# T-BERD® 950
Communications Analyzer

Product Highlights

- Multiple service testing capabilities combined in a single test instrament
- Analog and digital testing support
- Growth-oriented protocol service board and interface module expansion slot for future test access capability
- TNT Task Based Testing user inter face makes routine test set-up simple and intuitive
- Large graphical LCD allows for two user display screens and a two-line results display
- Use AC or battery power with dual hot-swappable, field replaceable batteries

Application Highlights

- Qualify local loop copper wire pairs for both analog and digital services
- Perform full-duplex monitoring of active T1 and DDS lines
- Verify and troubleshoot ISDN BRI and PRI services
- Test the ability to handle incoming calls with PBX/Switch emulation
- Install and maintain frame relay service from T1, DDS, and Datacom interface
- Perform IP service verification and trouble isolation from a 10BaseT interface

The Acterna T-BERD 950 Communications Analyzer is a multi-functional instrument that combines troubleshooting and turn-up testing capabilities for digital, analog, voice, and data circuits in one unit. The T-BERD 950 thoroughly tests digital services such as T1/FT1, DDS local loop, and T1 PBX trunks. It also supports testing for analog services such as DID and analog data. Protocol services including ISDN BRI, ISDN PRI, and frame relay, in addition to other network technologies and services are also supported by the T-BERD 950. Built with the demands of the field technician in mind, the T-BERD 950 is designed to expand and support new technologies and services without sacrificing ease of use or portability.

ACTERNA™
The Keepers of Communications
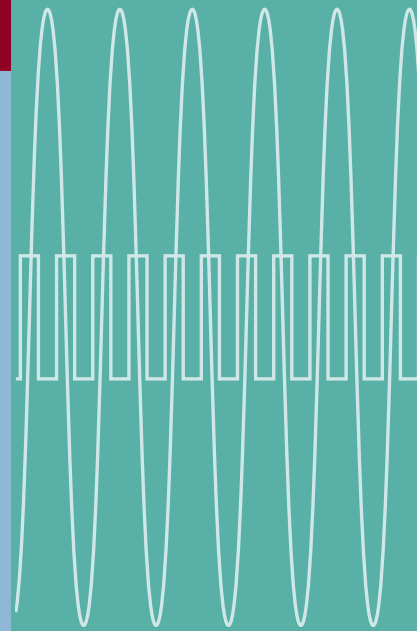
Functions

- Perform standard T1 BER testing and signal analysis measurements
- Gain T1/FT1 access for BER testing with standard and advanced stress patterns, as well as built-in T1 smart repeater and HDSL loopcodes
- Test end-to-end WAN service through DTE/DCE equipment emulation and in-service monitoring
- Perform TIMS measurements for qualification of voice and data circuits; place, receive calls, and perform signaling event/digit analysis on analog loop start, ground start, and DID voice circuits
- Verify circuit-switched ISDN BRI voice, data, and D packet services by performing NT1 and LT BERT, or NT1/TE emulation

The T-BERD 950 can verify network/WAN connectivity from an Ethernet interface by transmitting Internet control message protocol (ICMP) echo requests (PINGs) and respond to received PINGs. Additionally, the T-BERD 950 can place, receive, and monitor ISDN PRI calls on 23 B+D, 47 B+D, and 46 B+2D circuits while viewing full layer 3 D channel decodes. When testing DS0 channels, the T-BERD 950 can place, receive, or monitor calls as well as analyze captured signaling events and digits on T1 voice trunks when performing PCM TIMS tests such as C-message noise and three tone slope over individual channels. Accessing standard BERT options such as frame relay allows the T-BERD 950 to perform dual receiver monitoring or terminated testing at the customer's four-wire DDS 64k, 56k, or sub-rate lines. The T-BERD 950 provides complete link management at customer premises equipment (CPE) and test frame generation to verify frame relay LMI functionality, PVC status and quality of service (QoS).

Applications

T1 Testing

The T-BERD 950 T1 tester provides T1 measurements to determine frame and CRC errors, and signal level, allowing T1/FT1 access for standard BERT and testing applications such as signaling, PCM TIMS, frame relay and ISDN PRI. The two transmitters and receivers provide terminate, drop and insert, and dual receiver monitoring test mode.

Extensive, standard BERT features provide the most accurate measure of point-to-point transmission performance by stress testing circuits to ensure proper circuit configuration and identify transmission impairments. Advanced features such as automatic pattern synchronization, MULTIPAT, built-in HDSL loopcodes and T1 smart repeater loopcodes, round trip delay measurements, and G.821 performance results accompany a full range of stress patterns.

Get all of the testing power you need to turn up and troubleshoot multiple services—in one compact, rugged tester
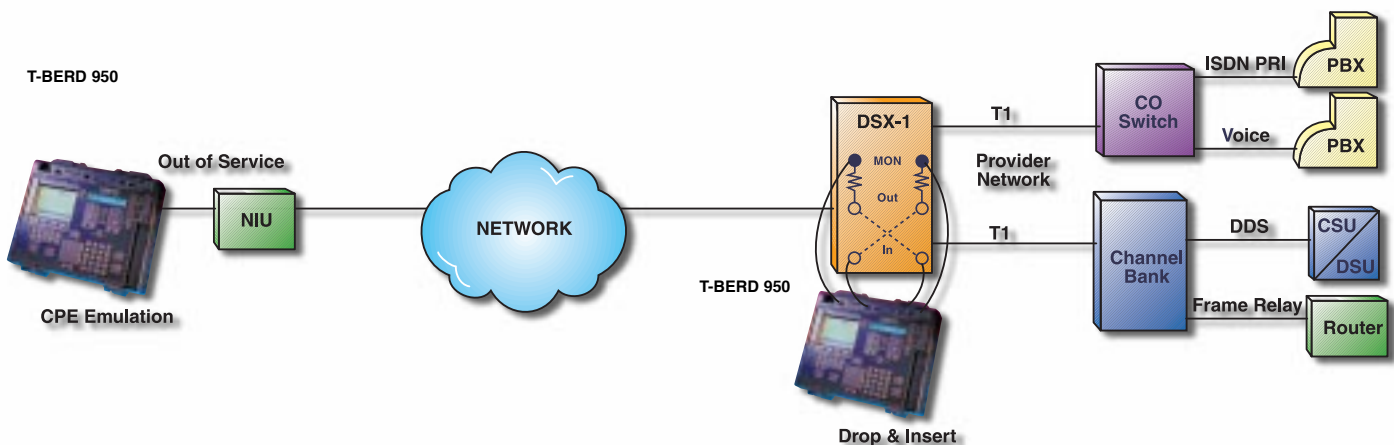
DDS Local Loop Testing

The DDS local loop option provides capability for testing and analyzing the DDS four-wire local loop. The CSU/DSU emulation feature allows the user to perform the turn-up as well as verify switch parameters for the existing DDS service. In the event that the local loop is not the cause of the trouble, the OCU-DP emulation feature helps determine if possible problems reside at the CPE. In addition, dual-receiver monitoring allows for troubleshooting the DDS circuit by analyzing receive frequency, signal level, sealing current, BPVs, DDS frame errors, and timing slips.

CSU/DSU emulation
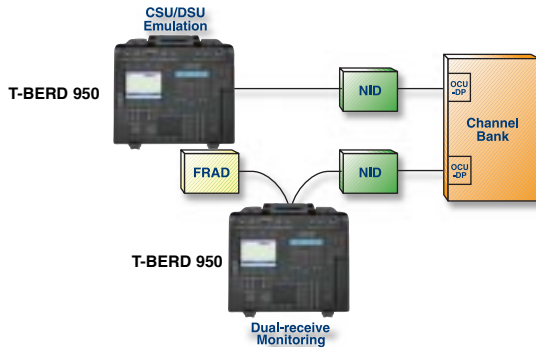
OCU-DP emulation
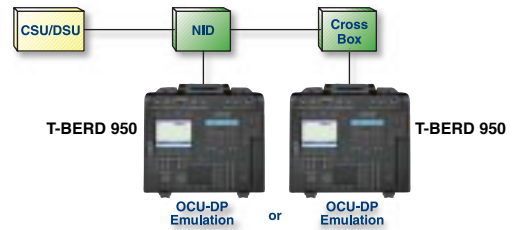
ISDN PRI Testing

The ISDN Primary Rate Interface (PRI) option enables the T-BERD 950 to emulate an NT or TE device, such as a PBX at the CPE, for verification of ISDN service and the correct switch translations for inbound and outbound calls. Call placement, receipt, and monitoring is supported on single PRI configurations as well as NFAS and NFAS with D channel back-up implementations. It also supports monitoring of D channel activity simultaneously with T1 facility conditions from a T1 access point and provides plain English descriptions for Q.931 Cause Codes. Like the frame relay option, the ISDN PRI option requires the installation of the Protocol Services Board.

Primary rate ISDN testing
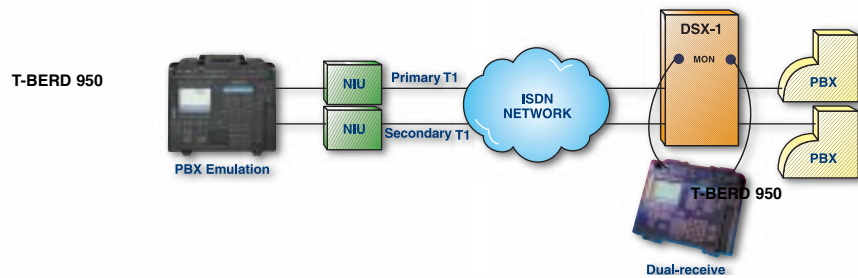
Dual receiver monitoring
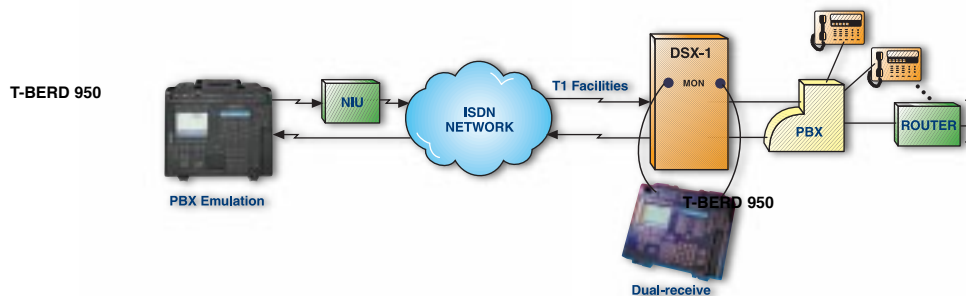
ISDN BRI Testing

The ISDN Basic Rate Interface (BRI) option, in conjunction with the Protocol Services Board option, enables the T-BERD 950 to perform BER testing, protocol analysis (D channel analysis), voice and data call placement and receipt and X.25 D channel packet call analysis. The LT and the NT1 emulation features allow the user to perform BER testing on the U interface toward the NT1 and toward the LT, respectively. In addition, the NT1/TE emulation provides a tool for placing and receiving voice and data calls at the U interface.

Use the T-BERD 950 to BERT the copper wire pair for ISDN BRI service

T-BERD 950

LT

NT1 Emulation

T-BERD 950

NT1

LT Emulation

T-BERD 950

ISDN NETWORK

Use the T-BERD 950 to verify the ISDN BRI voice and data service

NT1/TE Emulation
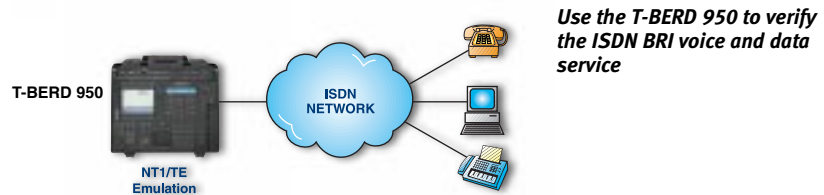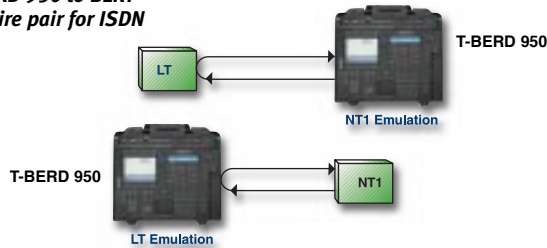
Analog 2-Wire/4-Wire Testing

The T-BERD 950 Analog 2W/4W Interface Module provides technicians with the capability to perform installation and troubleshooting tests for analog voice, analog data, and digital data services. The module is an optional interface for the T-BERD 950 that can be used for the following test applications:

- TIMS pre-qualification of the copper pair for analog point-to-point service
- TIMS pre-qualification for the copper pair for digital wide band service including DDS, ISDN, HDSL, and IDSL
- Testing of analog voice services including loop start, ground start, and DID through PBX emulation. (Note: The current Analog 2-Wire/4-Wire Interface Module supports only DID PBX emulation).

Location A

T-BERD 950

Analog Module

Punch Down Block

Analog Data Network

Punch Down Block

Location B

Modem or CSU/DSU
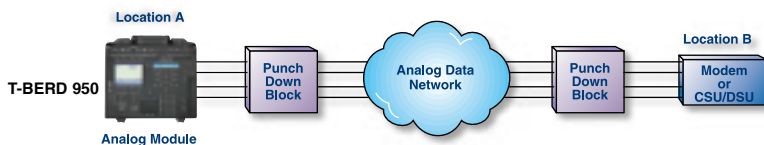
Analog point-to-point service testing

Location A

T-BERD 950

Analog Module

RJ-21X

Public Switched Network

RJ-21X

Location B

PBX
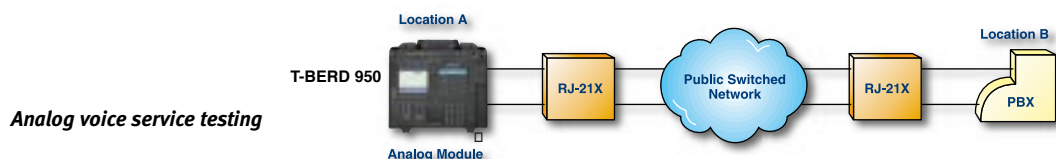
Analog voice service testing

Datacom Testing

The Datacom (DTE/DCE) Interface Module is an optional interface module to the T-BERD 950. With this option, the user can perform BER or frame relay testing, or emulate the CPE. The Datacom (DTE/DCE) Interface Module allows the user to emulate a DTE or DCE, while dual–receiver monitoring supports full duplex monitoring at synchronous BER testing rates from 50 bps to 10 Mbps. Overall, this module allows the user to extend end-to-end testing at synchronous data rates by supporting the most common data interfaces.

Point-to-point data testing

Packet switched data testing
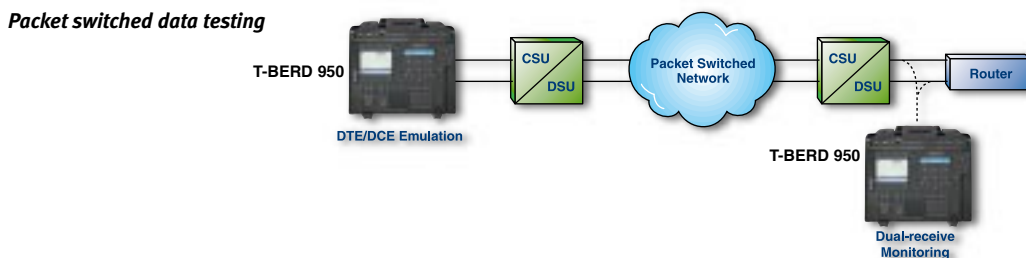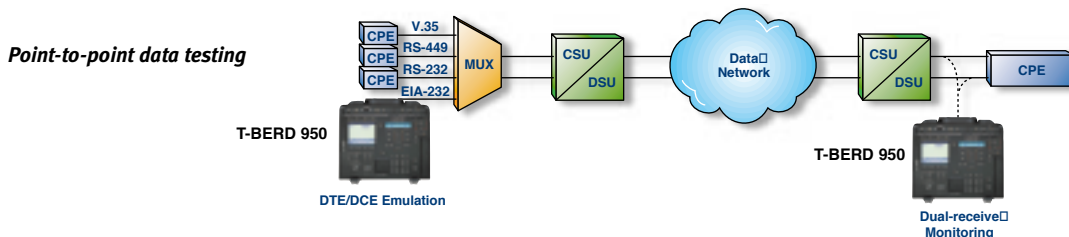
Frame Relay Testing

Frame Relay testing is an option for the T-BERD 950 that requires installation of the Protocol Services Board. It enables the user to perform frame relay service installation and maintenance from the T1, DDS-LL, and datacom interface. This option offers strong CPE emulation and dual receiver monitoring features. In addition, the frame relay option allows the user to perform link management emulation and test frame generation to verify LMI functionality, PVC status, and QoS.

Frame relay testing
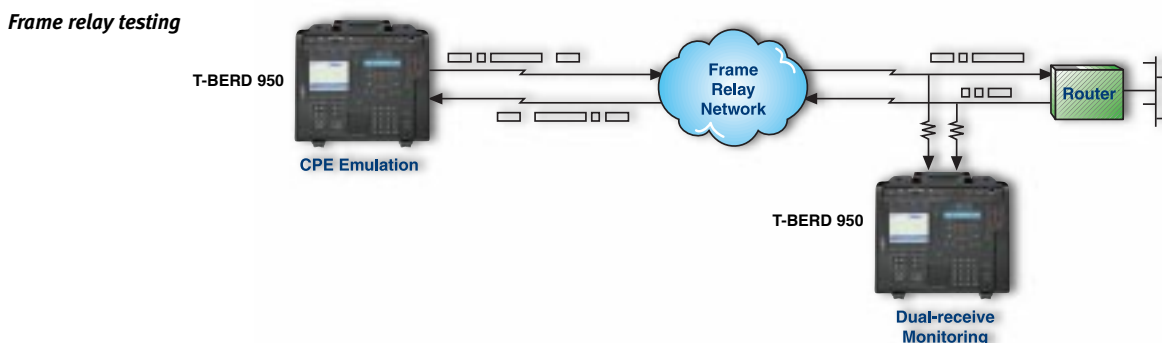
10BaseT Testing

The T-BERD 950 10BaseT option supports the verification of IP service from 10BaseT interface. Connectivity can be verified from the CPE on the drop side of an IAD or router to various points within the network by transmitting and responding to ICMP echo requests (PINGs). The option also allows the user to transmit and receive IP traffic at user-selectable rates to verify actual throughput performance against the expected rate for the WAN access circuit in use. Additionally, basic Ethernet physical layer results and IP statistics are provided. Like the Frame Relay and ISDN PRI options, this option also requires the installation of the Protocol Services Board.

Ping testing from 10BaseT interface

IP Traffic generation from 10BaseT interface
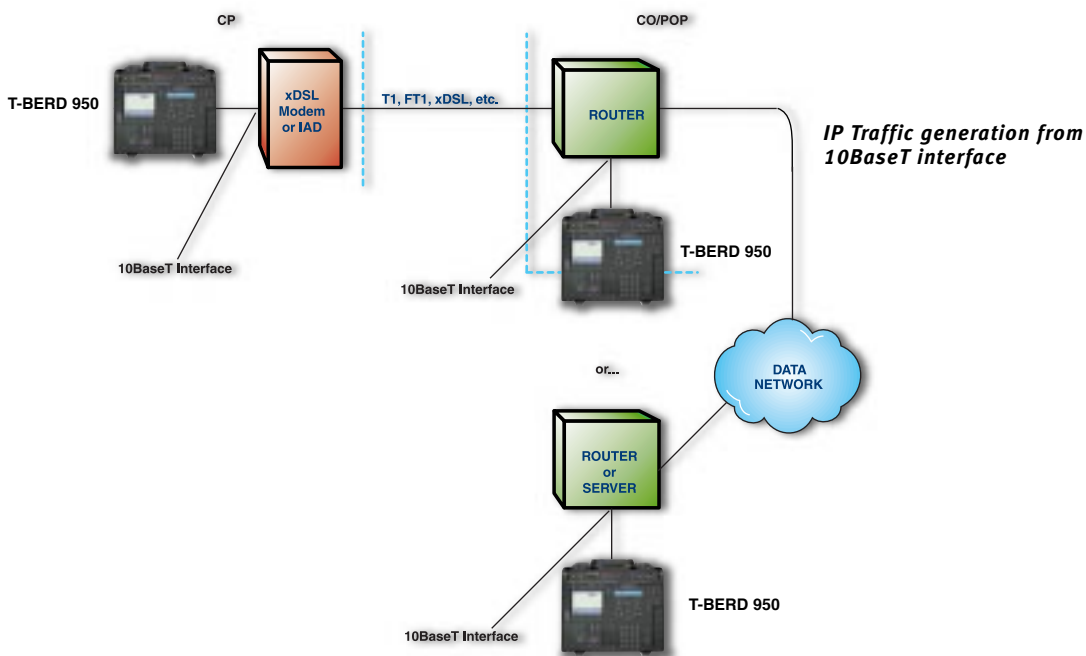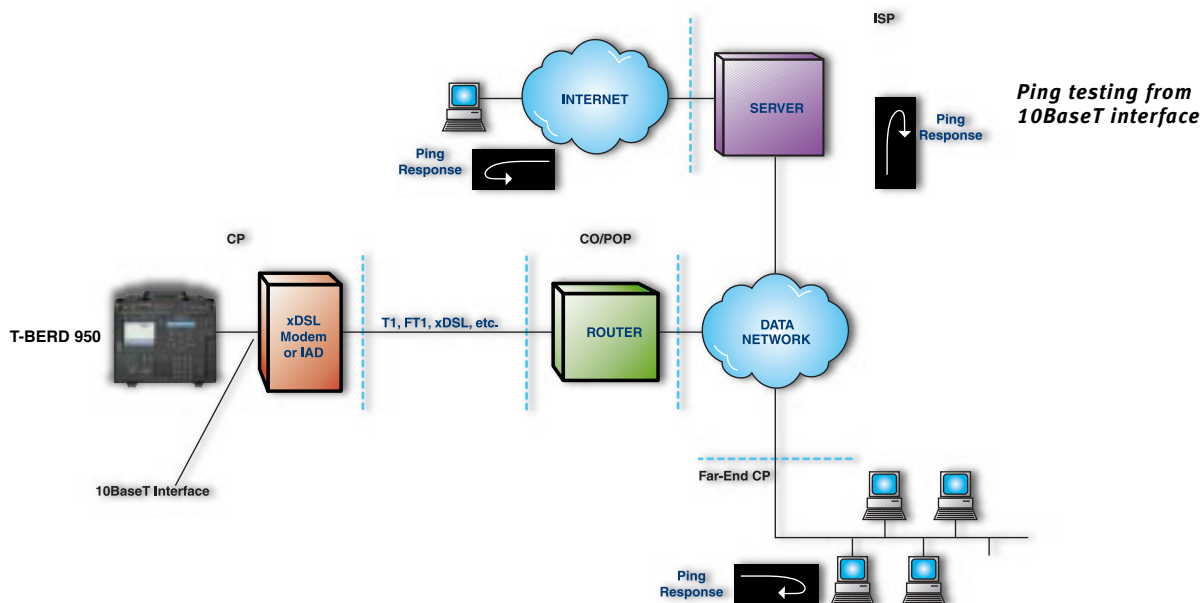
PCM TIMS Testing

The PCM TIMS option enables the user to perform testing on individual voice channels from a digital (T1) access point. The PCM TIMS option operates in three different T1 configuration modes: terminate, drop and insert, or monitor. End-to-end channel performance can be tested from the T1 access to ensure proper VF service quality. When this type of testing is performed on a VF channel, the T-BERD 950's two T1 receivers allow non-intrusive PCM TIMS measurement with the presence of a variable frequency/level tone, holding tone, or quiet transmission. By performing the PCM TIMS measurement at various points along the T1 circuit, the user can differentiate between VF service and T1 transmission problems.

Signaling

The T-BERD 950 Signaling option allows the user to verify service when turning up a new T1 trunk and supports troubleshooting of PBX to switch connections. The entire T1 trunk can be terminated for out of service testing or drop and insert testing can be performed on a single DS0 channel. Proper PBX and switch operation can be verified through call origination, call termination, signaling verification, and in-depth event and digit measurements. With two T1 receivers, the T-BERD 950 supports full duplex monitoring of signaling events and digits associated with a specific DS0.

TNT Task Based Testing

The T-BERD 950 currently supports six physical interfaces for testing, including T1, DDS Local Loop, Datacom (RS-232, EIA-53, RS-449, X.21 and V.35), Analog 2-wire/4-wire, BRI (U interface), and 10BaseT. TNT Task Based Testing provides an efficient user interface, which simplifies turn-up and troubleshooting procedures for testing of services on all supported interfaces. By using the tasks and terminology typically employed by a technician, TNT Task Based Testing streamlines the testing process by reducing the number of configuration items and time required to obtain results.

Technical Specifications

PHYSICAL CHARACTERISTICS

Overall dimensions . . . . 10.5 x 13.25 x 4 in.

(26.8 x 33.66 x 10.17 cm)

Weight . . . . 10 lbs (4.55 kg) without batteries, 13 lbs (5.9 kg)

ENVIRONMENTAL

Temperature Range

Operating . . . . 32° F to 122° F (0° C to +50° C)

Non-Operating . . . . -4° F to 140° F (-20° C to +60° C)

Humidity . . . . 10% to 90% Relative Humidity, **non**

Vibration . . . . Per BellCore NEBS TR-EOP-000063

Shock . . . . Per IEEE-743-1985

ALTITUDE

Operating . . . . 200 ft. (61 m) below sea level to 16,400

Non-operating storage or transportation . . . 49,210 ft, (15,000 m)

POWER REQUIREMENTS

AC Power

Input Voltage . . . . 90 to 240 VAC, 47 to 63 Hz, autodetected

Power Dissipation . . . . 30 watts (typical), 68 watts

(peak - two batteries receiving initial charge)

Fuse Type . . . . . . 250 Volt, 1 Amp Slo-Blo (LittleFuse p/n 218001)

DC Power

Battery Type. . . . . Panasonic LCS-2012DP (2 required)

Operating Time . . . . Depends on configuration, up to 4 hours

T1 SPECIFICATIONS

Operating Modes . . . . Terminate (TERM),
Drop & Insert (D&I), Monitor (MON), Line Loopback (LLB)

Framing . . . . ESF, SF, SLC, Unframed, Auto

T1 Input

Frequency . . . . 1.544 MHz ±5000 Hz

Input Impedance

TERM. . . . . 100 ohms ±5%

BRIDGE. . . . . 1000 ohms minimum

DSX-MON. . . . . 100 ohms ±5%

Operating Range. . . . .

TERM . . . . +6 dBdsx to -35.0 dBdsx cable attenuation

DSX-MON . . . . +6 dBdsx to 35.0 dBdsx cable attenuation

T1 Output

Frequency . . . . 1.544 MHz ±7 Hz

Clock Sources . . . . Internal Oscillator, Recovered

(from associated path receiver)

Line Build Out (LBO) . . . 0, -7.5, -15, -22.5 dB ± 1 dB at 772kHz

Operating Range. . . . .

DSX MON . . . . -10 dBdsx to -30 dBdsx resistive attenuation

Line Coding . . . . AMI, B8ZS

Error Insert Type . . . . BPV, Logic, Frame, L&BPV

(Logic and BPV errors)

Indicators. . . . . Signal Present, Frame Sync, Pattern Sync,
B8ZS Detect, AIS (Alarm Indication Signal) and Yellow Alarm

FREQUENCY MEASUREMENT

Accuracy . . . . ± 10 ppm

Resolution 1Hz

Level

Peak to Peak . . . . 20mV to 12.0 V

Positive and Negative Base to Peak. . . . . 10mV to 6.0 V

Positive and Negative Base to Peak . . . . -48.0 dBdsx to +6.7 dBdsx

Resolution1 . . . . ±1 dB

Simplex Current

Range . . . . 10 to 207 mA, and under 10 mA

Accuracy . . . . ±10% or 2mA (whichever is greater)

Wander

Resolution . . . . 1 UI

Accuracy . . . . 1 UI

DDS SPECIFICATIONS

Data Formats. . . . . Standard DDS and DDS

with Secondary Channel

Primary Channel Data Rates 2.4, 4.8, 9.6, 19.2, 38.4, 56,

and 64 kbps

Secondary Channel Data . . . . Idle, 511, and 2047

BER testing patterns are available

Clock Source . . . . Internal Oscillator
Recovered timing from received signal

Receive Signal

Connection . . . . OCU-DP mode: RJ-45 pins 1 & 2,
DSU/CSU mode: RJ-45 pins 7 & 8,

Monitor mode . . . . RJ-45 pins 1& 2 and 7 & 8

Termination Impedance . . . . Balanced, 135 Ω ±5%

Bridging Impedance . . . . Greater than 1900 Ω

Operating Range . . . . +6.0 dB to -45 dB minimum

(56 kbps and 64 kbps) -OR- +6.0 dB to -40 dB minimum

(all other data rates)

Transmit Signal

Connection . . . . OCU-DP mode: RJ-45: pins 7 & 8
DSU/CSU mode: RJ-45: pins 1& 2

Termination Impedance

Output Levels. . . . . Balanced, 135 W, ±5%

Output Levels. . 0, -3, -6, and -9 dB of simulated cable attenuation

Test Modes . . . . TERMINATE, MONITOR, Line Loop Back (LLB)

Emulation Modes. . . . . DSU/CSU, OCU-DP or Metallic

Simplex Current

Input Level. . . . . ±30 mA maximum

Measurement range. . . . . ±26 mA
with an accuracy of ±10% or 2mA

OCU-DP mode current output . . . . ≥ 4 mA to 20 mA
depending on span length

Error Insertion

Operation . . . . Single or continuous

Error insert type . . . . Logic, BPV, L&BPV, or Frame

Loop Response V.54,
DSU/CSU,
Disabled

FRAME RELAY SPECIFICATIONS

Test Modes. . . . . Terminate,
Drop & Insert (T1 Interface only),
Monitor

Link Management Analysis . . . . LMI Rev.1, T1.617 Annex D,
Auto, None

PING Testing . . . . ICMP Echo Test
NLPID Encapsulation

ISDN BRI U INTERFACE SPECIFICATIONS

Interface. . . . . U Interface with To LT and To NT

Devices. NT1

Physical Configuration . . . . Point to Point, Synchronous and
Full-Duplex

Bit Rate. . . . . 160 kbps

User Data Rate . . . . 144 kbps

Line Coding. 2B1Q

Line Rate. . . . . 192 kbps

Maximum Voltage . . . . ± 2.5 V

10BASET/ETHERNET SPECIFICATIONS

Test Modes . . . . Terminate

DHCP Implementation . . . . RFC 2131

PING Testing . . . . ICMP Echo Test

Traffic Generation

Load Rate . . . . 1 kbps to 10 Mbps (User Selectable)

Packet Length. . . . . 70 to 1518 bytes (User Selectable)

ANALOG MODULE SPECIFICATIONS

Interfaces

Two Bantam connectors. . . . .
2-wire alternate Transmit and Receive on the 2W/4W Tx
connector. 4-wire simultaneous Transmit on the 2W/4W Tx
connector and Receive on the 4W Rx connector

Termination Impedance. . . . . 135 Ω, 600 Ω, or 900 Ω

Loopbacks . . . . Tx VF Loop Up
Tx VF Loop Down

2713 Hz Loopback response

Level . . . . 10 dB to -30 dB

Frequency. . . . . 2706 Hz to 2720 Hz

Receive Holding Tone

Frequency . . . . 1004 Hz

Level . . . . Controllable from +10 dBm to -40dBm

Stability . . . . ±0.005 Hz

Ring Detection (2 Wire Only) . . . . 40 V to 150 V
RMS ringing signal, 16 Hz to 68 Hz

Line Holding Current . . . . 26 mA DC, -8.6 V to -56.7 V
(Signaling or Signaling plus TIMS)

Dial and Receive Digit Types

DP. . . . . Dial Pulse

DTMF . . . . Dual Tone Multifrequency

MF . . . . Multifrequency (DID only)

DATACOM MODULE SPECIFICATIONS

Interface

EIA-232-D . . . . Supports EIA-232-D/V.24/
V.28 - BA, BB, CA, CB, DD, CF, DB,
DD, LL, RL, CD, DA and TM

EIA-530 . . . . Supports EIA-422-B for BA, BB,
CA, CB, CC, CD, CF, DA, DB, and DD
Supports EIA-423-B for LL, RL and TM

RS-449 . . . . Supports EIA-422-B for SD, RD,
RS, CS, DM, TR, RR, RT, ST and TT
Supports EIA-423-B for LL, RL and TM (Requires DB25 to
DB37 adapter for EIA-530 Connector)

V.35/306 . . . . Supports balanced clock and data
circuits, and EIA-232/ V.24/V.28 control circuits
Supports 306 for SCT, SCTE, SCR, SD and RD
Supports V.35 for 103, 104, 114 and 115
Supports V.28 for 105, 106, 107 and 109

X.21 . . . . Supports V.11 for R, I, S, T and C

Data Rates EIA-232

Max. Synchronous Data Rate: . . . . 128 kbps

Max. Recovered Data Rate: . . . . 128 kbps

RS-449 Terminated

Max. Synchronous Data Rate. . . . . 10 Mbps

Max. Recovered Data Rate . . . . . . 512 kbps RS-449 Unterminated

Max. Synchronous . . . . with cable characteristics

Max. Recovered . . . . 512 kbps

EIA-530 Terminated

Max. Synchronous Data Rate . . . . 10 Mbps

Max. Recovered Data Rate . . . . 512 kbps

EIA-530 Unterminated

Max. Synchronous. . . . . Varies with cable characteristics

Max. Recovered. . . . . 512 kbps. X.21

Max. Synchronous. . . . . Varies with cable characteristics

Max. Recovered . . . . Varies with cable characteristics. V.35

Max. Synchronous. . . . . Varies with cable characteristics

Max. Recovered . . . . 512 kbps.V.35-306 Max. Synchronous

Data Rate . . . . 5 Mbps Max. Recovered Data Rate: 512 kbps

Test Modes . . . . BERT,
Frame Relay

Clock Source

Tx Timing . . . . Interface, internal synthesizer
recovered from received data

Rx Timing. . . . . Interface, internal
synthesizer recovered from the received data or automatic

Operation Modes. . . . . DCE Emulation,
DTE Emulation,
Monitor

Ordering Information

Mainframe/Interface Modules

TB950-ANLG	Analog (2W/4W) Interface Module
TB950-DATA	Datacom (DTE/DCE) Interface Module

Options

TB950-BRI*	Basic Rate ISDN
TB950-LL	DDS Local Loop
TB950-10BT*	Ethernet 10BaseT
TB950-FR*	Frame Relay
TB950-SIG	PCM Signaling
TB950-TIMS	PCM TIMS

950DS/A/LL/GER/3-01

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