USER MANUAL

BTM-10

Transmission Analyzer

☐ **BTM-10/E1**

☐ **BTM-10/T1**

☐ **BTM-10/E1/T1**

CTC union **CTC Union Technologies Co., Ltd.**

Version 3.0a

2002/12

Chapter 20: SLIP Measurement

Chapter 21: Remote Control

Chapter 22: Datacom BERT

Chapter 23: Sa Bits Setup

Chapter 24: Low Speed Datacom BERT

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Appendix A: Acronyms and Abbreviations

Appendix B: Cable Pin Out

Appendix C: SS7 Analysis

Appendix D: V5.1/V5.2 Protocol Analysis

Appendix E: ISDN Analysis

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E1/T1 Brief History

E1/T1 technology has its roots in the original AT&T T1 public telephone networks. The AT&T T1 carrier used PCM (Pulse Code Modulation) and time-division multiplexing over wire pairs with digital repeaters spaced 6000 feet apart. The 24 speech channels were encoded on the 1.544 Mbps bit stream. Seven bits were used for encoding each sample. The system was designed to transmit voice frequencies up to 4 kHz, and therefore required sampling at 8000 samples per second. Each frame was 125 usec. There are a total of 193 bits in each frame, giving 193 x 8000 = 1.544 Mbps.

When T1 facilities were first introduced by AT&T, they were installed mainly in the public telephone network to implement connections between switching offices. The T1 carrier has become so successful that individual users of telecommunications can now lease T1 facilities from a variety of common carriers and are routinely used to implement communication links where high data rates are required.

The T1 carrier remains as the accepted standard for North America, and the Digital Service metallic interface has been further defined by the American National Standards Institute under ANSI T1.403-1995.

The ANSI recommendation for Digital Services differs slightly from the original standard set by AT&T. It employs a 193 bit frame with 8 bits per channel timeslot. The frame alignment bit is the first bit. Twenty-four timeslots make up the frame. A superframe (SF) consists of twelve consecutive frames. An extended superframe (ESF) consists of twenty-four consecutive frames.

Figure 1-1 shows both the superframe (SF) and extended superframe (ESF) formats.

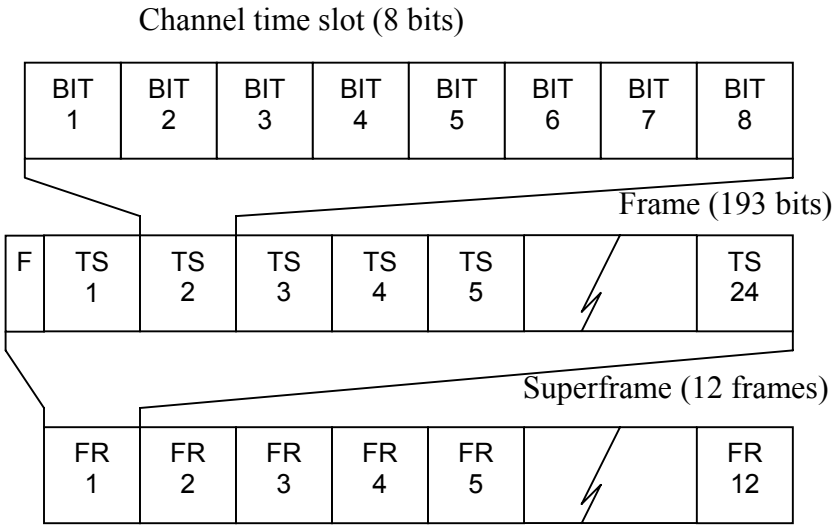


Fig. 1-1(a) ANSI Superframe bit assignment

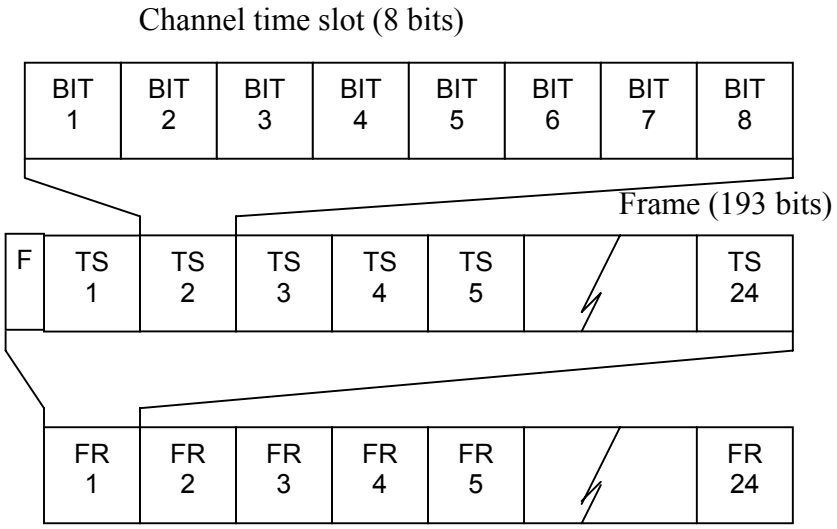


Fig. 1-1(b) ANSI Extended Superframe bit assignment

Superframe Format (SF, D4)

The Superframe Format (SF), is also referred to as the D4 format. The requirement for associated signaling in frames 6 and 12 dictates that the frames be distinguishable. This leads to a multiframe structure consisting of 12 frames per superframe (SF). See Figure 1-1 and Tables 1-1.

The SF structure consists of a multiframe of 12 frames. Each frame has 24 channels, plus an F-bit, and 8 bits per channel. A channel is equivalent to one voice circuit or one 64 kbps data circuit.

This structure of frames and multiframes is defined by the F-bit pattern. The F-bit is designated alternately as an Ft bit (terminal framing bit) or an Fs bit (signaling framing bit). The Ft bit carries a pattern of alternating zeros and ones (101010) in odd frames that defines the frame boundaries so that one channel may be distinguished from another. The Fs bit carries a pattern of (001110) in even frames, and defines the multiframe boundaries so that one frame may be distinguished from another.

Table 1-1. Superframe Format (SF, D4)

Frame#	Bit#	F-Bits		Bit Use in Each Time Slot		Signaling Channel
		Terminal Framing Ft	Signaling Framing Fs	Traffic	Sig	
1	0	1		1-8		
2	193		0	1-8		
3	386	0		1-8		
4	579		0	1-8		
5	772	1		1-8		
6	965		1	1-7	8	A
7	1158	0		1-8		
8	1351		1	1-8		
9	1544	1		1-8		
10	1737		1	1-8		
11	1930	0		1-8		
12	2123		0	1-7	8	B

Extended Superframe Format (ESF)

In Extended Superframe Format (ESF) Figure 1-2, and Table 1-2, the multiframe structure is extended to 24 frames. The channel structure is identical to D4 (SF) format. Robbed-bit signaling is accommodated in frame 6 (A-bit), frame 12 (B-bit), frame 18 (C-bit), and frame 24 (D-bit).

The F-bit pattern of ESF contains three functions:

1 Framing Pattern Sequence (FPS), which defines the frame and multiframe boundaries.

2 Facility Data Link (FDL), which allows data such as error performance to be passed within the T1 link.

3 Cyclic Redundancy Check (CRC), which allows error performance to be monitored and enhances the reliability of the receiver's framing algorithm.

Table 1-2. Extended Superframe Format (ESF)

Frame#	Bit#	F-Bits			Bit Use in Each Time Solt		Signaling Channel		
		FPS	DL	CRC					
1	0	-	m	-	1-8				
2	193	-	-	C1	1-8				
3	386	-	m	-	1-8				
4	579	0	-	-	1-8				
5	772	-	m	-	1-8				
6	965	-	-	C2	1-7	8	A	A	A
7	1158	-	m	-	1-8				
8	1351	0	-	-	1-8				
9	1544	-	m	-	1-8				
10	1737	-	-	C3	1-8				
11	1930	-	m	-	1-8				
12	2123	1	-	-	1-7	8	B	B	A
13	2316	-	m	-	1-8				
14	2509	-	-	C4	1-8				
15	2702	-	m	-	1-8				
16	2895	0	-	-	1-8				
17	3088	-	m	-	1-8				
18	3281	-	-	C5	1-7	8	C	A	A
19	3474	-	m	-	1-8				
20	3667	1	-	-	1-8				
21	3860	-	m	-	1-8				
22	4053	-	-	C6	1-8				
23	4246		m	-	1-8				
24	4439	1	-	-	1-7	8	D	B	A

Notes: 1. FPS indicates the Framing Pattern Sequence (…001011…)
2. DL indicates the 4Kb/s Data Link with message bits m.
3. CRC indicates the cyclic redundancy check with bits C1 to C6.
4. Signaling options include 16 state, 4 state, and 2 state.

SLC 96 Format (SLC)

SLC framing mode allows synchronization to the SLC 96 data link pattern. This pattern, which is described in the Bellcore TR-TSY-000008, contains both signaling information and a framing pattern that overwrites the Fs bit of the SF framer pattern.

Table 1-3. SLC-96 Fs Bit Contents

Frame#	Fs Bit	Frame#	Fs Bit	Frame#	Fs Bit
2	0	26	C2	50	0
4	0	28	C3	52	M1
6	1	30	C4	54	M2
8	1	32	C5	56	M3
10	1	34	C6	58	A1
12	0	36	C7	60	A2
14	0	38	C8	62	S1
16	0	40	C9	64	S2
18	1	42	C10	66	S3
20	1	44	C11	68	S4
22	1	46	0	70	1
24	C1	48	1	72	0

Notes:1. The SLC-96 frame format is similar to that of SF as shown in Table 1-1 with the exceptions shown in this table.
2. C1 to C11 are concentrator field bits.
3. M1 to M3 are maintenance field bits.
4. A1 and A2 are alarm field bits.
5. S1 to S4 are line switch field bits.
6. The Fs bits in frames 46, 48, and 70 are spoiler bits which are used to protect against false multiframing.

The ITU-T (formerly CCITT) has made two recommendations for PCM transmission which can be achieved over most telephone wire pairs, one for the T1 carrier speed of 1.544 Mbps and one for E1 transmission at 2.048 Mbps,. The ITU-T recommendation for 1.544 Mbps differs slightly from the North American standard set by AT&T. It employs a 193 bit frame with 8 bits per channel, and the frame alignment bit is the first bit, not the 193rd as in the AT&T standard. Sixteen frames of 256 bits each are grouped together to form one multi-frame. There are thirty-two 8-bit time slots in each frame, giving 30 speech channels of 64 Kbps each, one synchronization channel, and one signaling channel. 64 Kbps x 32 channels = 2.048 Mbps.

Figure 1-2 shows the ITU-T 2.048 Mbps recommendation, which most of the world outside North America uses for PCM transmission.

The E1 frame structure:

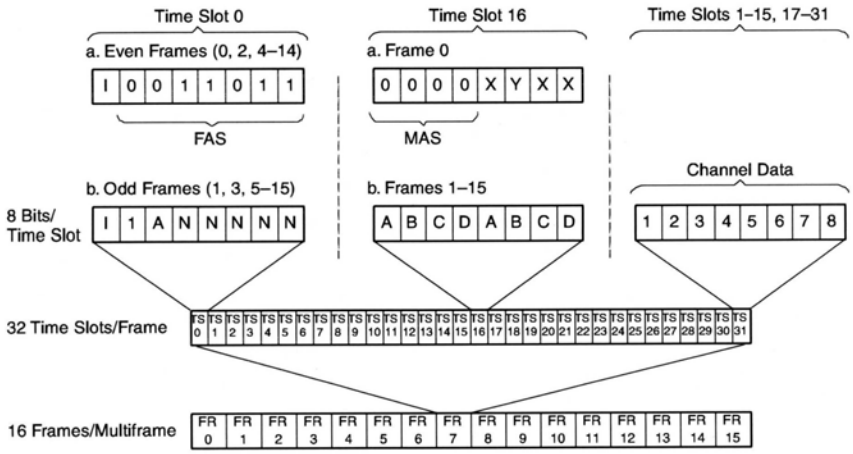


Fig. 1-2 ITU-T E1 Frame Structure

Technical Standards

E1 transmission technology is defined by a number of technology standards. The following standards cover many of the important aspects of E1 transmission technology:

ITU G.703 Physical/Electrical characteristics of interfaces
ITU G.704 Synchronous frame structures
ITU G.706 Frame alignment and CRC
ITU G.821 Error performance of an international connection
ITU G.826 Error performance and objectives for international
ITU M.550/M.2100 Bringing an international connection into service
ITU Q.400 to Q.490 Specs for R2 Signaling Systems
ITU Q.700 Series SS7 Specification
ITU Q.921 and Q.931 ISDN Layer 2 and 3 protocol

Pulse Code Modulation

To transmit voice in a digital medium, such as a 2.048 Mbps line, the analog voice signal must first be encoded into a binary format. The conversion is achieved via Pulse Code Modulation. For voice signals a maximum frequency of 4000 Hz provides adequate clarity while conserving transmission bandwidth. The Nyquist theorem requires that a signals maximum frequency be sampled at two times to reproduce the signal without loss of information. Therefore to achieve the 4000 Hz bandwidth, the analog signal is sampled at 8000 samples/second.

The analog signal is first run through a compander (compression circuit) to raise the analog signals to their maximum level. Then the level at each of the samples is converted to an 8-bit word code. Referring to Figure 1-3 below, a 1 KHz sine wave is sampled at 8 KHz (8 samples per cycle) and yields a discrete 8-bit value at each sample point. The 8-bit words occurring at 8000 times per second form a 64 Kbps data bit stream.

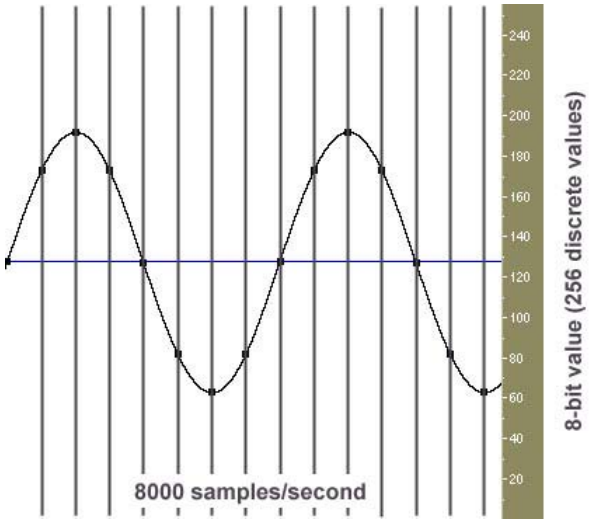


Fig. 1-3 PCM Sampling Example

Line Coding

There are two common types of line coding defined for use in an E1 network: AMI and HDB3

AMI

AMI (Alternate Mark Inversion) is the simplest of the two line coding formats and is used to represent successive ones in a bit stream with alternating positive and negative pulses. A zero bit will not generate any pulse. AMI is not used in most E1 transmissions because of synchronization loss during long strings of data zeros.

HDB3

HDB3 coding was adopted to eliminate the synchronization problems occurring with AMI. In the HDB3 format, a string of four consecutive zeros is replaced with a substitute string containing an intentional BPV (Bi-Polar Violation). The receiving equipment then reads the code and reconstructs the original data. HDB3 code provides high pulse density so that receiving equipment is always able to maintain synchronization with the received signal.

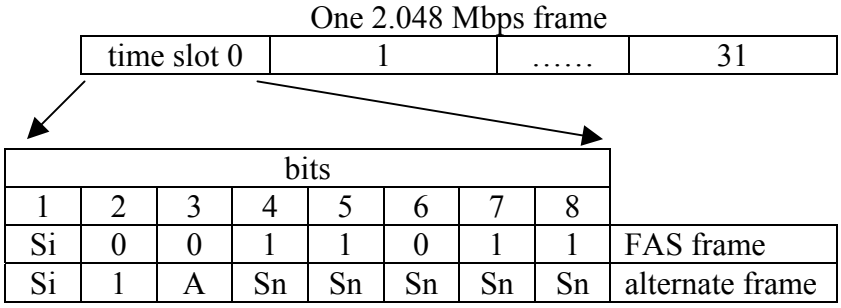
Framing

Framing is necessary so that receiving equipment is able to identify and extract the individual channels. E1 transmissions utilize two major types of framing: Frame Alignment Signal (FAS) and Multi-frame Alignment Signal (MFAS).

FAS

The 2.048 Mbps frame consists of 32 individual time slots numbered 0 to 31. Each time slot consists of a 64 Kbps channel of data.

Time slot zero of every other frame is reserved for the FAS pattern. Alternate frames contain the FAS Distant Alarm indication bit. Data may be placed in the remaining 31 time slots. PCM-31 uses FAS.



bits								
1	2	3	4	5	6	7	8	
Si	0	0	1	1	0	1	1	FAS frame
Si	1	A	Sn	Sn	Sn	Sn	Sn	alternate frame

Figure 1-3 The FAS Frame Format

Sn: bit reserved for national use
Si: bit reserved for international use
A: remote FAS Distant Alarm bit
0011011: frame alignment signal pattern

MFAS (FAS+CAS)

MFAS (Multi-Frame Alignment Signal) framing provides Channel Associated Signaling (CAS) to transmit ABCD bit supervision information for each channel. The MFAS method uses the 32 time slot frame format, including time slot 0 for FAS and time slot 16 for MFAS and CAS signaling. It takes 16 frames to make up a Multi-Frame. When the MFAS frame is transmitted, the individual FAS frames and framing information remains intact. Time slot 16 of the first frame contains the MFAS framing information. Time slot 16 of the remaining 15 frames of the Multi-Frame contain the ABCD bits. Refer to Figure 1-4 for the MFAS frame format.

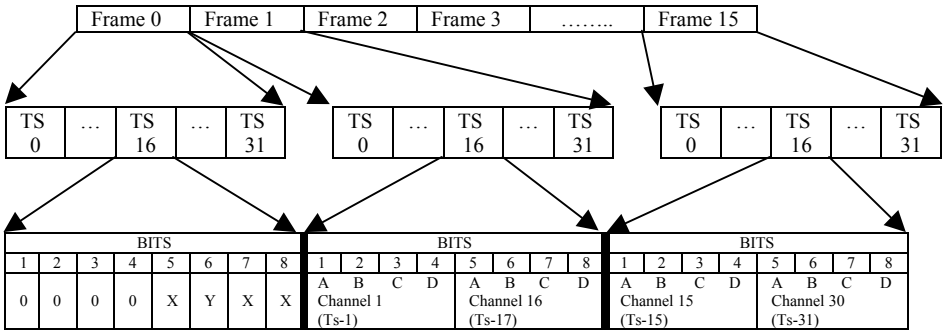


Figure 1-4 The MFAS Frame Format

Frame 0 Time Slot 16: bits 0000XYXX

X=spare bits (equals 1 if not used)

Y=MFAS Remote Alarm (equals 1 if sync is lost)

notes:

1) Frames are transmitted with 30 voice channels on TS1-15,17-31.

2) TS16 contains ABCD bits for signaling (CASS).

3) MFAS framing still includes the original FAS frames and framing information.

CRC-4

A Cyclic Redundancy Check-4 (CRC-4) is used in E1 transmission to identify possible bit errors. CRC-4 allows detection of errors within the 2.048 Mbps signal while in service.

CRC-4 is based upon simple mathematical calculations performed on each sub multi-frame of data. The equipment which originates the E1 data calculates the CRC-4 bits for one sub multi-frame and inserts them into the CRC-4 positions of the next sub multi-frame. The receiving equipment then performs the reverse mathematical calculations on the sub multi-frame, examines the CRC-4 bits received in the next sub multi-frame, and then compares the received CRC-4 bits to the calculated value. If the values do not compare, a CRC-4 error is reported.

CRC-4 Notes:
1) A CRC-4 error does not necessarily indicate a single bit error. Multiple bit errors within the same sub multi-frame will only generate a single CRC-4 error for the block.
2) There is a remote possibility that the calculated and transmitted CRC-4 bits compare even though an error has occurred.

Table 1-4. ITU-T CEPT Frame Format Timeslot 0 Bit Allocations

SMF	Frame #	Time Slot 0 Bits 1 to 8 of each frame							
		1	2	3	4	5	6	7	8
I	0	C1/Si	0	0	1	1	0	1	1
	1	0/Si	1	A	SA4	SA5	SA6	SA7	SA8
	2	C2/Si	0	0	1	1	0	1	1
	3	0/Si	1	A	SA4	SA5	SA6	SA7	SA8
	4	C3/Si	0	0	1	1	0	1	1
	5	1/Si	1	A	SA4	SA5	SA6	SA7	SA8
	6	C4/Si	0	0	1	1	0	1	1
	7	0/Si	1	A	SA4	SA5	SA6	SA7	SA8
II	8	C1/Si	0	0	1	1	0	1	1
	9	1/Si	1	A	SA4	SA5	SA6	SA7	SA8
	10	C2/Si	0	0	1	1	0	1	1
	11	1/Si	1	A	SA4	SA5	SA6	SA7	SA8
	12	C3/Si	0	0	1	1	0	1	1
	13	E/Si	1	A	SA4	SA5	SA6	SA7	SA8
	14	C4/Si	0	0	1	1	0	1	1
	15	E/Si	1	A	SA4	SA5	SA6	SA7	SA8

Notes:

1. SMF indicates the sub-multi-frame. This partitioning is used in the CRC-4 calculation.
2. Si bits are International Spare Bits.
3. A bit is used to indicate a remote alarm condition (active high).
4. SA4 to SA8 are spare bits that may be recommended by ITU-T for use in specific point-to-point applications (e.g., transcoder equipment conforming to Recommendation G.761).
5. SA4 to SA8 where these are not used should be set to 1 on links crossing an international border.
6. E bit is used to indicate a CRC-4 error. The normal state is both bits set to 1, when a CRC-4 error is detected one of the E bits is set to 0.
7. C1 to C4 bits are used to carry the CRC-4 code.
8. Timeslot 0 that contains the 0011011 sequence is defined as the FAS word and Timeslot 0 that does not contain the FAS is the Not-Word.

Table 1-5. IRSM CEPT Frame Format Timeslot 0 Bit Allocations

SMF	Frame #	Time Slot 0 Bits 1 to 8 of each frame							
		1	2	3	4	5	6	7	8
I	0	C1/Si	0	0	1	1	0	1	1
	1	0/Si	1	A	D	E0	E1	E16	E17
	2	C2/Si	0	0	1	1	0	1	1
	3	0/Si	1	A	D	E2	E3	E18	E19
	4	C3/Si	0	0	1	1	0	1	1
	5	1/Si	1	A	D	E4	E5	E20	E21
	6	C4/Si	0	0	1	1	0	1	1
	7	0/Si	1	A	D	E6	E7	E22	E23
II	8	C1/Si	0	0	1	1	0	1	1
	9	1/Si	1	A	D	E8	E9	E24	E25
	10	C2/Si	0	0	1	1	0	1	1
	11	1/Si	1	A	D	E10	E11	E26	E27
	12	C3/Si	0	0	1	1	0	1	1
	13	E/Si	1	A	D	E12	E13	E28	E29
	14	C4/Si	0	0	1	1	0	1	1
	15	E/Si	1	A	D	E14	E15	E30	E31

Notes:

1. SMF indicates the sub-multi-frame. This partitioning is used in the CRC-4 calculation.
2. Si bits are International Spare Bits.
3. NA bit is used to indicate a remote alarm condition (active high).
4. Ei are per channel control bits.
5. E bit is used to indicate a CRC-4 error. The normal state is both bits set to 1, when a CRC-4 error is detected one of the E bits is set to 0.
6. C1 to C4 bits are used to carry the CRC-4 code.
7. Timeslot 0 that contains the 0011011 sequence is defined as the FAS word and Timeslot 0 that does not contain the FAS is the Not-Word.
8. D bits are a 4Kbit/s data link.
9. Bit 2 of the Not-Word is defined as the alternate framing bit.

Table 1-6. CEPT (ITU-T and IRSM) Frame Format Timeslot 16 Bit Allocations

SMF	Frame #	Time Slot 16 Bits 1 to 8 of each frame							
		1	2	3	4	5	6	7	8
I	0	0	0	0	0	X0	Y	X1	X2
	1	A1	B1	C1	D1	A17	B17	C17	D17
	2	A2	B2	C2	D2	A18	B18	C18	D18
	3	A3	B3	C3	D3	A19	B19	C19	D19
	4	A4	B4	C4	D4	A20	B20	C20	D20
	5	A5	B5	C5	D5	A21	B21	C21	D21
	6	A6	B6	C6	D6	A22	B22	C22	D22
	7	A7	B7	C7	D7	A23	B23	C23	D23
II	8	A8	B8	C8	D8	A24	B24	C24	D24
	9	A9	B9	C9	D9	A25	B25	C25	D25
	10	A10	B10	C10	D10	A26	B26	C26	D26
	11	A11	B11	C11	D11	A27	B27	C27	D27
	12	A12	B12	C12	D12	A28	B28	C28	D28
	13	A13	B13	C13	D13	A29	B29	C29	D29
	14	A14	B14	C14	D14	A30	B30	C30	D30
	15	A15	B15	C15	D15	A31	B31	C31	D31

Notes:

1. SMF indicates the sub-multi-frame.
2. Ai-Di are the per channel signaling bits.
3. X0-X2 are the X spare bits normally set to 1.
4. Y is the Remote Multi-frame Yellow Alarm Indication bit. When Y is set to a 1 it indicates that the alarm is active.
5. The Multi-frame Alignment Sequence (MAS) is defined as the Time Slot 16 word that contains the 0000XYXX sequence.

The AMI line code requires at least 12.5% average 1s density and no more than 15 consecutive 0s. A 1 is encoded as either a positive or negative pulse; a 0 is the absence of a pulse. Two consecutive pulses of the same polarity are referred to as a Bipolar Violation (BPV).

The B8ZS line code replaces strings of 8 consecutive 0s or no pulses with the B8ZS octet 000VB0VB, where B represents a normal bipolar pulse and V represents a BPV. A BPV that is not part of B8ZS octet is a BPV error.

The HDB3 line code replaces 4 consecutive 0s by 000V or B00V code, where B is an AMI pulse and V is a bipolar violation (see Figure 1-5).

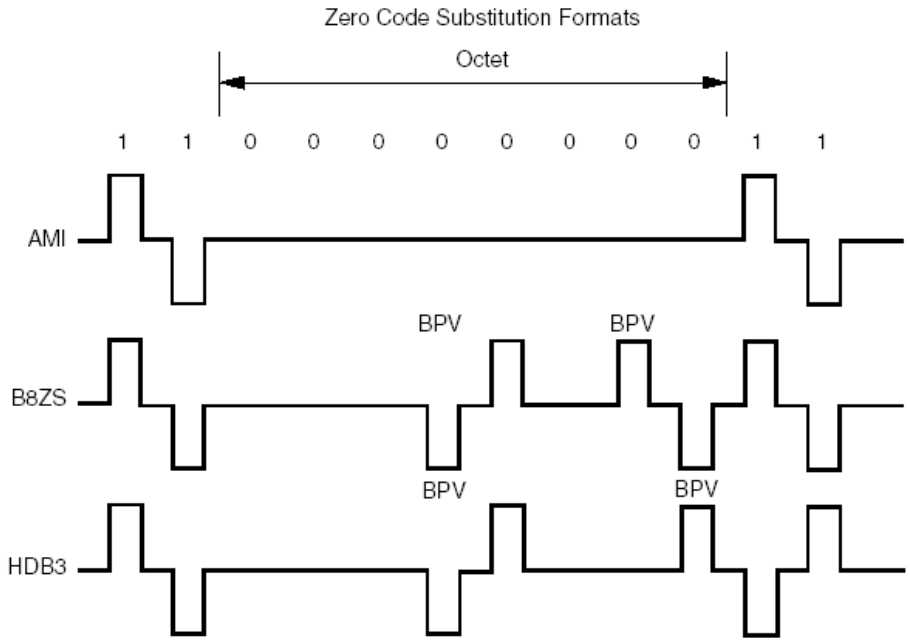


Figure 1-5 Zero Code Substitution Format

2.1 Introduction

The **BTM10** series analyzers come in three firmware models that support E1 Only, T1 Only and a dual E1/T1 model. The BTM10 series analyzers are compact, notebook sized PCM measuring instruments designed for field use in analysis and maintenance of E1 (2.048Mbps) or T1 (1.544Mbps) lines. The **BTM10** performs Frame Analysis, Drop and Insert 64Kbps voice or n*64Kbps data into any time slot. The **BTM10** series analyzer also provides a variety of E1/T1 line statuses, transmission performance testing (BERT) and monitoring. On the E1/T1 line, the **BTM10** series product may be used as a time source generator or receiver.

2.2 Functions

- E1/T1 BERT Analysis: E1/T1 frame, code, CRC, and BPV performance analysis, Histogram analysis, M.2100 analysis(optional) , and E1/T1 signal generator.
- Alarm and Looping Setting: Manual or automatic alarm and loop setting.
- VF Access: Drop and insert 4K voice; low frequency generator and measurement (VF frequency from 60 to 3950 Hz + 0 to -55dBm); voice access by using telephone handset.(Optional)
- Pulse Shape: E1/T1 pulse shape analysis.(Optional)
- Signal Result: E1/T1 PCM level meter and frequency analysis. (Optional)
- Signaling Setting: ABCD bit setting.
- Signaling Display: Display all channels of ABCD bits.
- Datacom BERT: Data port BERT performance analysis.(Optional)
- Examine Analysis: off-line analysis of BERT performance.
- External Drop and Insert: Acts as a fractional E1 or T1 to datacom converter.(Optional)

- User Programmable Pattern Setting: There are three 32 bits programmable patterns, which can be inserted onto the E1/T1 line and drop for analysis. (Datacom BERT also)
- Low Speed Datacom BERT.(Optional)
- SS7 Analysis. (Optional)
- Datacom Clock Measurement. (Optional)
- ISDN Analysis. (Optional)
- V5.1/V5.2 Analysis. (Optional)
- Round Trip Delay
- Timeslot Setting: Drop and Insert n*56K data onto T1 line. Drop and Insert n*64K or n*56K data onto E1 line.
- Timeslot Mapping Data: Analyze any channel data of two frames.
- SLIP Measure: Uncontrolled, Controlled, Frame, and Timing SLIP.
- Remote Control: User can access BTM10 unit using an ASYNC terminal.
- File Management: Five configuration and result memory locations can be stored or recall by user.
- Sa Bits Setup: Sa bits transmission setting and receive monitor.(E1 only)

2.3 General Specifications

2.3.1 E1 Specifications:

1. Receiver Interface of E1/CEPT

- Line Code: HDB3/AMI
- Pulse characteristics: meets ITU-T G.703
- Jitter Tolerance: meets ITU-T G.823
- Input Port Type:
  Coaxial pair: BNC (unbalanced)
  Symmetrical pair: Bantam or DB15 (balanced)
- Input mode (with AGC):
  Termination:
    Coaxial Pair Impedance: 75 ohm resistive (unbalanced)
    Symmetrical Pair Impedance: 120 ohm resistive (balanced)
    Return Loss: > 18 dB
    Receive Sensitivity: +3 dB to -40 dB
  Bridge Mode:
    Impedance: > 1000 ohm
    Receive Sensitivity: +3dB to -30 dB
  DSX-MONitor Mode:
    Coaxial Pair Impedance: 75 ohm resistive (unbalanced)
    Symmetrical Pair Impedance: 120 ohm resistive (balanced)
    Receive Sensitivity: +6dBdsx to -30dBdsx

- Receive Timing Range: 2.048MHz ± 4000Hz

2. Transmitter Interface of E1/CEPT

- Bit Rate: 2048K bit/s ± 10ppm.
- Line Code: HDB3/AMI
- Pulse characteristics: meets ITU-T G.703
- Pulse Amplitude: Nominal 2.37V for Coaxial Pair 75 ohm
  Nominal 3.00V for Symmetrical Pair 120 ohm
- Zero Amplitude: ± 0.1 V max.

- Jitter Tolerance: meets ITU-T G.823
- Output Port Type:
  Coaxial pair: BNC (unbalanced)
  Symmetrical pair: Bantam or DB15 (balanced)
- TX Clock Source:
  Internal Timing: 2.048 MHz ± 10 ppm.
  External Timing:
  Recovery from RX Timing (Loop Timing)
  Data Port Timing
  Internal Timing plus 50 ppm offset: 2.048 MHz +50 ppm.(Option)
  Internal Timing minus 50 ppm offset: 2.048 MHz -50ppm(Option)

3. E1/CEPT Frame Structure

- FAS (PCM31)
- FAS+CRC4 (PCM31 with CRC)
- FAS+CAS (PCM30)
- FAS+CRC4+CAS (PCM30 with CRC)
- Unframed

4. Line Build Out:

- 0 dB
- -7.5 dB
- -15 dB
- -22.5 dB

  (Accuracy: ± 1dB)

2.3.2 T1 Specifications:

1. Receiver Interface of T1/DS1

- Line Code: B8ZS/AMI
- Pulse characteristics: meets ITU-T G.703
- Jitter Tolerance: meets ITU-T G.824
- Input Port Type:
  Symmetrical pair: Bantam or DB15 (balanced), and BNC
- Input mode (with AGC):
  Termination:
  Symmetrical Pair Impedance: 100 ohm ± 5% resistive (balanced)
  Return Loss: > 18 dB
  Receive Sensitivity: +6 dB to -36 dB
  Bridge Mode:
  Impedance: > 1000 ohm
  Receive Sensitivity: +6 dB to -30 dB
  DSX-MONitor Mode:
  Symmetrical Pair Impedance: 100 ohm ± 5% resistive (balanced)
  Receive Sensitivity: up to -30dBdsx
- Receive Timing Range: 1.544MHz ± 4000Hz

2. Transmitter Interface of T1/DS1

- Bit Rate: 1544K bit/s ± 10ppm.
- Line Code: B8ZS/AMI
- Pulse characteristics: meets ITU-T G.703
- Pulse Amplitude: Nominal 3.00V for Symmetrical Pair 100 ohm
- Zero Amplitude: ± 0.1 V max.
- Jitter Tolerance: meets ITU-T G.824
- Output Port Type:
  Symmetrical pair: Bantam, DB15 (balanced), or BNC

- TX Clock Source:
  Internal Timing: 1.544MHz ± 10ppm
  External Timing
  Recovery from RX Timing (Loop Timing)
  Data Port Timing
  Internal Timing plus 50 ppm offset: 1.544 MHz +50 ppm.(Option)
  Internal Timing minus 50 ppm offset: 1.544 MHz -50 ppm.(Option)

3. T1/DS1 Frame Structure
- D4 (SF)
- ESF
- ESF+CRC6
- SLC-96
- T1DM
- Unframed

4. Line Build Out:
- 0 dB
- -7.5 dB
- -15 dB
- -22.5 dB

(Accuracy: ± 1 dB)

- 0~133 Ft.
- 266~399 Ft.
- 399~533 Ft.
- 533~655 Ft.

2.3.3 BERT Test:

1. BERT Patterns

63, 127, 2^9-1 (511), 2^{11}-1 (2047), 2^{15}-1 ITU standard, 2^{15}-1 non-standard (inverted), 2^{20}-1 ITU standard, 2^{20}-1 non-standard (inverted), QRSS, 2^{23}-1 ITU standard, 2^{23}-1 non-standard (inverted), ALL ONEs (Mark), ALL ZEROs (Space), ALT (0101..), 3 in 24, 1 in 16, 1 in 8, 1 in 4, User Programmable #1,#2,#3, and LIVE.

2. BERT Display Format
- Normal
- ITU-T G.821
- ITU-T G.826
- Histogram

3. BERT Transmit Error Rate

- Force Single Error: Logic (Bit,Code), Frame, CRC, and BPV (Bipolar Violation)
- Force 10^{-3} to 10^{-7} Error Rate: Logic (Bit), Frame, CRC, and BPV

4. Performance Analysis:

- Logic, Frame, CRC, BPV, E-bit Errors
- Receive Counter
- Error Seconds
- Error Free Seconds
- Error Rate
- Available Seconds
- Degraded Minutes
- Severely Error Seconds
- G.821 Error Seconds
- Unavailable Seconds
- LOF (Loss of Frame) Events
- COFA (Change of Frame Alignment) Events
- Severely Error Frame Count

5. BERT Test on Data Port

- Data rates for 56Kbps multiples; n*56Kbps (n=1~24)
- Data rates for 64Kbps multiples; n*64Kbps (n=1~32)

2.3.4 Analyzer Mode:

1. Channel Map Screen

2. Line Attenuation

3. Slip Measure

4. Signaling: [ABCD]

5. General Status:
- Signal Present
- B8ZS/HDB3
- Pattern Sync
- Frame Sync
- Tester Looped

6. Results:
- Bit Errors
- BPV Errors
- Frame Errors
- CRC Errors
- G.821 Analysis (includes Logic, Frame, CRC, and BPV)
- G.826 Analysis (includes Logic)
- Histogram Analysis (includes Alarms, Logic, Frame, CRC, and BPV)
- M.2100 Analysis (Option)

7. Alarm/Warning
- Signal Loss (Pulses)
- Frame Loss
- Pattern Loss
- Excess Zero Error
- One Density
- AIS
- SLIP
- Yellow Alarm (T1)
- RAI (E1)
- MRAI (E1)
- Loop Up Code Detecting (T1)
- Loop Down Code Detecting (T1)

8. Print out of test results

2.3.5 Other Features:

1. Pulse Wave Analyzer (option)
Built-in PUB CB119, ANSI T1.403(T1), and ITU-T G.703(E1/T1)

2. In-Band and Out-of-Band Loop Control
- Line Loop (LLB)
- Pay Load Loop (PLB)
- SmartJack Loop
- User Programmable Loop
- Loop Up
- Loop Down

3. Large LCD display
- 32 Characters x 8 Lines
- Text / Graphic mode

4. Result Report
- Internal Memory storage of test result.
- Direct display on LCD screen
- Direct display on LED (real-time, frozen, history)
- Print out via Parallel Printer port
- Print out via RS-232 Series Port (option)

5. Portable for field use

6. Upgradeable for advanced features

7. Rechargeable Battery with battery low indicator

8. Temp. Range
0 °C to 50 °C (operating)
-20 °C to 60 °C (storage)

9. Humidity: up to 95%

10. Power Source AC 90~240V / DC12V/1A Switching Adapter.

11. Dimension
173 mm(L) x 235 mm(L) x 54 mm (H)

12. Weight
under 1.7 kg net weight

2.3.6 Interface Port Description:

- DB15 (Male): E1/T1 TX and RX Port
- BNC * 2: E1/T1 TX and RX Ports
- Bantam * 2: E1/T1 TX and RX Ports
- Bantam * 1: External Clock In
- HD26 (Female): Data Port (RS-449/530,V.35, RS-232 interface)
- DB15 (Female): Printer Port
- DB9 (Male): Remote Control Port / Serial RS-232 Printer Port (option)
- RJ-45/RJ-11: Voice In/Out
- Slide Switch: External (Reference) Clock Setting: TTL/PCM
- Power Switch: Power ON/OFF
- Mini-Jack: DC12V IN

2.4 Status LEDs

The **BTM10**'s LEDs on the top panel indicate the following:

	SYSTEM	INTERFACE	
Ext. Power	Red LED	Green LED	Bridge
Bat. Low	Red	Green	Terminal
DTE	Red	Green	DSX-MON
DCE	Red	Green	E1
DATACOM	Red	Green	T1

	RECEIVE STATUS		
Signal Present	Green LED	Red LED	One Den
Frame Sync	Green	Red	AIS
Pattern Sync	Green	Red	SLIP
B8ZS/HDB3	Green	Red	Yellow
Tester Looped	Green	Red	RAI/L.Up
Signal Loss	Red LED	Red	MRAI/L.Dn
Frame Loss	Red	Red	Errors
Pattern Loss	Red	Red	Freeze
Power Loss	Red	Red	History
Excess Zero	Red	Red	Ins Err

And their detailed descriptions are as follows:

1) SYSTEM

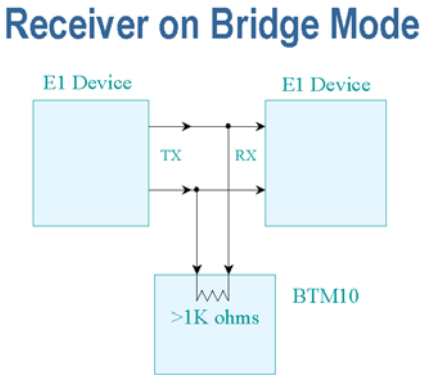
Ext. Power (External Power):
When the external power adapter is plugged into the **BTM10**, this LED will light.

Bat. Low (Battery Low):
When the power of the built-in battery is weak, and is in need of a recharge, this LED will light.

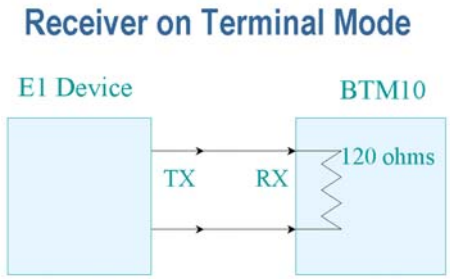
DTE:
Data port is working in DTE mode.
DCE:
Data port is working in DCE mode.
DATACOM:
Data port is under use, such as with "Ext. Drop and Insert" or "BERT on data port" functions.

2) INTERFACE

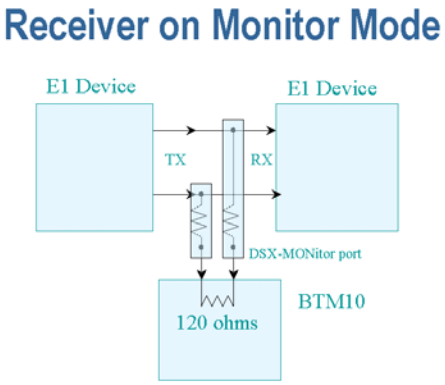
Bridge:
BTM10 E1/T1 RX port is in bridge mode. Impedance is greater than 1K Ohm.



Terminal:
BTM10 E1/T1 RX port is in terminal mode. Impedance is 75(E1), 100(T1), or 120(E1) ohms.



DSX-MON:
BTM10 E1/T1 RX port is in DSX-MONitor mode and the impedance is 75(E1), 100(T1), or 120(E1) ohms.



E1:
BTM10 is working as an E1 analyzer.
T1:
BTM10 is working as a T1 analyzer.

3) RECEIVE STATUS

Following LEDs will light depending on the current E1/T1 RX port status and may change every second.

Signal Present:
BTM10 E1/T1 RX is receiving available PCM analog signal.
Frame Sync:
Remains lit if not receiving loss of frame alignment status.

Pattern Sync:
Lights if E1/T1 RX has received correct pattern, which matches for 32 consecutive bit positions.

B8ZS/HDB3:
Lights if one or more B8ZS(T1) or HDB3(E1) substitution patterns have been detected on the E1/T1 RX port. Otherwise, the received line code may be AMI mode.

Loop Up:
Indicates **BTM10** takes loop back action on E1/T1 RX to TX port.

Signal Loss:
Indicates E1/T1 RX input signal amplitude remained below available PCM analog signal threshold for more than 1 ms.

Frame Loss:
Lights if receipt of loss of frame alignment. In E1 CRC enabled mode, lights when 3 consecutive FAS or 915 CRC errors are received. In E1 CRC disabled mode, lights when 3 consecutive FAS errors only are received. In T1 mode, lights when 2 out of 6 F-bit errors.

Pattern Loss:
Lights if E1/T1 RX port has received 6 or more bits out of 64 in error.

Power Loss: (reserve)
BTM10 has been powered off during testing.

Excess Zero:
Lights if one or more long string of zeros are detected on E1/T1 RX port. A long string of zeros is 10 consecutive zeros in E1 AMI mode, 16 consecutive zeros in T1 AMI mode.

One Den(One Density):

This is the criteria for detection and clearance of Receive Loss of Signal (RLOS) per ITU G.775 and ANSI T1.231. In E1 mode, will light upon reception of 32 consecutive zeros, and is cleared upon reception of 192 bits in which no interval of 32 consecutive zeros appear, where the 192-bit window begins with reception of a pulse.

In T1 mode, will light if 100 consecutive zeros are received, and is cleared if received data sustains an average pulse density of 12.5%(24 or more ones) over a period of 192 bits starting with the receipt of a pulse, and no reoccurrence of 100 consecutive zeros.

AIS: (Receive Alarm Indication Signal)

The criteria for detection and clearance of RAIS is per ITU G.775 and ANSI T1.231.In E1 mode, will light if 2 consecutive double frames (500us) each contain 2 or less zeros out of 512 bits and FAS alignment is loss. RAIS will turn off if 2 consecutive double frames each containing 3 or more zeros out of 512 bits is received or if FAS alignment is recovered.

In T1 mode, will light if data received for a period of 3 ms contains 4 or less zeros out of 4632 bits and frame alignment is loss. RAIS will turn off if data received for a period of 3 ms contains 5 or more zeros out of 4632 bits or if frame alignment is recovered.

SLIP:

Lights if a slip error is received.

Yellow:

In T1 mode, will light when receiving a Yellow Alarm or a Multi-frame Yellow Alarm.

RAI: (Receive Remote Alarm)

In E1 mode, will light for 4 frames if 2 consecutive NFAS frames each contain TS0 bit 3 = 1. It will turn off for 4 frames if 2 consecutive NFAS frames each contain TS0 bit 3 = 0.

MRAI: (Receive Multi-frame Remote Alarm)

In E1 mode, will light for 2 multi-frames if frame 0 has 2 consecutive multi-frames each containing TS16 bit 6 = 1. It will turn off for 2 multi-frames if frame 0 contains TS016 bit 6 = 0.

L.Up: (Loop Up)

In T1 mode, will light if loop up code has been detected.

L.Dn: (Loop Down)

In T1 mode, will light if loop down code has been detected.

Errors:

Will light under any of the following error conditions.

1) Logic error
2) Frame Error (Ft/Fs/T1DM/FPS/FAS pattern error)
3) MFAS pattern error
4) CRC6/CRC4 Block Error.
5) CAS pattern error
6) Loss of T1/FAS alignment.
7) Loss of MFAS Alignment
8) Loss of CAS Alignment
9) Receive Pulse Density Violation according to ANSI T1.403 sliding windows criteria.
10) Receive TS16 Alarm Indication Signal (E1 CAS mode only). Criteria for detection and clearance of RMAIS are per ITU G.775.
11) Severely erred frame. Criteria for detection and clearance of SEF are per ANSI T1.231.

Freeze:

It will light if the LEDs' status is frozen. User can press the **F** key to freeze the LEDs' status, press the **F** key again will release freeze condition and show the real-time status. Press the **C** key to clear all of history and show the real-time status.

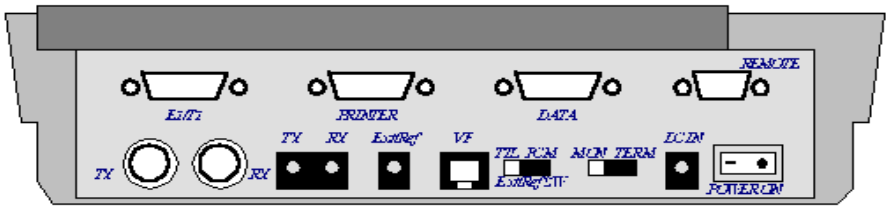
History:

Flashes when there is an error indication on history. User can press the **?** key to review all of the error LEDs, and at this moment, the History LED will light. Press the **C** key to clear all of history and **BTM10** will show the real-time status on LEDs.

Ins Err:

Lights when the **BTM10** is forcing single or an error rate of logic, frame, CRC, or BPV.

2.5 Rear Panel



The **BTM10** Rear Panel

Descriptions:

POWER ON:
Power on switch.

DC IN:
This jack is used to plug in the DC12V/1A adapter. It may be used to power the unit when in use or to recharge the built-in battery when battery power is low.

TX(BNC):
This port is the E1/T1 TX port, BNC type. If the E1/T1 TX (Bantam) port is used, this port will be disabled.

RX(BNC):
This port is the E1/T1 RX port, BNC type. If the E1/T1 RX (Bantam) port is used, this port will be disabled.

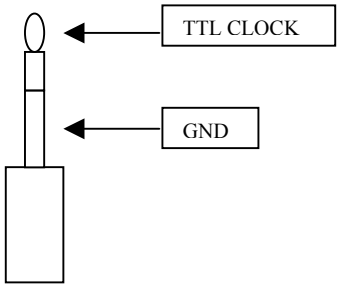
TX/RX(Bantam):
This port is the E1/T1 TX and RX port, Bantam type.

E1/T1(DB15):
This port is the E1/T1 TX and RX port, DB15 type.

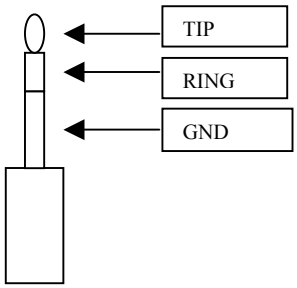
DB15 Pin Assignment:
Pin 1: TTIP (E1/T1 TX)
Pin 2: GND
Pin 3: RTIP (E1/T1 RX)
Pin 4: GND
Pin 9: TRING (E1/T1 TX)
Pin 11 RRING (E1/T1 RX)

Ext/Ref:
This port is the external/reference clock input. The reference clock input may be either a TTL or PCM signal. If switch Ext/Ref SW is turned to the TTL side, the Ext/Ref port is configured in TTL mode. If switch Ext/Ref SW is turned to the PCM side, the Ext/Ref port is configured in E1/T1 PCM signal mode.

Bantam pin assignment(TTL):



Bantam pin assignment (E1/T1 PCM):



VF:

This port (RJ-45) is the voice frequency port. It can be connected to a telephone handset directly and is used for insert and drop 64K voice on E1/T1 line.

RJ-45 pin assignment:
- Pin 1: N.C.
- Pin 2: Voice Ground
- Pin 3: MIC+ / input
- Pin 4: RCVR+ / output
- Pin 5: RCVR- / output
- Pin 6: MIC- / input
- Pin 7: Voice Ground
- Pin 8: N.C.

RJ-11 pin assignment:
- Pin 1: MIC+ / input
- Pin 2: RCVR+ / output
- Pin 3: RCVR- / output
- Pin 4: MIC- / input

Ext/Ref SW:

If this switch is slid to the TTL position, then the Ext/Ref port is configured for TTL mode. If the switch is slid to the PCM position, then the Ext/Ref port is configured for E1/T1 PCM signal mode.

MON TERM switch (Reserved):

Printer:

This printer port can be adapted to connect to any Centronics standard interface by the use of the **BTM-PRN** adapter cable. The DB15 pin assignment is as follows:

Pin	Signal	Description
1	/STROBE	/STROBE pulse sent with data out.
2	DATA 1	These signals represent information for the 1st to 8th bits of parallel data. Each signal is at HIGH level when data is logical 1 and LOW when it is logical 0.
3	DATA 2	
4	DATA 3	
5	DATA 4	
6	DATA 5	
7	DATA 6	
8	DATA 7	
9	DATA 8	
10	GND	
11	BUSY	A High signal received indicates that the printer cannot receive data. The signal goes HIGH in the following cases: During data entry During printing When off-line During printer error
12	GND	
13	GND	
14	/AUTO FEED XT	+5V supplied to printer through 10K ohm resistor.
15	/SLCT IN	Connect to GND.

Data:

This is the data port. It can be configured as RS-232, V.35, or RS-449/530/X.21 interface type via a combination of **BTM10** configuration setups and adapter cables. In addition, the adapter cables can support external drop, insert, and BERT on the data port.

HD26 Pin Assignment:			
Pin 1	FGND	Pin 14	CTS(B)
Pin 2	TD(A)	Pin 15	TC(A)
Pin 3	RD(A)	Pin 16	XTC(B)
Pin 4	RTS(A)	Pin 17	RC(A)
Pin 5	CTS(A)	Pin 18	N.C.
Pin 6	DSR(A)	Pin 19	N.C.
Pin 7	GND	Pin 20	DTR(A)
Pin 8	DCD(A)	Pin 21	RD(B)
Pin 9	N.C.	Pin 22	DSR(B)
Pin 10	N.C.	Pin 23	TC(B)
Pin 11	TD(B)	Pin 24	XTC(A)
Pin 12	DTR(B)	Pin 25	RC(B)
Pin 13	RTS(B)	Pin 26	DCD(B)

Remote:

The remote control port is an RS-232 asynchronous serial port, based upon the 9 pin serial standard.

DB9 Pin Assignment:	
Pin 1	DCD
Pin 2	RD
Pin 3	TD
Pin 4	DTR
Pin 5	GND
Pin 6	DSR
Pin 7	RTS
Pin 8	CTS
Pin 9	N.C.

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3.1 Introduction

The **BTM10**'s keyboard combines the latest in membrane switch technology to provide a full ASCII keyboard with special functions and cursor movement keys. The keyboard is dust and moisture proof to provide long life use. Key lettering colors are grouped for easy identification and selection when entering data in different keyboard modes. The blue lettered keys contain the FUNCTION (***F1-F5***) keys. The magenta colored keys are used to enter control codes. The black lettered keys are for hexadecimal data entry while the red lettered keys are for QWERTY mode entry.

When the **BTM10** is powered on, the keyboard is in hexadecimal mode. In this mode, the center functions of the keys are active (for example the large black hexadecimal digits). To enter any of the characters, shown in white, in the upper-right hand corner of some keys, press and hold ***SHIFT*** (white lettered) and press the appropriate key. To enter any of the control characters such as DC1, ETB, ENQ, etc., shown in magenta in the upper-left corner of the keys, press and hold the ***CTRL*** (magenta colored) key and press the appropriate key.

To switch to the QWERTY mode, press the ***ALPHA*** (red colored) key. The QWERTY keys are shown in red and are located in the lower-right hand corner of the keys. The ***ALPHA*** key toggles the keyboard between hexadecimal and QWERTY modes. When in QWERTY mode, to enter a lowercase character, press and hold ***SHIFT*** and press the selected alphabet key.

3.2 Keyboard Figure

Figure 3-1 Keyboard Figure

3.3 Key Functions

3.3.1 Menu Function Keys:

F1 **---- Configuration Setup**
Setup parameters such as framing, code, line interface, TX timing, etc.

F2 **---- BERT Analysis**
Run and examine T1/E1 BERT results.

F3 **---- Alarms and Looping**
Choose AIS, RAI, or MRAI alarm generation, or In-Band/ Out-Band control setting.

F4 **---- Reset System**
Used to restore all internal settings to the factory defaults and clear all data files.

F5 **---- Back light On/Off**
Toggle LCD back light on or off.

MORE **Next Page**
Selects the second menu set of functions.

F1 **---- VF Access**
Setup channel, transmit and measure voice frequency and level.

F2 **---- Pulse Shape**
Display a graphic representation of the interface pulse wave shape.

F3 **---- Signal Result**
Displays a numeric readout of signal strength in decibels (dB) and peak-to-peak voltage as well as the actual frequency in hertz.

F4 **---- Signaling Setup**
Used to set the ABCD bits for selected timeslots.

F5 **---- Signaling Display**
A visual display of the ABCD bits for all timeslots.

MORE **Next Page**
Selects the third menu set of functions.

F1 **---- Datacom BERT (option)**
Perform as a Datacom BERT analyzer.
F2 **---- Remote Port Setup**
Setup remote port baud rate.
F3 **---- Examine Analysis**
Review the result of T1/E1 BERT or Datacom BERT.
F4 **---- Ext. Drop and Insert**
Calls up the Datacom Drop/Insert onto E1/T1 setup.
F5 **---- User Program Pattern**
Used to enter the user programmable pattern.
MORE **Next Page**
Selects the fourth menu set of functions.

F1 **---- Time Slot Setting**
Use this display to setup the used and unused time slots
F2 **---- Time Slot Map Data**
Used to display all the time slots data of two frames
F3 **---- File Management**
Control the management of (load, save, delete, etc.) a maximum of five data save files which are held in the internal battery backed-up RAM.
F4 **---- Miscellaneous**
Calls up a menu to setup key sound, printer, and clock as well as to display the **BTM10**'s hardware and firmware version information.
F5 **---- Self Test**
Provides a means to test the internal RAM and ROM, the data port, the printer port, the LCD, keyboard, as well as VF tests.
MORE **Next Page**
Selects the fifth menu set of functions.

F1 **---- SLIP Measure function**
Use to do Uncontrolled, Controlled, Frame, and Timing SLIP measure.

F2 **---- Sa Bits Setup (E1 mode only)**
Use to do setup transmission E1 Sa bits and monitor a whole received multiframe E1 Sa bits.

F3 **---- Low Speed Datacom BERT (Option)**
Perform as a Low Speed Datacom BERT analyzer.

F4 **---- SS7 Analysis (Option)**
Perform as SS7 analyzer.

F5 **---- Datacom Clock Measure (Option)**
Use to do datacom clock measurement.

MORE **Next Page**
Selects the sixth menu set of functions.

F1 **---- ISDN Analysis(Option))**
Perform as ISDN-D analyzer.

F2 **---- V5.1/V5.2 Analysis (Option)**
Perform as V5.1/V5.2 analyzer.

F3 **---- Round Trip Delay**
Measure the propagation delay of a loopbacked E1/T1 link.

MORE **Next Page**
Returns to the first menu page of functions

3.3.2 Other Function Keys:

ESC
ESCAPE or go back to previous menu.

RUN
Begin to EXECUTE

HEX
Toggle the display of screen data between HEXIDECIMAL and ALPHANUMERIC modes.

PRINT
Print the current data in storage.

⇦ ⇨
Move the CURSOR to the LEFT or RIGHT.

⇧ ⇩
Move the CURSOR UP or DOWN.

PgUp
During data display, Jump "UP" to the previous page.

PgDn
During data display, Jump "DOWN" to the next page.

HOME
Move the CURSOR to the HOME position.

END
Move the CURSOR to the END position.

HELP
Displays an OPERATION Message if available.

SPACE
Insert a SPACE.
Insert single error on BERT Analysis function.

BACK
BACKSPACE, CLEAR a CHARACTER.
Turn backlight on or off on BERT Analysis function.

C
Clear history of LED error status and show real-time LED status. Any error status will store into history and the **History** LED will flash.

F
Freeze current LED status when you first press the ***F*** key, and the **Freeze** LED will light at this moment. Release frozen LED status when you press the ***F*** key again. The **BTM10** will show real-time LED status without clearing the history of LED error status, any error status in history

will flash the **History** LED, and the **Freeze** LED will turn off again.

?

Shows the history of LED error status. The **History** LED will turn on, indicating that the current state of History is under review mode.

3.3.3 Special Keys:

CTRL

Use this key to generate special characters such as DC1, DC2, DC3. Press and hold the CTRL key and any of the "magenta" characters. (magenta characters are shown in the upper left of each key).

ALPHA

Use this key to toggle between the "QWERTY" keys (red characters in lower right of keys) and the large black alpha-numeric keys

SHIFT

Use this key to enter lower case alpha characters and the special symbols in "white" (shown in the upper right corner of key).

3.3.4 Cursor Keys Details:

Maneuvering through the **BTM10**'s menu system is accomplished through the use of the function and blue cursor movement keys. Please follow the next example which demonstrates both the function and cursor key operations.

Power on the **BTM10** and wait for the first menu. Press the ***F1*** key to display the manual configuration function menu.

```
  MANUAL CONFIGURATION (F1:Auto)
Configuration   : E1(CEPT)
Channel         : Full
Framing         : FAS+CAS
CRC             : CRC4
Code            : HDB3
Idle Timeslot   : Pass Thru
E-bit           : Automatic
```

Parameter Setting Screen

Note that the parameter for "Configuration" is "E1(CEPT)". This is the default setting (for E1 or E1/T1 units) and is in inverse text, which indicates the current cursor position. For a T1 only unit, the default would of course be "T1(DS1)". Press the blue down arrow key repeatedly. Note that when you reach the bottom, the screen will scroll up to display additional parameters. To toggle/select from the available parameters for any of the configuration settings, press the right arrow key. The current setting will be shown in reverse text.

```
-----  MANUAL CONFIGURATION  -----
Tx Timing       : Recovery
Pattern         : QRSS
Error Type      : Logic
Ins Error Rate  : Single
Test Period     : Continuous
Display Type    : Brief
Print Interval  : Disable
```

Parameter Setting Screen

For example, after viewing all the available settings under manual configuration, use the up arrow key until reaching the "Tx Timing" setting. Repeated pressing of the right arrow key will display the available parameters for the "Tx Timing" setting, "Recovery, External, Data Port, 2048+50ppm, 2048-50ppm" and then back to

"Internal." Use the up and down arrow keys to move to the other settings, then use the right or left arrow key to view and set their respective parameters. **Note:** Press the ***PgDn*** (page down) or ***PgUp*** (page up) key to see next page or previous page of settings. Pressing the ***HOME*** key will move the cursor to the top page and top parameter. Press ***END*** key will move the cursor to the last page and bottom parameter.

Pressing the ***ESC*** key will exit the "Manual Configuration" menu.

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4.1 BTM10 Power Up

When the **BTM10** is powered on, a quick screen will flash announcing the **BTM10** model and displaying the firmware version number.

If this unit is an E1 and T1 protocol analyzer with Datacom BERT and +/- 50 ppm features, the LCD screen will display as follows:

```
BTM-10 E1/T1 PROTOCOL ANALYZER
with Datacom BERT and +/- 50 ppm
          Version: 4.39-10
```

If this unit is a T1 only protocol analyzer with Datacom BERT and +/- 50 ppm features, the LCD screen will display as follows:

```
BTM-10 T1 PROTOCOL ANALYZER
with Datacom BERT and +/- 50 ppm
          Version: 3.39-10
```

If this unit is an E1 only protocol analyzer with Datacom BERT and +/- 50 ppm features, the LCD screen will display as follows:

```
BTM-10 E1 PROTOCOL ANALYZER
with Datacom BERT and +/- 50 ppm
          Version: 2.39-10
```

Note: Datacom BERT and +/- 50 ppm are optional.

Following the quick screen will be the first of five menu pages.

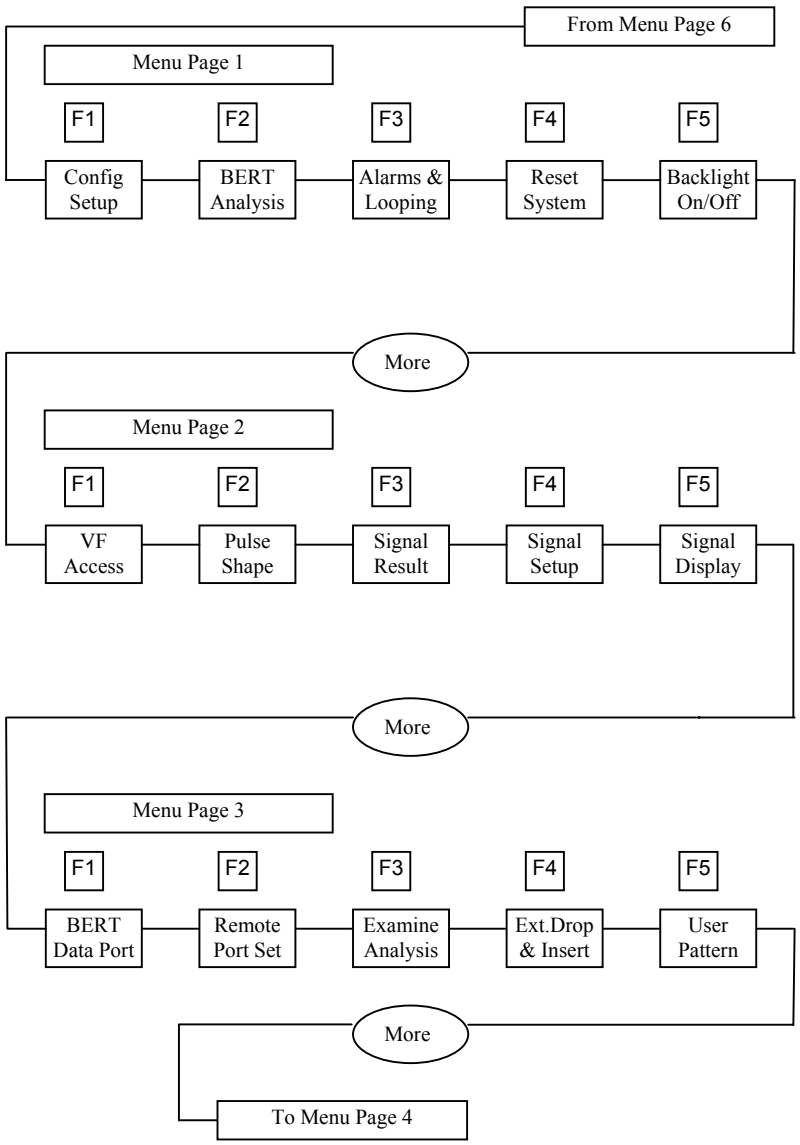
```
F1     : Configuration Setup
F2     : BERT Analysis
F3     : Alarms and Looping
F4     : Reset System
F5     : Backlight On/Off
MORE   : Next Page
Please select one function or
press 'MORE' to see next page.
```

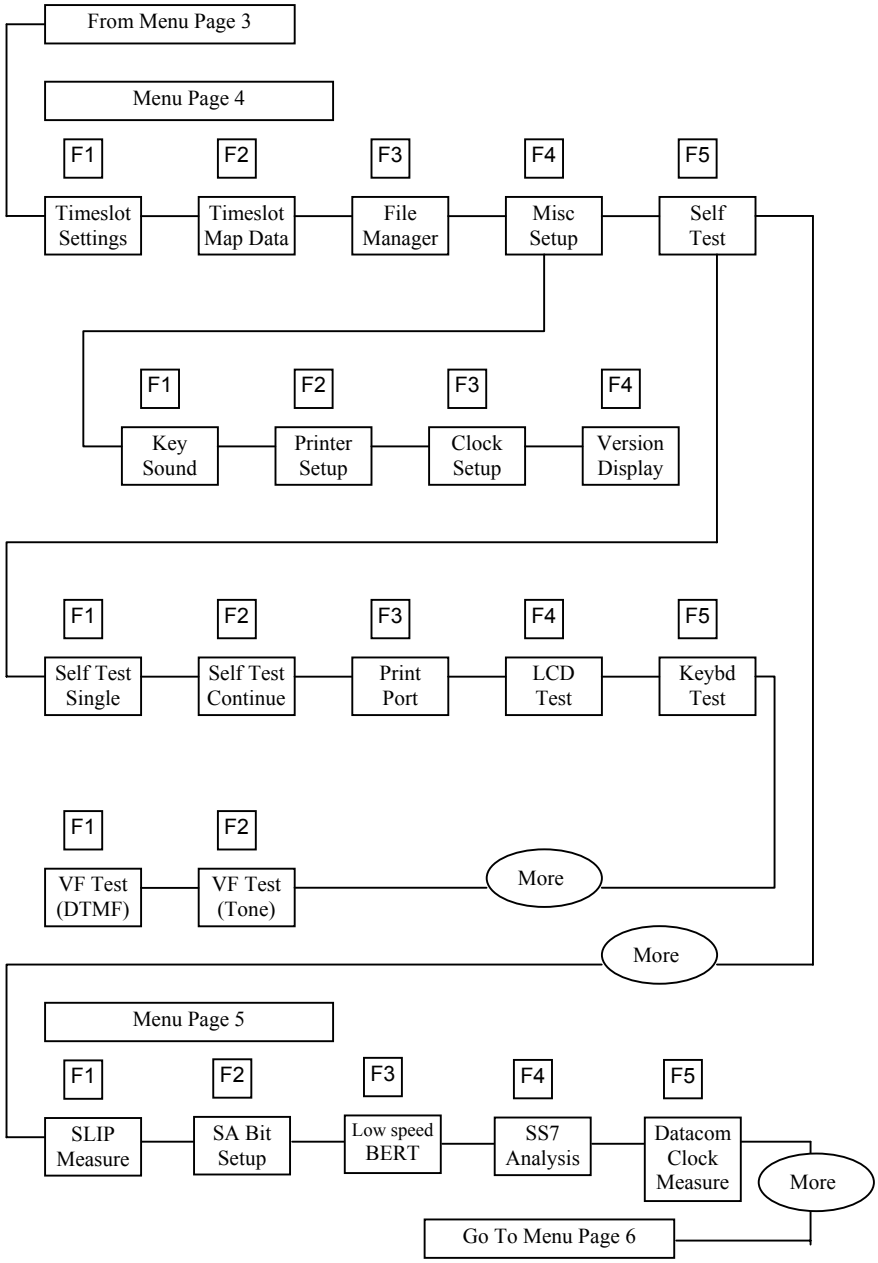
Press the ***MORE*** key to scan through all of the top level menu pages. Press one of the function keys, ***F1*** to ***F5***, to select any of the functions from the menu page. You will then enter the next level of a nested function, change parameters for specific settings or execute into a selected function, depending upon your location in the **BTM10** menu system. Pressing the ***ESC*** key will "back out" one level in the menu system or will quit the current running status. Refer to Chapter 3 for keyboard operation details.

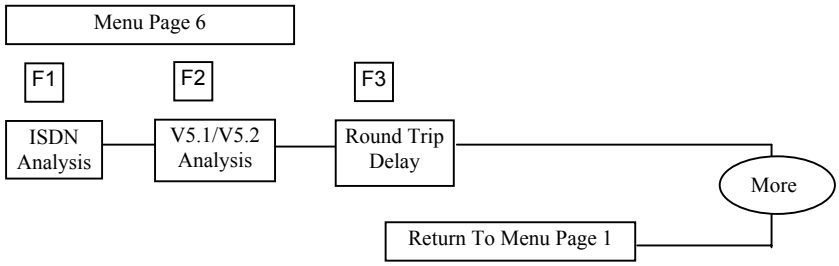
4.2 BTM10 Menu System

The following page shows a graphic overview of the **BTM10**'s menu system and operation flow.

BTM10 Menu System Flow Block Diagram




From Menu Page 3
Menu Page 4
F1
F2
F3
F4
F5
Timeslot Settings
Timeslot Map Data
File Manager
Misc Setup
Self Test
F1
F2
F3
F4
Key Sound
Printer Setup
Clock Setup
Version Display
F1
F2
F3
F4
F5
Self Test Single
Self Test Continue
Print Port
LCD Test
Keybd Test
F1
F2
VF Test (DTMF)
VF Test (Tone)
More
More
Menu Page 5
F1
F2
F3
F4
F5
SLIP Measure
SA Bit Setup
Low speed BERT
SS7 Analysis
Datacom Clock Measure
More
Go To Menu Page 6


Menu Page 6
F1
F2
F3
ISDN Analysis
V5.1/V5.2 Analysis
Round Trip Delay
More
Return To Menu Page 1

4.3 System Reset

When you first receive your **BTM10**, it is advisable to do a "**System Reset**" to clear the internal buffers and to initialize the unit to a known state. This is also the quickest way to clear user files, etc. or to revive the unit should it become "hung" due to a user error or unknown bug in the **BTM10** firmware. To enter the reset function, press the ***F4*** key from the first menu page, toggle the left arrow key to "Yes" and press ***ENTER*** twice. All the parameters will be set to the default settings. It is also useful to reset the unit if you get the **BTM10** into an unknown state or receive an unfamiliar status.

```
Reset will:
 1.Reset all parameters to
   default.
 2.Clear all saved files and
   captured data.

Do you want to reset? YES / NO
```

System Reset Screen

4.4 Back light Toggle

The back light on the **BTM10**'s LCD may be toggled on or off by directly pressing the ***F5*** key from the first menu page. In BERT analysis function, you may press the ***BACK*** key to toggle back light.

4.5 Examine Analysis

All of the test results of T1/E1 BERT analysis or BERT on Data Port are stored in memory and can be reviewed and/or printed out by entering the "**Examine Analysis**" function. via the ***F3*** key on the main menu page 3.

For more information about BERT analysis and BERT on Data Port feature, please refer to Chapter 6.

The rest of this page is blank intentionally.

5.1 Configuration Setup

While your **BTM10** is located on the first menu page, press the ***F1*** key to enter the configuration setup screen. The screen displays the configuration settings and the current parameters, similar to the display below:

```
MANUAL CONFIGURATION (F1:AUTO)
Configuration   : E1(CEPT)
Channel         : Full
Framing         : FAS+CAS
CRC             : CRC4
Code            : HDB3
Idle Timeslot   : Pass Thru
E-bit           : Automatic
```

Configuration Setup Screen

These are the main settings of the **BTM10** and will effect associated operations. The inverted cursor block is located on the first parameter, E1 (CEPT). You can move the cursor up and down by pressing the up and down arrow keys. You may change the current parameter, where the cursor is located, by pressing the right or left arrow key. Press the ***PgDn*** (page down) or ***PgUp*** (page up) key to see next page or previous page of settings. Pressing the ***HOME*** key will move the cursor to the top page and top parameter. Press ***END*** key will move the cursor to the last page and bottom parameter.

5.2 Configuration Setting Parameter Details

There are two main configuration sets, E1(CEPT) and T1(DS1). Obviously, the T1(DS1) configuration is not available in the E1 Only unit, while E1(CEPT) is not available in the T1 Only unit. The available settings and meanings of each configuration parameter in the "Manual Configuration" function are as follows:

E1(CEPT) mode setting:

Setting	Parameter	Description
Config.:	E1(CEPT)	**BTM10** is configured for E1 mode
	T1(DS1)	**BTM10** is configured for T1 mode
		T1 not available on E1 only model. E1 not available on T1 only model Please contact your agent if you wish to add a configuration feature.
Channel:	Full	The **BTM10** may use any of the following combinations : 1) PCM31 (FAS, and TS1 to TS 31 are used) 2) PCM31 + CRC (FAS, CRC4 enable, and TS1 to TS31 are used) 3) PCM30 (FAS, CAS enable, TS1 to TS15 and TS17 to TS31 are used) 4) PCM30 + CRC (FAS, CRC4 enable, CAS enable, TS1 to TS15, and TS17 to TS31 are used) or 5) Unframe mode(TS0 to TS31 are used)

Channel	n*64K	The **BTM10** may use any of the following combinations: 1) FAS + Timeslot sets available ones, 2) FAS + CRC + Timeslot sets available ones, 3) FAS + CAS + Timeslot sets available ones, or 4) FAS + CAS + CRC + Timeslot sets available ones,
Framing:	FAS only	Frame mode only
	FAS+CAS	Frame mode plus CAS function
	Unframed	Unframe mode is selected
CRC:	CRC4	In E1 mode, will set CRC4 enable on. This is not available if using unframe mode
	NO	This disables CRC4.
Code:	HDB3	In E1 mode, this sets the E1 PCM code to HDB3 encoding mode.
	AMI	This sets the PCM code to normal AMI encoding mode.
Idle Timeslot Default:	Pass Through	If the TX timing is set to recovery mode, the default idle TX channel will be set to pass through mode, loopback RX data to TX
	Fill 7EH	The default idle timeslot will be filled in with hexadecimal 0x7E code.
	Fill 7FH	The default idle timeslot will be filled in with hexadecimal 0x7F code.
	Fill FFH	The default idle timeslot will be filled in with hexadecimal 0xFF code.

E-bit:	Automatic	E-bit is used to indicate a CRC-4 error. Both E-bits are set to 1 in normal mode. When a CRC-4 error is detected, one of the E-bits is set to 0.
	Manual[11]	Both of the E-bit positions of multiframe are set to 1
	Manual[10]	Manually transmits 1 in E-bit position of frame 13; manually transmits 0 in E-bit position of frame 15.
	Manual[01]	Manually transmits 0 in E-bit position of frame 13; manually transmits 1 in E-bit position of frame 15.
	Manual[00]	Both of the E-bit positions of a multiframe are set to 0.
Line Interface:	TERM 75	Sets **BTM10** to E1 75 ohm terminal mode on TX and RX port.
	TERM 120	Sets **BTM10** to E1 120 ohm terminal mode on TX and RX port.
	Bridge 75	Sets **BTM10** to bridge mode on RX port and E1 75 ohm mode on TX port.
	Bridge 120	Sets **BTM10** to bridge mode on RX port and E1 120 ohm mode on TX port.
	DSXMON 75	Sets **BTM10** to E1 75 ohm DSX-MONitor mode on RX port.
	DSXMON 120	Sets **BTM10** to E1 120 ohm DSX-MONitor mode on RX port.
LBO:	0 dB	TX Line Build Out is set to 0 dB
	-7.5dB	TX Line Build Out is set to -7.5 dB
	-15dB	TX Line Build Out is set to -15 dB
	-22.5dB	TX Line Build Out is set to -22.5 dB

Tx Timing: (E1/T1 TX PCM clock source)	Internal	Clock source from **BTM10** internal oscillator, 2048K bps on E1
	Recovery	Clock source from E1/T1 RX port recovered clock
	External	Clock source from E1/T1 Ext/Ref clock input jack
	Data Port	Clock source is derived from the data port clock
	+50 ppm	Clock source is from **BTM10** internal oscillator, 2048K bps, with +50 ppm offset
	-50 ppm	Clock source is from **BTM10** internal oscillator, 2048K bps, with −50 ppm offset

Pattern: (**BTM10** will transmit and analyze this pattern into E1/T1 frame.)	63	Pseudo random pattern: 2e6-1
	127	Pseudo random pattern: 2e7-1
	511	Pseudo random pattern: 2e9-1 (O.153)
	2047	Pseudo random pattern: 2e11-1 (O.152 AND O.153)
	2e15-1 standard	Pseudo random pattern: 2e15-1 (O.151)
	2e15-1 non-standard	Pseudo random pattern: 2e15-1 (O.151 inverted)
	2e20-1 standard	Pseudo random pattern: 2e20-1 (O.153)
	2e20-1 non-standard	Pseudo random pattern: 2e20-1 (inverted)
	QRSS	Pseudo random pattern: 2e20-1 (O.151 QRSS)
	2e23-1 standard	Pseudo random pattern: 2e23-1 (O.151)
	2e23-1 non-standard	Pseudo random pattern: 2e23-1 (O.151 inverted)
	All One	Repetitive pattern: all ones (11111...)
	All Zero	Repetitive pattern: all zeros (00000...)
	ALT(0101)	Repetitive pattern: alternating ones and zeros (10101010...)
	3 in 24	Repetitive pattern: 3 in 24
	1 in 16	Repetitive pattern: 1 in 16
	1 in 8	Repetitive pattern: 1 in 8
	1 in 4	Repetitive pattern: 1 in 4
	User Prog	User programmable repetitive pattern. The length of this pattern may be set from 1 to 32 bits. Please refer to Chapter 11 for details.
	LIVE	Will not care about the received pattern, which may be a real live signal or data. In this mode, the transmitting pattern will be set to Pseudo random pattern: 2e32-1.

Error Type:	Logic	Force TX error type: Logic bit
	Frame	Force TX error type: Framing bit
	CRC	Force TX error type: CRC4
	BPV	Force TX error type: BPV
Ins Error Rate:	Single	Will force a single error when you press the Force Error Key.
	1e-3	Will force errors continuously at transmit rate of 1e-3.
	1e-4	Will force errors continuously at transmit rate of 1e-4.
	1e-5	Will force errors continuously at transmit rate of 1e-5.
	1e-6	Will force errors continuously at transmit rate of 1e-6.
	1e-7	Will force errors continuously at transmit rate of 1e-7.
Test Period:	Continuous	The BERT test will run forever
	1 Minute	BERT will run for one minute.
	15 Minutes	BERT will run for fifteen minutes.
	30 Minutes	BERT will run for half an hour.
	1 Hour	BERT will run for an hour.
	24 Hours	BERT will run for one day.
Display Type:	Brief	Upon entering BERT function, the screen will show in “brief” mode.
	Logical	Upon entering BERT function, the screen will show in “logic” mode.
	Frame	Upon entering BERT function, the screen will show in “frame” mode.
	CRC	Upon entering BERT function, the screen will show in “CRC” mode.
	BPV	Upon entering BERT function, the screen will show in “BPV” mode.

	Histogram	Upon entering BERT function, the screen will show in "Histogram" mode.
Print Interval:	Disable	The printer will not print out results periodically.
	5 Min	The printer will print out test results every five minutes.
	10 Min	The printer will print out test results every ten minutes.
	15 Min	The printer will print out test results every fifteen minutes.
	30 Min	The printer will print out test results every half an hour
	60 Min	The printer will print out test results every hour.
Print On Error:	Disable	The printer will not print out current test results while errors are received
	Enable	The printer will print out current test results while errors are received.
Histogram Storage Duration	Disable	The histogram feature is disable.
	1 Min	The histogram storage duration is set to 1 minutes.
	2 Min	The histogram storage duration is set to 2 minutes.
	30 Min	The histogram storage duration is set to 30 minutes.
Sensitivity	High	E1 receiver sensitivity up to –42dB
	Low	E1 receiver sensitivity up to –38dB

T1(DS1) mode setting:

Setting	Parameter	Description
Config.:	T1(DS1)	**BTM10** is configured to T1 mode
	E1(CEPT)	**BTM10** is configured to E1 mode
		T1 not available on E1 only model. E1 not available on T1 only model Please contact your agent if you wish to add a mode feature.
Channel	Full	The **BTM10** may be used any of the following combinations : 1) ESF (F-bit, and TS1 to TS 24 are used) 2) ESF+CRC (F-bit, CRC6 enable, and TS1 to TS24 are used) 3) D4(SF) (F-bit, and TS1 to TS24 are used) 4) SLC-96 (F-bit, and TS1 to TS24 are used) 5) T1DM (F-bit, TS1 to TS23, and T1DM Sync byte are used) or 6) Unframe mode(whole frame is used)

Channel	n*64K	The **BTM10** may use any of the following combinations: 1) ESF + Timeslot sets available ones, 2) ESF + CRC + Timeslot sets available ones, 3) D4(SF) + Timeslot sets available ones, 4) SLC-96 + Timeslot sets available ones, or 5) T1DM + Timeslot sets available ones,
	n*56K	The **BTM10** may use any of the following combinations: 1) ESF + Timeslot sets available ones + AB or ABCD Signaling, 2) ESF + CRC + Timeslot sets available ones + AB or ABCD Signaling, 3) D4(SF) + Timeslot sets available ones + AB Signaling, 4) SLC-96 + Timeslot sets available ones + AB Signaling, or 5) T1DM + Timeslot sets available ones + AB Signaling,
Framing:	ESF	ESF frame mode (use CRC6 normally)
	D4(SF)	D4 frame mode
	SLC-96	SLC-96 frame mode
	T1DM	T1DM frame mode
	Unframed	Unframe mode is selected
CRC:	CRC6	ESF frame mode includes CRC6. This is not available if using D4, SLC-96, T1DM, or unframe mode.
	NO	This disables CRC6.

Code:	B8ZS	In T1 mode, this sets the T1 PCM code to B8ZS encoding mode.
	AMI	This sets the PCM code to normal AMI encoding mode.
Idle Timeslot Default:	Pass Through	If the TX timing is set to recovery mode, the default idle TX channel will be set to pass through mode, loopback RX data to TX
	Fill 7EH	The default idle timeslot will be filled with hexadecimal 0x7E code.
	Fill 7FH	The default idle timeslot will be filled with hexadecimal 0x7F code.
	Fill FFH	The default idle timeslot will be filled with hexadecimal 0xFF code.
Performance Report	No	Don't Transmit T1 performance report...
	Automatic al	Transmit T1 performance report automatically
Line Interface:	TERM 100	Sets **BTM10** to T1 100 ohm terminal mode on TX and RX port.
	Bridge	Sets **BTM10** to bridge mode on RX port and T1 100 ohm mode on TX port.
	DSXMON 100	Sets **BTM10** to T1 100 ohm DSX-MONitor mode on RX port.
LBO:	0 dB	TX Line Build Out is set to 0 dB
	-7.5dB	TX Line Build Out is set to -7.5 dB
	-15dB	TX Line Build Out is set to -15 dB
	-22.5dB	TX Line Build Out is set to -22.5 dB
	0-133 Ft	TX Line Build Out is set to 0-133 Ft
	133-266 Ft	TX Line Build Out is set to 133-266 Ft
	266-399 Ft	TX Line Build Out is set to 266-399 Ft
	399-533 Ft	TX Line Build Out is set to 399-533 Ft
	533-655 Ft	TX Line Build Out is set to 533-655 Ft

Tx Timing: (E1/T1 TX PCM clock source)	Internal	Clock source is from **BTM10** internal oscillator, 1544K bps on T1.
	Recovery	Clock source is from E1/T1 RX port recovered clock
	External	Clock source is from E1/T1 Ext/Ref clock input jack
	Data Port	Clock source is derived from the data port clock
	+50 ppm	Clock source is from **BTM10** internal oscillator, 1544K bps, with +50 ppm offset
	-50 ppm	Clock source is from **BTM10** internal oscillator, 1544K bps, with -50 ppm offset

Pattern: (**BTM10** will transmit and analyze this pattern onto E1/T1 frame.)	63	Pseudo random pattern: 2e6-1
	127	Pseudo random pattern: 2e7-1
	511	Pseudo random pattern: 2e9-1 (O.153)
	2047	Pseudo random pattern: 2e11-1 (O.152 AND O.153)
	2e15-1 standard	Pseudo random pattern: 2e15-1 (O.151)
	2e15-1 non-standard	Pseudo random pattern: 2e15-1 (O.151 inverted)
	2e20-1 standard	Pseudo random pattern: 2e20-1 (O.153)
	2e20-1 non-standard	Pseudo random pattern: 2e20-1 (inverted)
	QRSS	Pseudo random pattern: 2e20-1 (O.151 QRSS)
	2e23-1 standard	Pseudo random pattern: 2e23-1 (O.151)
	2e23-1 non-standard	Pseudo random pattern: 2e23-1 (O.151 inverted)
	All One	Repetitive pattern: all ones (11111...)
	All Zero	Repetitive pattern: all zeros (00000...)
	ALT(0101)	Repetitive pattern: alternating ones and zeros (10101010...)
	3 in 24	Repetitive pattern: 3 in 24
	1 in 16	Repetitive pattern: 1 in 16
	1 in 8	Repetitive pattern: 1 in 8
	1 in 4	Repetitive pattern: 1 in 4
	User Prog	User programmable repetitive pattern. The length of this pattern may be set from 1 to 32 bits. Please refer to Chapter 11 for details.
	LIVE	Will not care about the received pattern, which may be a real live signal or data. In this mode, the transmitting pattern will be set to Pseudo random pattern: 2e32-1.

Error Type:	Logic	Force TX error type: Logic bit
	Frame	Force TX error type: Framing bit
	CRC	Force TX error type: CRC4
	BPV	Force TX error type: BPV
Ins Error Rate:	Single	Will force a single error when you press the Force Error Key.
	1e-3	Will force errors continuously at transmit rate of 1e-3.
	1e-4	Will force errors continuously at transmit rate of 1e-4.
	1e-5	Will force errors continuously at transmit rate of 1e-5.
	1e-6	Will force errors continuously at transmit rate of 1e-6.
	1e-7	Will force errors continuously at transmit rate of 1e-7.
Test Period:	Continuous	The BERT test will run forever
	1 Minute	BERT will run for one minute.
	15 Minutes	BERT will run for fifteen minutes.
	30 Minutes	BERT will run for half an hour.
	1 Hour	BERT will run for an hour.
	24 Hours	BERT will run for one day.
Display Type:	Brief	Upon entering BERT function, the screen will show in “brief” mode.
	Logical	Upon entering BERT function, the screen will show in “logic” mode.
	Frame	Upon entering BERT function, the screen will show in “frame” mode.
	CRC	Upon entering BERT function, the screen will show in “CRC” mode.
	BPV	Upon entering BERT function, the screen will show in “BPV” mode.

	Histogram	Upon entering BERT function, the screen will show in "Histogram" mode.
Print Interval:	Disable	The printer will not print out results periodically.
	5 Min	The printer will print out test results every five minutes.
	10 Min	The printer will print out test results every ten minutes.
	15 Min	The printer will print out test results every fifteen minutes.
	30 Min	The printer will print out test results every half an hour
	60 Min	The printer will print out test results every hour.
Print On Error:	Disable	The printer will not print out current test results while errors are received
	Enable	The printer will print out current test results while errors are received.
Histogram Storage Duration	Disable	The histogram feature is disable.
	1 Min	The histogram storage duration is set to 1 minutes.
	2 Min	The histogram storage duration is set to 2 minutes.
	30 Min	The histogram storage duration is set to 30 minutes.
Sensitivity	High	T1 receiver sensitivity up to –42dB
	Low	T1 receiver sensitivity up to –38dB

Any changes made in any of the configuration menus do not have an immediate effect. By either leaving the configuration menu via the "***ESC***" key, or running BERT directly, the **BTM10** will undergo a system re-initialization. Only then will the new configuration settings take effect.

When you press the ***RUN*** key while in configuration setup, the **BTM10** will re-initialize and run the BERT analysis function. Please refer to Chapter 6 for more information on the BERT analysis function.

5.3 Auto-Configuration

The auto-configuration function may be used rather than the manual configuration. Under auto-configuration, the **BTM10** will attempt to self configure by analyzing the live line connection. If the previous setting of the **BTM10** was E1 mode, it will check and try all possible combinations of E1 framing, channel mode, coding, and patterns. If a match is not found, the **BTM10** will check and try any and all possible combinations of T1 framing, channel mode, coding, and patterns.

To initiate the auto-configuration function, from the Manual Configuration selection menu, press the ***F1*** key. The BTM10 will directly enter and execute the auto-configure function. While testing for a match, the BTM10 will show a "Testing…." message. When a configuration match is found, the BTM10 will display a "Test complete!" message. If the **BTM10** cannot detect the current configuration, it will show a "No match!" message.

The test result will be displayed similar to the following:

```
Auto configuration
  Framing          : FAS+CAS
  Channel          : Full
  Code             : HDB3
  CRC              : CRC4
  Pattern          : QRSS
  Test complete!
  <Press any key to continue.>
```

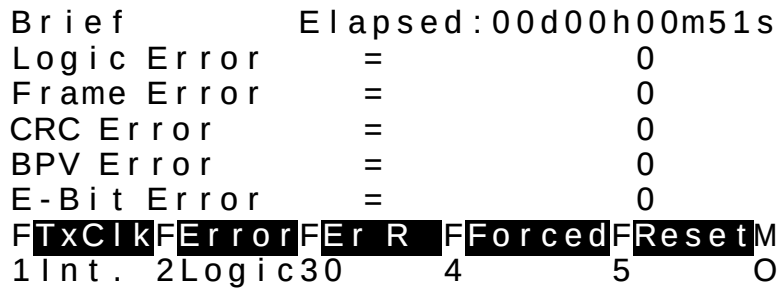
Auto-configuration Screen

6.1 Introduction

When the screen of the **BTM10** is on the first main menu page, pressing the ***F2*** key will enter and run the BERT analysis function. Alternately, you may also enter this function by pressing the ***RUN*** key while located within the Configuration Setup.

The BERT function will analyze E1/T1 line performance in common display mode, ITU-G.821, ITU-G.826 mode, or histogram analysis, and will generate standard E1/T1 line code.

After entering the function, the screen should show a display similar to below:



Brief Display Mode Screen

The upper-left indicator, Brief, LOGIC, FRAME, CRC, or BPV, depends upon the setting parameter for "Display Type" in the configuration setup. Please refer to Chapter 5 for details on configuration setup.

The top-right message, elapsed time, shows the duration of the current test. This analysis mode can be paused by pressing the ***RUN*** key, and continued again by pressing the ***RUN*** key. The bottom two lines show available function keys and their abbreviation. Pressing the ***MORE*** key will display additional function keys.

By simply pressing the ***PgUp*** (page up) or ***PgDn*** (page down) keys, all of the display type screens can be viewed. Examples of all the other screens are shown in the following:

```
LOGIC          Elapsed:00d00h00m51s
Receive Count   =   100602189
Errors          =           0
Error Sec       =           0
Error Free Sec  =          51
Error Rate      =     0.0e-00
FTxClkFErrorFEr R FForcedF      M
1Int. 2Logic30    4       5     O
```

Logic Display Screen

```
LOGIC G.821  Elapsed:00d00h00m51s
Available Sec. =          51 100%
Degraded Min.  =           0    %
Severely ErrSec=           0    %
Errored Second =           0    %
Unavailable Sec=           0    %
FTxClkFErrorFEr R FForcedF      M
1Int. 2Logic30    4       5     O
```

Logic G.821 Display Screen

```
FRAME          Elapsed:00d00h00m51s
Receive Count   =      405654
Errors          =           0
Error Second    =           0
Error Free Sec. =          51
LOF Events(Red)=           0
FTxClkFErrorFEr R FForcedF      M
1Int. 2Logic30    4       5     O
```

Frame Display Screen, page 1

```
FRAME          Elapsed:00d00h00m51s
COFA Events      =              0
Severely Err     =              0
Frame Loss Sec   =              0
Error Rate       =      0.0e-00

FTxClkFErrorFEr R FForcedF      M
1Int. 2Logic30    4       5     O
```

Frame Display Screen, page 2

```
FRAME G.821  Elapsed:00d00h00m51s
Available Sec.  =             51 100%
Degraded Min.   =              0    %
Severely ErrSec=              0    %
Errored Second  =              0    %
Unavailable Sec=              0    %
FTxClkFErrorFEr R FForcedF      M
1Int. 2Logic30    4       5     O
```

Frame G.821 Display Screen

```
CRC            Elapsed:00d00h00m51s
Receive Count    =          50706
Errors           =              0
Error Sec        =              0
Error Free Sec   =             51
Error Rate       =      0.0e-00
FTxClkFErrorFEr R FForcedF      M
1Int. 2Logic30    4       5     O
```

CRC Display Screen

```
CRC   G.821  Elapsed:00d00h00m51s
Available Sec. =           51 100%
Degraded Min.  =            0    %
Severely ErrSec=            0    %
Errored Second =            0    %
Unavailable Sec=            0    %
FTxClkFErrorFEr R FForcedF       M
1Int. 2Logic30    4       5      O
```

CRC G.821 Display Screen

```
BPV          Elapsed:00d00h00m51s
Receive Count  =  100602189
Errors         =           0
Error Sec      =           0
Error Free Sec =          51
Error Rate     =    0.0e-00
FTxClkFErrorFEr R FForcedF       M
1Int. 2Logic30    4       5      O
```

BPV Display Screen

```
BPV   G.821  Elapsed:00d00h00m51s
Available Sec. =           51 100%
Degraded Min.  =            0    %
Severely ErrSec=            0    %
Errored Second =            0    %
Unavailable Sec=            0    %
FTxClkFErrorFEr R FForcedF       M
1Int. 2Logic30    4       5      O
```

BPV G.821 Display Screen

If you desire a hard copy print out of all the test results, connect the printer adapter cable from the printer port to a printer and press the ***PRINT*** key. You may also set testing duration, time interval to print results, or print when error occurs. For more information on setting these options, please refer to Chapter 5 Configuration Setup.

6.2 Performance

The **BTM10** analyzes and displays received E1/T1 frame on the LCD screen and LEDs. This section depicts all of the on screen abbreviations and meanings.

In "Brief" Format:

Logic Error	: Received Error Logic Bit Counter
Frame Error	: Received Error Framing Bit Counter
CRC Error	: Received Error CRC Counter
BPV Error	: Received Error BPV(Bipolar Violation) Counter
E-Bit Error	: Received Error Far End Block(E-bit) Counter (applicable only in E1 mode)
PatLos	: Received Pattern Loss Status.
SigLos	: Received Signal Loss Status.
FrmLos	: Received Frame Loss Status.

In "Logic" Format:

Receive Count	: Received Total Logic Bit Counter
Errors	: Received Error Logic Bit Counter
Error Sec	: Received Logic Bit Error Seconds
Error Free Sec	: Received Logic Bit Error Free Seconds
Error Rate	: Received Logic Error Rate (calculated of dividing received error logic bit counter by total received logic bit counter)
PatLos	: Received Pattern Loss Status.

In "Logic G.821" Format:

Available Sec.	: Received G.821 Logic Bit Available Seconds
Degraded Min.	: Received G.821 Logic Bit Degraded Minutes

Severely ErrSec	: Received G.821 Logic Bit Severely Error Seconds
Erred Second	: Received G.821 Logic Bit Error Seconds
Unavailable Sec	: Received G.821 Logic Bit Unavailable Seconds

In "Logic G.826" Format:

Block	: Received G.826 Logic Block Seconds
Avl.Sec	: Received G.826 Logic Block Available Second
Errored Blocks	: Received G.826 Logic Errored Block Counter (EB)
Backgnd BlkErr	: Received G.826 Logic Background Block Error (BBE) and Background Block Error Ratio (BBER)
Errored Second	: Received G.826 Logic Seconds (ES) and Errored Second Ratio (ESR)
SeverelyErrSec	: Received G.826 Logic Severely Errored Second (SES) and Severely Errored Second Ratio (SESR)

In "Frame" Format:

Receive Count	: Received Total Frame Counter
Errors	: Received Error Framing Bit Counter
Error Second	: Received Framing Bit Error Seconds
Error Free Sec.	: Received Framing Bit Error Free Seconds
LOF Events(Red)	: Received Loss of Frame Counter
COFA Events	: Received Change of Frame Alignment Counter
Severely Err	: Received Severely Error Frame Counter
Frame Loss Sec.	: Received Frame Loss Seconds
Error Rate	: Received Frame Error Rate (calculated by dividing the received error framing bit counter by the total received framing bit counter)
SigLos	: Received Signal Loss Status.
FrmLos	: Received Frame Loss Status.

In “Frame G.821” Format:

Available Sec.	: Received G.821 Frame Available Seconds
Degraded Min.	: Received G.821 Frame Degraded Minutes
Severely ErrSec	: Received G.821 Frame Severely Error Seconds
Erred Second	: Received G.821 Frame Erred Seconds
Unavailable Sec	: Received G.821 Frame Unavailable Seconds

In “CRC” Format:

Receive Count	: Received Total CRC Counter
Errors	: Received Error CRC Counter
Error Sec	: Received CRC Error Seconds
Error Free Sec	: Received CRC Error Free Seconds
Error Rate	: Received CRC Error Rate (calculated of dividing received error CRC counter by total received CRC counter)

In “CRC G.821” Format:

Available Sec.	: Received G.821 CRC Available Seconds
Degraded Min.	: Received G.821 CRC Degraded Minutes
Severely ErrSec	: Received G.821 CRC Severely Error Seconds
Erred Second	: Received G.821 CRC Error Seconds
Unavailable Sec	: Received G.821 CRC Unavailable Seconds

In “BPV” Format:

Receive Count	: Received Total Logic Bit Counter
Errors	: Received Error BPV Counter
Error Sec	: Received BPV Error Seconds
Error Free Sec	: Received BPV Error Free Seconds

Error Rate : Received BPV Error Rate
(calculated by dividing received error BPV counter by the total received logic bit counter)

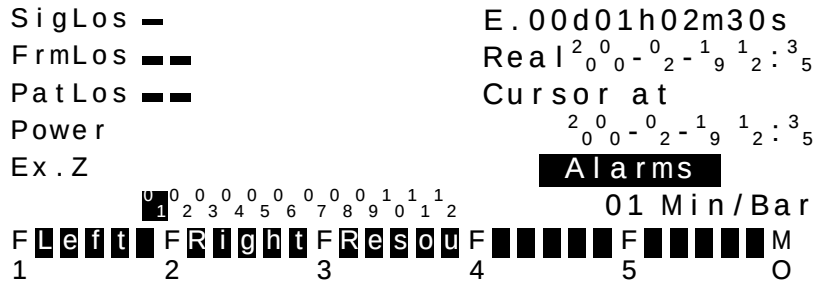
In "BPV G.821" Format:

Available Sec. : Received G.821 BPV Available Seconds

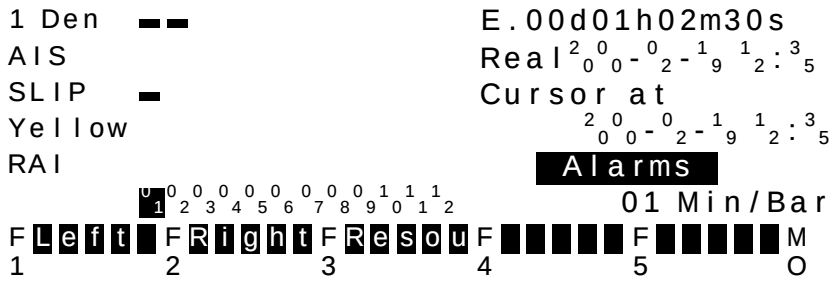
Degraded Min. : Received G.821 BPV Degraded Minutes
Severely ErrSec : Received G.821 BPV Severely Error Seconds
Erred Second : Received G.821 BPV Error Seconds
Unavailable Sec : Received G.821 BPV Unavailable Seconds

6.3 Histogram

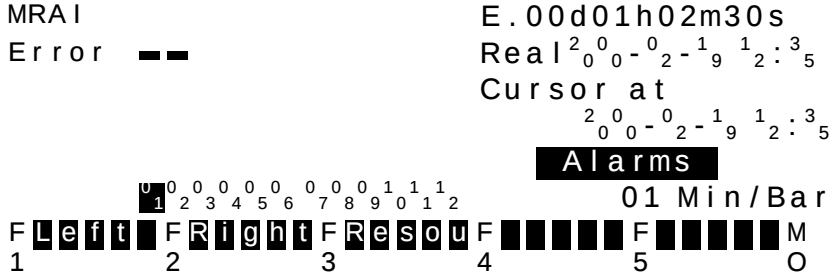
By pressing PgUp(page up) or PgDn (page down) keys, the other Histogram analysis screen can be views also. Examples of all the Histogram analysis screen are shown in the following:



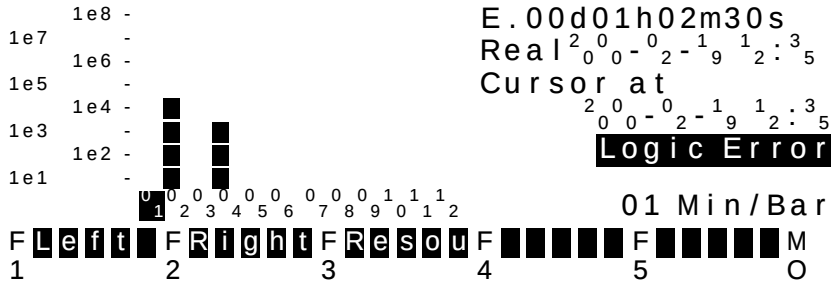
Alarms Histogram Display Screen (1)



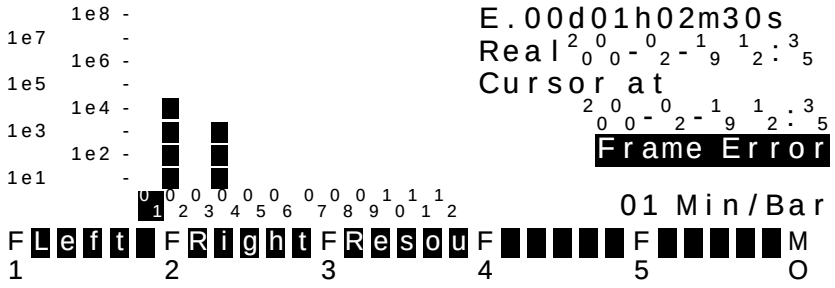
Alarms Histogram Display Screen (2)



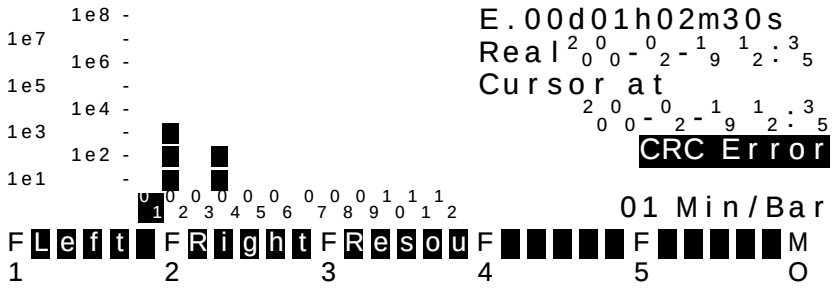
Alarms Histogram Display Screen (3)



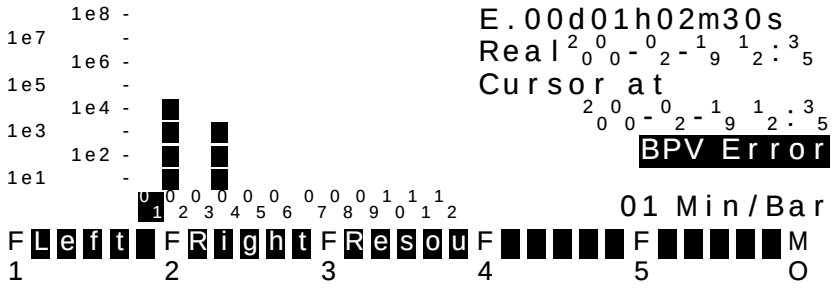
Logic Error Histogram Display Screen



Frame Error Histogram Display Screen



CRC Error Histogram Display Screen



BPV Error Histogram Display Screen

The "E.00d01h02m30s" shows the duration of the current test, elapsed time. The "Real$^{2}_{0}{}^{0}_{0}$-$^{0}_{2}$-$^{1}_{9}$ $^{1}_{2}$:$^{3}_{5}$" shows real time date and clock in year-month-day hour:minute format. The "Cursor at $^{2}_{0}{}^{0}_{0}$-$^{0}_{2}$-$^{1}_{9}$ $^{1}_{2}$:$^{3}_{5}$" shows cursor location. The above example has a flashing cursor at location 01 position, and it indicates alarms or error counts status at storage time 2000/2/19 12:35. The "Alarms", "Logic Error", "Frame Error", "CRC Error", and "BPV error" indicates the current page is what kind of histogram analysis. The "01 Min/Bar" shows the resolution per bar of Histogram.

If the Histogram Storage is set to off, the feature of Histogram analysis is not available, and the Histogram screens will display the message "No Data".

If the Histogram storage time period is set to 1 minute, the display can show records for up to 3 days. If it is set to 2 minutes, the display can show records for up to 6 days. If it is set to 30 minutes, the display can show records for up to 90 days. By pressing "**F1) Left**", "**F2) Right**" function keys, or "⇦", "⇨" arrow keys on these screens will move the Histogram cursor to the left or right. The related storage time is shown on "Cursor at". It is useful for the customer to view the testing results in history.

By pressing "**F3) Resou** (Resolution)" function key or "⇩" arrow key the resolution of the Histogram analysis screen will change. The fine resolution is one minute per bar. It can be zoomed out to 6 hours, and then zoomed in to 30 minutes, 2 minutes, and 1 minute per bar of resolution.

The Alarms Histograms shows whether there are any Alarm errors in each period of storage time or not. If there are any alarm errors occuring in that period, the related position will get a bar.

The Logic, Frame, BPV, and CRC error Histogram shows how many errors in each period of storage time. Zooming out the resolution will get the maximum errors count of this period of storage time. The display cannot zoom in the period of storage time.

The Examine Analysis can review BERT normal, G.821, G.826 testing results and Histograms. The file management function can store and recall normal BERT, G.821, and G.826 results but not Histogram.

Please refer to Chapter 2 BTM10 Overview, Receive Status, for more Alarms information. The following are the meanings of abbreviations on the Histogram screens:

SigLos	: Signal Loss Alarm
FrmLos	: Frame Loss Alarm
PatLos	: Pattern Loss Alarm
Power	: (reserve)
Ex.Z	: Excess Zero Alarm
1 Den	: One Density Alarm
AIS	: AIS Alarm
SLIP	: SLIP Alarm
Yellow	: Yellow Alarm
RAI	: RAI Alarm
MRAI	: MRAI Alarm
Error	: Errors Alarm

6.4 Function Keys

At the bottom of each display screen are two lines, with abbreviated and inverted character text indicating functions that may be applied in run mode. Under the abbreviated function is the current status. If you press any function key, the **BTM10** will take some action immediately, such as changing the E1/T1 line status, framing mode, or forcing errors. The current status will be modified if it has several selected statuses.

The function keys are in three different groups or sets of keys. Press the ***MORE*** key repeatedly to display the other function key groups.

For example:

```
F TxClk F Error F Er R  F Forced F Reset M
1 Int.  2 Logic 3 0     4        5       O
```

Press "***MORE***"

```
F Disp. F Frame F CRC    F Code    F RMode M
1 Brief 2 FAS   3 CRC4   4 HDB3    5 T 75  O
```

Press ***MORE***

```
F LBO   F Pattn F Durn. F ReSyn   F Store M
1 0     2 QRSS  3 Cont. 4         5       O
```

Press ***MORE***

```
F Left  F right F Resou F        F        M
1       2       3       4        5        O
```

Following are the function key detailed meanings and actions.

Group 1

[**F1**]TxClk Transmit Clock Source

Int. Change to internal clock source, initialize and restart test.

Recov Change to RX recovery clock source, initialize and restart test.

Ext. Change to external clock source, initialize and restart test.

Data Change to data port clock source, initialize and restart test.

+50 Change to internal clock plus 50 ppm offset as clock source, initialize and restart test.

-50 Change to internal clock minus 50 ppm offset as clock source, initialize and restart test.

[**F2**]Error Forced Error Type

Logic Change forced error type to logic.

Frame Change forced error type to frame.

CRC Change forced error type to CRC.

BPV Change forced error type to BPV.

[**F3**]Er R Automatic Forced Error Rate

0 Disable automatic forced errors action.

1e-3 Automatic forced error rate is set at a rate of 1e-3.

1e-4 Automatic forced error rate is set at a rate of 1e-4.

1e-5 Automatic forced error rate is set at a rate of 1e-5.

1e-6 Automatic forced error rate is set at a rate of 1e-6.

1e-7 Automatic forced error rate is set at a rate of 1e-7.

[**F4**]Forced Force a Single Error

Insert a single error immediately.

[**F5**]Reset Reset all test results and clear all of the received counters and timers.

Group 2 (after pressing the MORE key)

[**F1**]Disp. Display Format

Brief Changes the display format to brief display mode.
Logic Changes the display format to logic display mode.
Frame Changes the display format to frame display mode.
CRC Changes the display format to CRC display mode.
BPV Changes the display format to BPV display mode.

[**F2**]Frame Frame Type

FAS Changes the frame type to E1 FAS only mode. (E1 only)
F+CAS Changes the frame type to E1 FAS and CAS enabled mode. (E1 only)
Unfr. Changes the frame type to unframed mode.
ESF Changes the frame type to T1 ESF mode. (T1 only)
D4 Changes the frame type to T1 D4(SF) mode. (T1 only)
SLC96 Changes the frame type to T1 SLC-96 mode. (T1 only)
T1DM Changes the frame type to T1 T1DM mode. (T1 only)

[**F3**]CRC CRC Enable/Disable

CRC4 Changes the E1 CRC to CRC4 enabled mode. (E1 only)
NO Disables the CRC feature.
CRC6 Changes the T1 CRC to CRC6 enabled mode. (T1 only)

[**F4**]Code Code Format

HDB3 Changes to HDB3 coding mode. (E1 only)
AMI Changes to AMI coding mode.
B8ZS Changes to B8ZS coding mode. (T1 only)

[**F5**]Rmode Receive Mode

T 75 Change to 75 ohm terminal mode. (E1 only)
T 100 Change to 100 ohm terminal mode. (T1 only)
T 120 Change to 120 ohm terminal mode. (E1 only)

B 75	Change to Rx bridge mode, and Tx connects to 75 ohm terminal mode. (E1 only)
Bridg	Change to Rx bridge mode, and Tx connects to 100 ohm terminal mode. (T1 only)
B 120	Change to Rx bridge mode, and Tx connects to 120 ohm terminal mode. (E1 only)
M 75	Change to DSX-MONitor 75 ohm mode.(E1 only)
M 100	Change to DSX-MONitor 100 ohm mode.(T1 only)
M 120	Change to DSX-MONitor 120 ohm mode.(E1 only)

Group 3 (after pressing the MORE key again)

[**F1**]LBO	Line Build Out Attenuation
0	Change LBO to 0 dB
-7.5	Change LBO to -7.5 dB
-15	Change LBO to -15 dB
-22.5	Change LBO to -22.5 dB

[**F2**]Pattn	Pattern
63	63
127	127
511	511(O.153)
2047	2047(O.152 AND O.153)
2e15s	2e15-1(O.151)
2e15n	2e15-1(O.151 inverted)
2e20s	2e20-1(O.153)
2e20n	2e20-1(inverted)
QRSS	QRSS(O.151 QRSS)
2e23s	2e23-1(O.151)
2e23n	2e23-1(O.151 inverted)
All 1	All Ones
All 0	All Zeros
0101	Alternate(0101)
3in24	3 in 24

1in16 1 in 16
1 in8 1 in 8
1 in4 1 in 4
User1,2,3 User programmable pattern #1, #2 or #3
LIVE Live signal or data

[**F3**]Durn. Test Duration
Cont. Continuous
1 Min 1 Minute
15Min 15 Minutes
30Min 30 Minutes
60Min 1 Hour
24Hrs 24 Hours

[**F4**]ReSyn Re-sync framing

[**F5**]Store Histogram storage duration
Off Histogram feature is disable.
1 Min The duration of Histogram storage is set to 1 minute.
2 Min The duration of Histogram storage is set to 2 minute.
30 Min The duration of Histogram storage is set to 30 minute.

Group 4 (after pressing the MORE key again)

[**F1**]Left Moves the Histogram cursor to the left position.

[**F1**]Right Moves the Histogram cursor to the right position.

[**F1**]Resou Changes the resolution of Histogram.

1 Min The resolution of Histogram display is set to 1 minute.
2 Min The resolution of Histogram display is set to 2 minutes.
30 Min The resolution of Histogram display is set to 30 minutes.
6 Hour The resolution of Histogram display is set to 6 hours.

Other keys that have functions while running BERT:

SPACE
Insert single error on BERT Analysis function.

BACK
Turn backlight on or off on BERT Analysis function.

C
Clears the history of LED error status and returns LED status to real-time display. Any error status will be stored into the history buffer and the **History** LED will flash.

F
Freezes the current LED status when you press the ***F*** key. The **Freeze** LED will immediately light. To release the frozen LED status, press the ***F*** key again. The **BTM10** will again show real-time LED status without clearing the history of LED error status, any error status in history will flash the **History** LED, and the **Freeze** LED will turn off again.

?
Shows the history of LED error status. The **History** LED will turn on solid, indicating that the current state of history is under review.

⇦ ⇨
Move the Histogram cursor to the LEFT or RIGHT.

⇩
Changes the resolution of Histogram.

7.1 Alarms and Looping

To enter the "**Alarm Setting**" or "**Looping Setting**" function, press the ***F3*** key from the first menu page.

There is no **Looping Setting** when the **BTM10** is set to E1 mode. Therefore, the **BTM10** will go directly to the "**Alarm Setting**" screen.

When the **BTM10** is set to T1 mode, there is a sub-menu. The user may select between "**Alarm Setting**" or "**Looping Setting**" as in the following display screen:

```
F1  :Alarm Setting
F2  :Looping Setting
```

Press the ***F1*** key to enter the "**Alarm Setting**" function, or press the ***F2*** key to enter the "**Looping Setting**" function.

7.2 Alarm Setting

Upon entering the "**Alarm Setting**" function, you will see a screen similar to the following:

```
Alarm Generate: [AIS              ]
          Mode: [Off  ]


F1 AIS   F2 YEL.(RAI)   F3 SIG LOSS   F4          F5
```

Alarms Setting Screen for T1(cursor in "Alarm Generate" field)

```
Alarm Generate: [AIS                ]
          Mode: [Off  ]


F1AIS   F2REMOT F3MULTI REMOT F4SIG LOSS F5      .
```

Alarms Setting Screen for E1(cursor in "Alarm Generate" field)

In T1 mode, the **BTM10** can generate **AIS** (Alarm Indication Signal), or **Yellow Alarm** (RAI) automatically or manually. You may move the cursor up or down between the two entry fields by pressing the up or down arrow keys. When the cursor is located in the "Alarm Generate" field, you may select the type of alarm, which you require, simply by pressing the appropriate function key directly:

[**F1**]AIS	Alarm Indication Signal (unframed all ones)
[**F2**]YEL.(RAI)	Yellow Alarm (Remote Alarm Indicator)

While in E1 mode, the **BTM10** can generate **AIS** (Alarm Indication Signal), **RAI** (Remote Alarm Indication), or **MRAI** (Multi-Remote Alarm Indication) manually. You may move the cursor up or down between the three entry fields by pressing the up or down arrow keys. When the cursor is located in the "Alarm Generation" field, you may select the type of alarm, which you require, simply by pressing the appropriate function key directly:

[**F1**]AIS	Alarm Indication Signal (unframed all ones)
[**F2**]REMOT	RAI (Remote Alarm Indicator)
[**F3**]MULTI REMOT	MRAI (Multi Remote Alarm Indicator)
[**F4**]SIG. LOSS	Signal Loss (Terminate the Tx signal)

Pressing the down arrow key will move the cursor to the "Mode" field, a second set of function keys are then active. Refer to the screen display below:

```
Alarm Generate: [AIS                ]
          Mode: [Off  ]


FOff    FOn     FAUTO   F       F
1       2       3       4       5
```

Alarm Setting Screen (cursor in "Mode" field)

You may then select whether alarm generation is on, off, or auto simply by pressing the function key directly:

[**F1**]Off	alarm generation disable
[**F2**]On	generate alarm manually
[F3]AUTO	automatic alarm generation (E1 mode only)

AIS (Alarm Indication Signal):
When activated, the **BTM10** replaces all data output on the TX port with an unframed all ones signal (AIS).

Yellow Alarm (Remote Alarm): In T1 mode:

SF(D4)	Bit 2 of every timeslot set to 0.
ESF	By configuration DL1 to continuously transmit an all 0 BOP priority codeword.
SLC96	Bit 2 of every timeslot set to 0.
T1DM	Y bit of the sync byte (24th byte) set to 0.

RAI (Remote Alarm Indicator): In E1 mode, A bit in timeslot 0 is set to 1.

MRAI (Multi Remote Alarm Indicator): In E1 mode, Y bit in timeslot 16 is set to 1.

7.3 Looping Setting

NOTE: Looping Setting is not applicable when in E1 mode.

After entering the "**Looping Setting**" function, you will see a screen similar to the ones below:

```
TYPE [IN-BAND] [LINE (CSU)    ]
LOOP UP          10000
LOOP DOWN        100
FRAMING          [INSERTED    ]
AUTO RESPONSE                 [OFF  ]
TESTER PAYLOAD LOOPED         [DOWN ]
Fin-   Fout-  F      F       F      .
1band  2band  3      4       5      .
```

Loopback Setting Screen (cursor in "In-band" field)

Or:

```
TYPE [OUT-BAND][LINE (CSU)    ]
LOOP UP      00001110 11111111
LOOP DOWN    00111000 11111111
AUTO RESPONSE                 [OFF  ]
TESTER LINE LOOPED            [DOWN ]
TESTER PAYLOAD LOOPED         [DOWN ]
Fin-   Fout-  F      F       F      .
1band  2band  3      4       5      .
```

Loopback Setting Screen (cursor in "Out-band" field)

The **BTM10** can generate **Loop Up Code** or **Loop Down Code** manually, detect and respond to them automatically. You may move the cursor up or down between the two entry fields by pressing the up or down arrow keys. When the cursor is located in the "Alarm Generation" field, you may select the type of looping, which you require, simply by pressing the appropriate function key directly:

Only ESF has both In-Band and Out-Band loop codes, D4, SLC-96, and T1DM have only In-Band loop codes.

Pressing the / key will force generating of loop up code, while pressing the _ key will force generating of loop down code.

The following are the specification of **BTM10** Looping Setting:

1) Loop Type :	InBand, Out-Band	
2) In-Band Loop Code Type :	LINE (CSU), SmartJack (4), SmartJack (5), User Programmable	
3) Out-Band Loop Code Type :	LINE (CSU), Payload(CSU), SmartJack	
4) In-Band Loop Code :	LINE (CSU)	Up: 10000 Down: 100
	SmartJack (4)	Up: 1100 Down: 1110
	SmartJack (5)	Up: 11000 Down: 11100

5) Out-Band Loop Code : LINE (CSU) Up: 00001110 11111111
Down: 00111000 11111111
Payload(CSU) Up: 00010100 11111111
Down: 00110010 11111111
SmartJack Up: 00010010 11111111
Down: 00100100 11111111

6) In-Band Framing: Inserted: framed DS1 loop code with the framing bits replacing bits of the pattern.
Overwritten: unframed (non-standard) DS1 loop code signaling.

7) Tester Auto Response: On: When **BTM10** detects loop up code, it will set tester to looped mode; When **BTM10** detects loop down code, it will release tester looped mode.
Off: The **BTM10** will not respond to loop codes.

8) Tester Line Looped: Up: Force **BTM10 Line Looping** T1 Rx onto Tx port.
Down: Release **BTM10 Line Looping** mode.

9) Tester Payload Looped: Up: Force **BTM10 Payload Looping** T1 Rx onto Tx port.
Down: Release **BTM10 Payload Looping** mode

10) Indications: **"L.Up."** LED: will be lit if **BTM10** detects loop up code. (Located at E1 RAI LED.)
"L.Dn." LED: will be lit if **BTM10** detects loop down code. (Located at E1 MRAI LED.)

The "**Signal Result**" function allows the user to verify the received E1/T1 PCM signal. The "**Signal Result**" function is entered by pressing the ***F3*** key from the second menu page. When you enter this function, the E1/T1 RX port signal results will be displayed as follows:

```
Receive Level  :  -02  dBdsx
                  05.00 Volts p-p
RX Frequency      :  02048000 Hz
RX Freq. Offset   :  0000   ppm
EXT Frequency     :  -------- Hz
EXT Freq. Offset  :  ------ Hz
```

Signal Result Screen display

Receive Level: The current RX port signal level is measured in dBdsx, and calculated in peak-to-peak voltage.

Rx Frequency: The current RX port signal frequency is shown, measured in Hertz.

Rx Freq. Offset: The current RX port signal frequency is compared with the internal clock frequency, and shown with the offset in ppm.

EXT Frequency: The current Ext/Ref port signal frequency is shown, measured in Hz.

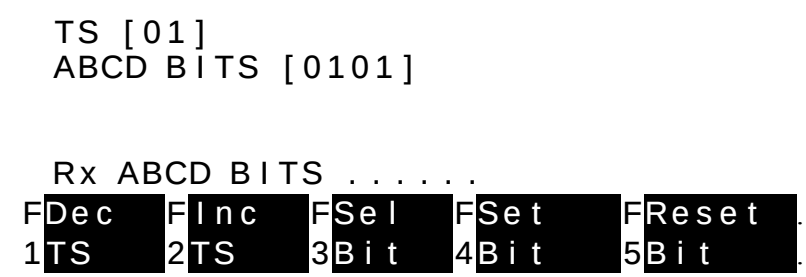
EXT Freq. Offset: The current Ext/Ref port signal frequency is compared with the Rx port signal frequency, and shown with the offset in Hz.

Press the ***ESC*** key to exit this function.

This page left blank intentionally.

In E1 mode, when you set the **BTM10** to E1 CAS framing mode, signaling is enabled. To enter the signaling setup function, press the ***F4*** key from the second menu set pages. If the **BTM10** is not in CAS mode, it is not able to enter this function.

In T1 mode, when you set the **BTM10** to T1 **n*56K** channel mode, signaling is enabled. Please refer to Chapter 5 for more information on Channel setting. To enter the signaling setup function, press the ***F4*** key from the second menu set pages. If the **BTM10** is not in **n*56K** channel mode, the signaling bits will not be correct. While in n*56K channel mode, the timeslots use 7 bits for data, the eighth bit can then be used for signaling. Since all 8 bits are used for data while in n*64K channel mode, there is no room for the signaling bit. Trying to display the bits in this mode will result in a garbage display. The ESF mode has A,B,C,D or A,B, signaling bit modes. In D4, SLC-96, and T1DM modes, there is only A, B signaling bits mode. After you enter this function, you will see a screen similar to that below:



Signaling Setup Screen

The screen shows which TX time slot is under setup, and its current receiving (Rx) ABCD bits. The flashing cursor is under the ABCD bit field, and can be moved to A, B, C, or D locations by pressing the right or left arrow keys, or by pressing the ***F3*** Select Bit key.

The Signaling Setup function key definitions are as follows:

[**F1**] DecTS: Will decrement to the previous time slot selection.
[**F2**] Inc TS: Will increment to the next time slot selection.
[**F3**] Sel Bit: Will select one of the ABCD bits.
[**F4**] Set Bit: Will set the selected ABCD bit to "one".
[**F5**] Reset Bit: Will clear the selected ABCD bit to "zero".

[**Up Arrow**] Select previous timeslot number. (same as **F1**)
[**Down Arow**] Select next timeslot number. (same as **F2**)

To exit the "Signaling Setup" function, press the ***ESC*** key.

To enter the "**Signaling Display**" function, press the ***F5*** key from the second menu set page. In E1 mode, after you enter this function, you will see a screen similar to that below:

```
MA:0000 08:0101 XY:1011 24:0101
01:0101 09:0101 17:0101 25:0101
02:0101 10:0101 18:0101 26:0101
03:0101 11:0101 19:0101 27:0101
04:0101 12:0101 20:0101 28:0101
05:0101 13:0101 21:0101 29:0101
06:0101 14:0101 22:0101 30:0101
07:0101 15:0101 23:0101 31:0101
```

E1 Signaling Display Screen

The screen shows every RX time slot's signaling A,B,C, and D bits. The actual location of the bits is in time slot 16 during E1 CAS framing mode. If the **BTM10** is not in CAS mode, it is not able to enter this function.

The first time slot 16 of the first frame of multi-frame contains the multi-frame alignment and XYXX bits. They are shown in the **MA** and **XY** fields.

In T1 mode, after you enter this function, you will see a screen similar to that below:

```
01:0101 09:0101 17:0101
02:0101 10:0101 18:0101
03:0101 11:0101 19:0101
04:0101 12:0101 20:0101
05:0101 13:0101 21:0101
06:0101 14:0101 22:0101
07:0101 15:0101 23:0101
08:0101 16:0101 24:0101
```

T1 Signaling Display Screen

The screen shows every RX time slot's signaling A,B,C, and D bits. The actual location of the bits is in each bit 8 of each timeslot. If the **BTM10** doesn't receive n*56K mode data and signaling bits, the values may be shown randomly depending upon the T1 Rx data. For more information on channel setting, please refer to Chapter 5.

To exit the "Signaling Display" function, press the ***ESC*** key.

11.1 Introduction

To enter the "User Program Pattern" function, press the ***F5*** key from the third menu selection page. When you enter the function, you will see a screen similar to that below:

```
User programmable pattern #1:
Size:[08] bits
Pattern(in binary)(left first)
10000000.........................

F1Set 0   F2Set 1   F3Go Head  F4Del Tail  F5Change Pat #_
```

User Program Pattern Screen

There are three user programmable patterns, which can be sent and analyzed on E1/T1 TX and RX ports while doing BERT analysis. Please refer to Chapter 6, BERT Analysis, or Chapter 22, Datacom BERT, for more details of the BERT function.

The programmable pattern number is show as #1, #2, or #3, on line one of display. The total repetitive pattern length will be counted automatically and shown as a number size in bits, on line two of the display. The maximum pattern length is 32 bits. The left bit of the programmable pattern will be sent or received first, MSB first.

11.2 Operation

You may enter "1" to set the current flashing bit in the pattern or you may enter "0" to clear the current flash bit to zero. If you want to move the position of the flashing cursor, just press the “Right” or “Left” arrow keys. Press the "-" key to delete the last bit while the cursor is at the last bit position, then the current bit symbol will change to "." and the length of pattern will decrease by one bit. The minimum length of the programmable repetitive pattern is one bit.

Following are the function key detailed meanings and actions.

[***F1***]Set 0	Set current bit to 0.
[***F2***]Set 1	Set current bit to 1.
[***F3***]Go Head	Move the cursor to the first bit position.
[***F4***]Del Tail	Delete the last bit and move the cursor after the last bit position.
[***F5***]Change Pat#	Change setting pattern. It may change to user programmable pattern #1, #2, or #3.

To exit the “User Programmable Pattern” function, press the ***ESC*** key.

12.1 introduction

The "Time Slot Setting" function is not available if E1/T1 is set to unframed or if the mode is set to full channel. Only n*64K or n*56K channel mode can enter this function.

To enter the "Time Slot Setting" function, press the ***F1*** key from the fourth menu set page. After you enter this function, you will see a screen similar to that below:

```
T01~07:    f   [*]  *    *    *    *    *    *
T08~15:    *    *   *    *    *    *    *    *
T16~23:    *    *   *    *    *    *    *    *
T24~31:    *    *   *    *    *    *    *    *
Current: TS01 -> :used
Total:31 timeslot(s) are used.
F Set     F Set     F Prog.   F All     F Default
1 Used    2 ByPas   3 Idle    4         5 Idle
```

E1 Time Slot Setting Screen

Or

```
T01~07:    f   [*]  *    *    *    *    *    *
T08~15:    *    *   *    *    *    *    *    *
T16~23:    *    *   *    *    *    *    *    *
T24~31:    *
Current: TS01 -> :used
Total:24 timeslot(s) are used.
F Set     F Set     F Prog.   F         F Default
1 Used    2 ByPas   3 Idle    4         5 Idle
```

T1 Time Slot Setting Screen

If the mode is set to **E1 FAS frame** mode, only 31 time slots **TS1 to TS31** may be set. If the mode is set to **E1 FAS frame and CAS** mode, only 30 time slots **TS1 to TS15 and TS17 to TS31** are settable. The **BTM10** must also be set to **n*56K** or **n*64K** channel mode.

In **T1** mode, there are 24 timeslots **TS1 to TS24** that may be selected. If the mode is set to **T1 T1DM** mode, only 23 time slots **TS1 to TS23** are settable.

You may also press "F4" to configure all the timeslot in the following format.

[***F1***] All Used	Set ALL current timeslot to used mode.
[***F2***] All Bypass	Set ALL current timeslot to bypass (pass through) mode.
[***F3***] All Idle	Set ALL current timeslot to programmable idle code mode.
[***F4***] Back	Return to the previous level menu.
[***F5***] All Def Idle	Set ALL current timeslot to Default Idle TS mode. Please refer to manual configuration setup.

In the E1 mode example, there are 31 numbers, star (*), "c", or "p" symbols on the screen. Each one represents the status of one timeslot as follows:

*	This time slot is set to used.
p	This time slot is set to pass through mode (bypass).
number	This time slot is set to idle mode, and fills in a programmable number on the transmit side.
c	This time slot is E1 CAS mode time slot 16. (not settable)
t	This time slot is T1 T1DM mode time slot 24. (not settable)

Note : The bypass mode : The received channel data will be sent to transmit channel data; loopback this channel data only.

12.2 Operation

There is a flashing cursor at any location of the time slot map. You may press the "Right Arrow", "Left Arrow", "Up Arrow", or "Down Arrow" keys to move the flashing cursor's position.

If you want to change the time slot status, used, idle, or pass through, all you have to do is press the ***ENTER*** key. The current status will be changed to idle status (number), pass through status (p symbol), or used status (star symbol).

Following are the function key detailed meanings and actions.

[F1]Set Used	Set current timeslot to used mode.
[F2]Set ByPas	Set current timeslot to Bypass mode.
[F3]Prog.Idle	Set current timeslot to programmable idle code mode.
[F4]All	Set ALL timeslots mode.
[F5]Default Idle	Set current timeslot to Default Idle TS mode. Please refer to Manual Configuration Setup.

If the cursor is located at a programmable time slot, the user can type in number from 0 to 9, or A to F for hexadecimal code. And this code will be filled into this transmitted idle time slot.

When performing BERT analysis, you may insert and drop a test pattern into used time slots if you set the channel to **n*64K** mode or **n*56K** mode. For more information on changing setup parameters, please refer to Chapter 5, Configuration Setup.

You may enter "External Drop and Insert" and run this function directly by pressing the ***RUN*** key at this stage. For more information, please refer to Chapter 13, External Drop and Insert.

To exit the "Time Slot Setting" function, press the ***ESC*** key.

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13.1 Introduction

The "External Drop and Insert" function lets the data stream on the data port drop and insert its data into the E1/T1 port. The E1/T1 framing configuration is based on the setting of "Configuration Setup". The available time slots are assigned by the function of "Time Slot Setting". For more information, please refer to Chapter 5 Configuration Setup and Chapter 12 Time Slot Setting.

13.2 Parameter Setting

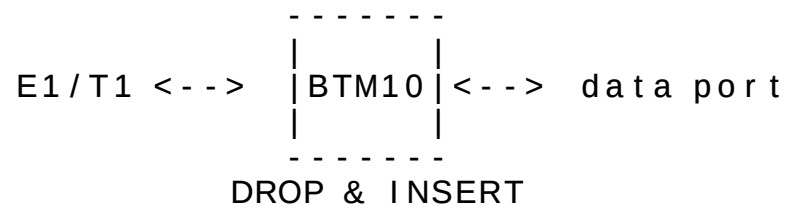
The "External Drop and Insert" function may be entered by pressing the ***F4*** key from the third menu page. After you enter this function, you will see a screen similar to that below:

```
------ DROP/INSERT SETUP -------
Data Port          : DTE          .
Interface          : RS-449/530/X.21
Clock Source       : Internal
Datacom Tx Clock   : Normal
Datacom Rx Clock   : Normal

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Drop and Insert Setup Screen

After you set the parameters by using standard menu key operations, press the ***RUN*** key to activate this function. You will receive a screen similar to the screen on the following page:



Drop and Insert Screen

To exit the "External Drop and Insert" function, press the ***ESC*** key. The available settings and parameters for each are shown and explained in the following table:

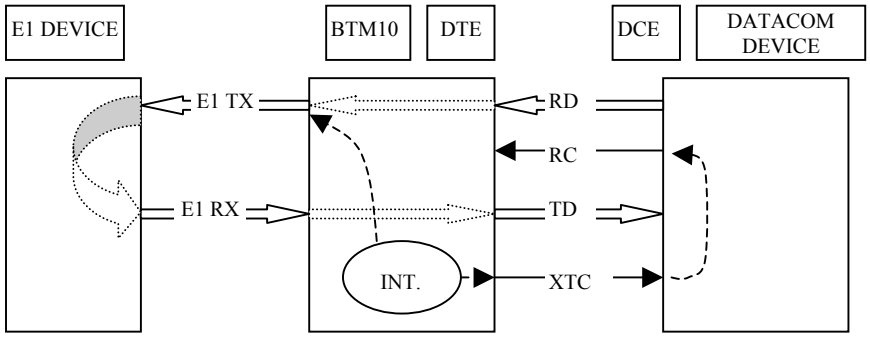
Items	Selected parameters	Definition					
Data Port	(1) DTE	The data port is configured in DTE mode. This data port can be connected to another DCE instrument, such as a modem					
	(2) DCE	The data port is configured in DCE mode. This data port can be connected to another DTE instrument, such as a PC.					
Inter-face	(1) RS-232	The data port is set to RS-232.					
	(2) V.35	The data port is set to V.35.					
	(3) RS-449/ 530 /X.21	The data port is set to RS-449,RS-530, or X.21.					
Clock Source		E1/T1 TX port Clock Source	E1/T1 RX port Clock Source	DTE mode		DCE mode	
				Tx Signal / Clock Source	Rx Signal / Clock Source	Tx Signal / Clock Source	Rx Signal / Clock Source
	(1) Internal	Internal OSC.	Recovery	TD / XTC	RD / RC	RD /TC,RC	TD / XTC
	(2) Recovery	Recovery	Recovery	TD / XTC	RD / RC	RD /TC,RC	TD / XTC
	(3) Ext/Ref	Ext/Ref	Recovery	TD / XTC	RD / RC	RD /TC,RC	TD / XTC
	(4) Data Unit	RC	Recovery	TD / RC	RD / RC	RD / XTC	TD / XTC
	(5) Int. X.21	Internal OSC.	Recovery	TD / XTC	RD / Internal	RD /TC,RC	TD / InternaL
Datacom TXClk	(1) Normal	The Tx clock polarity of data port is normal.					
	(2) Inverted	The Tx clock polarity of data port is inverted.					
Datacom RXClk	(1) Normal	The Rx clock polarity of data port is normal.					
	(2) Inverted	The Rx clock polarity of data port is inverted.					

External Drop and Insert setting parameters table

13.3 Applications

1) BTM10 Datacom Performs as DTE:

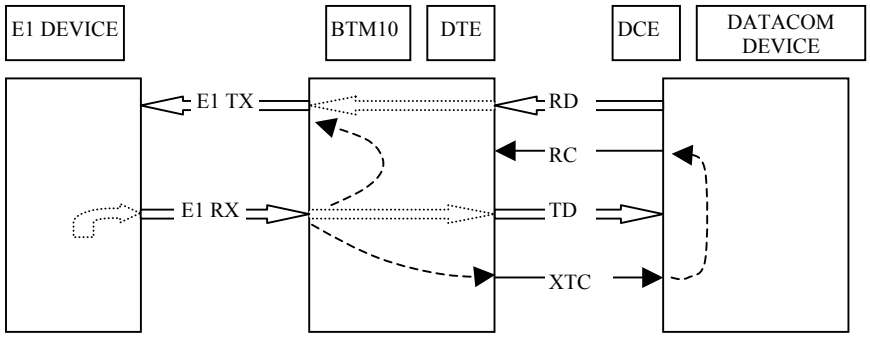
1.1) Clock Source: Internal (BTM10 supplies clock to datacom and E1/T1 devices).



Tx Clock: Recovery (Loop) | Clock Source: Internal | Tx Clock: External, Rx Clock: External

Note: RC should be synchronized with XTC.

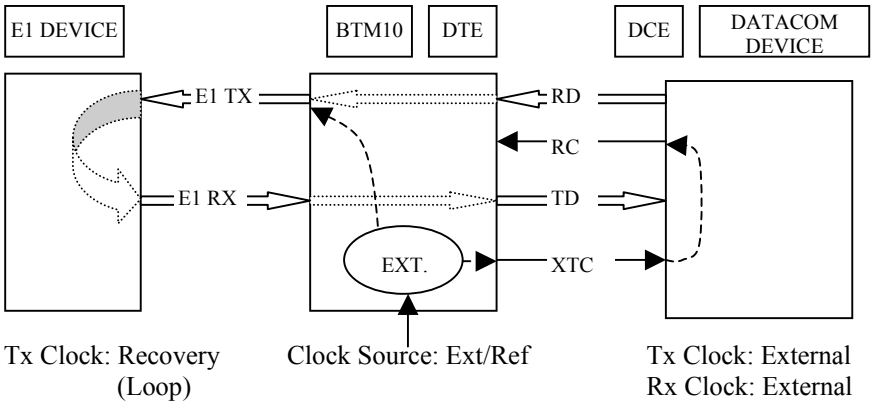
1.2) Clock Source: Recovery (E1/T1 device supplies clock to BTM10 and datacom devices).



Tx Clock: Internal | Clock Source: Recovery | Tx Clock: External, Rx Clock: External

Note: RC should be synchronized with XTC.

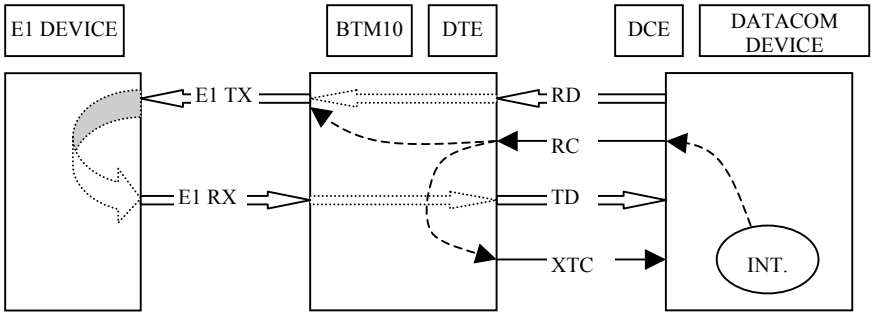
1.3) Clock Source: Ext/Ref (BTM10 Ext/Ref port supplies clock to BTM10, datacom devices, and E1/T1 devices).



Tx Clock: Recovery (Loop) | Clock Source: Ext/Ref | Tx Clock: External, Rx Clock: External

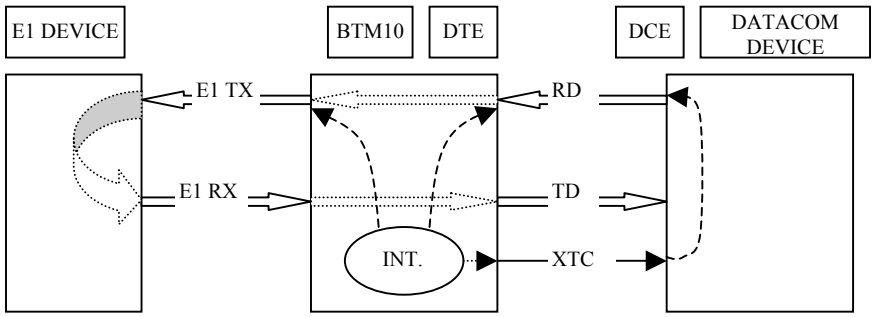
Note: RC should be synchronized with XTC.

1.4) Clock Source: Data Unit (Datacom device supplies clock to BTM10 and E1/T1 devices).



Tx Clock: Recovery (Loop) | Clock Source: Data Unit | Tx Clock: Internal, Rx Clock: External

1.5) Clock Source: Internal X.21 (BTM10 supplies clock to datacom and E1/T1 devices).

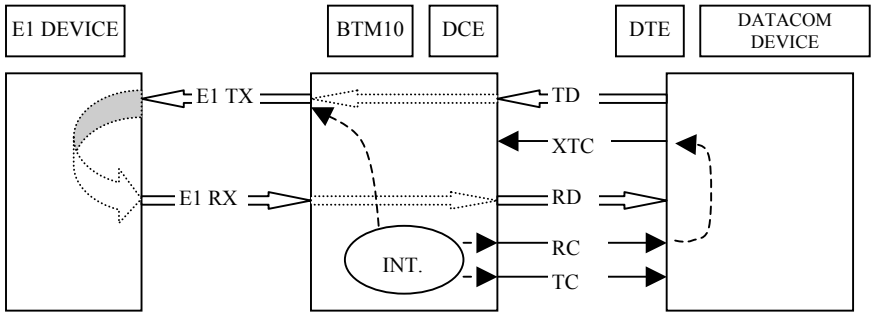


Tx Clock: Recovery (Loop) | Clock Source: Internal X.21 | Tx Clock: External, Rx Clock: External

Note: RD should be synchronized with XTC.

2) BTM10 Datacom Performs as DCE:

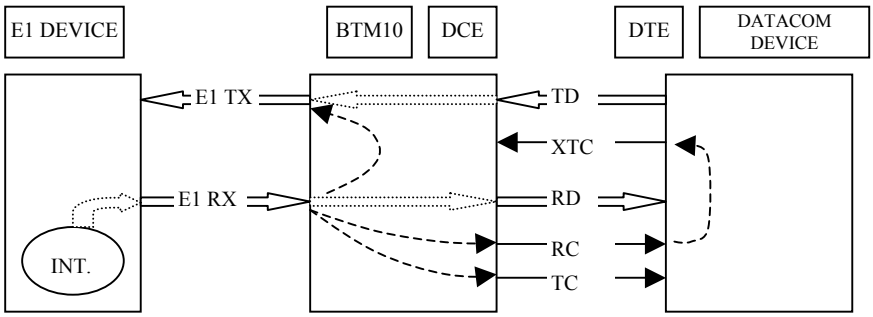
2.1) Clock Source: Internal (BTM10 supplies clock to datacom and E1/T1 devices).



Tx Clock: Recovery (Loop) | Clock Source: Internal | Tx Clock: External, Rx Clock: External

Note: XTC should be synchronized with RC.

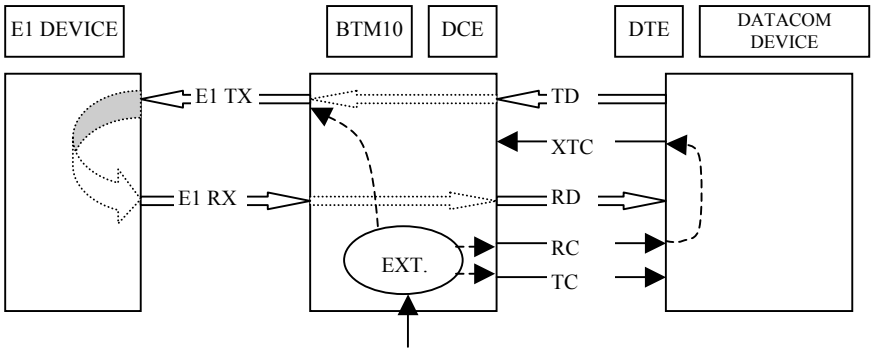
2.2) Clock Source: Recovery (E1/T1 device supplies clock to BTM10 and datacom devices).



Tx Clock: Internal Clock Source: Recovery Tx Clock: External
Rx Clock: External

Note: XTC should be synchronized with RC.

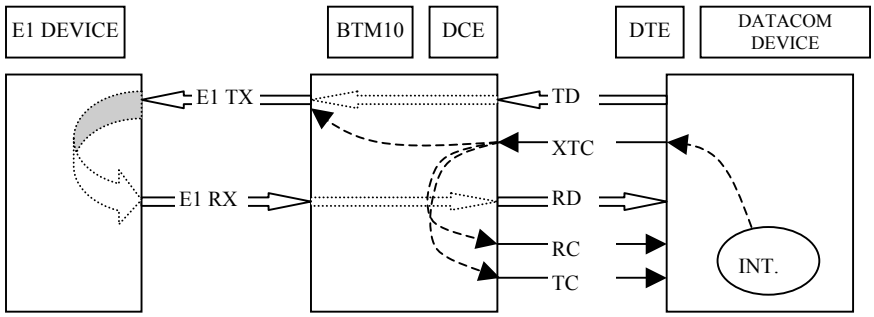
2.3) Clock Source: Ext/Ref (BTM10 Ext/Ref port supplies clock to datacom, BTM10, and E1/T1 devices).



Tx Clock: Recovery (Loop) Clock Source: Ext/Ref Tx Clock: External
Rx Clock: External

Note: XTC should be synchronized with RC.

2.4) Clock Source: Data Unit (Datacom device supplies clock to BTM10 and E1/T1 devices).

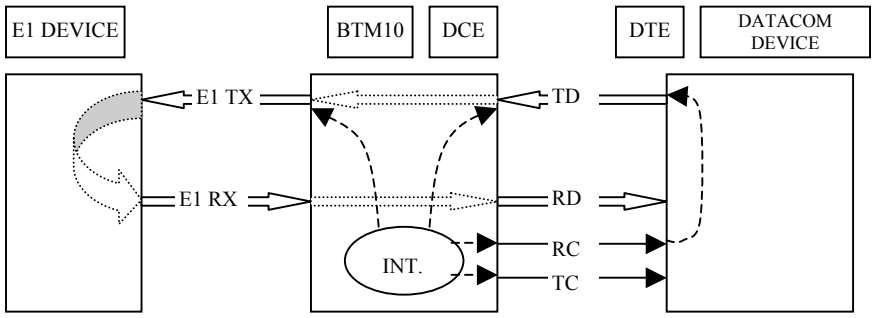


Tx Clock: Recovery (Loop)

Clock Source: Data Unit

Tx Clock: Internal
Rx Clock: External

2.5) Clock Source: Internal X.21 (BTM10 supplies clock to datacom and E1/T1 devices).



Tx Clock: Recovery (Loop)

Clock Source: Internal X.21

Tx Clock: External
Rx Clock: External

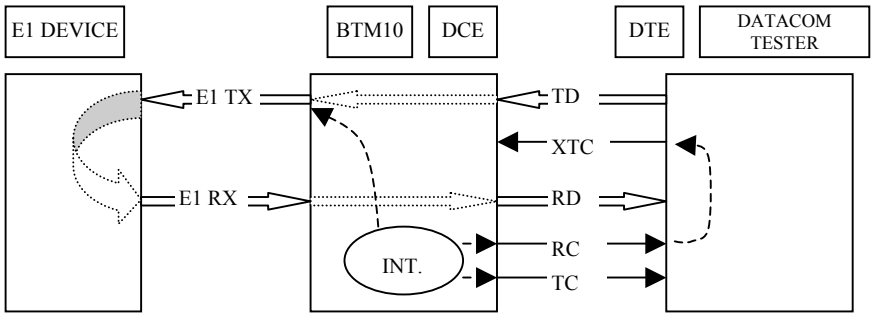
Note: TD should be synchronized with RC.

13.4 Examples

1) **BTM10** Configuration:
Configuration: E1(CEPT)
Channel: Full
Framing: Unframe

BTM10 Ext. Drop and Insert Configuration:
Data Port : DCE
Interface : RS-449/530/X.21
Clock Source: Internal
Datacom Tx Clk: Normal
Datacom Rx Clk: Normal

Datacom Tester Configuration:
Mode : DTE
Speed: 2048K
Tx Clock: External
Rx Clock: DPLL (or External)



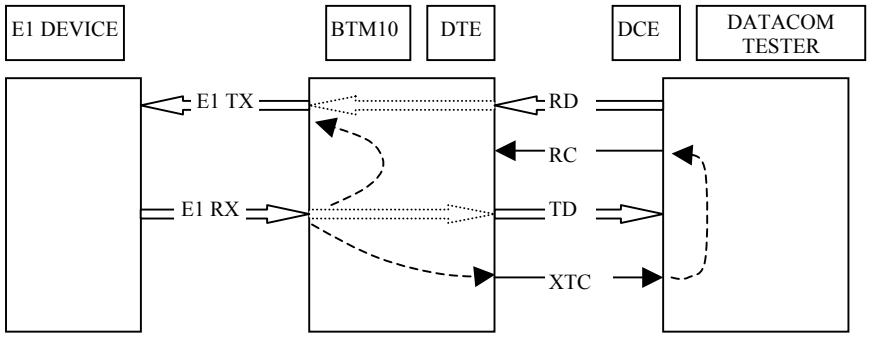
2) BTM10 Configuration:
Configuration: E1(CEPT)
Channel: n*64K
Framing: FAS+CAS
BTM10 Ext. Drop and Insert Configuration:
Data Port : DTE
Interface : RS-449/530/X.21
Clock Source: Recovery
Datacom Tx Clk : Normal
Datacom Rx Clk : Normal

```
.*******        TS:00 .:unused
********       30 timeslot(s) used
.*******
********

< Press "ENTER" key to set time
  slot used(*) or not( .)>
```

Time Slot Setting Screen

Datacom Tester Configuration:
Mode : DCE
Speed: 1920K
Tx Clock: External
Rx Clock: DPLL



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The **BTM10** has the ability to display two frames of E1 32 time slot data in real-time. One frame is FAS, the other is NFAS. From the forth menu page, press the ***F2*** key "Time Slot Map Data". The screen will display similar to the following:

```
FAS   TS0:9B AA AA AA AA AA AA AA
       TS8:AA AA AA AA AA AA AA AA
      TS16:55 AA AA AA AA AA AA AA
      TS24:AA AA AA AA AA AA AA AA
NFAS  TS0:5F AA AA AA AA AA AA AA
       TS8:AA AA AA AA AA AA AA AA
      TS16:55 AA AA AA AA AA AA AA
      TS24:AA AA AA AA AA AA AA AA
```

E1 Time Slot Map Data Screen

The **BTM10** has the ability to display two frames of T1 24 time slot data in real-time, also. The screen will display similar to the following:

```
F1    TS1 :F  AA AA AA AA AA AA AA
      TS8 :AA AA AA AA AA AA AA AA
      TS16:AA AA AA AA AA AA AA AA
      TS24:AA
F2    TS1 :F  AA AA AA AA AA AA AA
      TS8 :AA AA AA AA AA AA AA AA
      TS16:AA AA AA AA AA AA AA AA
      TS24:AA
```

T1 Time Slot Map Data Screen

For readability, the screen will pause for 0.5 second and then the data will be refreshed.

To exit the "Time Slot Map Data" function, press the ***ESC*** key.

Once you enter the display timeslot map data screen, the system will display either in "HEX mode" or "Binary mode".

F1 HEX Mode

F2 Binary Mode

The following example on this page will be display in "Binary mode", others will be display in "HEX mode".

The screen display for the E1 Mode

FAS	NFAS
TS1:1010 1010	TS1:10101010
TS2:1010 1010	TS2:10101010
TS3:1010 1010	TS3:10101010
TS4:1010 1010	TS4:10101010
TS5:1010 1010	TS5:10101010

<PgUp><PgDn> change page up/down

Press "PgUp" to return the previous page.
Press "PgDn" to go to the next page.

The screen display for the T1 Mode

```
      Frame1                Frame2
TS1:1010 1010         TS1:10101010
TS2:1010 1010         TS2:10101010
TS3:1010 1010         TS3:10101010
TS4:1010 1010         TS4:10101010
TS5:1010 1010         TS5:10101010
TS6:1010 1010         TS5:10101010

<PgUp><PgDn> change page up/down
```

Press "PgUp" to return the previous page.
Press "PgDn" to go to the next page.

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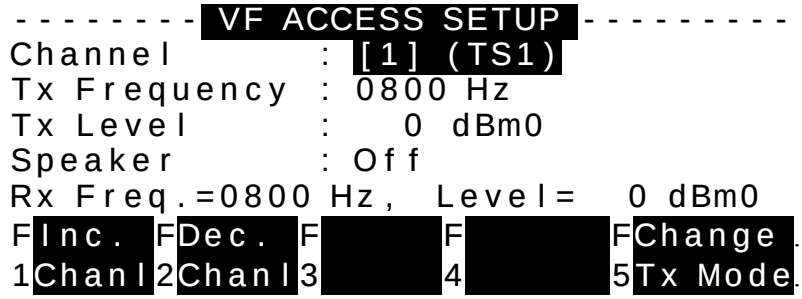
15.1 Introduction

The "VF Access" function (Voice Frequency) is used to place and monitor an audio frequency (from 60 to 3950 Hz), which is sampled by 8KHz, onto the selected time slot. To enter the "VF Access" function, press the ***F1*** key from the second menu selection page.



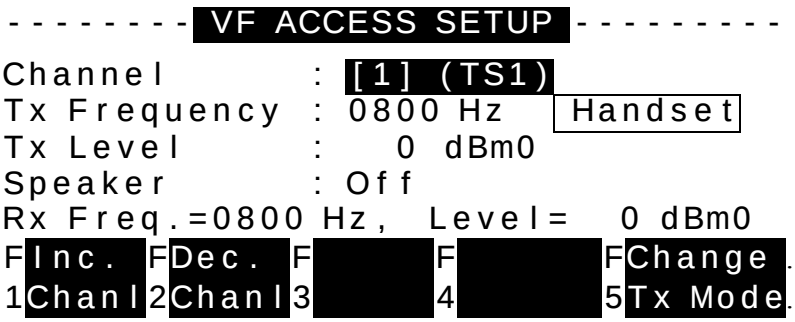
VF Access Setup Screen

15.2 Generate Voice Frequency Internal

Depending upon the VF access setting, the **BTM10** will generate a low frequency (audio sine wave) and insert it into an E1/T1 64K channel internal. The **BTM10** is also able to monitor the VF frequency and level on the same E1/T1 64K channel and output the audio to its built-in speaker.

15.3 Generate Voice Frequency by Handset

The user may press the ***F5*** key to change the voice frequency generator. Press the ***F5*** key, the **BTM10** will now use a handset as its voice generator. And the screen will be shown as follows:

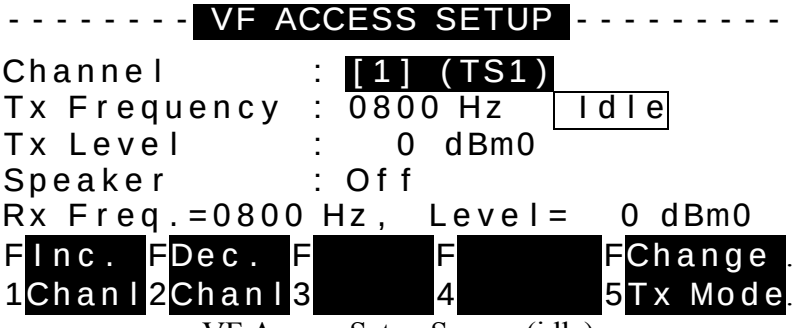


VF Access Setup Screen (use handset)

In this mode, the user may talk and listen by using an external handset. The talking voice will be inserted into a specific E1 or T1 64K channel. **BTM10** will drop this channel voice and transfer to the handset ear, also. In the meanwhile, the **BTM10** will keep monitoring the dropped voice and show its frequency and level on screen. Make sure your handset has the same pin assignment as detailed in Chapter 2 VF RJ-45 and RJ-11 pin assignment.

15.4 Keep Silent on Voice Channel

Press ***F5*** key again, will change the voice frequency generator to silent mode as shown below:



VF Access Setup Screen (idle)

BTM10 will transmit silence on that channel, and keep monitoring the dropped voice while showing its frequency and level on screen.

15.5 Operation

Depending upon the VF access setting, the **BTM10** will generate a low frequency (audio sine wave) and insert it into an E1/T1 64K channel. The **BTM10** is also able to monitor the VF frequency and level on the same E1/T1 64K channel and output the audio to its built-in speaker.

Standard editing functions apply, the up and down arrow keys will move between settings, the right and left arrow keys will modify the setting parameters. Additionally, the function keys may be used as different functions are applied to each particular setting. The meaning and available settings for this configuration function are as follows:

Setting Item	Selected parameters	Definition
Channel	From TS1 to TS31	Generate VF onto specific channel and monitor voice on the same channel.
Frequency	From 60 to 3950 Hz	Generate a specific voice frequency from 60 to 3950 Hz with a resolution of 1 Hz.
Level	From –55 to +3 dBm0	Generate the specific voice frequency at a level from –55 to +3dBm with a resolution of 5 dB.
Speaker	(1)Off	The monitor speaker is turned off.
	(2)Loud	The monitor speaker is turned on and loud.
	(3)Soft	The monitor speaker is turned on and soft.
Change Tx Mode	(1) Normal	The BTM10 generate voice frequency internal, and the screen has no flash word.
	(2) Handset	Talk and listen voice by handset, and the screen shows flash “Handset” word.
	(3) Idle	The BTM10 send silent onto channel, and the screen shows flash “Idle” word.

VF Notes:

The Rx Frequency and Level measurement will not be exact if the incoming signal level is too small or its frequency is under 100 Hz or over 3900 Hz.

Due to the small physical size and limited frequency response of the internal speaker in the **BTM10**, low frequencies below 200 Hertz will be greatly decreased in audio level.

16.1 Description

The diagnostic self tests performed by the **BTM10** are selected from the fourth menu page by the ***F5*** key. From the Self Test menu, ***F1*** and ***F2*** select the **SINGLE MODE** and **CONTINUOUS MODE** test respectively. The same tests are available under both **SINGLE MODE** and **CONTINUOUS MODE**. The difference between the two modes is that in **SINGLE MODE**, the tests are run for one pass only. In **CONTINUOUS MODE**, the tests are run repeatedly until a key is pressed when the "press any key to exit." message is displayed, the unit is powered off, or the battery becomes too low for the unit to function properly.

The tests confirm proper operation of the **BTM10**'s Central Processing Unit (CPU), the Read Only Memory (ROM), and the Random Access Memory (RAM) as well as internal loop-back tests for the communications interface. Selecting ***F3***, runs the Printer Port Test. The ***F4*** key selects the Liquid Crystal Display (LCD) for testing, while ***F5*** will test the tactile membrane Keyboard. Press the ***MORE*** key to see another menu screen page. ***F1*** selects VF DTMF test. ***F2*** selects the VF Tone test. (These tests are detailed on page 16-4.)

16.2 Self Test Single Mode

From the Page 4 MENU, select ***F5***, Self Test.

```
---------SELF TEST-----------
F1    : Self Test Single Mode
F2    : Self Test Continue Mode
F3    : Print Port Test
F4    : LCD Test
F5    : Keyboard Test
MORE  : Next Page
-------------------------------
```

Self Test Screen

Selecting ***F1*** from the Self Test Menu will run the internal test routines for one pass. The resultant display will look like this.

```
---------- SELF TEST ------------
 System ROM  :  Pass!
 System RAM  :  Pass!
 Internal -
   DTE Port  :
   DCE Port  :

----Press any key to exit.--------
```

Self Test Single results Screen

16.3 Self Test Continuous Mode

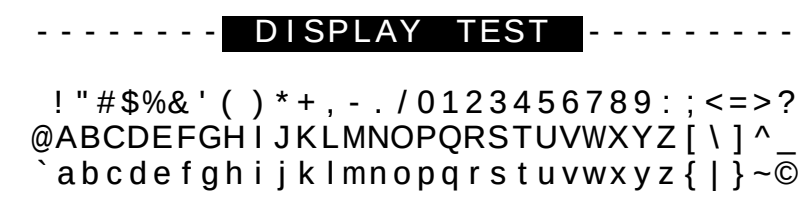
Selecting ***F2*** **Self Test Continue Mode**, from the Self Test Menu, will run the internal tests continuously, non-stop. In continuous mode, the display test is added to the test routine.

16.4 Print Port Test

Selecting ***F3*** **Print Port Test**, will print an ASCII CODE pattern of printable characters (20H---7FH) to any attached printer. If no printer is attached to the parallel port, a PRINTER BUSY message will be displayed on the LCD screen.

16.5 LCD Test

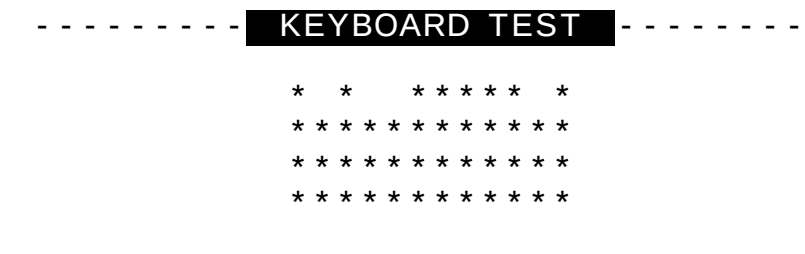
Selecting ***F4*** **LCD Test**, will test the LCD display in the following manner. All pixels will light ON and then OFF. Then the Display will show the character set with NORMAL, FLASHING, and REVERSE video attributes.



Display Test results Screen

16.6 Keyboard Test

F5 **Keyboard Test** will bring up the keyboard test from the Self Test menu. The display should resemble the following:



Keyboard Test Screen

The relative key positions will be shown on the LCD. With every press of a key on the keyboard, the relative position markers will change to a square box, indicating proper operation of the key.

To EXIT the test at any time, press ***SHIFT*** and ***ESC***.

16.7 VF Test (DTMF)

Pressing ***MORE*** from the first self test menu page will display the second test menu page as follows:

```
---------- SELF TEST ------------
F1    : VF Test (DTMF)
F2    : VF Test (Tone)
F3    :
F4    :
F5    :
MORE  : Previous Page
---------------------------------
```

Self Test, second menu screen

Please add a loop back cable between Tx and Rx.

Pressing the ***F1*** key will enter the VF (DTMF) test.

```
A-Law DTMFSpeaker louder.1234567
890#*ABCSpeaker soft.1234567890*
#ABCSpeaker off.1234567890*#AB
```

VF Test (DTMF) screen results

16.8 VF Test (Tone)

Please add a loop back cable between Tx and Rx.

Pressing the ***F2*** key will enter the VF (Tone) test.

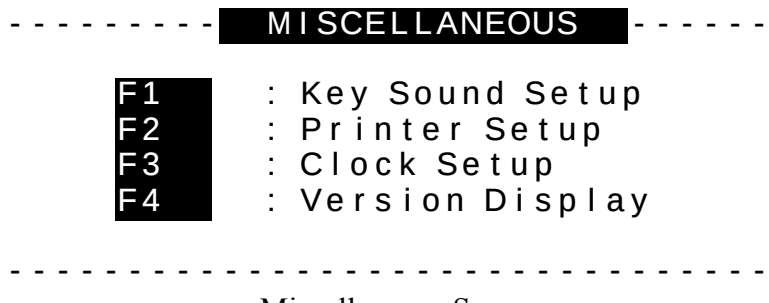
```
Tone is sending. Please loopback.
Speaker is louder.
Speaker is soft.
Speaker is off.
Frequency scanning.
```

VF Test (Tone) screen results

Press ***ESC*** to exit tests.

17.1 Description

From the Page 4 Menu, select function ***F4*** **Miscellaneous**. The following will be displayed:

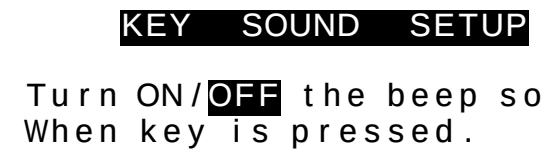


Miscellaneous Screen

The following sections will define the four miscellaneous functions.

17.2 Key Sound Setup

The beep sound when a key is depressed can be turned OFF or ON. From the Miscellaneous Menu press the ***F1*** key. The following will be displayed:

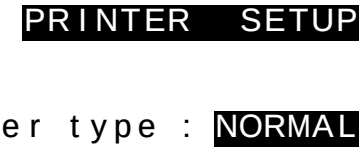


Key Sound Setup Screen

Toggle between ON and OFF, using left and right arrow keys, to enable or disable the Beep sound and then press the ***ESC*** key.

17.3 Print function setting

The mode of printing may be selected between normal or condensed print. From the Miscellaneous Menu press the ***F2*** key. The following will be displayed.

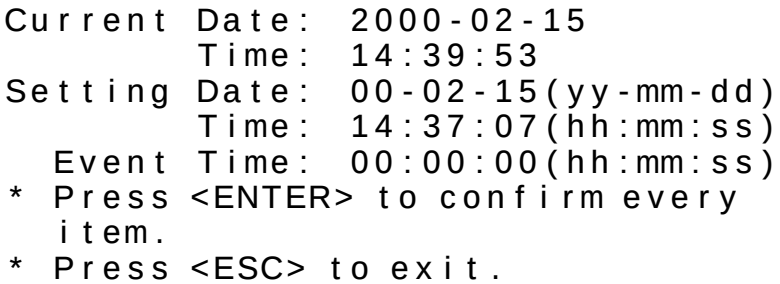


Printer Setup Screen

Toggle between NORMAL and CONDENSE, using the left and right arrow keys, to enable or disable condensed printing and then press the ***ESC*** key.

17.4 Clock Setup

The internal clock of the **BTM10** may be set through this menu. From the Miscellaneous Menu press the ***F3*** key. The following will be displayed:



Clock Setup Screen

From the cursor position, either change the entry or press ***ENTER*** to accept the current value. Only the fields for setting date & time and the event time may be edited. Press ***ESC*** anytime to exit. In order for changes to be saved, you must press ***ENTER*** on all of the remaining fields.

After completing all of the entry fields, the "**Press <F1> key to confirm this function**" message will be displayed. By confirming this function, the entry placed in the "setting date" and "time" fields will become the **BTM10**'s current date and time. When the event time equals the current time, any process you may be running, such as an emulation program, will stop automatically.

17.5 Version Display

The hardware, software versions, and serial number of the **BTM10** may be displayed through this function. Press the ***F4*** key from the miscellaneous menu, a similar screen will be displayed:

```
Firmware version: 4.19-0F
Hardware version: L2.4 + L3.4
Serial Number   : 1234567
< press any key to exit >
```

Version Display Screen

Press any key to exit back to the miscellaneous menu. Press the ***ESC*** key to exit the miscellaneous menu.

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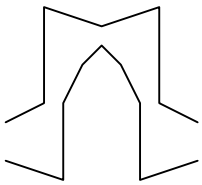
18.1 Introduction

The **BTM10** has the ability to analysis the incoming E1/T1 pulse shape. According to the specification of ITU-T G.703 or ANSI T1.403, the **BTM10** will draw the incoming pulse shape in graphics on the LCD and do a pulse shape analysis. The **BTM10** will show a "Good!" comment when the pulse shape meets the standards, otherwise it will issue a "No Good!" comment. After you enter this function, you should see a screen similar to the following:



Good!

(F1) Change Mask
(F2) Re-Trigger
(F3) Print out
(F4) Mask On
(F5) Mask Off

Pulse Shape Display Screen

If the received frequency is not the same as standard E1/T1 or the signal level is too small, the **BTM10** will not accept the signal for analysis. The function may also be unavailable if the incoming pulses are few or the data is without continuous ones. Make sure there are enough continuous pulses (ones) on the incoming E1/T1 RX port. The recommend received testing pattern is all ones.

If the power of the built-in battery is weak, the LED may indicate a battery low condition. In this case the test result may also be incorrect. Please recharge the battery or test with the external power adapter plugged into the **BTM10**.

18.2 Function Keys

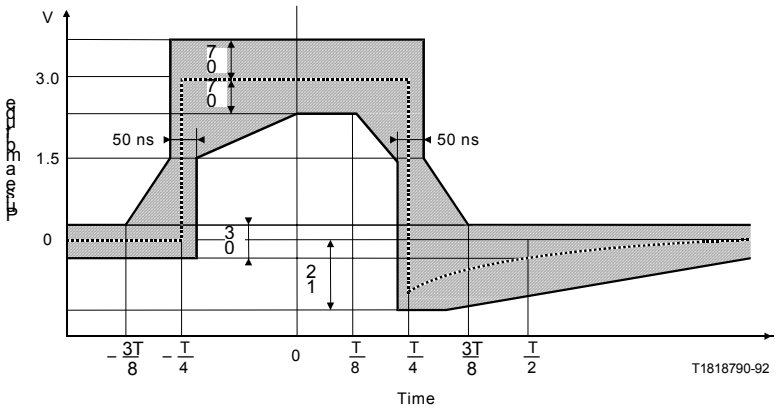
There are four functions, which you may select, shown on the right side of the screen. The meaning of each function is shown in the following table:

Function	Meaning
[F1] Change Mask	Change mask specification. (T1 only)
[F2] Re-Trigr	Re-Sync and re-trigger measurement.
[F3] Print out	Print out the current pulse shape.
[F4] Mask on	Show both pulse shape and ITU-T G.703 or ANSI T1.403 mask.
[F5] Mask off	Show only the pulse shape.

Note: You may also press the left or right arrow keys to move the mask slightly left or right.

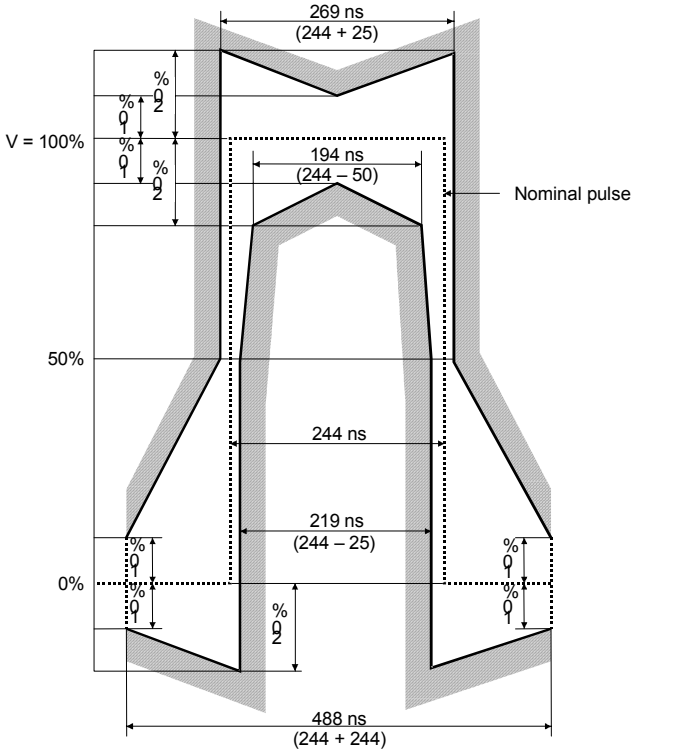
To exit this function, press the ***ESC*** key.

T1 standard pulse shape is as follows:



Pulse mask for interface at 1544 kbit/s

E1 standard pulse shape is as follows:



Note – V corresponds to the nominal peak value.

Mask of the pulse at the 2048 kbit/s interface

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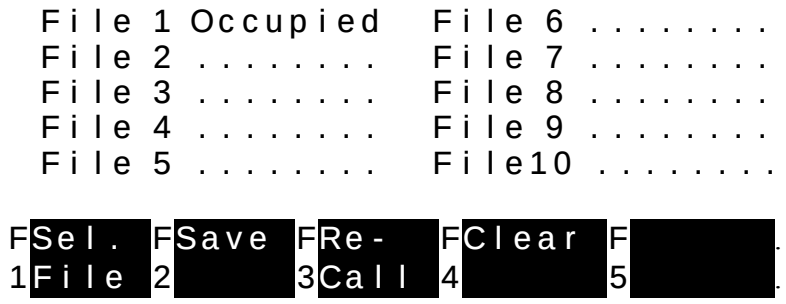
19.1 Introduction

The **BTM10** is capable of storing configuration and BERT results into its internal memory. You may recall this data from memory at a later date. There are ten locations where the data can be stored. This function is useful for retaining different field test and analysis results. The results will remain in memory even after you turn the unit power off. To enter this function, press the ***F3*** key from the fourth menu page. A screen will be displayed similar to the following:



File Manager Display Screen

19.2 Operation

There will be a flashing cursor at the beginning of one of the ten file locations. The cursor position indicates the selected file. You may then take one of the following actions, **Save**, **Recall**, or **Clear**, simply by pressing the appropriate function key. If a file location is occupied with previously saved data, its line will show the "Occupied" message. Empty file locations will show as a dotted line.

If a file location is "Occupied", the only operations allowed are to **Recall** or **Clear**. The **Recall** operation will restore the selected file location's contents into the **BTM10**'s working memory. The **Clear** operation will erase the file location contents, freeing it for further **Saves**.

If the file location is empty, you may only do a **Save** operation, as there is no data to **Clear** or **Recall**. The **Save** will immediately take the working memory contents and place them into the selected file location for later **Recall** or **Clear**.

The meaning of each function is shown in the following table:

Function	Meaning
[F1] Sel. File	Moves the flashing cursor to the next file location.
[F2] Save	Saves current configuration parameter and BERT test results to the location indicated by the flashing cursor.
[F3] Re-call	Recalls the stored data from internal file memory location indicated by the flashing cursor.
[F4] Clear	Clears the file data from the location indicated by the flashing cursor.

Note:

You may also use the up and down arrow keys to move flashing cursor's position.

To exit this function, press the ***ESC*** key.

20.1 Introduction

When the E1/T1 RX port recovered clock is different from Ext/Ref port recovery clock, the frame timing may become misaligned or may "Slip". The **BTM10** is able to measure the differences in the clocks whether due to faster or slower recovered clocks or due to jitter (short term variations of the digital signal from their ideal positions in time) from the clock. There are three Slip parameters that may be measured by the **BTM10**; uncontrolled Slip, frame Slip and timing Slip. The function is entered by pressing the ***F1*** key from the fifth menu page. A screen similar to the following will be displayed:

```
SLIP:          Elapsed:00d00h00m10s
Uncontrolled SLIP              0


Frame SLIP                     0
Timing SLIP                    0
```

SLIP Measurement Display Screen

Uncontrolled SLIP:

This is the count of uncontrolled SLIP. It indicates that the E1/T1 RX port has received signal with underrun or overflow caused by jitter or out of tolerance clock from the **BTM10**'s default. The result is an uncontrolled jitter data slip. This value is the sum total of all uncontrolled SLIPs.

Frame SLIP:

This is the count of controlled +/- 1 frame SLIP. It indicates that the E1/T1 RX port recovered clock is different from Ext/Ref port recovery clock and that the **BTM10**'s receiver caused a whole frame of data to slip. The value shown is the sum of the total frame SLIPs.

Timing SLIP:

This is the count of timing SLIP (or frequency SLIP). It indicates that the E1/T1 RX port recovered clock is different from the Ext/Ref port recovery clock. This value is the total difference in timing measured in Hertz.

20.2 Operation

Press the ***F1*** key from the fifth menu page, measurement will start and continue. If you want to clear the counters, simply press the ***RUN*** key again.

If the E1/T1 RX port has no incoming signal, all of the counters will show the "……" message. The **BTM10** takes these measurements from the E1/T1 RX port signal.

If the Ext/Ref port does not have any incoming signal, the counters of frame SLIP and timing SLIP will show the "no ext clk" message. This shows that these two measurements are dependent upon the difference between the Ext/Ref port signal and E1/T1 RX port signal. When the **BTM10** Ext/Ref port is set to PCM, the clock signal is detected and derived from the E1/T1 signal. If the Ext/Ref port is set to TTL mode, the **BTM10** will be unable to determine if Ext/Ref signal is present. In this case the "no ext clk" message will not be displayed even when lacking a TTL input clock signal.

To exit this function, press the ***ESC*** key.

21.1 Introduction

The actual function of the REMOTE CONTROL utility is to provide the PC with a terminal emulation ability. This utility may be found on the accessory floppy diskette and is designed to run in a pure DOS ™ mode only. The remote functions may also be run from a stand alone terminal or by using a different terminal emulation program on your PC such as a VT100™ emulator or Windows 9X™ HyperTerminal™, by Hilgraeve.

The remote PC can control the **BTM10** by direct connection or via dial-up MODEM as displayed in the following figures.

Figure 21-1 Direct Connection

Figure 21-2 Dial-up MODEM Connection

Direct connection is made between the PC's communication port, COM1:, COM2:, COM3:, or COM4:, and the male DB9 Remote Control port connector on the **BTM10** with the supplied Remote cable. As the **BTM10**'s Remote Control Port is DCE, a null modem cable must be used when using a dial-up connection. (Refer to ***Appendix B*** for cable pinouts).

When using REMOTE CONTROL or other terminal emulation program to connect to the **BTM10**, the following functions of the **BTM10** may be controlled remotely:

1. Configuration Setup.
2. BERT Test and Analysis.
3. Reset System.
4. Timeslot Setup
5. VF Access
6. Signal Result
7. Loopback Setup
8. Signaling Setup
9. Round Trip Delay
10. Alarm
11. User Program Pattern
12. Miscellaneous
13. Optional Features, such as SS7, ISDN, V5.1/V5.2 Analysis

21.2 Remote Port Setup

You can enter this setup menu by pressing the **F2** key from main menu page 3. The screen will show a display similar to the following:

```
-----Remote Port Setup-------
Baud              : 9600
Data Bits         :[8     ]
Parity            :[None  ]
```

Remote Port Setup Display Screen

Pressing the Right or Left Arrow keys will change the remote port baud rate. The available remote port baud rates are 300, 600,

1200, 2400, 4800, 9600, 19200, and 38400 bps. The data bits and parity are set to 8 and none respectively and cannot be changed.

21.3 Operation

Operating the **BTM10** remotely via the Remote Port simply involves connecting the **BTM10** as shown in figure 21-1 or 21-2 and running a terminal emulation program on the remote PC. The remote PC must set its RTS (signal 105) and DTR (signal 108) to active (space, 0) and use the same baud rate, data bit, and parity settings to control the **BTM10**.

When powered on, the **BTM10** will initialize and check for an active connection on its Remote Port. After the **BTM10** initials Remote Port, pressing the space bar twice on the PC or the terminal will display the remote screen. There are totally four pages for the main menu. They will be displayed as following :

```
*BTM-10 MAIN MENU*  P1
1)CONFIG. SETUP
2)BERT ANALYSIS
3)RESET SYSTEM
4)ALARM
5)LOOPBACK SETUP
0)EXIT
+:PGDN -:PGUP
*SELECT 0-5
```

Remote Control Page 1 -- PC Display Screen

```
*BTM-10 MAIN MENU*  P2
1)VF ACCESS
2)PULSE SHAPE
3)SIGNAL RESULT
4)SIGNALING SETUP
5)USER PROGRAM PATTERN
0)EXIT
+:PGDN -:PGUP
*SELECT 0-5
```

Remote Control Page 2 -- PC Display Screen

```
*BTM-10 MAIN MENU*  P3
1)TIME SLOT SETUP
2)TIME SLOT MAP DATA
3)MISCELLANEOUS
4)CLOCK SETUP
5)LED STATUS
0)EXIT
+:PGDN -:PGUP
*SELECT 0-5
```

Remote Control Page 3 -- PC Display Screen

```
*BTM-10 MAIN MENU*  P4
1)SS7 ANALYSIS
2)ISDN ANALYSIS
3)V5.1/V5.2 ANALYSIS
4)ROUND TRIP DELAY
4)SIGNALING DISPLAY
0)EXIT
+:PGDN -:PGUP
*SELECT 0-5
```

Remote Control Page 4 -- PC Display Screen

To exit, press the zero key on PC. The **BTM10** will disable CTS/DSR and DTR, wait 2 seconds and then exit. If you are using modem connections, they will automatically hang up when DTR drops.

Pressing the "1" key will enter the Configuration Setup function. Pressing the "2" key will enter the BERT Analysis function. Pressing the “3” key will enter the System Reset function...

After entering a sub-function, you may type in any of the commands which are shown on the remote PC screen. The **BTM10** will execute the appropriate action and send an "OK" message to the remote PC. If a command is incorrectly entered, the remote PC will receive the "ERROR COMMAND, TRY AGAIN!" message from the **BTM10**.

Pressing the "0" key will escape the current sub-function and return to the main menu.

The following display is an example of the Configuration Setup sub-function. The commands all consist of two letters, one number key combinations. Please refer to 21.4.2 for a complete list of the Configuration Setup commands.

```
*CONFIG SETUP*'     P1-1
CF1,CF2,CH1~3,CO1,CO2,CR1,CR2,
EB1~5,ET1~4,FM1~5,ID1~4,IE1~6,
LB1~9,LI1~6,PA1~9,PAA~M,TT1~4
*COMMAND/0/SPACE?
```

(Configuration Setup)
Remote PC Display Screen

The following display is an example of the BERT Analysis sub-function. The commands all consist of two letters, one number key combinations. Please refer to 21.4.3 for a complete list of the BERT Analysis commands.

```
*BERT ANALYSIS*
CO1,CO2,CR1,CR2,ET1~4,FM1~5,
FR1,IE1~6,LB1~9,LI1~6,PA1~9,
PAA~M,RS1,RT1,SH1~7,TT1~4
*COMMAND/0/SPACE?
```

(BERT Analysis)
Remote PC Display Screen

The following is the System Reset sub-function. Please refer to 21.4.4 for a complete list of the BERT Analysis commands.

```
*RESET SYSTEM*
*YES/0/SPACE?
```

(Reset System)
Remote PC Display Screen

The following is the Alarm sub-function. Please refer to 21.4.5 for a complete list of the BERT Alarm commands.

```
*Alarm*    P1-4
AI1,AI2,AI3,RA1,RA2,RA3,
MR1,MR2,MR3,SL1,SL2,SH1
*COMMAND/0/SPACE?
```

The following display is after you keyin the "SH1" as the command and press "ENTER" button.

```
Alarm Generate:[AIS           ]
Mode:[OFF ]
```

(Alarm)
Remote PC Display Screen

The following display is an example of the Loopback Setup sub-function. Please refer to 21.4.6 for a complete list of commands.

```
*LOOPBACK SETUP*
LD:LOOP DOWN
LU:LOOP UP
*COMMAND/0/SPACE?
```

(Loopback Setup)
Remote PC Display Screen

The following display is an example of the VF Access sub-function. Please refer to 21.4.7 for a complete list of the VF Access commands.

```
*VF Access*'
CT1~CT3,H0060~H3950,SH1,SK1~SK3,
T01~T31,TL1~TLC
*COMMAND/0/SPACE?
```

(VF Access)
Remote PC Display Screen

After entering the SH1(show) command, the **BTM10** will send out the following message:

```
Channel      : [1] (TS1)
Tx Frequency : 3904 Hz
Tx Level     : -10 dBm0
Speaker      : Off
Rx Freq.=  3904 Hz, Level= -10  dBm0
```

(VF Access Status)
Remote PC Display Screen

The following display is an example of the Pulse Shape sub-function. It includes current setting status and testing result. Please refer to 21.4.8 for a complete list of the Pulse Shape commands.

```
*PULSE SHAPE*
1)Change Mask
2)Re-Trigger
3)Print Out
*SELECT 0-3/SPACE?
```

The following display is after you press "2" button.

```
Please wait…
Good!(G.703)
```

(Pulse Shape)
Remote PC Display Screen

The following display is an example of the Signal Result sub-function. It includes current setting status and testing result. Please refer to 21.4.9 for a complete list of the Signal Result commands.

```
*SINGNAL RESULT*
Receive Level : +00 dBdsx
                06.00 Volts p-p
RX Frequency    : 02048000 Hz
RX Freq. Offset :  0000 ppm
EXT Frequency   : 02048001 Hz
EXT Freq. Offset:  00001 Hz
*SPACE=TESTING NEW RESULT*
*0/SPACE?
```

(Signal Result Status)
Remote PC Display Screen

The following display is an example of the Signaling Bits Setup sub-function. Please refer to 21.4.10 for a complete list of the Signaling Bits Setup commands. Whenever setting up the timeslot signaling bits, the screen will get the last modified timeslot signaling bits status.

```
*SIGNALING SETUP*
--- TS [01] ABCD BITS [1010] ---
COMMAND: T010001 ~ T311111
*COMMAND/0/SPACE?
```

(Signaling Bits Setup)
Remote PC Display Screen

The following display is an example of the User Program Pattern sub-function. Please refer to 21.4.11 for a complete list of the commands.

```
*User Program Pattern*    P2-5
SH1,UP1~3,L01~32,P00000000~PFFFFFFFF
*COMMAND/0/SPACE?
```

The following display is after you keyin the "SH1" as the command and press "ENTER" button.

```
User Pattern #1:
Size : [08]
Pattern:10000000........................
```

The following display is an example of the Timeslot Setup sub-function. The commands all consist of four letters, timeslot setting command includes two number key combinations. Please refer to 21.4.12 for a complete list of the Timeslot Setup commands.

```
*TIMESLOT SETUP*
SHOW,T01I~T31I,T01P~T31P,
T01U~T31U
*COMMAND/0/SPACE?
```

(Timeslot Setup)
Remote PC Display Screen

After entering the SHOW command, the **BTM10** will send out a timeslot mapping message similar to the following:

```
T01~07: F  *  *  *  *  *  *  *
T08~15: *  *  *  *  *  *  *  *
T16~23: *  *  *  *  *  *  *  *
T24~31: *  *  *  *  *  *  *  *
```

(Timeslot Setup Status)
Remote PC Display Screen

The following display is an example of the Miscellaneous sub-function. Please refer to 21.4.14 for a complete list of the commands.

```
*MISCELLANEOUS*    P3-3
KS1~2,PS1~2,SH1~2
*COMMAND/0/SPACE?
```

The following display is after you keyin the "SH1" as the command and press "ENTER" button.

```
Key Sound: ON
Printer type : Normal
```

The following display is after you keyin the "SH2" as the command and press "ENTER" button.

```
Firmware version: 4.65-10
Hardware version: L2.4 + L3.4
Serial Number   : 3000069
```

The following display is an example of the Clock Setup sub-function. Please refer to 21.4.15 for a complete list of the commands.

```
*CLOCK SETUP*    P3-4
Current: Date:2002-12-10
         Time: 20:00:04
Setting Date(yy-mm-dd):02-12-10
Setting Time(hh-mm-ss):19-00-00
```

The following display is an example of the LED Status sub-function. It includes current setting status and testing result. Please refer to 21.4.16 for a complete list of the LED Status commands.

```
*LED STATUS*
*0/SPACE?
```

(LED Status)
Remote PC Display Screen

The following display is an examples of error messages showing on E1 received signal loss, frame loss, pattern loss, excess zero error, one density, AIS, SLIP, yellow alarm, RAI, MRAI, and other errors.

```
* LED Status (E1)*
OK
** '0' to exit **

* LED Status (E1)*
Signal Loss
** '0' to exit **

* LED Status (E1)*
Pattern Loss/Error
** '0' to exit **
```

(LED Status)
Remote PC Display Screen

The following display is an example of the SS7 Analysis sub-function (optional). It includes current setting status and testing result. Please refer to 21.4.17 for a complete list of the SS7 Analysis commands.

```
*SS7 Analysis*
SHOW,PGUP,PGDN,END,HOME
*COMMAND/0/SPACE?
```

(SS7 Analysis)
Remote PC Display Screen

The ISDN-D Channel Analysis (optional) and V5.1/V5.2 Analysis (optional) sub-functions are similar to SS7 Analysis.

The following display is an example of the Round Trip Delay sub-function. It includes current setting status and testing result. Please refer to 21.4.20 for a complete list of the Round Trip Delay commands.

```
*ROUND TRIP DELAY* P4-4
T01~T31,WT1~WT3,SH1,R
*COMMAND/0/SPACE?
```

(Round Trip Delay)
Remote PC Display Screen

The following display is an example of the Signaling Display sub-function. Please refer to 21.4.21 for a complete list of the Signaling Display commands.

```
*SIGNALING DISPLAY*    P4-5
MA:0000 08:1010 XY:1011 24:1010
01:1010 09:1010 17:1010 25:1010
02:1010 10:1010 18:1010 26:1010
03:1010 11:1010 19:1010 27:1010
04:1010 12:1010 20:1010 28:1010
05:1010 13:1010 21:1010 29:1010
06:1010 14:1010 22:1010 30:1010
07:1010 15:1010 23:1010 31:1010

*SPACE=NEW DATA*
*COMMAND/0/SPACE?
```

21.4 Commands

21.4.1 Main Menu Setup Command List:

<space> Shows the current page again.
<0> Initials MODEM, exits remote control function.
<1> Enters Configuration Setup.
<2> Enters BERT Analysis.
<3> Enters Reset System.
<4> Enters Alarm.
<5> Enters Loopback Setup.
<6> Enters VF Access.
<7> Enters Pulse Shape.
<8> Enters Signal Result.
<9> Enters Signal Setup.
<10> Enters User Program Pattern.
<11> Enters Time Slot Setup.
<12> Enters Time Slot Map Data.
<13> Enters Miscellaneous.
<14> Enters Clock Setup.
<15> Enters LED Status.
<16> Enters SS7 Analysis.
<17> Enters ISDN Analysis.
<18> Enters V5.1/V5.2 Analysis.
<19> Enters Round Trip Delay

21.4.2 Configuration Setup Command List:

<space> Shows current page again.
<0> Escapes to main menu.
<CF1> Sets to E1 configuration mode.
<CF2> Sets to T1 configuration mode.
<CH1> Sets to Full channel mode.
<CH2> Sets to n*64K channel mode.

(Configuration Setup Command list continued)

<CH3> Sets to n*56K channel mode. (T1)
<CO1> Sets code to HDB3 mode (E1) or B8ZS mode (T1).
<CO2> Sets code to AMI mode.
<CR1> Sets CRC enable.
<CR2> Sets CRC disable.
<EB1> Sets E-bit to Automatic mode. (E1)
<EB2> Sets E-bit to Manual 11 mode. (E1)
<EB3> Sets E-bit to Manual 10 mode. (E1)
<EB4> Sets E-bit to Manual 01 mode. (E1)
<EB5> Sets E-bit to Manual 00 mode. (E1)
<ET1> Sets error type to Logic.
<ET2> Sets error type to Frame.
<ET3> Sets error type to CRC.
<ET4> Sets error type to BPV.
<FM1> Sets to FAS only mode (E1) or ESF mode (T1).
<FM2> Sets to FAS+CAS mode (E1) or SF/D4 mode (T1).
<FM3> Sets to Unframe mode (E1) or SLC96 mode (T1).
<FM4> Sets to T1DM mode (T1).
<FM5> Sets to Unframe mode (T1).
<ID1> Sets default idle timeslot to Fill 7EH mode.
<ID2> Sets default idle timeslot to Fill 7FH mode.
<ID3> Sets default idle timeslot to Fill FFH mode.
<ID4> Sets default idle timeslot to Pass Thru mode.
<IE1> Sets insert error rate to Single.
<IE2> Sets insert error rate to 1e-3.
<IE3> Sets insert error rate to 1e-4.
<IE4> Sets insert error rate to 1e-5.
<IE5> Sets insert error rate to 1e-6.
<IE6> Sets insert error rate to 1e-7.
<LB1> Sets LBO to 0dB.
<LB2> Sets LBO to -7.5dB.
<LB3> Sets LBO to -15dB.
<LB4> Sets LBO to -22.5dB.

(Configuration Setup Command list continued)

<LB5> Sets LBO to 0-133 Ft. (T1)
<LB6> Sets LBO to 133-266 Ft. (T1)
<LB7> Sets LBO to 266-399 Ft. (T1)
<LB8> Sets LBO to 399-533 Ft. (T1)
<LB9> Sets LBO to 533-655 Ft. (T1)
<LI1> Sets line interface to terminate 75 ohm (E1) or terminate 100 ohm (T1).
<LI2> Sets line interface to terminate 120 ohm (E1) or Bridge 100 ohm (T1).
<LI3> Sets line interface to Bridge 75 ohm (E1) or Monitor 100 ohm (T1).
<LI4> Sets line interface to Bridge 120 ohm (E1).
<LI5> Sets line interface to Monitor 75 ohm (E1).
<LI6> Sets line interface to Monitor 120 ohm (E1).
<PA1> Sets pattern to 63.
<PA2> Sets pattern to 127.
<PA3> Sets pattern to 511.
<PA4> Sets pattern to 2047.
<PA5> Sets pattern to 2e15 standard.
<PA6> Sets pattern to 2e15 non-standard.
<PA7> Sets pattern to 2e20 standard.
<PA8> Sets pattern to 2e20 non-standard.
<PA9> Sets pattern to QRSS.
<PAA> Sets pattern to 2e23 standard.
<PAB> Sets pattern to 2e23 non-standard.
<PAC> Sets pattern to All 1 (mask).
<PAD> Sets pattern to All 0 (space).
<PAE> Sets pattern to 0101 (alternate).
<PAF> Sets pattern to 3 in 24.
<PAG> Sets pattern to 1 in 16.
<PAH> Sets pattern to 1 in 8.
<PAI> Sets pattern to 1 in 4.
<PAJ> Sets pattern to User Programmable #1.

(Configuration Setup Command list continued)

<PAK> Sets pattern to User Programmable #2.
<PAL> Sets pattern to User Programmable #3.
<PAM> Sets pattern to LIVE.
<TT1> Sets Tx Timing to Internal mode.
<TT2> Sets Tx Timing to Recovery mode.
<TT3> Sets Tx Timing to External mode.
<TT4> Sets Tx Timing to Data Port mode.
<TT5> Set Tx Timing to +50 ppm
<TT6> Set Tx Timing to –50 ppm
<PE1> Set Print On Error to Disable
<PE2> Set Print On Error to Enable
<BM1> Set Beep Mode to Disable
<BM2> Set Beep Mode to Enable
<TP1> Set Test Period to Continuous
<TP2> Set Test Period to 1 Minute
<TP3> Set Test Period to 15 Minute
<TP4> Set Test Period to 30 Minute
<TP5> Set Test Period to 1 Hour
<TP6> Set Test Period to 24 Hour
<PI1> Set Print Interval to Disable
<PI2> Set Print Interval to ..5 Min
<PI3> Set Print Interval to ..10 Min
<PI4> Set Print Interval to ..15 Min
<PI5> Set Print Interval to ..30 Min
<PI6> Set Print Interval to ..60 Min
<SE1> Set Sensitivity to High
<SE2> Set Sensitivity to Low
<HI1> Set Histogram Store to Off
<HI2> Set Histogram Store to 1 Min
<HI3> Set Histogram Store to 2 Min
<HI4> Set Histogram Store to 30 Min

21.4.3 BERT Analysis Command List:

<Space> Shows current page again.
<0> Escapes to main menu.
<CO1> Sets code to HDB3 mode (E1) or B8ZS mode (T1).
<CO2> Sets code to AMI mode.
<CR1> Sets CRC enable.
<CR2> Sets CRC disable.
<ET1> Sets error type to Logic.
<ET2> Sets error type to Frame.
<ET3> Sets error type to CRC.
<ET4> Sets error type to BPV.
<FM1> Sets to FAS only mode (E1) or ESF mode (T1).
<FM2> Sets to FAS+CAS mode (E1) or SF/D4 mode (T1).
<FM3> Sets to Unframe mode (E1) or SLC96 mode (T1).
<FM4> Sets to T1DM mode (T1).
<FM5> Sets to Unframe mode (T1).
<FR1> Force one error.
<IE1> Sets insert error rate to Single.
<IE2> Sets insert error rate to 1e-3.
<IE3> Sets insert error rate to 1e-4.
<IE4> Sets insert error rate to 1e-5.
<IE5> Sets insert error rate to 1e-6.
<IE6> Sets insert error rate to 1e-7.
<LB1> Sets LBO to 0dB.
<LB2> Sets LBO to -7.5dB.
<LB3> Sets LBO to -15dB.
<LB4> Sets LBO to -22.5dB.
<LB5> Sets LBO to 0-133 Ft. (T1)
<LB6> Sets LBO to 133-266 Ft. (T1)
<LB7> Sets LBO to 266-399 Ft. (T1)
<LB8> Sets LBO to 399-533 Ft. (T1)
<LB9> Sets LBO to 533-655 Ft. (T1)

(BERT Analysis Command list continued)

<LI1> Sets line interface to terminate 75 ohm (E1) or terminate 100 ohm (T1).
<LI2> Sets line interface to terminate 120 ohm (E1) or Bridge 100 ohm (T1).
<LI3> Sets line interface to Bridge 75 ohm (E1) or Monitor 100 ohm (T1).
<LI4> Sets line interface to Bridge 120 ohm (E1).
<LI5> Sets line interface to Monitor 75 ohm (E1).
<LI6> Sets line interface to Monitor 120 ohm (E1).
<PA1> Sets pattern to 63.
<PA2> Sets pattern to 127.
<PA3> Sets pattern to 511.
<PA4> Sets pattern to 2047.
<PA5> Sets pattern to 2e15 standard.
<PA6> Sets pattern to 2e15 non-standard.
<PA7> Sets pattern to 2e20 standard.
<PA8> Sets pattern to 2e20 non-standard.
<PA9> Sets pattern to QRSS.
<PAA> Sets pattern to 2e23 standard.
<PAB> Sets pattern to 2e23 non-standard.
<PAC> Sets pattern to All 1 (mask).
<PAD> Sets pattern to All 0 (space).
<PAE> Sets pattern to 0101 (alternate).
<PAF> Sets pattern to 3 in 24.
<PAG> Sets pattern to 1 in 16.
<PAH> Sets pattern to 1 in 8.
<PAI> Sets pattern to 1 in 4.
<PAJ> Sets pattern to User Programmable #1.
<PAK> Sets pattern to User Programmable #2.
<PAL> Sets pattern to User Programmable #3.
<PAM> Sets pattern to LIVE.
<RS1> ReSync E1/T1 RX.
<RT1> Reset test result.

(BERT Analysis Command list continued)
<SH1> Show current configuration settings
<SH2> Show BRIEF testing result.
<SH3> Show LOGIC testing result.
<SH4> Show FRAME testing result.
<SH5> Show CRC testing result.
<SH6> Show BPV testing result.
<SH7> Show LED status.
<SH8> Show History LED Status.
<SH9> Clear History and Show Now LED Status.
<TT1> Sets Tx Timing to Internal mode.
<TT2> Sets Tx Timing to Recovery mode.
<TT3> Sets Tx Timing to External mode.
<TT4> Sets Tx Timing to Data Port mode.
<TP5> Set Test Period to 1 Hour
<TP6> Set Test Period to 24 Hour

21.4.4 System Reset Command List:

<space> Shows current page again.
<0> Escapes to main menu.
<YES> Reset BTM10 system.

21.4.5 Alarm Command List:

<Space> Shows current page again.
<0> Escapes to main menu.
<AI1> Set Alarm to AIS OFF
<AI2> Set Alarm to AIS ON
<AI3> Set Alarm to AIS AUTO (Only E1)
<RA1> Set Alarm to Remote(RAI) OFF (Only E1)
<RA2> Set Alarm to Remote(RAI) ON (Only E1)
<RA3> Set Alarm to Remote(RAI) AUTO (Only E1)
<MR1> Set Alarm to Multi Remote(MRAI) OFF (Only E1)

(Alarm Command list continued)

<MR2> Set Alarm to Multi Remote(MRAI) ON (Only E1)
<MR3> Set Alarm to Multi Remote(MRAI) AUTO (Only E1)
<SL1> Set Alarm to Signal Loss OFF
<SL2> Set Alarm to Signal Loss ON
<YL1> Set Alarm to Yellow(RAI) OFF (Only T1)
<YL2> Set Alarm to Yellow(RAI) ON (Only T1)
<SH1> Show Alarm setting

21.4.6 Loopback Setup Command List:

<Space> Shows current page again.
<0> Escapes to main menu.
<LD1> Starts generation loop down code.
<LU1> Starts generating loop up code.
<LT1> Set In-Band
<LT2> Set Out-Band (ESF Only)
<LC1> Set LoopBack code type to LINE(CSU)
<AR1> Set AUTO RESPONSE to Off. (OUT-BAND only)
<AR2> Set AUTO RESPONSE to On. (OUT-BAND only)
<LC2> Set LoopBack code type to SMATRJACK(4) (IN-BAND only)
Set LoopBack code type to PAYLOAD(CSU) (OUT-BAND only)
<LC3> Set LoopBack code type to SMARTJACK(5) (IN-BAND only)
Set LoopBack code type to SMARTJACK (OUT-BAND only)
<LC4> Set LoopBack code type to USER PROGRAM (IN-BAND only)
<TL1> Set TESTER LINE LOOPED to Down
<TL2> Set TESTER LINE LOOPED to Up
<TP1> Set TESTER PAYLOAD LOOPED to Down. (OUT-BAND only)

(Loopback Command list continued)

<TP2> Set TESTER PAYLOAD LOOPED to Up. (OUT-BAND only)
<FR1> Set FRIMING to Inserted. (IN-BAND only)
<FR2> Set FRIMING to Overwrites (IN-BAND only)
<SH1> Show LOOPBACK Setup parameters

21.4.7 VF Access Command List:

<Space> Shows current page again.
<0> Escapes to main menu.
<CT1> Sets Tx mode to normal.
<CT2> Sets Tx mode to handset.
<CT3> Sets Tx mode to idle.
<H0060> Sets Tx Frequency to 60 Hz.
<H0061> Sets Tx Frequency to 61 Hz.
...
<H3950> Sets Tx Frequency to 3950 Hz.
<SH1> Shows VF Access result.
<SK1> Sets speaker to off mode.
<SK2> Sets speaker to soft mode.
<SK3> Sets speaker to loud mode.
<T01> Sets VF access on timeslot 1.
<T02> Sets VF access on timeslot 2.
<T03> Sets VF access on timeslot 3.
...
<T31> Sets VF access on timeslot 31.
<TL1> Sets Tx Level to 0 dBm0.
<TL2> Sets Tx Level to -5 dBm0.
<TL3> Sets Tx Level to -10 dBm0.
<TL4> Sets Tx Level to -15 dBm0.
<TL5> Sets Tx Level to -20 dBm0.
<TL6> Sets Tx Level to -25 dBm0.
<TL7> Sets Tx Level to -30 dBm0.
<TL8> Sets Tx Level to -35 dBm0.
<TL9> Sets Tx Level to -40 dBm0.

(VF Access Command list continued)

<TLA> Sets Tx Level to -45 dBm0.
<TLB> Sets Tx Level to -50 dBm0.
<TLC> Sets Tx Level to -55 dBm0.

21.4.8 Pulse Shape Command List:

<0> Escapes to main menu.
<1> Changes pulse shape mask to G.703 or T1.403. (T1)
<2> Re-trigger. Measures pulse shape again.
<3> Prints out pulse shape to printer.

21.4.9 Signal Result Command List:

<Space> Shows current page again.
<0> Escapes to main menu.

21.4.10 Signaling Bits Setup Command List:

<Space> Shows current page again.
<0> Escapes to main menu.
<T010000> Sets timeslot 01 transmit signaling ABCD bits to 0000. (Note: set signaling ABCD bits to 0000 is not allowed on some E1 servers)
<T010001> Sets timeslot 01 transmit signaling ABCD bits to 0001.
<T010010> Sets timeslot 01 transmit signaling ABCD bits to 0010.
<T010100> Sets timeslot 01 transmit signaling ABCD bits to 0100.
<T011000> Sets timeslot 01 transmit signaling ABCD bits to 1000.
<T011111> Sets timeslot 01 transmit signaling ABCD bits to 1111.
<T020001> Sets timeslot 02 transmit signaling ABCD bits to 0001.
<T030001> Sets timeslot 03 transmit signaling ABCD bits to 0001.
<T310001> Sets timeslot 31 transmit signaling ABCD bits to 0000.

21.4.11 User Program Command List:

<L01~32> Set Pattern length.
<P00000000~PFFFFFFFF> Set Patter
<UP1> Set User Patter #1
<UP2> Set User Patter #2
<UP3> Set User Patter #3
<SH1> Show Patter Status

21.4.12 Timeslot Setup Command List:

<Space> Shows current page again.
<0> Escapes to main menu.
<SHOW> Shows current timeslots setting
<T01I> Sets timeslot 1 to programmable idle mode.
<T02I> Sets timeslot 2 to programmable idle mode.
<T03I> Sets timeslot 3 to programmable idle mode.
...
<T31I> Sets timeslot 31 to programmable idle mode.
<T01P> Sets timeslot 1 to bypass mode.
<T02P> Sets timeslot 2 to bypass mode.
<T03P> Sets timeslot 3 to bypass mode.
...
<T31P> Sets timeslot 31 to bypass mode.
<T01U> Sets timeslot 1 to used mode.
<T02U> Sets timeslot 2 to used mode.
<T03U> Sets timeslot 3 to used mode.
...
<T31U> Sets timeslot 31 to used mode.
<ALLI> Sets all timeslot to programmable idle mode.
<ALLP> Sets all timeslot to bypass mode.
<ALLU> Sets all timeslot to used mode.

21.4.13 Timeslot Map Data Command List:

<Space> Shows New Time Slot Map Data

21.4.14 Miscellaneous Command List:

<KS1> Set Key Sound to ON
<KS2> Set Key Sound to OFF
<PS1> Set Printer Type to Normal
<PS2> Set Printer Type to Condense
<SH1> Show Key Sound and Printer type status
<SH2> Show Version

21.4.15 Clock Setup Command List:

<ESC> Escapes to main menu.
<Enter> Confirm setting.

21.4.16 LED Status Command List:

<space> Show current page again
<0> Escapes to main menu

At the LED Status display screen, it will automatically display the error message once the error occurs.
(Signal Loss, Frame Loss, Pattern Loss, Power Loss, Excess Zero Error, One Density, AIS, SLIP, Yellow Alarm, RAI, MRAI, Error)

21.4.17 SS7 Analysis Command List:

<Space>	Shows current page again.
<0>	Escapes to main menu.
<T01>	Sets monitor channel to timeslot 1.
<T02>	Sets monitor channel to timeslot 2.
	...
<T31>	Sets monitor channel to timeslot 31
<DM1>	Sets display mode to "data mode".
<DM2>	Sets decode mode to "ITU(CCITT) frame mode".
<DM3>	Sets decode mode to "ANSI/Bellcore frame mode".
<DM4>	Sets display mode to "performance analysis"
<CM1>	Sets display code mode to "ASCII".
<CM2>	Sets display code mode to "EBCDIC".
<CM3>	Sets display code mode to "Transcode".
<CM4>	Sets display code mode to "IPARS".
<CM5>	Sets display code mode to "EBCD".
<CM6>	Sets display code mode to "HEX".
<SH1>	Shows current parameter settings.
<RUN>	Runs protocol analysis.
<SH2>	Shows frame page 1.
<SH3>	Shows frame page 2.
<SH4>	Shows frame page 3.
<STP>	Stops running.
<HOM>	Shows the first display page.
<END>	Shows to the end display page.
<PGU>	Shows to the previous display page.
<PGD>	Shows to the next display page.

21.4.18 ISDN-D Analysis Command List:

<Space>	Shows current page again.
<0>	Escapes to main menu.
<T01>	Sets monitor channel to timeslot 1.
<T02>	Sets monitor channel to timeslot 2.
	...
<T31>	Sets monitor channel to timeslot 31
<DM1>	Sets display mode to "data mode".
<DM2>	Sets decode mode to "ITU(CCITT) frame mode".
<CM1>	Sets display code mode to "ASCII".
<CM2>	Sets display code mode to "EBCDIC".
<CM3>	Sets display code mode to "Transcode".
<CM4>	Sets display code mode to "IPARS".
<CM5>	Sets display code mode to "EBCD".
<CM6>	Sets display code mode to "HEX".
<SH1>	Shows current parameter settings.
<RUN>	Runs protocol analysis.
<SH2>	Shows frame page 1.
<SH3>	Shows frame page 2.
<SH4>	Shows frame page 3.
<STP>	Stops running.
<HOM>	Shows the first display page.
<END>	Shows to the end display page.
<PGU>	Shows to the previous display page.
<PGD>	Shows to the next display page.

21.4.19 V5.1/V5.2 Analysis Command List:

<Space>	Shows current page again.
<0>	Escapes to main menu.
<T01>	Sets monitor channel to timeslot 1.
<T02>	Sets monitor channel to timeslot 2.
	...
<T31>	Sets monitor channel to timeslot 31
<DM1>	Sets display mode to "data mode".
<DM2>	Sets decode mode to "ITU(CCITT) frame mode".
<CM1>	Sets display code mode to "ASCII".
<CM2>	Sets display code mode to "EBCDIC".
<CM3>	Sets display code mode to "Transcode".
<CM4>	Sets display code mode to "IPARS".
<CM5>	Sets display code mode to "EBCD".
<CM6>	Sets display code mode to "HEX".
<SH1>	Shows current parameter settings.
<RUN>	Runs protocol analysis.
<SH2>	Shows frame page 1.
<SH3>	Shows frame page 2.
<SH4>	Shows frame page 3.
<STP>	Stops running.
<HOM>	Shows the first display page.
<END>	Shows to the end display page.
<PGU>	Shows to the previous display page.
<PGD>	Shows to the next display page.

21.4.20 Round Trip Delay Command List:

<Space>	Shows current page again.
<0>	Escapes to main menu.
<T01>	Sets the testing channel to timeslot 1 (channel 1).
<T02>	Sets the testing channel to timeslot 2 (channel 2).
	...
<T31>	Sets the testing channel to timeslot 31(channel 31).
<WT1>	Sets the maximum wait time to 1 ms.
<WT2>	Sets the maximum wait time to 2 ms.
<WT3>	Sets the maximum wait time to 3 ms.
<SH1>	Shows current configuration setting.
<R>	Runs round trip delay testing.

21.4.21 Signaling Display Command List:

<Space>	Show Signaling Data

22.1 Introduction

The **BTM10** has the ability to do Datacom BERT (BERT on data port). The speeds are multiples of 64K or 56K, which may be up to 2048K bit/s. The available interfaces are RS-530/RS-449/X.21, V.35, and RS-232. To enter the "Datacom BERT" function, press the ***F1*** key from the third menu selection page.

The Datacom BERT function will analyze datacom line performance in common display mode or ITU-T G.821 mode, and generate specific patterns on data port.

22.2 Configuration Setup

After entering this function, the screen should show a display similar to below:

```
------ DATACOM BERT CONFIG ------
Data Port        : DTE
Interface        : RS-449/530/X.21
Pattern          : QRSS
Test Period      : Continuous
Alarm            : 1 bit
Datacom Baud     : 64K (N64)
Datacom Tx Clk   : Internal
```

Configuration Setup Screen

These are the main settings of the **BTM10** and will effect associated operations. The inverted cursor block is located on the first parameter, DTE. You can move the cursor up and down by pressing the up and down arrow keys. You may change the current parameter, where the cursor is located, by pressing the right or left arrow key. Press the ***PgDn*** (page down) or ***PgUp*** (page up) key to see next page or previous page of settings. Pressing the ***HOME*** key will move the

cursor to the top page and top parameter. Press ***END*** key will move the cursor to the last page and bottom parameter.

The available setting and meaning of each configuration parameter in the "Datacom BERT Configuration" function are as follows:

Setting	Parameter	Description
Data Port:	DTE	**BTM10** is configured as DTE device.
	DCE	**BTM10** is configured as DCE device.
Interface:	RS-449/530 /X.21	**BTM10**'s data port is set to RS-449, RS-530, or X.21 mode.
	RS-232	**BTM10**'s data port is set to RS-232 mode.
	V.35	**BTM10**'s data port is set to V.35 mode.
Pattern: (**BTM10** will transmit and analyze this pattern into datacom port)	63	Pseudo random pattern: 2e6-1
	127	Pseudo random pattern: 2e7-1
	511	Pseudo random pattern: 2e9-1 (O.153)
	2047	Pseudo random pattern: 2e11-1 (O.152 AND O.153)
	2e15-1 standard	Pseudo random pattern: 2e15-1 (O.151)
	2e15-1 non-standard	Pseudo random pattern: 2e15-1 (O.151 inverted)
	2e20-1 standard	Pseudo random pattern: 2e20-1 (O.153)
	2e20-1 non-standard	Pseudo random pattern: 2e20-1 (inverted)
	QRSS	Pseudo random pattern: 2e20-1 (O.151 QRSS)
	2e23-1 standard	Pseudo random pattern: 2e23-1 (O.151)

	2e23-1 non-standard	Pseudo random pattern: 2e23-1 (O.151 inverted)
	All One	Repetitive pattern: all ones (11111...)
	All Zero	Repetitive pattern: all zeros (00000...)
	ALT(0101)	Repetitive pattern: alternating ones and zeros (10101010...)
	3 in 24	Repetitive pattern: 3 in 24
	1 in 16	Repetitive pattern: 1 in 16
	1 in 8	Repetitive pattern: 1 in 8
	1 in 4	Repetitive pattern: 1 in 4
	User Prog #1	User programmable repetitive pattern #1. The length of this pattern may be set from 1 to 32 bits. Please refer to Chapter 11 for details.
	User Prog #2	User programmable repetitive pattern #2. The length of this pattern may be set from 1 to 32 bits. Please refer to Chapter 11 for details.
	User Prog #3	User programmable repetitive pattern #3. The length of this pattern may be set from 1 to 32 bits. Please refer to Chapter 11 for details.
Test Period:	Continuous	The BERT test will run forever
	1 Minute	BERT will run for one minute.
	15 Minutes	BERT will run for fifteen minutes.
	30 Minutes	BERT will run for half an hour.
	1 Hour	BERT will run for an hour.
	24 Hours	BERT will run for one day.
Datacom Baud	N64K	The speeds available on 64K mode are 64K, 128K, 192K, 256K, 320K, 384K, 448K, 512K, 576K, 640K, 704K, 768K, 832K, 896K, 960K, 1024K, 1088K, 1152K, 1216K, 1280K, 1344K, 1408K, 1472K, 1536K, 1544K, 1600K, 1664K,

		1728K, 1792K, 1856K, 1920K, 1984K, 2048K
	N56K, 1544K	The speeds available on 56K mode are 56K, 112K, 168K, 224K, 280K, 336K, 392K, 448K, 504K, 560K, 616K, 672K, 728K, 784K, 840K, 896K, 952K, 1008K, 1064K, 1120K, 1176K, 1232K, 1288K, 1344K, 1400K, 1456K, 1512K, 1544K, 1568K, 1624K, 1680K, 1736K, 1792K
Datacom Tx Clk (Datacom Transmission Clock)	Internal	Tx clock sets to internal.
	Int. INV.	(Internal Inverted) Tx clock sets to internal and its polarity is inverted.
	External	Tx clock sets to eternal.
	Ext. INV.	(External Inverted) Tx clock sets to external and its polarity is inverted.
Datacom Rx Clk: (Datacom Receiver Clock)	External	Tx clock sets to eternal.
	Ext. INV.	(External Inverted) Tx clock sets to external and its polarity is inverted.

TxClk Sense: (Sense of Transmit Clock)	Normal	The sense of Tx clock sets to normal. (Transmit on falling edge of transmit clock.)
	Inverted	The sense of Tx clock sets to invert. (Transmit on rising edge of transmit clock.)
Ins Error Rate:	Single	Will force a single error when you press the Force Error Key.
	1e-3	Will force errors continuously at transmit rate of 1e-3.
	1e-4	Will force errors continuously at transmit rate of 1e-4.
	1e-5	Will force errors continuously at transmit rate of 1e-5.
	1e-6	Will force errors continuously at transmit rate of 1e-6.
	1e-7	Will force errors continuously at transmit rate of 1e-7.
Datacom Flow C	Disable	Always transmit out testing pattern.
	CTS/RTS ON	When BTM10 sets to DTE mode, it will transmit out testing pattern if CTS active; when BTM10 sets to DCE mode, it will transmit out testing pattern if RTS active. Otherwise, BTM10 will not transmit out testing pattern.
Print Interval:	Disable	The printer will not print out results periodically.
	5 Min	The printer will print out test results every five minutes.
	10 Min	The printer will print out test results every ten minutes.

	15 Min	The printer will print out test results every fifteen minutes.
	30 Min	The printer will print out test results every half an hour
	60 Min	The printer will print out test results every hour.
Print On Error:	Disable	The printer will not print out current test results while errors are received
	Enable	The printer will print out current test results while errors are received.

Pressing the ***ESC*** key will exit this function. Press the ***RUN*** key to run Datacom BERT analysis.

22.3 Clock setting

The clock source setting of Datacom BERT depends upon the user's application. If the external device can supply the clock source, then the **BTM10** datacom transmission clock should be set to external, otherwise, the **BTM10** must supply its internal transmission clock for the external device. The **BTM10** receiver clock is always set to external. Both of the clock polarities can be set to normal or inverted. The selection table is depicted as below:

Mode	**Clock Source Selection**		**TX**	**RX**	**TX Clock Source**	**RX Clock Source**
DTE	TX Clock	Internal	TD		XTC(internal)	
		External	TD		TC	
	RX Clock	External		RD		RC
DCE	TX Clock	Internal	RD		TC or RC(internal)	
		External	RD		XTC	
	RX Clock	External		TD		XTC

22.4 Datacom BERT Analysis

When the screen of the **BTM10** is on Datacom BERT Configuration, pressing the ***RUN*** key will enter and run the Datacom BERT analysis function.

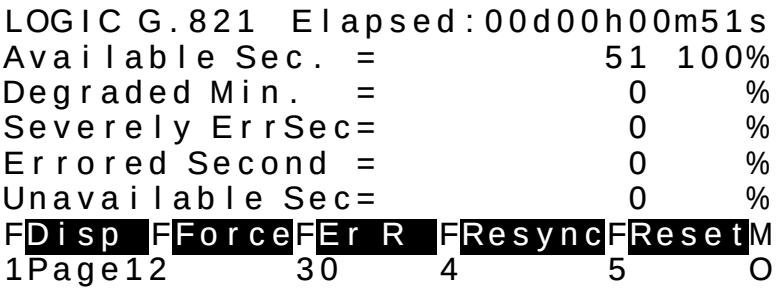
After entering the function, the screen should show a display similar to below:

```
LOGIC          Elapsed:00d00h00m51s
Receive Count   =   100602189
Errors          =             0
Error Sec       =             0
Error Free Sec  =            51
Error Rate      =     0.0e-00
FDisp FForceFEr R FResyncFResetM
1Page12      30     4       5      O
```

Logic Display Screen

The top-right message, elapsed time, shows the duration of the current test. This analysis mode can be paused by pressing the ***RUN*** key, and continued again by pressing the ***RUN*** key. The bottom two lines show available function keys and their abbreviation. Pressing the ***MORE*** key will display additional function keys.

By simply pressing the ***PgUp*** (page up) or ***PgDn*** (page down) keys, two of the display type screens can be viewed. The second screen is shown on the following page:



Logic G.821 Display Screen

If you desire a hard copy print out of all the test results, connect the printer adapter cable from the printer port to a printer and press the ***PRINT*** key. You may also set testing duration, time interval to print results, or print when error occurs.

22.5 Performance

The **BTM10** analyzes and displays received Datacom BERT on the LCD screen. This section depicts all of the on screen abbreviations and meanings.

In "Logic" Format:

Receive Count	: Received Total Logic Bit Counter
Errors	: Received Error Logic Bit Counter
Error Sec	: Received Logic Bit Error Seconds
Error Free Sec	: Received Logic Bit Error Free Seconds
Error Rate	: Received Logic Error Rate (calculated of dividing received error logic bit counter by total received logic bit counter)

In "Logic G.821" Format:

Available Sec.	: Received G.821 Logic Bit Available Seconds
Degraded Min.	: Received G.821 Logic Bit Degraded Minutes
Severely ErrSec	: Received G.821 Logic Bit Severely Error Seconds
Errored Second	: Received G.821 Logic Bit Error Seconds
Unavailable Sec	: Received G.821 Logic Bit Unavailable Seconds

22.6 Function Keys

At the bottom of each display screen are two lines, with abbreviated and inverted character text indicating functions that may be applied in run mode. Under the abbreviated function is the current status. If you press any function key, the **BTM10** will take some action immediately, such as changing the display mode, or forcing errors. The current status will be modified if it has several selected statuses.

The function keys are in two different groups or sets of keys. Press the ***MORE*** key repeatedly to display the other function key groups.

For example:

Press "***MORE***"

Following are the function key detailed meanings and actions.

Group 1

[**F1**]Disp. Display Format
Page1 Changes the display format to page 1 (common mode).
Page2 Changes the display format to page 2 (G.821 mode).

[**F2**]Forced Force a Single Error
Insert a single error immediately.

[**F3**]Er R Automatic Forced Error Rate
0 Disable automatic forced errors action.
1e-3 Automatic forced error rate is set at a rate of 1e-3.
1e-4 Automatic forced error rate is set at a rate of 1e-4.
1e-5 Automatic forced error rate is set at a rate of 1e-5.
1e-6 Automatic forced error rate is set at a rate of 1e-6.
1e-7 Automatic forced error rate is set at a rate of 1e-7.

[**F4**]ReSyn Re-sync framing

[**F5**]Reset Reset all test results and clear all of the received counters and timers.

Group 2 (after pressing the MORE key)

[**F1**]Pattn Pattern
63 63
127 127
511 511(O.153)
2047 2047(O.152 AND O.153)
2e15s 2e15-1(O.151)
2e15n 2e15-1(O.151 inverted)

2e20s	2e20-1(O.153)
2e20n	2e20-1(inverted)
QRSS	QRSS(O.151 QRSS)
2e20s	2e20-1(O.151)
2e20n	2e20-1(O.151 inverted)
All 1	All Ones
All 0	All Zeros
0101	Alternate(0101)
3in24	3 in 24
1in16	1 in 16
1 in8	1 in 8
1 in4	1 in 4
User1	User Programmable Pattern #1.
User2	User Programmable Pattern #2.
User3	User Programmable Pattern #3.

[**F2**]Durn. Test Duration

Cont.	Continuous
1 Min	1 Minute
15Min	15 Minutes
30Min	30 Minutes
60Min	1 Hour
24Hrs	24 Hours

Other keys that have functions while running BERT:

SPACE Insert single error on BERT Analysis function.

ESC Press the first ***ESC*** key will stop running and enter Examine Analysis mode. The user may press the ***PgUp*** or ***PgDn*** key to review two pages of results. Pressing the ***PRINT*** key will print out the testing results. Pressing the ***ESC*** key again will exit and go to the main menu.

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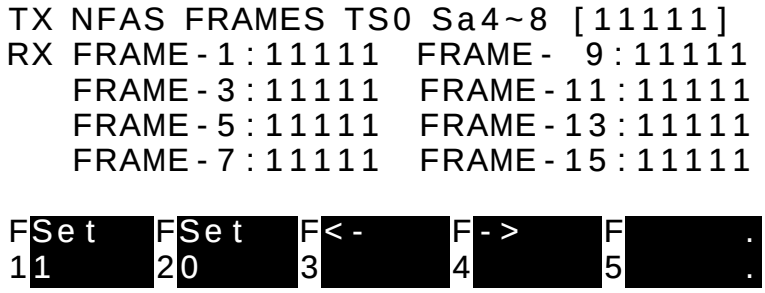
23.1 Introduction

The Sa4 to Sa8 are spare bits that may be recommended by ITU-T for use in specific point-to point applications. When they are not used, they should be set to 1 on links crossing an international border. The Sa4 to Sa8 bits are allocated in E1 format timeslot 0, please refer to Table 1-4 for E1 frame format timeslot 0 bit allocations.

Only when the **BTM10** is set to E1(CEPT) mode can this feature be entered.

When the screen of the **BTM10** is on the fifth main menu page, pressing the F2 key will enter Sa Bits Setup. After entering this function, the screen should show a display as follows:



Sa bits Setup Screen

This screen show setting of current transmission Sa bits on the first line, and shows the real-time status of received Sa bits on each odd E1 frame on the following four lines.

23.2 Sa Bits Transmission Setting

The flashing cursor is located on the transmission Sa Bits field, and can be moved to another location by press the right arrow, left arrow F3, or F4 keys. The first location is Sa4, the second location is Sa5, the third location is Sa6, the fourth location is Sa7, and the last location is Sa8. All of the setting will effect every Sa bit on each transmitted odd frame.

The setup function key definitions are as follows:

[F1] Set 1: Set current TX Sa bit to 1.
[F2] Set 0: Set current TX Sa bit to 0.
[F3] <-: Move current cursor location to previous TX Sa bit.
[F4] ->: Move current cursor location to next TX Sa bit.

Other keys that have functions are:

1 Set current TX Sa bit to 1.
0 Set current TX Sa bit to 0.
Left Arrow Move current cursor location to previous TX Sa bit.
Right Arrow Move current cursor location to next TX Sa bit.
ESC Exit this function.

23.3 Sa bits Monitor

The Sa4, Sa5, Sa6, Sa7, and Sa8 bits are located at each odd E1 frame timeslot 0. There are eight E1 frames that have Sa bits in one E1 multiframe. Received Sa bits are shown in real-time on the screen, line 2 to line 5 as follows:

```
RX FRAME-1:11111  FRAME- 9:11111
   FRAME-3:11111  FRAME-11:11111
   FRAME-5:11111  FRAME-13:11111
   FRAME-7:11111  FRAME-15:11111
```

The 1s or 0s following the FRAME-# are bits of Sa4, Sa5, Sa6, Sa7, and Sa8, which are contained at that frame.

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24.1 Low Speed Datacom BERT SETUP

24.1.1 : Setup

From the fifth main menu page, press the ***F3*** key. The following screen will be displayed.

```
-----LOW SPEED BERT CONFIG-----
Data Port       : DTE
Interface       : RS-449/530/X.21
Pattern         : 511
Block Size      : 1000bits
Test Period     : Continuous
Alarm           : 1 bit
Protocol        : Sync(BSC)
```

Low Speed Datacom BERT Setup Screen

Using the "⇩" arrow key, further menu items will scroll up the screen. Move the arrow down to the last menu item. The screen should look as follows.

```
-----LOW SPEED BERT CONFIG-----
Parity          : [None]
Tx Clock        : DTE
Xon/off         : Disable
Flow Control    : Disable
Print Interval: Disable
Print on Error: Disable
--------------------------------
```

Low Speed Datacom BERT Setup Screen (cont.)

Return the cursor to the top of the screen (to the "Data Port" parameter setting) by using the "⇧" arrow key.

24.1.2 : Data Port Setting

Use the "⇨" arrow key to select the available data port mode for BERT. The **BTM10** can perform in DTE or DCE modes.

24.1.3 : Interface Setting

Use the "⇨" arrow key to set the available interface type. They include RS-232, V.35, and RS-449/530/X.21 types.

24.1.4 : Pattern Setting

Use the "⇨" arrow key to select the available data patterns for BERT. They include 63, 511, 2047, "Fox" (ASCII), Space (all zeros), Mark (all ones), and Alt (alternate ones and zeros).

24.1.5 : Block Size Setting

Hi-light the parameter setting for Block Size and press the "⇨" arrow key to set the block size to either the pattern size or to 1000 bits.

24.1.6 : Duration Setting

Follow the same keystroke procedures and set the Duration of bit counts to 10^3, 10^4, 10^5, 10^6, 10^7, 10^8 bits, or to minutes duration of 1, 5, 10, 15, 30, 60 minutes or set to run continuously.

24.1.7 : Alarm Setting

The alarm settings may be disabled or set to trigger after 1, 10, 100, or 1000 bits in error.

24.1.8 : Protocol Setting

The ***BTM10*** supports both ASYNC and SYNC protocols. Select the protocol for your application.

24.1.9 : Speed Setting

Select the appropriate speed for your application.

ASYNC : 50, 75, 110, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3200, 3600, 4800, 7200, 9600, 12k, 14.4k, 16k, 19.2k, 28.8k, 38.4k, 48k, 57.6k, 64k, 72k, 115.2kbps.

SYNC : 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3200, 3600, 4800, 7200, 9600, 12k, 14.4k, 16k, 19.2k, 28.8k, 38.4k, 48k, 57.6k, 64k, 72kbps.

24.1.10 : Bits Setting

When using ASYNC protocol, the ***BTM10*** supports 5, 6, 7, or 8 bits. Only 8 bits are supported in SYNC mode. When choosing SYNC protocol, 8 bits will automatically be set.

24.1.11 : Parity Setting

When using ASYNC protocol, the ***BTM10*** supports a parity setting of ODD, EVEN or NONE. No Parity bits are supported in SYNC mode. When choosing SYNC protocol, no parity bits will apply.

24.1.12 : Stop Bits Setting

Stop bits only apply when using ASYNC protocol settings. The stop bits may be set to 1, 1.5, or 2.

24.1.13 : Tx Clock Setting

The Tx Clock only applies when using SYNC protocol settings. The Tx Clock may be set to DCE or DTE. When set to DCE, the TD rate is set according to the TC (is dependent on an external source or internal clock). When set to DTE, the ***BTM10***'s TD rate is set according to the XTC (which is based upon an external source or internal clock). RD is always synchronized by RC.

Config.	TD and RD Clock Source			
	DTE Mode		DCE Mode	
Tx Clock:	TD	RD	TD	RD
DCE	**TC**	**RC**	**TC=RC***	**TC=RC***
DTE	**XTC***	**RC**	**XTC**	**TC=RC***

Tx Clock Source Table
*denotes that clock is issued from the ***BTM10***

24.1.14 : Xon/off Setting

The ***BTM10*** allows enabling or disabling transmission of software flow control. Set according to your application.

24.1.15 : Flow control Setting

The ***BTM10*** allows enabling or disabling transmission of hardware flow control. Set as required by your application.

24.1.16 : Print Interval Setting

Automatic printout can be enabled at intervals of 5, 10, 15, 30, or 60 minutes.

24.1.17 : Print On Error Setting

By enabling this parameter, the ***BTM10*** will print whenever an error condition occurs.

24.2 Running Low Speed Datacom BERT

24.2.1 : Start Bit Error Rate Testing

After all parameters are set and connections made, BERT testing is started by pressing the ***RUN*** key. The following screen will be displayed.

```
-BERT/BLERT-   Sp:9600  Pat:511
Bit Tx=     170024|BlkTx=      170
Bit Rx=     169968|BlkRx=      169
Bit Er=          0|BlkEr=        0
Bit Er/R=0.0e-00|ErSec=         0
Forced Er=       0|    0D00:00:18
F1 Force F2 Force F3 Reset F4
```

Low Speed Datacom BERT Running

While BERT is running the following function keys are in effect:

F1

Forces a single bit error.

F2

Forces five(5) single bit errors.

F3

Resets the timer and all bit/block counters to zero.

ESC

Exits BERT testing.

RUN

Halts BERT testing. HALT will be displayed. At this point, a printout may be done by pressing the ***PRINT*** key. Pressing ***RUN*** again will restart testing.

24.2.2 : Communication Line Quality Test

To test and check the quality of a transmission line, the ***BTM10*** sends continuous data which is then looped back, received, and compared. Any discrepancies indicate that an error has occurred.

a: Available BAUD Rates for testing:
ASYNC : 50 bps - 128 Kbps,
SYNC (BSC) : 150 bps - 72 Kbps.

b: Available test transmission PATTERNS :
63/511/2047, MARK (all 1's), SPACE (all 0's), FOX (ASCII), and ALT (0101).

24.2.3 : Connections

There are two recommended connection methods. The first requires two ***BTM10***s, one connected on each side of the communication line via a "straight" or "null" connection. In other words, the transmit signal from one unit is connected to the receive input of the other unit and visa versa.

The second method requires only one ***BTM10*** on one end of the communication line and a physical loop back at the other end. The ***BTM10*** can transmit the selected pattern continuously, will synchronize with the received data and count bit errors. By looping back at different points on the data link or by testing with various BAUD rates, the **BERT** test function can determine line quality, acceptable band width, or serve as an aid in trouble shooting and isolating cable/connector deficiencies.

24.2.4 : Setup

When using an ***BTM10*** on both sides of the communication line, set the parameters SELECT PATTERN, DATA BLOCK, SPEED, CLOCK (if sync), and ALARM TIMER to identical settings on both units. Connect the units such that transmit pin of one unit is connected to the receive pin of the other. If using a single unit, set a loop back on the

transmission cable from the receive pin to the transmit pin, or set the remote device to remote loopback mode.

24.2.5 : Testing

To start testing, if using two units, press the ***RUN*** key at the same time on both units on each end of the communications line. Otherwise, just press the ***RUN*** on the single unit.

The length of testing time is determined by the setup information. The advantage of using two units for testing is that the sending and receiving channels can be tested simultaneously since each ***BTM10*** contains its own transmitter and receiver.

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25.1 Datacom Clock Measure Setup

BTM10 has the ability to do Datacom Clock measurement. From the fifth main menu page, press the ***F5*** key. The following screen will be displayed.

```
- - - - - DATACOM CLOCK MEASURE - - - - -
Data Port       : DTE
Interface       : RS-449/530/X.21
```

Low Speed Datacom BERT Setup Screen

Using the "⇧" and "⇩" arrow keys to move the arrow up and down.

25.1.1 : Data Port Setting

Use the "⇨" arrow key to select the available monitor data port for Datacom Clock Measurement. The **BTM10** can do clock measurement on DTE or DCE datacom port.

25.1.2 : Interface Setting

Use the "⇨" arrow key to set the available interface mode. They include RS-232, V.35, and RS-449/530/X.21 modes.

25.2 RUNNING Datacom Clock Measurement

After all parameters are set and connections made, BERT testing is started by pressing the ***RUN*** key. Depending upon

the Data Port setting, the following DTE or DCE clock measurement screen will be displayed.

```
XTC(113) Frequency : 02048000 Hz
         Freq. Max.: 02049999 Hz
         Freq. Min.: 02048001 Hz


Press RUN key to clear counters
```

DTE Clock Measurement Screen

```
TC(114) Frequency  : 02048000 Hz
        Freq. Max. : 02049999 Hz
        Freq. Min. : 02048001 Hz
RC(115) Frequency  : 02048000 Hz
        Freq. Max. : 02049999 Hz
        Freq. Min. : 02048001 Hz

Press RUN key to clear counters
```

DCE Clock Measurement Screen

The "XTC, TC, or RC Frequency" shows current measurement in Hertz on that signal input. The "Freq. Max." shows the maximum measured frequency on that signal input since running started. The "Freq. Min." shows the minimum measured frequency on that signal input since running started.

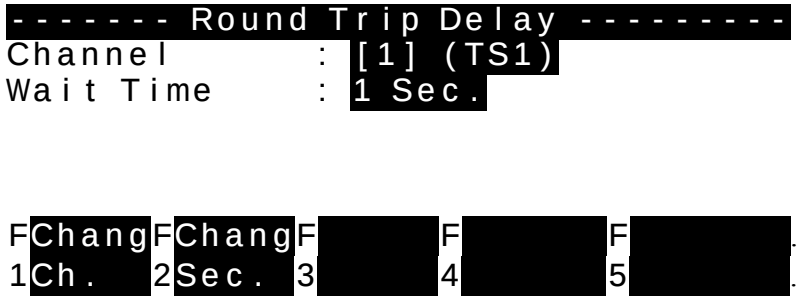
Press the "RUN" key to clear all the results and redo clock measurement on those signals. Press "ESC" key to exit the Datacom Clock Measurement function.

26.1 Introduction

The "Round Trip Delay" feature measures the propagation delay of a loop backed E1 or T1 link. The user can select a specific E1 or T1 timeslot to do this measurement, use the **BTM10** to send out a testing string onto this timeslot, and measure the timing interval between start of transmission and receiving of the returned string. The testing result is shown in millisecond (ms) units.

26.2 Operation

After entering the "Round Trip Delay" function, you will see a screen similar to the following:



Round Trip Delay Screen

Pressing ***F1*** will change the testing timeslot of E1 or T1. The timeslot can be selected from 1 to 31 in E1 mode, or from 1 to 24 in T1 mode.

Pressing the ***F2*** key will change the maximum wait return time. Any reception in excess of this wait time will result in a "Receive Time Out." message on screen.

Pressing the ***RUN*** key will do the first five tests in a similar matter as displayed on the following screen:

```
WAIT.....
Round Trip Time : <    1 ms
Round Trip Time : <    1 ms
Round Trip Time :      1 ms
Round Trip Time :      1 ms
Round Trip Time :      2 ms
Press RUN key to restart testing.
```

Round Trip Delay Testing Screen

Pressing the ***RUN*** key again will do five more tests. Pressing the ***ESC*** key will return to the previous menu.

ADC	Analog to Digital Converter
AGC	Automatic Gain Control
AIS	Alarm Indication Signal
ALBO	Automatic Line Build Out
ALOS	Analog Loss of Signal
AMI	Alternate Mark Inversion
ANSI	American National Standards Institute
B8ZS	Binary with 8 Zero Substitution
BER	Bit Error Rate
BERR	Bit Error Counter
BFA	Basic Frame Alignment
BOP	Bit-Oriented Protocol
BPV	Bipolar Violation
CAS	Channel Associated Signaling
ITU-T	International Telegraph and Telephone Consultative Committee
CCS	Common Channel Signaling
CERR	CRC Errors
CGA	Carrier Group Alarm
CI	Customer Installation
COFA	Change of Frame Alignment
CRC	Cyclic Redundancy Check
CSU	Channel Service Unit
DAC	Digital to Analog Converter
DCS	Digital Cross-Connect System
DDS	Digital Data System
DMI	Digital Multiplexed Interface
DPLL	Digital Phase Locked Loop
DS1	Digital Signal Level 1
DSU	Data Service Unit
ESF	Extended Superframe
EXZ	Excessive Zeros
FAS	Frame Alignment Sequence (E1 Format)
FCC	Federal Communications Committee

FCS	Frame Check Sequence
FDL	Facility Data Link
FEBE	Far End Block Error
FERR	Framing Bit Error
FPS	Frame Pattern Sequence (EFS Format)
HCDS	High-Capacity Digital Service
HDB3	High-Density Bipolar of order 3
ICOT	Intercity and Outstate Trunk
IDLC	Integrated Digital Loop Carrier
ISDN	Integrated Service Digital Network
JAT	Jitter Attenuator
JCLK	Jitter Attenuated Clock
JTAG	Joint Test Action Group
LBO	Line Build Out
LCV	Line Code Violation
LEC	Local Exchange Carrier
LIU	Line Interface Unit
LOAS	Loss of Analog Signal
LOF	Loss of Frame
LOS	Loss of Signal -DS1
LSB	Least Significant Bit
MAIS	Multiframe AIS
MART	Maximum Average Reframe Time
MAS	Multiframe Alignment Sequence (CAS Format)
MAT	Metropolitan Area Trunk
MERR	MFAS Error
MFAS	Multiframe Alignment Sequence (CRC4 format)
MOP	Message-Oriented Protocol
MOS	Message Oriented Signaling
MSB	Most Significant Bit
MVIP	Multi-Vendor Integration Protocol
MYEL	Multiframe Yellow Alarm
NI	Network Interface
NRZ	Non-Return to Zero

OOF	Out of Frame
PDV	Pulse Density Violation
PIC	Polyethylene-insulated Cable
PLCC	Plastic Leaded Chip Carrier
PLL	Phase Locked Loop
PM	Performance Monitoring
PRBS	Pseudo-Random Bit Sequence
PRI	Primary Rate Interface
PRM	Performance Report Message
RAI	Remote Alarm Indication
RBOP	Bit-Oriented Protocol Detector
RBS	Robbed Bit Signaling
RCVR	Receiver
RDL1	Receive Data Link 1
RDL2	Receive Data Link 2
RDL3	External Receive Data Link
RFRAME	Receive Framer
RJAT	Receive Jitter Attenuator
RLIU	Receive Line Interface Unit
RMAIS	Receive Multiframe AIS
RPDV	Receive Pulse Density Violation
RPLL	Receive Phase Locked Loop
RSB	Receive System Bus
RSBI	Receive System Bus Interface
RSIG	Receive Signaling Buffer
RSLIP	Receive Slip Buffer
RXCLK	Receive Clock
RZCS	AMI/HDB3/B8ZS Line Decoder
QRSS	Quasi-Random Signal Source
SEF	Severely Erred Framing Event
SERR	CAS Error
SF	Super Frame
SLC	Subscriber Loop Carrier
TAP	Test Access Port

TBOP	Bit Oriented Protocol Formatter
TDL1	Transmit Data Link 1
TDL2	Transmit Data Link 2
TDL3	External Transmit Data Link
TDM	Time Division Multiplexed
TSB	Transmit System Bus
TSBI	Transmit System Bus Interface
TJAT	Transmit Jitter Attenuator
TLIU	Transmit Line Interface Unit
TLOS	Transmit Loss of Signal
TSB	Transmit System Bus
TSIC	Time Slot Inter-Change
TSIG	Transmit Signaling Buffer
TSLIP	Transmit Slip Buffer
TZCS	AMI/HDB3/B8ZS Line Encoder
UI	Unit Interval
UMC	Unassigned Mux Code
UNICODE	Universal Trunk Out Of Service Code
UTP	Unshielded Twisted Pair
VCO	Voltage Controlled Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VGA	Variable Gain Amplifier
XMTR	Digital Transmitter
YEL	Yellow Alarm
ZCS	Zero Code Suppression

Part#: 58-H2MD2S2Y0 : Y-Cable, HD26 Male-DB25 Male/Female, RS530, 1.5M

HD26(Male)	PIN#	<->	PIN#	DB25(Male/Female)
TD(A)	2	<->	2	
TD(B)	11	<->	14	
RD(A)	3	<->	3	
RD(B)	21	<->	16	
RTS(A)	4	<->	4	
RTS(B)	13	<->	19	
CTS(A)	5	<->	5	
CTS(B)	14	<->	13	
DSR(A)	6	<->	6	
DSR(B)	22	<->	22	
DTR(A)	20	<->	20	
DTR(B)	12	<->	23	
DCD(A)	8	<->	8	
DCD(B)	26	<->	10	
TC(A)	15	<->	15	
TC(B)	23	<->	12	
RC(A)	17	<->	17	
RC(B)	25	<->	9	
XTC(A)	24	<->	24	
XTC(B)	16	<->	11	
XRC(A)	9	<->	21	
XRC(B)	18	<->	18	
GND	7	<->	7	
FGND	1	<->	1	

Note: The (A)(B) of the same name must be a twisted pair.

Part#: 58-H2MD3S2Y0 : Y-Cable, HD26 Male-DB37 Male/Female, RS449, 1.5M

HD26(Male)	PIN#	<->	PIN#	DB37(Male/Female)
TD(A)	2	<->	4	SD(A)
TD(B)	11	<->	22	SD(B)
RD(A)	3	<->	6	RD(A)
RD(B)	21	<->	24	RD(B)
RTS(A)	4	<->	7	RS(A)
RTS(B)	13	<->	25	RS(B)
CTS(A)	5	<->	9	CS(A)
CTS(B)	14	<->	27	CS(B)
DSR(A)	6	<->	11	DM(A)
DSR(B)	22	<->	29	DM(B)
DTR(A)	20	<->	12	TR(A)
DTR(B)	12	<->	30	TR(B)
DCD(A)	8	<->	13	RR(A)
DCD(B)	26	<->	31	RR(B)
TC(A)	15	<->	5	ST(A)
TC(B)	23	<->	23	ST(B)
RC(A)	17	<->	8	RT(A)
RC(B)	25	<->	26	RT(B)
XTC(A)	24	<->	17	TT(A)
XTC(B)	16	<->	35	TT(B)
XRC(A)	9	<->	14	RL
XRC(B)	18	<->	10	LL
GND	7	<->	19,37,20,	SG,SC,RC
FGND	1	<->	1	

Note: The (A)(B) of the same name must be a twisted pair.

Part#: 58-H2MM3S2Y0 : Y-Cable, HD26 Male-MB34 Male/Female, V.35, 1.5M

HD26(Male)	PIN#	<->	PIN# MB34(Male/Female)
TD(A)	2	<->	P
TD(B)	11	<->	S
RD(A)	3	<->	R
RD(B)	21	<->	T
RTS(A)	4	<->	C
CTS(A)	5	<->	D
DSR(A)	6	<->	E
DTR(A)	20	<->	H
DCD(A)	8	<->	F
TC(A)	15	<->	Y
TC(B)	23	<->	AA
RC(A)	17	<->	V
RC(B)	25	<->	X
XTC(A)	24	<->	U
XTC(B)	16	<->	W
XRC(A)	9	<->	Z
XRC(B)	18	<->	BB
GND	7	<->	B
FGND	1	<->	A

Note: The (A)(B) of the same name must be a twisted pair.

Part#: 58-H2MD1S2Y0 : Y-Cable, HD26 Male-DB15 Male/Female, X.21, 1.5 M

HD26(Male)	PIN#	<->	PIN#	DB15(Male/Female)
TD(A)	2	<->	2	T(A)
TD(B)	11	<->	9	T(B)
RD(A)	3	<->	4	R(A)
RD(B)	21	<->	11	R(B)
RTS(A)	4	<->	3	C(A)
RTS(B)	13	<->	10	C(B)
DCD(A)	8	<->	5	I(A)
DCD(B)	26	<->	12	I(B)
RC(A)	17	<->	6	S(A)
RC(B)	25	<->	13	S(B)
XTC(A)	24	<->	7	
XTC(B)	16	<->	14	
GND	7	<->	8	Ground
FGND	1	<->	1	Shield

Note: The (A)(B) of the same name must be a twisted pair.

Part#: 58-H2MD2S2Y1 : Y-Cable,HD26 Male-DB25 Male/Female, RS232, 1.5M

HD26(Male)	PIN#	<->	PIN#	DB25(Male/Female)
TD	2	<->	2	
RD	3	<->	3	
RTS	4	<->	4	
CTS	5	<->	5	
DSR	6	<->	6	
DTR	20	<->	20	
DCD	8	<->	8	
TC	15	<->	15	
RC	17	<->	17	
XTC	24	<->	24	
XRC	9	<->	21	
GND	7	<->	7	
FGND	1	<->	1	

Part#: 58-D1FR4M000, Cable, DB15 Female-RJ45 Male,
T1 100 ohm, 2M
Part#: 58-D1FR4M001, Cable, DB15 Female-RJ45 Male,
E1 120 ohm, 2M

DB15(Female)	PIN#	<->	PIN#	RJ-45
TTIP(Tx)	1	<->	4	Transmit(+)
GND	2	<->	3	GND
RTIP(Rx)	3	<->	1	Receive(+)
GND	4	<->	6	GND
TRING(Tx)	9	<->	5	Transmit(-)
RRING(Rx)	11	<->	2	Receive(-)

Note: The TTIP and TRING must be a twisted pair.
The RTIP and RRING must be a twisted pair.

Part#: 58-D9FD2F000, Cable,DB9 Female-DB25 Female, Remote/ PC,1 M

DB9(Female)	PIN#	<->	PIN#	DB25(Female)
	2	<->	3	
	3	<->	2	
	4	<->	20	
	5	<->	7	
	6	<->	6	
	7	<->	4	
	8	<->	5	
	9	<->	22	

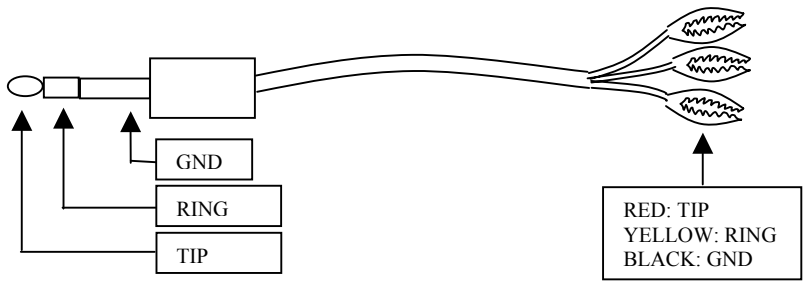
Part#: 58-D9FD2M000, Cable,DB9 Female-DB25 Male, Remote/ Modem,1 M

DB9(Female)	PIN#	<->	PIN#	DB25(Male)
	2	<->	2	
	3	<->	3	
	4	<->	6	
	5	<->	7	
	6	<->	20	
	7	<->	5	
	8	<->	4	

Part#: 58-D1MC3M000, Cable,DB15 Male-C36 Male, Printer,1 M

DB15(Male)	PIN#	<->	PIN#	C36 (Male)
	1	<->	1	/STROBE
	2	<->	2	DATA1
	3	<->	3	DATA2
	4	<->	4	DATA3
	5	<->	5	DATA4
	6	<->	6	DATA5
	7	<->	7	DATA6
	8	<->	8	DATA7
	9	<->	9	DATA8
	11	<->	11	BUSY
	14	<->	14	/AUTO FEED XT
	15	<->	36	/SLCT IN
	10	<->	19	GND
	12	<->	20	GND
	13	<->	21	GND

Part#: 58-BAMALG000 : T1 Alligator Cable, Bantam Male Alligator Clip, 2M
Part#: 58-BAMALG001 : E1 Alligator Cable, Bantam Male Alligator Clip, 2M



Note 1: The TIP and RING must be a twisted pair.

NOTES:

C.1. About this SS7 Software Option

The BTM10 SS7 (SS No. 7, or SS#7) Analysis option allows real-time troubleshooting of your SS7 network up to level 4 layer. It provides data traffic monitor, ITU (CCITT) SS7, and ANSI / Bellcore SS7 frame structure decode features. It is easy to use and maintain under E1 or T1 SS7 analysis fields.

The SS7 signalling system is optimized for operation over 64 kbit/s digital channels. This software option is working and analyzing under one E1 or T1 channel. **Please configure your BTM10 well according to received E1 or T1 line before you do SS7 testing and monitor.** Please refer to Chapter 5 Configuration Setup for more information.

C.2. Introduction to SS7

Common Channel Signaling (CCS)

Early signaling system used the call control path is the same physical circuit as the speech path. Supervisory functions must be interspersed with the voice traffic. This is not an efficient technique.

Common channel signalling is a signalling method in which a single channel conveys, by means of labelled messages, signalling information relating to, for example, a multiplicity of circuits, or other information such as that used for network management. Common channel signalling can be regarded as a form of data communication that is specialized for various types of signalling and information transfer between processors in telecommunications networks. CCS separates the call control path from the speech path.

General

Signalling System # 7 has been developed to meet these demands, it uses a single channel for all signaling between exchanges or other nodes in the telecommunication network served by the system.

SS7 defines the procedures for the set up, ongoing management, and clearing of a call between telephone users. It performs these functions by exchanging telephone control message between the SS7 components that supports the end user' connection.

Examples of applications supported by SS7 are:

- PSTN;
- ISDN;
- Interaction with Network Databases, Service Control Points for service control;
- Mobiles (Public Land Mobile Network);
- Operations Administration and Maintenance of Networks.

Signaling Points

There are three kinds of signaling points in SS7 network:

- SSP (Service Switching Point)
- STP (Signal Transfer Point)
- SCP (Service Control Point)

Signaling Links

The SS7 signaling data link is a full-duplex, digital transmission channel operating at 64 Kbit/s digital channels. It is also suitable for operation over analogue channels and at lower speeds.

Signalling link Type

Designator	Name	Function
A Links	Access Links	Connect SCP/SSPs to home STP
B Links	Bridge Links	Connect two STPs at the same level
C Links	Cross Links	Connect mated STPs to each other
D Links	Diagonal Links	Connect STPs at different levels
E Links	Extended Links	Connect SCP/SSPs to non-home STP
F Links	Fully Associated Links	Connect (directly) SCP/SSPs

Signalling modes

In the **associated mode of signalling**, the messages relating to a particular signalling relation between two adjacent points are conveyed over a link set, directly interconnecting those signalling points.

In the **non-associated mode of signalling**, the messages relating to a particular signalling relation are conveyed over two or more linksets in tandem passing through one or more signalling points other than those which are the origin and the destination of the messages.

The **quasi-associated mode of signalling** is a limited case of the non-associated mode where the path taken by the message through the signalling network is pre-determined and, at a given point in time, fixed.

SS7 is specified for use in the associated and quasi-associated modes.

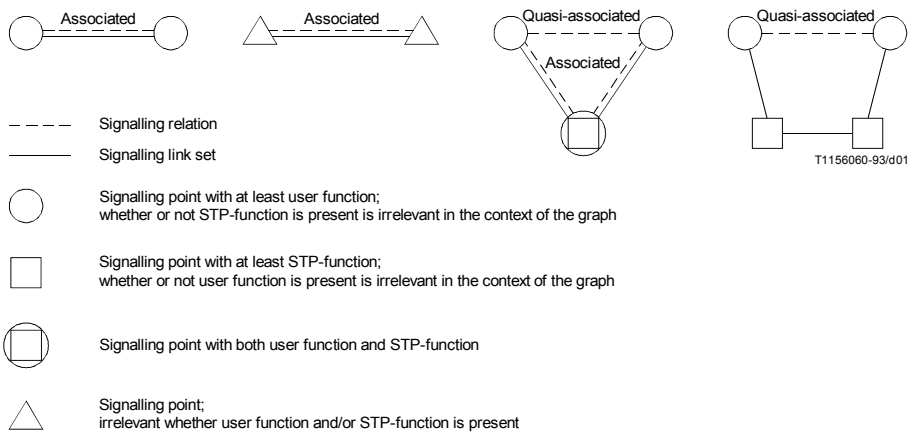


FIGURE 1/Q.700

Example of associated and quasi-associated signalling modes and definition of signalling network graph symbols

C.3. Architecture

From the perspective of an end user, the service provided by a telecommunications network may be regarded as a Network Layer service. However, from a signalling network perspective, the service may be provided at a different layer/level.

C.3.1. Message Transfer Part (MTP) levels 1-3

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C.3.1.1. Signalling data link functions (level 1)

Level 1 defines the physical, electrical and functional characteristics of a signalling data link and the means to access it. The level 1 function provides a bearer for a signalling link.

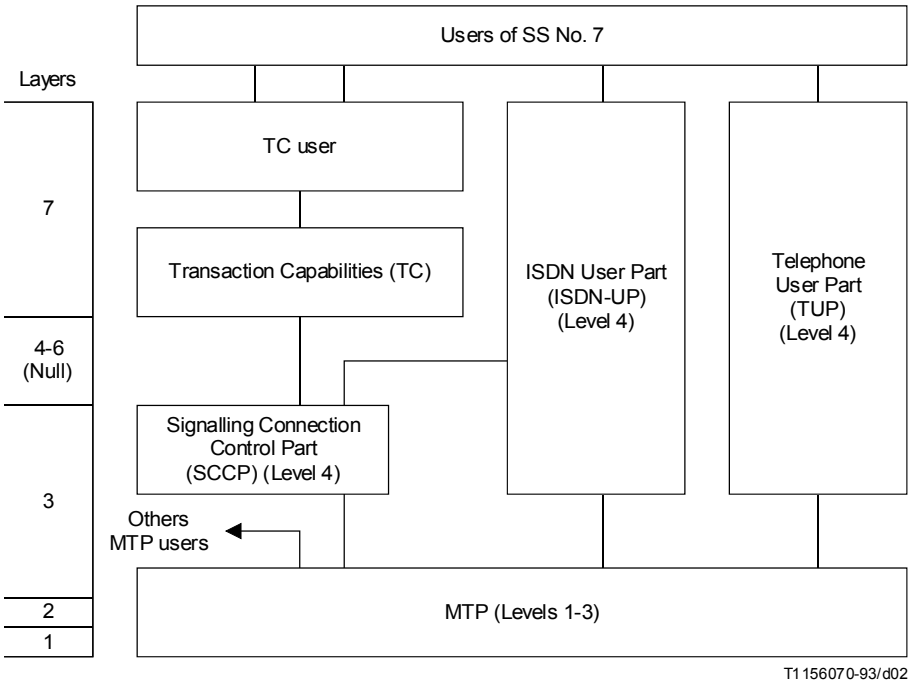


FIGURE 2/Q.700

Architecture of SS No. 7

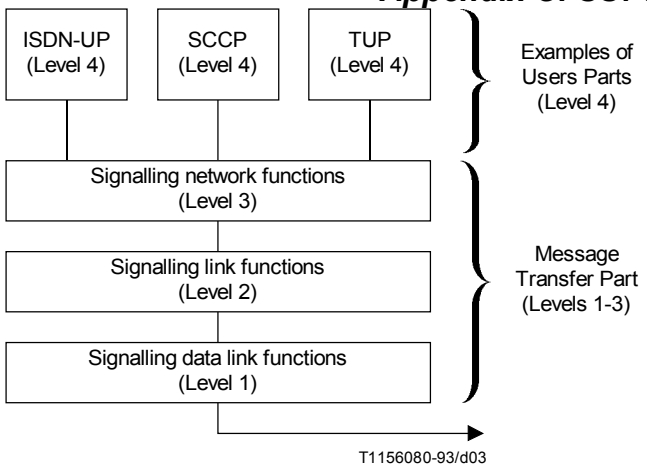


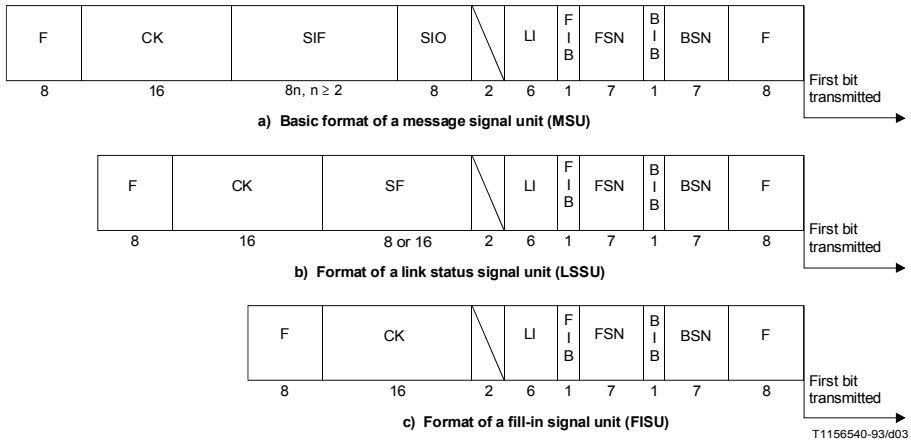
FIGURE 3/Q.700

SS No. 7 functional levels

C.3.1.2. Signalling link functions (level 2)

Level 2 defines the functions and procedures for and relating to the transfer of signalling messages over one individual signalling data link. The level 2 functions together with a level 1 signalling data link as a bearer, and provides a signalling link for reliable transfer of signalling messages between two points.

Three types of signal unit are differentiated by means of the *length indicator* contained in all signal units, i.e. message signal units, link status signal units and fill-in signal units. Message signal units are retransmitted in case of error, link status signal unit and fill-in signal units are not. The basic formats of the signal units are shown as following figure.



BIB	Backward indicator bit
BSN	Backward sequence number
CK	Check bits
F	Flag
FIB	Forward indicator bit
FSN	Forward sequence number
LI	Length indicator
n	Number of octets in the SIF
SF	Status field
SIF	Signalling information field
SIO	Service information octet

FIGURE 3/Q.703
Signal unit formats

Function and codes of the signal unit fields

General

The message transfer control information encompasses 8 fixed length fields in the signal unit which contain information required for error control and message alignment.

Flag

The opening flag indicates the start of a signal unit. The opening flag of one signal unit is normally the closing flag of the preceding signal unit. The closing flag indicates the end of a signal unit. The bit pattern for the flag is 01111110.

Length indicator

The length indicator is used to indicate the number of octets following the length indicator octet and preceding the *check bits* and is a number in binary code in the range 0-63. The length indicator differentiates between the three types of signal units as follows:

Length indicator = 0:	Fill in signal unit
Length indicator = 1 or 2:	Link status signal unit
Length indicator > 2:	Message signal unit

In the case that the signalling information field of a message signal unit is spanning 62 octets or more, the length indicator is set to 63. It is mandatory that LI is set by the transmitting end to its correct value as specified above.

Service information octet

The *service information octet* is divided into the *service indicator* and the *subservice field*. The service indicator is used to associate signalling information with a particular user part and is present only in message signal units.

Sequence numbering

The *forward sequence number* is the sequence number of the signal unit in which it is carried.

The *backward sequence number* is the sequence number of a signal unit being acknowledged.

The forward sequence number and backward sequence number are numbers in binary code from a cyclic sequence ranging from 0 to 127.

Indicator bits

The *forward indicator bit* and *backward indicator bit* together with the forward sequence number and backward sequence number are used in the basic error control method to perform the signal unit sequence control and acknowledgement functions.

Check bits

Every signal unit has 16 check bits for error detection.

Signalling information field

The *signalling information field* consists of an integral number of octets, greater than or equal to 2 and less than or equal to 272.

The value 272 allows a single message signal unit to accommodate information blocks of up to 268 octets in length accompanied by a routing label.

The format and codes of the signalling information field are defined for each user part.

Status field

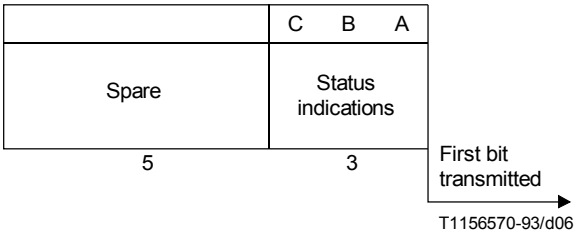


FIGURE 6/Q.703

Status field format

They are coded as follows:

C	B	A
0	0	0 – Status indication “O”
0	0	1 – Status indication “N”
0	1	0 – Status indication “E”
0	1	1 – Status indication “OS”
1	0	0 – Status indication “PO”
1	0	1 – Status indication “B”

Spare fields

Spare fields are coded 0, unless otherwise indicated.

Order of bit transmission

Within each field or subfield the bits will be transmitted with the least significant bit first. The 16 check bits are transmitted in the order generated.

C.3.1.3. Signalling network functions (level 3)

Level 3 in principle defines those transport functions and procedures that are common to and independent of the operation of individual signalling links. These functions fall into two major categories:

a) *Signalling message handling functions*.

b) Signalling network management function.

Service information octet

The service information octet of message signal units contains the service indicator and the sub-service field. The structure of the service information octet is shown in Figure 13.

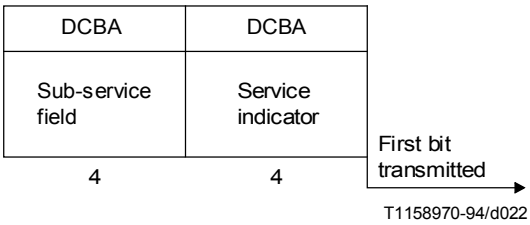


FIGURE 13/Q.704

Service information octet

Service indicator

The service indicator is used by signalling handling functions to perform message distribution and, in some special applications, to perform message routing.

The service indicator codes *for the international signalling network* are allocated as follows:

Bits DCBA				
0	0	0	0	Signalling network management messages
0	0	0	1	Signalling network testing and maintenance messages
0	0	1	0	Spare
0	0	1	1	SCCP
0	1	0	0	Telephone User Part
0	1	0	1	ISDN User Part
0	1	1	0	Data User Part (call and circuit related messages)
0	1	1	1	Data User Part (facility registration and cancellation messages)
1	0	0	0	Reserved for MTP Testing User Part
1	0	0	1	Spare
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

Sub-service field

The sub-service field contains the network indicator (bits C and D) and two spare bits (bits A and B).

The *network* indicator is used by signalling message handling functions (e.g. in order to determine the relevant version of a User Part).

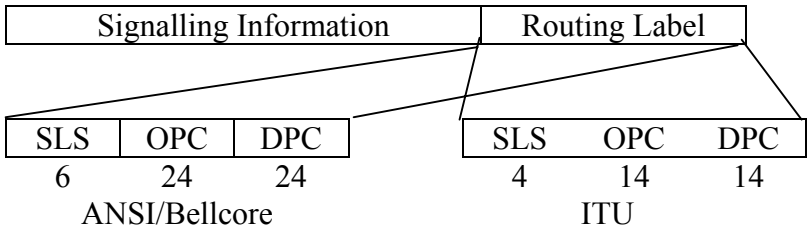
The network indicator codes are allocated as follows:

Bits D C

0 0	International network
0 1	Spare (for international use only)
1 0	National network
1 1	Reserved for national use

Label

For signalling network management messages the label coincides with the routing label and indicates the destination and originating signalling points of the message. The routing label is in the signalling information field (SIF) of message signal units.



Standard label structure

DPC Destination Point Code
OPC Originating Point Code
SLC Signalling Link Code

In ANSI standard, the routing label uses 7 octets; In ITU-T standard, the routing label uses 4 octets. ANSI point codes use 24 bits, 3 octets; ITU point codes typically use 14 bits.

The national point code format is different for every country. In the United States there are three parts to the point code, the network identifier, the cluster identifier, and the member identifier. Each part is one octet.

The international point code format consists of zone, area, and member identifiers. The zone identifier is a 3-bit field, the area identifier is an 8-bit field, and the member identifier is a 3-bit field.

In ANSI standard, the size of SLS was originally 5-bit field, it has been moved to adopt an 8-bit field to provide better loadsharing across signaling links. In ITU standard, the size of SLS is 4-bit field.

Following figure shows the routing label and its location:

C.3.2. Level 4: MTP User functions

Level 4 consists of the different User Parts. Each User Part defines the functions and procedures of the signalling system that are particular to a certain type of user of the system. The following entities are defined as User Parts in SS7.

C.3.2.1. Signalling Connection Control Part (SCCP)

The SCCP provides additional functions to the Message Transfer Part to provide connectionless and connection-oriented network services to transfer circuit-related, and non-circuit-related signalling information.

The SCCP provides the means to

- control logical signalling connections in a SS 7 network;
- transfer Signalling Data Units across the SS 7 network with or without the use of logical signalling connections.

SCCP provides a routing function which allows signalling messages to be routed to a signalling point based on, for example, dialled digits. This capability involves a translation function which translates the global title (e.g. dialled digits) into a signalling point code and a sub-system number.

SCCP also provides a management function, which controls the availability of the "sub-systems", and broadcasts this information to other nodes in the network which have a need to know the status of the "sub-system". An SCCP sub-system is an SCCP User.

The SCCP message is comprised of a one-octet message type field which defines the contents of the remainder of the message.

Message Type
0000 0001 : CR Connection Request
0000 0010 : CC Connection Confirm
0000 0011 : CREF Connection Refused
0000 0100 : RLSD Released
0000 0101 : RLC Release Complete
0000 0110 : DT1 Data Form 1
0000 0111 : DT2 Data Form 2
0000 1000 : AK Data Acknowledgement
0000 1001 : UDT Unitdata
0000 1010 : UDTS Unitdata Service
0000 1011 : ED Expedited Data
0000 1100 : EA Expedited Data Acknowledgement
0000 1101 : RSR Reset Request
0000 1110 : RSC Reset Confirm
0000 1111 : ERR Protocol Data Unit Error
0001 0000 : IT Inactivity Test

0001 0001 : XUDT Extended Unitdata
0001 0010 : XUDTS Extended Unitdata Service

C.3.2.2. Telephone User Part (TUP)

The TUP Recommendations define the international telephone call control signalling functions for use over SS7.

TUP Heading Code Allocation:

xxxx 0001 FAM Forward address message
0001 0001 IAM Initial address message
0010 0001 IAI Initial address message with additional information
0011 0001 SAM Subsequent address message
0100 0001 SAO Subsequent address message with one signal

xxxx 0010 FSM Forward set-up message
0001 0010 GSM General forward set-up information message
0011 0010 COT Continuity signal
0100 0010 CCF Continuity-failure signal

xxxx 0011 BSM Backward set-up message
0001 0011 GRQ General request message

xxxx 0100 SBM Successful backward set-up information message
0001 0100 ACM Address complete message
0010 0100 CHG Charging message

xxxx 0101 UBM Unsuccessful backward set-up information message
0001 0101 SEC Switching-equipment-congestion signal
0010 0101 CGC Circuit-group-congestion signal
0011 0101 NNC National-network-congestion signal
0100 0101 ADI Address incomplete signal
0101 0101 CFL Call-failure signal
0110 0101 SSB Subscriber-busy signal (electrical)

0111 0101 UNN Unallocated-number signal
1000 0101 LOS Line-out-of-service signal
1001 0101 SST Send-special-information tone signal
1010 0101 ACB Access barred signal
1011 0101 DPN Digital path not provided signal
1100 0101 MPR Misdialled trunk prefix
1111 0101 EUM Extended unsuccessful backward set-up information message

xxxx 0110 CSM Call supervision message
0000 0110 ANU Answer signal, unqualified
0001 0110 ANC Answer signal, charge
0010 0110 ANN Answer signal, no charge
0011 0110 CBK Clear-back signal
0100 0110 CLF Clear-forward signal
0101 0110 RAN Reanswer signal
0110 0110 FOT Forward-transfer signal
0111 0110 CCL Calling party clear signal

xxxx 0111 CCM Circuit supervision message
0001 0111 RLG Release-guard signal
0010 0111 BLO Blocking signal
0011 0111 BLA Blocking-acknowledgement signal
0100 0111 UBL Unblocking signal
0101 0111 UBA Unblocking-acknowledgement signal
0110 0111 CCR Continuity-check-request signal
0111 0111 RSC Reset-circuit signal

xxxx 1000 GRM Circuit group supervision messages
0001 1000 MGB Maintenance oriented group blocking message
0010 1000 MBA Maintenance oriented group blocking-acknowledgement message
0011 1000 MGU Maintenance oriented group unblocking message
0100 1000 MUA Maintenance oriented group unblocking-acknowledgement message

0101 1000 HGB Hardware failure oriented group blocking message
0110 1000 HBA Hardware failure oriented group blocking-acknowledgement message
0111 1000 HGU Hardware failure oriented group unblocking message
1000 1000 HUA Hardware failure oriented group unblocking-acknowledgement message
1001 1000 GRS Circuit group reset message
1010 1000 GRA Circuit group reset-acknowledgement message
1011 1000 SGB Software generated group blocking message
1100 1000 SBA Software generated group blocking-acknowledgement message
1101 1000 SGU Software generated group unblocking message
1110 1000 SUA Software generated group unblocking-acknowledgement

xxxx 1010 CNM Circuit network management message group
0001 1010 ACC Automatic congestion control information message

C.3.2.3. Data User Part (DUP)

It defines the protocol to control interexchange circuits used on data calls, and data call facility registration and cancellation.

C.3.2.4. ISDN User Part (ISUP)

The ISUP encompasses signalling functions required to provide switched services and user facilities for voice and non-voice applications in the ISDN.

The ISUP is also suited for application in dedicated telephone and circuit-switched data networks and in analogue, and mixed analogue/digital networks.

Message Types:

00000110 ACM Address complete
00001001 ANM Answer
00010011 BLO Blocking
00010101 BLA Blocking acknowledgement
00011101 CMC call modification completed +
00011100 CMRJ call modification reject +
00011110 CMR call modification request +
00101100 CPG Call progress
00011000 CGB Circuit group blocking
00011010 CGBA Circuit group blocking acknowledgement
00101010 CQM Circuit group query @
00101011 CQR Circuit group query response @
00010111 GRS Circuit group reset
00101001 GRA Circuit group reset acknowledgement
00011001 CGU Circuit group unblocking
00011011 CGUA Circuit group unblocking acknowledgement
00110001 CRG Charge information @
00101111 CFN Confusion
00000111 CON Connect
00000101 COT Continuity
00010001 CCR Continuity check request
00100111 DRS delayed release +
00110011 FAC Facility @
00100000 FAA Facility accepted
00100001 FRJ Facility reject
00011111 FAR Facility request
00001000 FOT Forward transfer
00110110 IDR Identification request
00110111 IRS Identification response
00000100 INF Information @
00000011 INR Information request @
00000001 IAM Initial address
00100100 LPA Loop back acknowledgement @

00110010 NRM Network resource management
00110000 OLM Overload @
00101000 PAM Pass-along @
00001100 REL Release
00010000 RLC Release complete
00010010 RSC Reset circuit
00001110 RES Resume
00111000 SGM Segmentation
00000010 SAM Subsequent address
00001101 SUS Suspend
00010100 UBL Unblocking
00010110 UBA Unblocking acknowledgement
00101110 UCIC Unequipped CIC @
00110101 UPA User Part available
00110100 UPT User Part test
00101101 USR User-to-user information

+ The format of this message is not used in the 1993-version Recommendations.
@ the format of this message is a national matter.

C.3.3. Transaction Capabilities

TC provides the means to establish non-circuit-related communication between two nodes in the signalling network.

C.3.4. Applications

Applications are modelled in layer 7. They are the process which provide the end user of the telephone or ISDN network with the basic and supplementary telecommunication services. They comprise the users of TC.

C.4. Standards of SS7

SS7 consists of a number of components or functions which are defined in the ITU Q.7xx-Series Recommendations, and national variants such as ANSI T1.11x Series Standards. The following table lists important SS7 standards documents:

SS7 Layer	ITU	ANSI
MTP Level 2	ITU Q.701-Q.703, 1993	ANSI T1.111.2-T1.111.3, 1992
MTP Level 3	ITU Q.704-Q.707, 1993	ANSI T1.111.4-T1.111.7, 1992
SCCP	ITU Q.711-Q.714, 1993	ANSI T1.112, 1992
TUP	CCITT Q.721-Q.724, 1988	Not Applicable
ISUP	ITU Q.761-Q.764,1993	ANSI T1.113, 1992
TCAP	ITU Q.771-Q.775,1993	ANSI T1.114, 1992

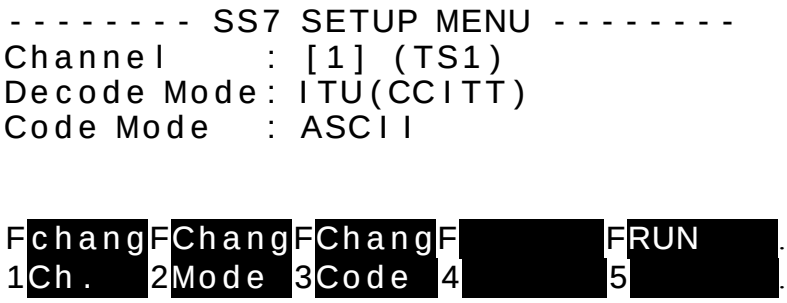
C.5. Using SS7 Application

C.5.1. Configure BTM10

Please make sure the BTM10 is configured as same as received E1 or T1 line frame format at first. This can be verified by BTM10 LED panel, Frame Sync LED must be lighted always. The other way you can go to BERT Analysis function, there is no any "Frm Los (Frame Loss)" or "Sig Los (Signal Loss)" message on the screen, and frame error count, CRC error count, BPV error count, and E-bit error count must be all zero. Please refer to Chapter 5 Configuration Setup for more information.

C.5.2. Operation

From the fifth menu page, press F4 key "SS7 Analysis" will enter this feature. The screen will show as following:



SS7 Analysis Screen

You may select specific E1 or T1 channel, decode method, and character code mode to analyze SS7 message by pressing following function keys:

[F1]Chang Ch.	Change channel (timeslot). In E1 mode, you can select available E1 timeslot from 1 to 31; In T1 mode, you can select available T1 timeslot from 1 to 24.
[F1]Chang Mode	Change decode mode. There are three kinds of decode modes, ITU(CCITT), ANSI/Bellcore, and Data only modes.
[F1]Chang Code	Change display character code type. The available display character code type are ASCII, EBCDIC, Transcodes, IPARS, EBCD, and HEX codes.
[F1]RUN	Execute this analysis feature.
RUN	Execute this analysis feature.
ESC	Exit this analysis feature.

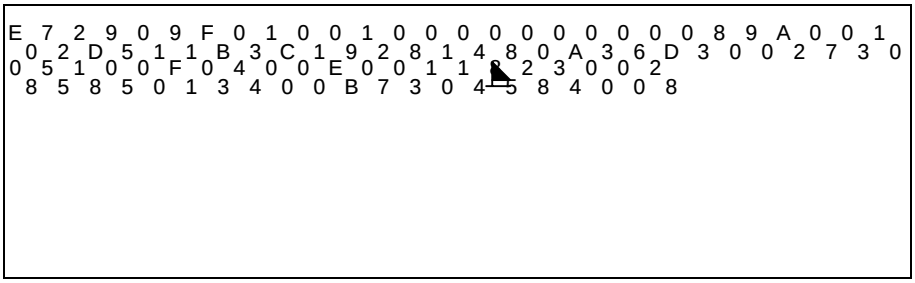
C.5.3. Running SS7 Analysis

After executing this feature by pressing F5 or RUN key, you will get the "WAITING FOR DATA ..." message. If BTM10 received incoming SS7 message, will decode, if the decode mode is selected to ITU or ANSI/Bellcore decode mode, and display the message on the screen. There are totally three pages of decoding displays.

After program is running, the following function keys are enable:

ESC	Exit this analysis feature.
HEX	Toggle from alphabetical display mode and hexadecimal mode.
⇨	Display the next decoded page of current frames on the screen.
⇦	Display the previous decoded page of current frames on the screen.

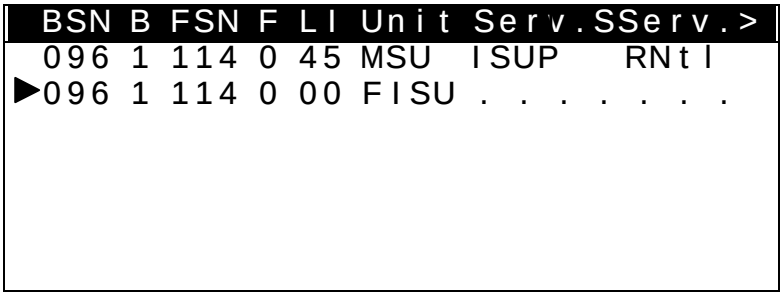
In the data mode, the screen may be as same as following:



Data mode display screen

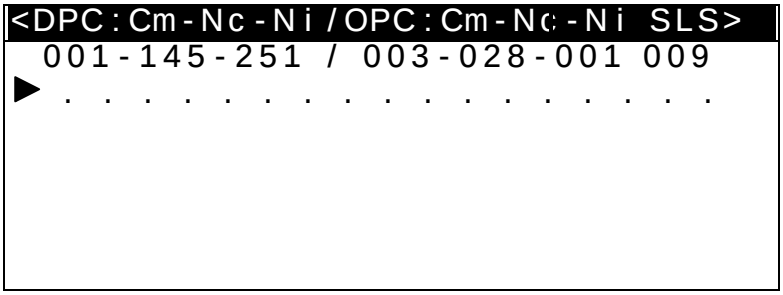
The normal "◣" is the symbol of SS7 frame check bits good. The flash "◣" is the symbol of SS7 frame check bits error. The flash ""¯" is the symbol of SS7 frame abort indicator.

In the ITU(CCITT) decode or ANSI/Bellcore decode mode, the screen may be as following:



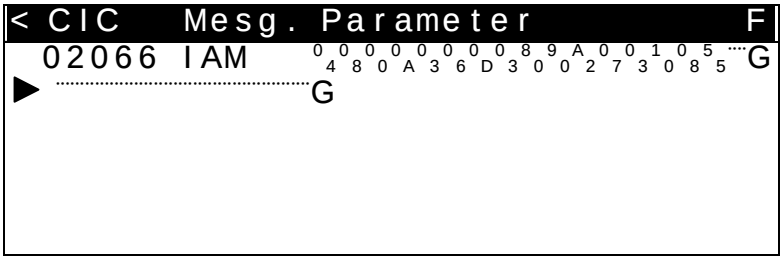
Data mode display screen (page 1)

Press ⇨ key will get the display as following:



Data mode display screen (page 2)

Press ⇨ key again will get the display as following:



Data mode display screen (page 3)

Following is all display mnemonics and its meanings:

Field	**Mnemonic**	**Meaning**	**Type**
BSN	0~127	Backward sequence number	
B	0,1	BIB, Backward indicator bit	
FSN	0~127	Forward sequence number	
F	0,1	FIB, Forward indicator bit	
LI	0~63	Length indicator	
Unit		Signal unit:	
	FISU	Fill-in Signal Unit	
	LSSU	Link Status Signal Unit	
	MSU	Message Signal Unit	
Serv.		Service indicator:	
	SN_mgmt	Signaling network management	
	SN_test	Signaling network testing	
	SCCP	SCCP	
	TUP	Telephone User Part	
	ISUP	ISDN User Part	
	DUP	Data User Part	
	MTP_TUP	Reserved for MTP Testing User Part	
	---	Spare	

(SF)		Status field:	
	O	Out of alignment	
	N	Normal alignment	
	E	Emergency alignment	
	OS	Out of service	
	PO	Processor Outage	
	B	Busy	
	---	Spare	
SServ		Sub-service field:	
	Intl	International network	
	Natl	National network	
	RNtl	Reserved for national use	
	---	Spare	
DPC:		Destination point code:	
Cm	0~7	ITU, signalling point identification	
	0~255	ANSI, network cluster member	
Nc	0~255	ITU, area/network identication; ANSI, network cluster,	
Ni	0~7	ITU, zone identification	
	0~255	ANSI, network identifier	
OPC:		Originating point code:	
Cm	0~7	ITU, signalling point identification	
	0~255	ANSI, signalling point identification	
Nc	0~255	ITU, area/network identication; ANSI, network cluster,	
Ni	0~7	ITU, zone identification	
	0~255	ANSI, network identifier	
SLS	0~15	ITU, signalling link selection, signalling link code(SLC)	
	0~255	ANSI, signalling link selection, signalling link code(SLC)	
CIC	0~4095	ITU, circuit identification code	
	0~16383	ITU, circuit identification code	

Mesg.		Message type code:	
	ACB	Access barred signal	TUP
	ACC	Automatic congestion Control information message	TUP
	ACM	Address complete message	ISUP, TUP
	ADI	Address incomplete signal	TUP
	AK	Data Acknowledgement	SCCP
	ANC	Answer signal, charge	TUP
	ANM	Answer	ISUP
	ANN	Answer signal, no charge	TUP
	ANU	Answer signal, unqualified	TUP
	BLA	Blocking acknowledgement signal	ISUP, TUP
	BLO	Blocking signal	ISUP, TUP
	CBK	Clear-back signal	TUP
	CC	Connection Confirm	SCCP
	CCF	Continuity-failure signal	TUP
	CCL	Calling party clear signal	TUP
	CCR	Continuity-check-request signal	ISUP, TUP
	CFL	Call-failure signal	TUP
	CFN	Confusion	ISUP
	CGB	Circuit group blocking	ISUP
	CGBA	Circuit group blocking acknowledgement	ISUP
	CGC	Circuit-group-congestion signal	TUP
	CGU	Circuit group unblocking	ISUP
	CGUA	Circuit group unblocking acknowledgement	ISUP
	CHG	Charging message	TUP
	CLF	Clear-forward signal	TUP
	CMC	call modification completed +	ISUP

	CMR	call modification request +	ISUP
	CMRJ	call modification reject +	ISUP
	CON	Connect	ISUP
	COT	Continuity signal	ISUP, TUP
	CPG	Call progress	ISUP
	CQM	Circuit group query @	ISUP
	CQR	Circuit group query response @	ISUP
	CR	Connection Request	SCCP
	CREF	Connection Refused	SCCP
	CRG	Charge information @	ISUP
	DPN	Digital path not provided signal	TUP
	DRS	delayed release +	ISUP
	DT1	Data Form 1	SCCP
	DT2	Data Form 2	SCCP
	EA	Expedited Data Acknowledgement	SCCP
	ED	Expedited Data	SCCP
	ERR	Protocol Data Unit Error	SCCP
	EUM	Extended unsuccessful backward set-up information message	TUP
	FAA	Facility accepted	ISUP
	FAC	Facility @	ISUP
	FAR	Facility request	ISUP
	FOT	Forward-transfer signal	ISUP, TUP
	FRJ	Facility reject	ISUP
	GRA	Circuit group reset-acknowledgement message	ISUP, TUP
	GRQ	General request message	TUP
	GRS	Circuit group reset message	ISUP, TUP
	GSM	General forward set-up information message	TUP

	HBA	Hardware failure oriented group blocking-acknowledgement message	TUP
	HGB	Hardware failure oriented group blocking message	TUP
	HGU	Hardware failure oriented group unblocking message	TUP
	HUA	Hardware failure oriented group unblocking-acknowledgement message	TUP
	IAI	Initial address message with additional information	TUP
	IAM	Initial address message	ISUP, TUP
	IDR	Identification request	ISUP
	INF	Information @	ISUP
	INR	Information request @	ISUP
	IRS	Identification response	ISUP
	IT	Inactivity Test	SCCP
	LOS	Line-out-of-service signal	TUP
	LPA	Loop back acknowledgement @	ISUP
	MBA	Maintenance oriented group blocking-acknowledgement message	TUP
	MGB	Maintenance oriented group blocking message	TUP
	MGU	Maintenance oriented group unblocking message	TUP
	MPR	Misdialled trunk prefix	TUP
	MUA	Maintenance oriented group unblocking- acknowledgement message	TUP
	NNC	National-network-congestion signal	TUP
	NRM	Network resource management	ISUP
	OLM	Overload @	ISUP
	PAM	Pass-along @	ISUP
	RAN	Reanswer signal	TUP
	REL	Release	ISUP

	RES	Resume	ISUP
	RLC	Release Complete	SCCP, ISUP
	RLG	Release-guard signal	TUP
	RLSD	Released	SCCP
	RSC	Reset Confirm	SCCP
	RSC	Reset-circuit signal	ISUP, TUP
	RSR	Reset Request	SCCP
	SAM	Subsequent address message	ISUP, TUP
	SAO	Subsequent address message with one signal	TUP
	SBA	Software generated group blocking-acknowledgement message	TUP
	SEC	Switching-equipment-congestion signal	TUP
	SGB	Software generated group blocking message	TUP
	SGM	Segmentation	ISUP
	SGU	Software generated group unblocking message	TUP
	SSB	Subscriber-busy signal (electrical)	TUP
	SST	Send-special-information tone signal	TUP
	SUA	Software generated group unblocking-acknowledgement	TUP
	SUS	Suspend	ISUP
	UBA	Unblocking-acknowledgement signal	ISUP, TUP
	UBL	Unblocking signal	ISUP, TUP
	UCIC	Unequipped CIC @	ISUP
	UDT	Unitdata	SCCP
	UDTS	Unitdata Service	SCCP
	UNN	Unallocated-number signal	TUP

	UPA	User Part available	ISUP
	UPT	User Part test	ISUP
	USR	User-to-user information	ISUP
	XUDTS	Extended Unitdata Service	SCCP
Para-meter		Mandatory fixed part, mandatory variable part, optional part	
F		Flag, check bits	
	G	Good	
	B	CRC error	
	A	Abort	
	E	Frame length error or short	

LAPV5(LAPV5-EF)

	Flag 07EH	Envelope Function Address	Envelope Function Address	Information	FCS (fist octet)	FCS (second octet)	Flag 07EH
Octets	1	2	3	4	N-2	N-1	N

LAPV5-EF

LAPV5(LAPV5-DL)

	Link address	Link address (low order octet)	Control	Control
Octets	1	2	3	

Format A

	Link address	Link address (low order octet)	Control	Control	Information
Octets	1	2	3		N

Format B

Control field bits (modulo 128)	8	7	6	5	4	3	2	1	
I format	N(S)							0	Octet 4
	N(R)							P	5
S format	X	X	X	X	S	S	0	1	Octet 4
	N(R)							P/F	5
U format	M	M	M	P/F	M	M	1	1	Octet 4

N(S) Transmitter send sequence number
N(R) Transmitter receive sequence number
S Supercisory function bit
M Modifier function bit
P/F Poll bit when issued as a command, final bit when issued as a response
X Reserved and set to 0

Control field format

Layer 3

Bits 8	7	6	5	4	3	2	1	Octets
Protocol discriminator								1
Layer 3 address							1	2
Layer 3 address (lower)								3
0	Message type							4
Other information elements as required								etc.

BTM10 V5 Analysis Display

Field	Mnemonic	Meaning	Type
EFaddr	0~8191	Envelope Function Address	
LKaddr	0~8191	Link address	
CR	0,1	Command/response field bit	
Frame		Frame types (Commands and responses)	
	INFO	Information	I format
	RR	Receive ready	S format
	RNR	Receive not ready	S format
	REJ	Reject	S format
	SABME	Set asynchronous balanced mode extended	U format
	DM	Disconnected	U format
	UI	Unnumbered information	U format
	DISC	Disconnect	U format
	UA	Unnumbered acknowledgement	U format
	FRMR	Frame reject	U format
	XID	Exchange Identification	U format
NS	0~127	Transmitter send sequence number	
NR	0~127	Transmitter receive sequence number	
PF	0,1	Poll bit when issued as a command, final bit when issued as a response	
Protocol		Protocol	
	PSTN	PSTN protocol	
	Control	Control protocol	
	BCC	BCC protocol	
	Protect	Protection protocol	
	Link CTL	Link Control protocol	
PD	00~FFH	Protocol discriminator	
L3addr	0~65535	Layer 3 address	
MessageType		Message type	

	ESTABLISH	Establish	PSTN protocol
	ESTAB ACK	Establish acknowledge	PSTN protocol
	SIGNAL	Signal	PSTN protocol
	SIGNAL ACK	Signal acknowledge	PSTN protocol
	DISCON	Disconnect	PSTN protocol
	DISCON COMP	Disconnect complete	PSTN protocol
	STATUS ENQ	Status enquiry	PSTN protocol
	STATUS	Status	PSTN protocol
	PROTO PARAME	Protocol parameter	PSTN protocol
	PORT CONTROL	Port control	Control protocol
	PORT CTL ACK	Port control acknowledge	Control protocol
	COM CONTROL	Common control	Control protocol
	COM CTL ACK	Common control acknowledge	Control protocol
	SW-OVER REQ	Switch-over request	Protection protocol
	SW-OVER COM	Switch-over command	Protection protocol
	OS SW-OV COM	Os switch-over command	Protection protocol
	SW-OVER ACK	Switch-over acknowledge	Protection protocol
	SW-OVER REJ	Switch-over reject	Protection protocol
	PROTOCOL ERR	Protocol error	Protection protocol
	RESET SN COM	Reset SN command	Protection protocol
	RESER SN ACK	Reset SN acknowledge	Protection protocol
	ALLOCATION	Allocation	BCC protocol
	ALLOCAT COMP	Allocation complete	BCC protocol
	ALLOCAT REJ	Allocation reject	BCC protocol
	DE-ALLOCAT	De-allocation	BCC protocol
	DE-ALLO COMP	De-allocation complete	BCC protocol
	DE-ALLO REJ	De-allocation reject	BCC protocol
	AUDIT	Audit	BCC protocol

	AUDIT COMP	Audit complete	BCC protocol
	AN FAULT	An fault	BCC protocol
	AN FAULT ACK	An fault acknowledge	BCC protocol
	PROTOCOL ERR	Protocol error	BCC protocol
	LINK CONTROL	Link control	Link Control protocol
	LINK CTL ACK	Link control acknowledge	Link Control protocol
Information		Information element	
	SEQUENCE NUMBER	Sequence number	PSTN protocol
	CADENCED RING	Cadenced ringing	PSTN protocol
	PULSED SIGNAL	Pulsed signal	PSTN protocol
	STEADY SIGNAL	Steady signal	PSTN protocol
	DIGIT SIGNAL	Digit signal	PSTN protocol
	RECOGNISE TIME	Recognition time	PSTN protocol
	ENAB AUTO ACK	Enable autonomous acknowledge	PSTN protocol
	DISAB AUTO ACK	Disable autonomous acknowledge	PSTN protocol
	CAUSE	Cause	PSTN protocol
	RESOURCE UNA	Resource unavailable	PSTN protocol
	CTL FUNCT ELEM	Control function element	Control protocol
	CTL FUNCTION ID	Control function identification	Control protocol
	VARIANT	Variant	Control protocol
	INTERFACE ID	Interface identification	Control protocol
	LINK CTL FUNCT	Link control function	Link Control protocol
	USER PORT ID	User port identification	BCC protocol
	ISDN PORT CH ID	Isdn port channel identification	BCC protocol
	V5 TIMESLOT ID	V5 time slot identification	BCC protocol
	MULTI-SLOT MAP	Multi-slot map	BCC protocol
	REJECT CAUSE	Reject cause	BCC protocol

	PROTO ERR CAUSE	Protocol error cause	BCC protocol
	CONNEC INCOM	Connection incomplete	BCC protocol
	SEQUENCE NUMBER	Sequence number	Protection protocol
	PHYSI C-CH ID	Physical c-channel identification	Protection protocol
	REJECT CAUSE	Reject cause	Protection protocol
	PROTO ERR CAUSE	Protocol error cause	Protection protocol
	LINE INFORM	Line information	PSTN protocol
	STATE	State	PSTN protocol
	AUTO SIG SEQ	Autonomous signal sequence	PSTN protocol
	SEQ RESPONSE	Sequence response	PSTN protocol
	END OF PULSE	End of pulse	PSTN protocol
	PERFOR GRADING	Performance grading	Control protocol
	REJECT CAUSE	Reject cause	Control protocol
Parameter		Other information elements as required	
F		Flag, Check bit	
	G	Good	
	B	CRC error	
	A	Abort	
	E	Frame length error or short	

Q.921

	Flag 07EH	Address (high order octet)	Address (low order octet)	Control	Control	FCS (fist octet)	FCS (second octet)	Flag 07EH
Octets	1	2	3	4	5	N-2	N-1	N

Format A

	Flag 07EH	Address (high order octet)	Address (low order octet)	Control	Control	Information	FCS (fist octet)	FCS (second octet)	Flag 07EH
Octets	1	2	3	4	5	…….	N-2	N-1	N

Format B

8	7	6	5	4	3	2	1	
SAPI						C/R	EA 0	Octet 2
TEI							EA 1	3

Address field format

Control field bits (modulo 128)	8	7	6	5	4	3	2	1	
I format	N(S)							0	Octet 4
	N(R)							P	5
S format	X	X	X	X	S	S	0	1	Octet 4
	N(R)							P/F	5
U format	M	M	M	P/F	M	M	1	1	Octet 4

N(S) Transmitter send sequence number
N(R) Transmitter receive sequence number
S Supercisory function bit
M Modifier function bit
P/F Poll bit when issued as a command, final bit when issued as a response
X Reserved and set to 0

Control field format

Q.931

Bits

8	7	6	5	4	3	2	1	Octets
Protocol discriminator								1
0	0	0	0	Length of reference value (in octets)				2
Call reference value								3
0	Message type							etc.
Other information elements as required								

BTM10 ISDN-D Analysis Display

Field	Mnemonic	Meaning	Type
EA0	0,1	Address field extension bit	
CR	0,1	Command/response field bit	
SAPI	0~63	Service access point identifier	
EA1	0,1	Address field extension bit	
TEI	0~127	Terminal endpoint identifier	
Frame		Frame types (Commands and responses)	
	INFO	Information	I format
	RR	Receive ready	S format
	RNR	Receive not ready	S format
	REJ	Reject	S format
	SABME	Set asynchronous balanced mode extended	U format
	DM	Disconnected	U format
	UI	Unnumbered information	U format
	DISC	Disconnect	U format
	UA	Unnumbered acknowledgement	U format
	FRMR	Frame reject	U format
	XID	Exchange Identification	U format
NS	0~127	Transmitter send sequence number	
NR	0~127	Transmitter receive sequence number	
PF	0,1	Poll bit when issued as a command, final bit when issued as a response	
PD	00~FFH	Protocol discriminator	
LE	0~15	Length call reference value	
CRV	0~32767	Call reference value	
MessageType		Message type	
	NET (00H)	Escape to nationally specific message type	
	ALERTING	Alerting	
	CALL PROC	Call proceeding	

	PROGRESS	Progress	
	SETUP	Setup	
	CONNECT	Connect	
	SETUP ACK	Setup acknowledge	
	CONN ACK	Connect acknowledge	
	USER INFO	User information	
	SUSP REJ	Suspend reject	
	RESUM REJ	Resume reject	
	HOLD	Hold	
	SUSPEND	Suspend	
	RESUME	Resume	
	HOLD ACK	Hold acknowledge	
	SUSP ACK	Suspend acknowledge	
	RESUM ACK	Resume acknowledge	
	HOLD REJ	Hold reject	
	RETRIEVE	Retrieve	
	RET ACK	Retrieve acknowledge	
	RET REJ	Retrieve reject	
	DISCON	Disconnect	
	RESTART	Restart	
	RELEASE	Release	
	RES ACK	Restart acknowledge	
	REL COMP	Release complete	
	SEGMENT	Segment	
	FACILITY	Facility	
	REGISTER	Register	
	FACIL ACK	Facility acknowledge	
	REG ACK	Register acknowledge	
	NOTIFY	Notify	
	FACIL REJ	Facility reject	
	REG REJ	Register reject	
	STAT ENQ	Status enquiry	
	CNGST CTL	Congestion control	
	INFO	Information	
	STATUS	Status	
Parameter		Other information elements as required	
F		Flag, Check bit	
	G	Good	

	B	CRC error	
	A	Abort	
	E	Frame length error or short	

Section 1. Introduction

The **BTM10** now supports a BIOS update function in conjunction with the **BTM10UP2.EXE** program running on a PC. Distribution agents must apply "**PASSWD.TXT**" file from CTC UNION first, this file is identification for one **BTM10** unit only, and it is a necessary file for following update procedure.

W A R N I N G

The BTM10 flash update is intended to be performed by distribution agents and dealers ***ONLY***. This procedure should never be attempted by the end user. Failure to follow the proper procedures, improper connection, loss of power, or any interruption in the upgrade process before completion may leave the BTM10 unit in an unusable state, requiring return to the factory, at user's expense.

BTM Testing Procedure

Prepare testing instrument:

1. *Frequency counter * 1*
2. *Standard E1 tester, likes BTM10 * 1*

Item	Function	Sub-Function	Testing Procedures	Testing Results	Status	Remark
1.	Power on initial and Firmware version		1) Turn on the power and watch the welcome logo on BTM10 LCD display. 2) Watch the latest version.	1) The screen shows: BTM10-E1 PROTOCOL ANALYZER ... Version:**x.65-13** S/N:1000495 2) The screen show main selection menu.		1) If the system halts on "SYSTEM INITIAL" or "L3(5) WRONG VERSION" message, it is failure. 2) Contact your agent to check whether you need to upgrade to new version or not.
2.	LCD		1) Adjust LCD display "Contrast" tuner. Watch LCD display.	1) The LCD display can be adjusted to light and dark. 2) Adjust to suitable viewing.		
3.	System Reset		1) Press F4 key in main menu page 1. 2) Press Left Arrow key to select "YES" 3) Press "ENTER", "ENTER" key to confirm it.	1) System reset and goes back to main menu page1.		

4.	Key Sound and Backlight		1) Press F5 key several times in main menu page 1.	1) The key sound is generated. 2) The backlight will be toggled to light or not.		
5.	E1 BERT testing	Bit Error Rate	1) Loopback E1 BNC TX port to RX port. 2) Press "F2" in main menu, execute BERT analysis. 3) Watch the display and LEDs testing results.	1) All the received error counters are 0. 2) In the LED panel, following LEDs are always lights: (the others don't) Signal Present Frame Sync Pattern Sync HDB3/B8ZS		
		Force Error	1) While the F2 shows Error/Logic, press "F4" key to force one logic error. 2) Watch the display and LEDs testing results. 3) Press "ESC","ESC" key to exit this function and go to main menu page 1.	1) The logic error should be 1. (got an logical error) 2) In the LED panel, following LEDs are always lights: Signal Present Frame Sync Pattern Sync HDB3/B8ZS 3) The "History" LED is flash. (the others don't)		

6.1.	VF Access	Frequency	1) Press “MORE" key to main menu page 2. 2) Press "F1" VF Access function. 3) Set the Tx Frequency to 800Hz, Tx Level to 0 dBm0. 4) Move the cursor down to “Speaker” item, press RIGHT ARROW to select “Soft”. 5) Watch the Rx frequency and level. 6) Hear the speaker.	1) The Rx Frequency should be 800Hz (plus or minus 1 Hz), and the Rx Level should be 0dBm0. 2) Can hear 800Hz tone.		It is loopback E1 BNC TX port to RX port now.
			7) Set the Tx Frequency to 1800Hz. 8) Watch the Rx frequency and level. 9) Hear the speaker.	1) The Rx Frequency should be 1800Hz (plus or minus 1 Hz), and the Rx Level should be 0dBm0. 2) Can hear 1800Hz tone.		
			10) Set the Tx Frequency to 2800Hz. 11) Watch the Rx frequency and level. 12) Hear the speaker.	1) The Rx Frequency should be 2800Hz (plus or minus 1 Hz), and the Rx Level should be 0dBm0. 2) Can hear 2800Hz tone.		
			13) Set the Tx Frequency to 3800Hz. 14) Watch the Rx frequency and level. 15) Hear the speaker.	1) The Rx Frequency should be 3800Hz (plus or minus 1 Hz), and the Rx Level should be 0dBm0. 2) Can hear 3800Hz tone.		

6.2.		Handset (testing option)	1) Press “F5” key to change Tx Mode to “Handset”. 2) Using a handset and plug it into VF port. Make noise on handset, you will get the voice on BTM10 speaker.	Make noise on handset, you will get the voice on BTM10 speaker.		
7.	Pulse Shape		1) Press "ESC", "ESC" key to main menu. 2) Press "F1" Configuration Setup mode. 3) Move down cursor and press RIGHT arrow key to select following parameters: Framing: Unframe Tx Timing: Internal Pattern: All one 4) Press "ESC" key to confirm and exit this setting. 5) Press “MORE” key to page 2, press “F2” pulse shape function. 6) Press “F2” to do testing. 7) Watch the testing result. 8) Press “ESC” key to	1) The E1 pulse shape should be inner “mask”, and display show “Good”.		1) Make sure your BTM10 is powered by external power adaptor. 2) It is loopback E1 BNC TX port to RX port now.

			exit this function and go back to main menu page 2.			
8.1.	PCM signal input test	Level and frequency measurement	1) Press "F3" to select "Signal Result" function. 2) Watch the test result on display.	1) The Receiver Level should be 0 or –1 dBdsx. 2) The Rx Frequency should be 02048000Hz or plus/minus 1 Hz.		1) Make sure your BTM10 is powered by external power adaptor. 2) It is loopback E1 BNC TX port to RX port now.
8.2.		External clock frequency measurement	1) Use another standard E1 tester. 2) Connect the standard E1 tester E1 Tx port to target BTM10 Ext/Ref port. 3) Watch the test result on display.	1) The LCD display shows: Ext. Frequency: 02048000Hz Ext. Freq. Offset:00000Hz (it may have +/- 1 Hz tolerance)		
8.3.		Disconnect measurement	1) Take off loopback of E1 BNC TX port to RX port.	1) The Receiver Level should be -43 dBdsx. --- Volts p-p		
9.1.	PCM signal output test	Internal clock measurement .	1) Prepare a frequency counter instrument. 2) Connects BTM10 E1 TX port to frequency counter Rx testing port. 3) Sets frequency counter to 1s measure period.	1) The internal OSC. frequency will force E1 AIS signal to 1024000Hz measured by frequency counter. 2) The tolerance is +/- 5 ppm. So, the frequency counter will get the value between		If the clock frequency is not exact, please contact CTC for calibration document. (The BTM10 is sending

			4) Watch frequency counter measured value.	1024005.12 to 1023994.88 Hz. [OQC] The tolerance is +/- 1 ppm, So, the frequency counter will get the value between 1024001.03 to 1023998.97 Hz.		out AIS, unframe all ones, signal now.)
9.2.		Internal clock plus 50ppm measurement.	1) Press “ESC”, “ESC” to go to main menu page 1. 2) Press "F1" Configuration Setup mode. 3) Move down cursor to Tx Timing item and press RIGHT arrow key to select following parameters: Framing: Unframe Tx Timing: +50 ppm Pattern: All one 4) Press "ESC" key to confirm and exit this setting. 5) Watch frequency counter measured value.	1) The internal OSC. frequency will force E1 AIS signal to 1024051.2Hz measured by frequency counter. 2) The tolerance is +/- 5 ppm. So, the frequency counter will get the value between 1024056.32 to 1024046.08 Hz. [OQC] The tolerance is +/- 1 ppm, So, the frequency counter will get the value between 1024050.17 to 1024052.23 Hz.		
9.3.		Internal clock minus 50ppm measurement.	1) Press "F1" Configuration Setup mode. 2) Move down cursor to	1) The internal OSC. frequency will force E1 AIS signal to 1023948.8Hz measured by frequency counter.		

			Tx Timing item and press RIGHT arrow key to select following parameters: Framing: Unframe Tx Timing: --50 ppm Pattern: All one 3) Press "ESC" key to confirm and exit this setting. 4) Watch frequency counter measured value. Take off the cable between BTM10 and frequency counter if you want to exit this testing.	2) The tolerance is +/- 5 ppm. So, the frequency counter will get the value between 1023943.68 to 1023953.92 Hz. [OQC] The tolerance is +/- 1 ppm, So, the frequency counter will get the value between 1023947.77 to 1023949.83 Hz.		
	System Reset to clear AIS status		1) Press “ESC”, “ESC” key to go to main menu page 1. 2) Press F4 key in main menu page 1. 3) Press Left Arrow key to select "YES" Press "ENTER", "ENTER" key to confirm it.	System reset and goes back to main menu page1.		
10.	Datacom BERT		1) Prepare standard E1 tester, likes BTM10. 2) Set standard E1 tester	Both standard E1 tester and BTM10 target get Receive Count and Second increase.		

			to do Datacom BERT (or 2M BERT) as following configure: MODE: DTE Interface: RS449/530/X.21 Pattern: QRSS Test Period: Continue Alarm: 1 bit Datacom Baud: 2048K(N64) Datacom Tx Clk: Internal Datacom Rx Clk: Normal Tx Clk Polarity: Normal Ins. Error Rate: Disable Datacom Flow Control: Disable 3) Set the BTM10 target to Datacom BERT: press “MORE”, “MORE” key to main menu page 3, select F1: Datacom BERT, and set the following configuration: MODE: DCE Interface: RS449/530/X.21 Pattern: QRSS	There is no any error on both units. (Error and Error second should be zero.)		

			Test Period: Continue Alarm: 1 bit Datacom Baud: 2048K(N64) Datacom Tx Clk: Internal Datacom Rx Clk: Normal Tx Clk Polarity: Normal Ins. Error Rate: Disable Datacom Flow Control: Disable 4) Connect both standard E1 tester and BTM10 target datacom port. 5) Run standard E1 tester BERT testing, 6) Run the BTM10 target BERT testing, 7) watch the testing result.			
			8) Force the BTM10 target to send out 1 error. (by press F2) 9) Watch the standard E1 tester result.	The standard E1 tester should get 1 error.		
			10) Force the standard E1 tester to send out 1 error. 11) Watch the BTM10	The target BTM10 should get 1 error, and the error second increased 1.		

			target result. 12) Press “ESC” key to exit this function.			
11.1.	External Drop and Insert	Drop and insert 1984K RS-530 to E1	1) Prepare standard E1 tester, likes BTM10. 2) Set standard E1 tester to do Datacom BERT (or 2M BERT) as following configure: MODE: DTE Interface: RS449/530/X.21 Pattern: QRSS Test Period: Continue Alarm: 1 bit Datacom Baud: 1984K(N64) Datacom Tx Clk: Internal Datacom Rx Clk: External Tx Clk Polarity: Normal Ins. Error Rate: Disable Datacom Flow Control: Disable 3) Set the BTM10 target to nx64K channel mode: At main menu page 1, press F1:Config. setup.	The standard E1 tester gets Receive Count and Second increase. There is no any error on both units. (Error and Error second should be zero.)		

			Move the cursor down to “Channel” item, and press Right Arrow to select “n* 64K” mode. Press “ESC” key to confirm it. 4) Press “MORE”, “MORE” key to main menu page 3, select F4: Drop and Insert, and set the following configuration: MODE: DCE Interface: RS449/530/X.21 Clock Source: Internal Datacom Tx Clock: Normal Datacom Rx Clock: Normal 5) Connect both standard E1 tester and BTM10 target datacom port. 6) Loopback the BTM10 target E1 Tx to Rx port. 7) Run the BTM10 target drop and insert function by press “RUN” key. 8) Run standard E1 tester BERT testing, 9) watch the standard E1			

			tester testing result.			
			10) Insert one error on standard E1 tester. 11) Watch the standard E1 tester testing result. 12) Press “ESC” key to exit this function and go to main menu page 3.	The standard E1 tester will get a received error.		
11.2.		Drop and insert 64K RS-232 to E1	1) Press “MORE” key to go to main menu page 4, press “F1” to go to Time Slot Setting. 2) Set the timeslot setting map to: f * FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF Total:01 timeslot(s) are used. 3) Press “ESC”, “ESC” to main menu page 1. select F4: Drop and Insert, and set the following configuration: MODE: DTE	The standard E1 tester gets Receive Count and Second increase. There is no any error on both units. (Error and Error second should be zero.)		

			Interface: RS-232 Clock Source: Internal Datacom Tx Clock: Normal Datacom Rx Clock: Normal 4) Set standard E1 tester to do Datacom BERT (or 2M BERT) as following configure: MODE: DCE Interface: RS-232 Pattern: QRSS Test Period: Continue Alarm: 1 bit Datacom Baud: 64K(N64) Datacom Tx Clk: Internal Datacom Rx Clk: External Tx Clk Polarity: Normal Ins. Error Rate: Disable Datacom Flow Control: Disable 5) Connect both standard E1 tester and BTM10 target datacom port. 6) Loopback the BTM10 target E1 Tx to Rx port.			

			7) Run the BTM10 target drop and insert function by press “RUN” key. 8) Run standard E1 tester BERT testing, 9) Watch the standard E1 tester testing result.			
			10) Insert one error on standard E1 tester. 11) Watch the standard E1 tester testing result. 12) Press “ESC” key to exit this function and go to main menu page 3.	The standard E1 tester will get a received error.		
12.1.	Self Test	Self Test Continue Mode	1) Press "MORE" key to main menu page 4. 2) Press "F5" key to select Self Test function. 3) Press "F2" key to do self-test continue mode. 4) Press "ESC" key while the "Press any key to exit" message is appear on screen if you want to exit this function.	1) System ROM, RAM test ok. 2) LEDs scan from DTE,DCE,DATACOM,Signal Present,...,Excess Zero, Bridge,...T1,One Den,...,to Ins Err. 3) LCD all dark, white and show characters.		
12.2.		Printer Port Test	1) While the BTM10 in main menu page 4, press "F5" to select	1) if there is a PRINTER BUSY message shown on screen, the print feature is failure.		

			Self Test function. 2) Connects BTM10 printer port to printer centronics port. 3) Press "F3" key, the BTM10 will send out test characters to printer.	Check printer cable or check whether printer is ready or not.		
12.3.		Keyboard Test	1) Press "F5" key will enter Keyboard Test. 2) Press every key to verify they all work fine. 3) Press SHIFT and ESC at the same time will exit this testing feature.			
12.4.		VF test	1) Press "MORE" key will go to self-test page 2 menu. 2) Connect BTM10 E1 Tx port to Rx port. 3) Press "F2" to select VF Test (Tone). 4) Press "ESC" key will exit this function.	1) While the screen shows "Speaker louder", you will hear a loud sound. 2) While the screen shows "Speaker soft", you will hear a soft sound. 3) While the screen shows "Speaker off", you will not hear a sound. 4) While the screen show "Frequency scanning.", you will hear a low to high frequency scan.		
13.	Clock Setup		1) Go to main menu page 4.			

			2) Press "F4: Miscellaneous and "F3" Clock Setup function. 3) Enter setting date, time, and even time. 4) Ignore Even: stop time by press any key. 5) Press "f3" Clock Setup to confirm your change is updated. 6) Press "ESC", "ESC" key to go back to main menu page 1.			

BTM10 testing procedure summary:

Model/SN#/Testing Date:_____

item	Function	Sub-Function	Status	Remark
1.	Power on initial and Firmware version			
2.	LCD			
3.	System Reset			
4.	Key Sound and Backlight			
5.	E1 BERT testing			
6.1.	VF Access	Frequency		
6.2.		Handset (option)		
7.	Pulse Shape			
8.1.	PCM signal input test	Level and frequency		
8.2.		External clock frequency		
8.3.		Disconnect		
9.1.	PCM signal output test	Internal clock		
9.2.		Internal clock plus 50ppm		
9.3.		Internal clock minus 50ppm		
10.	Datacom BERT			
11.1.	External Drop and Insert	Drop and insert 1984K RS-530 to E1		
11.2.		Drop and insert 64K RS-232 to E1		
12.1.	Self Test	Self Test Continue Mode		
12.2.		Printer Port Test		
12.3.		Keyboard Test		
12.4.		VF test		
13.	Clock Setup			