16 IXIA Xcellon-Lava Load Modules

This chapter provides specification and feature details of the Xcellon-Lava 40/100 Gigabit Ethernet load modules. This family of load modules consist of the following 3-port cards:

- LavaAP40/100GE 2P
- LavaAP40/100GE 2RP
- LavaAP40/100GE 2P-NG

The Xcellon-Lava 40/100-Gigabit Ethernet load modules belong to the family of Ixia's High Speed Ethernet (HSE) products. These load modules combine the advantages of the Xcellon architecture and provide the highest 40GE and 100GE port densities. Lava load modules can be used for testing layer 1 to layer 7 applications. They are supported by Ixia's test applications, including IxNetwork and IxLoad.

Xcellon-Lava load modules are used for testing high-density data center 40 Gigabit Ethernet (40GbE) and 100 Gigabit Ethernet (100GbE) network equipments. 40GbE and 100GbE are high-speed computer network standards developed by the IEEE 802.3ba. Lava load modules extends the 802.3 protocol to operating speeds of 40 Gbps and 100 Gbps in order to provide greater bandwidth while maintaining maximum compatibility with the installed base of 802.3 interfaces.

Xcellon-Lava load modules are compatible with Ixia's XG12™, XM12, and XM2 chassis, and a broad range of Ethernet interfaces, allowing real-world, layer 1 to layer 7 test and measurement in a single chassis.

LavaAP40/100GE 2P-NG load module has capabilities similar to LavaAP40/100GE 2P and includes N2X support.

The Xcellon-Lava load module is shown in the following figure:

Figure 16-1. Xcellon-Lava Load Module

LED function table

The LED functions are described in the following tables.

Table 16-1. Xcellon-Lava LED Ports

LED Label	Usage
Link	Green if Ethernet link is up (established) or the port is in a forced Link Up state, OFF (no color) if link is down. Link may be down due to no signal or no PCS lock.
Tx Active	Green indicates that Tx is active and frames being sent; red indicates Tx is paused; off indicates Tx is not active.
Rx Active	Green indicates that Rx is active and frames being received; red indicates Rx is paused; off indicates Rx is not active.
Rx/Error	Green indicates valid Rx frames are being received; red indicates error frames being received; off indicates no frames being received.
Pwr Good	Green when power is on, red if power fault occurs.

CFP adapter diagrams

CFP adapter diagrams are as follows:.

The CFP-to-QSFP+ Interface adapter module is shown in the following figure:

Figure 16-2. CFP-to-QSFP+ Interface adapter

The CFP-to-QSFP+ Dual-Port Interface adapter module is shown in the following figure:

Figure 16-3. CFP-to-QSFP+ Dual-Port Interface adapter

The CFP to CXP-Adapter is shown in the following figure:

Figure 16-4. CFP-to-CXP-Adapter.

Part Numbers

The part numbers are shown in *Table 16-2*.

Table 16-2. Part Numbers for Xcellon-Lava Load Module and Supported Adapters

Model Number	Part Number	Description
Lava AP40/ 100GE 2P	944-1067	This is the dual speed 40GE/ 100GE Ethernet Lava load module with Accelerated Performance. Each load module consists of 2-ports and 1-slot with CFP MSA interfaces. This load module supports full feature for layer 1 to layer 7 testing. **Note**: If XM12-01 (941-0002) chassis is used with this load module, the FRU-OPTIXIAXM12-01 (943-0005) power supply upgrade kit must be installed.
Lava AP40/ 100GE 2RP	944-1068	This is the dual speed 40GE/ 100GE Ethernet Lava load module with data plane support only. It is an economic alternative to the Accelerated Performance load module, perfectly suitable for testing layer 1 to layer 3 applications that does not require routing protocol emulation. Each load module consists of 2-ports and 1-slot with CFP MSA interfaces. **Note**: If XM12-01 (941-0002) chassis is used with this load module, the FRU-OPTIXIAXM12-01 (943-0005) power supply upgrade kit must be installed.

Table 16-2. Part Numbers for Xcellon-Lava Load Module and Supported Adapters

Model Number	Part Number	Description
CFP-to-QSFP+ Interface Adapter Module	948-0022	A pluggable unit that converts an Ixia CFP MSA port interface to 1-port of the pluggable 40 GE QSFP+ for multimode fiber or copper cable assemblies or standalone transceivers. The adapter is compatible with the HSE40GETSP1-01, 40-Gigabit Ethernet load module (944-0069), HSE40/100GETSP1-01, 40/100-Gigabit Ethernet, dual-speed, load module (944-0091), HSE40/100GETSPR1-01, 40/100-Gigabit Ethernet, dual-speed, Data Plane Ethernet load module (944-0099), Xcellon-Lava 40/100-Gigabit Ethernet, Accelerated Performance, load module (944-1067) and Xcellon-Lava 40/100-Gigabit Ethernet, Reduced Performance load module (944-1068).

Table 16-2. Part Numbers for Xcellon-Lava Load Module and Supported Adapters

Model Number	Part Number	Description
CFP-to-QSFP+ Dual-Port Interface Adapter Module	948-0023	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) and Xcellon-Lava 40/100-Gigabit Ethernet, Reduced Performance, load module (944-1068). Both load modules accept up to two of the Dual Interface Adapter Modules.
CFP-to-CXP Interface Adapter Module	948-0027	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 HSE100GETSP1-01 100- Gigabit Ethernet load module (944-0070), HSE40/100GETSP1-01, 40/100-Gigabit Ethernet, dual-speed, load module (944-0091), HSE40/100GETSPR1-01, 40/100-Gigabit Ethernet, dual-speed, Data Plane load module (944-0099), Xcellon-Lava 40/100-Gigabit Ethernet, Accelerated Performance, load module (944-1067) and the Xcellon-Lava 40/100-Gigabit Ethernet, Reduced Performance load module (944-1068).

CFP Adapter usage for Xcellon-Lava Ethernet Load Modules

Table 16-3. The CFP Slot #1 specification

Adapter Present	CFP Mode	Speed	Port(s) Available
948-0027	Single	100G/40G	Port 1
	Dual	N/A	Not Supported
948-0022	Single	40G	Port #1
	Dual	40G	Port #3
948-0023	Single	40G	Top port: Unavailable Bottom port: Port #1
	Dual	40G	Top port: Port #4 Bottom port: Port #3

Table 16-4. The CFP Slot #2 specification

Adapter Present	CFP Mode	Speed	Port(s) Available
948-0027	Single	100G/40G	Port 2
	Dual	40G	Not Supported
948-0022	Single	40G	Port #2
	Dual	40G	Port #5
948-0023	Single	40G	Top port: Unavailable Bottom port: Port #2
	Dual	40G	Top port: Port #6 Bottom port: Port #5

CFP Mode

The CFP mode can be of two types:

- **Single Port Operation**: CFP provides one port of 40G or 100G. Speed is selected in a Port Property.
- **Dual Port Operation**: CFP provides two ports of 40G, when using CFP-to-QSFP+ Dual-Port Interface Adapter.

Dual Port Operations has following limitations:

- BERT functionality not available
- Capture buffer is half the capacity of Single Port Operation.
- Max Streams supported = 256
- “No CRC” option not supported
- Value List memory is half that of Single Port Operation

- TX Flow sequence memory is half that of Single Port Operation
- Sequence Checking memory is half that of Single Port Operation
- PPM adjustment is per CFP (pair of QSFP+ ports)
- DCE support not available at this time
- Front panel LEDs not functional

Specifications

The load module specifications are described in the following table:

Table 16-5. Xcellon-Lava Ethernet Load Module Specifications

Feature	LavaAP40/100GE 2P	LavaAP40/100GE 2RP
Load Modules	LavaAP40/100GE 2P	LavaAP40/100GE 2RP
Number of ports per module	2-100GE CFP MSA 2-40GE CFP MSA or (4) 40GE QSFP+ [with interface adapter]	2-100GE CFP MSA 2-40GE CFP MSA or (4) 40GE QSFP+ [with interface adapter]
Number of chassis slots per module	1	1
Chassis Support	XG12™ XM12 XM2	XG12™ XM12 XM2
Maximum ports per chassis	XG12™: (24) 100GE CFP MSA and (48) 40GE QSFP+ XM12: (20) 100GE CFP MSA and (40) 40GE QSFP+ XM2: (2) 100GE CFP MSA and (4) 40GE QSFP+	XG12™: (24) 100GE CFP MSA and (48) 40GE QSFP+ XM12: (20) 100GE CFP MSA and (40) 40GE QSFP+ XM2: (2) 100GE CFP MSA and (4) 40GE QSFP+
Capture buffer size	1.4 GB	1.4 GB
Streams per port	256. **Note**: In packet stream (sequential) or advanced stream (interleaved) mode, each stream definition can generate millions of unique traffic flows. In the Data Center mode, the number of transmit streams is 256.	
Latency	Standard resolution in packet timestamp is 20ns. User selectable high resolution in packet timestamp is 2.5ns	No

Feature	LavaAP40/100GE 2P	LavaAP40/100GE 2RP
Transceiver support	• CFP MSA 1.4, pluggable • SFF-8436 QSFP+, pluggable fiber/copper cables (passive/ active) with adapter	
CFP interface adapters	• 1-port, CFP-to-QSFP+ for 40GE • 2-port, CFP-to-QSFP+ for 40GE • 1-port CFP-to-CXP for 100GE operation	
Hardware capture buffer per port	1.4 GB	
Interface protocols	40-Gigabit Ethernet 40GBASE-R and 100-Gigabit Ethernet 100GBASE-R as per IEEE802.3ba-2010 standard	
Layer 2/3 routing protocol emulation	The following protocols are supported in LavaAP40/100GE 2P Full Performance load module: • **MPLS**: RSVP-TE, RSVP-TE P2MP, LDP, PWE, L3 MPLS VPN, 6VP, MPLSTP • **Routing**: RIP, RIPng, OSPFv2/v3, ISISv4/v6, EIGRP, EIGRPv6, BGP-4,BGP+ • **VPLS**: 6PE, BGP Auto-Discovery with LDP FEC 129 Support, VPLS-LDP, VPLS-BGP • **IP Multicast**: IGMPv1/v2/v3, MLDv1/v2, PIM-SM/SSM, PIM-BSR, Multicast VPN, VPNv6 • **Switching**: STP/RSTP, MSTP, PVST+/RPVST+, LACP • **Carrier Ethernet**: Link OAM, CFM, Service OAM, PBT/PBB-TE, SyncE, IEEE 1588v2 PTP • **High-Availability**: BFD The following Host/Client protocols are supported in LavaAP40/ 100GE2 RP Full Performance load module: • ARP • NDP • ICMP (PING) • IPv4 • IPv6	
Layer 4-7 application traffic testing	This is suppoted only in LavaAP40/100GE 2P Accelerated Performance load module.	
Transmit flows per port (sequential values)	Billions	Billions
Transmit flows per port	1 million	1 million
Trackable receive flows per port	1 million	1 million
Table UDF entries	512K **Note**: Comprehensive packet editing function for emulating large numbers of sophisticated flows is supported by Xcellon-Lava load module. 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.	

Feature	LavaAP40/100GE 2P	LavaAP40/100GE 2RP
Packet flow statistics	Xcellon-Lava load module tracks over 1 million flows.	
Transmit engine	The Xcellon-Lava load module supports wire-speed packet generation with timestamps, sequence numbers, data integrity signature, and packet group signatures.	
Receive engine	The Xcellon-Lava load module supports wire-speed packet filtering, capturing, realtime latency and inter-arrival time for each packet group, data Integrity, and sequence checking.	
User Defined Field (UDF) Features	The Xcellon-Lava load module supports the UDF features of fixed, increment or decrement by user-defined step, value list, cascade, random, and chained.	
Filters	The Xcellon-Lava load module uses 48-bit source/destination address, 2x128-bit userdefinable pattern and offset, frame length range, CRC error, data integrity error, sequence checking error (small, big, reverse)	
Error Generation	CRC (good/bad/none), undersize, oversize	
Transmit Line Clock Adjustment	Xcellon-Lava load module has the ability to adjust the parts per million (ppm) line frequency over a range of -100 ppm to +100 ppm.	
Latency measurements	Standard resolution in packet timestamp is 20ns. User selectable high resolution in packet timestamp is 2.5ns	
Layer 1 BERT capability	The Xcellon-Lava load module supports the following BERT features on both 40 GE and 100 GE speeds: • User selected PRBS pattern for each PCS Lane • User can select from a wide range of PRBS data patterns to be transmitted with the ability to invert the patterns • Send single, continuous, and exponentially controlled amounts of error injection • 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), and Number of Mismatched 1's and 0's. • Lane Stats Grouping per lambda for SMF and MMF 40GE and 100GE based on IEEE 802.3ba defined physical medium dependent (PMD).	

Feature	LavaAP40/100GE 2P	LavaAP40/100GE 2RP
40/100 GE Physical Coding Sublayer (PCS) test features	The Xcellon-Lava load module supports IEEE 802.3ba compliant PCS transmit and receive side test capabilities. The supported PCS features are as follows: • **Per PCS lane, transmit lane mapping**: Supports all combination of PCS lane mapping: Default, Increment, Decrement, Random, and Custom. • **Per PCS lane, skew insertion capability**: User selectable from zero up to 3 microseconds of PCS Lane skew insertion on the transmit side. • **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. • **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, and BIP8 errors.	
IPv4, IPv6, UDP, TCP checksum	Xcellon-Lava load module supports hardware checksum generation and verification.	
Frame length controls	Xcellon-Lava load module supports fixed, random, weighted random, or increment by user-defined step, random, and weighted random.	
Preamble view	Xcellon-Lava load module allows to select to view and edit the preamble contents.	
Link Fault Signaling	Xcellon-Lava load module generates 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.	
Operating temperature range	41°F to 95°F (5°C to 35°C), ambient air **Note**: When an Xcellon-Lava load module is installed in an XM12, XM2, or XG12 chassis, the maximum operating temperature of the chassis is 35°C (ambient air).	
Load module dimensions	16.0" (L) x 12.0" (W) x 1.3" (H) 406mm (L) x 305mm (W) x 33mm (H)	
Weight	Module only: 9.8 lbs (4.45 kg) Shipping: 12.0 lbs (5.45 kg)	
ppm Adjust range	+/-100ppm	+/-100ppm
ppm Adjust port/card	Card	Card
Trigger out	No	No
External Clock In(Frequence)	No	No

Feature	LavaAP40/100GE 2P	LavaAP40/100GE 2RP
External Clock Out	No	No
Ambient Operating Temperature Range (C)	5-40	5-40
Timestamp - Resolution	20ns	20ns
Timestamp - High Resolution	No	No
Timestamp - End of Frame Instrumentation	No	No
Timestamp - Floating Intrumentation	No	No
IEEE802.3x Flow control	No	No
WAN	No	No
Streams per port	16	16
Number of streams in Advanced Scheduler Mode (Data Center Mode)	16	16
Transicevier Intrinsic Latency Calibration	No	No
Intrinsic Latency	Yes	Yes
Data Integrity	Yes	Yes
Auto Instrumentation	Yes	Yes
Preamble - Changeable Content	No	No
Preamble - Byte Count Mode	No	No
Preamble - SFD Detect Mode	Yes	Yes
Preamble - Cisco CDL Mode	No	No

The Ixia application support for Lava AP40/100GE 2P and Lava AP40/100GE 2RP is provided in the following table:

Table 16-6. Xcellon-Lava Application Support

Lava AP40/100GE 2P	Lava AP40/100GE 2RP
IxExplorer	IxExplorer
IxNetwork	IxNetwork
IxAutomate	IxAutomate
TCL API	TCL API

Updated enumerated types in API for LavaAP support in IxN2X

AgtPortSelector ModuleType

- AGT_CARD_TWOPORT_100GBASE_R
- AGT_CARD_TWOPORT_40GBASE_R

AgtPortSelector Personality

Please note that the port speed is selected by the personality

- AGT_PERSONALITY_100GBASE_R
- AGT_PERSONALITY_40GBASE_R

AgtEthernetLinkMode

- AGT_ETHERNET_LINK_40G_FULLDUPLEX,
- AGT_ETHERNET_LINK_100G_FULLDUPLEX

EAgtPluginMediaType

- AGT_PLUGIN_CXP
- AGT_PLUGIN_QSFP
- AGT_PLUGIN_CFP

EAgtPcsStatus

- AGT_PCS_STATUS_SYNC_ERROR
- AGT_PCS_STATUS_ILLEGAL_CODE
- AGT_PCS_STATUS_ILLEGAL_IDLE
- AGT_PCS_STATUS_EXTENDED_ERROR_MASK
- AGT_PCS_STATUS_ALL_ERROR_MASK

Note: The Xcellon-Lava AP is a CFP module. CFP-to-CXP and CFP-to-QSFP adaptors are available separately.

2x40 QSFP adaptor

N2X only supports single port mode, even with the dual-port adaptors. In a vertical orientation, it is the bottom port in each adaptor that is supported by N2X and the upper port is inactive.

Single Port Mode: Single and Dual CFP-to-QSFP+ adapter module configurations