

test up to

100G

Next Generation High Speed Networks



Calnex Paragon - **100G**

Calnex Paragon - *x*

Prove Ethernet Sync to 100GbE

Ethernet systems have varying transmission delays and other effects that can significantly disrupt the precise transfer of timing in high-speed networks. The Paragon-100G solution provides up to 100GbE PTP and SyncE testing to nanoseconds of accuracy, combined with emulation of network effects, to prove protocol and timing performance.

It is designed to meet the stringent test requirements of NEMs who are developing, verifying and manufacturing 100GbE devices, and for those designing and deploying 100G networks and systems. It precisely

measures frequency and phase synchronization at rates up to 100GbE in accordance with SyncE and PTP standards such as ITU-T G.826x and G.827x.

High network efficiency and reduced data transmission costs are only possible with highly accurate timing. To make sure your devices and systems deliver the high quality network services of the future, look no further than the Paragon-100G for verifying synchronization accuracy and compliance.

Analyse PTP conformance to standards-based or user-defined profiles, with automatic indication of pass/fail and reason for non-compliance, plus report generation.

Generate SyncE Wander and Jitter for ITU-T G.8262 testing. Simultaneously measure SyncE wander and PTP Time Error. Control ESMC message generation for testing to ITU-T G.8264.

Emulate PTP Master and Slave Clock to maximise accuracy and repeatability of PTP test, including specific test modes for various DUTs and automatic test selection for ITU-T standards conformance.



PTP Field Verifier (PFV)

- Analyze PTP protocol for conformance to standards or user-defined profiles.
- Automatic Pass/Fail indication – check captured PTP messages against a pre-defined set of rules, with clear Pass/Fail alerts.

Direction	Packet #	Arrival Time	messageType	reserved	seqid	sourcePortIdentity	sequenceid	logMessageInterval
→	0	0.000000000	SYNC	0x0	0	0x4F4C2F7FEA	19826	-4
→	1	0.00374565	DEL-REQ	0x0	0x000000000002	38231	127	origTimestamp=2013 312 22 08 21 43003
→	2	0.00651895	DEL-RESP	0x0	0x4F4C2F7FEA	19827	-4	recyTimestamp=2013 312 06 21 27 46578
→	3	0.03001640	SYNC	0x0	0x4F4C2F7FEA	19827	-4	origTimestamp=2013 312 22 08 21 43003
→	4	0.059567000	SYNC	0x0	0x4F4C2F7FEA	19828	-4	origTimestamp=2013 312 06 21 27 46578
→	5	0.08874565	DEL-REQ	0x0	0x000000000002	38232	127	recyTimestamp=2013 312 06 21 27 46578
→	6	0.093838000	DEL-RESP	0x0	0x4F4C2F7FEA	19829	-4	origTimestamp=2013 312 22 08 21 43003
→	7	0.060020580	SYNC	0x0	0x4F4C2F7FEA	19829	-4	origTimestamp=2013 312 06 21 27 46578
→	8	0.12254845	SYNC	0x0	0x4F4C2F7FEA	19830	-4	recyTimestamp=2013 312 06 21 27 46578
→	9	0.13374565	DEL-REQ	0x0	0x000000000002	38233	127	origTimestamp=2013 312 22 08 21 43003
→	10	0.13184375	DEL-RESP	0x0	0x4F4C2F7FEA	19831	-4	origTimestamp=2013 312 06 21 27 46578
→	11	0.150113265	SYNC	0x0	0x4F4C2F7FEA	19832	-4	recyTimestamp=2013 312 06 21 27 46578
→	12	0.16834160	SYNC	0x0	0x4F4C2F7FEA	38234	-4	origTimestamp=2013 312 22 08 21 43003
→	13	0.193874565	DEL-REQ	0x0	0x000000000002	38235	127	origTimestamp=2013 312 06 21 27 46578
→	14	0.19443055	DEL-RESP	0x0	0x4F4C2F7FEA	19833	-4	recyTimestamp=2013 312 06 21 27 46578
→	15	0.21940100	SYNC	0x0	0x4F4C2F7FEA	19834	-4	origTimestamp=2013 312 22 08 21 43003
→	16	0.240021820	SYNC	0x0	0x4F4C2F7FEA	19835	-4	origTimestamp=2013 312 06 21 27 46578
→	17	0.256374565	DEL-REQ	0x0	0x000000000002	38236	127	recyTimestamp=2013 312 06 21 27 46578
→	18	0.26691055	DEL-RESP	0x0	0x4F4C2F7FEA	19836	-4	origTimestamp=2013 312 22 08 21 43003
→	19	0.27000055	SYNC	0x0	0x4F4C2F7FEA	19837	-4	origTimestamp=2013 312 06 21 27 46578
→	20	0.30067725	SYNC	0x0	0x4F4C2F7FEA	38237	-4	recyTimestamp=2013 312 06 21 27 46578
→	21	0.318874565	DEL-REQ	0x0	0x000000000002	19838	127	origTimestamp=2013 312 22 08 21 43003

Average Message Rate (msg/sec)

Message Type	Rate (msg/sec)
SYNC	20.72
FOLLOW-UP	0.00
ANNOUNCE	0.00
DEL-REQ	10.30

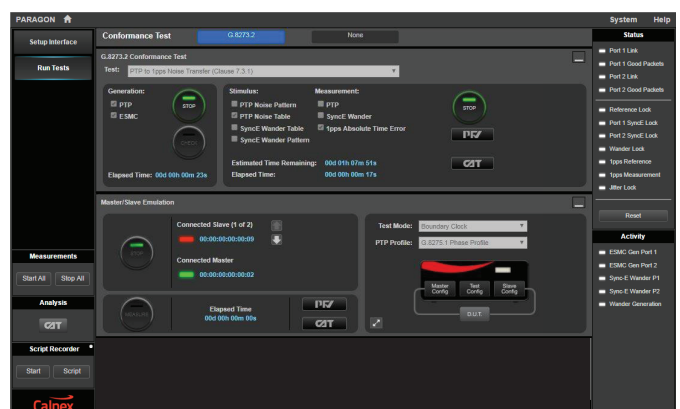
Total Counts

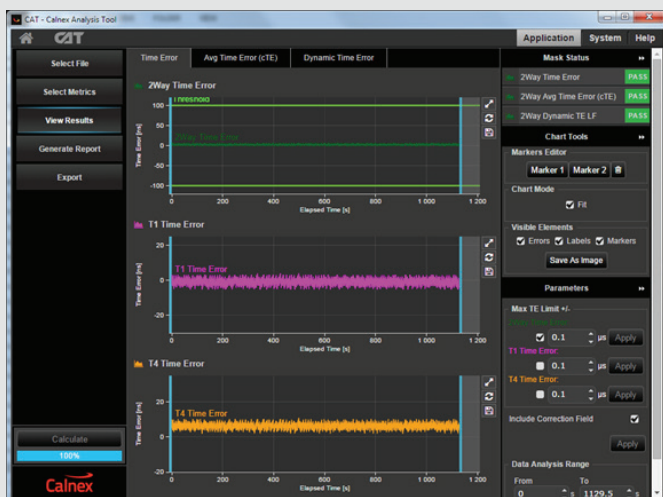
Count Type	Count
Packets	302
Errored Packets	10

FAIL
Total Pass Rate: 96.69%

Conformance Test Application

- Start testing in seconds – just two clicks to configure crucial standards-defined test sequences.
- Automatically generates PTP and ESMC messages, Time Error and SyncE impairments, and applies filters, metrics and masks.

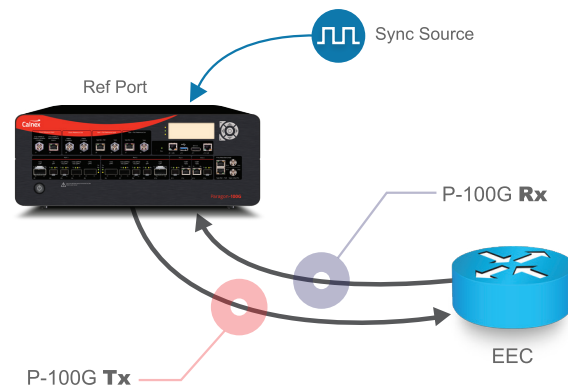




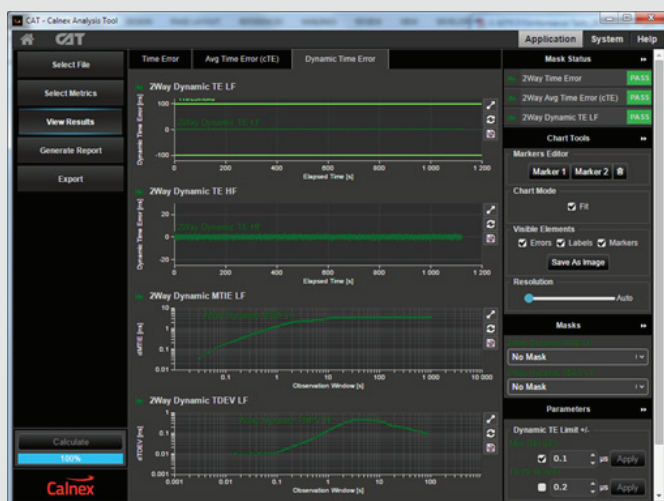
The Calnex Analysis Tool (CAT) provides powerful insight into network and device performance. All your measurement results are now in one place, and you can view multiple graphs simultaneously for easier correlation of your results. Plus, with enhanced graphics, it's easy to evaluate ITU-T metrics such as MTIE, TDEV, MAFE, MATIE against ITU-T masks.

SyncE Applications – ITU-T G.8262 (Jitter and Wander)

The Paragon-100G supports full SyncE testing up to 100GbE to ITU-T G.8262 including Jitter Tolerance, Jitter Generation, Wander Tolerance, Wander Transfer, Wander (Noise) generation, Pull-in, Hold-in and Pull-out ranges, Frequency Accuracy and Phase Transient.



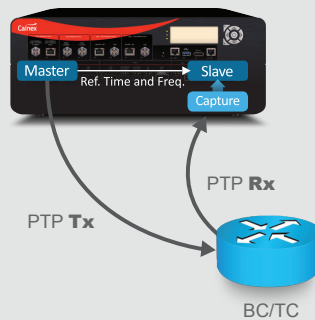
Application	P-100G Tx	P-100G Rx
SyncE Jitter Generation	Jitter free	Measure Jitter
SyncE Jitter Tolerance	Apply Jitter	Check Test Packets
SyncE Wander (noise) Generation	Wander free	Measure Wander
SyncE Wander (noise) Tolerance	Apply Wander	Check ESMC
SyncE Wander (noise) Transfer	Apply Wander	Measure Wander
SyncE Short Term Phase Transient	Break line or set ESMC QL=DNU	SyncE TIE, MTIE



- Analyze the Time Error (TE) of, for example, T-Boundary Clocks between ingress and egress.
- Apply standards-defined Time Error impairments.
- Combine with SyncE and ESMC for complex tests such as Phase Noise Response to SyncE Transient.

1588 (PTP) applications

Test hybrid devices simultaneously with 1588 PDV/SyncE wander and measure output packet timing, recovered clocks and SyncE wander.



Application	Standard
Boundary Clock Testing	ITU-T G.8273.2
Transparent Clock Testing	ITU-T G.8273.2
Assisted Partial Timing Support Clock Testing	ITU-T G.8273.4
Master Clock Testing	ITU-T G.8272
Slave Clock Testing	ITU-T G.8273.2

PTP Performance Summary

- Capture and decode PTP packets for analysis and Time Error testing.
- PTP Master/Slave emulation, plus unique conformance test app, removes uncertainty and maximizes test repeatability.
- Automatic test of PTP profile compliance for simple and reliable verification against standards-based or user defined profile configurations.

SyncE Performance Summary

- Prove SyncE wander performance to ITU-T G.8262.
- Evaluate MTIE/TDEV Pass/Fail results to ITU-T G.8262 masks.
- Check ESMC (SSM) messaging to ITU-T G.8264.
- Test SyncE jitter performance to ITU-T G.8262.

Prove Ethernet Sync to 10GbE

The performance of today's mobile backhaul depends on proving its overall synchronization quality, and probing its underlying packet-layer and physical-layer mechanisms.

For technologies up to 10 Gb/s, the Calnex Paragon-X offers direct insight to actual device and service behaviour, and the ability to generate a broad range of real-world disruption scenarios to validate the operation of your network devices and systems to industry standards.

It's the definitive one-box solution to rigorously test SyncE, PTP and NTP synchronization mechanisms, as well as E1/T1/ToD sync interfaces and Ethernet OAM. It brings together all the measurements you need — from jitter and wander through to measuring the accuracy of the recovered Time of Day (ToD), Phase (1pps) and Frequency (MTIE/TDEV) — to ensure your products will work reliably in the complex world of Ethernet switches, routers and gateways.

For design through to evaluation, it's for good reason the Paragon-X is the industry's tester of choice for proving Ethernet sync up to 10 Gb/s.

All the measurements you need in one box



1588 and CES

- One-box testing for Master Clock, Slave Clock, Boundary Clock and Transparent Clock devices
- Emulate two PTP masters for BMCA and G.8265 conformance test
- Capture and replay PDV stress profiles
- Run ITU-T and MEF-18 test cases



SyncE

- Prove SyncE Jitter and Wander to G.8262
- MTIE/TDEV Pass/Fail evaluation
- 1 nanosecond accuracy
- ESMC (SSM) message testing and proving to G.8264
- Full hybrid SyncE/PTP test suite

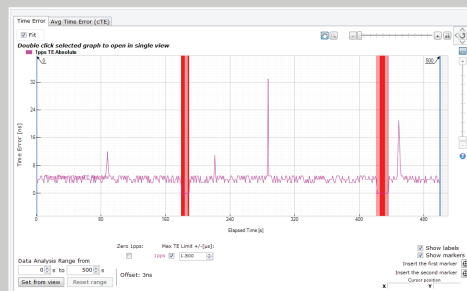


Ethernet OAM

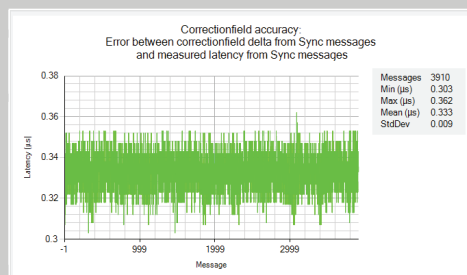
- Prove Connectivity Fault Management (CFM) and Performance Monitoring (PM) for Y.1731, 802.1ag and 802.3ah
- Add latency, jitter, errors, dropped packets to prove OAM implementation
- Prove G.8031/2 protection
- Support for 1000s of MEGs



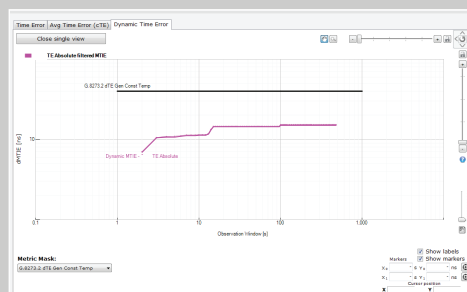
1588



1588

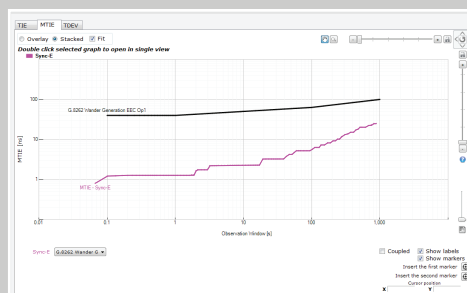


1588



SyncE

Diagram illustrating the FEC system architecture. A Calnex Targetex 4000 device is connected to a blue router labeled 'FEC'. A green arrow labeled 'Add wander/jitter' points from the device to the router. A blue arrow labeled 'Measure wander/jitter' points from the router back to the device.



Prove SyncE wander transfer, jitter/wander tolerance and jitter/wander generation to ITU-T G.8262.

	1588 (option 250)
Packet Sync Rates	Any packet rate.
Protocols	PTP (1588), Multicast Ethernet.
Standards Supported	G.8273.2 and G.8275.1 (Phase Profile), G.8275.2 (PTS Profile), G.8265.1 (Frequency Profile).
Measurement Accuracy	5 ns.
Master/Slave Emulation	Emulate one 1588 master with full parametric control. Emulate one 1588 slave. Calculate and display: TC and BC Time Error.
Standards-defined Time Error Impairments	Noise Tolerance (G.8273.2), Noise Transfer (G.8273.2).
Graphs Displayed (Calnex Analysis Tool, CAT)	PTP Time Error (dT _E , cT _E , Max T _E), Transparent Clock accuracy, latency. Packet Delay Distribution; Packet MTIE/TDEV, MAFE, MATIE.
PTP Field Verifier (Option PFV)	Decode and display PTP Fields. Display Pass/Fail to standards-based or user-defined rules. Report generation capability.
	SyncE (options 208, 213, 223)
Jitter/Wander Measurement	ITU-T G.8262 and O.174. Jitter/Wander Generation, Wander Transfer, Jitter/Wander Tolerance, Phase Transient, built-in frequency offset plus sinusoidal, MTIE and TDEV wander generation.
Wander Analysis	Built-in (CAT) software including industry standard ITU-T Pass/Fail Masks with clear Pass/Fail indication. ITU-T Masks: G.813, G.823, G.824, G.8261, G.8262, G.8263, G.8261.1, GR.1244 Clock Wander Measurements: TIE, MTIE, TDEV, clock MAFE, clock FFO.
ESMC (SSM) Features	Decode ESMC messages to ITU-T G.8264 and graph/plot Quality Level (QL) changes graphically (bi-directional). QLs: PRS, PRC, INV3, SSU-A/ TNC, INV5, INV6, ST2, SSU-B, INV9, EEC2/ST3, EEC1/SEC, SMC, ST3E, PROV, STU/UKN, DNU/DUS. Overwrite ESMC Message to change QL status.
ESMC Generation	Generate ESMC (SSM) packets per ITU-T G.8264 QLs: PRS, PRC, INV3, SSU-A/ TNC, INV5, INV6, ST2, SSU-B, INV9, EEC2/ST3, EEC1/SEC, SMC, ST3E, PROV, STU/UKN, DNU/DUS. Generate ESMC Messages, change QL value and measure impact on Wander.
SyncE Master	Accuracy traceable to Reference source (refer to Reference Clocks).
Measurement Accuracy	1 ns.
	Advanced Time of Day (option 230)
Time of Day (ToD) Emulation	Generate ToD messages to CCSA, NMEA and ITU-T standards.
Control Fields/Values	Event Message: TimeSource Type, TimeSource Status, TimeSource Alarms. Information Message: Leap Seconds, PPS Status, TAcc.
ToD Measurement	Decode and display ToD fields. Highlight errors e.g. CRC, Second jumps. Validate ToD alignment to 1 pps. Compare ToD and PTP message and status.
Measurement Accuracy	1 ns.
	Interfaces
Optical Interfaces (optical modules not supplied)	100GbE: QSFP28 – 2 slots (optional). 100GbE: CFP4 – 2 slots (optional). 100GbE: CXP – 2 slots (optional). 40GbE: QSFP+ – 2 slots (optional). 25GbE: SFP28 – 2 slots (optional). 1/10GbE: SFP/SFP+ – 2 slots (optional).
External Reference Clocks	Lock internal timing reference to external reference. Reference Lock soft LED indication. External reference inputs: 64 kHz, 2.048 MHz, 10 MHz, T1 BITS clock (1.544 Mb/s), E1 MTS (2.048 Mb/s), SyncE.
Internal Reference Clock	Frequency Stability over Temp: $\pm 1.5 \times 10^{-7}$
Clock Ref. Output Ports	2 x 10 MHz/2.048 MHz Reference Outputs (BNC).
Clock Measurement¹	1000BT, 100BT Electrical - RJ45, 1 GbE Optical (SFP required). E1 (2.048 Mb/s), 10 MHz, 2.048 MHz – BNC (unbalanced). E1 (2.048 Mb/s), T1 (1.544 Mb/s) – RJ48 (balanced).
Phase Measurement	1 pps – BNC (unbalanced), RJ (balanced).
1 pps + ToD Ref. Input	1 pps unbalanced Input (BNC), 1 pps balanced Input + ToD (RJ48C). ToD Format: CCSA, CISCO, NTP, NMEA format.
1 pps + ToD Ref. Output	1 pps unbalanced Output (BNC), 1 pps balanced Output + ToD (RJ48C).
	Control
PC/Mac or Tablet Control	Web-based GUI approach with built-in controller enables use of any PC or Android Tablet with any browser with screen resolution of 1024 x 768 pixels.
Interface	RJ 45 LAN connection to instrument.
TCP/IP Settings	TCP Port, IP Address and Gateway settable.
Remote Control	Scripting via TCL, Perl and Python. Automatic Script Recorder for TCL, Perl and Python.

¹Later release

Paragon-X

Specifications

1588 (PTP) (options 25x and 201, option PFV)		
Master/Slave Emulation (Option 25x)	Emulate up to two 1588 masters with full parametric control and Time Error/PDV/protocol anomaly impairment functions. Each master can have up to 8 attached slaves.	
	Emulate 1588 slave; calculate and display: PTP Time Error, 1 pps Time Error/ToD accuracy, TC CorrectionField accuracy, BC Time Error.	
Additional features for End-to-End (Option 250/253)	Automatic configuration for e.g. ITU-T Phase Profile, 2-Way Time Error metrics, plus flexible user configuration.	
Additional features for Peer-to-Peer (Option 252/253)	Automatic configuration for e.g. IEEE 802.1AS gPTP, Turnaround Time and Rate Ratio metrics.	
Header Capture and Alarms	MessageType, TransportSpecific, VersionPTP, MessageLength, DomainNo, Flags, CorrectionField, SourcePortIdentity, SequenceID (errors highlighted), ControlField, LogMessageInterval, OriginTimestamp.	
Graphs Displayed (Calnex Analysis Tool, CAT)	PTP Time Error (dT _E , cT _E , Max T _E), Transparent Clock accuracy, latency.	
	Packet Delay Distribution.	
	PacketMTIE/TDEV, MAFE, MATIE.	
	Sync PDV (Master-to-Slave PDV), Delay_Req PDV (Slave-to-Master PDV), Slave Clock Wander (T3), Follow-up PDV, Delay_Resp PDV, PDelay_Req PDV, PDelay_Resp PDV, Delay Distribution Curve/Histogram.	
Standards Supported	ITU-T G.826x/7x, MEF-18, IEEE/IEC 61850-9-3, IEEE C 37 238, IEEE 802.1AS	
PTP Field Verifier (PFV)	Decode and display PTP Fields.	
	Display Pass/Fail to standards-based or user-defined rules.	
	Report Generation capability.	
PDV Editor Suite	Edit any PDV file from the graphs. Profile Edits: Extract, Repeat, Copy, Paste (Replace or Insert); Modulate, Scale (%), Banding (Deplete or Concentrate); Adjust Delay Floor.	
Measurement Accuracy	5 ns.	
SyncE (options 213, 207, 208, 223)		
Jitter/Wander Measurement	To ITU-T G.8262 and O.174 - jitter/wander generation, wander transfer, jitter/wander tolerance, phase transient. Built-in frequency offset plus sinusoidal, MTIE and TDEV wander generation.	
MTIE/TDEV Analysis	Built-in Calnex Analysis Tool (CAT) software with ITU-T and masks with Pass/Fail indication.	
SyncE Master	Accuracy traceable to Reference source used (refer to Reference Clocks).	
Measurement Accuracy	1 ns.	
ESMC (SSM) Features to G.8264, G.781, etc	Decode ESMC messages to ITU-T G.8264 and plot Quality Level (QL) changes graphically (bi-directional). QLs: PRS, PRC, INV3, SSU-A/TNC, INV5, INV6, ST2, SSU-B, INV9, EEC2/ST3, EEC1/SEC, SMC, ST3E, PROV, STU/UKN, DNU/DUS.	
	Overwrite ESMC Message to change QL status.	
	Support for ESMC Decode and SyncE in 1588 mode (for concurrent SyncE and 1588 implementations).	
	Integrated display in Calnex Analysis Tool (CAT).	
ESMC Generation	Generate ESMC (SSM) packets per ITU-T G.8264 QLs: PRS, PRC, INV3, SSU-A/TNC, INV5, INV6, ST2, SSU-B, INV9, EEC2/ST3, EEC1/SEC, SMC, ST3E, PROV, STU/UKN, DNU/DUS. Generate ESMC messages, change QL value and measure impact on wander.	
Ethernet OAM (option 301)		
Capture and Decode	Packet Number, Arrival Time, Ethernet Destination Address, Ethernet Source Address, OAM Message Type, MEP ID, RDI, Period fps, TransID, TxFCf, RxFCf, TxFCb, Tx Timestamp(f), Rx Timestamp(f), Tx Timestamp(b), Rx Timestamp(b), Maintenance Domain Length, Maintenance Domain Name, Short MA Name Format, Short MA Name Length, Short MA Name, Time To Live, Origin MAC, Target MAC, Relay Action, OUI, TLV Offset, TLVs.	
Round-trip Delay	Based on DMM/DMR messages. Displayed in table and graph. MEF and ITU-T delay methods supported.	
View Filtering	MAC addresses and OAM Message types.	
Standards Supported	ITU-T Y.1731, IEEE 802.1ag, IEEE 802.3ah, ITU-T G.8031, ITU-T G.8032	
Message Filters for Corruption and Delay	CCM, LBM, LBR, LTM, LTR, AIS, LCK, TST, APS, MCC, LMM, LMR, 1DM, DMM, DMR, EXM, EXR, VSM, VSR. Any combination of above messages. CCM at 1 s and 3.33 ms both supported.	
Impairments and Delay	Lost, Misordered, Repeated, Errored, AIS/LCK/RDI Generation, Fixed Delay, Variable Delay.	
Header Overwrite	Ethernet Header or OAM Header – overwrite any bit (first 128 bytes) with hex or binary value or invert.	
Multi-MEG Mode	Capture information for 1000s of MEGs including Eth Dest, Eth Src, SVID, CVID, MEL, MEP ID, OAM Message Count, AIS, RDI, CCM, CCM fps, etc.	
NTP (option 404) and CES (option 202)		
	NTP	CES
Packet Sync Rates	Any packet rate.	T1, E1, T3, E3 or Any.
Protocols	NTP (up to v4).	SAToP, CESoPSN, TDMoIP.
Header Capture and Alarms	Version, Mode, Stratum, Poll, Precision, Root Delay, Root Dispersion, ReferenceId, Reference Time, Origin, Receive, Transmit.	L, R, M, FRG, Length and Sequence # (errors highlighted). L, R, M Alarm Injection.
Graphs Displayed	Inter-Packet (Reserved_0, Sim_Active, Sim_Passive, Client, Server, Broadcast, Control, Reserved_7, all), Client PDV (Client-to-Server PDV), Server PDV (Server-to-Client PDV), RTD Variation. Delay Distribution Curve/Histogram.	TIE vs Nominal, TIE vs Measured Average, Delay vs Packet #, Inter-packet Time (vs Time and vs Packet #), Delay Distribution Curve/Histogram.
Standards Supported	G.8261 (Test Cases 1 – 17), G.8273.2 and MEF-18.	
PDV Editor Suite	Edit any PDV file from the graphs. Profile Edits: Extract, Repeat, Copy, Paste (Replace or Insert); Modulate, Scale (%), Banding (Deplete or Concentrate); Adjust Delay Floor.	
Measurement Accuracy	5 ns.	

Advanced Time of Day (option 230)	
Time of Day (ToD) Emulation	Generate ToD messages to CCSA, NMEA and ITU-T standards.
Control Fields/Values	Event Message: TimeSource Type, TimeSource Status, TimeSource Alarms. Information Message: Leap Seconds, PPS Status, TAcc.
Time of Day Measurement	Decode and display ToD fields. Highlight errors e.g. CRC, Second jumps. Validate ToD alignment to 1 pps. Compare ToD and PTP message and status.
Measurement Accuracy	1 ns.
General	
Physical Interfaces	Ethernet 100 M Electrical, 100 M Optical (SGMII).* 1 G Electrical, 1 G Optical - SFP. 10 G Optical (optional) – XFP or SFP+ (LAN-PHY). *PTP PDV, NTP, CES, Services
Reference Clocks	Lock internal timing reference to external reference. Reference Lock soft LED indication. External reference inputs: 64 kHz, 2.048 MHz, 10 MHz; T1 BITS clock; E1 MTS, SyncE. Internal reference Stratum-3, ± 4.6 ppm.
PC Control Interface	Any standard PC or laptop running Windows Vista, 7 or 8. RJ45 LAN connection to instrument.
TCP/IP Settings	TCP Port, IP Address and Gateway settable.
Automatic Flow-selection in Multi-flow Environment	Automatic filter setting for 1588 in Master/Slave Emulation mode. Automatic detection of OAM (MEGs), 1588, CES and other flows and filter setup using FlowWizard. Filter (1 to 64 bytes): Setup messages for capture and replay. Select OAM type within a MEG flow. Select 1588 Message type(s) or groups. Integrated decode using industry-standard tool, Wireshark. Additional PTP analysis capability with PFV.
Packet Capture Memory	Capture complete packet and display contents. The filters can specify the packet types to be captured. Internal (2 Gb) or External (via USB).
Graph Manipulation	Zoom in (X and Y), Zoom out (X and Y), Marker 1, Marker 2, Min/Max display in nanoseconds.
Impairments – Delay	
Fixed Delay	6 μ s to 10 s.
Variable Delays	Gaussian, Gamma, User Defined – stored PDV profiles or captures from networks, G.8261 and MEF-18 Test Cases, Sawtooth – Systematic, Beating (F) and Beating (S), Step Function, Latency Ramp.
1588 Delays applied to:	Packet Sending Time, CorrectionField or Both.
Impairments – Corruption	Misordered, Lost, Repeated or Errored Packets.
Control	Single, Burst (1 to 10000), Duration (0.1 s to 10 s), Rate (0.00001% to 99.99999%), Ratio (1×10^{-7} to 9×10^{-1}) or Constant.
Overwrite Header	Any bytes with any value in first 128 bytes.
Switch Simulation	Independently set: Latency, Buffer Depth (1 byte to 256 kbytes), Bandwidth (0% to 100%).
Timing Measurements (Options 205, 206, 230)	E1/T1 wander – TIE, MTIE, TDEV analysis with ITU-T masks - sample rate 0.1 Hz to 100 Hz. 1 pps accuracy – recovered slave clock 1 pps vs reference. ToD analysis.
Simultaneous Measurements	Chosen packet measurements can be performed simultaneously with all timing measurements (SyncE and Clock wander, 1pps Accuracy, ToD analysis).
Remote Control	Scripting via TCL, Perl and Python.
Operation and Regulatory	Temperature 5 - 50°C, Humidity 0 - 95%, CE and EMC (incl. EN-61010, EN-61326, etc.) certified. Voltage 85 - 246 VAC, 100 - 240 VAC (Nominal) @ 50/60 Hz.
GPS Antenna, Receiver and Rb Ref. (Option 132)	PRS/Stratum 1 (GPS-locked): typical 1×10^{-12} Outputs: 10 MHz, 1 pps.

Specification is subject to change without notice.

Related Products

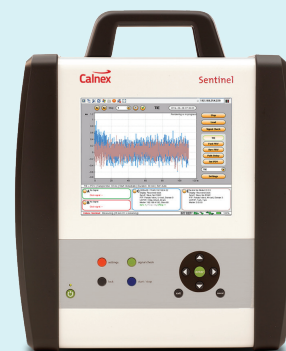


Calnex Paragon-t

- Speed up test time and reduce test complexity with multi-clock measurements and 4 x wander generators
- Measure multiple outputs; chains of Boundary Clocks, groups of Slave Clocks, SECs and EECs
- 4 x Frequency (SyncE/E1/T1/2.048 M/10 M Wander) measurements plus generators
- 4 x Phase (1 pps accuracy) measurements
- 4 x ToD display measurements

Calnex Sentinel

- PTP, NTP, SyncE and TDM in one portable box
- Measure ALL parameters at the SAME time
- Test networks for Frequency and Phase
- Test networks with Boundary Clocks and Transparent Clocks
- Standard industry masks and packet metrics, with built-in Pass/Fail limits when measuring the network
- Measurement reports in pdf format
- Embedded GPS receiver and Rubidium (Rb)



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CX2012 v3.2

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