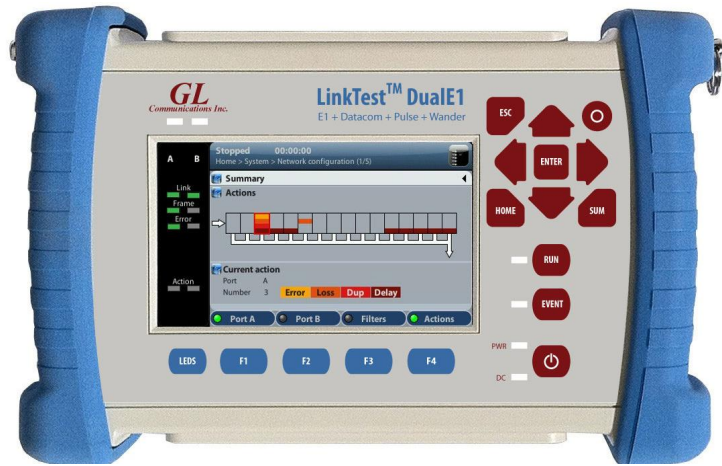


LinkTest™ Dual E1 (E1, Datacom Jitter, Wander Testing)



Fully Featured and High Performance in E1, Datacom, and Jitter Testing

Multiplexer and Demultiplexer

Pulse Mask Testing

Jitter Measurement

CAS Generation and Analysis

USB & RJ-45 Ports

Portable, Rugged, Low-cost, & Battery Operated

ITU-T G.821, G.826, and M.2100 Performance Analysis

Overview

The GL's robust **LinkTest™ Dual E1** is a handheld dual port tester for E1 & data communications (V.11 / X.24, V.24/RS232, V.35, V.36/RS449, EIA-530, EIA-530A) interfaces. Port A is full featured 2048 kb/s interface. On the other hand, Port B usage is configurable (2048 kb/s TX/RX, co-directional, clock input). The LinkTest™ Dual E1 has an external DC input but it also has internal batteries. Test results can be saved in a Memory stick or transferred to a PC. This makes this tester suitable for field testing applications.

With the support of a large range of software options for E1 services and sub rate multiplexing system, this handheld unit provides a scalable test solution for E1 and data testing. It provides a large, high resolution screen with a full set of physical layer tests for E1 balanced and unbalanced circuits including BERT, VF, round trip delay and signal level.

For more information on **LinkTest™ Dual E1**, refer to <http://www.gl.com/linktest-dual-e1-datacom-tester.html>

Main Features

- Multi-interface capability: V.24/RS232, V.11/X.24, V.35, V.36/RS449
- Supports ITU-T G.711 encoding with A law, G.703 (E1 2.048 Mbit/s), G.704, G.703 co-directional,
- ITU-T G.821, G.826, and M.2100 performance analysis
- Supported Line codes – HDB3 (High-density bipolar with three zeroes), AMI (Alternate mark inversion)
- Rugged, hand-held, battery operated, low-cost, and software upgradable design for field use
- Carry out generation and analysis of both framed signals (as per ITU-T G.704) and unframed tests
- Collection of call records from remote locations
- CAS signaling generation and monitoring
- Extensive error detection and alarm generation for detecting bit errors, frame errors, signal defects and anomalies
- Error Insertion at physical level, frame level, and patten level – Modes are Single, Rate, Burst or Continuous burst
- BER patterns - PRBS 11, PRBS 15, PRBS 20, PRBS 23, All 1 or their inverted versions
- BERT - extensive error and alarm generation
- VF tone generation and measurement, drop and insert
- Frequency, clock slip, round trip delay, and signal level measurement
- Jitter measurement as per ITU-T G.823 standard
- Pulse mask testing as per ITU-T G.703 standard
- Reports can be generated in PDF and Text formats



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Applications

The LinkTest™ Dual E1 tester is a simple to use, rugged handset, used for installation, commissioning and maintenance of digital networks. The unit is an excellent tester for network operators, contractors and enterprise users who have to manage fixed and mobile networks that are using E1 and Datacom backhaul circuits.

The main applications include digital voice and data testing, jitter measurement, wander measurement, and pulse mask compliance. It can be used for maintaining and troubleshooting PDH, Synchronization, and Datacom links Upgradable software via an integrated USB interface is offered.

Operation Modes

- **E1 monitor** – Analyzes life signals without disturbing the network. The monitor connection is suitable for performing non-intrusive monitoring.
- **E1 endpoint** – Emulates an E1 network terminating point. The endpoint connection is suitable for tests where the LinkTest™ Dual E1 tester has to replace a network node or a complete network.
- **E1 through** – E1 through mode is suited for unidirectional or bidirectional intrusive monitoring. The signal could be bypassed from the receiver to the transmitter without any modification but dropping/adding time slots to the signal, inserting events or modifying the FAS / NFAS and CAS time slots is also possible.
- **Datacom endpoint** – Generates and analyzes V.24/V.28, X.21/V.11, V.35, V.36 and EIA-530 datacom signals
- **Datacom monitor** – Analyzes V.24/V.28, X.21/V.11, V.35, V.36 and EIA-530 datacom signals without disturbing communications between the DTE and DCE.
- **Co-directional** – Generates and analyzes variable bit rate Co-directional signals compliant with ITU-T G.703
- **Analog** – Generates a test audio signal in the analogue audio output

Testing Physical Properties

The LinkTest Dual E1™ performs some basic testing that does not depend on the particular frame structure. These analogue tests include **frequency**, **attenuation** and **round trip delay (RTD)**.

Voice Frequency Measurements

In Analog operation mode, the equipment accepts an analogue telephone signal in its audio input and measures its frequency and signal level. Users can configure a threshold for the analogue measurements. The received signal will be considered to be invalid if the set line objectives are not met. In the summary screen (SUM key), the line results are compared with their thresholds and aggregated to the global Pass / Fail indication. It also generates a test audio signal in the analogue audio output.

When the LinkTest™ Dual E1 is configured for receiving framed 2048 kb/s signals, it provides independent information about frequency and level for each time slot it using ‘occupancy grid’.

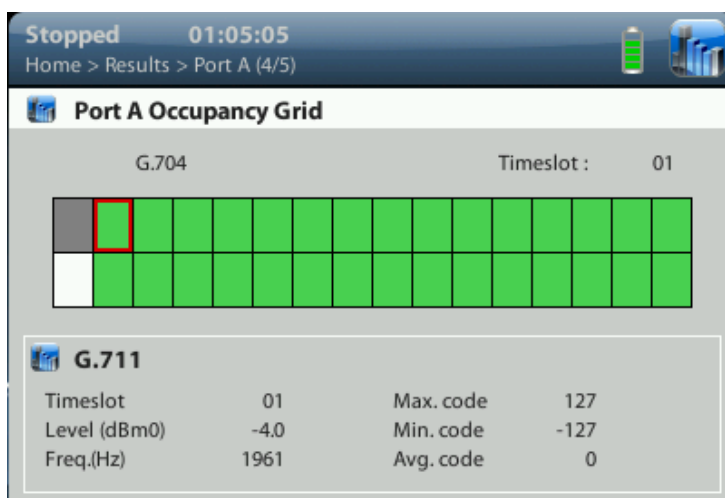


Figure: Occupancy Grid Panel

Delay, RTD Measurements

The LinkTest™ Dual E1 is prepared to verify that the delay is under acceptable limits in Circuit Emulation Services (CES) or legacy E1 services. Delay measurement is also available over data communications interfaces and the G.703 co-directional interface. The operation modes that support the delay measurement are the **E1 Endpoint**, **E1 Through**, **Datacom Endpoint** and **Co-directional**. Round trip delay (RTD) is measured as the aggregated delay in the forward & backward paths.



Figure: Attenuation, Frequency, Deviation and RTD Results

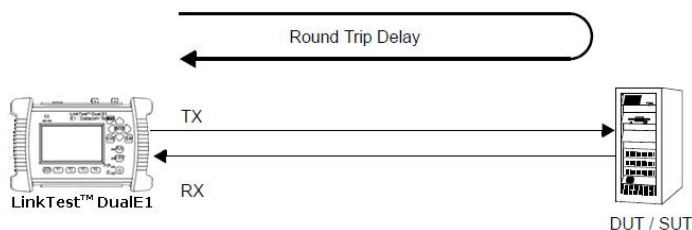


Figure: Round-Trip Delay Measurement Setup



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Pulse Mask Compliance

Pulse mask analysis is available as per ITU-T G.703 standard for the Port A balanced and unbalanced inputs. The operation modes compatible with the G.703 pulse analysis are the E1 Monitor, E1 Endpoint and E1 Through modes.

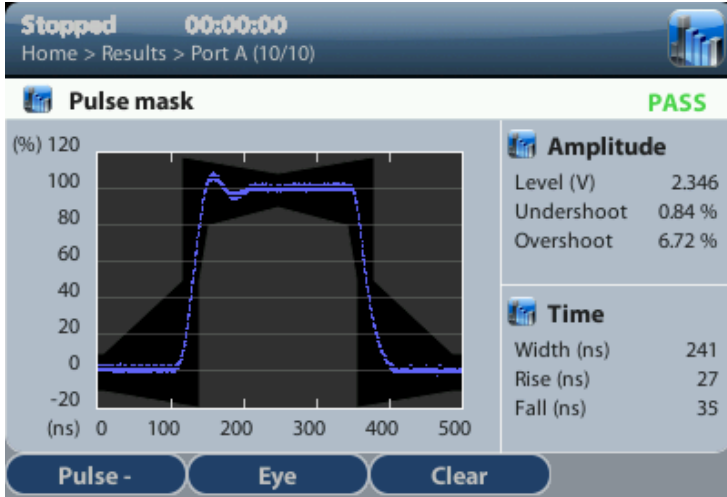


Figure: Pulse Mask Measurement

Jitter Generation and Analysis

The LinkTest™ Dual E1 is able to generate and analyze (supported on Port A only) jitter to make sure that the phase fluctuations in network equipment outputs remain under the limits specified by the standards.

The jitter measurement obtains jitter amplitude (expressed in UIs) in a specific bandwidth present in the output port of a specific network equipment specified by the ITU-T G.825 (SDH) and G.823 (PDH), and Telcordia GR-253 (SONET) and GR-499 (T-carrier) recommendations for each rate in the PDH and SDH hierarchies.

Wander Generation and Analysis

The LinkTest™ Dual E1 measures and displays the current Time Interval Error (TIE), MTIE, TDEV along with the frequency offset, frequency drift.

Wander generation can be used to stress network elements and see how phase modulation is accumulated as it is propagated through the network. The LinkTest™ Dual E1 generates wander in the Port A only. Users can specify the Sinusoidal Modulation waveform, peak-to-peak amplitude and frequency of the modulating signal.

BER Test

The bit error ratio (BER) is the most basic performance figure for TDM circuits. The LinkTest™ Dual E1 is able to analyze different kinds of test patterns and signals. Individual time slots can also be inserted and dropped to a secondary low speed interface (Port B only) for its analysis by an external equipment.

CAS Generation and Analysis

The LinkTest™ Dual E1 is compatible with Channel Associated Signaling (CAS) transported within the time slot 16. The equipment can both generate and analyze CAS signaling. CAS generation requires configuration of a frame structure with CAS (G.704+CAS or G.704+CRC+CAS) in the transmitter. On the other hand, CAS analysis needs the previous configuration of a frame structure with CAS in the receiver.

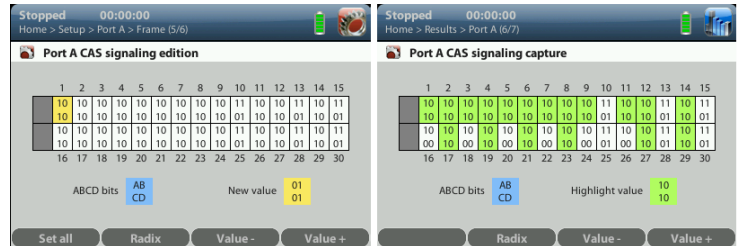


Figure: CAS Generation and Analysis

Datacom Testing

- Add / Drop of E1 Tributaries to Datacom Interfaces
- DTE + DCE for all operation modes
- Capable of testing BER / Performance tests over datacom interfaces and logic analysis of datacom signals through datacom endpoints
- Datacom monitor mode enables analysis of datacom signals between the DTE and DCE without disturbing them
- No extra hardware or adapters required



Figure: Datacom Testing



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Specifications

E1 Testing

Standard

- ITU-T G.703 compliant (pulse)
- ITU-T G.823 compliant (jitter)
- ITU-T G.704
- Coaxial Pair Impedance: 75 Ohm BNC unbalanced
- Symmetrical Pair Impedance: 120 Ohm RJ-45 balanced
- Return Loss: compliant O.162
- Receive Sensitivity: 0 dB to -43 dB
- Receive Timing Range: 2.048MHz, data or clock, nominal and PMP -20dB
- Additional balanced secondary E1 port 0 to -6dB, nominal and PMP -20dB

Ports

- Port A: Unbalanced (BNC) 75 Ω and balanced (RJ-45) 120 Ω .
- Port B: Balanced (RJ-45) 120 Ω .
- External signal: Analogue (Port A only), 64 kb/s co-directional (Port A only), Datacom interface
- Bidirectional testing (E1 monitor, E1 endpoint, E1 through) by simultaneous operation of Port A and Port B

Input Modes

- Operation: Terminal, Through and Monitor
- Impedance: >1000 Ohm

Line

- Bit Rate: 2048 Kbit/s \pm 3ppm
- Codes: HDB3 / AMI
- Unframed
- PCM31: FAS / FAS+CRC4
- PCM30: FAS+CAS / FAS+CRC
- Internal Timing: 2.048 MHz \pm 25000 ppm
- External Timing
- Recovery from RX Timing (Loop Timing)
- Multiple standard, non-standard PRBS, and user defined patterns
- PRBS 9 (ITU-T O.150, O.153), PRBS 11 (ITU-T O.150, O.152, O.153), PRBS 15 (ITU-T O.150, O.151), PRBS 20 (ITU-T O.150, O.153), PRBS 23 (ITU-T O.150, O.151), PRBS 9 inverted, PRBS 11 inverted, PRBS 15 inverted, PRBS 20 inverted, PRBS 23 inverted, all 0, all 1
- User configurable 32 bit word
- Transmit Error Rate
- Force Single Error: Bit, Frame, CRC, and BPV (Bipolar Violation)
- G.826, G.821, and M.2100
- RTD and VF tone generation
- Tone (from 10 Hz to 4000 Hz, from +10 dBm to -60 dBm)
- Alarms and errors count, and generation

Analysis

Analogue

- Line attenuation (dB), frequency (Hz), frequency deviation (ppm), round trip delay (μ s). Analogue results include pass / fail indications

Defects

- LOS, LOF, AIS, RAI, CRC-LOM, CAS-LOM, MAIS, MRAI, LSS, All 0, All 1

Anomalies

- Code, FAS error, CRC error, REBE, MFAS error, TSE, Slip
- Live and history LEDs for all Defects and Anomalies

Modes

- Single (anomalies), rate (anomalies), continuous (defects), M-single (defects), MN-repetitive (defects)

ITU-T G.821 performance

- ES, SES, UAS, DM. ITU-T G.821 results include pass / fail indications

ITU-T G.826 performance

- ES, SES, UAS, BBE (near and far end statistics). ITU-T G.826 results include pass / fail indications

ITU-T M.2100 performance

- ES, SES, UAS, BBE (near and far end statistics). ITU-T M.2100 results include pass / fail indications

ITU-T G.711

- Occupation map and time slot analysis: current code, maximum code, minimum code, average code, timeslot level and frequency
- FAS / NFAS word analysis
- CAS a, b, c, d bit analysis

Datacom

Interfaces

- Smart Serial 26p DTE / DCE ports
- V.24/V.28 async. (RS-232) from 50 b/s to 128 kb/s
- V.24/V.28 sync. (RS-232) from 50 b/s to 128 kb/s
- X.24/V.11/X.24, V.24/V.28, V.24/V.35, V.24/V.11 (V.36/RS449), EIA530 and EIA-530A
- V.35 from 50 b/s to 128 kb/s
- V.36 (RS-449) from 50 b/s to 128 kb/s
- EIA530 and EIA-530A from 50 b/s to 128 kb/s
- Co-directional according G.703
- Rate: 50, 60 bit/s, 1.2, 2.4, 4.8, 8, 9.6, 16, 19.2, 32, 48, 72, 128, 144, 192, 1544 kbit/s
- N x 56 kbit/s (N=1 to 27); N x 64 kbit/s (N=1 to 32), up to 10 Mbit/s



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Specifications (contd.)

Tests

- DTE, DCE emulation and full duplex monitor
- Test pattern generation and analysis over a datacom interfaces
- Logic analyzer capability
- Defects: LOC, AIS, LSS, All 0, All 1
- Anomalies: TSE, Slip
- Analogue: Line attenuation (dB), frequency (Hz), frequency deviation (ppm)

Jitter and Wander

Standard

- Overpass ITU-T O.172
- Compliance: ITU-T G.823
- 100% digital based generation and analyzer

Jitter Analysis

- Closed loop phase measurement method. Reference frequency not required
- Jitter level, tolerance, transfer
- Event detection
- Jitter measurement observation time: 1 s
- Measurement selectable filters: LP (off - 100 kHz), HP (off - 20 Hz - 18 kHz)
- Status indication: No clock, unlock, lock, out of range
- Jitter measurement results: peak to peak jitter, positive peak jitter, negative peak jitter, RMS jitter, maximum jitter, hits detection and count (user selectable threshold)
- Modulation frequency range: 0.1 Hz to 100 kHz (locking time 10 s), 1 Hz to 100 kHz (locking time 1 s), 10 Hz to 100 kHz (locking time < 1 s)
- Modulation amplitude: 0 to 1000 UIpp (single range) (maximum amplitude depends on modulation freq.)
- Modulation amplitude resolution: 1 mUIpp
- Measurement accuracy: better than ITU-T O.172

Wander Analysis

- Open loop measurement method. Ref. freq. required
- Modulation frequency range: 1 mHz to 10 Hz
- Wander sampling frequency: 50 Hz
- Modulation amplitude: 0 to ± 1 s (single range)
- Modulation amplitude resolution: 2 ns
- Instantaneous: TIE, frequency offset, frequency drift.
- Statistics results: TIE, MTIE, TDEV
- Statistics range: 102, 103, 104, 105, 106 s
- Built in, real-time statistics analysis

Jitter and Wander Generation

- Modulation waveform: sinusoidal
- Modulation frequency range: 1 mHz to 100 kHz
- Modulation frequency resolution: 0.1 Hz (jitter), 1 mHz (wander)
- Modulation amplitude: 0 – 1000 UIpp. Maximum depends on modulation frequency
- Modulation amplitude resolution: 1 mUIpp or 1/104 configured value
- Modulation amplitude accuracy: better than O.172
- Smooth changes in range (10 Hz – 100 KHz)
- Intrinsic jitter < 10 mUIpp

Pulse Mask

Pulse characteristics

- Meets ITU G.703
- PASS / FAIL function
- Graphic display scope
- Nominal 2.37V for Coaxial Pair 75 Ohm
- Nominal 3.00 V for Symmetrical Pair 120 Ohm

Dimension and Ergonomics

Dimensions

- 223 mm x 144 mm x 65 mm

Weight

- 1.0 kg (inc. rubber boot and one battery pack)

Ergonomics

- Display 480 x 272 TFT full color screen
- IP remote control through attached Ethernet port
- Export stored configuration and reports through attached USB port
- Serial Port RS-232C
- Operation time with NiMH batteries: 5h. (one pack) and 10h (two packs)
- Operation time with Lilon batteries: 8h. (one pack) and 16h (two packs) fast recharging time
- AC Power Adapter Input: 100 ~ 240 V AC, 50/60 Hz
- Operating Temperature 0°C ~ 50°C, Storage Temperature - 20°C ~ 70°C, Humidity 5% ~ 95%
- Soft LEDs: all events at a glance

Buyer's guide

- [LTS010](#) - LinkTest™ Dual E1
- [LTS015](#) - LinkTest™ Dual E1 Remote Option
- [LTS011](#) - LinkTest™ Dual E1 with DataCom ports
- [LTS012](#) - LinkTest™ Dual E1 with DataCom ports and Jitter/Wander and Pulsemask

Related Hardware

- [LTS001](#) - LinkTest™ Single Hand Portable Single T1E1 Tester
- [LTS002](#) - LinkTest™ Single Hand Portable Single T1E1,T3E3 Test set
- [LTS003](#) - Portable Dual T1E1,T3E3 Test set with full color display
- [PTE001](#) - tProbe™ T1 E1 Base Unit



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