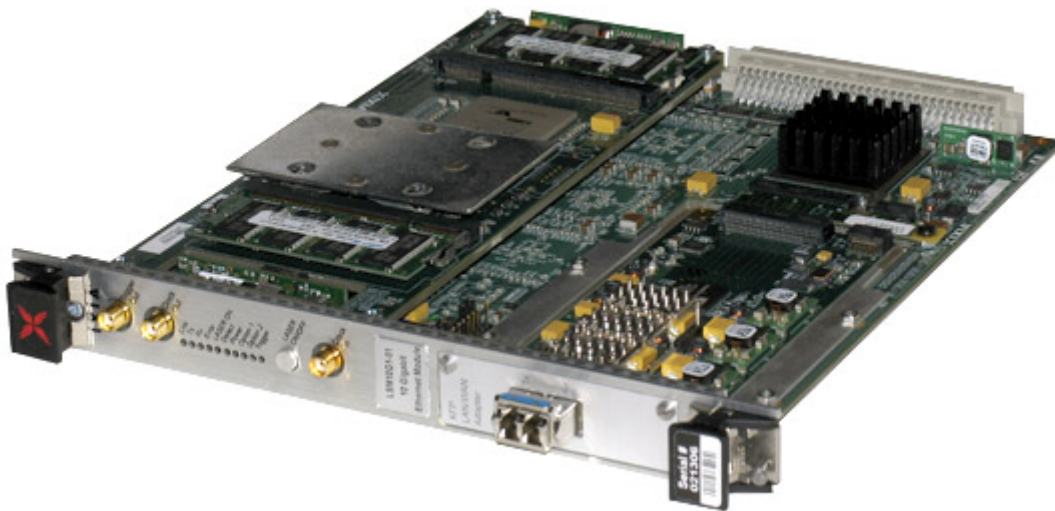


# 10 Gigabit Ethernet LAN Services Module for SFP+/XFP/10GBASE-T/CX4/XENPAK/X2

The Ixia 10 Gigabit Ethernet LAN Service Module (LSM) offers unprecedented scalability, performance, and service testing flexibility. The Ixia 10GE LSM is Ixia's third generation 10 Gigabit Ethernet LAN/WAN solution. This 10GE test platform offers a wide range of pluggable 10GE port interface technologies, and enables a broad portfolio of edge/core testing solutions for the most demanding test environments, including performance, scalability, and conformance testing of Layer 2-3 routing protocols and high performance Layer 4-7 testing. It supports wire-speed 10 Gbps IPv4/v6 traffic generation and advanced analysis, as well as IPv4/v6 routing and bridging protocol emulation.

The Ixia 10GE LSM supports a comprehensive portfolio of service testing solutions for the next generation service provider networks, including Metro Ethernet E-LAN and E-LINE services; and MPLS VPNs, such as Layer 2 VPNs, Layer 3 RFC 2547 VPNs, and VPLS.



## Key Features

- A flexible 10GE test solution that can be used in Ixia's standard form factor chassis and in the XM form factor chassis via a card adapter.
- Supports traffic generation of millions of unique flows, eliminating the need to aggregate multiple 10GE test interfaces to perform high scalability tests
- Tracks and analyzes up to 2 million flows for real-time latency, inter-arrival time, packet loss, data integrity, and sequence checking
- Comprehensive and integrated data plane and control plane traffic generation and analysis for IPv4/v6 routing protocols, L2/L3 MPLS VPNs, multicast, and L4-7 testing
- Sophisticated multi-protocol encapsulation and label stacking, including IPv4/v6, GRE, MPLS, IP over IP, and QinQ (stacked VLANs)
- Supports SFP+, 10GBASE-T, XFP, XFP-CX4, X2 and XENPAK via an array of interchangeable interface adapter modules

## General Interface Specifications

Load Module	LSM10G1-01	LSM10GXL6-02	LSM10GL1-01
Number of Ports	1	6	1
Number of Slots	1	1	1
Maximum Ports per Chassis	16	60	16
Pluggable Interface	SFP+, XFP, XFP-CX4, X2 or XENPAK	XFP	SFP+, XFP, XFP-CX4, X2 or XENPAK
Functionality <sup>1</sup>	LAN/WAN	LAN/WAN	LAN/WAN
Routing Protocol Emulation and Application Support	Yes	Yes	No
Capture Buffer (per port)	350 MBytes with configurable trigger and filter conditions		
Number of Trackable Flows (per port)	Up to 2 million		
Number of Streams	256 in either Packet Stream (sequential) or Advanced Stream (interleaved) modes		

<sup>1</sup> 10GbE WAN mode is supported with XFP and SFP+ transceivers with the exception of SFP+ for 10GBASE-LRM  
 26601 Agoura Rd. Calabasas, CA 91302

<b>Transmit Engine</b>	Built-in FPGA logic for wire-speed packet generation with timestamps, sequence numbers, data integrity signature, and packet group signatures
<b>Receive Engine</b>	Built-in FPGA logic for 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 lists, range lists, cascade, random, and chained
<b>Table UDF Feature</b>	Comprehensive packet editing function for emulating large numbers of sophisticated flows. Up to one million entries of up to 256 bytes of lists of values can be specified to be 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>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>Data Field (per stream)</b>	Fixed, increment (Byte/Word), decrement (Byte/Word), random, repeating, user-specified up to 13K bytes
<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, User-Defined Stat 1, User-Defined Stat 2, 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>Packet Flow Statistics</b>	Real-time statistics to track up to 2 million packet flows
<b>Latency Measurements</b>	20 ns resolution
<b>IPv4, IPV6, UDP, TCP</b>	Hardware checksum generation
<b>Frame Length Controls</b>	Fixed, random, weighted random, or increment by user-defined step, random, weighted random

### Applications

<b>LSM10G1-01</b>	<b>LSM10GXL6-02</b>	<b>LSM10GL1-01</b>
<p>IxLoad, IxChariot®: Layer 4-7 performance testing                      IxNetwork: integrated Layer 2-3 data/control plane performance and functional testing.                      Routing/bridging emulation includes: BGP4/4+, OSPFv2/v3, IS-ISv4/v6, RIP/RIPng, RSVP-TE, LDP, L2 MPLS VPNs, L3 MPLS VPNs, VPLS, IGMPv1/v2/v3, MLDv1/v2, PIM-SMv4/v6, STP, RSTP, and MSTP                      IxAutomate: Automated test environment for Layer 2-3 data and control plane testing                      IxAccess: Broadband access performance testing, including PPPoX and L2TPv2/v3                      IxAuthenticate: 802.1x authentication performance testing</p>		<p>No Layer 4-7 Support                      IxNetwork: integrated Layer 2-3 data plane performance and functional testing. No control plane and protocol support.                      IxAutomate: Automated test environment for Layer 2-3 data plane testing. No control plane and protocol support.</p>
<p>IxExplorer: Layer 2-3 wire-speed traffic generation and analysis                      Tcl API: Custom user script development for Layer 2-7 testing                      Linux Software Development Kit (SDK): Custom user application development. Full TCP/IP connectivity through management interface (Telnet, FTP, etc.)</p>		

### Flexible Packet Generation

Traffic is generated in real time by intelligent logic implemented in FPGAs on each Ixia port. Data is generated on each port by defining up to 256 streams. Within each stream, millions of packets or unique flows can be configured with completely customizable characteristics for every packet header field. Customizable payload contents can also be defined. Frame size can be fixed, varied according to a pattern, or be randomly assigned across a weighted range.

### Real-Time Latency and Jitter Analysis

Packets representing different traffic profiles can be associated Jitter Analysis with Packet Group Identifiers (PGIDs). The receive port measures the minimum, maximum, and average latency or packet inter-arrival time in real time for each packet belonging to different groups. Measurable latencies include:

- Instantaneous latency or inter-arrival time, where each packet is associated with one group ID
- Latency bins, where PGIDs can be associated with a latency range

- Latency over time, where multiple PGIDs can be placed in "Time Buckets" with fixed durations
- First and Last Timestamps, where each PGID can store the timestamps of first and last received packets

### **Transmit Scheduler**

There are two modes of transmission available - Packet Streams and Advanced Stream Scheduler:

#### **Packet Streams**

The packet streams transmit engine allows generation of up to 256 unique streams on each port. Multiple streams can be defined in sequence containing multiple packets with custom characteristics. After transmission of all packets in the first stream, control is passed to the next defined stream in the sequence. After reaching the last stream in the sequence, transmission may either cease or control may be passed on to any other stream in the sequence. In this way, multiple streams are cycled through, each representing different traffic profiles to simulate real-world traffic.

#### **Advanced Stream Scheduler**

Up to 256 unique streams can be interleaved per port, each having its own packet characteristics and rate. For example, assume that Port 1 is configured with three streams. If Stream 1 is defined with IP packets at 20% of line utilization, and Stream 2 is defined with TCP packets at 50% of line utilization, and Stream 3 is defined with MPLS packets at 30% of line utilization, then data on Port 1 will be transmitted at an aggregate utilization of 100% with interleaved IP, TCP, and MPLS packets.

#### **Extensive Statistics**

- Real-time 64-bit counts and frame rates
- Spreadsheet format for convenient manipulation of statistics counters
- Eight Quality of Service (QoS) counters (supporting 802.1p, DSCP, and IPv4 TOS)
- Up to six user-defined statistics that use a trigger condition
- Extended statistics for ARP, ICMP, BGP, OSPF, IS-IS, RSVP-TE, and LDP
- TX stream statistics for transmit frame count and rate
- External file logging for statistics and alerts
- Audible and visual alerts with user-definable thresholds

### **Data Capture**

Each 10 Gigabit Ethernet port is equipped with 350 MB of capture memory. The capture buffer can be configured to store packets based on user-defined trigger and filter conditions. Decodes for IPv4, IPv6, UDP, ARP, BGP-4, IS-IS, OSPF, TCP, DHCP, IPX, RIP, IGMP, CISCO ISL, VLAN, and MPLS are provided.

### **Routing/Bridging Protocol Emulation**

The 10GE LSM Load Modules support Ixia's routing/bridging protocol emulation suites via the IxNetwork application, including IPv4/IPv6 routing (BGP-4, OSPF, IS-IS, and RIP), MPLS (RSVP-TE, LDP, L2 MPLS VPNs, L3 MPLS VPNs, and VPLS), multicast protocols (IGMP, MLD, and PIM-SM), and bridging protocols (STP, RSTP, MSTP). Highly scalable scenarios can be created, emulating up to thousands of routers advertising millions of routes per 10GE LSM port. Up to wire-speed Layer 2/3 traffic can be automatically created to target routes and MPLS LSPs.

### **Data Integrity**

As packets traverse through routers and the IP header contents are changed, the CRC value is recalculated by the router. To validate router performance, the 10 Gigabit Ethernet data integrity function allows packet payload contents to be verified with a unique CRC that is independent of the packet CRC. This ensures that the payload is not disturbed as the router changes header fields.

### **Sequence and Duplicate Packet Checking**

Sequence numbers can be inserted at a user-defined offset in the payload of each transmitted packet. Upon receipt of the packets through the Device Under Test (DUT), out-of-sequence errors, or duplicated packets, are reported in real time at wire-speed rates. The user can define a sequence error threshold to distinguish between small versus big errors, and the receive port can measure the amount of small, big, reversed, and total errors. Alternatively, the user can use the duplicate packet detection mode to observe that multiple packets with the same sequence number are received and analyzed.

### **In-Line Network Monitoring**

The 10 Gigabit LSM Load Modules with XFP transceiver can be configured to be used in-line with the network and can passively monitor at full wire speed. This is a very useful feature for network troubleshooting, and it eliminates the need for optical splitters.

## MDIO

A Management Data Input/Output (MDIO) interface is provided to the user directly through the industry standard 70pin XENPAK connector. The Ixia Load Module acts as the Station Management entity (STA), and can control one or more MDIO Manageable Devices (MMD) within a XENPAK transceiver. Multiple MMDs can be attached to the interface. The user can set and read the MDIO control/status registers inside a MMD via a Graphical User Interface.

## Tcl API

Ixia's 10 GE LSMs are supported by a full Tcl Application Programming Interface (API). This API allows users to develop custom scripts and integrate the modules into automated test environments.

## Custom Applications

The Linux Software Development Kit (SDK) enables existing Linux applications to be compiled and run on the 10 GE LSMs that have a PowerPC. Additionally, users can develop custom applications that can be integrated into the Ixia test environment.

## Product Ordering Information

### 944-0003 LSM10GXL6-02

10 Gigabit Ethernet Load Module, 6-port LAN/WAN, for OPTIXIAXL10 chassis, 1GHz PowerPC processor with 512MB, Full Features, supports Routing and Linux-based applications; REQUIRES six XFP transceivers, options include XFP-1310 and XFP-1550

### 944-0022 LSM10G1-01

1-port 10GE LAN/WAN, single slot, full-featured load module. Supports routing/bridging protocols, Linux SDK, and L4-L7 Applications. Requires XENPAK, XFP, XFP, X2, 10GBASE-T, or SFP+ adapter module and matching transceiver or Direct Attach Cable.

### 944-0024 LSM10GL1

1-port, 10GE LAN/WAN, single slot, L2/3 data plan only load module. Does not support routing/bridging protocols or L4-L7 Applications. Requires XENPAK, XFP, X2, 10GBASE-T, or SFP+ adapter module and matching transceiver or Direct Attach Cable

## 10GE Adapter Module Ordering Information

### 948-0012 SFP+ADAP

SFP+ 10 Gigabit Ethernet Adapter Module, SFP+ LAN/WAN, for 944-0022 (LSM10G1-01) and 944-0024 (LSM10GL1-01) load modules. Requires one SFP+ transceiver or Direct Attach Cable assembly.

### 948-0002 XFP-ADAP

XFP 10 Gigabit Ethernet Adapter Module, LAN/WAN, for 944-0022 (LSM10G1-01) and 944-0024 (LSM10GL1-01) load modules. Requires one XFP transceiver.

### 948-0007 XENPAK-ADAP

XENPAK 10 Gigabit Ethernet Adapter Module for 944-0022 (LSM10G1-01) and 944-0024 (LSM10GL1-01) load modules.. Requires one XENPAK transceiver.

### 948-0008 X2-ADAP

X2 10 Gigabit Ethernet Adapter Module, LAN/WAN, for 944-0022 (LSM10G1-01) and 944-0024 (LSM10GL1-01) load modules Requires one X2 transceiver.

## 10GE Transceiver Ordering Information

### SFP+ transceiver and Direct Attach Cable options for LSM10G1-01 and LSM10GL1-01 load modules:

- **948-0013** SFP+10GBASE-SR/SW, Accessory, SFP+ transceiver for 10 Gigabit Ethernet LAN/WAN load modules with pluggable SFP+ interface, 850nm
- **948-0014** SFP+10GBASE-LR/LW, Accessory, SFP+ transceiver for 10 Gigabit Ethernet LAN/WAN load modules with pluggable SFP+ interface, 1310nm
- **948-0015** SFP+10GBASE-LRM, Accessory, SFP+ transceiver for 10 Gigabit Ethernet LAN/WAN load modules with pluggable SFP+ interface, For multimode fiber, 1300nm<sup>4</sup>
- **948-0016** SFP+10GSFP+Cu, Accessory, passive, Direct Attach Cable Assembly for 10 Gigabit Ethernet LAN/WAN load modules with pluggable SFP+ interface, copper twinaxial, 3 meter length

<sup>4</sup>The 948-0015 SFP+ transceiver for 10GBASE-LRM only supports the 10 Gigabit Ethernet in the LAN mode.

**XENPAK and X2 transceiver options for LSM10G1-01 and LSM10GL1-01 load modules:**

- **XENPAK-ER10GBASE-ER**, Accessory, XENPAK transceiver for 10 Gigabit Ethernet LAN/WAN load modules with pluggable XENPAK interface, 1550nm
- **XENPAK-LR 10GBASE-LR**, Accessory, XENPAK transceiver for 10 Gigabit Ethernet LAN/WAN load modules with pluggable XENPAK interface, 1310nm
- **XENPAK-SR10GBASE-SR**, Accessory, XENPAK transceiver for 10 Gigabit Ethernet LAN/WAN load modules with pluggable XENPAK interface, 850nm
- **948-0010** 10GBASE-LR, Accessory, X2 transceiver for 10 Gigabit Ethernet LAN/WAN load modules with pluggable XENPAK interface, 1310nm

**10GBASE-CX4 transceiver options for LSM10G1-01 and LSM10GL1-01 load modules:**

- **948-0006 CX4 XENPAK Adapter-Passive** Passive (No re-timing) CX4 XENPAK Adapter; Operates with 948-0007 (XENPAK-ADAP) adapter module
- **XENPAK-CX4** XENPAK Transceiver, CX4 interface (10GBASE-CX4); for the 944-0022 (LSM10G1) or 944-0024 (LSM10GL1) with the 948-0007 (XENPAK-ADAP) adapter module
- **948-0011 XFP-CX4** XFP Transceiver, CX4 interface (10GBASE-CX4); for the 944-0022 (LSM10G1) or 944-0024 (LSM10GL1) with 948-0001 (XFP-ADAP-01) or 948-0002 (XFP-ADAP-02), LSM10GXL6-01, 944-0012 (MSM10G1-02), 944-0003 (LSM10GXL6-02), 944-0004 (LSM10GXM3-01), and 944-0005 (LSM10GXMR3-01)

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