Novus QSFP28 High-Density 100 / 50 / 40 / 25 / 10GE Load Module Family

Evolve Your High-Speed Multi-Rate Ethernet Testing

High-Density 100 / 50 / 40 / 25 / 10GE QSFP28 with Multi-Rate Ethernet Capability is Here to Stay!

Bandwidth requirements for enterprises, cloud service providers, and global data centers are growing rapidly, surpassing the bandwidth that today's 10GE and 40GE interface speeds can provide. Cloud service providers and Hyper-scale data centers are deploying high-density 100GE, 50GE, and 25GE networking infrastructure solutions to meet these demands.

Network Equipment Manufacturers (NEMs) are rapidly increasing port densities and delivering highly flexible multi-rate switch/routing ports to capture market share. These products are designed to support 100 / 50 / 40 / 25 / 10GE on a single port. The new requirements to remain competitive involve previously unheard levels of complexity.

To capitalize on today's innovation, NEMs need native QSFP28 test and measurement systems to deliver higher density 100GE products with multi-rate Ethernet speed capabilities. At the same time, they must ensure support for legacy 40GE/10GE as their customers transition to 100GE / 50GE / 25GE. As data centers, cloud service providers, and large enterprises implement this same high-density network equipment in their own networks, they too need the same type of test solution to verify performance and functionality before deployment.

Highlights

- Enable affordable, high-density 5-speed 100 / 50 / 40 / 25 / 10GE testing.
- Validate 100GE, 40GE, 25GE, and 10GE over copper, multimode and single-mode fiber media.
- Validate 50GE over copper DAC and multimode fiber AOC media.
- Leverage excellent interoperability, functional, and performance test platform for the new 100GBASE-SR4, 100GBASE-CR4, 50GBASE-CR, 25GBASE-CR, 25GBASE-SR, with auto-negotiation, FEC, and link training.
- Generate broad range of traffic and analysis with full L2 / 3 protocol coverage.

KEYSIGHT



Figure 1. Novus native QSFP28 8-ports, 100 / 50 / 40 / 25 / 10GE 1-slot load module

Novus QSFP28 100G load module family enables high-density, multi-rate switch/router testing. With Novus providing full, mid-range, and reduced scale and performance, respectively, it is the ideal platform for interoperability and functional testing, as well as high-port-count performance testing across cloud, hyperscale data center, service provider, and enterprise networks. It supports 8-ports of native QSFP28 100GE with optional fanouts that support 16-ports of 50GE, 8-ports of 40GE, or 32-ports of 25GE or 10GE per load module. We also offer an affordable lower-density 4-port full feature configuration that can upgrade to 8-ports as testing grows to take advantage of full power, performance, and scale of this load module.

As complex multi-rate test requirements for validating 100GE, 50GE, 40GE, 25GE, and 10GE on the same physical port have become mainstream, Novus native QSFP28 100GE interfaces with different fan-out speed mix or point-to-point cable support provides a more efficient and flexible set of test use cases.

Novus QSFP28 load modules are available in two different models:

- **NOVUS100GE8Q28+FAN:** A full-featured model that is an 8-port, 100GE, 50GE, 40GE, 25GE, and 10GE load module designed for enterprise and data center switch and router testing.
- **NOVUS100GE4Q28+FAN:** A full-featured model that is a 4-port, 100GE, 50GE, 40GE, 25GE, and 10GE load module designed for enterprise and data center switch and router testing.

Model	Performance Level	Usage
NOVUS100GE8Q28+FAN **NOVUS100GE4Q28+FAN**	Full Featured	Enterprise and Data Center switch and router testing

Key Features

Novus provides these key features:

- Multi-vendor interoperability of 100GE, 50GE, 40GE, 25GE, and 10GE testing between different speeds that run over these optics and media: Pluggable optical transceivers, Active Optical Cables (AOC), and passive copper Direct Attach Cable (DAC) media.
- L2 / 3 protocol emulation to validate performance and scalability of L2 / 3 routing/switching and data center test cases by using Keysight's IxNetwork application.
- Line-rate hardware packet capture and decode tools to detect and de-bug data transmission errors.

- An excellent test platform for full line rate 100Gb/s to evaluate the new 100GE and new multi-rate ASIC designs, FPGAs, and hardware switch fabrics that use the 2x50 or 4x25Gb/s electrical interface with NRZ encoding.
- Benchmark the data plane and protocol emulation performance and scale of ultra-high-density 100 / 50 / 40 / 25 / 10GE-capable network equipment; use industry-standard RFC benchmark tests in large test beds with hundreds of ports in a single test.
- Support for advanced features such as: Ethernet Forward Error Correction both RS-FEC and FC_FEC, auto-negotiation, and link training on 100GE, 50GE, and 25GE speeds.
- Coherent optical transceiver support for optics with up to 4.5 watts of power consumption in all front panel ports of all the Novus QSFP28 load modules.
- 100GE speed support for multimode 100GBASE-SR4 and single-mode 100GBASE-LR4.
- 50GE speed support (requires purchase of the 50GE load module speed option):
  - Support for independent 50GE physical fan-out cable configurations including 1x50GE and 2x50GE per port support on passive copper DAC media.
  - Up to 2x50GE links per port over single point-to-point 100GE DAC media.
  - Up to 2x50GE links per port over single point-to-point 100GE AOC multimode fiber media.
- 25GE speed support (requires purchase of the 25GE load module speed option):
  - Support for independent 25GE physical fan-out cable configurations per port including 1x25GE, 2x25GE, 3x25GE, and 4x25GE support on multimode and single mode fiber (MT-MT, MT-4xLC) and copper media (QSFP28-to-4x25GE SFP28).
  - Up to 4x25GE links per port over single point-to-point 100GE cable media (MT-MT, AOC, or DAC media).
- 40GE and 10GE speed support (requires purchase of the 40/10GE load module speed option):
  - Support for independent 40GE physical cable configuration for 1x40GE per port support on passive copper DAC media.
  - Up to 1x40GE link per port over single point-to-point 100GE DAC media.
- Up to 1x40GE link per port over single point-to-point 100GE AOC multimode fiber media.
- Application support, including IxExplorer, IxNetwork, and the related Tcl and automation APIs.

Specifications

Product Description	**NOVUS** **100GE8Q28+FAN** **100GE4Q28+FAN** **TAA Compliant NOVUS100GE8Q28+FAN** **100 / 50 / 40 / 25 / 10GE**
Part number	944-1140 944-1165 944-4004-T (TAA)
Hardware Load Module Specifications	
Slot / Number of ports	A 1-slot load module with: • 8x100GE native QSFP28 ports • 16x50GE ports via fan-out media; requires 50GE speed option • 8x40GE ports via fan-out media; requires 40 / 10GE speed option • 32x25GE ports via fan-out media; requires 25GE speed option • 32x10GE ports via fan-out media; requires 40 / 10GE speed option Note: NOVUS 100GE4Q28+FAN is an 8-port hardware load module with 4-ports enabled and all other specifications apply.
Physical interfaces	8-ports of native QSFP28 Note: NOVUS 100GE4Q28+FAN is an 8-port hardware load module with 4-ports enabled.
Supported port speeds	• 100GE/port: 100GE-capable fiber and passive copper cable media • 2x50GE/port: 50GE-capable passive copper (DAC) for point-point and fan-out cables, and multimode fiber point-to-point AOC media • 40GE/port: 40GE-capable passive copper (DAC) for point-point and fan-out cables, and multimode fiber point-to-point AOC media, and PLR4 optical transceiver • 4x25GE/port: 25GE-capable fiber and passive copper point-point and fan-out cable media • 4x10GE/port: 10GE-capable fiber and passive copper point-point and fan-out cable media
Number of users	Up to 8-users per load module
CPU and memory	Multicore processor with 2GB of CPU memory per port for 100GE and 40GE, 1GB of RAM for each of the 2x50GE fan-outs, and shared across the 4x25GE and 4x10GE fan-outs
IEEE interface protocols	• IEEE 802.3 100GBASE-R LAN • IEEE P802.3bj • IEEE P802.3bm • IEEE P802.3by • IEEE 802.3ba • IEEE 802.3ae
25G/50G Consortium specification	25GE and 50GE speed support compatible with version 1.6 of the specification
Advanced layer 1 support	100GE: • Auto-Negotiation (AN), Clause 73 for passive copper DAC • Link training for 100GE copper cable media, Clause 73 • Ethernet Forward Error Correction RS-FEC, Clause 91 FEC statistics: • RS-FEC Corrected and Uncorrected Codeword Counts • Ability to independently turn ON or OFF AN with Link training, or FEC, or to allow IEEE defaults to automatically manage the interoperability 50GE: • Auto-Negotiation (AN), Clause 73 for passive copper DAC. Compatible with 25G/50G Consortium v 1.6 (uses 25G CID) • Link Training (LT) for 50GE copper DAC media (Clause 93, 110); note: Clause 72 link training patterns are not supported

Product Description	**NOVUS** **100GE8Q28+FAN** **100GE4Q28+FAN** **TAA Compliant NOVUS100GE8Q28+FAN** **100 / 50 / 40 / 25 / 10GE**
	Ethernet Forward Error Correction: • FC-FEC, Clause 74 for BASE-R PHYs • RS-FEC, Clause 91 for 50GBASE-R PHYs FEC statistics: • RS-FEC Corrected and Uncorrected Codeword Count • FC-FEC Corrected and Uncorrected Block Count • FC-FEC Corrected Error Bits • Ability to independently turn ON or OFF AN with Link training, or FEC, or to allow IEEE defaults to automatically manage the interoperability • Independent fan-out ports with physical fan-out media for up to 2x50GE per QSFP28 port 40GE: • Auto-negotiation (AN), Clause 73 for passive copper DAC • Link training for copper cable media, Clause 73 25GE: • Auto-negotiation (AN), Clause 73 for passive copper DAC. Compatible with 25G/50G Consortium v 1.6 (uses 25G CID) • Link Training (LT) for 25GE copper DAC media (Clause 93, 110); note: Clause 72 link training patterns are not supported Ethernet Forward Error Correction: • FC-FEC, Clause 74 for BASE-R PHYs • RS-FEC, Clause 108 for 25GBASE-R PHYs FEC statistics: • RS-FEC corrected and uncorrected codeword count • FC-FEC corrected and uncorrected block count • FC-FEC corrected error bits • FC-FEC corrected error bits ability to independently turn ON or OFF AN with Link training, or FEC, or to allow IEEE defaults to automatically manage the interoperability • Independent fan-out ports with physical fan-out media for up to 4x25GE per QSFP28 port 10GE: • Independent fan-out ports with physical fan-out media for up to 4x10GE per port
Transceiver support	• 100GBASE-SR4 and 4x25GBASE-SR QSFP28 for multimode fiber o Pluggable transceiver - 10GE speed support requires a point-to-point or a fan-out cable - 25GE speed support requires a point-to-point or a fan-out cable - 40GE speed support requires a point-to-point cable A TAA complaint version is available; see the Ordering section of this data sheet • 100GBASE-LR4 QSFP28 for single mode fiber o Pluggable transceiver - 40GE speed support requires a point-to-point cable A TAA complaint version is available; see the Ordering section of this data sheet • 100GE PSM4 QSFP28 for single mode fiber o Pluggable transceiver - 100GE support requires a point-to-point cable - 25GE support requires a point-to-point or a fan-out cable - Fiber fan-out cable for 4x25GE support, use QSFP28-PSM4-CBL • 100GE CWDM4 QSFP28 for single mode fiber o Pluggable transceiver o Support 1x100GE, 2x50GE and 4x25GE Ethernet speeds per front panel port on the Novus load modules using a single, point-to-point, single mode, fiber cable with LC connectors. o There is no physical fan-out cable capability on CWDM4 optics. • 40GBASE-PLR4 QSFP+ for single-mode fiber

Product Description	○ Pluggable transceiver - 10GE speed support requires a fan-out cable - Fiber fan-out cable for 4x10GE support, use QSFP-PLR4-CBL
Cable media	• 100GBASE-SR4 multimode fiber Active Optical Cable (AOC) and MT-MT 12-fiber point-to-point cables for QSFP28 • 100GBASE-CR4, passive, copper Direct Attached Cable (DAC) up to 5 meters in length; note: requires RS-FEC to be enabled • 50GBASE-CR2 passive, copper Direct Attached Cable (DAC) QSFP28-to-2xQSFP28 fan-out media, up to 3 meters in length; note: requires BASE-R FEC Clause 74 or RS-FEC Clause 91 to be enabled • 50GBASE-SR2 multimode fiber Active Optical Cable (AOC) media, 850nm, 3-meter length • 25GBASE-SR multimode fiber Optical Cable (AOC) and MT-MT 12-fiber point-to-point cable for QSFP28, 3-meter length is available • 25GBASE-SR multimode fiber MT-to-4xLC fan-out cable for QSFP28, 3-meter and 5-meter lengths are available • 25GBASE-LR single mode fiber MT-to-4xLC fan-out cable for QSFP28, 3-meter length is available • 25GBASE-CR passive, copper Direct Attached Cable (DAC) point-point, up to 5 meters in length; note: requires BASE-R FEC Clause 74 or RS-FEC Clause 91 to be enabled • 25GBASE-CR passive, copper Direct Attached Cable (DAC) QSFP28-to-4xSFP28 fan-out media, up to 5 meters in length; note: requires BASE-R FEC Clause 74 or RS-FEC Clause 91 to be enabled
Load module dimensions	17.3” (L) x 1.3” (W) x 12.0” (H) 440 mm (L) x 33 mm (W) x 305 mm (H)
Load module weights	Module only: 11.8 lbs. (5.35 kg) Shipping: 18.6 lbs. (8.44 kg)
Temperature (Ambient air)	Operating: 41 °F to 95 °F (5 °C to 35 °C) Storage: 41 °F to 122 °F (5 °C to 50 °C)
Humidity (Ambient air)	Operating: 0 % to 85 %, non-condensing Storage: 0 % to 85 %, non-condensing
Chassis Capacity: Maximum Number of Cards and Ports per Chassis Model	
12 slot rack-mount chassis (XGS12-SD / SDL / HSL) models	12 load modules per chassis: • 96-ports of 100GE • 192-ports of 50GE • 96-ports of 40GE • 384-ports of 25GE • 384-ports of 10GE
2-slot rack-mount chassis (XGS2-SD / SDL / HSL) models	2 load modules per chassis: • 16-ports of 100GE • 32-ports of 50GE • 32-ports of 40GE • 64-ports of 25GE • 64-ports of 10GE
Transmit Feature Specifications	
Transmit engine	Wire-speed packet generation with timestamps, sequence numbers, data integrity signature, and packet group signatures

Max. Streams per port (Normal mode)	**100GE**	**50GE**	**40GE**	**25GE**	**10GE**
	64	16	64	16	16

Max. Streams per port (High stream mode)	**100GE**	**50GE**	**40GE**	**25GE**	**10GE**
	128	64	128	64	64

Product Description	**NOVUS** **100GE8Q28+FAN** **100GE4Q28+FAN** **TAA Compliant NOVUS100GE8Q28+FAN** **100 / 50 / 40 / 25 / 10GE**
Stream controls	Rate and frame size change on the fly, sequential and advanced stream scheduler
Minimum frame size	• 60 bytes at full line rate • 49 bytes at less than full line rate
Maximum frame size	14,000 bytes
Maximum fame size in data center Ethernet	9,216 bytes
Priority flow control	• 8 line-rate-capable queues, each supporting up to 2,500-byte frame lengths • 1 queue supporting up to 9,216-byte frame lengths Note: In high stream mode, only 1 PFC queue is supported
Frame length controls	Fixed, increment by user-defined step, weighted pairs, uniform, repeatable random, IMIX, and Quad Gaussian
User Defined Fields (UDF):	Fixed, increment or decrement by user-defined step, sequence, value list, and random configurations; up to ten, 32-bit-wide UDFs are available
Value lists (Max.) (Normal mode)	1M / UDF x 10
Value lists (Max.) (High stream mode)	2M / UDF x 5
Sequence (Max.)	**100GE** 8K/UDF **50GE** 4K/UDF **40GE** 8K/UDF **25GE** 2K/UDF **10GE** 2K/UDF
Error generation	Generate good CRC or force bad CRC, undersize and oversize standard Ethernet frame lengths, and bad checksum
Hardware checksum generation	Checksum generation and verification for IPv4, IP over IP, ICMP/GRE/TCP/UDP, L2TP, GTP
Link fault signaling	Reports, no fault, remote fault, and local fault port statistics; generate local and remote faults with controls for the number of faults and order of faults, plus the ability to select the option to have the transmit port ignore link faults from a remote link partner
Latency measurement resolution	2.5 nanoseconds
Intrinsic latency compensation	Removes inherent latency error from the 100GE port electronics
Transmit line clock adjustment	Ability to adjust the parts-per-million line frequency over a range of -100 ppm to +100 ppm across all ports on the load module
Receive Feature Specifications	
Receive engine	Wire-speed packet filtering, capturing, real-time latency, and inter-arrival time for each packet group, with data integrity, sequence and advanced sequence checking capability
Trackable receive fows per Port	**100GE** / **50GE** / **40GE** / **25GE** / **10GE** Limited Statistics Mode: 32K / 15K / 32K / 8K / 8K Full Statistics Mode: 4K / 4K / 4K / 2K / 2k
Minimum frame size	• 60 bytes at full line rate • 64 bytes at full line rate into the capture buffer • 49 bytes at less than full line rate
Filters (User-Defined Statistics, UDS)	2 SA/DA pattern matchers, 2x16-byte user-definable patterns with offsets capability for start of: frame, IP, or protocol; up to 6 UDS counters are available

Product Description	NOVUS 100GE8Q28+FAN 100GE4Q28+FAN TAA Compliant NOVUS100GE8Q28+FAN 100 / 50 / 40 / 25 / 10GE	

Hardware capture buffer (Standard)	There are two hardware capture buffers on the card; user can select which port or resource group each capture buffer may be assigned for capture purposes, as follows:
	• 1x100GE, 1x40GE:
	  ○ 2GB per port
	• 2x50GE, 4x25GE, 4x10GE:
	  ○ 1 GB per Resource Group (that is, assign 1 buffer to a port in the Resource Group)
		There are two 1 MB hardware capture buffers on the card; user can select which port or resource group each capture buffer may be assigned for capture purposes, as follows:
		• 1x100GE, 1x40GE:
		  ○ 1MB per port
		• 2x50GE, 4x25GE, 4x10GE:
		  ○ 1 MB per Resource Group (that is, assign 1 buffer to a port in the Resource Group)

Hardware capture buffer (Extended to all 8-ports)	Extended capture allows the following: *
	• 1x100GE, 1x40GE, 2x50GE:
	  ○ 2 GB per port
	Can capture across all 8-ports
	• 4x25GE, 4x10GE:
	  ○ 1 GB per Resource Group (that is, assign 1 buffer to a port in the Resource Group)
	Can capture across all 8-ports, or all 4-ports for 4-port configuration card
	
	*Note: Only supported for XGS12-SD/SDL/HSL chassis. Once the feature is enabled, slots 1, 2, 11 and 12 will become inactive	

Statistics and rates	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), 8 QoS counters, data integrity frames, data integrity errors, sequence and advanced sequence checking frames, sequence checking errors, ARP, and PING requests and replies, FEC statistics: RS-FEC Corrected and Uncorrected Block Counts, FEC Corrected Error Bits, FEC Sync	
Latency / Jitter measurements	Cut-through, store and forward, forwarding delay, up to 16-time bins latency/jitter, MEF jitter, and inter-arrival time	
Receive-side PCS lanes port satistics counters	PCS Sync Errors, Illegal Codes, Remote Faults, Local Faults, Illegal Ordered Set, Illegal Idle, Illegal SOF, Out of Order SOF, Out of Order EOF, Out of Order Data, Out of Order Ordered Set	
100GE Physical Coding Sublayer (PCS) receive-side statistics and indicators	IEEE 802.3ba-compliant PCS transmit and receive side test capabilities include: Per PCS lane, receive lanes statistics - PCS Sync Header and Lane Marker Lock, Lane Marker mapping, Relative Lane deskew up to 104 microseconds for 100GE, Sync Header and PCS Lane Marker Error counters, indicators for Loss of Synch Header and Lane Marker, and BIP8 errors	
Layer 2-3 Protocol Support		
Routing and switching	BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, EIGRP/EIGRPv6, RIP/RIPng, BFD, Seamless BFD, IGMP/MLD, PIM-SM/SSM, STP/RSTP/MSTP, PVST+/RPVST+, Link Aggregation (LACP), LISP	
Software defined network	OpenFlow, Segment Routing MPLS (ISIS, OSPFv2, OSPFv3, BGP), Segment Routing IPv6 (ISIS, L3VPN, EVPN), BGP Link State (BGP-LS), PCEP, VXLAN, EVPN VXLAN, OVSDB, GENEVE, BGP FlowSpec, BGP SR TE Policy, Netconf, BIER, eCPRI, Flex-Algo (ISIS, OSPFv2)	
MPLS	RSVP-TE P2P/P2MP, LDP/LDPv6/mLDP, LDP L2VPN (PWE/VPLS), BGP VPLS/VPWS, L3VPN/6VPE, 6PE, BGP RFC3107, MPLS-TP, MPLS OAM, EVPN/PBB-EVPN, Multicast VPN Rosen Draft, NG Multicast VPN	

Product Description	**NOVUS 100GE8Q28+FAN 100GE4Q28+FAN TAA Compliant NOVUS100GE8Q28+FAN 100 / 50 / 40 / 25 / 10GE**
Broadband and authentication	PPPoX/L2TPv2, DHCPv4/DHCPv6, ANCP, IPv6 Autoconfiguration (SLAAC), IGMP/MLD, 802.1x, Bonded GRE HG
Industrial Ethernet	Link OAM (IEEE 802.3ah), CFM/Y.1731, PBB/PBB-TE, ELMI, Sync-E ESMC, IEEE 1588v2 (PTP), NTP
Data center Ethernet	DCBX/LLDP, FCoE/FIP, PFC (IEEE 802.1Qbb), TRILL, Cisco FabricPath, SPBM, VEPA
L2 security	Static MACsec (Support full feature card only, not supported on R and M card)

Application Support

NOVUS100GE8Q28+FAN 100 / 50 / 40 / 25 / 10GE

IxExplorer: Layer 2-3 wire-speed traffic generation and analysis with HSE PCS Lanes Rx-side testing. Note: Not all Keysight loads modules support Layer 1 BERT and/or the complete set of Tx PCS Lanes test capabilities.

IxNetwork: Wire-rate traffic generation with service modeling that builds realistic, dynamically controllable data-plane traffic. IxNetwork offers the industry's best test solution for functional and performance testing by using comprehensive emulation for routing, switching, MPLS, IP multicast, broadband, authentication, Carrier Ethernet, and data center Ethernet protocols.

Tcl API: Custom user script development for Layer 1-3 testing.

Ordering Information

This section includes the ordering information for TAA complaint part numbers. Please see part number in their applicable sub-sections with a “-T” suffix on the part number.

Load module

944-1140

NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE full scale and performance, load module, 1-slot with 8-ports with the native QSFP28 physical interface, L2-3 support with complete protocol coverage, and full scale and performance protocol emulation for routing, switching and access protocols. The load module is compatible with the XGS12-SD 12-slot, standard performance rack mount chassis bundle (940-0011), XGS2-SD 2-slot, 3RU standard performance chassis bundle (940-0010), XGS2-HSL 2-slot, 3RU high-speed performance chassis bundle (940-0014), and XGS12-HSL 12-slot, high-speed performance rackmount chassis bundle (940-0016).



944-1165

IXIA NOVUS100GE4Q28+FAN, 4-port enablement on the NOVUS100GE8Q28+FAN load module (944-1140), 1-slot with 4-ports, L2-3 load module with complete protocol coverage, and full scale and performance (944-1165). The load module is compatible with the XGS2-SD 2-slot, 3RU standard performance rack-mountable chassis bundle (940-0017), XGS12-SD 12-slot, 11RU standard performance rack-mountable chassis bundle (940-0018), XGS2-SDL 2-slot, 3RU standard performance rack-mountable chassis bundle (940-0013), XGS2-HSL 2-slot, 3RU high performance rack-mountable chassis bundle (940-0014), XGS12-SDL 12-slot, 11RU standard performance rack-mountable chassis bundle (940-0015), and XGS12-HSL 12-slot, 11RU high performance rack-mountable chassis bundle (940-0016).



TAA Compliant Load Module

944-4004-T

Ixia TAA Compliant NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE full scale and performance, load module, 1-slot with 8-ports with the native QSFP28 physical interface, L2-3 support with complete protocol coverage, and full scale and performance protocol emulation for routing, switching and access protocols. The load module is compatible with the XGS2-SD 2-slot, 3RU standard performance rack-mountable chassis bundle (940-0010), XGS12-SD 12-slot, 11RU standard performance rack-mountable chassis bundle (940-0011), XGS2-SDL 2-slot, 3RU standard performance rack-mountable chassis bundle (940-0013), XGS12-SDL 12-slot, 11RU standard performance rack-mountable chassis bundle (940-0015), XGS2-HSL 2-slot, 3RU high performance rack-mountable chassis bundle (940-0014), and XGS12-HSL 12-slot, 11RU high performance rack-mountable chassis bundle (940-0016).

Speed Option Bundles for 50GE, 25GE, 40 / 10GE

947-4060

Ixia, L23 100GE NOVUS bundle with 1 each NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE full scale and performance, L2-3 load module (944-1140), 1 each NOVUS 25GE FAN-OUT FACTORY INSTALLED option (905-1007), 1 each NOVUS 2x50GE FAN-OUT FACTORY INSTALLED option (905-1011) and 1 each NOVUS 1x40GE/4x10GE FAN-OUT FACTORY INSTALLED option (905-1025). Note, this bundle includes support for NRZ speeds per port of 1x100GE, 2x50GE, 1x40GE, 2x25GE, and 4x10GE (947-4060).

Speed Options — 50GE, 25GE, 40 / 10GE

905-1011

NOVUS 2x50GE FAN-OUT OPTION for a factory installed 2x50GE fan-out option for new purchases of the NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140); NOVUS100GE4Q28+FAN, 4-port enablement, QSFP28 100GE (944-1165); NOVUS-M100GE8Q28+FAN medium 8-port, QSFP28 100GE (944-1156); NOVUS-R100GE8Q28+FAN reduced, 8-port, QSFP28 100GE (944-1147) load modules. Note: This option is REQUIRED ON NEW PURCHASES to enable the 2x50GE speed on the NOVUS100GE8Q28+FAN, NOVUS100GE4Q28+FAN, NOVUS-M100GE8Q28+FAN and NOVUS-R100GE8Q28+FAN load modules. Note: For the 2x50GE upgrade purchase, please provide the serial number of the required load module to install the option on at the time of order placement.

905-1012

NOVUS 2x50GE FAN-OUT-UPG FIELD UPGRADE Option purchase of the 50GE fan-out option for the NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140); NOVUS100GE4Q28+FAN, 4-port enablement, QSFP28 100GE (944-1165); NOVUS-M100GE8Q28+FAN medium 8-port, QSFP28 100GE (944-1156); and NOVUS-R100GE8Q28+FAN, reduced 8-port, QSFP28 100GE (944-1147) load modules. Note: This option is REQUIRED ON FIELD UPGRADE PURCHASES to enable the 2x50GE speed on the NOVUS100GE8Q28+FAN, NOVUS100GE4Q28+FAN, NOVUS-M100GE8Q28+FAN and NOVUS-R100GE8Q28+FAN load modules. Note: For the 2x50GE upgrade purchase, please provide the serial number of the required load module to install the option on at the time of order placement.

905-1007

NOVUS 25GE FAN-OUT OPTION for a factory installed 25GE fan-out option for new purchases of the NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140); NOVUS100GE4Q28+FAN, 4-port enablement, QSFP28 100GE (944-1165); NOVUS-M100GE8Q28+FAN medium 8-port, QSFP28 100GE (944-1156); and NOVUS-R100GE8Q28+FAN, reduced 8-port, QSFP28 100GE (944-1147) load modules. Note: This option is REQUIRED ON NEW PURCHASES to enable the 25GE speed on the NOVUS100GE8Q28+FAN, NOVUS100GE4Q28+FAN, NOVUS-M100GE8Q28+FAN, or the NOVUS-R100GEQSFP28+FAN 8-port, QSFP28 100GE load modules. Note: For the 4x25GE upgrade purchase, please provide the serial number of the required load module to install the option on at the time of order placement.

905-1008

NOVUS 25GE FAN-OUT-UPG FIELD UPGRADE Option purchase of the 25GE fan-out option for the NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140); NOVUS100GE4Q28+FAN, 4-port enablement, QSFP28 100GE (944-1165); NOVUS-M100GE8Q28+FAN medium 8-port, QSFP28 100GE (944-1156); and NOVUS-R100GE8Q28+FAN, reduced 8-port, QSFP28 100GE (944-1147) load modules. Note 1: This option is REQUIRED ON FIELD UPGRADE PURCHASES to enable the 25GE speed on the NOVUS100GE8Q28+FAN, NOVUS100GE4Q28+FAN, NOVUS-M100GE8Q28+FAN, or the NOVUS-R100GE8Q28+FAN 8-port, QSFP28 100GE load modules. Note 2: For the 25GE upgrade purchase, please provide the serial number of the required load module to install the option on at the time of order placement.

905-1025

NOVUS 1x40GE/4x10GE FAN-OUT OPTION for a factory installed 1x40GE/4x10GE fan-out option for new purchases of the NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140); NOVUS100GE4Q28+FAN, 4-port enablement, QSFP28 100GE (944-1165); NOVUS-M100GE8Q28+FAN medium 8-port, QSFP28 100GE (944-1156); and NOVUS-R100GE8Q28+FAN, reduced 8-port, QSFP28 100GE (944-1147) load modules. Note 1: This option is REQUIRED ON NEW PURCHASES to enable the 1x40GE/4x10GE speed on the NOVUS100GE8Q28+FAN, NOVUS100GE4Q28+FAN, NOVUS-M100GE8Q28+FAN, or the NOVUS-R100GE8Q28+FAN load modules. Note 2: For the 1x40GE/4x10GE upgrade purchase, please provide the serial number of the required load module to install the option on at the time of order placement.

905-1026

NOVUS 1x40GE/4x10GE FAN-OUT-UPG FIELD UPGRADE Option purchase of the 1x40GE/4x10GE fan-out option for the NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140); NOVUS100GE4Q28+FAN, 4-port enablement, QSFP28 100GE (944-1165); NOVUS-M100GE8Q28+FAN medium 8-port, QSFP28 100GE (944-1156); and NOVUS-R100GE8Q28+FAN, reduced 8-port, QSFP28 100GE (944-1147) load modules. Note1: This option is REQUIRED ON FIELD UPGRADE PURCHASES to enable the 1x40GE/4x10GE speed on the NOVUS100GE8Q28+FAN, NOVUS100GE4Q28+FAN, NOVUS-M100GE8Q28+FAN, or the NOVUS-R100GE8Q28+FAN load modules. Note 2: For the 1x40GE/4x10GE upgrade purchase, please provide the serial number of the required load module to install the option on at the time of order placement.

TAA Compliant Speed Options — 50GE, 25GE, 40 / 10GE

905-5001-T

Ixia TAA Compliant NOVUS 2x50GE FAN-OUT OPTION for a factory installed 2x50GE fan-out option for new purchases of the NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140), NOVUS-M100GE8Q28+FAN medium 8-port, QSFP28 100GE (944-1156), and the NOVUS-R100GE8Q28+FAN reduced, 8-port, QSFP28 100GE (944-1147) load modules. Note: This option is REQUIRED ON NEW PURCHASES to enable the 2x50GE speed per port on the supported load modules.

905-5000-T

Ixia TAA Compliant NOVUS 25GE FAN-OUT OPTION for a factory installed 25GE fan-out option for new purchases of the NOVUS100GE8Q28+FAN (944-1140), NOVUS-M100GE8Q28+FAN (944-1156), or the NOVUS-R100GEQSFP28+FAN (944-1147), 8-port, QSFP28 100GE load modules. Note: This option is REQUIRED ON NEW PURCHASES to enable the 25GE speed on the NOVUS100GE8Q28+FAN, NOVUS-M100GE8Q28+FAN, or the NOVUS-R100GEQSFP28+FAN 8-port, QSFP28 100GE load modules.

905-5002-T

Ixia TAA Compliant NOVUS 1x40GE/4x10GE FAN-OUT OPTION for a factory installed 1x40GE/4x10GE fan-out option for new purchases of the following load modules: NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140), NOVUS-M100GE8Q28+FAN (944-1156), or the NOVUS-R100GE8Q28+FAN 8-port, QSFP28 100GE reduced (944-1147). Note: This option is REQUIRED ON NEW PURCHASES to enable the 1x40GE/4x10GE speed on the NOVUS100GE8Q28+FAN, NOVUS-M100GE8Q28+FAN and NOVUS-R100GE8Q28+FAN load modules.

Port Count Upgrade

905-1096

IXIA NOVUS-UPG, additional 4-port enablement FIELD UPGRADE for NOVUS100GE4Q28+FAN, 4-port full scale and performance load module (944-1165) to become NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE full scale and performance, load module (944-1140)

Performance Upgrade

905-1013

NOVUS-R-UPG FIELD UPGRADE for the Novus-R QSFP28 8x100GE reduced load module (944-1147) to enhance the data plane feature set and to add full support for all IxNetwork L23 protocol emulations equal to that of the full featured Novus QSFP28 8x100GE load module (944-1140). Note: For the Novus-R upgrade purchase please provide the serial number of the desired load module to install the upgrade on at the time of order placement.

Cables and Transceivers

QSFP28-DR1-XCVR

Ixia QSFP28 100GE 100GBASE-DR1 pluggable optical transceiver, SMF (single mode), 1310nm, 500m reach (948-0055). This optical transceiver is compatible with all Novus load modules: NOVUS-M100GE8Q28+FAN (944-1156), NOVUS-R100GE8Q28+FAN (944-1147) and NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE load module (944-1140). Note: This QSFP28 transceiver converts PAM4 signaling to NRZ signaling.

QSFP28-SR4-XCVR

Ixia, QSFP28 100GBASE-SR4 100GE pluggable optical transceiver, MMF (multimode), 850nm, 100m reach. COMPATIBLE VISIBILITY PRODUCTS: Vision X Family- MVX-SWCH (991-2033), MVX-NS12PC (991-2030), MVX-PS8PC (991-2032), Vision 7300/7303 - M7300-12PC (992-0072), BD-7816AC-32PC (991-0147) or BD-7816DC-32PC (991-0148), Vision E100 (991-0151) and iBypass 100G modules (MIBP100G-SR4/MIBP100G-SR4) (Tool ports). COMPATIBLE NETWORK TEST PRODUCTS: All Novus QSFP28, 100GE 8-port and 4-port load modules. This transceiver supports the Novus 100GE speed, and the 50GE, 40GE, 25GE, and 10GE speed options. All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.

QSFP28-LR4-XCVR

Ixia, QSFP28 100GBASE-LR4 100GE pluggable optical transceiver, SMF (single mode fiber), 1310nm, 10km reach. COMPATIBLE VISIBILITY PRODUCTS: Vision X Family- MVX-SWCH (991-2033), MVX-NS12PC (991-2030), MVX-PS8PC (991-2032), Vision 7300/7303 - M7300-12PC (992-0072), BD-7816AC-32PC (991-0147) or BD-7816DC-32PC (991-0148), Vision E100 (991-0151) and iBypass 100G modules (MIBP100G-SR4/MIBP100G-SR4) (Tool ports). COMPATIBLE NETWORK TEST PRODUCTS:

All Novus QSFP28, 100GE 8-port and 4-port load modules. This transceiver supports the Novus 100GE speed, and the 50GE and 25GE speed options. All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. The CloudStorm load modules (944-1231 to 944-1240). Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.

QSFP-PLR4-XCVR

Ixia, QSFP+ 40GBASE-PLR4 40GE pluggable optical transceiver, SMF (single mode), 1310nm, 10 km reach. COMPATIBLE NETWORK TEST PRODUCTS: All Novus QSFP28, 100GE 8-port and 4-port load modules. This transceiver supports the Novus 40GE and 10GE speed option. All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. The CloudStorm load modules (944-1231 to 944-1240). Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.

QSFP-PLR4-CBL

Ixia, MT-to-4xLC fan-out, SMF, 3-meter cable for 4x10GE fan-out (942-0079). REQUIRES QSFP-PLR4-XCVR, pluggable, transceiver 1310nm, SMF (single mode). COMPATIBLE TEST PRODUCTS: QSFP-PLR4-XCVR (948-0040) with all Novus QSFP28, 100GE 8-port and 4-port load modules with the 10GE fan-out option enabled, all AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed, and CloudStorm load modules (944-1231 to 944-1240). Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information. COMPATIBLE VISIBILITY PRODUCTS: QSFP-PLUS-PLR4-XCVR (948-0061) with Vision X (chassis & line cards), Vision 7300/7303, Vision ONE, E100, and E40.

QSFP28-PSM4-XCVR

Ixia, QSFP28 100GBASE-PSM4 100GE pluggable optical transceiver, SMF (single mode fiber), 1310nm, 2km reach. MPO Connector (948-0037). COMPATIBLE VISIBILITY PRODUCTS: Vision X Family- MVX-SWCH (991-2033), MVX-NS12PC (991-2030), MVX-PS8PC (991-2032), Vision 7300 Family- M7300-12PC (992-0072), and Vision E100. COMPATIBLE NETWORK TEST PRODUCTS: All Novus QSFP28, 100GE 8-port and 4-port load modules. This transceiver supports the Novus 100GE speed, and the 50GE and 25GE speed options. All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.

QSFP28-PSM4-CBL

Ixia, MT-to-4x25GE LC fan-out, SMF, 3-meter cable for 25GE fan-out (942-0127). REQUIRES QSFP28-PSM4-XCVR 100GE PSM4, pluggable optical transceiver, SMF (single mode fiber), 1310nm, 2km reach, MPO connector (948-0037). COMPATIBLE TEST PRODUCTS: All Novus QSFP28, 100GE 8-port and 4-port load modules with the 25GE fan-out option enabled, all AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information. COMPATIBLE VISIBILITY PRODUCTS: Vision X Family- MVX-

SWCH (991-2033), MVX-NS12PC (991-2030), MVX-PS8PC (991-2032), Vision 7300 Family- M7300-12PC (992-0072), and Vision E100.

948-0078

Ixia, QSFP28 CWDM4 optical transceiver, SMF (single mode) 4 lambdas, LC receptacle, 2km reach for all Novus 100GE QSFP28 load modules (948-0078). Note this optical transceiver only supports the 1x100GE, 2x50GE and 4x25GE Ethernet speeds per front panel port on the Novus load modules using a single, point-to-point, single mode, fiber cable. There is no physical fan-out cable capability.

942-0067

Ixia, MT-to-4xLC fan-out, MMF, 3-meter cable for 4x10GE and 4x25GE fan-out per port. This cable is compatible with this optical transceiver: QSFP28-SR4-XCVR, 100GBASE-SR4 100GE pluggable transceiver, 850nm, MMF (QSFP28-SR4-XCVR). This cable and transceiver combination are compatible with all Novus QSFP28, 100GE 8-port and 4-port load modules with the 10GE and 25GE fan-out options enabled, all AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.



942-0068

Ixia, MT-to-4xLC fan-out, MMF, 5-meter cable for 4x10GE and 4x25GE fan-out per port. This cable is compatible with this optical transceiver: QSFP28-SR4-XCVR, 100GBASE-SR4 100GE pluggable transceiver, 850nm, MMF (QSFP28-SR4-XCVR). This cable and transceiver combination are compatible with all Novus QSFP28, 100GE 8-port and 4-port load modules with the 10GE and 25GE fan-out options enabled, all AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.



942-0088

Ixia, QSFP28 passive, copper, Direct Attach Cable (DAC), passive copper, point-to-point, 3-meter length. It is compatible with all NOVUS QSFP28, 8-port and 4-port load modules, CloudStorm 2-port, QSFP28 100GE (944-1231 and 944-1232) load modules, and all AresONE-S 400GE QSFP-DD fixed chassis systems with the NRZ signaling option installed. Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.

942-0092

QSFP28 Active Optical Cable (AOC), multimode fiber, 850nm, 3-meter length. Compatible with the Xcellon-Multis XM100GE4QSFP28+ENH 100-Gigabit Ethernet, Enhanced load module (944-1117), NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE (944-1140), NOVUS-M100GE8Q28+FAN (944-1156), NOVUS100GE8Q28+FAN (944-1147), and the CloudStorm 2-port, QSFP28 100GE (944-1231 and 944-1232) load modules.

942-0093

Ixia, QSFP28-to-2x50GE QSFP28 Direct Attach Cable (DAC) passive copper, fan-out, 3-meter length. This cable supports the 50GE options for all Novus QSFP28, 8-port and 4-port load modules. NOTE: The NOVUS load modules REQUIRE the 2x50GE fan-out speed option to be installed to use this cable. NOTE2: Supports all AresONE-S 400GE QSFP-DD fixed chassis systems with the NRZ signaling option installed. Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.

942-0094

Ixia, QSFP28-to-4x25GE SFP28 Direct Attach Cable (DAC) passive copper, fan-out, 3-meter length. This cable is supports all Novus QSFP28, 8-port and 4-port load modules. NOTE: The load module must have the 4x25GE fan-out speed option installed to use this cable. NOTE2: Supports all AresONE-S 400GE QSFP-DD fixed chassis systems with the NRZ signaling option installed. Refer to the individual product datasheets and the Novus 100GE Optics and Cable guide, and the 400GE Optics and Cable Guide for additional configuration information.

TAA Complaint Cables and Transceivers

QSFP28-SR4-XCVR-T

Ixia, TAA compliant, QSFP28 100GBASE-SR4 100GE pluggable optical transceiver, MMF (multimode fiber), 850nm, 100m reach (995-8040). COMPATIBLE VISIBILITY PRODUCTS: Vision X Family- MVX-SWCH (991-2033), MVX-NS12PC (991-2030), MVX-PS8PC (991-2032), Vision 7300 - M7300-12PC (992-0072), BD-7816AC-32PC (991-0147) or BD-7816DC-32PC (991-0148), Vision E100 (991-0151) and iBypass 100G modules (MIBP100G-SR4/MIBP100G-SR4) (Tool ports). COMPATIBLE NETWORK TEST PRODUCTS: Novus 8-port, QSFP28 100GE load module family; NOVUS100GE8Q28+FAN (944-1140), NOVUS-M100GE8Q28+FAN (944-1156), and NOVUS-R100GE8Q28+FAN (944-1147) and these supported speeds; 1x100GE, 2x50GE, 1x40GE, 4x25GE and 4x10GE, please reference the Novus Optics and Cable Guide.

QSFP28-LR4-XCVR-T

Ixia, TAA compliant, QSFP28 100GBASE-LR4 100GE pluggable optical transceiver, SMF (single mode fiber), 1310nm, 10km reach (995-8039). COMPATIBLE VISIBILITY PRODUCTS: Vision X Family- MVX-SWCH (991-2033), MVX-NS12PC (991-2030), MVX-PS8PC (991-2032), Vision 7300 - M7300-12PC (992-0072), Vision E100 (991-0151) and iBypass 100G modules (MIBP100G-SR4/MIBP100G-SR4) (Tool ports). COMPATIBLE NETWORK TEST PRODUCTS: Novus 8-port, QSFP28 100GE load module family; NOVUS100GE8Q28+FAN (944-1140), NOVUS-M100GE8Q28+FAN (944-1156), and NOVUS-R100GE8Q28+FAN (944-1147) and these supported speeds; 1x100GE, 2x50GE, 4x25GE and 4x10GE, please reference the Novus Optics and Cable Guide.

942-0067-T

IXIA TAA Compliant, MT-to-4x10GE LC fan-out, MMF, 3-meter cable for 10GE and 25GE fan-out. 4x10GE fan-out per port REQUIRES a QSFP 40GBASE-SR4, pluggable, transceiver, 850nm, MMF (948-0031). This cable and transceiver are compatible with the following load modules: Xcellon-Multis XM10/40GE12QSFP+FAN 40-Gigabit Ethernet QSFP load module (944-1105), and the Xcellon-Multis XM10/40GE6QSFP+FAN 40-Gigabit Ethernet QSFP load module (944-1109). 4x25GE fan-out per port REQUIRES a 100GBASE-SR4 QSFP28 100GBASE-SR4 100GE pluggable transceiver, 850nm, MMF (QSFP28-SR4-XCVR). This cable and transceiver are compatible with the following load modules: NOVUS-M100GE8Q28+FAN (944-1156), NOVUS-R100GE8Q28+FAN (944-1147), NOVUS100GE8Q28+FAN, 8-port, QSFP28 100GE load module (944-1140), and the Xcellon-Multis XM100GE4QSFP28+ENH 100GE QSFP28, 4-port enhanced load module (944-1117).

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