DATA SHEET

K400 CFP8 Load Modules

Put Your 400GE Product to Work Now!

400GE is undergoing rapid development to meet the growing bandwidth requirements of ever-evolving data networks. Core networking applications are increasing by a factor of 10 every 5 years. 400GE addresses the broad range of bandwidth requirements to support these key application areas such as cloud-scale data centers, Internet exchanges, co-location services, wireless infrastructure, service provider and operator networks, and video distribution infrastructure.

Test tomorrow's technology today

Ixia's K400 CFP8-400GE load module will accelerate your development of IEEE 802.3bs-compliant 400GE networking systems. Giving development teams the options they need to create the networking technologies of the future, these load modules are available in two different models:

- Full feature and scale CFP8-400GE
- Reduced feature and scale CFP8-R400GE

Both models enable full line-rate traffic generation to transmit, receive, and capture functionality from 64B to 16,000B frame lengths. This facilitates stress testing, hardware/ASIC bring-up, optics and cable qualification, interoperability, and functional test and Layer 2/3 routing protocol emulation as required.

K400 CFP8-400GE: A full-featured model with 1-port, 2-slot, native CFP8 400GE load module designed for enterprise and data center switch and router testing.

Highlights

- Industry-leading400GE test system from the leader in Ethernet test
- World's first 400GE test system running IEEE 802.3bs RS-544 Forward Error Correction (FEC) –Special Award Winner for Testing in 2016 at Interop Tokyo, Japan
- World's first live 400GE line rate interoperability demonstration with FEC with two independent MAC/PCS/FEC implementations, in 2016 at ECOC in Dusseldorf, Germany
- Ixia developed the intellectual property for the critical elements of 400GE: MAC, PCS, FEC and FEC error injection and statistics—resulting in faster response times as industry standards evolve
- FEC error injection, PCS lanes Tx/Rx test capability and classical L1 BERT support provide essential tools for hardware development and bring-up

CFP8-400GE 1-port, 2-slot load module

KEYSIGHT TECHNOLOGIES

K400 CFP8-R400GE: A reduced-featured model with 1-port, 2-slot, native CFP8 400GE load module designed for hardware, ASIC, cable/optics qualification, and interoperability testing. The CFP8-R400GE scales down the L2/3 feature set and L2/3 networking protocol scaling, while increasing affordability.

The CFP8-R400GE load module may be upgraded in the field to have a higher capacity L2/3 feature set and L2/3 networking protocol scaling performance through a purchasable upgrade option. This extends the reuse of the load module and improves the ROI.

K400 Key Features

- Line-rate 400Gbps packet generation, capture, and analysis of received traffic to detect and de-bug data transmission errors
- Line-rate per-port and per-flow statistics
- High latency measurement resolution at 0.625ns
- RS-544 (KP4) Forward Error Correction (FEC) support
- Native 28Gb/s SERDES with NRZ encoding support that is IEEE 802.3bs compliant
- FEC error injection with a comprehensive set of FEC corrected and uncorrected statistics, including Bit Error Rate statistics for pre- and post-FEC operations
- Inject packet errors: CRCs, runts, giants, alignments, checksum errors, and out of sequence
- Standard Ixia instrumentation including timestamp, sequence number and flow identification, and data integrity
- Layer 1 BERT: 16 independent lanes of 28Gb/s PRBS pattern generation, error checking, and statistics
- 400G PCS lanes Transmit, error injection testing and receive measurement:
    - Per-lane controls and status, FEC and error monitoring, error insertion, lane mapping and skew insertion
- ±100 PPM line frequency adjustment
- Mid-to-high-range L2/3 networking protocol emulation to validate performance and scalability of L2/3 routing/switching and data center test cases using the Ixia's IxNetwork application
- An excellent test platform for full line-rate 400Gb/s to evaluate the new 400GE ASIC designs, FPGAs, and hardware switch fabrics that use the new 16x28Gb/s electrical interface with NRZ encoding
- Supports benchmarking of networking devices and equipment using industry-standard RFC benchmark tests at line-rate 400GE
- Supported by the XGS12 and XGS2 High Performance (HSL) and Standard Performance (SDL chassis model with the Native IxOS
- Application support including: IxExplorer, IxNetwork, and related Tcl and automation APIs

Specifications

Product description	CFP8-400GE full feature	CFP8-R400GE reduced feature
Part Number	944-1150	944-1151
Hardware load module specifications		
Slot/number of ports	2-slot, 1-port 400GE	
Physical interfaces	Native CFP8 physical port	
Supported port speeds	400GE over 400GE-capable fiber media	
CPU and memory	Multicore processor with 4GB of CPU memory per port	
IEEE interface protocols for 400GE	IEEE P802.3bs 400GbE, 400GBASE-R	
Advanced layer 1 support	400GE: • KP4 (RS-544) Ethernet Forward Error Correction, Clause 119 • Pre- and post-FEC statistics: Comprehensive per-port and per-lane statistics • FEC error injection • PCS lanes Tx and Rx test and statistics • Classical Layer 1 BERT test and statistics	
Transceiver support	Capable of support for 400GBASE-SR16, 400GBASE-LR8 10km and 400GBASE-FR8 2km optical transceivers	
Cable media	400GBASE capable multimode fiber and single mode fiber cables that are compatible with the optical receptacle on the CFP8 transceiver	
Load module dimensions	• 17.3” (L) x 1.3” (W) x 12.0” (H) • 440mm (L) x 33mm (W) x 305mm (H)	
Load module weights	• Module only: 11.8 lbs. (5.35 kg) • Shipping: 18.6 lbs. (8.44 kg)	
Temperature (ambient air)	• Operating: 41°F to 95°F (5°C to 35°C) • Storage: 41°F to 122°F (5°C to 50°C)	
Humidity (ambient air)	• Operating: 0% to 85%, non-condensing • Storage: 0% to 85%, non-condensing	
Chassis Capacity: Maximum Number of Cards and Ports per Chassis Model		
XGS12-HSL chassis (940-0016)	6 load modules: • 12-slot rackmount chassis • 6-ports of 400GE	

Product description	CFP8-400GE full feature	CFP8-R400GE reduced feature
XGS2-HSL chassis (940-0014)	1 load module: • 2-slot rackmount chassis • 1-port of 400GE	
XGS12-SDL chassis (940-0015)	6 load modules: • 12-slot rackmount chassis • 6-ports of 400GE	
XGS2-SDL chassis (940-0013)	1 load module: • 2-slot rackmount chassis • 1-port of 400GE	
Transmit feature specifications		
Transmit engine	Wire-speed packet generation with timestamps, sequence numbers, data integrity, and packet group signatures	
Max. streams per port	400GE: 128	400GE: 32
Max. streams per port in data center ethernet	400GE: 128	400GE: 32
Stream controls	• Rate and frame size change on the fly • Advanced stream scheduler	
Minimum frame size	400GE: • 60 bytes at full line rate • 49 bytes at less than full line rate	
Maximum frame size	16,000 bytes	
Maximum frame size in data center ethernet	9,216 bytes	
Priority flow control	• 4 line-rate-capable queues, each supporting up to 9,216-byte frame lengths • 1 line-rate capable queue, non-blocking supporting up to 9,216-byte frame lengths	
Frame length controls	Fixed, increment by user-defined step, weighted pairs (up to 16K), uniform, repeatable random, IMIX, and Quad Gaussian	
User defined fields (UDF):	Fixed, increment or decrement by user-defined step, sequence, value list, and random configurations; up to 10, 32-bit-wide UDFs are available	
Value lists (max.)	400GE: 1M / UDF	
Sequence (max.)	400GE: 32K / UDF	

Product description	CFP8-400GE full feature	CFP8-R400GE reduced feature
Error generation	• FEC symbol error-injection allows the user to inject FEC symbol errors using various weighted methods to achieve specific error rates • Generate good CRC or force bad CRC, undersize and oversize standard Ethernet frame lengths, and bad checksum	
Physical coding sublayer	• PCS lane skew injection • PCS lane re-mapping • PCS lane marker error injection • PCS bit error generation	
L1 BERT	Classical, line rate, un-encapsulated transmit and receive of various PRBS patterns, controls over the patterns that help to produce BER statistics	
Hardware checksum generation	Checksum generation for IPv4, IP over IP, ICMP/GRE/TCP/UDP, L2TP, GTP, and multilayer checksum. Support for protocol verification for control plane traffic	
Link fault signaling	Reports, no fault, remote fault, and local fault port statistics; generate local and remote faults with controls for the number of faults and order of faults, plus the ability to select the option to have the transmit port ignore link faults from a remote link partner	
Latency measurement resolution	400GE: 0.625 nanoseconds	
Intrinsic latency compensation	Removes inherent latency error from the 400GE port electronics	
Transmit line clock adjustment	Ability to adjust the parts-per-million-line frequency over a range of -100 ppm to +100 ppm on the 400GE port	
Transmit/receive loopback	Internal and line loopback support	
Receive feature specifications		
Receive engine	Wire-speed packet filtering, capturing, real-time latency, and inter-arrival time for each packet group, with data integrity, sequence and advanced sequence checking capability	
Trackable receive flows per port	400GE: • 32K with the full statistics	
Minimum frame size	400GE: • 64 bytes at full line rate • 49 bytes at less than full line rate	
Filters (user-defined statistics, UDS)	2 SA/DA pattern matchers, 2x16-byte user-definable patterns. 6 UDS counters are available with offsets for start of frame.	
Hardware capture buffer	256KB	

Product description	CFP8-400GE full feature	CFP8-R400GE reduced feature
Standard statistics and rates	Link state, line speed, frames sent, valid frames received, bytes sent/received, fragments, undersize, oversize, CRC errors, 6 user-defined stats, capture trigger (UDS 3), capture filter (UDS 4), data integrity frames, data integrity errors, sequence and advanced sequence checking frames, sequence checking errors, ARP, and PING requests and replies	
FEC statistics	• FEC port statistics: Total Bit Errors, Max Symbol Errors, Corrected Codewords, Total Codewords, Uncorrectable Codewords, Frame Loss Ratio, Pre-FEC Bit Error Rate, and Codeword error distribution analysis • FEC per lane Rx statistics: FEC Symbol Error Count, Corrected Bits Count, Symbol Error Rate, Corrected Bit Rate	
Latency/jitter measurements	Cut-through, store & forward, forwarding delay, up to 16 time bins latency/jitter, MEF jitter, and inter-arrival time	
Receive-side PCS lanes port statistics counters	PCS: Sync Errors, Illegal Codes, Remote Faults, Local Faults, Illegal Ordered Set, Illegal Idle, and Illegal SOF	
400GE physical coding sublayer (PCS) receive-side statistics and indicators	IEEE 802.3bs-compliant per-lane PCS receive capabilities include: • Receive – per-lane PCS receive statistics; Physical Lane Assignments, Lane Marker Lock, Lane Market Map, Relative Lane Skew, Lane Marker Error Count • Receive – per-lane FEC receive statistics; FEC Symbol Error Count, FEC Corrected Bits Count, FEC Symbol Error Rate, FEC Corrected Bit Rate	
Layer 2-3 Protocol Support		
Routing and switching	BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, EIGRP/EIGRPv6, RIP/RIPng, BFD, IGMP/MLD, PIM- SM/SSM, TP/RSTP/MSTP, PVST+/RPVST+, Link Aggregation (LACP), LISP	Complete protocol coverage with reduced session scale: • 100 routing & switching sessions • 2000 host/access sessions
Software defined network	OpenFlow, Segment Routing, BGP Link State (BGP-LS), PCEP, VXLAN, EVPN VXLAN, OVSDB, GENEVE, BGP FlowSpec, BGP SR TE Policy	Complete protocol coverage with reduced session scale: • 100 routing & switching sessions • 2000 host/access sessions

Product description	CFP8-400GE full feature	CFP8-R400GE reduced feature
MPLS	RSVP-TE, RSVP-TE P2MP, LDP/LDPv6, mLDP, PWE, VPLS-LDP, VPLS-BGP, BGP auto-discovery with LDP FEC 129 support, L3 MPLS VPN/6VPE, 6PE, BGP RT-Constraint, BGP Labeled unicast, L3 Inter-AS VPN Options (A, B, C), MPLS-TP, MPLS OAM, Multicast VPN (GRE, mLDP, RSVP- TE P2MP), EVPN, PBB-EVPN	Complete protocol coverage with reduced session scale: • 100 routing & switching sessions • 2000 host/access sessions
Broadband and authentication	PPPoX/L2TPv2, DHCPv4/DHCPv6, ANCP, IPv6 Autoconfiguration (SLAAC), IGMP/MLD, 802.1x	Complete protocol coverage with reduced session scale: • 100 routing & switching sessions • 2000 host/access sessions
Industrial ethernet	Link OAM (IEEE 802.3ah), CFM/Y.1731, PBB/PBB-TE, ELMI, Sync-E ESMC, IEEE 1588v2 (PTP)	Complete protocol coverage with reduced session scale: • 100 routing & switching sessions • 2000 host/access sessions
Data center ethernet	DCBX/LLDP, FCoE/FIP, PFC (IEEE 802.1Qbb), TRILL, Cisco FabricPath, SPBM, VEPA	Complete protocol coverage with reduced session scale: • 100 routing & switching sessions • 2000 host/access sessions
CFP8-400GE / CFP8-R400GE		
IxExplorer: Layer 1-3 wire-speed traffic generation, capture, and analysis with Forward Error Correction and error injection with statistics, PCS Lanes Tx/Rx testing with statistics, and Layer 1 BERT test and reporting capability. **IxNetwork:** Wire-rate traffic generation with service modeling that builds realistic, dynamically controllable data-plane traffic. IxNetwork offers the industry's best test solution for functional and performance testing by using comprehensive emulation for routing, switching, MPLS, IP multicast, broadband, authentication, Carrier Ethernet, and data center Ethernet protocols. **Tcl API:** Custom user script development for Layer 1-3 testing		

Ordering Information

Load module 944-1150

K400 CFP8-400GE 1-port, 2-slot CFP8 400GE load module with the native CFP8 physical interface, L2-3 support (944-1150). Compatible with the XGS12-HSL rack mount chassis (940-0016), the 2-slot high performance XGS2-HSL chassis (940-0014), the XGS2-SDL, 2-slot Standard Performance chassis (940- 0013), and the XGS12-SDL, 12-slot chassis (940-0015).

Load module 944-1151

K400 CFP8-R400GE 1-port, 2-slot CFP8 400GE reduced load module, with the native CFP8 physical interface, L2-3 support and reduced protocol emulation scale (944-1151). Compatible with the XGS12-HSL rack mount chassis (940-0016), the 2-slot high performance XGS2-HSL chassis (940-0014), the XGS2-SDL, 2-slot Standard Performance chassis (940-0013), and the XGS12-SDL, 12-slot chassis (940- 0015).

Load module upgrade option 905-1033

UPG-CFP8-R400GE is a FIELD UPGRADE that upgrades the reduced performance K400 CFP8-R400GE 1-port, 1-slot, L2-3 load module (944-1151) to an increased number of streams and have the higher L23 IxNetwork protocol emulation of the CFP8-400GE full feature, L2-3 load module (944-1150) model. Note: At the time of order placement of the purchase of the upgrade, please provide the serial number of the desired CFP8-R400GE load module to install the upgrade on.

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

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