

Turn-up and installation sync tester

For 3G/4G/5G Mobile Backhaul,
E911/Critical Infrastructure,
Financial Networks and
Power Comms



Platform Highlights

- Part of the Calnex family of sync testers
- Canned tests for quick turn-up and installation testing
- Embedded GPS/GLONASS/BEDOU receiver and optional mini Rubidium (GNSS disciplined Rb holdover)

Test PTP, SyncE and TDM in one box

- Accurately measures Time Error, PDV and Wander
- Tests both legacy and new networks
- Includes built-in pass/fail limits

Measure TDM (PDH/SDH/Sonet) signals

- Supports TDM network sync testing
- Includes industry-standard masks G.811/G.812/G.813/G.823/G.824

Automatic RFC 2544 and Y.1564 testing

- Verify network performance by testing Throughput, Frame Loss, Latency, Jitter and Burst
- Provides two way measurements for asymmetrical and symmetrical testing

Multistream testing

- Simultaneously test 8 traffic streams configured with CoS/QoS
- Simulate realistic traffic conditions such as Internet, VoIP and IPT

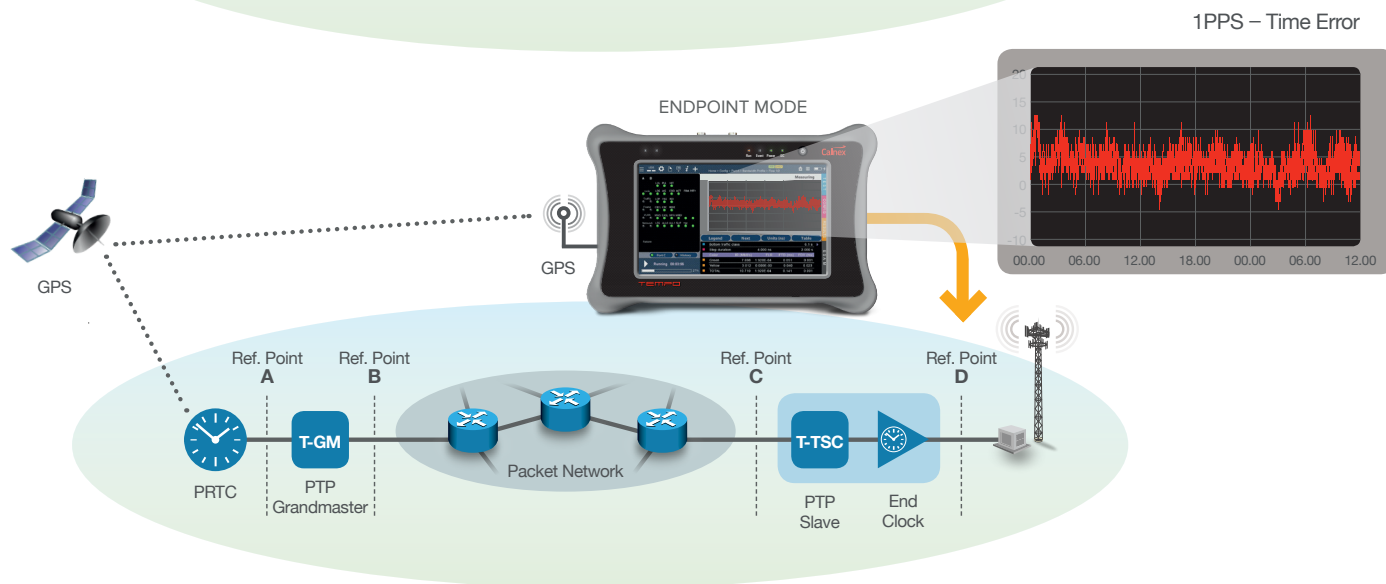
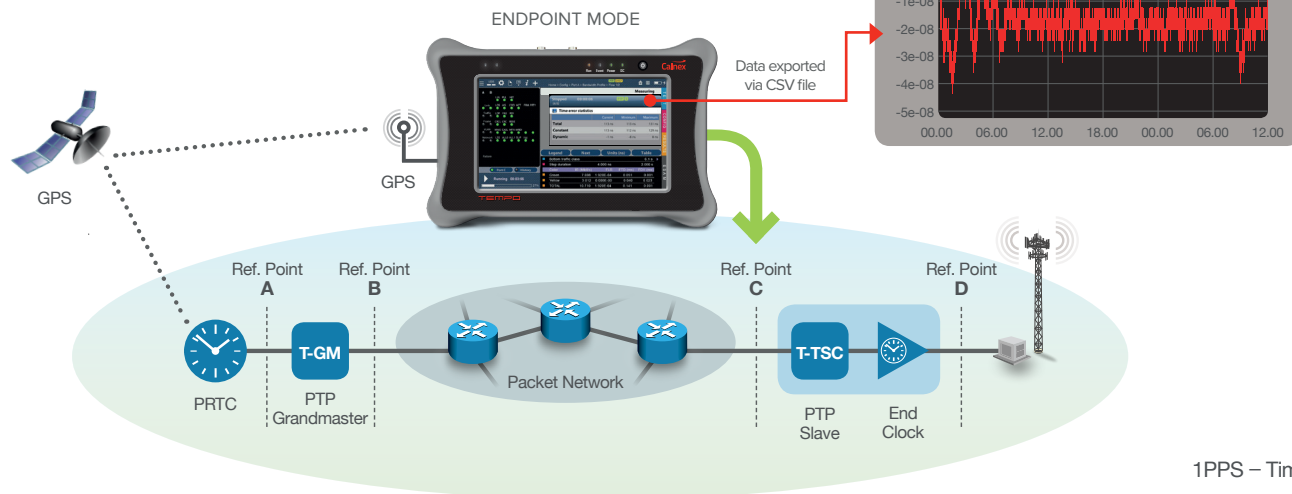
IEC 61850 testing

- GOOSE and SV analytics
- IIRIG-B references

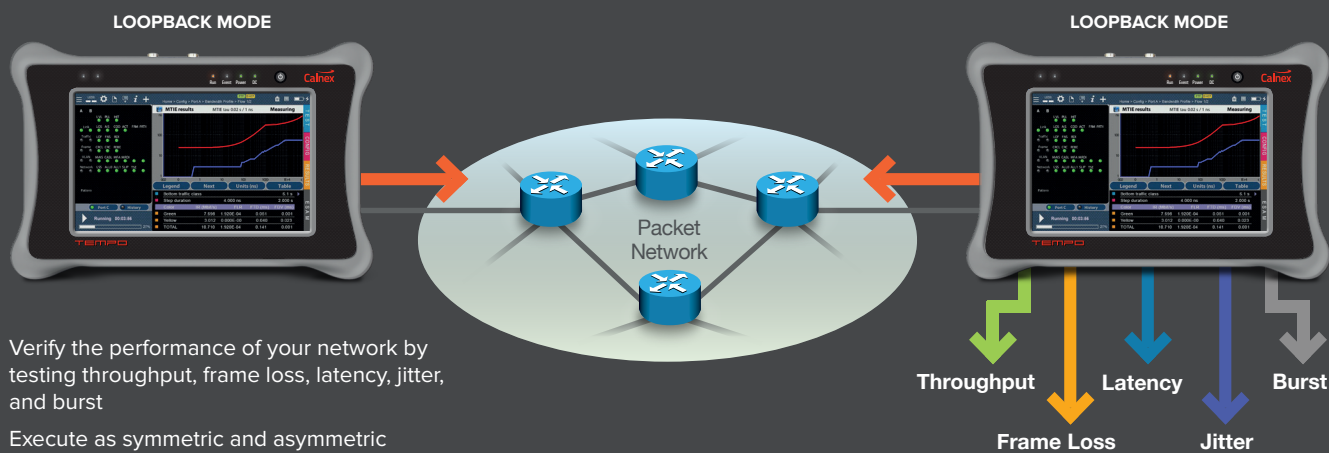
Applications

SYNCHRONIZATION INSTALLATION

- Verify Sync is working as expected
- Measure Time Error and PDV (PTP), Wander (SyncE, TDM), and clock output (frequency and phase)
- Test to ITU-T G.8265.1 and G.8275.1



ETHERNET/DATACOM – RFC2544 TESTING



- Verify the performance of your network by testing throughput, frame loss, latency, jitter, and burst
- Execute as symmetric and asymmetric
- Two modes: loopback mode or peer-to-peer mode

Throughput test				FAIL
Size	Throughput (B/s)	Max rate (B/s)	Max rate (%)	
64	1,486,295	700,451	47.02	
128	845,594	701,079	83.00	
256	452,088	452,888	100.00	
512	234,962	234,503	99.80	
1024	119,231	119,497	99.80	
1280	96,153	95,966	99.80	
1518	81,274	81,115	99.80	
%				Units

Frame loss test		FAIL
Throughput (%)	Frame loss (%)	
100.00	17.109	
90.00	7.899	
80.00	0.000	
70.00	0.000	
128 B		

Specifications

PTP and SyncE	
Synchronous Ethernet	<ul style="list-style-type: none">Clock Ref.: built-in Rubidium and GPS, OCXO, internal (<2.0 ppm), external (10 MHz, 2048/1544 Mb/s, 2048/1544 MHz, 1 PPS)Line Analysis: frequency (MHz), offset (ppm), drift (ppm/s) [clause 10]; Offset Generation: ±125 ppm (0.001 ppm) as per ITU-T O.174Wander Generation [ITU-T O.174 section 8.4] and MTIE / TDEV Measurement [ITU-T O.172 clause 10]SyncE Generation/Decoding ESMC and SSM [ITU-T G.8264]
PTP / IEEE 1588(v2)	<ul style="list-style-type: none">Precision Time Protocol (PTP): Master and Grandmaster id., Priority 1-2, Class, Accuracy, Variance, Time sourcePTP over UDP encapsulation, PTP generation/analysis/emulation; Hardware-assisted Decoding; End-point and Through modesCounts: Sync Inter Arrival Delay (IAD) Avg/Curr; Packet Total Delay (PTD): Std Dev/Range; Packet Delay Variation (PDV): Cur/Max/AvgTE and maxITIEI measurement on PTP constant and dynamic TE components. Frequency and phase offset master vs. local clock (ppm)Wander analysis – Real time MTIE and TDEV results (pkfiltered TDEV/MTIE)ITU-T Telecom profiles – G.8265.1, G.8275.1, G.8275.2
Internal Rubidium Clock	<ul style="list-style-type: none">Freerun (no GPS): Output freq. accuracy (7.5 mins warm up): ±1e-9; Output freq. accuracy on shipment (24 hr warm up): ±5.0e-11 Aging (1 day, 24 hrs warm up): ±0.5e-11; Aging (1 year): ±1e-9GPS Locked: Time/Phase accuracy to UTC: ±20 ns at 1σ after 24 hrs lock; Frequency accuracy: 1e-11 (averaged over one week)Hold-over: Output freq. accuracy (after 24 hr locked): 1.5e-11/24 hr; Output time accuracy (after 24 hr locked): ±100 ns/2 hr, ±1.0 μs/24 hr
Ethernet Testing	
Interfaces	<ul style="list-style-type: none">2 x SFP / SFP+ : 10GBASE-SR, 10GBASE-LR, 10GBASE-ER, 10GBASE-T, 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX, 100BASE-FX, 100BASE-TX2 x RJ45: 1000BASE-T, 100BASE-T, 10BASE-TAuto-negotiation: Bit rate at 10, 100, 1000 and 10000Mb/s, disable auto-negotiation and direct set upEtherType II (DIX v.2), IEEE 802.3, IEEE 802.1Q, IEEE 802.1ad; IEEE 802.2–LLC1, IEEE 802.3–SNAP; IPv4 (RFC791), IPv6 RFC2460)
Generation (8 streams)	<ul style="list-style-type: none">Traffic generation and analysis features up to 10 Gb/s, equivalent to 15 million frames, if frame size is set to 64 bytesMAC address: Source/Destination, Default/User defined, Single/RangeVLAN: Single VLAN support, Q-in-Q stacking, VID, DEI, S-VLAN, C-VLAN, and Priority codepointType/Length: Generation/Analysis, Jumbo frames with MTU up to 10 kBBandwidth Profile: Constant, in bit/s and frames/s, Periodic Burst, in high/low traffic, Ramp, in high/low traffic, PoissonLoopback: L1 to L4 layers, filtering conditions, broadcast and ICMP frames controlLayer 1 BER: HF, LF, MF, long/short continuous random, PRBS 231-1, A-seed, B-seed, mixed-frequencyLayer 2–4: PRBS 211-1, PRBS 215-1, PRBS 220-1, PRBS 223-1, PRBS 231-1 along with their inverted versions, user (32 bits)SLA payload; All zeros; Insertion of TSE: single, rate, randomRTD and VF tone generation
Filters for Statistics (up to 8 simultaneously)	<ul style="list-style-type: none">Ethernet Selection: MAC address, Type/Length, C-VID, S-VID, CoS and Priority with selection maskIPv4 and IPv6 Selection: address, protocol, DSCP, Flow (v6): single value or range. UDP Selection: port: single value or range
Traffic Statistics	<ul style="list-style-type: none">Top 16 talkers: Source/Destination MAC/IPv4/IPv6 addresses, VID (VLAN), C-VID (Q_in_Q), S-VID (MPLS)Ethernet Frame Counts (RFC 2819): VLAN, Q-in-Q, Priority, Control, Pause, BPDUsTx/Rx Uni-Multi-Broadcast, Errors, Undersized, Oversized, Fragments, Jabbers, Runts, (Late) Collisions, Sizes, MPLS stack lengthBandwidth Statistics: (in bit/s, frame/s, %) Rate, Max, Min, Aver, Occupancy, Unicast, Multicast, BroadcastIPv4 and IPv6 Counts: (in bit/s, frame/s, %) Unicast, Multicast, Broadcast, Errors, TCP, UDP, ICMP
Results	<ul style="list-style-type: none">Twisted Cable: MDI/MDI-X status, Open, Cable Length Test, Short, Polarities, Pair Skew. PoE: voltage and currentSFP: Presence current interface, Vendor, Part number, Optical power (over compatible SFP)Frame Delay (FTD) Y.1563: Min/Max/Med/Mean; Delay Variation (FDV) RFC1889: Peak; Jitter Curr/Max/Min/MeanFrame Loss (FLR) Y.1563, Duplicated: Out-of-Order packets (RFC 5236)Availability: SES and Y.1563 PEU; BER: Count, seconds with errors, Pattern losses, pattern loss seconds
RFC-2544 and Y.1564	<ul style="list-style-type: none">RFC 2544: Throughput, Latency, Frame Loss, Back-to-back, RecoveryeSAM: test up to 8 non-color or 4 color aware services. Configuration: CIR, EIR, max. throughput for each serviceTests (CIR, EIR and policing) with FTD, FDV, FLR and availabilityPerformance test with FTD, FDV, FLR and availability results for all services
ICMP	<ul style="list-style-type: none">RFC 792: IP Ping/Traceroute, Generation of ICMP echo request: Destination IP address, Packet length, Generation intervalAnalysis of ICMP echo reply: Round trip time, Lost packets, Time-To-Live exceeded, Port unreachable
E1 and T1 Testing	
Interfaces	<ul style="list-style-type: none">2 x Unbalanced (BNC) 75 ΩBalanced (RJ-45) 120 ΩAdditional balanced secondary T1, E1 port 0 to −6 dB, nominal and PMP −20 dBBit Rate: 1.544/2.048 Mb/s ± 3 ppm. Codes: HDB3/AMI3 x SMB: Clock Source; Internal Timing: 1.544 MHz, 2.048 MHz ± 25000 ppm; Recovery from Rx Timing (Loop Timing)SMA: External timing (GNSS)
BERT	<ul style="list-style-type: none">Unframed: FAS/FAS+CRC4; PCM30: FAS+CAS/FAS+CRCStandard, non-standard PRBS, and user patterns. Transmit Error RateForce Single Error: Bit, Frame, CRC, and BPV (Bipolar Violation); Alarms, Errors Count; G.826, G.821, and M.2100
Jitter and Wander	<ul style="list-style-type: none">Overpass O.172: Jitter level, tolerance, transfer and Event detection. 100% digital-based generation and analysisWander Generation and Measurements (TIE, MTIE, TDEV). Wander results from 20 secs to 100,000 secs
Pulse Mask	<ul style="list-style-type: none">Pulse mask compliance: ANSI T1.102-1999, ITU-T G.703; PASS/FAIL function with Persistent Graphic Display scopeNominal 2.37 V for Coaxial Pair 75 Ω, Nominal 3.00 V for Symmetrical Pair 120 Ω

Power Utility Testing

Clock References Inputs	<ul style="list-style-type: none">IRIG-B00X, B15X, B22X unbalanced (REF IN port). 50 Ω or high impedance modes. Up to 25Vpp. AC or DC couplingIRIG-B00X, B22X balanced (REF IN/OUT port). ITU-T V.11 electrical characteristics
Clock reference outputs	<ul style="list-style-type: none">IRIG-B00X, B12X, B13X, B14X, B15X, B22X unbalanced (REF OUT port). 50 Ω or high impedance modes. 5 Vpp. AC or DC couplingIRIG-B00X, B22X balanced (REF IN/OUT port). ITU-T V.11 electrical characteristicsDecodes and analyzes GOOSE frames encoded as specified in IEC 61850-7-2 and 61850-8-1
IEC 61850 GOOSE	<ul style="list-style-type: none">GOOSE protocol scan with GoCBName, GoID, DataSetGOOSE frame count for the active flow and all flowsLatency analysis: current, average, minimum, maximum, range and standard deviation computed over the active flow
IEC 61850 SV	<ul style="list-style-type: none">Decodes and analyzes SV frames encoded as specified in IEC 61850-7-2 and 61850-9-2SV protocol scan with svID population and selection of the active flowSV frame count for the active flow and all flowsSample count and sampling rate measurement for the active flowLatency analysis: current, average, minimum, maximum, range and standard deviation computed over the active flow
IEEE C37.94	
Connectors	<ul style="list-style-type: none">Dual port operation over SMF or MMF with suitable SFP
Line	<ul style="list-style-type: none">Transmission clock: Recovered or internally synthesizedLaser on and off control
Frame	<ul style="list-style-type: none">Unframed or framed operationFrame structure follows IEEE C37.94 section 4.1Configurable bit-rate between 64 kb/s and 768 kb/s in steps of 64 kb/s
Line Analysis	<ul style="list-style-type: none">Frequency (Hz), frequency deviation (ppm)Transmitted optical power (dBm), received optical power (dBm)Received data rate (kb/s)SFP information: transceiver, vendor, model and wavelength
Frame and Pattern Analysis	<ul style="list-style-type: none">ITU-T G.821 performance: ES, SES, UAS, DM. ITU-T G.821 results include pass/fail indicationsEvent detection and insertion: LOS, AIS, FAS, RDI (yellow), LSS, ALLO, ALL1, Slip, TSE

Product Ergonomics

Dimensions (w x h x d)	260 x 160 x 63 mm (10.2" x 6.3" x 2.5")
Weight	1.6 kg (3.5 lbs) with rubber boot and one battery pack
Screen	8 inch, TFT color (800 x 480 pixels)

Specification is subject to change without notice.

Ports and Connectors

Front Panel

PHM RJ45-C BNC-C SFP+-A SFP+-B RJ45-A RJ45-B

RJ45 SMB-C SMA SMB-1 SMB-2 SFP-A SFP-B Micro SD

Rear Panel

Power Console Management USB

DC IN 15V Max PVC Ethernet

PHM Interfaces				Modes
PHM-20	PHM-21	PHM-22	PHM-23	
Datacom endpoint Datacom monitor Datacom loop	IEEE C37.94 endpoint IEEE C37.94 through IEEE C37.94 monitor IEEE C37.94 loop	G.703/E0 endpoint G.703/E0 monitor G.703/E0 loop	Analog	
SS26 DCE SS26 DTE	2 x SFP	RJ-45	RJ-45 Headset	I/f

Test Interface and Clock Reference Summary

		Operating Modes				
		10GbE	1GbE	E1/T1	Clk Monitor	Cable
Input Interface	RJ45-A		Ethernet, IP, PTP, SyncE			Ethernet
			SyncE			SyncE
	RJ45-B		Ethernet, IP, PTP, SyncE			Ethernet
			SyncE			SyncE
	SFP-A		Ethernet, IP, PTP, SyncE			
			SyncE			
	SFP-B		Ethernet, IP, PTP, SyncE			
			SyncE			
	SFP+-A	Ethernet, IP, PTP, SyncE				
		SyncE				
	SFP+-B	Ethernet, IP, PTP, SyncE				
		SyncE				
	BNC-C			E1	5/10 MHz 2448 kHz 1544 kHz	
	RJ45-C			E1/T1	5/10 MHz 2448 kHz 1544 kHz 1PPS/1PP2S ToD	
	SMB-C				1PPS/1PP2S	
	SMA	GNSS	GNSS	GNSS	GNSS	GNSS
SMB-1	1PPS/1PP2S IRIG-B	1PPS/1PP2S IRIG-B	1PPS/1PP2S IRIG-B	1PPS/1PP2S IRIG-B	1PPS/1PP2S IRIG-B	
SMB-2	1PPS/1PP2S IRIG-B	1PPS/1PP2S IRIG-B	1PPS/1PP2S IRIG-B	1PPS/1PP2S IRIG-B	1PPS/1PP2S IRIG-B	
RJ45-1	E1/T1 5/10 MHz 2448 kHz 1544 kHz 1PPS/1PP2S ToD IRIG-B	E1/T1 5/10 MHz 2448 kHz 1544 kHz 1PPS/1PP2S ToD IRIG-B	E1/T1 5/10 MHz 2448 kHz 1544 kHz 1PPS/1PP2S ToD IRIG-B	E1/T1 5/10 MHz 2448 kHz 1544 kHz 1PPS/1PP2S ToD IRIG-B	E1/T1 5/10 MHz 2448 kHz 1544 kHz 1PPS/1PP2S ToD IRIG-B	
<div><div></div> Test Signal</div> <div><div></div> Clk Ref. Signal</div>						

■ Test Signal □ Clk Ref. Signal

Operating Modes vs Connection Modes

		Operating Modes							
		Eth	Eth L1	E1/T1	Analog	Data	Clock	E0	C37.94
Connection	End-point	●	●	●	●	●		●	●
	Monitor	●		●		●	●	●	●
	Pass	●							●
	Loop	●	●	●		●		●	●
	Mux Demux			●					

For more information on Calnex test equipment, and to take advantage of Calnex's extensive experience in Packet Sync and OAM testing technologies, contact Calnex Solutions today:

tel: +44 (0) 1506 671 416

email: info@calnexsol.com

calnexsol.com

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Related Products



Calnex Sentinel

- Tests PTP, NTP, SyncE and TDM in one portable box
- Measure ALL parameters at the SAME time
- Over-the-Air Time Error analysis
- For LTE-A, TDD LTE and small cell deployment – test network phase accuracy and validate network performance to ITU-T limits
- Measure and analyze metrics: PDV, FPP, TE/max|TE|/dTE, MTIE/TDEV
- Best-in-class internal Rubidium and measurement accuracy



Calnex Paragon-X

- Test PTP, SyncE, NTP, CES and OAM up to 10G
- Stress-test equipment with real network profiles from field-tests to debug network issues
- Prove PTP, SyncE, CES, Pseudowire, NTP, etc. implementations to ITU-T G.8261 etc.
- Test PTP Ordinary Clocks, Boundary Clocks and Transparent Clocks
- Measure Time of Day (ToD), Phase and Frequency

