

# **BTM10 Series Transmission Analyzer**

- ☐ **BTM10/E1**
- ☐ **BTM10/T1**
- ☐ **BTM10/E1/T1**



# **USER'S MANUAL**

**E1 and T1 Telecom/Datacom Analyzer**  
Portable Analyzer series

## **Introduction**

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

## **Functions**

- E1/T1 BERT Analysis: E1/T1 frame, code, CRC, and BPV performance analysis and generator.
- Alarm and Looping Setting: Manual or automatic alarm and loop setting.
- VF Access: Drop and insert 64K voice; low frequency generator and measurement (VF frequency from 60 to 3950 Hz + 0 to -55dBm)
- Pulse Shape: E1/T1 pulse shape analysis.
- Signal Result: E1/T1 PCM level meter and frequency analysis.
- Signaling Setting: ABCD bit setting.
- Signaling Display: Display all channels of ABCD bits.
- BERT on Data Port: Data port BERT performance analysis.
- Examine Analysis: off-line analysis of E1/T1 BERT performance.
- External Drop and Insert: Acts as a fractional E1 or T1 to datacom converter.
- User Programmable Pattern Setting: There is a 32 bits programmable pattern, which can be inserted onto the E1/T1 line and drop for analysis.

- Timeslot Setting: Drop and Insert n\*56K data onto T1 line. Drop and Insert n\*64K or n\*56K data onto E1 line.
- Timeslot Mapping Data: Analyze any channel data of two frames.
- SLIP Measure: Uncontrolled, Controlled, Frame, and Timing SLIP.
- Remote Control: User can access BTM10 unit using an ASYNC terminal.
- File Management: Five configuration and result memory locations can be stored or recall by user.

## **General Specifications**

### ***E1 Specifications:***

#### **1. Receiver Interface of E1/CEPT**

- Line Code: HDB3/AMI
- Pulse characteristics: meets ITU G.703
- Jitter Tolerance: meets ITU 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 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 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)
    - Data Port Timing
  - Internal Timing plus 50 ppm offset: 2.048 MHz +50 ppm.(Option)
  - Internal Timing minus 50 ppm offset: 2.048 MHz -50ppm(Option)

**3. E1/CEPT Frame Structure**

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

**4. Line Build Out:**

- 0 dB
  - -7.5 dB
  - -15 dB
  - -22.5 dB
- (Accuracy:  $\pm$  1dB)

***T1 Specifications:*****1. Receiver Interface of T1/DS1**

- Line Code: B8ZS/AMI
- Pulse characteristics: meets ITU G.703
- Jitter Tolerance: meets ITU G.823
- 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 G.703
- Pulse Amplitude: Nominal 3.00V for Symmetrical Pair 100 ohm
- Zero Amplitude:  $\pm$  0.1 V max.
- Jitter Tolerance: meets ITU G.823
- 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)

Data Port Timing

Internal Timing plus 50 ppm offset: 2.048 MHz +50 ppm.(Option)

Internal Timing minus 50 ppm offset: 2.048 MHz -50 ppm.(Option)

### **3. T1/DS1 Frame Structure**

- D4 (SF)
- ESF
- ESF+CRC6
- SLC-96
- T1DM
- Unframed

### **4. Line Build Out:**

- 0 dB
  - -7.5 dB
  - -15 dB
  - -22.5 dB
- (Accuracy:  $\pm$  1 dB)

### ***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, LIVE

#### **2. BERT Display Format**

- Normal
- ITU G.821

**3. BERT Transmit Error Rate**

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

**4. Performance Analysis:**

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

**5. BERT Test on Data Port**

- Data rates for 56Kbps multiples;  $n \times 56\text{Kbps}$  ( $n=1\sim 24$ )
- Data rates for 64Kbps multiples;  $n \times 64\text{Kbps}$  ( $n=1\sim 32$ )

***Analyzer Mode:*****1. Channel Map Screen****2. Line Attenuation****3. Slip Measure****4. Signaling: [ABCD]**

**5. General Status:**

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

**6. Results:**

- Bit Errors
- BPV Errors
- Frame Errors
- CRC Errors
- G.821 Analysis
- G.826 Analysis (Option)
- M.2100 Analysis

**7. Alarm/Warning**

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

**8. Print out of test results**



***Other Features:*****1. Pulse Wave Analyzer (option)**

Built-in PUB CB119, ANSI T1.403(T1), and ITU G.703(E1)

**2. In-Band and Out-of-Band Loop Control**

- Line Loop (LLB)
- Pay Load Loop (PLB)
- SmartJack Loop
- User Programmable Loop
- Loop Up
- Loop Down

**3. Large LCD display**

- 32 Characters x 8 Lines
- Text / Graphic mode

**4. Result Report**

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

**5. Portable for field use****6. Upgradeable for advanced features****7. Rechargeable Battery with battery low indicator****8. Temp. Range**

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

**9. Humidity:** up to 95%

**10. Power Source**     AC-110V / DC9V/1500mA adapter,  
or AC-230V / DC9V/1500mA adapter

**11. Dimension**

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

**12. Weight**

1.7 kg (3.75 lb) net weight

***Interface Port Description:***

- DB15 (Male):        E1/T1 TX and RX Port
- BNC \* 2:            E1/T1 TX and RX Ports
- Bantam \* 2:        E1/T1 TX and RX Ports
- Bantam \* 1:        External Clock In
- HD26 (Female):    Data Port (RS-449/530,V.35, RS-232 interface)
- DB15 (Female):    Printer Port
- DB9 (Male):        Remote Control Port / Serial RS-232 Printer Port (option)
- RJ-45/RJ-11:        Voice In/Out
- Slide Switch:        External (Reference) Clock Setting: TTL/PCM
- Power Switch:      Power ON/OFF
- Mini-Jack:           DC9V IN

**2.4 Status LEDs**

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

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

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

And their detailed descriptions are as follows:

**1) SYSTEM**

Ext. Power (External Power):

When the external power adapter is plugged into the **BTM10**, this LED will light.

Bat. Low (Battery Low):

When the power of the built-in battery is weak, and is in need of a recharge, this LED will light.

DTE:

Data port is working in DTE mode.

DCE:

Data port is working in DCE mode.

DATACOM:

Data port is under use, such as with "Ext. Drop and Insert" or "BERT on data port" functions.

## **2) INTERFACE**

Bridge:

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

Terminal:

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

DSX-MON:

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

E1:

**BTM10** is working as an E1 analyzer.

T1:

**BTM10** is working as a T1 analyzer.

## **3) RECEIVE STATUS**

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

Signal Present:

**BTM10** E1/T1 RX is receiving available PCM analog signal.

Frame Sync:

Remains lit if not receiving loss of frame alignment status.

**Pattern Sync:**

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

**B8ZS/HDB3:**

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

**Loop Up:**

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

**Signal Loss:**

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

**Frame Loss:**

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

**Pattern Loss:**

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

**Power Loss: (not ready)**

**BTM10** has been powered off during testing.

**Excess Zero:**

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

**One Den(One Density):**

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

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

**AIS: (Receive Alarm Indication Signal)**

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

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

**SLIP:**

Lights if a slip error is received.

**Yellow:**

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

**RAI: (Receive Remote Alarm)**

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

**MRAI: (Receive Multi-frame Remote Alarm)**

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

**L.Up: (Loop Up)**

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

**L.Dn: (Loop Down)**

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

**Errors:**

Will light under any of the following error conditions.

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

**Freeze:**

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

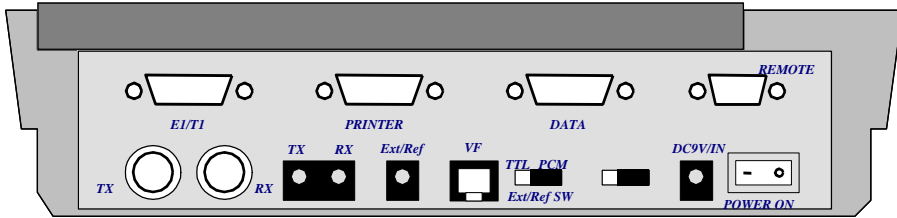
**History:**

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

**Ins Err:**

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



**Rear Panel**

The **BTM10** Rear Panel

**Descriptions:****POWER ON:**

Power on switch.

**DC9V/IN:**

This jack is used to plug in the DC9V/1.5A adapter. It may be used to power the unit when in use or to recharge the built-in battery when battery power is low.

**TX(BNC):**

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

**RX(BNC):**

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

**TX/RX(Bantam):**

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

**E1/T1(DB15):**

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

**DB15 Pin Assignment:**

Pin 1: TTIP (E1/T1 TX)

Pin 2: GND

Pin 3: RTIP (E1/T1 RX)

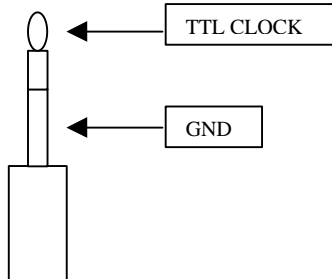
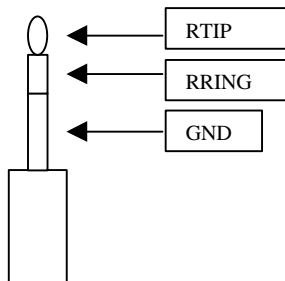
Pin 4: GND

Pin 9: TRING (E1/T1 TX)

Pin 11 RRING (E1/T1 RX)

**Ext/Ref:**

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

**Bantam pin assignment(TTL):****Bantam pin assignment (E1/T1 PCM):**

VF:

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

RJ-45 pin assignment:

Pin 1: N.C.

Pin 2: Voice Ground

Pin 3: MIC+ / input

Pin 4: RCVR+ / output

Pin 5: RCVR- / output

Pin 6: MIC- / input

Pin 7: Voice Ground

Pin 8: N.C.

RJ-11 pin assignment:

Pin 1: MIC+ / input

Pin 2: RCVR+ / output

Pin 3: RCVR- / output

Pin 4: MIC- / input

Ext/Ref SW:

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

MON TERM switch (Reserved):

Printer:

This printer port can be adapted to connect to any Centronics standard interface by the use of the printer adapter cable

(part#:58-D1MC3M000). 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 <sup>st</sup> to 8 <sup>th</sup> bits of parallel data. Each signal is at HIGH level when data is logical 1 and LOW when it is logical 0.
3	DATA 2	
4	DATA 3	
5	DATA 4	
6	DATA 5	
7	DATA 6	
8	DATA 7	
9	DATA 8	
10	GND	
11	BUSY	A High signal received indicates that the printer cannot receive data. The signal goes HIGH in the following cases: During data entry During printing When off-line During printer error
12	GND	
13	GND	
14	/AUTO FEED XT	+5V supplied to printer through 10K ohm resistor.
15	/SLCT IN	Connect to GND.

Data:

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

HD26 Pin Assignment:			
Pin 1	FGND	Pin 14	CTS(B)
Pin 2	TD(A)	Pin 15	TC(A)
Pin 3	RD(A)	Pin 16	XTC(B)
Pin 4	RTS(A)	Pin 17	RC(A)
Pin 5	CTS(A)	Pin 18	XRC(B)
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	XRC(A)	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 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.