

HCT-BERT/H

Network Tester Series

E1/T1/Datacom
Bit Error Rate Tester

User's Guide

Version 1.0
Sept. 2002

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HCT-BERT/H

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This manual supports the following models:

HCT-BERT/H

The information contained in this document is subject to change without prior notice.

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1.1 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 $193 \times 8000 = 1.544$ 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 (DS1) 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.

Channel time slot (8 bits)

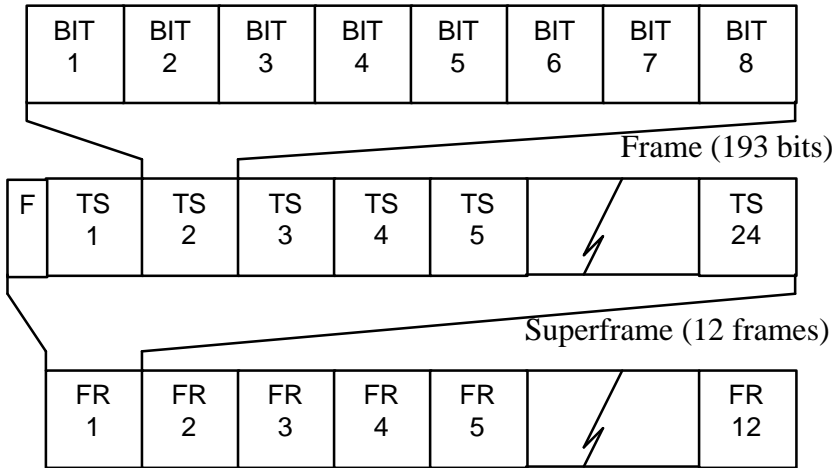
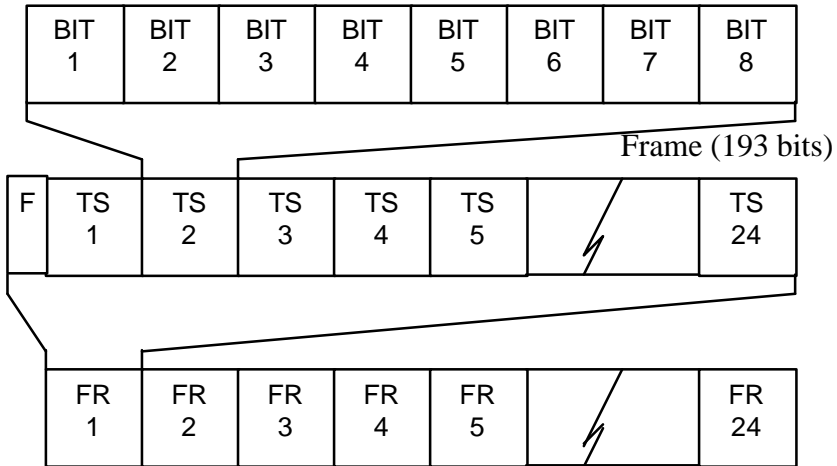


Fig. 1-1(a) ANSI Superframe bit assignment

Channel time slot (8 bits)



Extended Superframe (24 frames)

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 Slot		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. $64 \text{ Kbps} \times 32 \text{ channels} = 2.048 \text{ Mbps}$.

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:

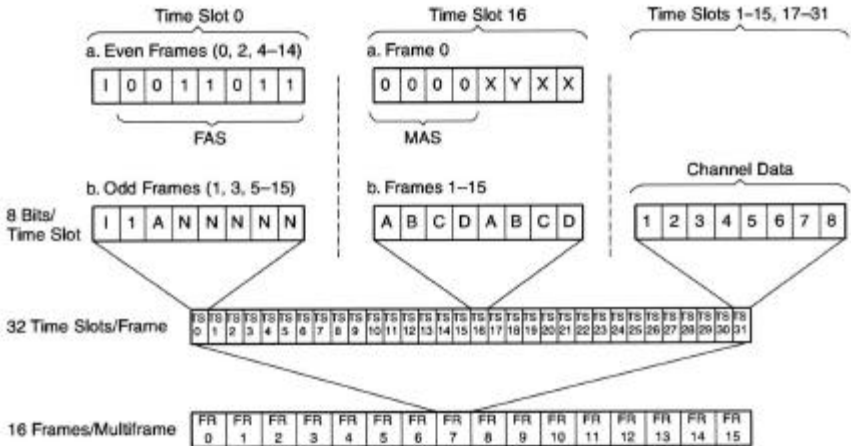


Fig. 1-2 ITU-T E1 Frame Structure

1.2 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

1.3 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.

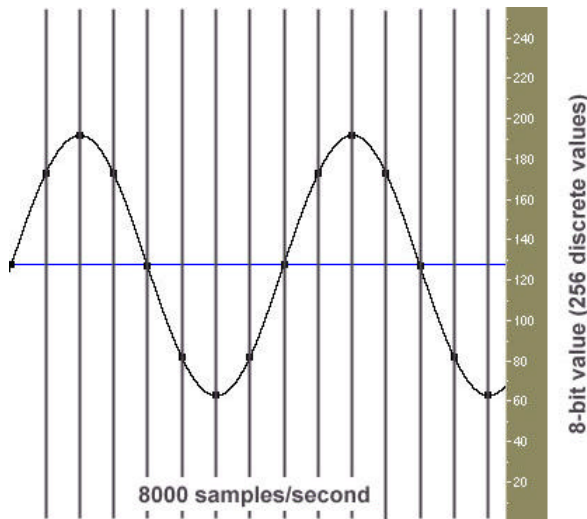


Fig. 1-3 PCM Sampling Example

1.4 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.

1.5 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.

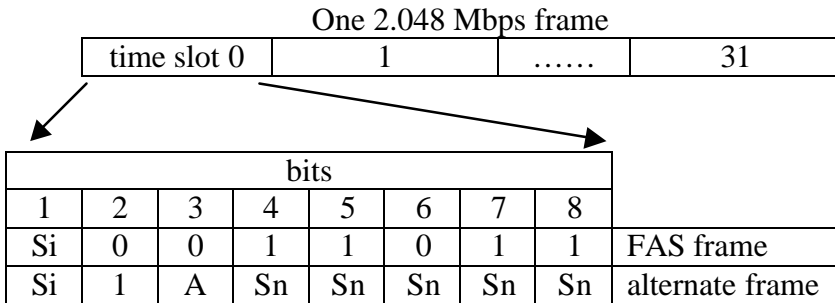


Figure 1-3 The FAS Frame Format

- 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.

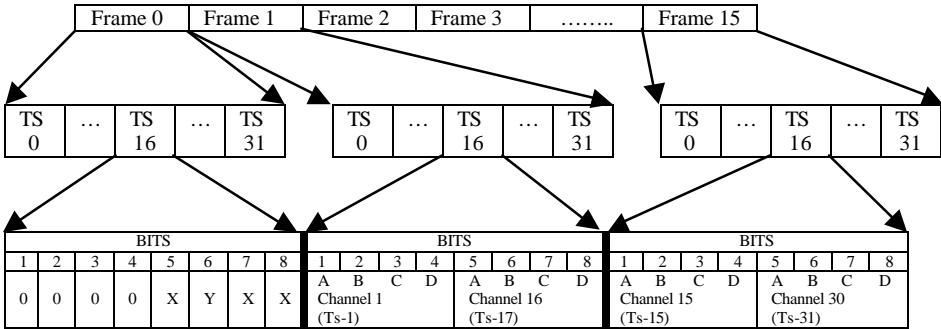


Figure 1-4 The MFAS Frame Format

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.

1.6 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
II	7	0/Si	1	A	SA4	SA5	SA6	SA7	SA8
	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
II	7	0/Si	1	A	D	E6	E7	E22	E23
	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
II	7	A7	B7	C7	D7	A23	B23	C23	D23
	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.

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2.1 Introduction

The **HCT-BERT/H** analyzer is a compact, notebook sized PCM measuring instruments designed for field use in troubleshooting communication lines or verifying quality of service of E1 (2.048Mbps), T1 (1.544Mbps), or data communication (V.35, X.21, RS-530, RS-449 or RS-232) lines. The **HCT-BERT/H** analyzer provides a variety of E1/T1/Datacom line statuses, transmission performance testing (BERT) of $n \times 64\text{Kbps}$ or $n \times 56\text{Kbps}$ data into any time slot and monitoring. On the E1/T1/Datacom line, the **HCT-BERT/H** unit 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, and E1/T1 signal generator, Datacom BERT generator.
- Alarm and Looping Setting: Manual or automatic alarm and loop setting.
- Signal Result: E1/T1 PCM frequency analysis.
- Signaling Setting: ABCD bit setting.
- Signaling Display: Display all channels of ABCD bits.
- Datacom BERT: Data port BERT performance analysis.
- Examine Analysis: off-line analysis of BERT performance.
- Preset Patterns: There are twenty preset patterns for BERT testing.
- User Programmable Pattern Setting: There are three 32 bits programmable patterns, which can be inserted onto the E1/T1 line for BERT testing.
- Timeslot Setting: Drop and Insert $n \times 56\text{K}$ BERT pattern data onto T1 line. Drop and Insert $n \times 64\text{K}$ or $n \times 56\text{K}$ BERT pattern data onto E1 line.
- Timeslot Mapping Data: Analyze any channel data of two frames.
- Remote Control: User can access HCT-BERT/H 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.

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 \pm 4000Hz

2. Transmitter Interface of E1/CEPT

- Bit Rate: 2048K bit/s \pm 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: \pm 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 \pm 10 ppm.
 - External Timing:
 - Recovery from RX Timing (Loop Timing)
 - Recover from Data Port RX Timing
 - Internal Timing plus 50 ppm offset: 2.048 MHz +50 ppm.
 - Internal Timing minus 50 ppm offset: 2.048 MHz -50ppm.

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: \pm 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 \pm 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 \pm 5% resistive (balanced)
 - Receive Sensitivity: up to -30dBdsx
- Receive Timing Range: 1.544MHz \pm 4000Hz

2. Transmitter Interface of T1/DS1

- Bit Rate: 1544K bit/s \pm 10ppm.
- Line Code: B8ZS/AMI
- Pulse characteristics: meets ITU-T G.703
- Pulse Amplitude: Nominal 3.00V for Symmetrical Pair 100 ohm
- Zero Amplitude: \pm 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 \pm 10ppm

External Timing

Recovery from RX Timing (Loop Timing)

Recover from Data Port RX timing

Internal Timing plus 50 ppm offset: 1.544 MHz +50 ppm.

Internal Timing minus 50 ppm offset: 1.544 MHz -50 ppm.

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

(Accuracy: \pm 1 dB)

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
- ITU-T M.2100

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
- M.2100 results

5. BERT Test on Data Port

- Synchronous data rates for 56Kbps and 64Kbps multiples up to 2048Kbps
- Low speed baud from 50 to 115.2K Async or 150 to 72K Sync

2.3.4 Analyzer Mode:

1. Channel Map Screen

2. Signaling: [ABCD]

3. General Status:

- Signal Present
- B8ZS/HDB3
- Pattern Sync
- Frame Sync
- Tester Looped

4. 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

5. 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)

6. Print out of test results

2.3.5 Other Features:

1. Large LCD display

- 32 Characters x 8 Lines
- Text mode

2. 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)

3. Portable for field use

4. Upgradeable for advanced features

5. Rechargeable Battery with battery low indicator

6. Temp. Range

- 0 °C to 50 °C (operating)
- 20 °C to 60 °C (storage)

7. Humidity: up to 95%

8. Power Source AC 100~240V / DC12V/1.25A Switching Adapter.

9. Dimension

173 mm(L) x 235 mm(L) x 54 mm (H)

10. 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)
- Slide Switch: External (Reference) Clock Setting: TTL/PCM
- Power Switch: Power ON/OFF
- Mini-Jack: DC IN

2.3.7 Cables and miscellaneous accessories:

- Bantam to Bantam x2
- BNC coaxial to BNC x2
- HD26M to DB25M (RS-232/530)
- HD26M to DB25F "
- HD26M to DB37M (RS-449)
- HD26M to DB37F "
- HD26M to DB15M (X.21)
- HD26M to DB15F "
- HD26M to MB34M (V.35)
- HD26M to MB34F "
- DB15M to 36C (printer)
- "Y" stub adapter
- Nylon strap
- AC power adapter, User's Guide, Nylon carry bag

2.4 Status LEDs

The **HCT-BERT/H**'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
HDB3/ B8ZS	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 **HCT-BERT/H**, 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.

DATA COM:

Data port is under use, such as with "BERT on data port" functions.

2) INTERFACE

Bridge:

HCT-BERT/H E1/T1 RX port is in bridge mode. Impedance is greater than 1K Ohm.

Terminal:

HCT-BERT/H E1/T1 RX port is in terminal mode. Impedance is 75(E1 coaxial), 100(T1), or 120(E1 Twisted Pair) ohms.

DSX-MON:

HCT-BERT/H E1/T1 RX port is in DSX-MONitor mode and the impedance is 75(E1), 100(T1), or 120(E1) ohms.

E1:

HCT-BERT/H is working as an E1 BERT tester.

T1:

HCT-BERT/H is working as a T1 BERT tester.

3) RECEIVE STATUS

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

Signal Present:

HCT-BERT/H 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.

Tester Looped:

Indicates **HCT-BERT/H** has taken 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: (reserved)

HCT-BERT/H 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.

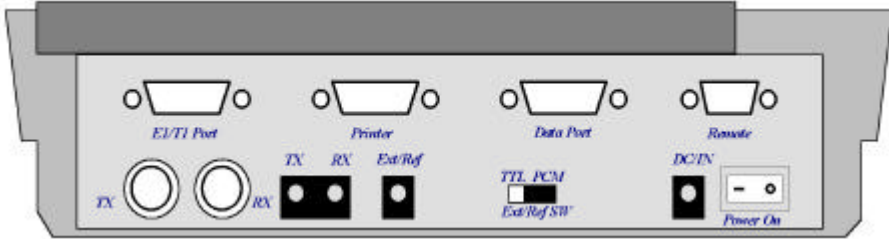
History:

Flashes when there is an error indication in history. User can press the **?** key to review all of the error LEDs, and at this moment, the History LED will light solid. Press the **C** key to clear all of history and **HCT-BERT/H** will show the real-time status on LEDs. The history LED will be extinguished.

Ins Err:

Lights when the **HCT-BERT/H** is forcing single bit errors or an error rate of logic, frame, CRC, or BPV is set.

2.5 Rear Panel



The **HCT-BERT/H** Rear Panel

Descriptions:

POWER ON:

Power on switch.

DC/IN:

This jack is used to plug in the DC 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.

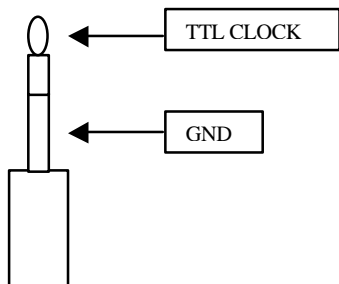
DB15 Pin Assignment:

- 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)

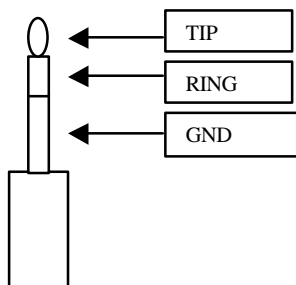
Ext/Ref:

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):



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.

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 1 st to 8 th 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 **HCT-BERT/H** configuration setups and adapter cables. The adapter cables allow for connection to standard data communication interfaces for 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.

3.1 Introduction

The **HCT-BERT/H**'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 colored 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 **HCT-BERT/H** 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.

3.3 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 loop back control settings (T1 only).

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 ---- Signal Result

Displays a numeric readout of the actual frequency in hertz.

F2 ---- Signaling Setup

Used to set the ABCD bits for selected timeslots.

F3 ---- Signaling Display

A visual display of the ABCD bits for all timeslots.

F4 ---- Remote Port Setup

Setup remote port baud rate.

F5 ---- Examine Analysis

Review the result of T1/E1 BERT or Datacom BERT.

MORE Next Page

Selects the third menu set of functions.

F1 ---- User Program Pattern

Used to enter the user programmable pattern.

F2 ---- Time Slot Setting

Use this display to setup the used and unused time slots

F3 ---- Time Slot Map Data

Used to display all the time slots data of two frames

F4 ---- 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.

F5 ---- Miscellaneous

Calls up a menu to setup key sound, printer, and clock as well as to display the **HCT-BERT/H**'s hardware and firmware version information.

MORE Next Page

Selects the fourth menu set of functions.

F1 ---- Self Test

Provides a means to test the internal RAM and ROM, the data port, the printer port, the LCD, and keyboard tests.

F2 ---- Sa Bits Setup (E1 mode only)

Use to do transmission setup of E1 Sa bits and monitor a whole received multiframe of E1 Sa bits.

F3 ---- Datacom BERT

Perform as a Datacom BERT analyzer.

F4 ---- Low Speed Datacom BERT

Perform as a Low Speed Datacom BERT analyzer.

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 **HCT-BERT/H** 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 **HCT-BERT/H**'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 **HCT-BERT/H**

HCT-BERT/H

Version: 4H.62-10
S/N: 0000001

and wait for the first menu. Press the **F1** key to display the Configuration Setup function menu.

```
MANUAL CONFIGURATION (F1: Auto)
Configuration : E1(CEPT)
Channel       : Full
Framing      : FAS Only
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 and is in inverse text, which indicates the current cursor position. 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      : Internal  
Pattern        : URSS  
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, and Ext/Ref" 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.

4.1 HCT-BERT/H Power Up

When the **HCT-BERT/H** is powered on, a quick screen will flash announcing the **HCT-BERT/H** model and displaying the firmware version and unit serial number.

```
HCT-BERT/H
```

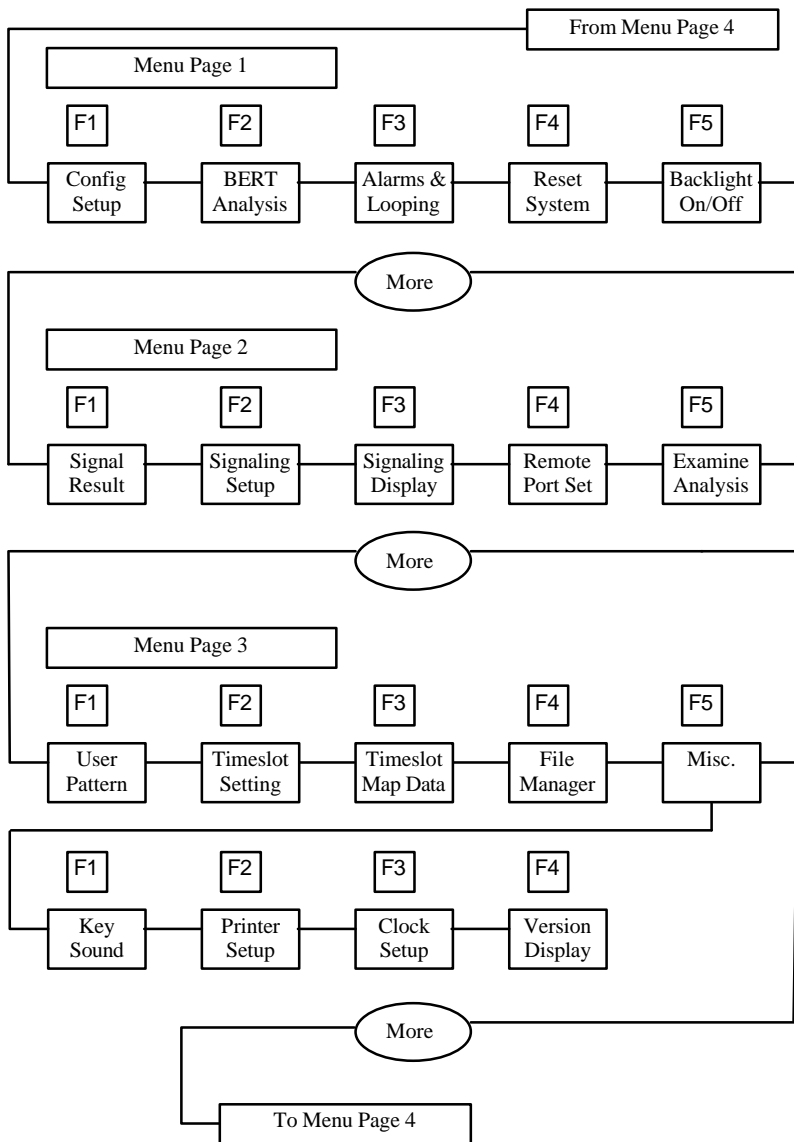
```
Version: 4H.62-10  
S/N: 00000001
```

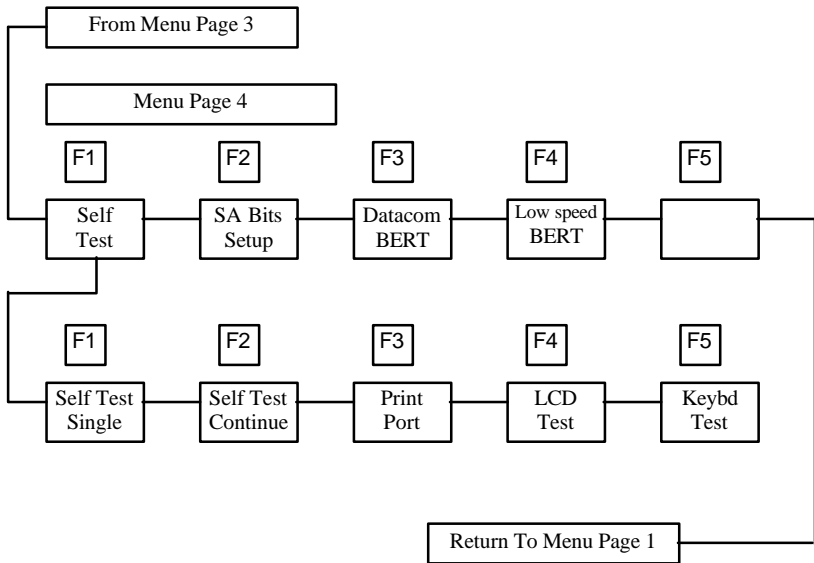
Following the quick screen will be the first of five menu pages.

```
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 **HCT-BERT/H** 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 HCT-BERT/H Menu System





4.3 System Reset

When you first receive your **HCT-BERT/H**, 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 **HCT-BERT/H** 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. It is also useful to reset the unit if you get the **HCT-BERT/H** 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 **HCT-BERT/H**'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 the back light on or off.

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 **F5** key on the main menu page 2. For more information about E1/T1 BERT analysis, please refer to Chapter 6; for information on the Datacom BERT feature, please refer to Chapter 19.

5.1 Configuration Setup

While your **HCT-BERT/H** 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 **HCT-BERT/H** 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). The HCT-BERT/H contains configuration sets for both E1 and T1. 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)	HCT-BERT/H is configured for E1 mode
	T1(DS1)	HCT-BERT/H is configured for T1 mode
Channel:	Full	The HCT-BERT/H may use any of the following combinations : 1) FAS Only (PCM31; TS1 to TS 31 are used) 2) FAS + CRC (PCM31, CRC4 enable, and TS1 to TS31 are used) 3) FAS+CAS (PCM30; CAS enable, TS1 to TS15 and TS17 to TS31 are used) 4) FAS+CAS + CRC (PCM30, CAS enable, CRC4 enable, TS1 to TS15, and TS17 to TS31 are used) or 5) Unframed mode (no framing, TS0 to TS31 are used)

Channel	n*64K	The HCT-BERT/H may use any of the following combinations: 1) FAS Only (TS1 to TS31 available for random setting) 2) FAS + CRC (CRC4 enable, TS1 to TS31 available for random setting) 3) FAS+CAS (TS1 to TS15, TS17 to TS31 available for random setting) or 4) FAS+CAS + CRC (CRC4 enable, TS1 to TS15, TS17 to TS31 available for random setting)
Framing:	FAS only	Frame mode only
	FAS+CAS	Frame mode plus CAS function
	Unframed	Unframed mode is selected
CRC:	CRC4	In E1 mode, will set CRC4 enable on. This is not available if using unframed 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 idle TX timeslots will be set to pass through mode, (pass unchanged RX data to TX)
	Fill 7EH	The idle timeslots will be filled in with hexadecimal 0x7E code.
	Fill 7FH	The idle timeslots will be filled in with hexadecimal 0x7F code.
	Fill FFH	The idle timeslots 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 HCT-BERT/H to E1 75 ohm terminal mode on TX and RX port.
	TERM 120	Sets HCT-BERT/H to E1 120 ohm terminal mode on TX and RX port.
	Bridge 75	Sets HCT-BERT/H to bridge mode on RX port (>1K ohm) and E1 75 ohm mode on TX port.
	Bridge 120	Sets HCT-BERT/H to bridge mode on RX port (>1K ohm) and E1 120 ohm mode on TX port.
	DSXMON 75	Sets HCT-BERT/H to E1 75 ohm DSX-MONitor mode on RX port.
	DSXMON 120	Sets HCT-BERT/H 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 TX PCM clock source)	Internal	Clock source from HCT-BERT/H internal oscillator, 2.048MHz on E1
	Recovery	Clock source from E1 RX port recovered clock
	Data Port	Clock source is from the Data port's RX timing
	External	Clock source from Ext/Ref clock input jack
	+50 ppm	Clock source is from HCT-BERT/H internal oscillator, 2048K bps, with +50 ppm offset
	-50 ppm	Clock source is from HCT-BERT/H internal oscillator, 2048K bps, with -50 ppm offset

Pattern: (HCT-BERT/H 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: 2e23-1.

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.
	M.2100	Upon entering BERT function, the screen will display in "M.2100" mode.
Print Interval:	Disable	The printer will not print out results automatically.
	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.
Beep Mode:	Disable	The unit will not issue audible "beeps" while errors are received.
	Enable	The unit will issue audible "beeps" while errors are received.
Histogram Storage Duration	Off	The histogram feature is disable.
	1 Min	The histogram storage duration is set to 1 minute.
	2 Min	The histogram storage duration is set to 2 minutes.
	30 Min	The histogram storage duration is set to 30 minutes.

T1(DS1) mode setting:

Setting	Parameter	Description
Config.:	T1(DS1)	HCT-BERT/H is configured to T1 mode
Channel	Full	The HCT-BERT/H 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) 6) Unframed mode (whole frame is used)

Channel	n*64K	The HCT-BERT/H may use any of the following combinations: 1) ESF (Random Timeslot setting available) 2) ESF + CRC (CRC6 enable, random Timeslot setting available) 3) D4(SF) (Random Timeslot setting available) 4) SLC-96 (Random Timeslot setting available) 5) T1DM (Random Timeslot setting)
	n*56K	The HCT-BERT/H may use any of the following combinations: 1) ESF (Random Timeslot setting available + AB or ABCD Signaling) 2) ESF + CRC (CRC6 enable, random Timeslot setting available + AB or ABCD Signaling) 3) D4(SF) (Random Timeslot setting available + AB Signaling) 4) SLC-96 (Random Timeslot setting available + AB Signaling) 5) T1DM (Random Timeslot setting available + AB Signaling)
Framing:	ESF	ESF frame mode
	D4(SF)	D4 frame mode
	SLC-96	SLC-96 frame mode
	T1DM	T1DM frame mode
	Unframed	Unframed mode is selected
CRC:	CRC6	In T1 mode, this enables CRC6. This is not available if using D4, SLC-96, T1DM, or unframed 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 idle TX timeslots will be set to pass through mode, (unchanged RX data to TX pass through)
	Fill 7EH	The idle timeslots will be filled with hexadecimal 0x7E code.
	Fill 7FH	The idle timeslots will be filled with hexadecimal 0x7F code.
	Fill FFH	The idle timeslots will be filled with hexadecimal 0xFF code.
Performance Report	No	Reserved
Line Interface:	TERM 100	Sets HCT-BERT/H to T1 100 ohm terminal mode on TX and RX port.
	Bridge	Sets HCT-BERT/H to bridge mode on RX port (>1K ohm) and T1 100 ohm mode on TX port.
	DSXMON 100	Sets HCT-BERT/H 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 HCT-BERT/H internal oscillator, 1.544MHz.
	Recovery	Clock source is from T1 RX port recovered clock
	Data Port	Clock source is from the Data port's RX timing
	External	Clock source is from Ext/Ref clock input jack
	+50 ppm	Clock source is from HCT-BERT/H internal oscillator, 1.544MHz, with +50 ppm offset
	-50 ppm	Clock source is from HCT-BERT/H internal oscillator, 1.544MHz, with -50 ppm offset

Pattern: (HCT-BERT/H 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: 2e23-1.

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.
	M.2100	Upon entering BERT function, the screen will show in "M.2100" mode.
Print Interval:	Disable	The printer will not print out results automatically.
	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	Off	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.

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 **HCT-BERT/H** 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 **HCT-BERT/H** 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 **HCT-BERT/H** will attempt to self configure by analyzing the live line connection. If the previous setting of the **HCT-BERT/H** 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 **HCT-BERT/H** 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 **HCT-BERT/H** will directly enter and execute the auto-configure function. While testing for a match, the **HCT-BERT/H** will show a "Testing...." message. When a configuration match is found, the **HCT-BERT/H** will display a "Test complete!" message. If the **HCT-BERT/H** cannot detect the current configuration, it will show a "No match!" message.

The test result will be displayed similar to the following:

```
Auto configuration
Frame Mode      : 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 **HCT-BERT/H** 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 or T1 line performance in common display mode (Brief, Logic, Frame, CRC, BPV), ITU-G.821, ITU-G.826 mode, ITU-M.2100, or histogram analysis, and will generate standard E1 or T1 line code.

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

```
Brief                Elapsed: 00d00h00m51s
Logic Error          =                0
Frame Error          =                0
CRC Error            =                0
BPV Error            =                0
E-Bit Error          =                0
FixClk Error Fer R  Forced Reset M
1Int. 2Logic30      4                5                0
```

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. However, all modes and parameters may be modified by using the function keys (and More) shown at the display bottom.

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
F [x]Clk F Error F Er R F Forced F M
1Int. 2Logic30 4 5 0
```

Logic Display Screen

```
LOGIC G.821 Elapsed: 00d00h00m51s
Available Sec. = 51 100%
Degraded Min. = 0 %
Severely ErrSec = 0 %
Errored Second = 0 %
Unavailable Sec = 0 %
F [x]Clk F Error F Er R F Forced F M
1Int. 2Logic30 4 5 0
```

Logic G.821 Display Screen

```
FRAME Elapsed: 00d00h00m51s
Receive Count = 405654
Errors = 0
Error Second = 0
Error Free Sec. = 51
LOF Events (Red) = 0
F [xCik] Error Fer R ForcedF M
1Int. 2Logic30 4 5 0
```

Frame Display Screen, page 1

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

```
F [xCik] Error Fer R ForcedF M
1Int. 2Logic30 4 5 0
```

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 %
F [xCik] Error Fer R ForcedF M
1Int. 2Logic30 4 5 0
```

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
```

```
F [xCik] F [Error] F [Er R] F [Forced] F [M]
1Int. 2Logic30 4 5 0
```

CRC Display Screen

```
CRC G.821 Elapsed: 00d00h00m51s
Available Sec. =                51 100%
Degraded Min.  =                   0 %
Severely ErrSec =                   0 %
Errored Second =                   0 %
Unavailable Sec =                   0 %
```

```
F [xCik] F [Error] F [Er R] F [Forced] F [M]
1Int. 2Logic30 4 5 0
```

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
```

```
F [xCik] F [Error] F [Er R] F [Forced] F [M]
1Int. 2Logic30 4 5 0
```

BPV Display Screen

```
BPV G.821 Elapsed: 00d00h00m51s
Available Sec. =          51 100%
Degraded Min.   =           0   %
Severely ErrSec=           0   %
Errored Second =           0   %
Unavailable Sec=           0   %
F [xClk] Error Fer R ForcedF M
1Int. 2Logic30 4 5 0
```

BPV G.821 Display Screen

```
M21 in-serv. Elapsed: 00d00h00m51s
ES (RX) =          0 | ES (TX) =          0
SES (RX) =          0 | SES (TX) =          0
=          0 | =          0
Unavailable Sec (RX) =          0
Unavailable Sec (TX) =          0
F [xClk] Error Fer R ForcedF M
1Int. 2Logic30 4 5 0
```

M.2100 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. All the configuration parameters may be set from the BERT display mode by using the function keys. Refer to section 6.4 Function Keys for an explanation of these keys and usage. For more information on setting these options and their meanings, please refer to Chapter 5 Configuration Setup.

6.2 Performance

The **HCT-BERT/H** displays the results of BERT testing for E1 or T1 on the LCD screen, while the LEDs provide instant display of status. 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 Error 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:

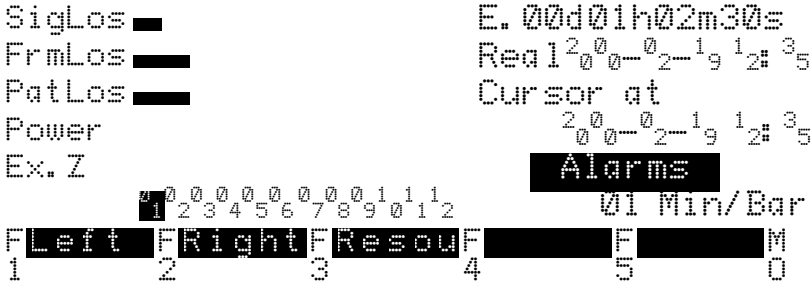
Available Sec. : Received G.821 BPV Available Seconds
Degraded Min. : Received G.821 BPV Degraded Minutes
Severely ErrSec : Received G.821 BPV Severely Error Seconds
Erred Second : Received G.821 BPV Error Seconds
Unavailable Sec : Received G.821 BPV Unavailable Seconds

In "M.2100" Format:

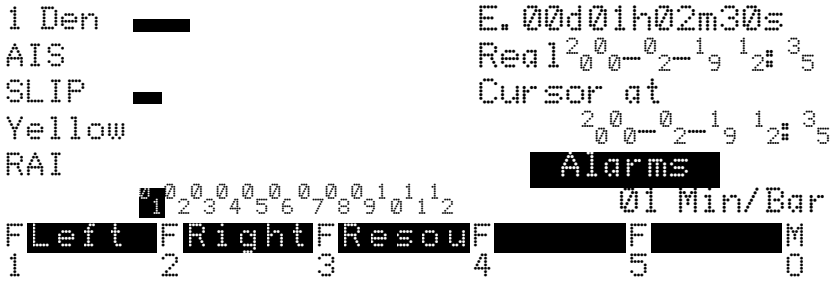
In-service ES(RX) : Received Errored Seconds
In-service ES(TX) : Transmitted Errored Seconds
In-service SES(RX) : Received Severely Errored Seconds
In-service SES(TX) : Transmitted Severely Errored Seconds
In-service Unavailable Sec(RX): Received unavailable seconds
In-service Unavailable Sec(TX): Transmit unavailable seconds
Out-of-service ES : Errored seconds
Out-of-service SES : Severely errored seconds
Out-of-service US : Unavailable seconds

6.3 Histogram

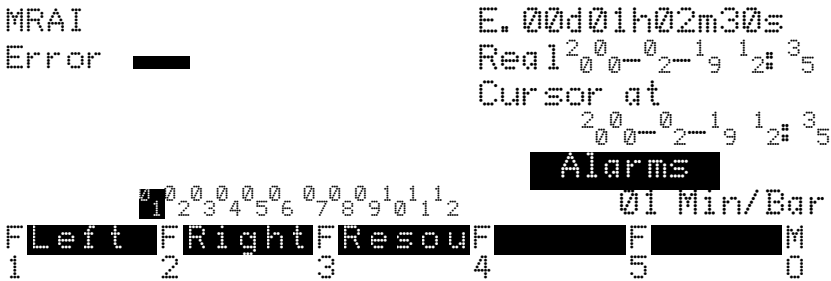
By pressing PgUp(page up) or PgDn (page down) keys, the other Histogram analysis screens can be viewed. Examples of all the Histogram analysis screens are shown in the following:



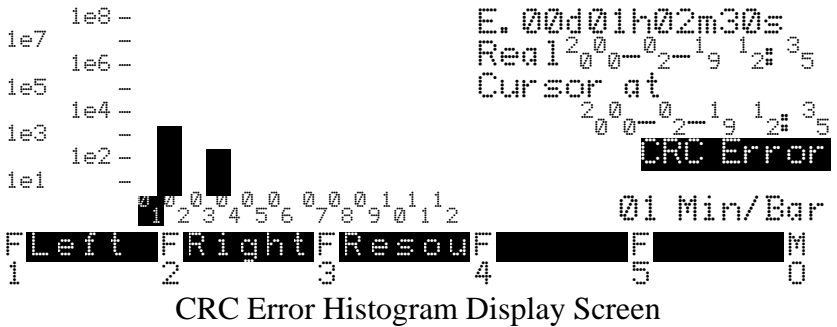
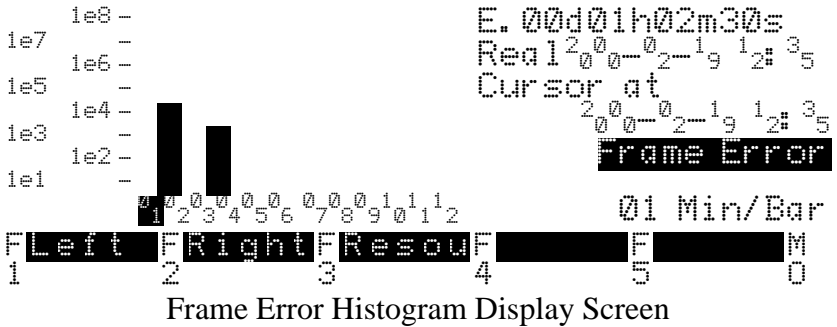
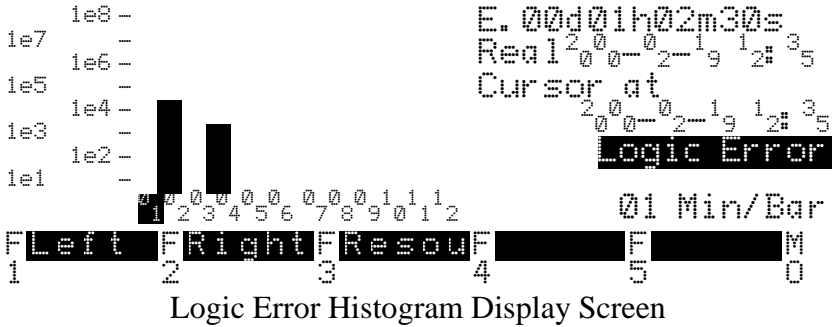
Alarms Histogram Display Screen (1)

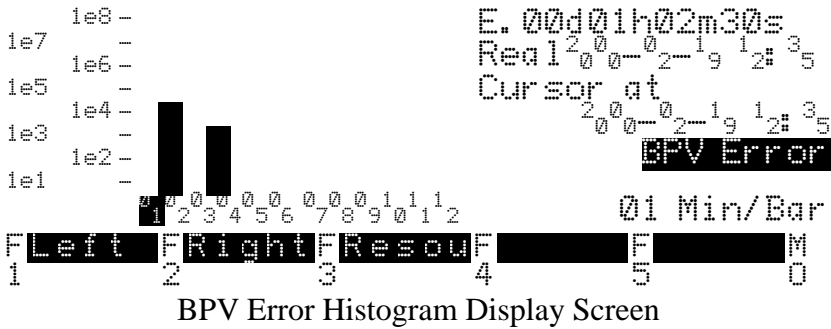


Alarms Histogram Display Screen (2)



Alarms Histogram Display Screen (3)





The "E.00d01h02m30s" shows the duration of the current test, in elapsed time. The "Real^{2 0 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}-^{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 "30 Min/Bar" shows the resolution per bar of Histogram.

If the Histogram Storage is set to off, the feature of Histogram analysis will not be 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 thirty minute per bar. It can be zoomed out to 6 hours per bar of resolution.

The Alarms Histograms shows whether there are any Alarm errors in each period of storage time or not. If there were any alarm errors occurring in that period, the related position will get a small horizontal bar. The "History" LED will also flash, indicating an alarm has been stored in the Histogram.

The Logic, Frame, BPV, and CRC error Histogram show 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, M.2100 testing results and Histogram. The file management function can store and recall normal BERT, G.821, and G.826 results but not the Histogram.

Please refer to Chapter 2 **HCT-BERT/H** Overview, Receive Status, for more Alarms information. The following are the meanings of abbreviations on the Histogram screens:

SigLos	: Signal Loss Alarm	AIS	: AIS Alarm
FrmLos	: Frame Loss Alarm	SLIP	: SLIP Alarm
PatLos	: Pattern Loss Alarm	Yellow	: Yellow Alarm
Power	: (reserve)	RAI	: RAI Alarm
Ex.Z	: Excess Zero Alarm	MRAI	: MRAI Alarm
1 Den	: One Density Alarm	Error	: Logic, Frame, CRC, or BPV 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 **HCT-BERT/H** 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 four different groups or sets of keys. Press the **MORE** key repeatedly to display the other function key groups.

For example:

```
FixDisk F Error F ER R F Forced F Reset M
1Int. 2Logic30 4 5 0
```

Press **MORE**

```
F Disp. F Frame F CRC F Code F RMode M
1Brief2FAS 3CRC4 4HDB3 5T 75 0
```

Press **MORE**

```
F LBO F Pattn F Durn. F ReSyn F Store M
10 2QRSS 3Cont. 4 5 0
```

Press **MORE**

```
F Left F Right F Resou F F M
1 2 3 4 5 0
```

Group 1

- [F1] **TxClock** Transmit Clock Source
- Internal Change to internal clock source, initialize and restart test.
- Recover Change to RX recovery clock source, initialize and restart test.
- DataPort Change to Data port RX clock source, initialize and restart test.
- Ext. Change to external 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 Type** 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] **Force** 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 dB Change E1 LBO to 0 dB
- 7.5 Change E1 LBO to -7.5dB
- 15 Change E1 LBO to -15dB
- 22.5 Change E1 LBO to -22.5dB
- 0 F Change T1 LBO to 0 Feet
- 133F Change T1 LBO to 133 Feet
- 266F Change T1 LBO to 266 Feet
- 399F Change T1 LBO to 399 Feet
- 533F Change T1 LBO to 599 Feet
- 0 dB Change T1 LBO to 0 dB
- 7.5 Change T1 LBO to -7.5dB
- 15 Change T1 LBO to -15dB
- 22.5 Change T1 LBO to -22.5dB

[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
UserP User Prog.# 1~3
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 disabled.
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 LED error status and returns LED status to real-time display. Any new 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 **HCT-BERT/H** 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 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 Loopback

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

There is no **Loopback Setting** when the **HCT-BERT/H** is set to E1 mode. Therefore, the **HCT-BERT/H** will go directly to the "Alarm Setting" screen.

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

```
F1 : Alarm Setting
F2 : Loopback Setting
```

Press the **F1** key to enter the "Alarm Setting" function, or press the **F2** key to enter the "Loopback 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]
```

```
F AIS F YEL F BIG. F F
1 2 (RAD) 3 LOSS 4 5
```

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

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

```
F[AIS] F[REMO] F[MULTI] F[SIG.]
1 [ ] 2 [ ] 3 [REMO] 4 [LOSS] 5 [ ]
```

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

In T1 mode, the **HCT-BERT/H** can generate **AIS** (Alarm Indication Signal), **Yellow Alarm** (RAI), or **SIGNAL LOSS** manually. You may move the cursor up or down between the two entry fields by pressing the up or down arrow keys. 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)
[F3] **SIG.LOSS** Signal Loss Alarm

While in E1 mode, the **HCT-BERT/H** can generate **AIS** (Alarm Indication Signal), **RAI** (Remote Alarm Indication), **MRAI** (Multi-Remote Alarm Indication), or **SIGNAL LOSS** manually or 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 alarm, which you require, simply by pressing the appropriate function key directly:

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

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] 1
```

```
F [OFF] F [DN] F [AUTO] 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 **HCT-BERT/H** 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, the "A" bit in timeslot 0 is set to 1.

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

7.3 Loopback Setting

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

After entering the "**Loopback Setting**" function, you will first see a screen for a few seconds describing the loop up and loop down keys:

"-" loop down "/" loop up

then 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 **HCT-BERT/H** 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 "Type" field, you may select the type of loopback, 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 **HCT-BERT/H** Loopback 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 **HCT-BERT/H** detects loop
 up code, it will set tester to looped mode; When **HCT-BERT/H**
 detects loop down code, it will release tester looped mode.
 Off: The **HCT-BERT/H** will not
 respond to loop codes.
- 8) Tester Line Looped: Up: Force **HCT-BERT/H Line**
 Loopback T1 Rx onto Tx port.
 Down: Release **HCT-BERT/H Line**
 Loopback mode.
- 9) Tester Payload Looped: Up: Force **HCT-BERT/H Payload**
 Loopback T1 Rx onto Tx port.
 Down: Release **HCT-BERT/H**
 Payload Loopback mode
- 10) Indications: "**L.Up.**" LED: will be lit if the **HCT-**
 BERT/H detects loop up code. (Located at E1 RAI LED.)
 "**L.Dn.**" LED: will be lit if the **HCT-**
 BERT/H detects loop down code. (Located at E1 MRAI LED.)

8.1 Signal Result

The "**Signal Result**" function allows the user to verify the received E1/T1 PCM signal. The "**Signal Result**" function is entered by pressing the **F1** key from the second menu page. When you enter this function, the E1/T1 RX port signal results will be displayed as follows:

```
-----Signal Result-----  
  
RX Frequency           : 01544001 Hz  
RX Freq. Offset       : 0001 ppm  
EXT Frequency         : ----- Hz  
EXT Freq. Offset     : ----- Hz
```

Signal Result Screen display

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.

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9.1 Signaling Setup

In E1 mode, when you set the **HCT-BERT/H** to E1 CAS framing mode, signaling is enabled. To enter the signaling setup function, press the **F2** key from the second menu set pages. If the **HCT-BERT/H** is not in CAS mode, it will not be able to enter this function.

In T1 mode, when you set the **HCT-BERT/H** 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 **F2** key from the second menu set pages. If the **HCT-BERT/H** 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:

```
TS [011]
Tx ABCD BITS [1010]

Rx ABCD BITS : 1010
FDec FInc FSel FSet FReset
1TS 2TS 3Bit 4Bit 5Bit
```

Signaling Setup Screen

The screen shows which TX time slot is under setup, and its current 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 Arrow] Select next timeslot number. (same as F2)

[Left Arrow] Selects the next bit to the left.

[Right Arrow] Selects the next bit to the left. (same as F3)

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

10.1 Signaling Display

To enter the "Signaling Display" function, press the **F3** 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 32 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 **HCT-BERT/H** is not in E1 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 24 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 **HCT-BERT/H** 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

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 (or CDRom) 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 **HCT-BERT/H** by direct connection or via dial-up MODEM as displayed in the following figures.



Figure 11-1 Direct Connection



Figure 11-2 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 **HCT-BERT/H** with the supplied Remote cable. As the **HCT-BERT/H**'s Remote Control Port is DCE, a null modem cable must be used when using a dial-up modem connection. (Refer to **Appendix B** for cable pinouts).

When using REMOTE CONTROL or other terminal emulation program to connect to the **HCT-BERT/H**, the following functions of the **HCT-BERT/H** may be controlled remotely:

1. Configuration Setup.
2. BERT Test and Analysis.
3. Reset System.
4. Timeslot Setup
5. Signal Result
6. Loopback Setup
7. Signaling Setup

11.2 Remote Port Setup

You can enter this setup menu by pressing the **F4** key from main menu page 2. 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.

11.3 Operation

Operating the **HCT-BERT/H** remotely via the Remote Port simply involves connecting the **HCT-BERT/H** as shown in figure 11-1 or 11-2 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 **HCT-BERT/H**.

When powered on, the **HCT-BERT/H** will initialize and check for an active connection on its Remote Port. After the **HCT-BERT/H** initializes the Remote Port, pressing the space bar twice on the PC or the terminal will display the remote screen.

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

(Main Menu)

Remote PC Display Screen #1

By pressing the "+" key the next menu page can be displayed. Pressing the "-" key will display the previous menu page. The **HCT-BERT/H** has three main menu pages. Page 2 and 3 are shown on the next page.

```
*HCT-BERT MAIN MENU*  P2
1)SIGNAL RESULT
2)SIGNALING SETUP
3)USER PROGRAM PATTERN
4)TIME SLOT SETUP
5)TIME SLOT MAP DATA
0)EXIT
+ : PGDN - : PGUP
*SELECT 0-5
```

(Main Menu)
Remote PC Display Screen #2

```
*HCT-BERT MAIN MENU*  P3
1)MISCELLANEOUS
2)CLOCK SETUP
3)LED STATUS

0)EXIT
+ : PGDN - : PGUP
*SELECT 0-3
```

(Main Menu)
Remote PC Display Screen #3

To exit, press the zero key on PC. The **HCT-BERT/H** will disable CTS/DSR and DTR, wait 2 seconds and then exit. If you are using a modem connection, the modem will automatically hang up when DTR drops.

Pressing the "1" key, from the first main menu page, 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, etc.

After entering a sub-function, you may type in any of the commands which are shown on the remote PC screen. The **HCT-BERT/H** 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 **HCT-BERT/H**.

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 11.4.2 for a complete list of the Configuration Setup commands.

```
*CONFIG SETUP* '  
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 , TT1~6 , SE1~2  
PE1~2 , PI1~6 , BM1~2 , TP1~6  
*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 11.4.3 for a complete list of the BERT Analysis commands.

```
*BERT ANALYSIS*      P1-2
CO1,CO2,CR1,CR2,ET1~4,FM1~5,
FR1,IE1~6,LB1~4,LI1~6,PA1~9,
PAA~M,RS1,RT1,SH1~9,TT1~6
TP1~6
*COMMAND/0/SPACE?
      (BERT Analysis)
      Remote PC Display Screen
```

The following is the System Reset sub-function. Please refer to 11.4.4 for a complete list of the BERT Analysis commands.

```
*RESET SYSTEM*
*YES/0/SPACE?
      (Reset System)
      Remote PC Display Screen
```

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 11.4.5 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 **HCT-BERT/H** 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 Time Slot Map Data function.

```
*TIME SLOT MAP DATA*      P2-5
  FAS TS0:1B 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 AA AA AA AA AA AA AA
  NFAS TS0:DF 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 AA AA AA AA AA AA AA
*SPACE=NEW TIME SLOT MAP DATA*
*COMMAND/0/SPACE?
```

(Timeslot MAP Data)
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 11.4.7 for a complete list of the Signal Result commands.

```
*SIGNAL RESULT*
RX Frequency      : 02048005 Hz
RX Freq. Offset  : 0002 ppm
EXT Frequency     : ----- Hz
EXT Freq. Offset : ----- 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 11.4.9 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 LED Status sub-function. It includes current setting status and testing result. Please refer to 11.4.12 for a complete list of the LED Status commands.

```
* LED Status (E1)*
OK
  '?':History
  'C':Clear History
** '0' to Exit **
                (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
```

11.4 Commands

11.4.1 Main Menu Setup Command List:

- <space> Shows the current page again.
 - <0> Initializes MODEM, exits remote control function.
 - <1> CONFIG. SETUP
 - <2> BERT ANALYSIS
 - <3> RESET SYSTEM
 - <4> ALARM
 - <5> LOOPBACK SETUP
- [page 2]
- <1> SIGNAL RESULT
 - <2> SIGNALING SETUP
 - <3> USER PROGRAM PATTERN
 - <4> TIME SLOT SETUP
 - <5> TIME SLOT MAP DATA
- [page 3]
- <1> MISCELLANEOUS
 - <2> CLOCK SETUP
 - <3> LED STATUS

11.4.2 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.

(Configuration Setup Command list continued)

- <CH1> Sets to Full channel mode.
- <CH2> Sets to n*64K channel mode.
- <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 Unframed mode (E1) or SLC96 mode (T1).
- <FM4> Sets to T1DM mode (T1).
- <FM5> Sets to Unframed 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.

(Configuration Setup Command list continued)

- <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)
- <LI1> Sets line interface to terminal 75 ohm (E1)
or terminal 100 ohm (T1).
- <LI2> Sets line interface to terminal 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.

(Configuration Setup Command list continued)

- <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.
- <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 +50ppm.
- <TT6> Set Tx Timing to -50ppm.
- <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 minutes.
- <TP4> Set Test Period to 30 minutes.
- <TP5> Set Test Period to 1 hour.
- <TP6> Set Test Period to 24 hours.

(Configuration Setup Command list continued)

- <PI1> Set Print Interval to Disable.
- <PI2> Set Print Interval to 5 minutes.
- <PI3> Set Print Interval to 10 minutes.
- <PI4> Set Print Interval to 15 minutes.
- <PI5> Set Print Interval to 30 minutes.
- <PI6> Set Print Interval to 60 minutes.
- <SE1> Set Sensitivity to High.
- <SE2> Set Sensitivity to Low.

11.4.3 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.

(BERT Analysis Command list continued)

- <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)
- <LI1> Sets line interface to terminal 75 ohm (E1)
or terminal 100 ohm (T1).
- <LI2> Sets line interface to terminal 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).

(BERT Analysis Command list continued)

- <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.
- <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.
- <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 +50ppm.
- <TT6> Set Tx Timing to -50ppm.
- <SH8> Show History LED Status.
- <SH9> Clear History and show current LED status.
- <TP1> Set Test Period to Continuous.
- <TP2> Set Test Period to 1 minute.
- <TP3> Set Test Period to 15 minutes.
- <TP4> Set Test Period to 30 minutes.
- <TP5> Set Test Period to 1 hour.
- <TP6> Set Test Period to 24 hours.

11.4.4 System Reset Command List:

- <space> Shows current page again.
- <0> Escapes to main menu.
- <YES> Reset HCT-BERT/H system.

11.4.5 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.

11.4.7 Signal Result Command List:

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

11.4.8 Loopback Setup Command List:

- <Space> Shows current page again.
- <0> Escapes to main menu.
- <LD> Starts generation loop down code.
- <LU> Starts generating loop up code.

11.4.9 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.

11.4.12 LED Status Command List:

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

12.1 Introduction

To enter the "User Program Pattern" function, press the **F1** 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.....

Fset  Fset  FGo  FDel  FChange
10    21    3Head 4Tail 5Pat #
```

User Program Pattern Screen

There are three user programmable patterns, which can be sent and analyzed on E1/T1/Datacom TX and RX ports while doing BERT analysis. Please refer to Chapter 6, BERT Analysis, or Chapter 19, Datacom BERT, for more details of the BERT function.

The programmable pattern number is show as #1, #2, or #3, on line one of the 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 minimum pattern length is one bit, while the maximum pattern length is 32 bits. The left bit of the programmable pattern will be sent or received first, ie. MSB first.

12.2 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.

13.1 Introduction

The "Time Slot Setting" function is not available if the E1 or T1 modes are set to unframed or if the modes are set to full channel. Only in n*64K or n*56K channel mode can the timeslot setting function be entered. To enter this function, press the **F2** key from the third menu set page. After you enter this function, you will see a screen similar to that below:

```
T01~07: f [* ]* * * * *
T08~15: * * * * *
T16~23: c * * * * *
T24~31: * * * * *
Current: TS01 -> used
Total : 30 timeslot (s) are used.
Fset Fset FProg. F Default
1Used 2ByPas3Head 4 5Idle
```

E1 (FAS+CAS) Time Slot Setting Screen

or

```
T01~07: f [* ]* * * * *
T08~15: * * * * *
T16~23: * * * * *
T24~31: * * * * *
Current: TS01 -> used
Total : 31 timeslot (s) are used.
Fset Fset FProg. F Default
1Used 2ByPas3Head 4 5Idle
```

E1 (FAS only) 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 **HCT-BERT/H** 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.

```
T01~07: f [* ]* * * * *
T08~15: * * * * *
T16~23: * * * * *
T24~31: t
Current: TS01 -> used
Total : 24 timeslot (s) are used.
Fset Fset FProg. F FDefault
1Used 2ByPas3Head 4 5Idle
```

T1 (T1DM) Time Slot Setting Screen

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 (FF, 7E, etc.) 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)

13.2 Operation

There is a flashing cursor (the bracket symbols "[]") at any location of the time slot map at any one time. 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), by repeatedly pressing the **ENTER** key.

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 (Pass Through) mode. |
| [F3]Prog.Idle | Set current timeslot to programmable idle code 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.

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

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14.1 Operation

The **HCT-BERT/H** 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 third menu page, press the **F3** key "Time Slot Map Data". If you choose the "Hex" display mode, the screen will display similar to the following:

```
FAS   TS0: 9E 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 (Hex)

The **HCT-BERT/H** 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.

If we set the display mode to Binary, we can see the bit data for each time slot as in the following display for E1.

```
      FAS:                      NFAS:
TS0  : 10011011   TS0  : 01011111
TS1  : 10101010   TS1  : 10101010
TS2  : 10101010   TS2  : 10101010
TS3  : 10101010   TS3  : 10101010
TS4  : 10101010   TS4  : 10101010
TS5  : 10101010   TS5  : 10101010
<PgUp><PgDn> change page up/down
      E1 Time Slot Map Data Screen (Binary)
```

In T1 mode, the display will look similar to that below.

```
      Frame 1:                  Frame 2:
TS1  : 10101010   TS1  : 10101010
TS2  : 10101010   TS2  : 10101010
TS3  : 10101010   TS3  : 10101010
TS4  : 10101010   TS4  : 10101010
TS5  : 10101010   TS5  : 10101010
TS6  : 10101010   TS6  : 10101010
<PgUp><PgDn> change page up/down
      T1 Time Slot Map Data Screen (Binary)
```

Use the PgUp and PgDn keys to view the data for other timeslots.

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

15.1 Introduction

The **HCT-BERT/H** 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 file 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 **F4** key from the third menu page. There will be a screen display similar to the following:

```

File 1 Occupied   File 6 .....
File 2 .....     File 7 .....
File 3 .....     File 8 .....
File 4 .....     File 9 .....
File 5 .....     File10 .....

Fsel.  Fsave  FRe-  FClear  F
1File 2  3Call 4  5
```

File Manager Display Screen

15.2 Operation

There will be a flashing cursor at the beginning of one of the ten file locations. The cursor position indicates the selected file. Use the cursor keys to move the cursor to any file location. 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 **HCT-BERT/H**'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, down, left and right arrow keys to move the flashing cursor's position.

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

16.1 Description

From the Page 3 Menu, select function **F5 Miscellaneous**. The following will be displayed:

```
----- MISCELLANEOUS -----  
F1      : Key Sound Setup  
F2      : Printer Setup  
F3      : Clock Setup  
F4      : Version Display  
-----
```

Miscellaneous Screen

The following sections will explain the four miscellaneous functions.

16.2 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  
Turn ON/OFF the beep sound,  
When key is pressed.
```

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.

16.3 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
```

```
Printer type : NORMAL/CONDENSE
```

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.

16.4 Clock Setup

The internal clock of the **HCT-BERT/H** may be set through this menu. From the Miscellaneous Menu press the **F3** key. The following will be displayed:

```
Current Date: 2002-07-21
              Time: 14:39:53
Setting Date: 02-07-21 (yy-mm-dd)
              Time: 14:39:07 (hh:mm:ss)
Event Time: 00:00:00 (hh:mm:ss)
* Press <ENTER> to confirm every
  item.
* Press <ESC> to exit.
```

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 **HCT-BERT/H**'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.

16.5 Version Display

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

```
Firmware version: 4H.62-10
Hardware version: L2.4 + L3.4
Serial Number    : 3004567
< 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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17.1 Description

The diagnostic self tests performed by the **HCT-BERT/H** are selected from the fourth menu page by the **F1** key. From the Self Test menu, **F1** and **F2** select the **SINGLE MODE** and **CONTINUOUS MODE** tests 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 **HCT-BERT/H**'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.

17.2 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 :  
-----
```

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
```

17.3 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. To exit continuous self test, press any key when you see the "Press any key to exit." message on the screen.

17.4 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.

17.5 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-----  
  
! "$%&' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ?  
@ ABCDEFGHIJKLMNOPQRSTUVWXYZ [ \ ] ^  
' abcdefghijklmnopqrstuvwxyz { | } ~   
  
NORMAL FLASHING REVERSE  
Press any key to exit.  
Display Test results Screen
```

17.6 Keyboard Test

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

```
-----KEYBOARD TEST-----  
  
* * * * *  
* * * * *  
* * * * *  
* * * * *  
  
---- Press SHIFT-ESC to exit ----  
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**.

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18.1 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 **HCT-BERT/H** is set to E1(CEPT) mode can this feature be entered.

When the screen of the **HCT-BERT/H** is on the fourth main menu page, pressing the **F2** key will enter Sa Bits Setup. After entering this function, the screen should show a display as follows:

```
TX NFAS FRAMES TS0 Sa4~8 [111111]
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
```



Sa bits Setup Screen

This screen shows settings 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.

18.2 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.

18.3 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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19.1 Introduction

The **HCT-BERT/H** 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 **F3** key from the fourth 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 the data port.

19.2 Configuration Setup

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

```
----- BERT ON DATA 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 **HCT-BERT/H** 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. Pressing the **END** key will move the cursor to the last page and bottom parameter.

The available settings and meanings of each configuration parameter in the "BERT ON DATA CONFIG" function are as follows:

Setting	Parameter	Description
Data Port:	DTE	HCT-BERT/H is configured as DTE device.
	DCE	HCT-BERT/H is configured as DCE device.
Interface:	RS-449/530 /X.21	HCT-BERT/H 's data port is set to RS-449, RS-530, or X.21 mode. (cable)
	RS-232	HCT-BERT/H 's data port is set to RS-232 mode. (cable)
	V.35	HCT-BERT/H 's data port is set to V.35 mode. (cable)
Pattern: (HCT-BERT/H 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 Control	Disable	Always transmit out testing pattern.
	CTS/RTS ON	When HCT-BERT/H is set to DTE mode, it will transmit out testing pattern if CTS active; when HCT-BERT/H is set to DCE mode, it will transmit out testing pattern if RTS active. Otherwise, HCT-BERT/H will not transmit out testing pattern.
Print Interval:	Disable	The printer will not print out results automatically.
	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.

19.3 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 **HCT-BERT/H** datacom transmission clock should be set to external, otherwise, the **HCT-BERT/H** must supply its internal transmission clock for the external device. The **HCT-BERT/H** receiver clock is always set to external. Both of the clock polarities can be set to normal or inverted. The selection table is depicted 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

19.4 Datacom BERT Analysis

When the screen of the **HCT-BERT/H** 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
F1Disp F2orce F3rk F4resync F5reset M
1Page12 30 4 5 0
```

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 by again pressing the **RUN** key. The bottom two lines show available function keys by 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 Elapsed: 00d00h00m51s
Available Sec. =          51 100%
Degraded Min.   =           0   %
Severely ErrSec=           0   %
Errored Second =           0   %
Unavailable Sec=           0   %
FDisp FForce FEr R FResync FReset M
1Page12      30      4      5      0
```

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 errors occurs.

19.5 Performance

The **HCT-BERT/H** 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

19.6 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 **HCT-BERT/H** 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:

```
FDisp F Force F Er R F Resync F Reset M
1Page12 30 4 5 0
```

Press "**MORE**"

```
F patn F Durn. F F F M
1QRSS 2Cont. 3 4 5 0
```

Following are the function key detailed meanings and actions.

Group 1

[F1]Disp. Display Format
Page1 Changes the display format to page 1 (G.821 mode).
Page2 Changes the display format back to page 2 (common 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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20.1 Low Speed Datacom BERT SETUP

20.1.1 : Setup

From the fourth main menu page, press the **F4** 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 or press **HOME**.

20.1.2 : Data Port Setting

Use the " " arrow key to select the available data port mode for BERT. The **HCT-BERT/H** can perform in DTE or DCE modes. Select DTE mode if connecting to Data Communication Equipment such as MODEMs. Select DCE mode if connecting to Data Terminal Equipment such as display terminals or PC Com ports.

20.1.3 : 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. Use the appropriate interface adapter cable for the selected interface type.

20.1.4 : 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).

20.1.5 : 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.

20.1.6 : 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.

20.1.7 : Alarm Setting

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

20.1.8 : Protocol Setting

The ***HCT-BERT/H*** supports both ASYNC and SYNC protocols. Select the protocol for your application.

20.1.9 : 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.

20.1.10 : Bits Setting

When using ASYNC protocol, the ***HCT-BERT/H*** 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.

20.1.11 : Parity Setting

When using ASYNC protocol, the ***HCT-BERT/H*** 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.

20.1.12 : Stop Bits Setting

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

20.1.13 : 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 *HCT-BERT/H*'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, the received clock.

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

*designates that clock is issued from the *HCT-BERT/H*

20.1.14 : Xon/off Setting

The *HCT-BERT/H* allows enabling or disabling transmission of software flow control. Set according to your application.

20.1.15 : Flow control Setting

The *HCT-BERT/H* allows enabling or disabling transmission of hardware flow control. Set as required by your application.

20.1.16 : Print Interval Setting

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

20.1.17 : Print On Error Setting

By enabling this parameter, the *HCT-BERT/H* will print whenever an error condition occurs.

20.2 Running Low Speed Datacom BERT

20.2.1 : 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 0000: 00: 18
F Force F Force F Reset F
1 1 Err 25 Err 3 Count 4
```

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.

20.2.2 : Communication Line Quality Test

To test and check the quality of a transmission line, the **HCT-BERT/H** 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).

20.2.3 : Connections

There are two recommended connection methods. The first requires two **HCT-BERT/Hs**, 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 **HCT-BERT/H** on one end of the communication line and a physical loop back at the other end. The **HCT-BERT/H** 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 troubleshooting and isolating cable/connector deficiencies.

20.2.4 : Setup

When using an **HCT-BERT/H** 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 loop back mode.

20.2.5 : 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 **HCT-BERT/H** contains its own transmitter and receiver.

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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 Commission

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 Frammer
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-H2MD2M000, Cable, HD26 Male-DB25 Male, RS530, 1M

Part#: 58-H2MD2F000, Cable, HD26 Male-DB25 Female, RS530, 1M

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.

HCT-BERT/H E1/T1/Datacom Bit Error Rate Tester

Appendix B: Cable Pin Out

Part#: 58-H2MD3M000, Cable, HD26 Male-DB37 Male, RS449, 1M

Part#: 58-H2MD3F000, Cable, HD26 Male-DB37 Female, RS449, 1M

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-H2MM3M000, Cable, HD26 Male-MB34 Male, V.35, 1M

Part#: 58-H2MM3F000, Cable, HD26 Male-MB34 Female, V.35, 1M

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.

HCT-BERT/H E1/T1/Datacom Bit Error Rate Tester

Appendix B: Cable Pin Out

Part#: 58-H2MD1M000, Cable, HD26 Male-DB15 Male, X.21, 1 M

Part#: 58-H2MD1F000, Cable, HD26 Male-DB15 Female, X.21, 1 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.

HCT-BERT/H E1/T1/Datacom Bit Error Rate Tester

Appendix B: Cable Pin Out

Part#: 58-H2MD2M001, Cable,HD26 Male-DB25 Male, RS232, 1M

Part#: 58-H2MD2F001, Cable,HD26 Male-DB25 Female, RS232, 1M

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-H2MR4M000, Cable, DB15 Male-RJ45 Male,T1 100 ohm,
1.5M

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	

HCT-BERT/H E1/T1/Datacom Bit Error Rate Tester

Appendix B: Cable Pin Out

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

NOTES:



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