

# Xcellon-Lava™ Dual-Speed, 40/100GE Higher Speed Ethernet Load Modules

The Xcellon-Lava 40/100-Gigabit Ethernet test modules are Ixia's ultra-high performance and scale Higher Speed Ethernet (HSE) products. They incorporate the advantages of the Xcellon multicore processor architecture and provide mid-range 40GbE and 100GbE CFP, QSFP+ and CXP port density. Xcellon-Lava is a layer 1-7 measurement and analysis test solution that is supported by Ixia's leading test applications, IxNetwork™, IxNetwork AppLibrary™, and IxLoad™.

Xcellon-Lava modules are essential for testing high-density data center 40GbE and 100GbE network equipment for large enterprises, service providers, and carrier-class networks. Xcellon-Lava load modules are compatible with Ixia's 12-slot rackmount and 2-slot chassis, and a broad set of Ethernet interfaces, allowing real-world, layer 1-7 test and measurement in a single chassis.

Two models are available:

- Xcellon-Lava Accelerated Performance 40GE and 100GE for layer 1-7 test
- Xcellon-Lava 40GbE and 100GbE Reduced Performance – an economical alternative to the Accelerated Performance load module. It is designed for testing layer 1-3 functionality that requires a high scale data plane feature set and a reduced scale and performance routing protocol emulation.

## Highlights

- Industry's highest L2/3 protocol emulation scale and performance testing using multicore processors for 40GbE and 100GbE
- Comprehensive L1-7 testing with integrated data plane and control plane traffic generation and analysis
- Per-port reservation for native CFP ports and for the 40GbE or 100GbE ports provided by the CFP-to-QSFP+, and CFP-to-CXP interface adapters
- Generates, captures, and analyzes full line-rate 40GE and 100GbE traffic
- Tracks and analyzes up to 1 million receive flows per port
- High resolution, 2.5ns packets timestamps for 40GbE and 100GbE operation
- Industry performance benchmark tests RFC2544, RFC2889, and RFC3918



Xcellon-Lava, dual-speed, 1-slot load module with CFP interfaces, shown from left to right with Lava's CFP-to-CXP 100GE and CFP-to-dual-port QSFP+ 40GE adapters

Since early in 2009, when Ixia released the world's first 100GE CFP test port, much of the test challenges involved the development new electronics hardware, ASIC development, hardware/firmware integration, and new optical/copper transceivers and interconnect cables. Interoperability of network equipment quickly followed in 2010 and 2011, proving that the majority of HSE system vendor equipment worked well together and were ready for deployment. Xcellon-Lava continues to serve these types of applications very well.

HSE has moved into areas of the data center where the increased bandwidth of 100GbE interfaces is used to provide backhaul services for fixed and mobile networks that support many different subscriber services, each with large numbers of subscribers. Xcellon-Lava is designed to test the data plane, protocol and scale performance, and the quality of service on 100GbE links carrying extreme amounts of traffic with large numbers of protocol interfaces and subscribers per port.

## Key Features

- Flexible interfaces for a broad range of 40GbE and 100GbE test cases: CFP, QSFP+ and CXP
- 24 ports of 100GE CFP or 48 ports of 40GbE QSFP+ in single rack mount chassis with Windows 7
- Compatible with the XGS2-SD and the XGS12-SD family of 2-slot and 12-slot chassis with Windows 7
- Comprehensive layer 1-7 testing with integrated data plane and control plane traffic generation and analysis
- Multicore processor implementation for ultra-high-scale L2/3 routing protocol emulation
- Independent, software-selectable, 40GbE or 100GbE speed per port
- Checks compliance and performance to IEEE-STD 802.3ba with a full array of statistics and real-time error indicators
- Injects and tracks errors in lane markers, 64/66b payloads, and synchronization bits with controls for different configurations of error injections

- Unframed layer 1 BERT support with individual PCS lane BERT test and error injection over a wide range of PRBS patterns, including standard MMF and SMF PMD support. A full set of BERT-related and bit error ratio (BER) statistics are available
- Per-port reservation for native CFP ports and for the QSFP+ and CXP ports provided by the CFP interface adapters
- Generates and analyzes full line rate 40GbE and 100GbE traffic
- Tracks and analyzes up to 1 million receive flows per port for:
  - Real-time latency
  - Inter-arrival time
  - Packet loss
  - Data integrity
  - Sequence checking
  - Packet capture
- High resolution, 2.5ns timestamp for 40GbE and 100GbE time-based measurements
- A 1.4GB hardware capture buffer per port
- Supported by Ixia's leading test applications, Tcl APIs, and test automation tools in IxNetwork and IxExplorer™
- Layer 2-3 application and automation support is provided by Ixia's IxNetwork product that provides options for industry performance benchmark tests RFC2544, RFC2889, and RFC3918 and a broad array of L2-3 protocol emulations
- Layer 4-7 application support is provided by Ixia's IxLoad and AppLibrary for IxNetwork

Together, Ixia's IxNetwork application and Xcellon-Lava load modules support a comprehensive portfolio of routing and service emulations for next-generation networks, including:

- **Routing and Switching:** BGP4/BGP4+, OSPFv2/OSPFv3, ISISv4/v6, RIP/RIPng, EIGRP/EIGRPv6, PIM-SM/SSM, BFD, STP/RSTP/MSTP, PVST+/RPVST+, LACP
- **MPLS:** RSVP-TE/P2MP, LDP/MLDP, L3 MPLS VPN/6VPE, LDP L2VPN (PWE/VPLS), BGP VPLS, Multicast VPN Rosen Draft, NG Multicast VPN, EVPN/PBB-EVPN, MPLS OAM, MPLS-TP, VXLAN
- **Data Center/SDN:** FCoE/FIP, LLDP/DCBX, VNTAG/VNIC, VEPA, FabricPath, TRILL, SPBM, OpenFlow, VXLAN
- **Carrier Ethernet:** Link OAM, CFM / Y.1731, PBB/PBB\_TE, E-LMI, 1588v2 (PTP), ESMC, TWAMP
- **Access:** DHCPv4/v6, PPPoX, L2TP, ANCP, IPv6 Autoconfiguration, DHCPv4/v6 over EoGRE, IGMP/MLD, IPTV One-time, AMT
- **Authentication:** 802.1x, WebAuth, EAPoUDP, Cisco NAC

The IxLoad test application provides:

- Ability to run on Ixia's load module and chassis test platforms to transmit and receive control and data plane traffic with the device under test
- A scalable solution for stateful testing with protocol support for: HTTP, SSL, FTP/TFTP, email (SMTP, POP3, IMAP), IPv4, IPv6, VLAN, ER

For more information on IxLoad, please visit the IxLoad product portal at [www.ixiacom.com/products/ixload](http://www.ixiacom.com/products/ixload)

## Specifications

Feature	Dual-Speed, 40/100GbE Accelerated Performance	Dual-Speed, 40/100GbE Reduced Performance
<b>Model name</b>	LavaAP40/100GE2P	LavaAP40/100GE2RP
<b>Ports per module</b>	<ul style="list-style-type: none"> <li>• (2) 100GbE CFP MSA</li> <li>• (2) 40GbE CFP MSA or (4) 40GbE QSFP+ [with dual-port interface adapter]</li> <li>• (2) 100GbE CXP [with interface adapter]</li> </ul>	
<b>Chassis slots per module</b>	1	
<b>Maximum ports per chassis</b>	<ul style="list-style-type: none"> <li>• XGS12-SD 12-slot rackmount: <ul style="list-style-type: none"> <li>◦ (24) 100GbE CFP MSA or (48) 40GbE QSFP+, (12) CXP</li> </ul> </li> <li>• XGS2-SD 2-slot: <ul style="list-style-type: none"> <li>◦ (4) 100GbE CFP MSA or (8) 40GbE QSFP+, (4) CXP</li> </ul> </li> </ul>	
<b>Transceiver support</b>	<ul style="list-style-type: none"> <li>• CFP MSA 1.4, pluggable MMF and SMF optical transceivers</li> <li>• SFF-8436 QSFP+, pluggable, and fiber/copper cables (passive/active) with the QSFP+ interface adapter</li> <li>• CXP MMF optical transceivers and passive, direct attach copper (DAC) cable media with the CXP interface adapter</li> </ul>	
<b>CFP interface adapters</b>	<ul style="list-style-type: none"> <li>• 2-port, CFP-to-QSFP+ for 40GbE operation</li> <li>• 1-port CFP-to-CXP for 100GbE operation</li> </ul>	
<b>Hardware capture buffer per port</b>	1.4GB	
<b>Interface protocols</b>	<ul style="list-style-type: none"> <li>• 40-Gigabit Ethernet 40GBASE-R and 100-Gigabit Ethernet 100GBASE-R, per IEEE802.3ba-2010 standard</li> </ul>	
<b>Layer 2/3 routing protocol emulation</b>	<ul style="list-style-type: none"> <li>• Comprehensive coverage of routing, MPLS, VPLS, high-availability, IP multicast, switching, Data Center/SDN, Carrier Ethernet, and authentication</li> <li>• The Accelerated Performance load module</li> </ul>	<ul style="list-style-type: none"> <li>• Comprehensive coverage of routing, MPLS, VPLS, high-availability, IP multicast, switching, Data Center/SDN, Carrier Ethernet, and authentication</li> <li>• The Reduced Performance load module supports up to</li> </ul>

Feature	Dual-Speed, 40/100GbE Accelerated Performance	Dual-Speed, 40/100GbE Reduced Performance
	supports ultra-high scale and performance for routing protocol emulation per port <ul style="list-style-type: none"> <li>Host/client protocol support: ARP, NDP, ICMP (PING), IPv4, and IPv6</li> </ul>	100 routing protocol emulation sessions and up to 2,000 broadband access emulation sessions per port <ul style="list-style-type: none"> <li>Host/client protocol support: ARP, NDP, ICMP (PING), IPv4, and IPv6</li> </ul>
<b>Layer 4-7 application traffic testing</b>	Yes, with IxLoad support for HTTP, SSL, FTP/TFTP, email (SMTP, POP3, IMAP), IPv4, IPv6, VLAN, ER and AppLibrary for IxNetwork	No
<b>Transmit flows per port (sequential values)</b>	Billions	
<b>Transmit flows per port (arbitrary values)</b>	1 million	
<b>Trackable receive flows per port</b>	1 million	
<b>Stream definitions per port</b>	512 In packet stream (sequential) or advanced stream (interleaved) mode, each stream definition can generate millions of unique traffic flows	
<b>Table UDF entries</b>	512K Comprehensive packet editing function for emulating large numbers of sophisticated flows. Entries of up to 256 bytes, using lists of values, can be specified and placed at designated offsets within a stream. Each list consists of an offset, a size, and a list of values in a table format.	
<b>Packet flow statistics</b>	Track over 1 million flows	
<b>Transmit engine</b>	Wire-speed packet generation with timestamps, sequence numbers, data integrity signature, and packet group signatures	
<b>Receive engine</b>	Wire-speed packet filtering, capturing, real-time latency and inter-arrival time for each packet group, data integrity, and sequence checking	
<b>User defined field features</b>	Fixed, increment or decrement by user-defined step, value list, cascade, random, and chained	

Feature	Dual-Speed, 40/100GbE Accelerated Performance	Dual-Speed, 40/100GbE Reduced Performance
<b>Filters</b>	48-bit source/destination address, 2x128-bit user-definable pattern and offset, frame length range, CRC error, data integrity error, sequence checking error (small, big, reverse)	
<b>Statistics and rates (counter size: 64 bits)</b>	Link state, line speed, frames sent, valid frames received, bytes sent/received, fragments, undersize, oversize, CRC errors, VLAN tagged frames, 6 user-defined stats, capture trigger (UDS 3), capture filter (UDS 4), user-defined stat 5, user-defined stat 6, 8 QoS counters, data integrity frames, data integrity errors, sequence checking frames, sequence checking errors, ARP, and ping requests and replies	
<b>Error generation</b>	CRC (good/bad/none), undersize, oversize	
<b>Latency measurement resolution</b>	2.5 nanoseconds and is compatible with all of Ixia's 10GbE, 1GbE fiber, and 10/100/1000Mbps Ethernet, ATM, and Packet over SONET load modules	
<b>Latency self-calibration</b>	Ability to remove inherent latency from 40/100GbE port electronics when used with MSA or SFF-8436-compliant transceivers	
<b>MDIO</b>	MDIO v1.4 support is provided for CFP MSA-compliant transceivers	
<b>Transmit line clock adjustment</b>	Ability to adjust the parts-per-million line frequency over a range of -100 ppm to +100 ppm	
<b>Layer 1 BERT capability</b>	<p>The load module supports the following BERT features on both 40GbE and 100GbE speeds:</p> <ul style="list-style-type: none"> <li>• User-selected PRBS pattern for each PCS Lane</li> <li>• User selects from a wide range of PRBS data patterns to be transmitted (true and complement) with the ability to invert the patterns</li> <li>• Send single, continuous, and exponentially controlled amounts of error injection</li> <li>• Wide range of statistics, including: Pattern Lock, Pattern Transmitted, Pattern Received, Total Number of Bits Sent and Received, Total Number of Errors Sent and Received, Bit Error Ratio (BER), Number of Mismatched 1's and 0's</li> <li>• Lane Stats Grouping per lambda for SMF and MMF 40GE and 100GE based on IEEE 802.3ba-defined physical medium dependent (PMD)</li> </ul>	
<b>40/100GE Physical Coding Sublayer (PCS) test features</b>	IEEE 802.3ba-2010 compliant PCS transmit and receive side test capabilities include:	

Feature	Dual-Speed, 40/100GbE Accelerated Performance	Dual-Speed, 40/100GbE Reduced Performance
	<ul style="list-style-type: none"> <li>Per PCS lane, transmit lane mapping - Supports all combination of PCS lane mapping: Default, Increment, Decrement, Random, and Custom.</li> <li>Per PCS lane, skew insertion capability - User selectable from zero up to 3 microseconds of PCS Lane skew insertion on the transmit side.</li> <li>Per PCS lane, lane marker, or lane marker and payload error injections - User-selectable ability to inject errors into the PCS Lane Marker and simultaneously into PCS Lane Marker and Payload fields. This includes the ability to inject sync bit errors into the Lane Marker and Payload. User can control the PCS lane, number or errors, period count and manage the repetition of the injected errors.</li> <li>Per PCS lane, receive lanes statistics - PCS Sync Header and Lane Marker Lock, Lane Marker mapping, Relative lane deskew up to 52 microseconds for 40GE and 104 microseconds for 100GE, Sync Header and PCS Lane Marker Error counters, indicators for Loss of Synch Header and Lane Marker, BIP8 errors.</li> </ul>	
<b>IPv4, IPv6, UDP, TCP checksum</b>	Hardware checksum generation and verification	
<b>Frame length controls</b>	Fixed, random, weighted random, or increment by user-defined step, random, weighted random	
<b>Preamble view</b>	Allows the user to select to view and edit the preamble contents	
<b>Link fault signaling</b>	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	
<b>Operating temperature range</b>	41°F to 95°F (5°C to 35°C), ambient air <sup>i</sup>	
<b>Load module dimensions</b>	16.0" (L) x 12.0" (W) x 1.3" (H) 406mm (L) x 305mm (W) x 33mm (H)	
<b>Weight</b>	Module only: 9.8 lbs. (4.45 kg) Shipping: 12.0 lbs. (5.45 kg)	

## Application Support

Dual-Speed, 40/100GE Accelerated Performance	Dual-Speed, 40/100GE Reduced Performance
<b>LavaAP40/100GE2P</b>	<b>LavaAP40/100GE2RP</b>
<b>IxExplorer:</b> Layer 2-3 wire-speed traffic generation and analysis and Layer 1 BERT and IEEE 802.3ba HSE PCS Lanes testing.	
<b>IxNetwork:</b> IxNetwork provides 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, MPLS, VPLS, high-availability, IP multicast, switching, Carrier Ethernet, broadband, and data center bridging protocols.	
<b>IxLoad:</b> A scalable L4-7 stateful traffic test solution for testing converged multiplay services, application delivery platforms, and security devices and systems. IxLoad emulates data, voice, and video subscribers and associated protocols to ensure quality of experience (QoE). <sup>ii</sup>	Not supported
<b>IxNetwork AppLibrary:</b> Introduces a simplified workflow and framework to emulate application profiles created from 1000's of application flows fueled by BreakingPoint ATl. It combines the best features of IxNetwork for protocol emulation and stateless traffic generation with the most current real-world stateful application simulations.	Not supported
<b>Tcl API:</b> Custom user script development for layer 1-3 testing.	

## Product Ordering Information

### Load modules and CFP adapters

#### 944-1067

Xcellon-Lava AP40/100GE2P 40/100 Gigabit Ethernet Accelerated Performance, dual-speed, load module, 2-ports, 1-slot with CFP MSA interfaces and full performance L2-7 support. The load module is compatible with the XGS12-SD 12-slot, standard performance rack mount chassis bundle (940-0011), and the XGS2-SD 2-slot, 3RU standard performance chassis bundle (940-0010).





## 944-1068

Xcellon-Lava 40/100GE2RP, 40/100 Gigabit Ethernet Reduced Performance, dual-speed, load module, 2-ports, 1-slot with CFP MSA interfaces and full featured L1-3 data plane support and up to 100 routing protocol emulations per port. The load module is compatible with the XGS12-SD 12-slot, standard performance rack mount chassis bundle (940-0011), and the XGS2-SD 2-slot, 3RU standard performance chassis bundle (940-0010).



## 948-0023

CFP-to-QSFP+ Dual-Port Interface Adapter. A pluggable, 2-port unit that converts an Ixia Xcellon-Lava CFP MSA port interface to 2-ports of pluggable 40 GE QSFP+ for fiber or copper cable assemblies or standalone transceivers. The adapter is compatible with the Xcellon-Lava 40/100-Gigabit Ethernet, Accelerated Performance, load module (944-1067), Xcellon-Lava 40/100-Gigabit Ethernet, Reduced Performance, load module (944-1068) and the Xcellon-Lava AP40/100GE2P-NG FUSION-enabled 40/100 Gigabit Ethernet Accelerated Performance load module (944-1074)\*. Both load modules accept up to two of the Dual Interface Adapter Modules. \*Note. When the adapter is used with the 944-1074 Xcellon-Lava AP40/100GE2P-NG FUSION load module only one port of the two ports of the adapter are operational at the 40GE speed.



## 948-0027

CFP-to-CXP Interface Adapter Module. A pluggable unit that converts an Ixia CFP MSA port interface to 1-port of the pluggable 100 GE CXP for multimode fiber or copper cable assemblies or standalone transceivers. The adapter is compatible with the Xcellon-Lava 40/100-Gigabit Ethernet, Accelerated Performance, load module (944-1067), Xcellon-Lava 40/100-Gigabit Ethernet, Reduced Performance load module (944-1068) and the Xcellon-Lava AP40/100GE2P-NG FUSION-enabled 40/100-Gigabit Ethernet Accelerated Performance, load module (944-1074).



## Transceivers and cables

### 948-0024

100GBASE-SR10 CFP MSA and IEEE802.3ba-2010 standard compliant Reflex Photonics, MMF, flat top (no heat sink), 10x10G LAN optical transceiver with MPO connector receptacle for the following Ixia 100 GE Higher Speed Ethernet load modules: Xcellon-Lava AP40/100GE2P 40/100GE dual-speed (944-1067), Xcellon-Lava 40/100GE2RP Reduced 40/100GE, dual-speed (944-1068), and Xcellon-Lava AP40/100GE2P-NG FUSION 40/100GE Dual-Speed (944-1074). NOTE: Requires a 24-Fiber MTP MMF cable (942-0035).

### 948-0019

100GBASE-LR4 CFP MSA and IEEE802.3ba-2010 standard compliant Finisar, SMF, flat top (no heat sink), 4x25G LAN-WDM optical transceiver with LC connector receptacles for the following Ixia 100 GE Higher Speed Ethernet load modules: Xcellon LavaAP40/100GE2P (944-1067), Xcellon-Lava 40/100GE2RP Reduced (944-1068), and Xcellon-Lava AP40/100GE2P-NG FUSION 40/100GE Dual-Speed (944-1074).

### 948-0031

QSFP+ 40GE, 40GBASE-SR4 optical transceiver, pluggable, MMF, 850nm. This transceiver is compatible with the following Ixia load modules and CFP-to-QSFP interface adapters: Xcellon-Multis XM10/40GE12QSFP+FAN 40-Gigabit Ethernet QSFP load module (944-1105), Xcellon-Multis XM10/40GE6QSFP+FAN 40-Gigabit Ethernet QSFP load module (944-1109), Xcellon Flex10G/40GSQ 10/40 Gigabit Ethernet Accelerated Performance load module (944-1062), Xcellon-FlexFE40G4Q 40 Gigabit Ethernet Full Emulation load module (944-1065), and the CFP-to-QSFP Dual Interface Adapter, 2-port (948-0023).

### 948-0030

CXP 100GE pluggable, optical transceiver with MPO receptacle for multimode fiber (MMF) 850nm operation. Compatible with Xcellon-Multis (944-1100) XM100GE4CXP CXP 100GE only, and XM100GE4CXP+FAN 100/40GE (944-1101) load modules. This optical transceiver may also be used with Xcellon-Lava AP40/100GE2P Accelerated Performance (944-1067), Xcellon-Lava 40/100GE2RP Reduced Performance (944-1068), and Xcellon-Lava AP40/100GE2P-NG FUSION load modules when used with the CFP-to-CXP Interface adapter module (948-0027).

### 942-0035

MT 24-Fiber Multimode cable for 100GBASE-SR10 100GE optical transceivers with MT Flat F-F connectors, 850nm, 3-meter length

### 942-0041

MT 12-Fiber Multimode cable for 40GBASE-SR4 40GE optical transceivers with MT Flat F-F connectors, 850nm, 3-meter length

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<sup>i</sup> When an Xcellon-Lava load module is installed in an XM12, XM2, XG12, XGS2, or XGS12 chassis, the maximum operating temperature of the chassis is 35°C (ambient air). Only one Xcellon-Lava load module may be installed into the 2-slot XM2 chassis, and the second slot may not have any other Ixia load module installed and must have a chassis slot cover installed.

<sup>ii</sup> The IxLoad application support for this load module is limited to the protocols listed in the Specifications table of this datasheet. The LavaAP40/100GE2RP model (944-1068) is not supported by the IxLoad application.

Learn more at: [www.keysight.com](http://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](http://www.keysight.com/find/contactus)

