

# 25

## *IXIA 10 Gigabit Ethernet Load Modules*

This chapter provides details about 10 Gigabit Ethernet (10GE) family of load modules—the specifications and features.

The 10 Gigabit Ethernet (10GE) family of load modules implements five of the seven IEEE 8.2.3ae compliant interfaces that run at 10Gbit/second. Cards are available which offer the following interfaces:

- 10GE LAN
- 10GE WAN
- XAUI
- XENPAK - with options for XPAK or X2 transceiver use.

[Figure 25-1](#) on page 25-2 shows an LM10GEXENPAK module.

Figure 25-1. LM10GEXENPAK



In addition, two families of multimode card are available which offers combined 10GE LAN/WAN, OC192 POS, BERT, and FEC functionality. The features available for these load modules are described in Chapter 26, *IXIA 10GE LAN/WAN and OC 192 POS Load Modules*.

The full details for these families may be found at:

- *LSM 10GE Family* on page 25-2
- *10GE LAN Family* on page 25-22.
- *XAUI Family* on page 25-25
- *XENPAK Family* on page 25-30

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## LSM 10GE Family

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 solution. It is the industry's first six-port solution, and it offers 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 IPv4 and IPv6 wire-speed traffic generation, advanced analysis and IPv4 and IPv6 routing protocol emulation.

The Ixia 10GE LSM supports a comprehensive portfolio of service testing solutions for the next-generation service provider networks including Metro

**IXIA 10 Gigabit Ethernet Load Modules**  
**LSM 10GE Family**

Ethernet E-LAN and E-LINE services; and MPLS VPNs such as Layer 2 VPNs, Layer 3 RFC 2547 VPNs, and VPLS.

Figure 25-2. LSM10GXM8-01 NGY Load Module



Figure 25-3. LSM10GXL6-01 Load Module



Figure 25-4. LSM10GXM3-01 Load Module



Figure 25-5. LSM10GL1-01(XENPAK Carrier Card)

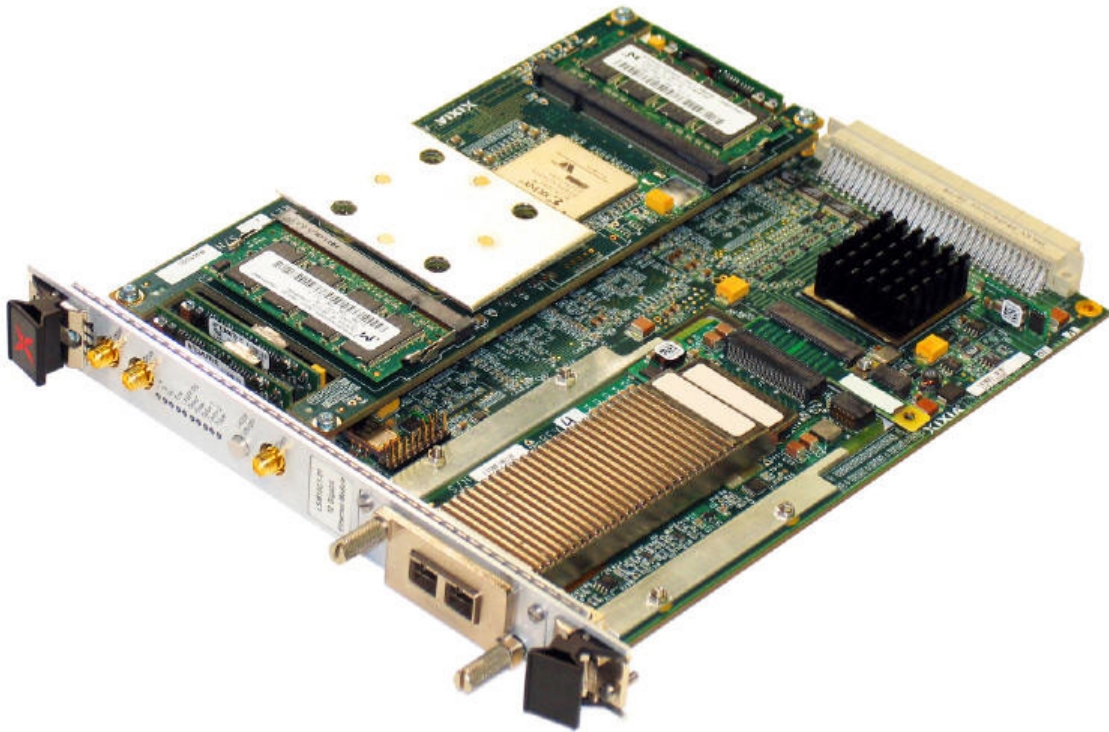
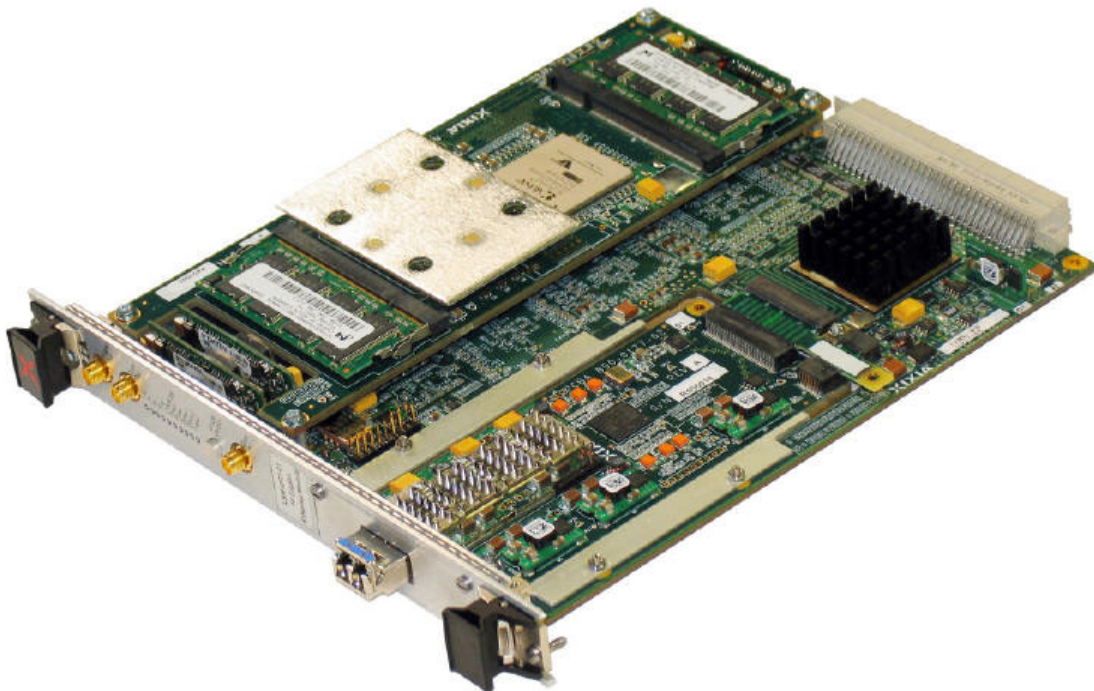


Figure 25-6. LSM10GMS-01(MACsec Carrier Card)



Figure 25-7. LSM10GL1-01 (XFP Carrier Card)



## Part Numbers

The LSM family part numbers are shown in [Table 25-1](#).

Table 25-1. 10GE LSM modules

Load Module	Part Number	Description
10GE LSM	LSM10G1-01	1-port 10GE, single slot, full-featured load module. Supports routing protocols, Linux SDK, and L4-7 applications (requires XENPAK or XFP adapter and matching transceiver).
10GE LSM LAN XFP	LSM10GL1-01	1-port, single slot, L2/L3 only, does not support routing protocols and L4-7 applications (requires XENPAK or XFP adapter and matching transceiver).
10GE LSM MACSec	LSM10GMS-01	1-port 10GE, single slot, full-featured load module. Supports routing protocols, Linux SDK, and L4-7 applications. Supports MACSec functionality for stream generated traffic. XFP LAN/WAN carrier card is integrated.
10GE LSM XL6	LSM10GXL6-01, -02	6-port 10GE, single slot, full featured LAN load module for Optixia XL10. Supports routing protocols, Linux SDK, and L4-7 applications (does not include XFP transceivers).
10GE LSM XM3	LSM10GXM3-01	3-Port 10GE, single slot, full-featured load module. Supports routing protocols, Linux SDK, and L4-7 applications.
10GE LSM XMR3	LSM10GXMR3-01	3-Port 10GE, single slot, reduced-featured load module. Supports Linux SDK and L4-7 applications.
10GE LSM XM8	LSM10GXM8-01	NGY 8-port 10GE, single slot, full-featured load module 800MHz, 512MB. Full L2/7 support. Linux SDK, and L4-7 applications.
10GE LSM XMR8	LSM10GXMR8-01	NGY 8-port 10GE, 400MHz, 128MB single slot, reduced L2/3 support with limited L3 routing, Linux SDK, and L4-7 applications. Includes 10GBASE-T version.
10GE LSM XMR8 10GBASE-T	LSM10GXMR8GBT-01	
10GE LSM XM8XP	LSM10GXM8XP-01	NGY 8-port 10GE, 800MHz, 1GB, Extra Performance. Includes 10GBASE-T version.
10GE LSM XM8 10GBASE-T	LSM10GXM8GBT-01	
10GE LSM XM8S	LSM10GXM8S-01	NGY 8-port 10GE, LAN/WAN, SFP+ interface with 1GB RAM per port; for OPTIXIA XM12-02 and OPTIXIA XM2-02 chassis; full L2/7 support. Requires one or more SFP+ transceiver options: 10GBASE-SR, 10GBASE-LR, 10GBASE-LRM, or 10GSFP+Cu.

Table 25-1. 10GE LSM modules

<b>Load Module</b>	<b>Part Number</b>	<b>Description</b>
10GE LSM XMR8S	LSM10GXMR8S-01	Same as 10GE LSM XM8S but reduced L2/3 support with limited L3 routing.
NGY-NP8-01	NGY-NP8-01	10 Gigabit Application Network Processor Load Module, 8-Port LAN/WAN, SFP+ interface.
10GE LSM XM4	LSM10GXM4-01	NGY 4-port 10GE, single slot, full-featured load module 800MHz, 512MB. Full L2/7 support. Linux SDK, and L4-7 applications.
10GE LSM XMR4 10GE LSM XMR4 10GBASE-T	LSM10GXMR4-01 LSM10GXMR4GBT-01	NGY 4-port 10GE, 400MHz, 128MB, single slot, reduced L2/3 support with limited L3 routing, Linux SDK, and L4-7 applications. Includes 10GBASE-T version.
10GE LSM XM4XP 10GE LSM XM4 10GBASE-T	LSM10GXM4XP-01 LSM10GXM4GBT-01	NGY 4-port 10GE, 1GHz, 1GB, Extra Performance. Includes 10GBASE-T version.
10GE LSM XM4S	LSM10GXM4S-01	NGY 4-port 10GE, LAN/WAN, SFP+ interface with 1GB RAM per port; for OPTIXIA XM12-02 and OPTIXIA XM2-02 chassis; full L2/7 support. Requires one or more SFP+ transceiver options: 10GBASE-SR, 10GBASE-LR, 10GBASE-LRM, or 10GSFP+Cu.
10GE LSM XMR4S	LSM10GXMR4S-01	Same as 10GE LSM XM4S but reduced L2/3 support with limited L3 routing.
NGY-NP4-01	NGY-NP4-01	10 Gigabit Application Network Processor Load Module, 4-Port LAN/WAN, SFP+ interface.
10GE LSM XM2XP 10GE LSM XM2 10GBASE-T	LSM10GXM2XP-01 LSM10GXM2GBT-01	NGY 2-port 10GE, 1GHz, 1GB, Extra Performance. Includes 10GBASE-T version.
10GE LSM XMR2 10GE LSM XMR2 10GBASE-T	LSM10GXMR2-01 LSM10GXMR2GBT-01	NGY 2-port 10GE, 400MHz, 128MB, single slot, reduced L2/3 support with limited L3 routing, Linux SDK, and L4-7 applications. Includes 10GBASE-T version.
10GE LSM XM2S	LSM10GXM2S-01	NGY 2-port 10GE, LAN/WAN, SFP+ interface with 1GB RAM per port; for OPTIXIA XM12-02 and OPTIXIA XM2-02 chassis; full L2/7 support. Requires one or more SFP+ transceivers: 10GBASE-SR, 10GBASE-LR, 10GBASE-LRM, or 10GSFP+Cu.
10GE LSM XMR2S	LSM10GXMR2S-01	Same as 10GE LSM XM2S but reduced L2/3 support with limited L3 routing.

Table 25-1. 10GE LSM modules

Load Module	Part Number	Description
NGY-NP2-01	NGY-NP2-01	10 Gigabit Application Network Processor Load Module, 2-Port LAN/WAN, SFP+ interface.
XENPAK-ADAP-01	948-0007	XENPAK LAN Adapter for LSM10Gx1-xx.
XFP-ADAP-02	948-0002	LAN/WAN Adapter for LSM10Gx1-xx
X2-ADAP-01	948-0008	X2 Carrier
10GBASET-ADAP-01	948-0009	10GBase-T Adapter for LSM10Gx1-xx
SFP-ADAP-01	948-0012	SFP+ Adapter for LSM10G1 and LSMGL1, must be used with an SFP+ transceiver.
SFP+ transceiver 10GBASE-SR	948-0013	10GBASE-SR Accessory, SFP+ Transceiver for 10GE LAN/WAN load modules with pluggable SFP interface, 850nm.
SFP+ transceiver 10GBASE-LR	948-0014	10GBASE-LR Accessory, SFP+ Transceiver for 10GE LAN/WAN load modules with pluggable SFP interface, 1310nm.
SFP+ transceiver 10GBASE-LRM	948-0015	10GBASE-LRM Accessory, SFP+ Transceiver for 10GE LAN load modules with pluggable SFP+ interface, 1300nm, MMF. <b>Note:</b> LAN mode is not supported.
SFP+ transceiver 10GSFP+Cu	948-0016	10GSFP+Cu Accessory, Direct Attach Cable Transceiver for 10GE LAN/WAN load modules with pluggable SFP+ interface, Copper Wire, 3 meter length.
10GE LSM XM8NGY	944-1070-01	LSM10GXM8NG-01 10 Gigabit Ethernet Load Module, 8-Port LAN/WAN, XFP interface
10GE LSM XM4NGY	944-1071-01	LSM10GXM4NG-01 10 Gigabit Ethernet Load Module, 4-Port LAN/WAN, XFP
10GE LSM XM2NGY	944-1096-01	LSM10GXM2NG 10 GIGABIT ETHERNET LOAD MODULE, 2-Port LAN/WAN, XFP

Table 25-2. 10GE LSM Load Module Specifications (except NGY)

	LSM10G1-01 LSM10GL1-01 <sup>1</sup>	LSM10GMS-01	LSM10GXL6-01, -02	LSM10GXM3-01 LSM10GXMR3-01 <sup>2</sup>
# ports	1	1	6	3
Data Rate	10GB	10GB	10GB	10GB



Table 25-2. 10GE LSM Load Module Specifications (except NGY)

	<b>LSM10G1-01 LSM10GL1-01<sup>1</sup></b>	<b>LSM10GMS-01</b>	<b>LSM10GXL6-01, -02</b>	<b>LSM10GXM3-01 LSM10GXMR3-01<sup>2</sup></b>
Port CPU Speed	1GHz (G1) 500MHz (GL1)	1GHz	1GHz	
Port CPU Memory	512MB (G1) 128MB (GL1)	512MB	512MB	512 MB (GXM) 128 MB (GXMR)
Connector/ Frequency-Mode	XFP or XENPAK/ X2. See <a href="#">XENPAK Connectors</a> on page 25-34 10GBase-T Adapter, see <a href="#">Removable Carrier Cards</a> on page 25-16 Also XFP-CX4 and SFP-CX4	Integrated XFP LAN/WAN carrier card Also XFP-CX4	XFP	XFP XFP-CX4
Ambient Operating Temp. Range	41°F to 95°F (5°C to 35°C)	41°F to 95°F (5°C to 35°C)	41°F to 95°F (5°C to 35°C)	41°F to 95°F (5°C to 35°C)
Capture buffer size	Up to 384 MB	Up to 384 MB	Up to 384 MB	GXM3: 350 MB GXMR3: 32 MB
Captured packet size	17-65,535 bytes	17-65,535 bytes	17-65,535 bytes	17-65,535 bytes
Streams per port	256	256	256	256
Advanced streams	256	256	256	256
Preamble size: min-max	8	8	8	8
Frame size: min-max (bytes)	17-65,535	17-65,535	17-65,535	17-65,535
Inter-frame gap: min-max <sup>3</sup>	4.0ns - 42sec in 3.2ns steps	4.0ns - 42sec in 3.2ns steps	4.0ns - 42sec in 3.2ns steps	4.0ns - 42sec in 3.2ns steps
Inter-burst gap: min- max	4.0ns - 42sec in 10.0ns steps	4.0ns - 42sec in 10.0ns steps	4.0ns - 42sec in 10.0ns steps	4.0ns - 42sec in 10.0ns steps
Inter-stream gap: min-max	4.0ns - 42sec in 10.0ns steps	4.0ns - 42sec in 10.0ns steps	4.0ns - 42sec in 10.0ns steps	4.0ns - 42sec in 10.0ns steps
Normal stream frame rate	0.023fps - full line rate	0.023fps - full line rate	0.023fps - full line rate	0.023fps - full line rate
Advanced stream min frame rate <sup>4</sup>	Slow: 0.023fps Fast: 1525fps	Slow: 0.023fps Fast: 1525fps	Slow: 0.023fps Fast: 1525fps	Slow: 0.023fps Fast: 1525fps

Table 25-2. 10GE LSM Load Module Specifications (except NGY)

	LSM10G1-01 LSM10GL1-01 <sup>1</sup>	LSM10GMS-01	LSM10GXL6-01, -02	LSM10GXM3-01 LSM10GXMR3-01 <sup>2</sup>
Latency <sup>5</sup>	20ns resolution	20ns resolution The 'No CRC' option is not supported.	20ns resolution	20ns resolution
Table UDF Entries	1M (full) 32K (reduced)	1M	1M	1M (GXM3) 32K (GXMR3)
Max Value List UDF entries	G1: 512K entries GL1: 8K entries	512K entries	512K entries	GXM3-01: 512K entries GXMR3-01: 8K entries
Max Range List UDF entries	G1: 256 entries GL1: 16 entries			GXM3-01: 256 entries GXMR3-01: 16 entries

1. Applications are not supported on LSM10GL1-01 (no Layer 4-5 support).
2. The LSM10GMR3-01 only supports IxNetwork, IxAutomate, and IxExplorer.
3. Packet gap size also depends on the stream mode selected—Fixed or Average.
4. Streams are divided up into two categories: 224 slow speed streams and 32 fast streams.
5. Cancel Intrinsic Latency feature measures and/or removes the latency induced by the test equipment (not the DUT). See [Intrinsic Latency Adjustment](#) on page 25-21.

Table 25-3. NGY Load Module Specifications

Feature	Extra Performance	Full Performance	Reduced Performance
Load Modules	LSM10GXM8XP LSM10GXM4XP LSM10GXM2XP LSM10GXM8S LSM10GXM4S LSM10GXM2S LSM10GXM8GBT LSM10GXM4GBT LSM10GXM2GBT	LSM10GXM8 LSM10GXM4	LSM10GXMR8 LSM10GXMR4 LSM10GXMR2 LSM10GXMR8S LSM10GXMR4S LSM10GXMR2S LSM10GXMR8GBT LSM10GXMR4GBT LSM10GXMR2GBT
Number of ports per module	8/4/2	8/4	8/4/2
Line rate	10 Gb/s	10 Gb/s	10 Gb/s
Number of chassis slots per module	1	1	1
Maximum ports per chassis			

Table 25-3. NGY Load Module Specifications

Feature	Extra Performance	Full Performance	Reduced Performance
XM12 High Performance	96/48/24 <sup>1</sup>	96/48 <sup>1</sup>	96/48/24 <sup>1</sup>
XM2 Desktop	16/12 <sup>1</sup> /8/4	16/8	16/8/4
Supported transceivers (optical and copper)	XFP, SFP+, RJ-45 10GBASE-T	XFP	XFP, SFP+, RJ-45 10GBASE-T
<b>Note:</b> The NGY family of load modules can support transceivers that use up to 2.5W of power. Do not use transceivers beyond 2.5W.			
Per-port CPU speed and memory	1 GHz, 1 GB <sup>2</sup>	800 MHz/512 MB	400 MHz/128 MB
Per-port capture buffer	512 MB	512 MB	64 MB
Captured packet size	17 bytes—absolute minimum frame size 64 bytes—minimum frame size at line rate		
Frame size	Minimum: 48 bytes Maximum: 16,000 bytes	For LSM10GXM8, LSM10GXM4 LSM10GXM2 Minimum Frame Size at Line Rate: 48 Minimum Frame Size - may not be at Line Rate: 48 Maximum Frame Size: 4Q: 9216 8 + 1Q: P0: 9216B others 2500B	For LSM10GXMR8, LSM10GXMR4 LSM10GXMR2 Minimum Frame Size at Line Rate: 48 Minimum Frame Size - may not be at Line Rate: 48 Maximum Frame Size: 4Q: 9216 8 + 1Q: P0: 9216B others 2500B
Interface protocols	10 GE LAN/WAN	10 GE LAN/WAN	10 GE LAN/WAN
Layer 2/3 routing protocol emulation	Yes	Yes	Yes
Layer 4-7 application traffic testing	Yes	Yes	No
Number of transmit flows per port (sequential values)	Billions	Billions	Billions
Number of transmit flow per port (arbitrary values)	1 million	1 million	32 K
Number of trackable receive flows	1 million	1 million	64K
Number of stream definitions per port	512	512	512

Table 25-3. NGY Load Module Specifications

<b>Feature</b>	<b>Extra Performance</b>	<b>Full Performance</b>	<b>Reduced Performance</b>
	In packet stream (sequential) or advanced stream (interleaved) mode, each stream definition can generate millions of unique traffic flows.		
Preamble size: min-max	8	8	8
Inter-frame gap: min-max	3.2ns - 27.48sec in 3.2ns steps	3.2ns - 27.48sec in 3.2ns steps	3.2ns - 27.48sec in 3.2ns steps
Inter-burst gap: min-max	3.2ns - 27.48sec in 3.2ns steps	3.2ns - 27.48sec in 3.2ns steps	3.2ns - 27.48sec in 3.2ns steps
Inter-stream gap: min-max	3.2ns - 27.48sec in 3.2ns steps	3.2ns - 27.48sec in 3.2ns steps	3.2ns - 27.48sec in 3.2ns steps
Normal stream frame rate	0.023fps - full line rate	0.023fps - full line rate	0.023fps - full line rate
Advanced stream min. frame rate	Slow: 0.023fps Fast: 1525fps	Slow: 0.023fps Fast: 1525fps	Slow: 0.023fps Fast: 1525fps
Number of streams in Packet Stream Mode (Non Data Center Mode)	512	512	512
Number of streams in Advanced Scheduler Mode (Non Data Center Mode)	Fast: 32 Slow: 480	Fast: 32 Slow: 480	Fast: 32 Slow: 480
Number of streams in Advanced Scheduler Mode (Data Center Mode)	Fast: 32 Slow: 224	Fast: 32 Slow: 224	Fast: 32 Slow: 224
Table UDF	1 million entries	1 million entries	32 K
	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.		
Max Value List UDF entries	512K entries for 32-bit and 24-bit, 1M entries for 8 and 16-bit.	512K entries for 32-bit and 24-bit, 1M entries for 8 and 16-bit.	256K entries for 32-bit and 24-bit, 512K entries for 8 and 16-bit.
Max Range List UDF entries	512 entries	512 entries	256 entries
Packet flow statistics	Track 1 million flows	Track 1 million flows	Track 64 K flows
Transmit engine	Wire-speed packet generation with timestamps, sequence numbers, data integrity signature, and packet group signatures		
Receive engine	Wire-speed packet filtering, capturing, real-time latency and inter-arrival time for each packet group, data integrity, and sequence checking		

Table 25-3. NGY Load Module Specifications

Feature	Extra Performance	Full Performance	Reduced Performance
User defined field features	Fixed, increment or decrement by user-defined step, value lists, range lists, cascade, random, and chained		
Filters	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)		
Data field per stream	Fixed, increment (byte/word), decrement (byte/word), random, repeating, user-specified		
Statistics and rates (counter size: 64 bits)	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		
Error generation	CRC (good/bad/none), undersize, oversize		
Latency measurements	20 ns standard 10 ns user-selectable		
Latency self-calibration	Ability to calibrate and remove inherent latency from any MSA-compliant 10GbE XFP transceivers, including unsupported transceivers		
Transmit line clock adjustment	Ability to adjust the parts per million (ppm) line frequency over a range of: <ul style="list-style-type: none"> <li>• LAN mode: -105 to +105 ppm<sup>3</sup></li> <li>• WAN mode: -30 to +30 ppm</li> </ul>		
IPv4, IPv6, UDP, TCP	Hardware checksum generation and verification		
Frame length controls	Fixed, random, weighted random, or increment by user-defined step, random, weighted random		
Operating temp. range	41°F to 95°F (5°C to 35°C), ambient air <sup>4</sup>		

1. XM12 High Performance chassis (941-0009) is required for 80 or more ports of 10 GbE NGY XFP or SFP+ 8-port, load modules to be installed in a single chassis. A field replaceable power supply upgrade kit (943-0005) is available for the XM12 chassis (941-0002) to convert it to the high-performance version. Up to ten 8-port NGY 10GBASE-T full performance load modules are supported in an XM12 High Performance chassis, and up to eight 8-port NGY 10GBASE-T full performance load modules are supported in a standard XM12 chassis). The XM2 chassis (941-0003) supports up to twelve ports of 10GBASE-T full performance load modules.
2. The LSM10GXM8XP, LSM10GXM8S, and LSM10GXM8GBT use a high performance 800MHz processor with additional layer 2 cache.
3. For 10GBASE-T interfaces on NGY the ppm does change the data rate, but does not change the bit period due to phy chip limitations.

4. When an NGY load module is installed in an XM12 or XM2 chassis, the maximum operating temperature of the chassis is 35°C (ambient air).

## Port LEDs

**Note:** The NGY 10GBASE-T load module has only 2 port LEDs:

- Rx/Error: Same as Rx/Error in the following table
- Tx/Link: Combines the Link and Tx/Pause functions. Solid green = link; blinking green = transmit; red = flow control.

Each 10GB port incorporates a set of LEDs, as described in the following figure.

Table 25-4. 10GE LSM Port LEDs

LED Label	Usage
Link	Green if Ethernet link is up (established) or the port is in a forced Link Up state, red if link is down. Link may be down due to no signal or no PCS lock.
Tx/Pause	Green while data is transmitted. Red while flow control frames are received. Off if no traffic is passing in either direction. <b>Note:</b> For NGY load modules LSM10GXM(R)8 and LSM10GXM(R)4: green indicates that Tx is active and frames being sent; red indicates Tx is paused; off indicates Tx is not active.
Rx/Error	Green while data is received. Red on any Ethernet error. Off if no frames are received. <b>Note:</b> For NGY load modules LSM10GXM(R)8 and LSM10GXM(R)4: green indicates valid Rx frames are being received; red indicates error frames being received; off indicates no frames being received..
LASER ON	Green when the port's laser is turned on. Off otherwise.
Detect	Green when valid plug in module is detected, red otherwise.
Power	Green when power is on, red if power fault occurs.
Option1/2	N/A
Trigger	See <a href="#">Trigger Out Values</a> on page 25-15.

## Clock In/Out

The load module provides coaxial connectors for clock input and clock output to allow the DUT to phase-lock with the interface. When running off an external

clock, the clock input signal must meet the requirements listed in the following figure to ensure proper performance of the load module.

The clock in/out electrical interface parameters are also defined in the following figure.

Table 25-5. Clock In/Out Electrical Interface Parameters

Parameter		Characteristic
Clock Input	Frequency	156.25 MHz $\pm$ 100ppm
	Duty cycle	50%
	Jitter	$\pm$ 150ps max. cycle to cycle, >1kHz
	Amplitude	Vpp = 4.0
	Impedance	50 ohm $\pm$ 5%, DC coupled
	Connector	Female SMA
Clock Output	Frequency	156.25MHz $\pm$ 105PPM (Programmable PPM in Internal Clock Mode) <b>LSM10GXM8-01</b> and variations: 156.25MHz (LAN) or 155.52MHz (WAN) $\pm$ 30PPM (Programmable PPM in Internal Clock Mode)
	Duty cycle	40 to 60%
	Jitter	20ps max cycle to cycle, >1kHz
	Amplitude	0.7Vpp min into 50 ohms, AC coupled output
	Edge rates	200ps to 340ps (20% to 80%) into 50 Ohms
	Impedance	50 ohms $\pm$ 5%, AC coupled
	Connector	Female SMA

The load module contains a phase-locked loop (PLL) that reduces the jitter of the input clock, either from the internal or external clock source. The bandwidth of the PLL is approximately 1 kHz.

## Trigger Out Values

The signals and LEDs available on the trigger out pins for these cards are described in the following table.

Table 25-6. 10GE LAN Trigger Out Signals

Pin/LED	Value
Trigger Out	Single ended output that pulses high for approximately 1.18s shortly after the Central FPGA is loaded, and following an event defined by UDS1. Voltage output = 3.3V for high, 0V for low.
Trigger LED	Pulses following an event defined by UDS1.

## Removable Carrier Cards

The 10GE10G1-01 and the LSM10GL1-01 load modules have removable carrier cards available for use:

- The XENPAK-ADAP-01 carrier card for XENPAK transceivers, shown in [Figure 25-8](#) on page 25-16.
- The XFP-ADAP-01 LAN only carrier card for XFP transceivers (not shown).
- The XFP-ADAP-02 LAN/WAN carrier card for XFP transceivers (shown being inserted into the LSM load module in [Figure 25-10](#) on page 25-18).
- X2 carrier card for X2 Transceiver (shown with transceiver installed in [Figure 25-9](#) on page 25-17).
- 10GBase-T-ADAP-01 10 Gigabit Ethernet adapter module (shown in [Figure 25-11](#) on page 25-19).

Figure 25-8. XENPAK-ADAP-01 Carrier Card

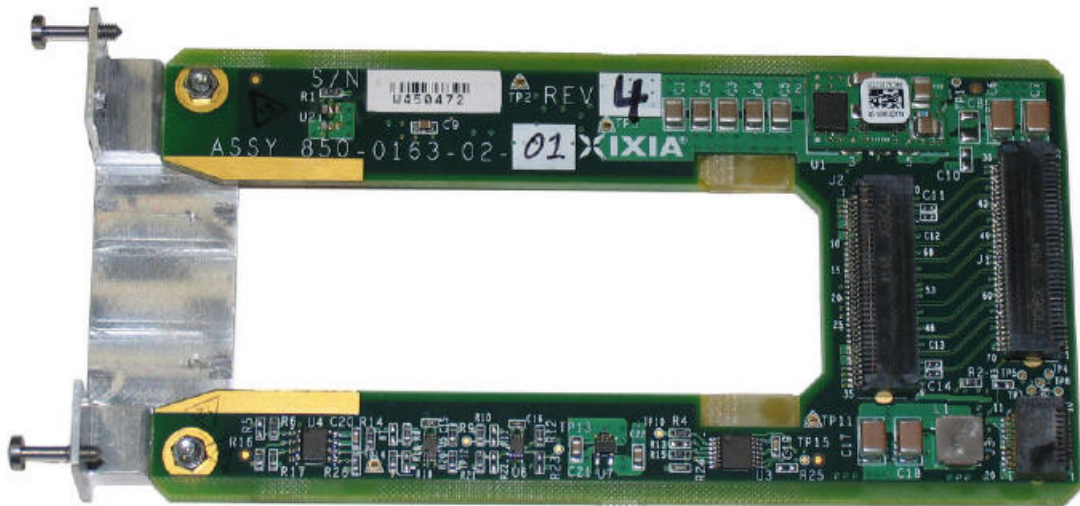




Figure 25-9. X2 Carrier Card with X2 Transceiver

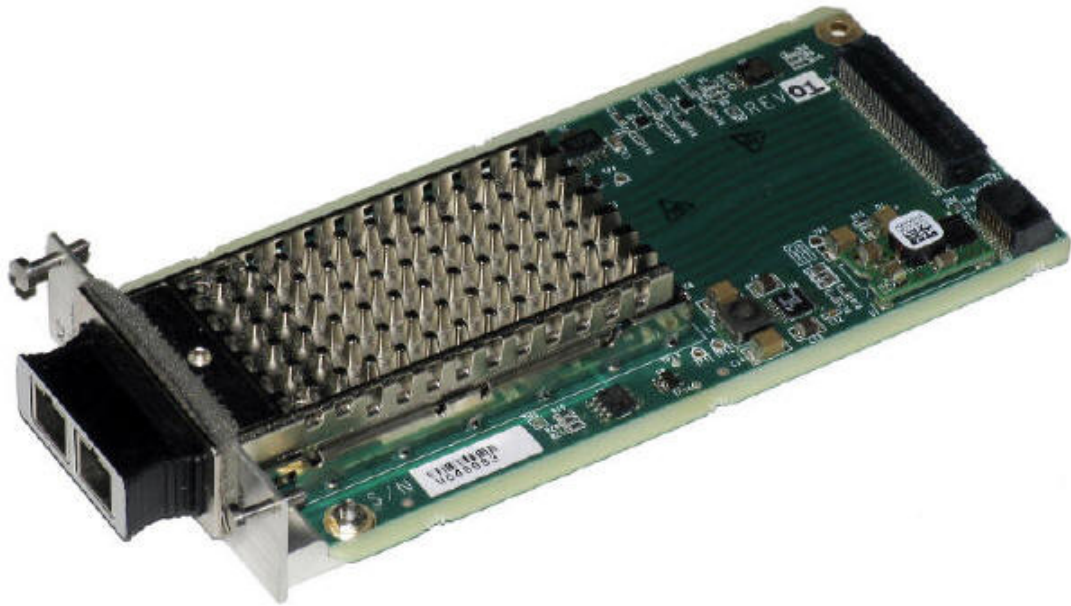


Figure 25-10. XFP-ADAP-02 Carrier Card

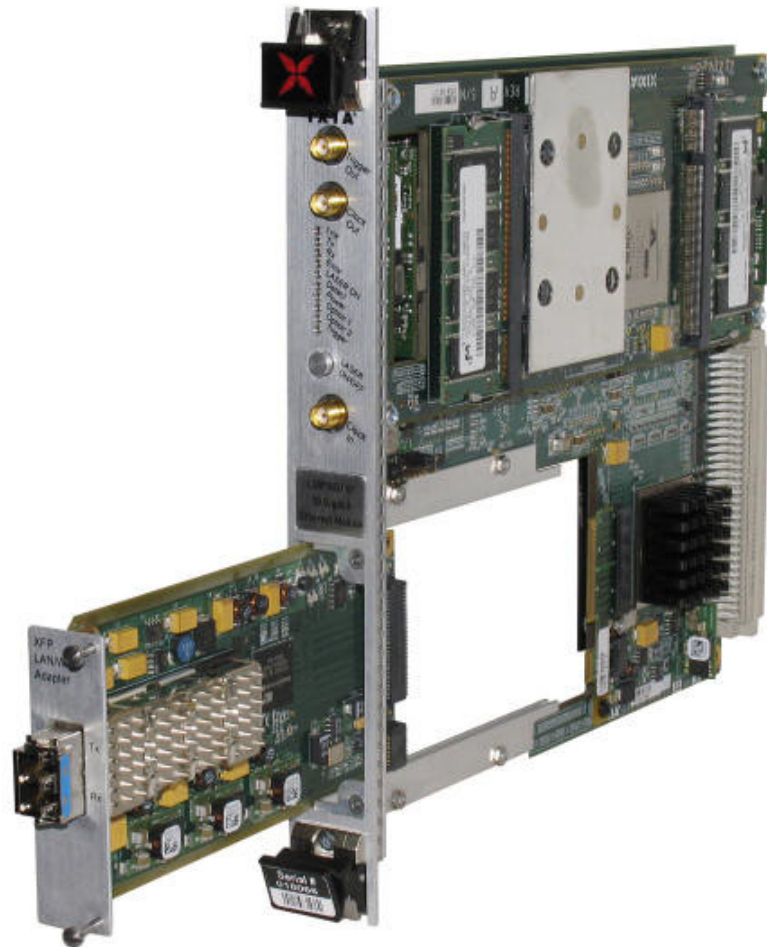
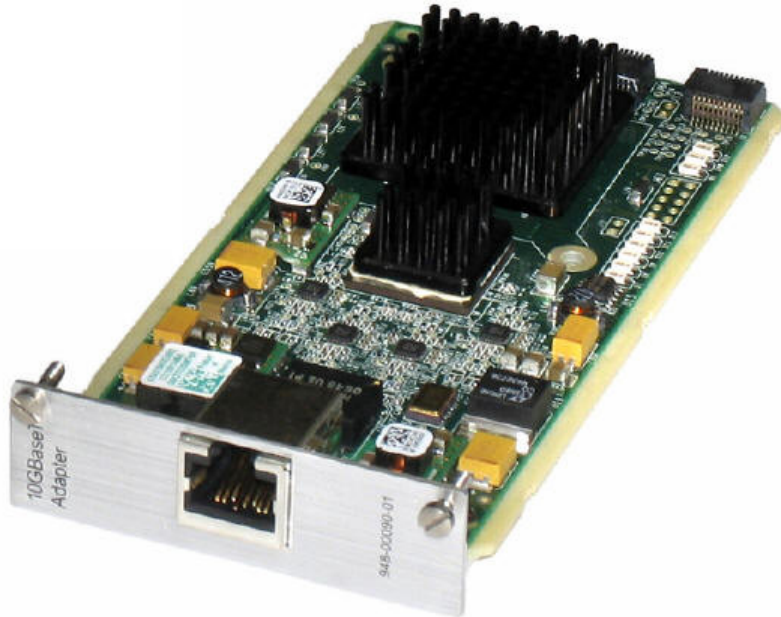


Figure 25-11. 10GBase-T Adapter Module



## Carrier Card Installation

To install the carrier card, do the following:

1. Insert the card into the opening in the 10GE LSM module.
2. Slide the card along the guide rails until it connects to the load module.
3. Tighten the screws so that the carrier card is firmly in place. Do not over tighten the screws (no more than a quarter turn once flush with the card front).

The carrier card can be installed either before or after the load module is connected to the chassis. It is best not to attach the transceiver to the carrier card until the card is installed in the load module. Load modules should be screwed down in the chassis before removing or installing a carrier card, to prevent from accidentally dislodging a load module from the chassis backplane.

**Note:** The carrier cards do not come with the required transceivers. They must be purchased separately.

## XENPAK/XAUI Connectors

The LSM10G1-01 and LSM10GL1-01 load modules have XAUI and XENPAK connectors available. See [XAUI Connectors](#) on page 25-28 and [XENPAK Connectors](#) on page 25-34 above for more information on XENPAK connectors.

These connectors are only applicable when the XENPAK carrier is being used.

**Statistics** Statistics for 10GE LSM cards (except NGY), under various modes of operation may be found in [Table B-23](#) on page B-118. Statistics for NGY load modules may be found in [Table B-24](#) on page B-127.

## NGY Fault Handling **IEEE Requirements**

IEEE 802.3ae, section 46.3.4 defines how a Reconciliation Sublayer (RS) shall respond to Local and Remote Faults. Response to a Local Fault is to immediately cease sending traffic on the transmit data path (even if doing so truncates a frame) and to send continual Remote Faults. Response to a Remote Fault is to stop sending MAC data (completing any frame that is being transmitted) and to send continual idles.

### NGY Operation

NGY load modules have a single statistic for Faults called Link Fault State. This statistic is real-time and indicates the current state of the port's Reconciliation Sublayer (RS) state machine. The possible statistics values are:

- No Fault
- Local Fault
- Remote Fault

### Features that force deviation from IEEE spec

**Note:** In general, if a NGY port appears to be transmitting according to the Frames Sent statistic, be aware that Link Fault State may override this.

#### Tx Ignores Rx Link Faults

This feature is enabled through the **Link Fault Signaling** tab of Port Properties. When the feature is enabled, the Fault statistic continues to indicate the RS state of the port; however, the transmit-side response behaves as if no fault was received. That is to say, Remote Faults are not sent as a response to Local Fault and Idles are not forced as a response to Remote Fault, even though Link Fault State indicates the board is in a Fault state.

#### Transmit Ignores Link Status

This feature is enabled through the Transmit Modes tab of Port Properties. When the feature is enabled, a port is permitted to transmit under conditions that would normally inhibit transmit. For instance, a port that has no link and is not in diagnostic loopback appears in IxExplorer as red color, and is normally not permitted to transmit. Enabling this feature allows transmit. When the feature is enabled, the statistic called Link State indicates 'Ignore Link'.

Note that if the port is in Fault, enabling this feature and forcing transmit may result in misleading results. The port shown in the following stat view ([Figure 25-12](#)) is ignoring link (see Link State statistic), is in Remote Fault (see Link

Fault State statistic), yet appears to be transmitting (see Frames Sent Rate statistic). The reality is that no frames are actually leaving the port because the port is in Remote Fault. This is because the block that maintains the transmit statistics is located before the block that forces idles as a response to Remote Fault.

Figure 25-12. Statistic View for NGY, Ignore Link Status

	A	B
1	Name	loopback:02.01
2	Link State	Ignore Link
3	Line Speed	10GE LAN
4	Frames Sent	164,624,279
5	Frames Sent Rate	14,880,954
6	Valid Frames Received	0
7	Valid Frames Received Rate	0
8	Bytes Sent	10,535,953,80
9	Bytes Sent Rate	952,380,945
10	Bytes Received	0
11	Bytes Received Rate	0
12	Fragments	0
13	Undersize	0
14	Oversize	0
15	CRC Errors	0
16	Link Fault State	Remote Fault
17	Scheduled Transmit Duration	0 : 0: 0.0
18	Bytes Sent / Transmit Duration	21,740,528
19	Bits Sent	84,287,630,43
20	Bits Sent Rate	7,619,047,560
21	Bits Received	0
22	Bits Received Rate	0
23	Central Chip Temperature(C)	45
24	Port Chip Temperature(C)	45
25	Port CPU Status	Ready
26	Port CPU DoD Status	Ready

## Intrinsic Latency Adjustment

This option, when present and enabled, reduces the measured latency by the amount of latency that is induced by the test equipment itself (not the DUT). For a specific transceiver, the system retrieves its pre-determined latency value and subtracts this from the measured overall latency. For an ‘unknown’ transceiver (not previously measured), it calculates and stores the intrinsic latency value.

On the **General** tab in **Port Properties**, the **Latency Calibration** option is only enabled for cards with transceivers that have not been pre-measured for intrinsic latency by Ixia. The **Latency Calibration** option is grayed-out if any one of the following conditions are present:

- There is no carrier.
- There is no transceiver.
- The transceiver is XFP or XAUI (which do not need to be calibrated).

- The transceiver is XENPAK or X2 and a value is found for it in the list of pre-calibrated values.

The **Latency Calibration** option is enabled if the transceiver is XENPAK or X2 but no pre-calibrated value is found in the stored list. The **Latency Calibration** option is also enabled for transceivers that you have previously calibrated, so that the calibration measurement may be repeated (if desired).

Clicking the **Latency Calibration** option runs a Tcl script that measures intrinsic latency and stores the value in an .xml file. The .xml file contains the values that you have produced and saved. Each value is identified for a specific transceiver (per manufacturer, model, and serial number). You can run the calibrate process repeatedly with the same transceiver (if desired). Each new measurement overwrites the previous one for that transceiver.

Running the calibration measurement puts the port into a special loopback mode to measure intrinsic latency. When done, the port is put back into default normal mode. Any port configuration you have set before calibrating intrinsic latency, is lost as the port reverts to a default configuration.

The **Enable** check box is grayed out when no value exists in the system for the specific transceiver. If a value exists (in the .xml file) then the **Enable** check box is available. Select the check box to enable the intrinsic latency adjustment.

After the intrinsic latency adjustment has been done, you may want to refresh the chassis or close and reopen the Port Properties dialog.

**Note:** The LSM10GMS-01 load module always compensates for intrinsic latency—it is not optional. Also, this load module does not support the 'No CRC' option. Any imported stream with No CRC enabled is Forced Valid to 'Bad CRC'.

## 10GE LAN Family

### Part Numbers

The currently available LAN family part numbers are shown in the following table. Items without a *Price List Names* entry are no longer available.

Table 25-7. 10GE LAN Load Modules

Load Module	Part Number	Description
LM10GELAN	LM10GE223F	10GBASE-LR (LAN), 1-port, 1310nm, singlemode
	LM10GE224F	10GBASE-ER, (LAN) 1-port, 1550nm, singlemode
LM10GELAN-M	LM10GE223M	10GBASE-LR (LAN), 1-port, 1310nm, singlemode, manufacturing mode
	LM10GE224M	10GBASE-ER (LAN), 1-port, 1550nm, singlemode, manufacturing mode

## Specifications

The limitations of -M, Layer 2/3 and Layer 7 cards are discussed in [Ixia Load Modules](#) on page 1-5.

Table 25-8. 10GB LAN Load Module Specifications

	<b>10GBASE-R (LAN)</b>
# ports	1
-M Card Available	Y
Layer2/Layer3 Card Available?	N
Layer 7 Card Available	N
Data Rate	10GB
Connector/Wavelength-Mode	SC/850 multimode, 1310nm /1550nm singlemode
Capture buffer size	32MB
Captured packet size	24-65,000 bytes
Streams per port	255, 32 (-M version)
Advanced streams	160, 16 (-M version)
Preamble size: min-max	8
Frame size: min-max	24-65,000
Inter-frame gap: min-max	4.0ns - 42sec in 3.2ns steps
Inter-burst gap: min-max	4.0ns - 42sec in 10.0ns steps
Inter-stream gap: min-max	4.0ns - 42sec in 10.0ns steps
Normal stream frame rate	0.023fps - full line rate
Advanced stream min frame rate <sup>1</sup>	Slow: 0.023fps Med: 95fps Fast: 1525fps
Latency	20ns resolution

- Streams are divided up into three categories: 144 slow speed streams, 8 medium streams and 8 fast streams.

The LAN-M boards includes all of the features of the LAN board with the following exceptions:

- No support for routing protocols
- No real-time latency, but timestamps are included
- 32 streams in packet stream mode
- 16 streams in advanced scheduler mode
- No configurable preamble

When performing sequence checking, no more than 8192 packet group IDs should be used.

## Port LEDs

Each 10GB LAN port incorporates a set of LEDs, as described in the [Table 25-9](#).

Table 25-9. 10GE LAN Port LEDs

LED Label	Usage
Link	Green if Ethernet link has been established, red otherwise. Link may be down due to no signal or no PCS lock.
Tx/Pause	Green while data is transmitted. Red while flow control frames are received. Off if no traffic is passing in either direction.
Rx/Error	Green while data is received. Red on any Ethernet error. Off if no frames are received.
Trigger	See below.
Option	Reserved for future use.
LASER ON	Green when the port's laser is turned on. Off otherwise.

## Trigger Out Values

The signals and LEDs available on the trigger out pins for these cards are described in the following table.

Table 25-10. 10GE LAN Trigger Out Signals

Pin/LED	Value
Trigger Out A	Low (0V) on Rx Pause Request, high (+5V) otherwise.
Trigger Out B	Low (0V) on User Defined Statistic 1 true, high (+5v) otherwise.
Trigger LED	Pulses each time a Pause Request is detected.

## Optical Specifications

The optical characteristics for the 10GE LAN cards is described in [Table 25-11](#).

Table 25-11. 10GE Optical Specifications

Specification	10GBASE-SR (LAN) 850nm	10GBASE-LR (LAN) 1310nm	10GBASE-ER (LAN) 1550nm
Tx Power (dBm)	-5 to -1	-6 to 2	-4 to 0
Rx Sensitivity (dBm)	-7 to -1	-11 to -1	-5 to 2
Safety	Class 1 Laser	Class 1 Laser	Class 1 Laser

## Statistics

Statistics for 10GB cards, under various modes of operation may be found in [Table B-21](#) on page B-104 and [Table B-22](#) on page B-111.



## XAUI Family

### Part Numbers

The XAUI family part numbers are shown in the following table.

Table 25-12. 10GE XAUI Load Modules

Load Module	Part Number	Description
LM10GEXAUI	LM10GE500F1	10GBASE (XAUI), 1 port
LM10GEXAUI+ BERT	LM10GE500F1B	10GBASE (XAUI), Ethernet/BERT, 1 port
LM10GEXAUI BERT only	LM10GE500M1B	10GBASE (XAUI), BERT, 1 port
Cables	CAB10GE500S1	XAUI cable, 20 inch, standard pinout
	CAB10GE500S2	XAUI cable, 40 inch, standard pinout
	BOB10GE500	XAUI SMA break-out box
	CON10GE500	XAUI Fujitsu MicroGiGa connector
	LPG10GE500	XAUI front panel loopback connector

### Specifications

The limitations of -M, Layer 2/3 and Layer 7 cards are discussed in [Ixia Load Modules](#) on page 1-5.

Table 25-13. 10GB XAUI Load Module Specifications

	10GBASE (XAUI)	10GBASE (XAUI/ BERT)
# ports	1	1
-M Card Available	N	N
Layer2/Layer3 Card Available?	N	N
Layer 7 Card Available	N	N
Data Rate	10GB	N/A
Connector/Frequency-Mode	See <a href="#">XAUI Connectors</a> on page 25-28	See <a href="#">XAUI Connectors</a> on page 25-28
Capture buffer size	32MB	N/A
Captured packet size	24-65,000 bytes	N/A
Streams per port	255	N/A
Advanced streams	160	N/A
Preamble size: min-max	8	N/A
Frame size: min-max	24-65,000	N/A

Table 25-13. 10GB XAUI Load Module Specifications

	10GBASE (XAUI)	10GBASE (XAUI/ BERT)
Inter-frame gap: min-max	4.0ns - 42sec in 3.2ns steps	N/A
Inter-burst gap: min-max	4.0ns - 42sec in 10.0ns steps	N/A
Inter-stream gap: min-max	4.0ns - 42sec in 10.0ns steps	N/A
Normal stream frame rate	0.023fps - full line rate	
Advanced stream min frame rate <sup>1</sup>	Slow: 0.023fps Med: 95fps Fast: 1525fps	
Latency	20ns resolution	N/A

- Streams are divided up into three categories: 144 slow speed streams, 8 medium streams and 8 fast streams.

XAUI accessories are discussed in *Appendix A, XAUI Connector Specifications*.

## Port LEDs

Each 10GB XAUI port incorporates a set of LEDs, as described in the following table.

Table 25-14. 10GE XAUI Port LEDs

LED Label	Usage
Link	Green if Ethernet link has been established, red otherwise. Link may be down due to no signal or no PCS lock.
Tx/Pause	Green while data is transmitted. Red while flow control frames are received. Off if no traffic is passing in either direction.
Rx/Error	Green while data is received. Red on any Ethernet error. Off if no frames are received.
Trigger	See below.
Option	Reserved for future use.
LASER ON	Green when the port's laser is turned on. Off otherwise.

## Trigger Out Values

The signals and LEDs available on the trigger out pins for these cards are described in the following figure.

Table 25-15. 10GE XAUI Trigger Out Signals

Pin/LED	Value
Trigger Out A	Low (0V) on Rx Pause Request, high (+5V) otherwise.
Trigger Out B	Low (0V) on User Defined Statistic 1 true, high (+5v) otherwise.
Trigger LED	Pulses each time a Pause Request is detected.

## Clock In/Out

The XAUI load module provides SMA coaxial connectors for clock input and clock output to allow the DUT to phase-lock with the XAUI interface. When running off an external clock, the clock input signal must meet the requirements listed in [Table 25-16](#) to ensure proper performance of the load module.

Table 25-16. XAUI Reference Clock Input Requirements

Parameter	Characteristic
Frequency	156.25 MHz $\pm$ 100ppm
Jitter	$\pm$ 150ps max. cycle to cycle, >1kHz
Amplitude	0.9 Vpp minimum, into 50 $\Omega$
Duty cycle	40 to 60%
Edge rates (20% to 80%)	600ps maximum, into 50 $\Omega$

The clock in/out electrical interface parameters are defined in [Table 25-17](#).

Table 25-17. XAUI Clock In/Out Electrical Interface Parameters

Parameter	Characteristic	
Clock Input	Connector	Female SMA
	Impedance	50 ohm $\pm$ 5%, DC coupled
	Absolute max input	6V (DC plus half AC peak-to-peak)
Clock Output	Connector	Female SMA
	Impedance	50 ohm $\pm$ 5%, AC coupled
	Amplitude	0.9 Vpp minimum, into 50 $\Omega$ . (1.5 Vpp typical)
	Edge rates	200ps to 340ps (20% to 80%) into 50 $\Omega$
	Duty cycle	45% to 55%
	Jitter	20ps max cycle to cycle, >1kHz
	Frequency	156.25 MHz $\pm$ 20ppm (internal clock mode)

The load module contains a phase-locked loop (PLL) that reduces the jitter of the input clock, either from the internal or external clock source. The bandwidth of the PLL is approximately 1kHz.

## XAUI Connectors

The following connectors and adapters are available for the XAUI Load Modules and are discussed in *Appendix A, XAUI Connector Specifications*.

- *Standard Connector Specifications*: the signals carried on the Load Module's XAUI connector.
- *Front Panel Loopback Connector*: a connector used to loopback XAUI signals at the external connector.
- *Standard Cable Specification*: the CAB10GE500S1 (20 inch) and CAB10GE500S2 (40 inch) cables.
- *SMA Break-Out Box*: the BOB10GE500 SMA break-out box.

## MDIO

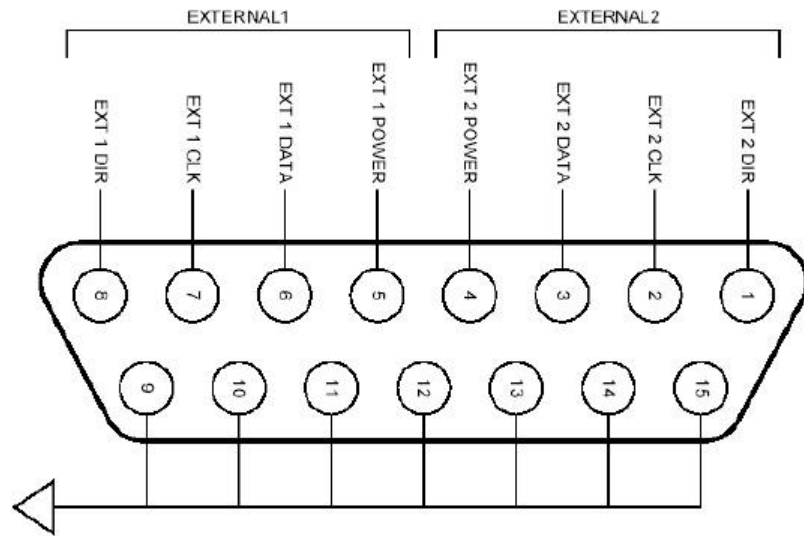
A Management Data Input/Output (MDIO) interface is provided to you. The Ixia Load Module acts as the Station Management entity (STA), and can control one or more MDIO Manageable Devices (MMD) in the users system. Multiple MMDs can be attached to the interface. You can set/read the MDIO control/status registers inside a MMD through a graphical user interface.

The connector used for the MDIO interface is a 15-pin female D-sub and provides with the ability to add up to two external Mii interfaces compliant to either 802.3 clause 22 or 802.3ae clause 45. The connector pin assignments, Mii Interface, signal names, and functional descriptions are listed in *Table 25-18*.

Table 25-18. MDC/MDIO Connector Pin Assignments

Pin No.	Mii Interface	Signal Name	Functional Description
1	External 2	DIR	Data direction control.
2	External 2	MDC	Clock.
3	External 2	MDIO	Bi-directional data.
4	External 2	+5V	+5Vdc supply.
5	External 1	+5V	+5Vdc supply.
6	External 1	MDIO	Bi-directional data.
7	External 1	MDC	Clock.
8	External 1	DIR	Data direction control.
9-15	GND	GND	Ground

Figure 25-13. MDC/MDIO D-sub Connector Pin Assignments



**WARNING:** The MDIO on the Ixia XAUI Load Module is 3.3V while the Ixia XENPAK Load Module, when used with the adapter for XAUI, is 1.2V. The reason for the difference is that the XENPAK MSA requires 1.2V for MDIO whereas most XAUI SerDes chips require 3.3V (LVTTTL). Therefore, when using the XAUI Load Module to test a XENPAK transceiver or SerDes, which require 1.2V, a level shifter is needed to convert 3.3V to 1.2V.

The MDIO/MDC interface has a clock line (MDC) and bi-directional data line (MDIO) as defined in IEEE 802.3ae. In addition to these, a +5Vdc supply, and data direction control line (DIR) are provided to make interfacing easier for you. The +5Vdc output is intended to power buffers and/or optocouplers at the user-end of the cable. This supply can be turned ON or OFF under software control through the GUI.

The +5Vdc supply is OFF when the chassis is initially powered-up, or following a reset.

For more information on XAUI connectors, see *Appendix A, XAUI Connector Specifications*.

## Statistics

Statistics for 10GB cards, under various modes of operation may be found in *Table B-21* on page B-104 and *Table B-22* on page B-111.

## XENPAK Family

The LM10GE700P3 family is referred to as the XENPAK load modules. Each card accepts a XENPAK transceiver, or with an appropriate carrier card accepts an XPAK or X2 transceiver. Five variants are available, which feature Ethernet and/or BERT modes and full or manufacturing mode.

### Part Numbers

The XENPAK family part numbers are shown in [Table 25-19](#).

Table 25-19. 10GE XENPAK Modules

Load Module	Part Number	Description
LM10GEXENPAK	LM10GE700F1	10GE (XENPAK), Ethernet, 1-port
	LM10GE700F1-P	10GE (XENPAK), Ethernet, 1-port, PowerPC with 256MB of processor memory.
LM10GEXENPAK-M	LM10GE700M1	10GE (XENPAK), Ethernet, 1-port, manufacturing mode
LM10GEXENPAK+BERT	LM10GE700F1B	10GE (XENBAK), Ethernet/Bert, 1-port
LM10GEXENPAK BERT only	LM10GE700M1B	10GE (XENPAK), BERT only, 1-port, manufacturing mode
LM10GEXENPAK-MA+BERT	LM10GE700M2B	10GE (XENPAK), Ethernet+BERT, 1-port, manufacturing mode
Transceivers	XENPAK-LR	XENPAK Transceiver - 1310nm LAN, 10GBASE-LR
	XENPAK-SR	XENPAK Transceiver - 850nm LAN, 10GBASE-SR
	XENPAK-ER	XENPAK Transceiver - 1550nm LAN, 10GBASE-ER
	XENPAK-CX4	XENPAK Transceiver - CX4 Interface (10GBASE-CX4)
Cables	CAB10GE-CX4	CX4-to-CX4 cable, 1 meter
	CX410GE500	CX4 to XENPAK adapter
	FXN10GE500	XAUI Fujitsu to XENPAK Adapter

## Specifications

The limitations of -M, Layer 2/3 and Layer 7 cards are discussed in [Ixia Load Modules](#) on page 1-5.

Table 25-20. 10GB Load Module Specifications—Part 3

	<b>10GBASE (XENPAK)</b>
# ports	1
-M Card Available	Y
Layer2/Layer3 Card Available?	N
Layer 7 Card Available	N
Data Rate	10GB
Connector/ Frequency-Mode	See <a href="#">XENPAK Connectors</a> on page 25-34
Capture buffer size	32MB
Captured packet size	24-65,000 bytes
Streams per port	255, 32 (-M version)
Advanced streams	160
Preamble size: min-max	8
Frame size: min-max	24-65,000
Inter-frame gap: min-max	4.0ns - 42sec in 3.2ns steps
Inter-burst gap: min-max	4.0ns - 42sec in 10.0ns steps
Inter-stream gap: min-max	4.0ns - 42sec in 10.0ns steps
Normal stream frame rate	0.023fps - full line rate
Advanced stream min frame rate <sup>1</sup>	Slow: 0.023fps Med: 95fps Fast: 1525fps
Latency	20ns resolution

- Streams are divided up into three categories: 144 slow speed streams, 8 medium streams and 8 fast streams.

The -M load modules includes all of the features of the non-M board with the following exceptions:

- No support for routing protocols
- No real-time latency, but timestamps are included
- 32 streams in packet stream mode
- 16 streams in advanced scheduler mode

- No configurable preamble

When performing sequence checking, no more than 8192 packet group IDs should be used.

## Port LEDs

Each 10GB port incorporates a set of LEDs, as described in the following tables.

Table 25-21. 10GE XENPAK Port LEDs

LED Label	Usage
Link	Green if Ethernet link has been established, red otherwise. Link may be down due to no signal or no PCS lock.
Tx/Pause	Green while data is transmitted. Red while flow control frames are received. Off if no traffic is passing in either direction.
Rx/Error	Green while data is received. Red on any Ethernet error. Off if no frames are received.
Trigger	See below.
LASER ON	Green when the port's laser is turned on. Off otherwise.

## Trigger Out Values

Trigger out values depend on the particular board type.

### XENPAK Load Modules

The signals and LEDs available on the trigger out pins for these cards are described in [Table 25-22](#).

Table 25-22. 10GE XENPAK 1-Slot Trigger Out Signals

Pin/LED	Value
Trigger Out A	Low (0V) on Rx Pause Request, high (+5V) otherwise.
Trigger Out B	Low (0V) on User Defined Statistic 1 true, high (+5v) otherwise.
Trigger LED	Pulses each time a Pause Request is detected.



## Clock In/Out

The load module provides SMA coaxial connectors for clock input and clock output to allow the DUT to phase-lock with the interface. When running off an external clock, the clock input signal must meet the requirements listed in [Table 25-23](#) to ensure proper performance of the load module.

Table 25-23. Reference Clock Input Requirements

Parameter	Characteristic
Frequency	156.25 MHz $\pm$ 100ppm
Jitter	$\pm$ 150ps max. cycle to cycle, >1kHz
Amplitude	0.9 Vpp minimum, into 50 $\Omega$
Duty cycle	40 to 60%
Edge rates (20% to 80%)	600ps maximum, into 50 $\Omega$

The clock in/out electrical interface parameters are defined in [Table 25-24](#).

Table 25-24. Clock In/Out Electrical Interface Parameters

Parameter	Characteristic	
Clock Input	Connector	Female SMA
	Impedance	50 ohm $\pm$ 5%, DC coupled
	Absolute max input	6V (DC plus half AC peak-to-peak)
Clock Output	Connector	Female SMA
	Impedance	50 ohm $\pm$ 5%, AC coupled
	Amplitude	0.9 Vpp minimum, into 50 $\Omega$ . (1.5 Vpp typical)
	Edge rates	200ps to 340ps (20% to 80%) into 50 $\Omega$
	Duty cycle	45% to 55%
	Jitter	20ps max cycle to cycle, >1kHz
	Frequency	156.25 MHz $\pm$ 20ppm (internal clock mode)

The load module contains a phase-locked loop (PLL) that reduces the jitter of the input clock, either from the internal or external clock source. The bandwidth of the PLL is approximately 1kHz.

XENPAK  
Connectors**Power Sequencing Specification**

The Xenpak 2.1 MSA does not specify any particular power sequencing for the various Xenpak power supply rails (3.3V, 5V, and APS).

When Xenpak Power is enabled, power sequencing is as follows:

- The 5V rail comes up first, with a ramp-up time of approximately 2.25 ms.
- The 3.3V and APS rails both start to come up about 500 us after 5V rail is up.
  - The 3.3V supply has a ramp-up time of approximately two milliseconds.
  - The APS supply ramp-up time varies, according to level required by APS Set resistor, but will be no more than two milliseconds. When no Xenpak module is inserted into the Load Module, APS voltage is less than 150 mV.

**Reset**

Hardware asserts a Reset by bringing Xenpak connector pin 10 low whenever either of the following conditions is true:

- The Xenpak module is not inserted into the load module; that is, Xenpak pin 14 is high.
- Xenpak power is turned off.

The hardware continues to assert Reset until both of these items are false. Once Xenpak Power is asserted, or if a Xenpak is hot-plugged, the system waits 5 seconds for Xenpak initialization (per MSA 2.1). Reset is then de-asserted, and the system waits an additional 500 ms for any vendor-based reset management to complete initialization. After this final 500 ms delay, the load module assumes the Xenpak module is ready for MII access or to transmit and receive.

## **XAUI Fujitsu to XENPAK Adapter**

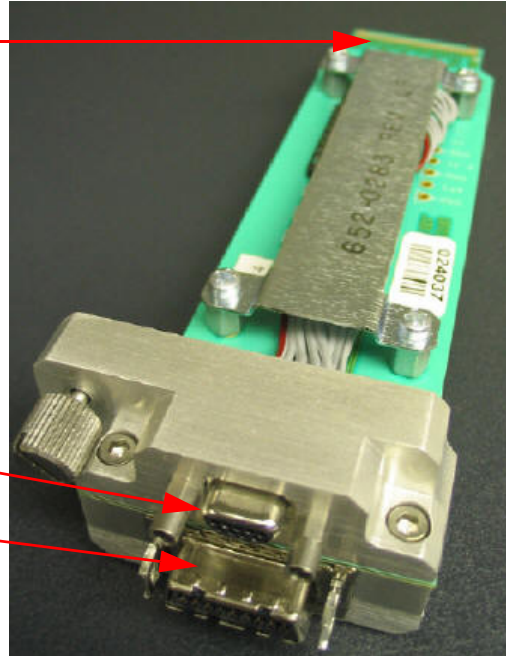
The XAUI Fujitsu to XENPAK Adapter (P/N FXN10GE500) is shown in [Figure 25-14](#).

Figure 25-14. XAUI Fujitsu to XENPAK Adapter

70-pin XENPAK Connector

MDIO Pins

Fujitsu Connector



The MDIO pins are pictured and described in [Figure 25-15](#) and [Table 25-25](#).

Figure 25-15. MDIO Pins for XAUI Fujitsu to XENPAK Adapter

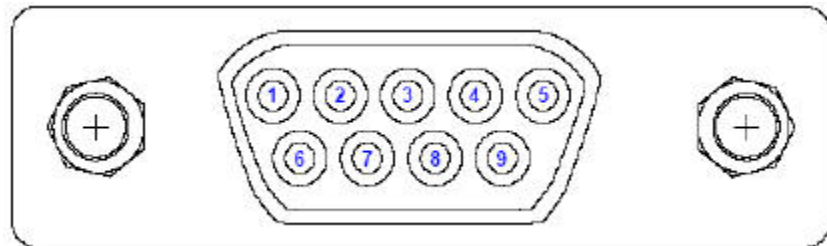


Table 25-25. MDIO Pin Assignments for XAUI Fujitsu to XENPAK Adapter

<b>Pin</b>	<b>Signal</b>
1	PU-5V
2	PU-3.3V
3	PU-APS
4	LASI (GND)
5	RESET
6	TX ON/OFF

Table 25-25. MDIO Pin Assignments for XAUI Fujitsu to XENPAK Adapter

Pin	Signal
7	MDIO
8	MDC
9	GND

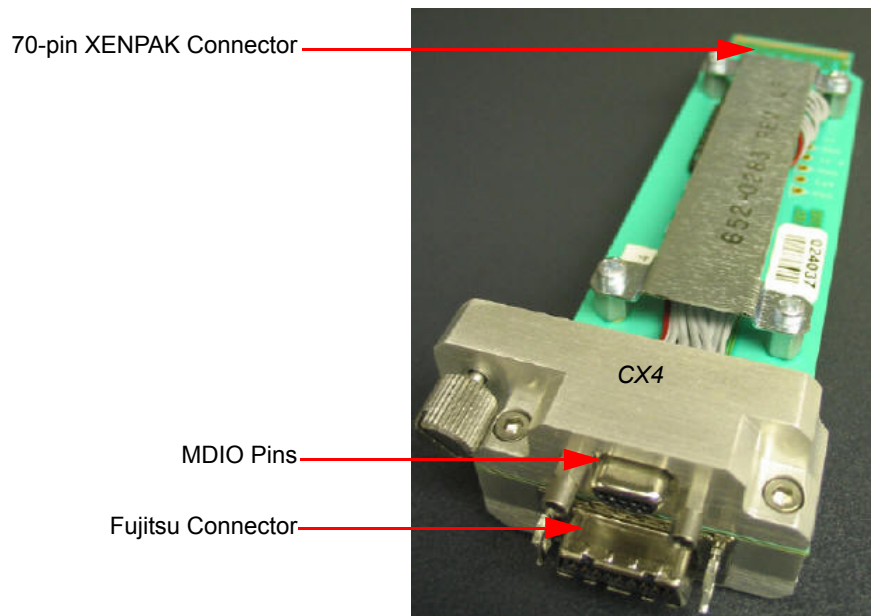
This MDIO pinout is the same for the CX4 to XENPAK adapter (P/N CX410GE500).

For more information on XAUI connectors, see *Appendix A, XAUI Connector Specifications*.

### CX4 to XENPAK Adapter

The CX4 to XENPAK Adapter (P/N CX410GE500) is shown in [Figure 25-16](#).

Figure 25-16. CX4 to XENPAK Adapter



The MDIO pins are pictured and described in [Figure 25-15](#) and [Table 25-25](#).

For more information on XAUI connectors, see *Appendix A, XAUI Connector Specifications*.

### Statistics

Statistics for 10GB cards, under various modes of operation may be found in [Table B-21](#) on page B-104 and [Table B-22](#) on page B-111.