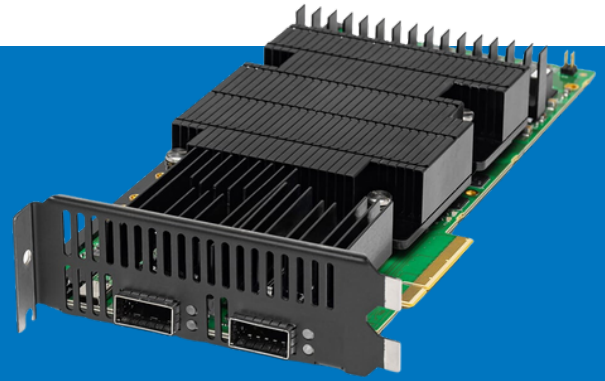


Z400qx Thor

Testing 7 different 56G PAM4 and NRZ speeds up to 400Gbps via QSFP-DD/QSFP56/QSFP28



Key Features

- Dual QSFP-DD/QSFP56/QSFP28 cages
- Supports, 400GE, 200GE, 100GE & 50GE speeds using 56G PAM4
- Supports 100GE, 50GE, 40GE, 25GE & 10GE speeds using 10G NRZ
- Traffic Generation and analysis
- Test with optics, LPOs, AECs, ACCs and DAC's
- Advanced Physical Layer testing with Xena PHY providing valuable Layer 1 insights
- Advanced Auto-Negotiation & Link Training (AN/LT) analysis on PAM4 signals
- Extensive software package including test suites for RFC2544, RFC2889 and RFC3918
- Python-based open-source automation framework
- Ease of use

Z400qx Thor 2 port traffic generator module can test seven Ethernet speeds - 400GE, 200GE, 100GE, 50GE, 40GE, 25GE and 10GE using 56G/25G/10G SerDes

Z400qx Thor is a versatile solution for testing the performance and functionality of Ethernet network infrastructure and equipment including switches, routers and NICs.

Equipped with 2 QSFP-DD cages this module can test speeds ranging from 10GE NRZ all the way to 400GE using 56G PAM4 SerDes, Z400qx Thor is really the ultimate test module when it comes to flexibility.

The module also provides advanced tool to help developers optimize signal integrity and Bit Error Rate (BER) performance on the tested links.

Z400qx Thor supports extensive L1 test features. With the integrated Xena PHY providing valuable insights into advanced PCS and PMA layer testing including dynamic transceiver clock sweep, lane skewing and PRBS modes. Signals can be analyzed in advanced Signal Integrity View (SIV), to provide visual information on signal quality.

Z400qx Thor can be installed in the Xena B2400 chassis for up to 12 400G ports, or it can be delivered in our Compact chassis, making it a small and lightweight 400G Ethernet test solution.

Z400qx Thor comes complete with XenaManager, the intuitive multi-user management software for generating and analyzing traffic. Also included is Xena OpenAutomation (XOA), an open-source scripting and automation framework designed to help test engineers make the most of Xena testers with tailored tests and standardized test methodologies.

Ethernet Auto-Negotiation & Link Training Test Tools

Z400qx Thor traffic generators support Auto-Negotiation and Link Training (AN/LT) on 56G SerDes (PAM4).

Z400qx Thor also provides a AN/LT Utility making additional AN/LT tools available for thorough testing of the endpoint behavior during AN and LT process.

The AN/LT Utility adds insight, visibility, and configuration possibilities to the AN and LT process making it easy to analyze DUT behavior during AN/LT, configure and optimize the relevant AN parameters and LT coefficients, on PAM4 signals.

INTERFACES AND STANDARDS

Number of module cages/connectors	2 x QSFP-DD/QSFP56/QSFP28																																			
Interface options in each cage	<table border="0"> <thead> <tr> <th data-bbox="592 416 778 443">56G Serdes</th> <th data-bbox="807 416 922 443">Line Code</th> <th data-bbox="986 416 1098 443">IEEE/ETC*</th> </tr> </thead> <tbody> <tr> <td data-bbox="592 450 708 477">1 x 400GE</td> <td data-bbox="831 450 898 477">PAM4</td> <td data-bbox="986 450 1278 477">IEEE 802.3bs or ETC* 400G</td> </tr> <tr> <td data-bbox="592 483 708 510">2 x 200GE</td> <td data-bbox="831 483 898 510">PAM4</td> <td data-bbox="986 483 1066 510">802.3cd</td> </tr> <tr> <td data-bbox="592 517 708 544">4 x 100GE</td> <td data-bbox="831 517 898 544">PAM4</td> <td data-bbox="986 517 1066 544">802.3cd</td> </tr> <tr> <td data-bbox="592 551 699 577">8 x 50GE</td> <td data-bbox="831 551 898 577">PAM4</td> <td data-bbox="986 551 1066 577">802.3cd</td> </tr> <tr> <th data-bbox="592 622 778 649">25G/10G Serdes</th> <th data-bbox="807 622 922 649">Line Code</th> <th data-bbox="986 622 1098 649">IEEE/ETC*</th> </tr> <tr> <td data-bbox="592 656 708 683">2 x 100GE</td> <td data-bbox="831 656 890 683">NRZ</td> <td data-bbox="986 656 1066 683">802.3bj</td> </tr> <tr> <td data-bbox="592 689 699 716">4 x 50GE</td> <td data-bbox="831 689 890 716">NRZ</td> <td data-bbox="986 689 1198 716">ETC* 25G/50G R2.0</td> </tr> <tr> <td data-bbox="592 723 699 750">2 x 40GE</td> <td data-bbox="831 723 890 750">NRZ</td> <td data-bbox="986 723 1066 750">802.3ba</td> </tr> <tr> <td data-bbox="592 757 699 784">8 x 25GE</td> <td data-bbox="831 757 890 784">NRZ</td> <td data-bbox="986 757 1374 784">IEEE 802.3by or ETC* 25G/50G R2.0</td> </tr> <tr> <td data-bbox="592 790 699 817">8 x 10GE</td> <td data-bbox="831 790 890 817">NRZ</td> <td data-bbox="986 790 1066 817">802.3ae</td> </tr> </tbody> </table> <p data-bbox="592 864 948 925">Power capacity using single cage: QSFP-DD: 25W</p> <p data-bbox="592 969 948 1030">Power capacity using both cages: QSFP-DD: 15W in each cage</p> <p data-bbox="592 1070 1026 1097">* ETC = Ethernet Technology Consortium</p>			56G Serdes	Line Code	IEEE/ETC*	1 x 400GE	PAM4	IEEE 802.3bs or ETC* 400G	2 x 200GE	PAM4	802.3cd	4 x 100GE	PAM4	802.3cd	8 x 50GE	PAM4	802.3cd	25G/10G Serdes	Line Code	IEEE/ETC*	2 x 100GE	NRZ	802.3bj	4 x 50GE	NRZ	ETC* 25G/50G R2.0	2 x 40GE	NRZ	802.3ba	8 x 25GE	NRZ	IEEE 802.3by or ETC* 25G/50G R2.0	8 x 10GE	NRZ	802.3ae
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LAYER 1 FEATURES

Pattern Generation	<ul style="list-style-type: none"> • PRBS-13, PRBS-31, PRBS-13Q, PRBS-31Q • SSPRQ test pattern (IEEE 802.3 Clause 120.5.11.2.3) • Square Wave (IEEE 802.3 Clause 120.5.11.2.4) • Statistics: Lock status, PRBS errors, PRBS error rate
Physical Coding Sublayer	<ul style="list-style-type: none"> • PCS virtual lane-to-SerDes mapping configuration
Forward Error Correction	<ul style="list-style-type: none"> • RS-FEC KP (544,514,t=15), IEEE 802.3 Clause 119 (200GE/400GE) • RS-FEC KR (528,514,t=7), IEEE 802.3 Clause 91 (100GE) • RS-FEC KP (544,514,t=15), IEEE 802.3 Clause 91 (100GE) • RS-FEC KP (544,514,t=15), IEEE 802.3 802.3cd Clause 134 (50GE/100GE) • RS-FEC KR (528,514,t=7), IEEE 802.3 Clause 108 (25GE) • RS-FEC KR (528,514,t=7), 25/50G Ethernet Consortium (25GE/50GE) • BASE-R FEC (Firecode) 2112,2080 IEEE 802.3 Clause 74 (10GE/25GE)
FEC Error Injection	<ul style="list-style-type: none"> • RS-FEC KP (544, 514, T=15) • RS-FEC KR (528, 514, T=7) • Configuration: Consecutive, Errored Codewords, Total Codewords Per Cycle, Errored Symbols Per Codeword • Bit error mask modes: Static, Rotate, Increment • Pre-defined profiles: Max. Consecutive Uncorrectable w/o Link Loss, Min. Consecutive Uncorrectable with Link Loss • Loop modes: Single, Continuous, Repeat • Injection statistics: Injected FEC Errors; Total Codewords, Total Uncorrectable Codewords, Total Correctable Codewords, Total Error-Free Codewords, Codeword Error Ratio, and Total Symbol Errors
Reconciliation Sublayer (Local/Remote Fault feature)	<ul style="list-style-type: none"> • Normal: Acts according to 802.3 standard • Force Local: Port will continuously transmit "Local Fault indication". • Force Remote: Port will continuously transmit "Remote Fault indication". • Disabled: Port does not respond to Local/Remote Fault from DUT
PMA Error Injection	<ul style="list-style-type: none"> • Repeatable error injection periods at PMA layer with millisecond precision.
Link Flap	<ul style="list-style-type: none"> • Single shot or repeatable link-down with millisecond precision.
Equalization Controls	<ul style="list-style-type: none"> • Tx Equalization Control • Rx Equalization Control: CTLE, AGC Adapt, OC Adapt, DFE Tap, CDR, Pre FFEs, and Post FFEs • Support value freezing and auto on Rx equalizations
Signal Integrity Analysis	<ul style="list-style-type: none"> • Advanced Signal Integrity View for modulated signal quality analysis
PPM Sweep	<ul style="list-style-type: none"> • Configurable • linear or step sweep +/- 400 ppm in steps of 1ppm (shared across all ports on module)
Auto Negotiation and Link Training	<ul style="list-style-type: none"> • Auto-negotiation: IEEE 802.3 Clause 73, ETC 25G/50G • Link training: IEEE 802.3 Clause 72, 136 and 161
Advanced AN and LT analysis**	Capture, Decode and analysis of Auto Negotiation and Link Training protocol

**Advanced ANLT Solution track, purchased separate

TRANSMIT ENGINES

Traffic Generation	<ul style="list-style-type: none"> • Wire-speed multi-stream traffic generation • Up to 256 hardware streams per port • Each stream can generate millions of traffic flows using field modifier
Transmit Line Clock Adjustment	<ul style="list-style-type: none"> • From -400 to 400 ppm in steps of 1 ppm (shared across all ports on module)
Oscillator Characteristics	<ul style="list-style-type: none"> • Initial Accuracy is +/- 1,5 ppm including temperature Stability. • Frequency drift over 1st year: +/- 2.5 ppm including temperature Stability. • Frequency drift over over 20 years: +/- 3.5 ppm including temperature Stability. • Temperature Stability mentioned above is +/- 0.5 ppm
Transmit Control	<ul style="list-style-type: none"> • Support adjustment of the effective line rate by forcing idle gaps equivalent to -1000 ppm (increments of 10 ppm) • Configurable average Inter-Frame Gap (IFG) from 18 to 63 bytes, default is 20B (12B IFG + 8B preamble) • Support optical laser or copper link enable/disable
Loopback Modes	<ul style="list-style-type: none"> • L1 RX-to-TX: Any received packet is bounced back through TX • TX(on)-to-RX: Packet goes out of TX but also internally direct to RX • TX(off)-to-RX: Packet goes directly to RX (No link sync needed) • Port-to-Port: Any received packet goes out through the neighbor port
Port Transmit Scheduling Modes	<ul style="list-style-type: none"> • Normal (stream interleaved mode): Default scheduling mode, precise rates, minor variation in packet inter-frame gap. • Uniform: With 100% uniform packet inter-frame gap, minor deviation from configured rates is available. • Sequential: Streams are scheduled continuously in sequential order, with configurable number of packets per stream. • Burst: Packets in a stream are organized in bursts. Bursts from active streams form a burst group is available. The user specifies time from start of one burst group till start of next burst group.
Stream Profile	<ul style="list-style-type: none"> • Packet Length: Fixed; Incrementing, Random, Butterfly. Minimum 56 bytes, maximum 16K bytes. • Packet Payload: Incrementing 8-bit, custom pattern (up to 18B repeated) • Burst Traffic with configurable Burst Size, and Burst Density • Flow Control: PFC support for both VLAN tagged and untagged traffic
Stream Header Types	Ethernet, VLAN, ARP, IPv4, IPv6, UDP, TCP, LLC, SNAP, GTP, ICMP, RTP, RTCP, STP, SCTP, MacCtrl, MPLS, PBB, FCoE, FC, IGMPv2, GRE, GTP, VxLAN, NVGRE, DHCPv4, Geneve, eCPRI, RoE, PWE, PFC, Custom.
Stream Modifiers	<ul style="list-style-type: none"> • Maximum 8 x 24-bit modifiers per stream • 24-bit header field modifiers with incremental, decremental, or random mode. • Each modifier has configurable bit-mask, repetition, min, max, and step parameters.

TRANSMIT ENGINES, CONT.

Layer 2 Error Injection	<ul style="list-style-type: none"> • Undersize (56 bytes min), and oversize (16000 bytes max.) packet lengths • FCS Error, Sequence Error, Misordering Error, Payload Integrity Error, Test Payload Error
Multicast	<ul style="list-style-type: none"> • Support for IPv4 • Up to 8 multicast group addresses • IGMPv2: Join (with configurable repeat interval), Leave All-Devices, Leave, General Query, Group Query • IGMPv3: Exclude (with configurable repeat interval), Include, Change-to-Exclude, Change-to-Include, Multi-group record support
ARP/NDP/Ping	<ul style="list-style-type: none"> • Auto address resolution • Auto reply to request per port and per stream
LLDP	<ul style="list-style-type: none"> • Configurable LLDP operation mode, timers, and TLVs • Support mandatory and optional TLV types • Display received LLDP information
Transmit Statistics	<ul style="list-style-type: none"> • Per-stream: bits/s, bytes/s, packets/s, packets, bytes • Per-port: ARP, NDP, Ping, requests and replies • Per-port injected errors: FCS Error, Sequence Error, Misordering Error, Payload Integrity Error, Test Payload Error • Two real-time histograms per port: TX Packet Length, IFG, or latency distribution for all traffic, a specific stream, or a filter
Packet Scheduling Modes	<ul style="list-style-type: none"> • Normal (stream interleaved mode) – standard scheduling mode, precise rates, minor variation in packet inter-frame gap. • Strict Uniform – with 100% uniform packet inter-frame gap, minor deviation from configured rates is available. • Sequential packet scheduling (sequential stream scheduling) is available. Streams are scheduled continuously in sequential order, with configurable number of packets per stream. • Burst. Packets in a stream are organized in bursts. Bursts from active streams form a burst group is available. The user specifies time from start of one burst group till start of next burst group.

RECEIVE ENGINE

Traffic Receive Capability	Number Of Traceable Rx Streams Per Port : 2016 (wire-speed)
Receive Statistics	<ul style="list-style-type: none"> • Per-stream: bits/s, bytes/s, packets/s, packets, bytes • Per-stream: Packet Loss, Misordered, Payload Errors • Per-stream: Latency and jitter with minimum, maximum and average • Per-port: ARP, NDP, Ping, with requests and replies • Per-port injected errors: FCS Error, Sequence Error, Misordering Error, Payload Integrity Error, Test Payload Error • Two real-time histograms per port: RX Packet Length, IFG, or latency distribution for all traffic, a specific stream, or a filter • Filter statistics: bits/s, bytes/s, packets/s, packets, bytes
Latency Measurement	<ul style="list-style-type: none"> • Latency can be measured on up to 2016 streams • Accuracy: ± 16 ns • Resolution: 1 ns (Latency measurements can be calibrated to remove latency from transceiver modules) • Measurement modes: Last-to-last, last-to-first, first-to-last, first-to-first
Jitter Measurement	<ul style="list-style-type: none"> • Jitter can be measured on up to 2016 streams • Jitter (Packet Delay Variation) measurements compliant to MEF10 standard with 1ns accuracy.
Traffic Filter	<ul style="list-style-type: none"> • 6 x 64-bit configurable match-term patterns with mask, and offset • 6 x frame length comparator terms (longer, shorter) • 6 x configurable filters expressed in logical expressions of the match and length terms
Filter Statistics (Counter size: 64 bits)	<p>Per filter:</p> <ul style="list-style-type: none"> • RX Mbit/s • packets/s • packets • bytes
Capture	<ul style="list-style-type: none"> • Start Trigger Criteria: FCS errors, filter match, payload error, manual • Stop Trigger Criteria: FCS errors, filter match, payload error, manual, buffer full • Capture Limit Per Packet: 16 – 16383 bytes • Wire-Speed Capture Buffer Per Port: 64 kB • Low Speed Capture Buffer Per Port (10 Mbits/s): 4096 packets (any size) • Packet header auto decode

SPECIFICATIONS	
Max. Power	<ul style="list-style-type: none"> • 100 W
Weight	<ul style="list-style-type: none"> • 2.32 lbs (1.05 kg)
Environmental	<ul style="list-style-type: none"> • Operating Temperature: 10 to 30°C • Storage Temperature: -40 to 70°C • Humidity: 8% to 90% non-condensing
Regulatory	<ul style="list-style-type: none"> • FCC (US) • CE (Europe)
User interface	<ul style="list-style-type: none"> • XenaManager (XM), XenaManager3 (XM3), Xena OpenAutomation (XOA) and XOA CLI • Xena2544, Xena2889, Xena3918, Xena1564
Connector insertions	<p>Xena uses high-quality 112Gbps-capable electrical connectors on Z400 Thor modules for optimal signal integrity and performance. However, all connectors experience wear when inserted, resulting in decreased signal integrity over time. The specification below is the minimum number of insertions where optimal signal integrity is guaranteed:</p> <ul style="list-style-type: none"> • Connectors, minimum number of guaranteed insertions: 1000 cycles
Notes	<ul style="list-style-type: none"> • The Z400qx Thor occupies 2 slot in a B2400 chassis. Please refer to module install guide for additional info and instruction if air guides are required. • The Z400qx Thor is also available in the standalone Compact chassis (P/N Z400qxc Thor)

Ordering Information

Product Description

Z400qxc Thor 2 port QSFP-DD/QSFP56/QSFP28 7-speed 400G (112G/56G PAM4, 25G/10G NRZ) test module in 1U Compact Chassis
 Z400qx Thor 2 port QSFP-DD/QSFP56/QSFP28 7-speed 400G (112G/56G PAM4, 25G/10G NRZ) test module

Product Code

C-Thor-400G-7S-2P
 Thor-400G-7S-2P



Local sales offices are located throughout the world. Visit our website to find the most convenient location.

1-800-5-LeCroy • teledynelecroy.com

