAND)
CDU1	0011111100000100 (IN-BAND)	11100 (IN-BAND)
CDU2	0011111100000110 (IN-BAND)	11100 (IN-BAND)

## **2-20. CSU**

This selection is made to loop up/down a CSU, typically on the far end of a T1 span (see Chapter 3).

## **2-21. NIU4, NIU5**

This selection is made to loop an NIU. The NIU (sometimes called smart jack) is part of the network equipment and belongs to the service provider. Most modern NIUs respond to the NIU5 code. Older NIUs only respond to the NIU4 code.

## **2-22. NTRWK**

This selection is only valid in ESF framing. The NTRWK loop code is transmitted "out of band" (in the facility data link (FDL) of the ESF signal). The distant ESF CSU will respond by looping the DS1 signal back at a point that includes the entire CSU. The NTRWK loop code may be used in conjunction with the LINE loop code to determine whether a fault exists in the facility or the CSU. In order to activate the NTRWK loop code, ESF framing must be selected (using the **TX FRAME** key).

## **2-23. LINE**

If ESF framing and LINE loop code are selected, pressing the **SEND LOOP UP** or **SEND LOOP DOWN** key will transmit LINE code "out of band" (in the FDL of the ESF signal). The distant ESF CSU will respond by looping the entire DS1 signal at a point that does not include the CSU circuitry. The LINE loop code may be used in conjunction with the NTRWK loop code to determine whether a fault exists in the facility or the CSU. The LINE loop code may also be sent in band when D4 framing is selected.

## **2-24. PYLD**

If ESF framing and PYLD loop code are selected, pressing the **SEND LOOP UP** or **SEND LOOP DOWN** key will transmit the PYLD code "out of band" (in the FDL of the ESF signal). The distant ESF CSU will respond by looping only the payload (the customer data) of the ESF signal. The FDL will not be looped back, as with the NTRWK or the LINE loop codes. Because the FDL is regenerated at the distant CSU, the PYLD loop code is useful in determining which side of a T1 facility is faulty.

## **2-25. ARM (ADTRAN)**

When ARM is selected and the **SEND LOOP UP** key is pressed, all ADTRAN HDSL equipment is armed, enabling the HDSL elements to be looped. When ARM is selected and the **SEND LOOP DOWN** key is pressed, all ADTRAN HDSL equipment is disarmed.

## **2-26. HTU-R (ADTRAN)**

This selection causes the HTU-R (remote-end HDSL unit) to transition from an armed state to a loopback state.

## **2-27. HTU-C (ADTRAN)**

This selection causes the HTU-C (central-office HDSL unit) to transition from an armed state to a loopback state.

## **2-28. HRE1 (ADTRAN)**

This selection causes the HRE1 (HDSL range extender 1; sometimes referred to as a "doubler") to transition from an armed state to a loopback state.

## **2-29. HRE2 (ADTRAN)**

This selection causes the HRE2 (HDSL range extender 2; sometimes referred to as a "doubler") to transition from an armed state to a loopback state.

## **2-30. NREM (PairGain)**

This selection causes the NREM (network remote) to transition to a loopback state.

## **2-31. NLOC (PairGain)**

This selection causes the NLOC (network local loop) to transition to a loopback state.

## **2-32. NDU1 (PairGain)**

This selection causes the NDU1 (network doubler 1) to transition to a loopback state.

## **2-33. NDU2 (PairGain)**

This selection causes the NDU2 (network doubler 2) to transition to a loopback state.

### 2-34. CREM (PairGain)

This selection causes the CREM (customer remote) to transition to a loopback state.

### 2-35. CLOC (PairGain)

This selection causes the CLOC (customer local loop) to transition to a loopback state.

### 2-36. CDU1 (PairGain)

This selection causes the CDU1 (customer doubler 1) to transition to a loopback state.

### 2-37. CDU2 (PairGain)

This selection causes the CDU2 (customer doubler 2) to transition to a loopback state.

## 2-38. FT1 CHANNEL SELECT Key

When in F64 or F56 test mode, the FT1 channels will be selected by scrolling through the DS0s using the **CHANNEL UP/DOWN** keys and viewing the two-character display. To select the displayed channel for F64 or F56 BERT, press the **FT1 CHANNEL SELECT** key. The selected channel(s) will blink on the display screen (shown below) if FT1 is selected as the result type (using the **RESULTS** keys).

<b>FT1</b>		<b>01</b>	<b>02</b>	<b>03</b>	<b>04</b>	<b>05</b>
<b>06</b>	<b>07</b>	<b>08</b>	<b>09</b>	<b>10</b>	<b>11</b>	<b>12</b>
<b>F64</b>		<b>CCIS</b>		<b>Rx</b>		<b>CSU</b>

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To clear or deselect all channels for F64 or F56 BERT, select no channel (shown as "--" on the two-character display). Then, press the **FT1 CHANNEL SELECT** key momentarily. To select all channels, press and hold the **FT1 CHANNEL SELECT** key for approximately two seconds.

## 2-39. CHANNEL UP/DOWN Keys

These keys are used to select the DS0 channel for data and signaling drop to the Signaling Bits and Data Bits LEDs. The selected DS0 will also be dropped

to the speaker (and headset jack). The DS0 channel selection (1-24) is shown on the display that is located to the left of the **CHANNEL UP/DOWN** keys. These keys are also used with Fractional T1 to select fractional channels.

### **2-40. ERROR INJECT Keys (QuickBERT-T1 only)**

The three **ERROR INJECT** keys allow insertion of logic, BPV, or frame errors into the data stream. When you press the **ERROR INJECT** key momentarily, the LED will flash and one error will be injected. When you press and hold the **ERROR INJECT** key for approximately two seconds, the LED will illuminate solid and the selected error will be injected at an error rate of  $1.0E-4$ . Pressing the **ERROR INJECT** key again will discontinue the error inject rate and turn the LED off.

### **2-41. SEND LOOP UP/DOWN Keys (QuickBERT-T1 only)**

Various circuit elements in a T1 span respond to loop codes. This allows one person to perform an out-of-service BERT. Press the **SEND LOOP UP** key to transmit the loop-up code (which has been selected by the **LOOP CODE** key). The **SEND LOOP UP** LED will illuminate to indicate the code is being transmitted. Once the device is looped, the **RECEIVE LOOP UP** LED will illuminate for approximately 3 seconds (5 seconds for HDSL loop codes) to indicate that the device has successfully looped up. Press the **SEND LOOP DOWN** key to transmit the loop-down code (which has been selected by the **LOOP CODE** key). The **SEND LOOP DOWN** LED will illuminate to indicate the code is being transmitted. The **RECEIVE LOOP DOWN** LED will illuminate for approximately 3 seconds (5 seconds for HDSL loop codes) to indicate that the device has successfully looped down. Table 2-1 lists all of the loop-code types supported by the QuickBERT-T1. When monitoring a span, if the QuickBERT-T1 detects a loop code, the **RECEIVE LOOP UP** LED will illuminate to indicate a pre-loop condition.

### **2-42. RX INPUT Key**

Before making a connection to the RX jack, the **RX INPUT** key should be set appropriately. This key allows you to choose between three different T1 terminations: **DSX MON** for monitoring in-service or out-of-service lines through a DSX Monitor jack; **TERM** typically for out-of-service testing; and **BRDG** for monitoring in-service or out-of-service lines. The following paragraphs describe each termination mode.

**DSX MON** - The DSX Monitor Mode is typically used to monitor in-service T1 spans through a DSX monitor jack that is resistor-isolated from the span. When DSX MON is selected, the receiver is terminated into 100 ohms. Due to the loading effect of the 100-ohm termination in series with the isolation resistors, there is approximately a 20 dB line drop seen by the receiver. See Chapter 3.

**TERM** - The Terminate Mode is used when the span is being terminated by the QuickBERT-T1 or QuickCHECK-T1. It is typically used for an out-of-service BERT (see section 3-8).

**BRDG** - The Bridge Mode is typically used to monitor in-service T-spans that do not have a DSX monitor jack. The test set assumes a bridged connection consists of a direct connection to one side of the span, and that the connection is not resistor-isolated to the receive connector of the test set. The receiver is set to the high-impedance state of greater than 1000 ohms.

### **2-43. TX PATTERN Key (QuickBERT-T1 only)**

The **TX PATTERN** key controls the data content of the signal being transmitted by the QuickBERT-T1. Twelve patterns are available for selection. The yellow Pattern LEDs illuminate to indicate that the corresponding pattern is being transmitted. To change the pattern, simply press the **TX PATTERN** key.

Since the transmitter and receiver of the QuickBERT-T1 are totally independent, the pattern being transmitted is not necessarily the pattern being received. So while the yellow Pattern LEDs indicate the pattern being transmitted, the green Pattern LEDs indicate the pattern being received. No selection is necessary for the received pattern.

The QuickBERT-T1 automatically evaluates the signal present at the receiver and the appropriate LED illuminates indicating pattern synchronization has been achieved. Sections 2-44 through 2-55 provide detailed descriptions of the individual patterns.

### **2-44. QRSS**

The quasi-random signal source (QRSS) pattern is modified  $2^{20}-1$  pseudorandom pattern which allows a maximum of 14 sequential zeros and 20 sequential ones. The QRSS pattern is the most widely used pattern to test DS1 facilities. It provides a random set of stresses including long strings of zeros and ones. Unless B8ZS is invoked, QRSS violates the ones-density requirements when framed.

**2-45. 1 IN 7**

This pattern is a sequence of a one and seven zeros in the following form: 0100 0000. The maximum number of sequential zeros is eight, when transmitted framed, and seven when transmitted unframed. This pattern is useful when testing for mis-optioned AMI/B8ZS equipment.

**2-46. 2 IN 8**

This pattern is a sequence of two ones in eight bits in the following form: 0100 1000. The maximum number of sequential zeros is four, either framed or unframed. This pattern is used to verify error-free transmission in B8ZS-optioned systems.

**2-47. 3 IN 24**

This pattern is a sequence of three ones in 24 bits in the following form: 0100 0100 0000 0000 0100. The maximum number of sequential zeros is 15. This pattern is used to stress timing recovery in AMI-optioned systems.

**2-48. ALL 0'S**

This pattern is a sequence of all zeros. This pattern is useful for testing B8ZS circuits.

**2-49. ALL 1'S**

This pattern is a sequence of all ones. "All ones" require the maximum power to regenerate. This pattern is used to make loss measurements of the DS1 signal.

**2-50. 1:1**

This pattern is a sequence of alternating ones and zeros.

**2-51. NET55**

This pattern is a repeating pattern of 55 bytes according to the following hexadecimal sequence.

```
01 01 03 01  01 01 00 01  01 01 01 01  01 03 01 01  01 01 07 01
01 01 01 55  55 55 55 AA  AA AA AA 01  01 01 01 01  01 FF FF FF
FF FF FF 80  01 80 01 80  01 80 01 80  01 80 01
```

This pattern creates a variety of stress on the circuits. Some service providers require end-to-end testing using the 55 patterns.

## 2-52. OCT55

This pattern is a modified  $2^{20}-1$  pseudorandom pattern which allows a maximum number of 14 sequential zeros and 20 sequential ones.

```
01 01 01 01 01 01 01 00 01 01 01 01 01 01 03 01 01 01 01 07 01
01 01 01 55 55 55 55 AA AA AA AA 01 01 01 01 01 01 FF FF FF
FF FF FF 80 01 80 01 80 01 80 01 80 01 80 01 80 01
```

This pattern creates a variety of stress on the circuits. Some service providers require end-to-end testing using the 55 patterns.

## 2-53. DALY55

This pattern is a repeating pattern of 55 bytes according to the following hexadecimal sequence.

```
01 01 01 01 01 01 01 80 01 01 01 01 01 01 03 01 01 01 01 07 01
01 01 01 55 55 55 55 AA AA AA AA 01 01 01 01 01 01 FF FF FF
FF FF FF 80 01 80 01 80 01 80 01 80 01 80 01 80 01
```

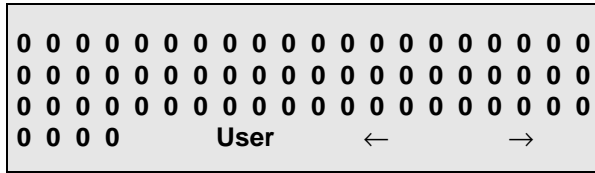
This pattern creates a variety of stress on the circuits. Some service providers require end-to-end testing using the 55 patterns.

## 2-54. USER

This pattern is a 64-bit user-programmable pattern, with a default pattern of 1:16. The 1:16 pattern is a repeating 16-bit pattern in the following form: 0100 0000 0000 0000.

When the unit is turned on, it automatically reverts to the default pattern. To set the user pattern to something other than the default, proceed with the following steps.

1. Press the **LOOP CODE** key and **RESULTS DOWN** key simultaneously. This will display the current user pattern. Twenty bits will be displayed on each of the top three lines. Four bits will be displayed in the first four character positions of the bottom line. Also displayed on the bottom line will be "User ← →".



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2. Press the **TX CLK SOURCE** key to scroll to the left and the **LOOP CODE** key to scroll to the right through the bits. The currently selected bit will blink.
3. Press the **RESULTS UP** key to select either "0" or "1." (The **RESULTS UP** key toggles between "0" and "1.")
4. Press and hold the **RESULTS UP** key for approximately two seconds to clear all bits (in the current length of the pattern) to "1."
5. When on the last character of the pattern, press the **RESULTS DOWN** key to delete the last character.
6. Press and hold the **RESULTS DOWN** key for approximately two seconds to clear all bits (in the current length of the pattern) to "0."
7. Press the **RESTART** key to erase all bits and start with a pattern length of one bit that is set to "0."
8. To exit the user pattern setup, press the **TEST MODE** key. The previously displayed results and setups will be displayed.

### 2-55. THRU

When this pattern is selected, the Rx signal is passed through the test set and transmitted back out the Tx jack. This is the only time that Rx and Tx are not independent. When this pattern is selected, signal monitoring continues and pattern sync still takes place.

### 2-56. TX LINE CODE Key (QuickBERT-T1 only)

The line-coding scheme should be set to AMI or B8ZS according to the configuration of the T1 facility being tested. The selection is made by pressing the **TX LINE CODE** key. The line-code selection affects the transmitted signal, not the received signal. The QuickBERT-T1 automatically evaluates the received signal and determines the line coding. See section 3-2 for additional information on the automatic-evaluation function of the QuickBERT-T1.

## **2-57. TX FRAME Key (QuickBERT-T1 only)**

Four possible framing selections are available with the QuickBERT-T1 (NONE, D4, ESF, SLC96). If NONE is selected, the QuickBERT-T1 will transmit the selected pattern unframed. That is, no framing bits are generated and no channels (DS0s) are defined. The full bandwidth of the T1 is used for data (in this case, the selected pattern). If D4 is selected, the QuickBERT-T1 will frame the selected pattern in 24 channels and 12 frames (as defined by AT&T<sup>®</sup> specification 62411). The ESF selection generates a T1 signal in the 24-frame, 24-channel format (per AT&T specification 62411). SLC96 is a special framing format that can be used when testing digital loop carriers (conforming to TR-TSY-00008).

### *Note*

*Sometimes D4 framing is referred to as SF or super frame.*

## **2-58. Volume Control**

If the receiver of the QuickBERT-T1 or QuickCHECK-T1 is in frame sync (indicated by the green Frame LEDs), a channel may be selected for audible monitoring. The demodulated audio signal for the selected channel (DS0) is dropped to an internal speaker. The volume control, located on the right side of the unit, is used to adjust the audio volume. A headset jack (for use with a customer-supplied headset) is also provided for noisy environments. See Appendix A for a description of the headset jack specifications.

## **2-59. Indicators**

Status, alarm, framing, signal presence, and coding information can be monitored from front-panel LEDs. Detailed descriptions of these front-panel LEDs are described in the following paragraphs.

## **2-60. Errors LEDs**

The Errors LEDs are labeled BIT ERR, BPV ERR, FRM ERR, CRC ERR, and FREQDEV. All of these LEDs illuminate solid to indicate errors are present and flash to indicate error history. Additional information on these errors can be viewed using the **RESULTS** keys. Detailed descriptions of each of these parameters are described earlier in this chapter.

## **2-61. Data Bits LEDs**

The received data for the selected DS0 channel is dropped to the eight Data Bits LEDs. The Data Bits LEDs are labeled 1 through 8, indicating the data-bit

positions. The first bit received for each DS0 byte is displayed in bit position 1 (least significant bit). If no channel is selected, the Data Bits LEDs will be off.

### **2-62. Signaling Bits LEDs**

The signaling for the selected DS0 channel is dropped to the Signaling Bits LEDs. These LEDs are labeled A, B, C, and D. The Signaling Bits LEDs will be off if no channel is selected. Table 2-2, shown below, lists the signaling bits.

**Table 2-2. Signaling Bits Displayed Based on Framing and Signaling Type**

<b>Framing Detected</b>	<b>Signaling Type Selected</b>	<b>Signaling Bits</b>
D4	Robbed Bit	A, B
ESF	Robbed Bit	A, B, C, D
SLC96	Robbed Bit	A, B
D4	CCIS or E-Bit	A, B
ESF	CCIS	A, B
ESF	E-Bit	A, B, C, D
None	Not Applicable	None

### **2-63. Rx Status/History LEDs**

The Rx Status LEDs provide a visual indication of an alarm condition. The corresponding History LEDs provide a visual indication of the history of an alarm condition.

### **2-64. AMI and B8ZS/HISTORY LEDs**

Line coding is assumed to be AMI until a B8ZS substitution is detected. The AMI and B8ZS LEDs automatically indicate the line coding present at the receiver. However, in order to distinguish between AMI and B8ZS, the data at the receiver must include at least one string that contains at least eight consecutive zeros. If live traffic is being monitored, it is logical to assume that eight zeros will transmit within a reasonable time period. However, if a pattern is transmitted, refer to section 2-43 to ensure that the particular pattern being received allows eight consecutive zeros. Monitor the green Pattern LEDs to determine if a pattern is being recognized by the test set.

*Note*

*An out-of-service T1 usually has framed all ones or a keep-alive signal present. The test set cannot detect B8ZS in this condition. In order to make a declaration of line coding, eight consecutive zeros or a B8ZS substitution (for eight zeros) must be received.*

The AMI LED illuminates only when AMI line coding is detected without B8ZS currently being detected. The B8ZS LED illuminates only when B8ZS (a zero substitution) is currently being detected. The B8ZS HISTORY LED illuminates to indicate a previously-received B8ZS substitution and will remain illuminated until the **RESTART** key is pressed.

### **2-65. SIGNAL PRESENT/HISTORY LEDs**

The SIGNAL PRESENT LED illuminates if a signal is detected by the Rx T1 receiver. The SIGNAL PRESENT LED turns off when 192 consecutive zeros (bit times without a pulse) are detected by the Rx T1 receiver. The SIGNAL PRESENT LED illuminates again when the next "1" is detected by the Rx T1 receiver.

The SIGNAL PRESENT HISTORY LED illuminates if a signal was detected and then lost (192 consecutive zeros were detected by the Rx T1 receiver). Once the SIGNAL PRESENT HISTORY LED illuminates, it will remain illuminated until the **RESTART** key is pressed.

### **2-66. OUT OF FRAME/HISTORY LEDs**

The OUT OF FRAME LED illuminates whenever an out-of-frame condition is detected. The test set must have previously detected D4, ESF, or SLC96 framing before an out-of-frame condition will be declared. For D4 or SLC96 framing, an out-of-frame condition is defined as 2 out of 4 FT (terminal framing) bits in error. For ESF framing, an out-of-frame condition is defined as 2 out of 4 FPS (framing pattern sequence) bits in error. The OUT OF FRAME LED will remain illuminated as long as the out-of-frame condition exists.

The OUT OF FRAME HISTORY LED illuminates when an out-of-frame condition is detected and then clears. Once the OUT OF FRAME LED illuminates, it will remain illuminated until the **RESTART** key is pressed.

### **2-67. BLUE ALARM (AIS)/HISTORY LEDs**

A blue alarm is declared if an out-of-frame condition exists and 14 or less zeros are counted in 13,895 bit times. The BLUE ALARM LED is unlit if the

out-of-frame condition clears, or if 15 or more zeros are counted in 13,895 or less bit times.

The BLUE ALARM (AIS) HISTORY LED illuminates when a blue alarm is detected and then clears. Once the BLUE ALARM (AIS) HISTORY LED illuminates, it will remain illuminated until the **RESTART** key is pressed.

### **2-68. ONES DENSITY/HISTORY LEDs**

In accordance with T1 standards (Pub 62411 and ANSI T1.403), a DS1 signal should maintain a minimum density of 1s bits. In the T1 transmission scheme (AMI), a one is represented by pulses of alternating polarity and a zero is represented by the absence of a pulse. T1 circuit elements depend on a minimum number of pulses to retain timing and regenerate proper clocking. If a signal contains too many consecutive zero bits (no pulses) these circuits cannot recover timing and bit errors occur. According to the accepted standards, a ones-density violation occurs when there are less than N ones within  $8(N+1)$  bit times where  $N=1-23$ . If the test set detects this condition, the ONES DENSITY LED will illuminate and remain illuminated until the violation clears. Some test patterns are intentionally generated to violate ones-density requirements to determine a failure point of network equipment (see section 2-43). If the DS1 is a B8ZS circuit and the circuit is provisioned properly, ones-density violations should not occur.

The ONES DENSITY HISTORY LED illuminates when a ones-density condition is detected and then clears. Once the ONES DENSITY HISTORY LED illuminates, it will remain illuminated until the **RESTART** key is pressed.

### **2-69. EXCESS ZEROS/HISTORY LEDs**

In accordance with T1 standards (Pub 62411 and ANSI T1.403), a DS1 signal should maintain a minimum density of 1s bits. In the T1 transmission scheme (AMI), a one is represented by pulses of alternating polarity and a zero is represented by the absence of a pulse. T1 circuit elements depend on a minimum number of pulses to retain timing and regenerate proper clocking. If a signal contains too many consecutive zero bits (no pulses) these circuits cannot recover timing and bit errors occur. According to the accepted standards, an excess-zeros violation occurs when DS1 has more than 15 consecutive zeros in the datastream. If the test set detects this condition, the EXCESS ZEROS LED will illuminate and remain illuminated until the violation clears. Some test patterns are intentionally generated to violate the excess-zeros requirement to determine a failure point of network equipment

(see sections 2-43). If the DS1 is a B8ZS circuit and the circuit is provisioned properly, excess-zero violations should not occur.

The EXCESS ZEROS HISTORY LED illuminates when an excess-zeros condition is detected and then clears. Once the EXCESS ZEROS HISTORY LED illuminates, it will remain illuminated until the **RESTART** key is pressed.

### **2-70. YELLOW ALARM/HISTORY LEDs**

A yellow alarm is a signal transmitted by a network terminal to inform the far end that it has lost communication with the network. A yellow alarm can be caused by trouble on the network or by interrupted transmission at the customer location. If the test set detects the yellow alarm code at the receiver, the YELLOW ALARM LED will illuminate and remain illuminated until the condition clears.

The YELLOW ALARM HISTORY LED illuminates when a yellow alarm condition is detected and then clears. Once the YELLOW ALARM HISTORY LED illuminates, it will remain illuminated until the **RESTART** key is pressed.

### **2-71. DS1 IDLE SIGNAL/HISTORY LEDs**

The DS1 IDLE SIGNAL LED illuminates whenever a DS1 idle condition is detected (as defined in ANSI T1.403-1995 Annex D). DS1 idle is the occurrence of 00010111 in all 24 DS0 channels. The DS1 IDLE SIGNAL LED remains illuminated until the DS1 idle condition clears.

The DS1 IDLE SIGNAL HISTORY LED illuminates when a DS1 idle code is detected and then clears. Once the DS1 IDLE SIGNAL HISTORY LED illuminates, it will remain illuminated until the **RESTART** key is pressed.

### **2-72. PATTERN SYNC LOSS/HISTORY LED**

If the test set has obtained synchronization, the corresponding green Pattern LED will illuminate. If the pattern is interrupted and the unit declares a loss of pattern sync, the PATTERN SYNC LOSS LED will illuminate and the Pattern LED will turn off. If pattern sync is re-established, the Pattern LED will again illuminate, and the PATTERN SYNC LOSS LED will remain illuminated until the **RESTART** key is pressed.

### **2-73. Error Inject LEDs (QuickBERT-T1 only)**

These three LEDs illuminate to indicate that a logic, BPV, or frame bit error has been injected. When the **ERROR INJECT** key is momentarily pressed, the LED will flash and one error will be injected. When the **ERROR INJECT** key is pressed and held for approximately two seconds, the LED will constantly illuminate and inject the selected error at an error rate of  $1.0E-4$ . Pressing the **ERROR INJECT** key again will discontinue the error inject and turn the LED off.

### **2-74. Receive Loop Up/Down LEDs (QuickBERT-T1 only)**

When looping up a device, if the pattern receiver detects the returned loop code and is able to achieve pattern sync, the QuickBERT-T1 assumes the device has been looped and the RECEIVE LOOP UP LED illuminates for 3 seconds. For loop-down code, the Rx pattern receiver is loaded with the code. If after 5 seconds the Rx pattern receiver loses sync, the span is assumed to be taken out of loop and the RECEIVE LOOP DOWN LED illuminates for 3 seconds.

#### *Note*

*When monitoring a span, if the QuickBERT-T1 detects a loop code, the RECEIVE LOOP UP LED will illuminate to indicate a pre-loop condition.*

### **2-75. Send Loop Up/Down LEDs (QuickBERT-T1 only)**

When the **SEND LOOP UP** or **SEND LOOP DOWN** key is pressed the appropriate LED will illuminate indicating that the selected loop code is being transmitted.

### **2-76. Rx Input LEDs**

The appropriate Rx Input LED (DSX MON, TERM, or BRDG) will illuminate to indicate the currently-selected termination mode.

### **2-77. Pattern LEDs**

T1 facilities are being called upon to transport various combinations of voice, analog and digital data, and video signals via the 192-bit payload of the DS1 frame. Specially-designed BERT patterns, when used under controlled conditions, provide a means of emulating certain payload signal characteristics. Use of one or more test patterns, with characteristics similar to those of the

expected customer payload, can provide an accurate estimate of the actual in-service network performance.

The QuickBERT-T1 and QuickCHECK-T1 have the ability to obtain pattern sync with the following patterns: QRSS, 1 IN 7, 2 IN 8, 3 IN 24, ALL ZEROS, ALL ONES, 1:1, NET55, OCT55, and DALY55. (The QuickBERT-T1 can also obtain pattern sync with a customizable USER pattern.) When the test set obtains pattern sync, a green Pattern LED will illuminate to indicate which pattern is being received. See section 2-43 for detailed descriptions of the individual patterns.

With the QuickBERT-T1, a pattern can be selected using the **TX PATTERN** key. The pattern selected for transmit is indicated by the yellow Pattern LEDs. Selecting a new transmit pattern will not necessarily affect the pattern being detected at the receiver (indicated by the green pattern LEDs).

### **2-78. Tx Line Code LEDs (QuickBERT-T1 only)**

The **TX LINE CODE** key is used to select the line code that the QuickBERT-T1 will use in transmitting the selected pattern. If the AMI selection is made, the QuickBERT-T1 will allow any amount of zeros to be transmitted. If the B8ZS selection is made, a B8ZS substitution will be made for a string of 8 consecutive zero bits in the pattern. The yellow LED corresponding to the chosen line code will illuminate. Changing the line code selection will not necessarily affect the line coding being detected at the receiver (green LED).

### **2-79. Frame LEDs**

The QuickBERT-T1 and QuickCHECK-T1 have the ability to detect NONE, D4, ESF, and SLC96 framing. If any of these frame formats are detected by the Rx T1 receiver, the corresponding green LED illuminates. Otherwise, they will remain off.

When transmitting (QuickBERT-T1 only), choose the frame format by using the **TX FRAME** key. The QuickBERT-T1 will frame the selected pattern according to the selection indicated by the yellow LEDs. Changing the transmit frame format selection will not affect the receiver.

### **2-80. Low Battery LED**

This LED illuminates to indicate that the battery life is nearly exhausted and that the battery should be recharged.

## **2-81. Battery Safe Mode**

In order to protect the battery pack from being damaged by a complete discharge, the QuickBERT-T1 and QuickCHECK-T1 incorporate a Battery Safe mode. If the test set is left on, the power supply will shut down internally to prevent a complete discharge. When the unit has entered the Battery Safe mode, it will no longer respond to the **ON/OFF** switch. To exit the Battery Safe mode, you must recharge the battery.

## **2-82. Battery Pack**

The QuickBERT-T1 and QuickCHECK-T1 incorporate a NiMH rechargeable battery pack. This battery pack provides a working voltage of 3.6 V at 1 amp for 3 hours, and has a battery life of approximately 4.75 hours of continuous operation (with a fully-charged battery pack). The charging voltage is 9-12 VDC and the rated current is 1 amp. A regulated or unregulated 12-V, 1-amp, DC power adapter may be used for charging. A 12-V, fused, automotive, cigarette lighter adapter may also be used where AC is not available.

The NiMH battery packs are not serviceable. To charge, connect the unit's 12-V power source to the DC jack. A full charge takes five hours. The bi-color LED located on the top panel of the unit indicates the charging status of the battery pack. The LED illuminates red to indicate the battery pack has entered the charging state. The LED illuminates green to indicate the battery pack is fully charged and has entered the "top off" or "trickle" charge state. If the battery pack is absent from the unit, the LED will remain off.

# **Chapter 3**

## **Operation**

### **3-1. Introduction**

This chapter of the manual includes operation procedures for the most commonly used tests of the QuickBERT-T1 and QuickCHECK-T1 test sets.

### **3-2. Automatic Evaluation**

When the **RESTART** key is pressed, the unit automatically evaluates the incoming signal for framing type, line coding, and BERT patterns. The test set first determines the frame type that is currently being used on the line (D4, ESF, SLC96, or NONE). Once the frame type has been detected, it determines the pattern that is being transmitted on the line (see section 2-43 for a list of supported BERT patterns). If the test set is unable to detect one of these BERT patterns, then none of the green Pattern LEDs will illuminate, indicating either live traffic or the presence of a pattern not supported by the unit.

The evaluation cycle will only operate if there is a valid input signal present at the RX jack. If the input signal disappears during the cycle, the unit will stop evaluating and wait for the signal to reappear.

The receiver and transmitter of the QuickBERT-T1 are totally independent of each other (except when the Thru Tx pattern is selected). The evaluated Rx signal and the receiver setup have no effect on the transmitter. The transmit signal will always be transmitted according to the manual setup.

### **3-3. Framing Evaluation**

The QuickBERT-T1 and QuickCHECK-T1 evaluate the incoming signal to determine the framing type: D4, ESF, or SLC96. If one of these framing types is detected, the corresponding Framing LED illuminates. If the unit does not recognize the framing type, the NONE LED will illuminate while the unit attempts to establish frame sync.

### **3-4. Pattern Evaluation**

The QuickBERT-T1 and QuickCHECK-T1 evaluate the data of the incoming signal to determine if it matches one of the supported BERT patterns. The unit supports QRSS, 1 IN 7, 2 IN 8, 3 IN 24, ALL 0'S, ALL 1'S, 1:1, NET55, OCT55, DALY55, or USER (QuickBERT-T1 only). If one of these patterns is detected, the corresponding Rx Pattern LED illuminates. If none of the patterns are detected, all of the Rx Pattern LEDs will be off and the data is assumed to be live traffic.

### **3-5. Line Code Evaluation**

The QuickBERT-T1 and QuickCHECK-T1 evaluate the data of the incoming signal to determine the line coding: B8ZS or AMI. If B8ZS is detected, the corresponding Rx Status LED will illuminate; otherwise, the AMI LED will illuminate.

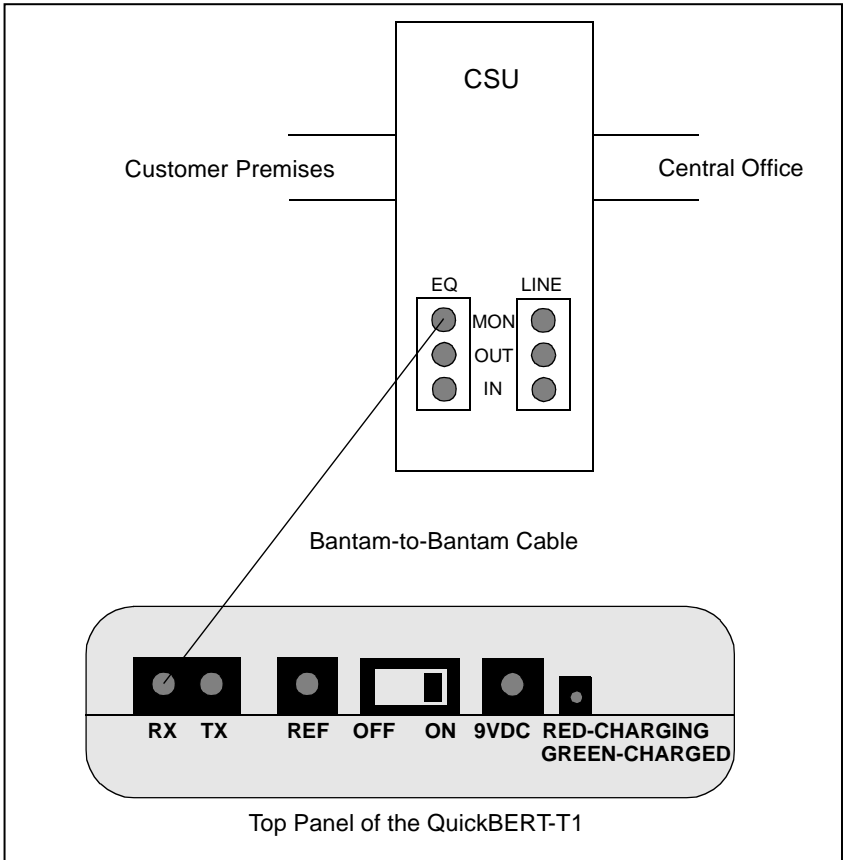
### **3-6. Evaluating Live Traffic**

Use the following procedure to evaluate live traffic.

1. Select a monitor point to perform the evaluation. The monitor point may be "monitor" jacks on a CSU, NIU, or DSX jack field. The unit may also be "bridged" across one side of the T1 line at any electrical access point.
2. Select DSX MON, TERM, or BRDG (using the **RX INPUT** key) to properly terminate the Rx T1 receiver. The DSX MON setting should be selected if the chosen test point is provided with the 432-ohm isolation resistors to isolate the test set from the T1 line (such as a DSX monitor jack in a central office). The TERM setting should be selected for out-of-service testing. The BRDG setting should be selected if the unit is to be bridged across the T1 line (such as at a 66 block).
3. Insert a bantam-ended test cord into the Rx T1 receiver on the QuickBERT-T1 or QuickCHECK-T1.
4. Connect the other end of the test cord to the selected access point

*Note*

*Not all CSU manufacturers provide proper isolation from the monitor jacks to the T1 line. Consult the literature from your CSU manufacturer to determine the proper setting for the test set.*



**Figure 3-1. Live-Traffic Monitoring**

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5. Press the **RESTART** key to erase any errors registered during setup and initiate auto evaluate.

6. Observe indicators.

a. Status LEDs

These LEDs provide information about the health of the T1 signal. See section 2-63 for a full definition of the functions of these indicators.

b. Framing

The test set automatically attempts to acquire frame sync to the T1 signal present on the facility. Once frame sync is obtained, the corresponding LED illuminates (D4, ESF, or SLC96). If the unit does not detect a framing pattern, the NONE LED illuminates. This is a legitimate condition if the signal is unframed.

c. Line Coding

AMI and B8ZS LEDs illuminate to indicate the line coding that is detected. See section 2-64 for a full definition of the functions of these indicators.

d. Errors

The test set detects BPV and framing errors on any T1 signal (assuming frame sync has been achieved). Any CRC errors will be recorded on ESF-framed signals. If an error is detected, the corresponding LED will flash. Use the **RESULTS** keys to step through the error types and display the number of recorded errors.

7. Perform further analysis of the T1 signal, if needed.

a. DS1 Frequency

To observe the frequency of the DS1 signal in hertz, use the **RESULTS** key to scroll through the selections.

b. DS1 Level

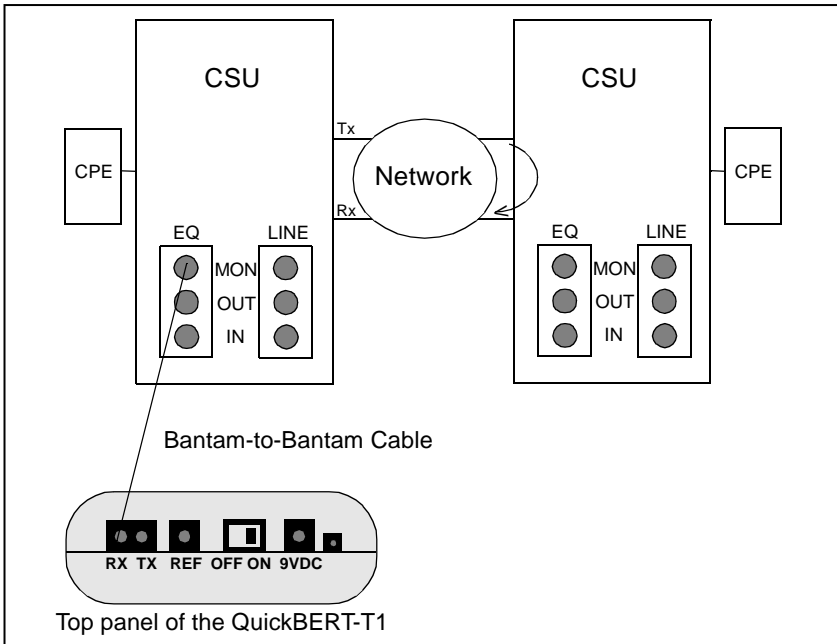
To observe the level of the DS1 signal in dBDSX or peak-to-peak volts, use the **RESULTS** keys to scroll through the selections.

*Note*

*Care must be taken if the readings are taken from a DSX monitor jack with the **RX INPUT** key set to DSX MON. In that case, the isolation resistors will cause the level reading to be approximately  $-20$  dB below the actual line level. In order to determine the actual line level from a DSX monitor jack,  $20$  dB must be added to the reading displayed on the display screen (if the readings are in dBDSX). If the readings have been converted to peak-to-peak volts, multiply by 10 in order to get a true line-level measurement at a DSX monitor jack.*

8. Proceed as follows to observe parameters associated with specific DS0s.
  - a. Use the **SIGNALING TYPE** key to select the type of signaling used on the T1 facility (robbed bit, CCIS, or E-Bit).
  - b. Use the **CHANNEL UP/DOWN** keys to select the DS0 to be monitored.
9. Observe the signaling bits associated with the selected DS0. A and B signaling bits will be displayed for D4- or SLC96-framed signals. A, B, C, and D signaling bits will be displayed for ESF- framed signals.
10. Observe the Data Bits LEDs, which will indicate the 1 or 0 state of the data bits associated with the selected DS0.
11. The demodulated audio signal from the selected DS0 may be monitored using the speaker and adjusted using the volume control. For your convenience, a headphone jack is provided.
12. Record the frequency and level of a test tone present on the selected DS0.
  - a. Use the **RESULTS** keys to observe the frequency of the test signal in hertz.
  - b. Use the **RESULTS** keys to observe the level of the test tone in dBm.

### 3-7. Capturing and Displaying DTMF Digits



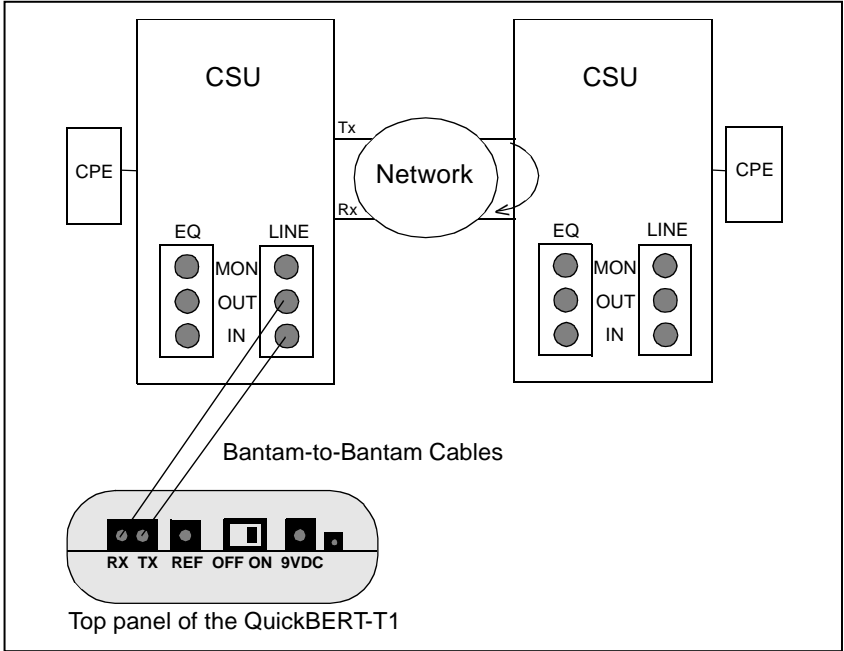
**Figure 3-2. Capturing and Displaying DTMF Digits**

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To capture and display DTMF digits, proceed with the following steps:

1. Turn the **ON/OFF** switch to On.
2. Use the **RX INPUT** key to select MON.
3. Connect the test cord from the QuickBERT-T1 or QuickCHECK-T1 RX jack to the EQ MON jack.
4. Select the channel to be monitored using the **CHANNEL UP/DOWN** keys.
5. Use the **RESULTS UP/DOWN** keys to scroll to the DTMF results screen (see section 2-14).
6. Either (1) select another channel to be monitored (using the **CHANNEL UP/DOWN** keys) or (2) press the **RESTART** key to clear the digits.

### 3-8. Performing a BIT Error Rate Test (BERT) (Quick BERT-T1 only)



**Figure 3-3. Performing an Out-of-Service BERT**

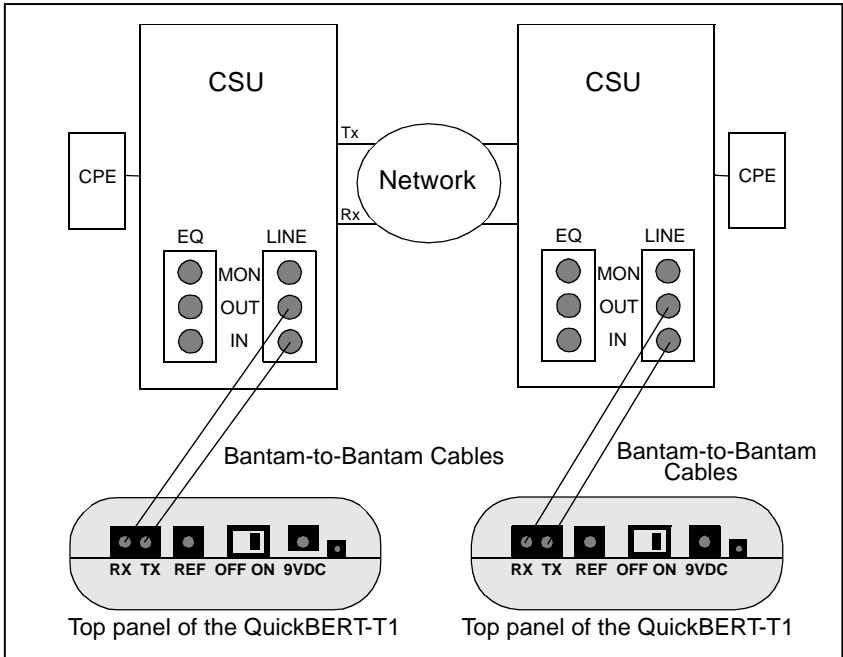
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The QuickBERT-T1 has the ability to perform two types of BERT: (1) an out-of-service BERT that allows one QuickBERT-T1 to send a loop code and then loop it back from the CSU (NIU), and (2) an end-to-end, out-of-service BERT that tests across the entire facility or to the service provider. Procedures for these tests are the same except for step 9, which allows you to choose which type of BERT to perform.

1. Turn the **ON/OFF** switch to On.
2. Use the **RX INPUT** key to select TERM
3. Use the **TX CLK SOURCE** key to select Int as the transmit clock source.
4. Press the **TX FRAME** key to select either D4, ESF, SLC96, or NONE.
5. Press the **TX PATTERN** key to select the desired BERT pattern.

6. Press the **TX LINE CODE** key to select either AMI or B8ZS line coding to match the equipment being tested.
7. Connect the test cord from the QuickBERT-T1 RX jack to the LINE OUT jack.
8. Connect a test cord from the QuickBERT-T1 TX jack to the LINE IN jack.
9. Press the **RESTART** key. This test can be performed one of two ways.
  - a. Test to a loop at the distant end (CSU, NIU, HDSL, or “hardwired”). See Figure 3-3 for an illustration of this setup.
  - b. Test with another test set at the distant end. See Figure 3-4 for an illustration of this setup.

If a signal is being received at the RX jack and is in frame and pattern sync, the green Frame and Pattern LEDs will illuminate. If an error occurs, the corresponding red LED (located in the upper left corner) will illuminate. Use the **RESULTS** keys to observe the error types.



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**Figure 3-4. Performing an End-to-End, Out-of-Service BERT**

### **3-9. Performing Fractional T1 BERT**

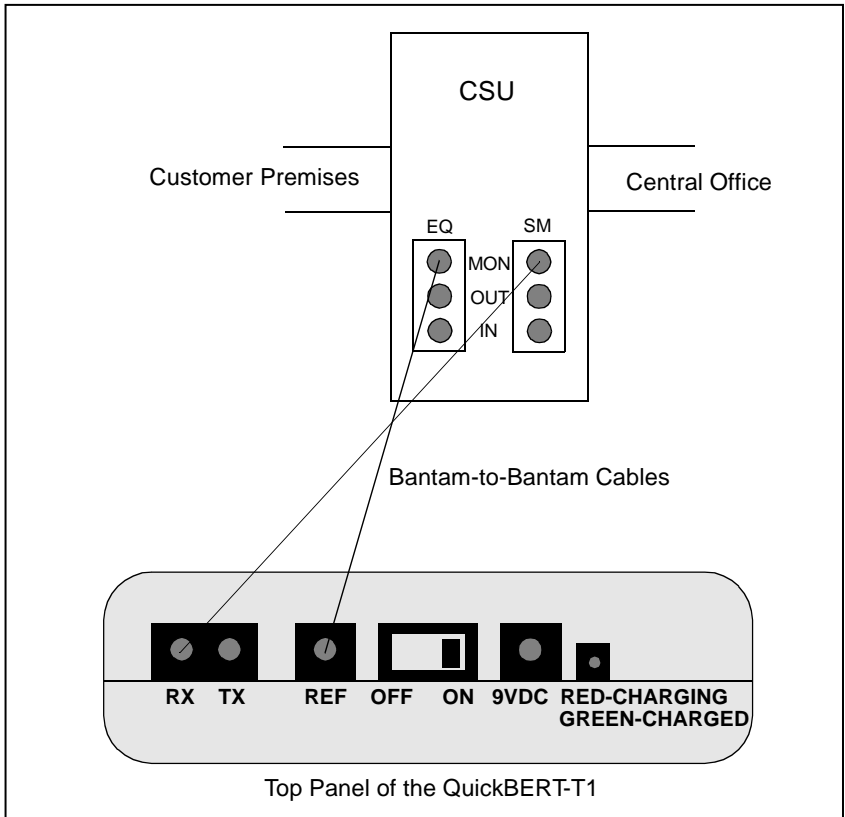
To perform a Fractional T1 BERT using either the QuickBERT-T1 or the QuickCHECK-T1, proceed with the following steps.

1. Turn the **ON/OFF** switch to On.
2. Use the **RX INPUT** key to select the proper termination.
3. Connect the test cord from the QuickBERT-T1 or QuickCHECK-T1 RX jack to the LINE OUT jack.
4. Press the **RESTART** key.

To perform a Fractional T1 BERT using the transmit function (QuickBERT-T1 only), proceed with the following steps.

1. Turn the **ON/OFF** switch to On.
2. Select the appropriate channels. See section 2-38 for a description of the procedure used to select channels.
3. Use the **RX INPUT** key to select TERM.
4. Use the **TX CLK SOURCE** key to select Int as the transmit clock source.
5. Press the **TX FRAME** key to select either D4 or ESF.
6. Press the **TX PATTERN** key to select the desired BERT pattern.
7. Press the **TX LINE CODE** key to select either AMI or B8ZS line coding to match the equipment being tested.
8. Connect the test cord from the QuickBERT-T1 RX jack to the LINE OUT jack.
9. Connect a test cord from the QuickBERT-T1 TX jack to the LINE IN jack.
10. Press the **RESTART** key.

### 3-10. Performing Clock-Slip Measurements



**Figure 3-5. Clock-Slip Measurements**

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In order to ensure proper network performance, clocks between various circuit elements must be synchronized. Clock-synchronization problems are a common occurrence when customer-premises equipment, such as PABXs and multiplexers, are connected to the public network. The QuickBERT-T1 and QuickCHECK-T1 have the ability to determine synchronization by measuring the clock-slip count between two clock sources. To perform a clock-slip measurement, proceed with the following steps.

1. Determine the test measurement points. Clock differential may be made between any two T1 clocking sources. In this example, thenetwork clock

is compared to the clock that is recovered from the DS1 signal transmitted from the customer side of the CSU.

2. Turn the **ON/OFF** switch to ON.
3. Insert a bantam-ended test cord into the Rx T1 receiver of the test set.
4. Use the **RX INPUT** key to select DSX MON.
5. Connect the other end of the test cord to the line-side monitor jack of the CSU.
6. Insert a second bantam-ended test cord into the REF T1 receiver of the test set.
7. Connect the other end of the second test cord to the equipment-side monitor jack for the CSU.
8. Press the **RESTART** key to erase any errors or false indications caused by establishing the connection.
9. Use the **RESULTS** keys to observe clock slip count.

*Note*

*The cables may be reversed for this test. If clock slips do occur, however, the sign (+/-) will be reversed.*

*Note*

*During a clock slip test, other indications (described in section 3-6) are valid for the side of the T1 line connected to the Rx T1 receiver.*

# Appendix A Specifications

## Introduction

This section of the manual contains specifications for the QuickBERT-T1 and QuickCHECK-T1 test sets.

## Mechanical Specifications

Table A-1 provides mechanical specifications for the QuickBERT-T1 and QuickCHECK-T1.

**Table A-1. Mechanical Specifications**

<b>Characteristic</b>	<b>Specification</b>
Enclosure	
Dimensions	1.75"H x 5"W x 9"D
Weight	1 lb, 6 oz
Connectors	
RX T1 Receiver Term/Monitor/Bridge	Bantam jack
TX T1 Transmitter (QuickBERT-T1 only)	Bantam jack
REF T1 Receiver	Bantam jack
Auxiliary Power	DC power jack (accepts 2.5 mm diameter female plug with center or tip "+" and outside "-")
Headset jack	3.5 mm phone plug - stereo (for customer-supplied headphones)

## Electrical Specifications

Table A-2 provides electrical specifications for the QuickBERT-T1 and QuickCHECK-T1.

**Table A-2. Electrical Specifications**

Characteristic	Specification
RX T1 Receiver	
Input Impedance	Bridge > 1000 ohms Term = 100 ohms $\pm$ 5% Monitor = 100 ohms $\pm$ 5%
Range	Bridge = 6 to -36 dB Term = 6 to -36 dB Monitor = -15 dB to -24 dB
Compatibility	ANSI T1.403, AT&T Pub 62411
Framing	NONE, D4, ESF, SLC96
Line Coding	AMI, B8ZS
Patterns	QRSS, 1 IN 7, 2 IN 8, 3 IN 24, ALL 0'S, ALL 1'S, 1:1, NET55, OCT55, DALY55, USER (QuickBERT-T1 only)
Status/History	AMI, B8ZS, SIGNAL PRESENT, OUT OF FRAME, BLUE ALARM(AIS), ONES DENSITY, EXCESS ZEROS, YELLOW ALARM, DS1 IDLE SIGNAL, PATTERN SYNC LOSS
Pattern Sync Loss	100 bit errors in 1000 bits
Pattern Sync Gain	0 bit errors in N + 1200 bits, N = 20 for QRSS, N = pattern length for the other pattern
Signal Present	absent when 192 consecutive zeros (no pulses) have been detected
RX T1 Receiver (cont.)	
Out of Frame	D4, SLC96: 2 out of 4 FT bits in error; ESF: 2 out of 4 FPS bits in error
Blue Alarm (AIS)	unframed all ones per TR-TSY-000191 (no framing and 14 or less zeros in 13,895 bits)

**Table A-2. Electrical Specifications (cont)**

<b>Characteristic</b>	<b>Specification</b>
Ones Density (insufficient ones)	<N ones in 8 (N + 1) bits, N = 1 to 23 per ANSI T1.403
Excess Zeros	>15 consecutive zeros per ANSI T1.403
Excess Zeros	>15 consecutive zeros per ANSI T1.403
Yellow Alarm	D4: >255 consecutive DS0 channels with bit 2 = 0; ESF: 16 repetitions of "00FFh" on the 4 kbps data link
DS1 Idle	all 24 DS0 channels contain 00010111 per ANSI T1.403-1995
DS0 Drop	Selected DS0 channel to 8 data-bit LEDs to speaker
DS0 Signaling Types	Robbed Bit, CCIS, E-Bit
DS0 Signaling Bits	A, B, C, D
<b>REF T1 Receiver</b>	
Input Impedance	100 ohms ± 5%
Range	0 to -36 dB
Compatibility	AT&T TA24/CB113
Framing	NONE, D4, ESF, SLC96
Frequency	1544000 Hz ± 5 ppm
<b>TX T1 Transmitter (QuickBERT-T1 only)</b>	
Line Code	AMI or B8ZS
Patterns	QRSS, 1 IN 7, 2 IN 8, 3 IN 24, ALL 0'S, ALL 1'S, 1:1, NET55, OCT55, DALY55, USER, THRU
Loop Codes	CSU, NIU4, NIU5, NTRK, LINE, PYLD, ARM, HTU-R, HTU-C, HRE1, HRE2, NREM, NLOC, NDU1, NDU2, CREM, CLOC, CDU1, CDU2
LBO	Fixed at 0 dB
Pulse Shape	Complies with AT&T Pub 62411 and ANSI T1.403
Jitter Tolerance	Complies with AT&T Pub 62411
<b>Results</b>	
Display	4x20 liquid crystal display (LCD)

Table A-2. Electrical Specifications (cont)

Characteristic	Specification
Results Types	clock slips, errors, signals
Clock Slips	positive number means reference clock faster; negative number means reference clock slower
Errors	BIT, BPV, FRAME, CRC, ERRORED SECONDS; maximum count: 2.8147E14
Signal	DS1 FREQ, DS1 LEVEL, DS0 FREQ, DS0 LEVEL
DS1 FREQ Accuracy	$\pm 5$ ppm, 0 $\hat{u}$ to 40 $\hat{u}$ C
DS1 FREQ Resolution	1 Hz
CHARACTERISTIC	SPECIFICATION
DS1 FREQ Range	1544000 $\pm$ 10000 Hz
DS1 LEVEL Accuracy	6 dBDSX to -20 dBDSX; -20 dBDSX to -30 dBDSX
DS1 LEVEL Range	6 dBDSX to -40 dBDSX
DS0 FREQ Accuracy	$\pm 1.5$ Hz
DS0 LEVEL Accuracy	$\pm 0.2$ dBm
<b>Power</b>	
Batteries (rechargeable)	nickel metal hydride (NiMH) battery pack
Battery Life	approximately 4.75 hours of continuous operation with fully-charged batteries
Low Battery Indication	red LED illuminates to indicate that the unit needs to be recharged
Auxiliary Power	9-12 VDC, 1000 mA
<b>Environmental</b>	
Operating Temperature Range	32 $^{\circ}$ to 122 $^{\circ}$ F 0 $^{\circ}$ to 50 $^{\circ}$ C
Storage Temperature Range	-4 $^{\circ}$ to 140 $^{\circ}$ F -20 $^{\circ}$ to 60 $^{\circ}$ C
Humidity	95% maximum, non-condensing

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