AresONE-S-400GE QSFP-DD High-Density 16-Port Test System

Challenge: Testing All PAM4 and NRZ Speeds

An 8x56 Gb/s electrical interface and PAM4 encoded technology is required with 400GE adoption. Most switch ASICs now support this new PAM4 modulation along with the legacy NRZ encoding that is used for lower-speed technologies—easing the transition from 100GE to 400GE. Testing all seven speeds from 10GE to 400GE on these platforms has become a new challenge. Bandwidth requirements for internet applications is driving the need of testing line rate traffic of 3.2, 6.4, 12.8, 25.6 and now 51.2 Tbps ASICs.

Keysight has extended its industry leading AresONE 400GE network test platforms to address these evolving market needs.

Solution: All in One Test Platform with 16-Port Density and 7 Speeds

With first-to-market solutions, both AresONE and AresONE High Performance 400GE solutions have established significant footprint in the networking equipment industry as enablers for testing bleeding-edge, high scale, 400GE technology. AresONE-S 400GE is our latest addition to the AresONE family of high-speed Ethernet product lines.

AresONE-S doubles the density of AresONE 400GE in the same 2RU fixed chassis form factor. A staggering 6.4 Tbps traffic generation capability, stackable to build higher-throughput test beds gives you a future-proof test platform that can grow with your needs. It enables testing 7 speeds in the same platform with each port capable of the following speeds:

- PAM4 Speeds: 1x400, 2x200, 4x100, 8x50GE
- NRZ Speeds: 2x100, 4x50, 2x40, 8x25, 8x10GE

KEYSIGHT

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Pay as you Grow — Full and Reduced, Speed Variants, All Field Upgradeable

AresONE-S fixed chassis are available in full- and reduced-performance models:

16-port hardware chassis:

- AresONE, S400GD-16P-QDD, High Density, 16-port, full performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces and L1-3 support (944-1186)
- AresONE, S400GDR-16P-QDD, High Density, 16-port, reduced performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces and L1-3 support (944-1187)

8-ports enabled on the 16-port hardware chassis:

- AresONE S400GD-16PHW-8P-QDD, High Density, 8-port, full performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces and L1-3 support (944-1300)
- AresONE S400GDR-16PHW-8P-QDD, High Density, 8-port, reduced performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces and L1-3 support (944-1301)

Keeping with the trend set by the earlier generation of AresONE 400GE, next generation AresONE-S offers flexibility for upgrade based on need. In addition to being field upgradable from reduced to full performance, users can field-upgrade from an 8-port configuration to a full chassis of 16 ports and add on PAM4 and/or NRZ speeds, as required.

Highlights

- AresONE-S 16 port model enables industry's highest-density testing in a single 2 RU fixed chassis platform
- 6.4 Tbps of line-rate traffic, with option to synchronize multiple chassis to test 25.6 Tbps and beyond switching platforms
- One platform for all 7 speeds: 400/200/100/50/40/25/10GE with PAM4 and NRZ signaling
- Complete L2/3 protocols emulation coverage and industry-leading scale and performance with Keysight's IxNetwork software application
- Flexible bundle options for port and performance upgrades, to extend your investment
- Improve your interoperability, link stability, and robustness testing with Keysight-developed intellectual property for the critical test elements of 400GE: MAC, PCS, FEC symbol error correction distribution, FEC error injection and statistics, and PAM4 / NRZ Rx Eye Histogram analysis

Figure 1. AresONE-S QSFP-DD-400GE 16-port, fixed chassis system

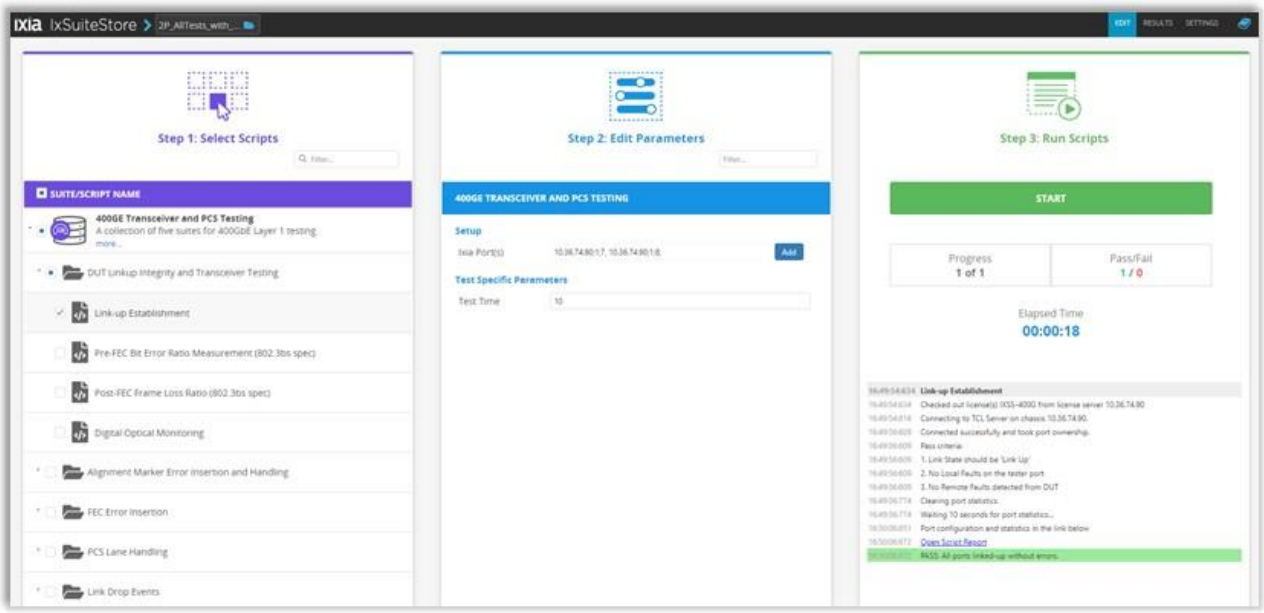
Key Features

- Line-rate 400 Gbps packet generation, capture, and analysis of received traffic to detect and debug data transmission errors for multiple speeds
- Multi-rate fan-out speed options, to configure the fan-out speeds with PAM4 or NRZ signaling or both modes:
  - PAM4 speeds: 2x200, 4x100, 8x50GE (optional)
  - NRZ speeds: 2x100, 4x50, 2x40, 8x25, 8x10GE (optional)
  - 1x400GE PAM4 is the default (that is, built-in) per port speed on the hardware chassis
- IxNetwork protocol bundles that provide easy and flexible pricing designed for fixed chassis systems
- IxSuiteStore, the industry's first fully automated IEEE 802.3bs-based test suite that enables automated validation of 400GE implementations, includes testing of physical coding sublayer (PCS) lanes, bit error rate (BER), KP4 FEC bit-error distribution with error insertion and link stability
- Field upgradability from reduced to full feature, incremental port density, and add-on speed options
- Bundles for easy ordering of multiple options under a single part number
- Line-rate, at all speeds with per-port and per-flow statistics
- High-latency measurement resolution at 0.625 ns at the 400GE speed and 1.25 ns at 200GE
- RS-544 (KP4) Forward Error Correction (FEC) support for all PAM4 speeds (400/200/100/50GE)
- RS-FEC and FC-FEC as applicable per industry standards for the NRZ speeds
- Overall optical and copper QSFP-DD MSA compatible interconnect media support with CMIS 5.0 and C-CMIS 1.0 support with IxExplorer GUI and Tcl automation

- Auto-negotiation (AN) and link training (LT) support for passive copper cables up to 3-meters in length. See the Specifications table for additional information
- Coherent optical transceiver support, 400G-ZR with CMIS 5.0 and C-CMIS 1.0 management. 400G-ZR optics with up to 20 watts of power consumption are support in all ports of the AresONE-S QSFP-DD chassis front panel. See the Specifications table for additional information
- Digital Optical Monitoring (DOM) that automatically provides information from the interconnect device plugged into the test port, along with the device status, electrical power, temperatures, power class, laser power and various LOL and LOS threshold and alarm monitoring information. The DOM also provides feedback when alarms and thresholds are exceeded. This capability is provided with the IxExplorer application
- 400GE and 2x200GE FEC symbol error injection and FEC symbol error density distribution; comprehensive set of FEC corrected and uncorrected counts, rates, and statistics; BER per lane and per port, and pre-FEC BER, frame loss ratio (FLR) analysis is provided to name a few
- Keysight instrumentation, including floating timestamp, sequence number, flow identification, and data integrity
- 400GE PCS lanes Transmit, error injection testing and receive measurement:
    - Per-lane controls and status, FEC and error monitoring, FEC and PCS error insertion, lane mapping and skew insertion; see details in Specification Table in this data sheet, as capabilities may vary per Ethernet speed
- Layer 1 BERT capability with per-lane and per-port BER statistics, ability to send PRBS patterns and inject bit errors per lane under user control
- Advanced Rx Eye Histogram Analysis Option that provides in-depth, user-selected, per-lane PAM4 signal shape analysis, symbol error rate (SER) statistics, comparison of signal quality between lanes and an array of eye measurements. Note that you must have one of the purchasable options 905-1098 or 905-1099. Please see the Ordering section.
- +/- 100 PPM line frequency adjustment
- Inject packet errors: CRCs, runts, giants, alignments, checksum errors, and out of sequence
- Mid-range L2/3 networking protocol emulation to validate performance and scalability of L2/3 routing/switching and data center test cases by using Keysight's IxNetwork protocol emulation application
- Supports RFC benchmarking of networking devices and equipment by using industry-standard RFC benchmark tests at line-rate 400/200/100/50GE speeds
- Supported with the Native IxOS software
- Application support: backwards compatible with existing chassis and software with IxExplorer and IxNetwork
- IxExplorer, IxNetwork, and related Tcl and REST API automation APIs

IxSuiteStore—Fast and Efficient Standards-Based Test Methodology for 400GE PAM4

The automated 400GE Transceiver and PCS Testing suite enables developers of 400GE equipment to accelerate testing and gain significant time to market advantage. Quality assurance teams can benefit from front-loading testing, flagging implementation issues more quickly, and reducing manual test time. Consumers of 400GE equipment like data center and service provider equipment validation teams can use the test suite to automate 400GE equipment and optical transceiver and copper cable validation during initial stages of qualification, to ensure quality of upgrades and avoid future interoperability issues.



The 400GE test suite is available by using Keysight's IxSuiteStore framework. The test suite validates key aspects of a 400GBASE-R PCS and supported physical media dependents (PMDs) per IEEE 802.3bs. Following are more details on this test suite:

- A set of Keysight-provided scripts exercising most of the Layer 1 test capabilities of Keysight AresONE hardware
- Enables quick start testing with basic steps and progressively guides to more advanced cases
- Customers can configure these tests to support regression testbeds
- Currently, 25 tests are available, covering key validations that are required in a 400GE implementation

Specifications

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD reduced feature 16-port / 8-port
Part Numbers	944-1186 / 944-1300	944-1187 / 944-1301
Hardware fixed chassis system specifications		
RU / Number of Ports	2 RU 16-port and 8-port enabled, fixed chassis systems	
Physical Interfaces	Native QSFP-DD physical port	
Supported Port Speeds	Default 1x400GE/port (PAM4): 400GE-capable fiber and passive copper cable media	
	Optional fan-out speeds: • PAM4: 2x200, 4x100, 8x50GE • NRZ: 2x100, 4x50, 2x40, 8x25GE, 8x10GE • Requires purchase of a factory or a field upgrade speed option or a bundle option. See the Ordering Section of this datasheet.	
CPU and Memory	Multicore processor with 2 GB of CPU memory per port	
Number of users	Each user owns 2 front panel ports at the same time: • The 16-port hardware chassis supports 8 simultaneous users • The 8-port enabled 16-port hardware chassis supports 4 simultaneous users	
IEEE Interface Protocols for 400GE	IEEE 802.3bs 200GE and 400GE, 400GBASE-R	
	IEEE 802.3cd 50 Gb/s, 100 Gb/s, and 200 Gb/s Ethernet	
IEEE Interface Protocols for 100GE and lower NRZ speeds	• 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 v1.6	
Layer 1 Support	PAM4, 400GE native ports and 200/100/50GE speed option: • KP4 (RS-544,514) Ethernet Forward Error Correction, Clause 119 • Auto-negotiation (AN) and link training (LT) support • All speeds support AN and LT for 1x400GE, 2x200GE, 4x100GE, and 8x50GE speed modes with the exceptions shown below • 8x50GE PAM4 speed mode Half-port density mode: • NOTE: The Half-port density mode is no longer supported from the 9.18 release and higher. In the 9.18 SW, this feature is removed as the Full-port density mode with AN and LT is enabled and is the recommended mode to use. • Ports 1, 3, 6, 8 and 9, 11, 14, 16 are active for the 8x50GE speed in PAM4 mode with AN and LT enabled on each port • Only needed for copper DAC support—Copper DACs require AN and LT to be enabled	

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD Reduced feature 16-port / 8-port
	• Up to 8 users will have one port each of 8x50GE from each port resource group on the 16-port hardware chassis Full-port density mode: • All ports in all port resource groups are in the 8x50GE PAM4 fan-out speed • AN and LT are enabled on all active ports in all resource groups. Note, requires the 9.18 software release or higher to have AN and LT enabled with the full 8x50GE fan-out on all ports. • Up to 8 users will have two ports each of 8x50GE per port in each port resource group on the 16-port hardware chassis • Correctable and uncorrectable FEC statistics per-port • FEC symbol error injection (400GE and 200GE speeds only) • FEC Codeword error distribution statistics support for all PAM4 speeds except for the Full port density mode of the 8x50GE fan-out speed • PCS lanes Tx and Rx test and statistics • Layer 1 BERT with PRBS-7Q, PRBS-9Q, PRBS-11Q, PRBS-13Q, PRBS-15Q, PRBS-20Q, PRBS-23Q, and PRBS-31Q pattern support NRZ, 100/50/40/25/10GE speed option: • 2x100, 4x50, 2x40, 8x25GE, and 8x10GE speed support • RS (528,514) Clause 91, BASE-R FEC Cause 74 Forward Error Correction, Clause 91 for applicable speeds • Auto-negotiation and link training support for all 100/50/40/25GE speeds • Correctable and uncorrectable FEC statistics per-port for applicable spe • Ability to independently turn ON or OFF AN with Link training, or FEC, or to allow IEEE defaults to automatically manage the interoperability • Layer 1 BERT with PRBS-7, PRBS-9, PRBS-11, PRBS-13, PRBS-15, PRBS-20, PRBS-23, and PRBS-31 pattern support	
QSFP-DD Optical Transceiver Support	Support for QSFP-DD MSA compliant optical transceivers up to Power Class 8 with up to 20 watts of power consumption such as: 400GBASE-DR4,400GBASE-FR4, 400GBASE-LR4, 400GBASE-SR8 and 400G-ZR coherent optics along with other optical transceiver types (for example, QSFP56), AEC's and AOCs. Please consult the factory for specific transceiver support information. See Optical Transceivers under the Ordering Information section of this data sheet for the current offerings of optical transceivers for this product. Please download the 400GE Optics and Cables Guide from www.keysight.com under Products+Services, Network Test Hardware.	
QSFP-DD Passive Copper Cable Media	400GBASE-CR8, passive, copper Direct Attached Cable (DAC) up to 3 meters in length. Both point-to-point and fan-out cables are supported. Please consult the factory for longer lengths and information on Active Electrical Cable information. See Cables and Transceivers under the Ordering Information section of this data sheet for current support for this product. Please download the 400GE Optics and Cables Guide from www.keysight.com under Products+Services, Network Test Hardware.	

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD reduced feature 16-port / 8-port
QSFP-DD Active Electrical Cable (AEC) Support	Active Electrical Cable support is for applications where PAM4 signaling is required to be converted to NRZ signaling. The application supported is 4x100GE fan-out of a QQSFP-DD port where the 100GE fan-out ends use NRZ signaling. See Cables and Transceivers under the Ordering Information section of this data sheet for current support for this product. Please download the 400GE Optics and Cables Guide from www.keysight.com under Products+Services, Network Test Hardware. An application note on the AEC use case is available, please consult the local Keysight sales account manager.	
QSFP28/QSFP+ Optical Transceiver Support	Support for QSFP28/ QSFP+ compliant optical transceivers up to Power Class 7 with 5 watts of power consumption such as: QSFP28-SR4, QSFP28-LR4, QSFP28-PSM4, QSFP-PLR4 and others. Please consult the factory for specific transceiver support information. See Optical Transceivers under the Ordering Information section of this data sheet for current support of optical transceiver for this product. Please download the 400GE Optics and Cables Guide from www.keysight.com under Products+Services, Network Test Hardware.	
QSFP28/QSFP+ Passive Copper Cable Media	100GBASE-CR4, 50GBASE-CR2, and 25GBASE-CR passive, copper Direct Attached Cable (DAC) up to 5 meters in length dependent upon technology type. Both point-to-point and fan-out cables are supported. Please consult the factory for longer lengths and information on Active Electrical Cable information. See Cables and Transceivers under the Ordering Information section of this data sheet for current support for this product. Please download the 400GE Optics and Cables Guide from www.keysight.com under Products+Services, Network Test Hardware.	
Common Management Interface Specification (CMIS) support	• CMIS 4.0 and 5.0 • C-CMIS 1.0 (Coherent CMIS) • Automatic version detection on the device in the port • Read/Write access to all management pages and registers via IxExplorer GUI and Tcl test automation programming interface • CMIS will operate with optical and copper interconnect media to the extent they are supported by the interconnect manufacturer	
Digital Optical Monitoring (DOM)	• Automatically provides information from the interconnect device plugged into the test port, along with the device status, electrical power, temperatures, power class, laser power and various LOL and LOS threshold and alarm monitoring information. The DOM also provides feedback when alarms and thresholds are exceeded. This capability is provided with the IxExplorer GUI application.	
400G-ZR Coherent Optics Transceiver support	• CMIS 5.0 and C-CMIS 1.0 (Coherent CMIS) provide Read/Write access to all management pages and Versatile Diagnostics Monitoring (VDM) registers via IxExplorer GUI and Tcl test automation programming interface • Coherent optics up to 20 watts of power consumption are supported on the manufacturers that have been qualified by Keysight. Please consult your Keysight Sales Representative for additional information.	
Fixed Chassis System Dimensions	30.3” (L) x 17.3” (W) x 3.46” (H) 770 mm (L) x 438.2 mm (W) x 88 mm (H)	

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD reduced feature 16-port / 8-port
Fixed Chassis System Weights	• Hardware only: 65 lbs. (29.5 kg) • Shipping: 99.2 lbs. (45 kg) [1]	
Fixed Chassis System Electrical Power	• Operates on 100–240 VAC, 50/60 Hz • 200–240 VAC is single phase • Requires (3) power sources when running 100–120VAC, 9 Amps for each power supply. AresONE fixed chassis is shipped with (3 each) 100–125 VAC power cords. ◦ Requires (2) power sources when running 200–240 VAC, 7 Amps for each power supply. For 200–240 VAC power cords, order part number 942–0110 from the Ordering Section of this datasheet. The kit is provided at no charge with the purchase of an AresONE fixed chassis when 200–240 VAC is required.	
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	
Regulatory Compliance Specifications	IEC 60950-1, UL 60950-1, CSA C22.2 No.60950-1, CE (LVD, EMC, RoHS), EN/IEC 55032, EN/IEC 55024, CFR 47, FCC Part 15B, ICES-003, AS/NZ CISPR 32/24, KN32/35	
Chassis synchronization extendibility		
Maximum Number of Chassis in Single Test Topology	• Each chassis has built-in star topology synchronization ports to connect to 5 additional compatible chassis systems • The Metronome Timing System is used for synchronizing a total of 6 or more chassis at one time. Consult factory for port count requirements beyond 5 chassis in a single configuration	
Transmit feature specifications		
Transmit Engine	Wire-speed packet generation with timestamps, sequence numbers, data integrity, and packet group signatures	
Max. Streams per Port and Speed (Including in Data Center Ethernet)	• 400GE: 256 • 200GE: 256 • 100GE: 128 • 50GE: 64 • 40GE: 128 • 25GE: 64 • 10GE: 64	• 400GE: 128 • 200GE: 128 • 100GE: 64 • 50GE: 32 • 40GE: 64 • 25GE: 32 • 10GE: 32
Stream Controls	• Rate and frame size change on the fly • Advanced stream scheduler support • Optional sequential stream support (must be ordered as a factory installed option-no field upgrade is available). Consult the Keysight product management before the quotation of this option.	
Minimum Frame Size	400GE and 200GE:	

1. Approximate (includes rackmount slides, power cords, sync cables, and packaging)

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD reduced feature 16-port / 8-port
	• 64 bytes at full line rate • 60 bytes at less than full line rate	
	100GE and below: • 4 bytes	
Maximum Frame Size	400GE and 200GE: 16,000 bytes 100GE and below: 14,000 bytes	
Maximum Frame Size in Data Center Ethernet	9,216 bytes	
Priority Flow Control	• 4 line-rate-capable queues, each supporting up to 2,500-byte frame lengths • 1 line-rate-capable queue, non-blocking supporting up to 9,216-byte frame length	
Frame Length Controls	Fixed, increment by user-defined step, weighted pairs (up to 16K in 400/200/100GE and 8K in 50GE and below), 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 10, 32-bit-wide UDFs are available	
Value Lists (Max.) per port	• 400GE: 64K /port /UDF • 200GE: 32K /port /UDF • 100GE: 64K /4 ports /UDF • 50GE: 32K /4 ports /UDF • 40GE: 64K /4 ports /UDF • 25GE: 16K /4 ports /UDF • 10GE: 16K /4 ports /UDF	
Sequence (Max.)	• 400GE: 32K • 200GE: 16K • 100GE: 8K • 50GE: 4K • 40GE: 4K • 25GE: 4K • 10GE: 4K	
Error Generation (FEC and Standard Keysight L2/3 Ethernet in PAM4 Mode Only)	400GE and 2x200GE FEC: • FEC symbol error-injection allows the user to inject FEC symbol errors using various weighted methods to achieve specific bit error rates (BER) for 400/200GE • No FEC error insertion and related statistics for 4x100GE and 8x50GE	
	400GE, 2x200GE, 4x100GE, 8x50GE L2/3 Ethernet: Generate good CRC or force bad CRC, undersize and oversize standard Ethernet frame lengths, and bad checksum	

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD reduced feature 16-port / 8-port
Physical Coding Sublayer	• PCS lane marker error injection • PCS lane re-mapping • PCS lane marker error injection • PCS bit error generation	
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 • Option to have the transmit port ignore link faults from a remote link partner and send traffic anyway	
Latency Measurement Resolution	• 400GE: 0.625 ns • 200GE: 1.25 ns • 100GE: 2.5 ns • 50GE: 2.5 ns • 40GE: 2.5 ns • 25GE: 2.5 ns • 10GE: 2.5 ns	
Intrinsic Latency Compensation	Removes inherent latency error from the port electronics for all speeds	
Transmit Line Clock Adjustment	Ability to adjust the parts-per-million (ppm) line frequency over a range of +/- 100 ppm on all the ports of a 400GE fixed chassis system	
Transmit/Receive Loopback	Internal loopback support	
Receive feature specifications		
Receive Engine	Wire-speed packet filtering, capturing, real-time latency, and inter-arrival time for each packet group, with data integrity, and sequence checking capability	
Trackable Receive Flows per Port without Sequence	• 400GE: 32K full statistics • 200GE: 32K full statistics • 100GE: 4K full statistics and 32K with minimum statistics	
Checking with Tx/Rx Synch	• 50GE: 4K full statistics and 16K with minimum statistic • 40GE: 4K full statistics and 16K with minimum statistic • 25GE: 2K full statistics and 8K with minimum statistic • 10GE: 2K full statistics and 8K with minimum statistic	
Trackable Receive Flows per Port with and without Sequence Checking and no Tx/RX Synch	• 400GE: 32K full statistics • 200GE: 32K full statistics • 100GE: 8K full statistics and 32K with minimum statistics • 50GE: 8K full statistics and 16K with minimum statistic • 40GE: 8K full statistics and 16K with minimum statistic • 25GE: 4K full statistics and 8K with minimum statistic • 10GE: 4K full statistics and 8K with minimum statistic	

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD reduced feature 16-port / 8-port
Minimum Frame Size	64 Bytes	
Filters (User-Defined Statistics, UDS)	2 SA/DA pattern matchers, 2x16-byte user-definable patterns. 6 UDS counters are available with offsets for start of frame	
Hardware Capture Buffer	1 MB per front panel port	
Standard Statistics and Rates	Link state, line speed, frames sent, valid frames received, bytes sent/received, fragments, undersize, oversize, CRC errors, 6 user-defined stats, capture trigger (UDS 3), capture filter (UDS 4), data integrity frames, data integrity errors, sequence checking frames, sequence checking errors, ARP, and PING requests and replies	
FEC Statistics	PAM4 400GE, 2x200GE, 4x100GE and Full-port density 8x50GE: • FEC port statistics: Total Bit Errors, Max Symbol Errors, Corrected Codewords, Total Codewords, Uncorrectable Codewords, Frame Loss Ratio, Pre-FEC Bit Error Rate, and Codeword error distribution analysis • FEC per lane Rx statistics: FEC Symbol Error Count, Corrected Bits Count, Symbol Error Rate, Corrected Bit Rate	
	NRZ speeds: 2x100, 4x50, and 8x25GE [2] • 100GE FEC statistics • Ethernet Forward Error Correction RS-FEC, Clause 91 • FEC statistics: ◦ RS-FEC Corrected and uncorrectable codewords • 50GE FEC statistics • FC-FEC, Clause 74 for BASE-R PHYs • RS-FEC, 50GE FEC statistics: ◦ RS-FEC Corrected and Uncorrected Codeword Count ◦ FC-FEC Corrected and Uncorrected Block Count ◦ FC-FEC Corrected Error Bits • 25GE FEC statistics • 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	
Latency / Jitter Measurements	Cut-through, store and forward, forwarding delay, latency/jitter, MEF jitter, and inter-arrival time	
Receive-side PCS Lanes Port Statistics Counters	PCS: Sync Errors, Illegal Codes, Remote Faults, Local Faults, Illegal Ordered Set, Illegal Idle, and Illegal SOF	

2. This is a minimum specification; consult factory for more information. Note: FEC is not supported on 40GE and 10GE speeds with NRZ signaling.

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD reduced feature 16-port / 8-port
400GE PCS Receive-Side Statistics and Indicators	Per-lane PCS receive capabilities include: • Receive—per-lane PCS receive statistics, Physical Lane assignments, Lane Marker Lock, Lane Market Map, Relative Lane Skew, Lane Marker Error Count • Receive—per-lane FEC receive statistics, FEC Symbol Error Count, FEC Corrected Bits Count, FEC Symbol Error Rate, FEC Corrected Bit Rate	
Advanced Rx Eye Histogram Analysis	Advanced Rx Eye Histogram Analysis Option provides in-depth, user-selected, per lane PAM4 signal shape analysis, SER statistics, comparison of signal quality between lanes and an array of eye measurements. This version of the feature is only for the AresONE-S 400GE platforms. Support of this feature REQUIRES the purchase of the 905-1098 Factory Installed option, or the 905-1099 Field Upgrade option.	
Layer 2-3 protocol pupport		
Basic	IxNetwork Base, RFC2544/2889/3918 QuickTest	
Routing, Switching, and Carrier Ethernet	BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, RIP/RIPng, EIGRP, BFD, Seamless BFD, IGMP/MLD, PIM-SM/SSM, STP/RSTP/MSTP/PVST, LACP/Protocol over LACP, GRE and Protocol over GRE, LISP, CFM/Y.1731, Link-OAM, PBB-TE, ELMI, 1588v2/SyncE ESMC, Y.1564QT, TWAMP, NTP; REQUIRES: 930-2201 IxNetwork Basic package for AresONE	Complete protocol coverage as shown on the left side of this row only with reduced session scale: • 100 routing and switching sessions • 2,000 host/access sessions
Software Defined Network	BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, RIP/RIPng, BFD; EVPN, VXLAN, GENEVE, Segment Routing (MPLS and IPv6), BGP-LS, PCEP, BGP SR-TE Policy, BGP FlowSpec, OVSDB, Netconf, BIER, OpenFlow; GRE and Protocol over GRE, LACP/Protocol over LACP, eCPRI; REQUIRES: 930-2201 IxNetwork Basic package for AresONE	Complete protocol coverage as shown on the left side of this row only with reduced session scale: • 100 routing and switching sessions 2,000 host/access sessions
MPLS and VPN	BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, RIP/RIPng, EIGRP, BFD, RSVP-TE P2P/P2MP, LDP/LDPv6/mLDP, LDP L2VPN (PWE/VPLS), BGP VPLS/VPWS, L3VPN/6VPE, BGP RFC3107, PIM-SM/SSM, Multicast VPN, MPLS-TP, MPLS OAM, EVPN/PBB-EVPN; REQUIRES: 930-2201 IxNetwork Basic package for AresONE	Complete protocol coverage as shown on the left side of this row only with reduced session scale: • 100 routing and switching sessions 2,000 host/access sessions

Product description	S400GD-16P-QDD full feature 16-port / 8-port	S400GDR-16P-QDD reduced feature 16-port / 8-port
Broadband Access and Authentication	PPPoX/L2TPv2, DHCPv4/DHCPv6, ANCP, IGMP/MLD, IPv6 Autoconfiguration (SLAAC), 802.1x, Bonded GRE HG, GRE/Protocol over GRE, LACP/Protocol over LACP, Session Aware Traffic, Service over MPLS, Broadband Control Plane QT, Asymmetric Data Performance QT; REQUIRES: 930-2201 IxNetwork Basic package for AresONE	Complete protocol coverage as shown on the left side of this row only with reduced session scale: • 100 routing and switching sessions • 2,000 host/access sessions
Data Center Ethernet	BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, RIP/RIPng, BFD; EVPN, VXLAN, GENEVE, OVSDB, DCBX, FCoE, Fabric Path, SPBM, VEPA, TRILL, FCoE QT, IxCloudPerf QT, RFC7747 BGP Convergence QT, LACP/Protocol over LACP; REQUIRES: 930-2201 IxNetwork Basic package for AresONE	Complete protocol coverage as shown on the left side of this row only with reduced session scale: • 100 routing and switching sessions • 2,000 host/access sessions

Application Support

QSFP-DD-400GE / QSFP-DD-R400GE
IxExplorer: Layer 1–3 wire-speed traffic generation, capture, and analysis with Forward Error Correction and error injection with statistics, PCS Lanes Tx/Rx with statistics, and reporting capability.
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.
IxSuiteStore: Test suite for functional validation of PCS lanes BER, KP4 FEC bit-error distribution with error insertion and link stability based on IEEE 802.3bs specification (at 400GE speed only).
Tcl API: Custom user script development for Layer 1-3 testing.

Ordering Information

This section contains all the part numbers for the chassis hardware, Ethernet speed and signaling options, port upgrades, performance upgrades, and the IxNetwork software and protocol bundle ordering part numbers.

Additionally, this section provides tables for the optical transceivers and copper cables that are qualified and sold by Keysight for the AresONE-S test systems. An NRZ signaling section has been incorporated to assist users to navigate the complexity of interconnect media that operates with PAM4 only signaling, PAM4 and NRZ signaling, and NRZ signaling only.

Please download the 400GE Optics and Cables Guide from www.keysight.com under Products+Services, Network Test Hardware.

Part number	Description
Fixed chassis	
944-1186	IXIA, AresONE S400GD-16PHW-16P-QDD, High Density, 16-port, full performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces and L1-3 support (944-1186)
944-1187	IXIA, AresONE S400GDR-16PHW-16P-QDD, High Density, 16-port, reduced performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces and L1-3 support (944-1187)
944-1300	IXIA, AresONE S400GD-16PHW-8P-QDD, High Density, 8-port, full performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces and L1-3 support (944-1300)
944-1301	IXIA, AresONE S400GDR-16PHW-8P-QDD, High Density, 8-port, reduced performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces and L1-3 support (944-1301)
200-240VAC power cord option kit	
942-0110	Ixia, AresONE 200-240VAC Power Cord Option Kit includes 2 each C13 to 6-20P, 8 feet in length, and 2 each C13 to L6-20P, 10 feet in length. Two cord types are provided that accommodate the most common 200-240VAC power receptacle types. Two of either cord type are required to power the any of the AresONE fixed chassis. These power cords are compatible with all AresONE 400GE. AresONE-S 400GE, AresONE High Performance 400GE, and AresONE 800GE QSFP-DD800 fixed chassis systems. The kit is optional and is sold at no charge. It is REQUIRED only when a AresONE fixed chassis must be connected to 200-240VAC single phase power sources. Note: Requires (2) power sources when running single phase 200-240VAC drawing 7 Amps for each power supply.

Part number	Description
Upgrade and speed options	
905-1060	Ixia, AresONE UPG-S400GDR-16PHW-16P-to-S400GD-16P FIELD UPGRADE for the reduced performance S400GDR-16PHW-16P-QDD (944-1187) to become the full performance S400GD-16PHW-16P-QDD (944-1186), (905-1060)
905-1077	Ixia, AresONE UPG-S400GD-16PHW-8P-to-S400GD-16P FIELD UPGRADE for the full performance S400GD-16PHW-8P-QDD (944-1300) to become the full performance S400GD-16PHW-16P-QDD (944-1186), (905-1077)
905-1078	Ixia, AresONE UPG-S400GDR-16PHW-8P-to-S400GDR-16P FIELD UPGRADE for the reduced performance S400GDR-16PHW-8P-QDD (944-1301) to become the reduced performance S400GDR-16PHW-16P-QDD (944-1187), (905-1078)
905-1079	Ixia, AresONE UPG-S400GDR-16PHW-8P-to-S400GD-8P FIELD UPGRADE for the reduced performance S400GDR-16PHW-8P-QDD (944-1301) to become the full performance S400GD-16PHW-8P-QDD (944-1300), (905-1079)
905-1056	IXIA, AresONE S400GD-16PHW/S400GDR-16PHW PAM4 Fan-out option: FACTORY INSTALLED option for 2x200GE, 4x100GE and 8x50GE speed support. (905-1056) One option is required for each fixed chassis system for all 16x400GE or 8x400GE physical ports. Note: This option is REQUIRED ON NEW PURCHASES to enable the fan-out speeds per port (905-1056).
905-1057	IXIA, AresONE S400GD-16PHW/S400GDR-16PHW PAM4 Fan-out option: FIELD UPGRADE option for 2x200GE, 4x100GE and 8x50GE speed support. (905-1057) One option is required for each fixed chassis system for all 16x400GE or 8x400GE physical ports. Note: This option is REQUIRED ON FIELD UPGRADE PURCHASES to enable the fan-out speeds per port (905-1057).
905-1058	IXIA, AresONE S400GD-16PHW/S400GDR-16PHW NRZ mode and NRZ mode Fan-out option: FACTORY INSTALLED option for 2x100GE, 4x50GE, 4x40GE, 8x25GE and 8x10GE speed support (905-1058). One option is required for each fixed chassis system for all 16x400GE or 8x400GE physical ports. Note: This option is REQUIRED ON NEW PURCHASES to enable the NRZ mode and NRZ mode Fan-out per port (905-1058).
905-1059	IXIA, AresONE S400GD-16PHW/S400GDR-16PHW NRZ mode and NRZ mode Fan-out option: FIELD UPGRADE option for 2x100GE, 4x50GE, 2x40GE, 8x25GE and 8x10GE speed support (905-1059). One option is required for each fixed chassis system for all 16x400GE or 8x400GE physical ports.

Part number	Description
	Note: This option is REQUIRED ON FIELD UPGRADE PURCHASES to enable the NRZ mode and NRZ mode Fan-out per port (905-1059).
Advanced Rx Eye Histogram Analysis Options	
905-1098	Ixia, Advanced Rx Eye Histogram Analysis Option, FACTORY installed for all AresONE-S QSFP-DD models. This option is supported ONLY on these AresONE-S QSFP-DD fixed chassis models: S400GD-16PHW-16P-QDD (944-1186), S400GDR-16PHW-16P-QDD (944-1187), S400GD-16PHW-8P-QDD (944-1300), S400GDR-16PHW-8P-QDD (944-1301), S400GD-8PHW-8P-QDD (944-1302), S400GDR-8PHW-8P-QDD (944-1303), S400GD-8PHW-4P-QDQ (944-1304) and S400GDR-8PHW-4P-QDD (944-1305).
905-1099	Ixia, Advanced Rx Eye Histogram Analysis Option, FIELD UPGRADE for all AresONE-S QSFP-DD models. This option is supported ONLY on these AresONE-S QSFP-DD fixed chassis models: S400GD-16PHW-16P-QDD (944-1186), S400GDR-16PHW-16P-QDD (944-1187), S400GD-16PHW-8P-QDD (944-1300), S400GDR-16PHW-8P-QDD (944-1301), S400GD-8PHW-8P-QDD (944-1302), S400GDR-8PHW-8P-QDD (944-1303), S400GD-8PHW-4P-QDQ (944-1304) and S400GDR-8PHW-4P-QDD (944-1305).
Fixed chassis system bundle options	
947-5086	IXIA, Bundle AresONE S400GD-16PHW-16P-QDD, High Density, 16-port, full performance fixed chassis model with native QSFP-DD 400GE (PAM4 and NRZ) physical interfaces, with all speed modes and L1-3 support (947-5086)
947-5087	IXIA, Bundle AresONE S400GD-16PHW-16P-QDD, High Density, 16-port, full performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces, with all speed modes and L1-3 support (947-5087)
947-5088	IXIA, Bundle AresONE S400GDR-16PHW-16P-QDD, High Density, 16-port, reduced performance fixed chassis model with native QSFP-DD 400GE (PAM4 and NRZ) physical interfaces, with all speed modes and L1-3 support (947-5088)
947-5089	IXIA, Bundle AresONE S400GDR-16PHW-16P-QDD, High Density, 16-port, reduced performance fixed chassis model with native QSFP-DD 400GE (PAM4) physical interfaces, with all speed modes and L1-3 support (947-5089)
Multiple AresONE/AresONE-S timing and synchronization chassis	
942-0090	IXIA, Metronome Timing System and Metronome Timing Software enabling advanced chassis timing. Includes Sync Cable 5m (942-0096). Compatible with the XGS-SD chassis, XGS-SDL chassis, XGS-HSL chassis, AresONE fixed chassis and Novus ONE PLUS fixed chassis. Note: The Metronome chassis is used when more than 5 AresONE-S chassis must be time synchronized.
IxNetwork AresONE Only — software bundle options	
930-2200	IxNetwork, All Inclusive package for AresONE. Supports all IxNetwork software features with exclusion; Excludes: 930-3461 IxNetwork AppLibrary Slot Bundle, Layer 4-7 Performance Test Application; 930-2207 IxNetwork Encryption test package for AresONE. Any optional script package or IxSuiteStore optional test suite is not considered as part of IxNetwork software features.[3]

3. All AresONE models do not support a traditional IxNetwork a la carte license, bundle licenses, and tier licenses.

Part number	Description
930-2201	IxNetwork Basic package for AresONE; INCLUDES: IxNetwork Base, RFC2544/2889 QuickTest
930-2202	IxNetwork Routing, Switching and Carrier Ethernet package for AresONE; Includes BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, RIP/RIPng, EIGRP, BFD, IGMP/MLD/PIM-SM/SSM, LACP/Protocol over LACP, STP/RSTP/MSTP/PVST, GRE and Protocol over GRE, CFM/Y.1731, Link-OAM, PBB-TE, ELMI, 1588v2/SyncE ESMC, Y.1564QT, TWAMP, NTP, LISP; REQUIRES: 930-2201 IxNetwork Basic package for AresONE
930-2203	IxNetwork MPLS and VPN package for AresONE; INCLUDES: BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, RIP/RIPng, BFD, RSVP-TE/P2MP, LDP/mLDP/LDPv6, L3VPN/6VPE, NGmVPN, PIM-SM/SSM/mVPN, MPLS-TP, MPLS OAM, GRE and Protocol over GRE, LACP/Protocol over LACP; REQUIRES: 930-2201 IxNetwork Basic package for AresONE
930-2204	IxNetwork SDN package for AresONE; INCLUDES: BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, RIP/RIPng, BFD; EVPN, VXLAN, GENEVE, Segment Routing, BGP-LS, PCEP, BGP SR-TE Policy, BGP FlowSpec, OVSDB, Netconf, BIER, OpenFlow; GRE and Protocol over GRE, LACP/Protocol over LACP; REQUIRES: 930-2201 IxNetwork Basic package for AresONE
930-2205	IxNetwork Data Center package for AresONE; INCLUDES: BGP4/BGP4+, OSPFv2/v3, ISISv4/v6, RIP/RIPng, BFD; EVPN, VXLAN, GENEVE, OVSDB, DCBX, FCoE, Fabric Path, SPBM, VEPA, TRILL, FCoE QT, IxCloudPerf QT, RFC7747 BGP Convergence QT, LACP/Protocol over LACP; REQUIRES: 930-2201 IxNetwork Basic package for AresONE
930-2206	IxNetwork Broadband Access and Authentication package for AresONE; INCLUDES: PPPoX/L2TP, DHCPv4/v6, ANCP, IGMP/MLD/IPTV, 802.1x, GRE/Protocol over GRE, LACP/Protocol over LACP, Session Aware Traffic, Service over MPLS, Broadband Control Plane QT, Asymmetric Data Performance QT; REQUIRES: 930-2201 IxNetwork Basic package for AresONE
930-2207	IxNetwork, Encryption Test package for AresONE (930-2207); INCLUDES: MACsec Emulation; REQUIRES: 930-2201 IxNetwork Basic package for AresONE; Recommend with: 930-3461 IxNetwork AppLibrary Slot Bundle, Optional Software, Layer 4-7 Performance Test Application for additional encryption/decryption capability in Static MACsec emulation
IxSuiteStore software option	
930-6001	Ixia IxSuiteStore optional test suite for functional validation of PCS lanes BER, KP4 FEC Bit-error distribution with error insertion and Link stability based on IEEE 802.3bs specification (at 400GE speed only). This software is compatible with the following hardware platforms with the native QSFP-DD 400GE interfaces: K400 QSFP-DD-400GE (944-1152), K400 QSFP-DD-R400GE (944-1153); and all AresONE QSFP-DD and OSFP models: T400GD-8P-QDD (944-1170), T400GDR-8P-QDD (944-1171), T400GD-4P-QDD (944-1172), T400GDR-4P-QDD (944-1173), T400GD-8P-OSFP (944-1174), T400GDR-8P-OSFP (944-1175), T400GD-4P-OSFP (944-1176), T400GDR-4P-OSFP (944-1177)

Copper cables, fiber cables, and optical transceivers section

This section outlines all the interconnect media available for purchase from Keysight. Here is what is covered in this section:

- QSFP-DD 400GE passive copper cables for point-to-point and fan-out applications
- QSFP-DD 400GE passive copper cables for fan-out applications
- QSFP28 and QSFP+ point-to-point and passive copper fan-out cables for NRZ support
- Active electrical fan-out cable for QSFP-DD 400GE to 4x100GE NRZ applications
- QSFP-DD 400GE optical transceivers and point-to-point fiber cables
- QSFP28 and QSFP+ optical transceivers for NRZ Ethernet Speeds
- QSFP28 and QSFP fiber fan-out cables for NRZ
- QSFP28 optical transceivers
- SFP28 optical transceivers for NRZ Ethernet speeds and adapter

	Description
QSFP-DD passive copper point-to-point cables	
QSFP-DD-1M-CBL	Ixia, QSFP-DD-1M-CBL 400GE 400GBASE-R passive copper, Direct Attach Cable (DAC), point-to-point cable, 1-meter length (942-0106). This copper DAC is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This fanout cable supports PAM4 and NRZ signaling. Consult the 400GE Optics and Cables Guide for the specific Ethernet speed support with the PAM4 or NRZ signaling.
QSFP-DD-2M-CBL	Ixia, QSFP-DD-2M-CBL 400GE 400GBASE-R passive copper, Direct Attach Cable (DAC), point-to-point cable, 2-meter length (942-0109). This copper DAC is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This fanout cable supports PAM4 and NRZ signaling. Consult the 400GE Optics and Cables Guide for the specific Ethernet speed support with the PAM4 or NRZ signaling.
QSFP-DD-2-5M-CBL	Ixia, QSFP-DD-2-5M-CBL 400GE 400GBASE-R passive copper, Direct Attach Cable (DAC), point-to-point cable, 2.5-meter length (942-0108). This copper DAC is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This fanout cable supports PAM4 and NRZ signaling. Consult the 400GE Optics and Cables Guide for the specific Ethernet speed support with the PAM4 or NRZ signaling.
QSFP-DD passive copper fan-out cables	
QSFPDD4XQ56-1-5M-CBL	Ixia, QSFPDD4XQ56-1-5M-CBL QSFP-DD-to-4xQSFP56 400GBASE-R Direct Attached Copper cable (DAC) fan-out cable, 1.5-meter length (942-0140). This copper, fan-out DAC is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This fanout cable supports PAM4 and NRZ signaling. Consult the 400GE Optics and Cables Guide for the specific Ethernet speed support with the PAM4 or NRZ signaling.
QSFPDD2XQ56-2-5M-CBL	Ixia, QSFPDD2XQ56-2-5M-CBL QSFP-DD-to-2xQSFP-DD 400GBASE-R Direct Attached Copper (DAC) fan-out cable, 2.5-meter length (942-0141). This copper, fan-out DAC is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This fanout cable supports PAM4 and NRZ signaling. Consult the 400GE Optics

	and Cables Guide for the specific Ethernet speed support with the PAM4 or NRZ signaling.
QSFPDD8XQ56-1-5M-CBL	Ixia, QSFPDD8XQ56-1-5M-CBL QSFP-DD-to-8xSFP56 400GBASE-R Direct Attached Cable (DAC) fan-out cable, 1.5-meter length (942-0142). This copper, fan-out DAC is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This fanout cable supports PAM4 and NRZ signaling. Consult the 400GE Optics and Cables Guide for the specific Ethernet speed support with the PAM4 or NRZ signaling.
QSFP28 and QSFP+ point-to-point and passive copper fan-out cables for NRZ support	
942-0071	Ixia, QSFP-to-QSFP 40GE 40GBASE-CR4 Direct Attach Cable (DAC), passive copper, point-to-point cable, 3-meter length. This cable is compatible with all AresONE-S 400GE QSFP-DD fixed chassis systems with the NRZ signaling option installed. Refer to the individual product datasheets 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.
942-0093	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.

Description	
Active electrical fan-out cable	
QSFPDD-4XQ28-AEC-CBL	Ixia, QSFP-DD-to-4xQSFP28 400GBASE-R Active Electrical Fan-out Cable (AEC), for 400GE to 4x100GE fan-out, 3-meter length (942-0139). This Active Electrical Copper (AEC) cable is compatible with all K400 QSFP-DD modules: K400 QSFP-DD-400GE (944-1152), K400 QSFP-DD-R400GE (944-1153); and the following AresONE QSFP-DD models: T400GD-8P-QDD (944-1170-06 and later), T400GDR-8P-QDD (944-1171-06 and later), T400GD-4P-QDD (944-1172-05 and later), T400GDR-4P-QDD (944-1173-05 and later), T400GP-4P-QDD (944-1178), and all AresONE-S models (See Note 3); S400GD-16PHW-16P-QDD (944-1186), S400GDR-16PHW-16P-QDD (944-1187), S400GD-16PHW-8P-QDD (944-1300), S400GDR-16PHW-8P-QDD (944-1301), S400GD-8PHW-8P-QDD (944-1302), S400GDR-8PHW-8P-QDD (944-1303), S400GD-8PHW-4P-QDD (944-1304), and S400GDR-8PHW-4P-QDD (944-1305).
	Note1: This cable converts 400GE PAM4 signaling to 100GE NRZ signaling. Note2: The original version of the AEC cable had version 2.5 firmware. It is identified with a label on the QSFP-DD connector-end that has an Ixia part number designator, CAC43X301D4P-A0-KT. It is compatible with AresONE and AresONE High Performance models. Note3: All AresONE-S models REQUIRE firmware version 2.7 to operate. The AEC cable has a new designator CAC43X301D4P-A1-KT. The label on the cable shows the firmware version 2.7. This version is compatible with all AresONE models.
Optical transceivers	
QSFP-DD-DR4-XCVR	Ixia, QSFP-DD-DR4-XCVR QSFP-DD 400GE 400GBASE-DR4 pluggable optical transceiver, SMF (singlemode), 1310 nm, 500-meter reach (948-0050). This optical transceiver is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This optical transceiver supports PAM4 signaling output.
QSFP28-DR1-XCVR	Ixia, QSFP28-DR1-XCVR QSFP28 100GE 100GBASE-DR1 pluggable optical transceiver, SMF (singlemode), 1310 nm, 500-meter reach (948-0055). This optical transceiver is compatible with all Novus 4port and 8-port, QSFP28 100GE load modules. Note: This QSFP28 transceiver converts PAM4 optical signaling to NRZ electrical signaling. It is used with the QSFP-DD-DR4-XCVR optical transceiver (948-0050) and the QSFP-DD-DR4-CBL MT-to-4x100GE LC fan-out, fiber cable (942-0138) for 4x100GE fan-out applications for the K400 (2x100GE) or AresONE QSFP-DD 400GE ports for Nx100GE connections to NRZ-based QSFP28 network devices.
QSFP-DD-FR4-XCVR	Ixia, QSFP-DD-FR4-XCVR QSFP-DD 400GE 400GBASE-FR4 pluggable optical transceiver, SMF (singlemode), 1310 nm, 2-kilometer reach (948-0052). This optical transceiver is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This optical transceiver supports PAM4 signaling output.
QSFP-DD-LR4-XCVR	Ixia, QSFP-DD-LR4-XCVR QSFP-DD 400GE 400GBASE-LR4 pluggable optical transceiver, SMF (singlemode), 1310 nm, 10-kilometer reach (948-0054). This optical transceiver is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This optical transceiver supports PAM4 signaling output.

Description	
QSFP-DD-SR8-XCVR	Ixia, QSFP-DD-SR8-XCVR 400GE 400GBASE-SR8 pluggable optical transceiver, MMF (multimode), 850 nm, 100-meter reach (948-0051). This optical transceiver is compatible with all K400 QSFP-DD load modules, AresONE QSFP-DD, and AresONE High Performance QSFP-DD, and all AresONE-S QSFP-QDD fixed chassis models. Note: This optical transceiver supports PAM4 signaling output.
Optical transceiver point-to-point cables	
QSFP-DD-MPO16-CBL	Ixia, QSFP-DD-MPO16-CBL MT-to-MT, MPO16, OM4, MMF, APC, 2-meter fiber point-to-point cable (942-0124) for the 400GE QSFP-DD-SR8-XCVR. REQUIRES QSFP-DD-SR8-XCVR pluggable optical transceiver, 850 nm, MMF (Multimode Fiber), 100-meter reach (948-0051). This cable supports 1x400GE, 2x200GE, 4x100GE and 8x50GE logical fan-out speed modes from a QSFP-DD physical port with the QSFP-DD-SR8-XCVR optical transceiver.
QSFP-DD-DR4-CBL	Ixia, QSFP-DD-DR4-CBL MT-to-4x100GE LC fan-out, SMF, 3-meter fiber cable for 4x100GE fan-out (942-0138). REQUIRES QSFP-DD-DR4-XCVR pluggable optical transceiver, 1310 nm, SMF (Single Mode Fiber), 500-meter reach (948-0050)
QSFP-DD-SR8-CBL	Ixia, QSFP-DD-SR8-CBL MT-to-8x50GE LC fan-out, OM4 MMF, MPO16, APC, 2-meter fan-out cable (942-0125) for 8x50GE fan-out speed mode. REQUIRES QSFP-DD-SR8-XCVR pluggable optical transceiver, 850 nm, MMF (Multimode Fiber), 100-meter reach (948-0051). This cable supports 8x50GE physical fan-out from a QSFP-DD physical port with the QSFP-DD-SR8-XCVR optical transceiver.
QSFP-DD optical transceivers for NRZ Ethernet speeds	
QSFP-DD-CWDM4-XCVR	Ixia, QSFP-DD-CWDM4-XCVR 2x100GE pluggable optical transceiver, SMF (single mode) 4 lambdas, Dual CS-connector, 2km reach (948-0076). This optical transceiver is compatible with AresONE-S 400GE QSFP-QDD fixed chassis models. Note: This optical transceiver supports 2x100GE NRZ signaling output. Note2: This transceiver requires one of the NRZ options to be installed on the AresONE-S fixed chassis. Note3: Requires one or two of the CS fiber cable types; CS-to-CS (942-0151), or CS-to-LC (942-0152).
QSFP28 and QSFP+ optical transceivers for NRZ Ethernet speeds	
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.

Description	
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-CWDM4-XCVR	Ixia, QSFP28 100GBASE CWDM4 pluggable optical transceiver, SMF (single mode fiber), 2km reach, LC connector (995-8036). 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). COMPATIBLE NETWORK TEST PRODUCTS: 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 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 (singlemode), 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.

Description	
QSFP28 and QSFP fber fan-out cables for NRZ	
942-0151	Ixia, CS-to-CS UPC Duplex, Singlemode fiber OS2, 3-meter cable (942-0151). This cable is compatible with the QSFP-DD-CWDM4-XCVR 2x100GE pluggable optical transceiver, SMF (single mode) 4 lambdas, Dual CS-connector, 2km reach (948-0076). Refer to the individual product datasheets and the 400GE Optics and Cable Guide for additional configuration information.
942-0152	Ixia, CS-to-LC UPC Duplex, Singlemode fiber OS2, 3-meter cable (942-0152). This cable is compatible with the QSFP-DD-CWDM4-XCVR 2x100GE pluggable optical transceiver, SMF (single mode) 4 lambdas, Dual CS-connector, 2km reach (948-0076). Refer to the individual product datasheets and the 400GE Optics and Cable Guide for additional configuration information.
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.
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 and line cards), Vision 7300/7303, Vision ONE, E100, and E40

	Description
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 .
SFP56 optical transceivers for NRZ Ethernet speeds	
SFP56-LR-XCVR	Ixia, SFP56 Dual-Rate 50GBASE-LR 50GE pluggable optical transceiver, SMF (singlemode), 1310nm (948-0044). COMPATIBLE NETWORK TEST PRODUCTS: All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. AresONE-S 400GE QSFP-DD fixed chassis systems REQUIRES the Ixia, QSA28/56 adapter for enabling SFP56 interfaces on each physical port (948-0072). 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.
SFP56-FR-XCVR	Ixia, SFP56 Dual-Rate 50GBASE-FR 50GE pluggable optical transceiver, SMF (singlemode), 1310nm (948-0045). COMPATIBLE NETWORK TEST PRODUCTS: All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. AresONE-S 400GE QSFP-DD fixed chassis systems REQUIRES the Ixia, QSA28/56 adapter for enabling SFP56 interfaces on each physical port (948-0072). 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.
SFP56-DR-XCVR	Ixia, SFP56 Dual-Rate 50GBASE-DR 50GE pluggable optical transceiver, SMF (singlemode), 1310nm (948-0046). COMPATIBLE NETWORK TEST PRODUCTS: All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. AresONE-S 400GE QSFP-DD fixed chassis systems REQUIRES the Ixia, QSA28/56 adapter for enabling SFP56 interfaces on each physical port (948-0072). 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.
SFP56-SR-XCVR	Ixia, SFP56 Dual-Rate 50GBASE-SR 50GE pluggable optical transceiver, SMF (multimode), 850nm (948-0047). COMPATIBLE NETWORK TEST PRODUCTS: All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. AresONE-S 400GE QSFP-DD fixed chassis systems REQUIRES the Ixia, QSA28/56 adapter for enabling SFP56 interfaces on each physical port (948-0072). 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.
SFP28 optical transceivers for NRZ Ethernet speeds	
SFP28-SR-XCVR	Ixia, SFP28 Dual-Rate 25GBASE-SR 25GE and 10GBASE-SR 10GE pluggable optical transceiver, MMF (multimode), 850nm (948-0059). COMPATIBLE VISIBILITY PRODUCTS: Vision X Family- MVX-SWCH

	Description
	(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. REQUIRES compatible transceiver adaptor: QSFP28-SFP28-ADPT (948-0073) to be ordered separately for Visibility products.
	COMPATIBLE NETWORK TEST PRODUCTS: NOVUS-S 10/25GE8SFP28, 8-port, SFP28 10/25GE load module (944-1164), with the REQUIRED QSFP28-to-SFP28 port adapters. All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. AresONE-S 400GE QSFP-DD fixed chassis systems REQUIRES the Ixia, QSA28 adapter for enabling SFP28 interfaces on each physical port (948-0072). 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.
SFP28-LR-XCVR	Ixia, SFP28 Dual-Rate 25GBASE-LR 25GE and 10GBASE-LR 10GE pluggable optical transceiver, SMF (singlemode), 1310nm (948-0058). 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. REQUIRES the compatible transceiver adapter: QSFP28-SFP28-ADPT (948-0073) to be ordered separately for Visibility products. COMPATIBLE NETWORK TEST PRODUCTS: NOVUS-S 10/25GE8SFP28, 8-port, SFP28 10/25GE load module (944-1164), with the REQUIRED QSFP28-to-SFP28 port adapters. All AresONE-S 400GE QSFP-DD fixed chassis systems are supported when the NRZ signaling option is installed. AresONE-S 400GE QSFP-DD fixed chassis systems REQUIRES the Ixia, QSA28 adapter for enabling SFP28 interfaces on each physical port (948-0072). 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.

	Description
948-0072	Ixia, QSA28 adapter for enabling SFP28 interfaces on AresONE-S 400GE QSFP-DD fixed chassis test systems in NRZ mode. This adapter (948-0072) is compatible with all the Ixia AresONE-S fixed chassis QSFP-DD models. Note: The QSA28 adapter requires purchase and installation of the NRZ signaling option on the AresONE-S fixed chassis test system. Please reference these options: S400GD-16PHW/S400GDR-16PHW NRZ mode and NRZ mode Fan-out option, FACTORY INSTALLED (905-1058), S400GD-16P-QDD NRZ mode and NRZ mode Fan-out option, FIELD UPGRADE (905-1059), S400GD-8PHW/S400GDR NRZ mode and NRZ mode Fan-out option, FACTORY INSTALLED (905-1086), and S400GD-8PHW/S400GDR NRZ mode and NRZ mode Fan-out option, FAN-OUT FIELD UPGRADE (905-1087). Refer to the individual product datasheets and the 400GE Optics and Cable Guide for additional configuration information.

This section provides tables for the optical transceivers and copper cables that are qualified and sold by Keysight for the AresONE-S test systems. An NRZ signaling section has been incorporated to assist users to navigate the complexity of interconnect media that operates with PAM4 only signaling, PAM4 and NRZ signaling, and NRZ signaling only.

Signaling and speed support
Copper cables, fiber cables, and optical transceivers

		PAM4 Signaling Support	NRZ Signaling Support	PAM4 Speed Support	NRZ Speed Support
Passive copper point-to-point QSFP-DD cables					
QSFP-DD-1M-CBL	Ixia, QSFP-DD-1M-CBL 400GE 400GBASE-R passive copper, Direct Attach Cable (DAC), point-to-point cable, 1-meter length.	✓	✓	1x400GE 2x200GE 4x100GE 8x50GE	2x100GE 4x50GE 8x25GE 2x40GE 8x10GE
QSFP-DD-2M-CBL	Ixia, QSFP-DD-2M-CBL 400GE 400GBASE-R passive copper, Direct Attach Cable (DAC), point-to-point cable, 2-meter length.	✓	✓	1x400GE 2x200GE 4x100GE 8x50GE	2x100GE 4x50GE 8x25GE 2x40GE 8x10GE
QSFP-DD-2-5M-CBL	Ixia, QSFP-DD-2-5M-CBL 400GE 400GBASE-R passive copper, Direct Attach Cable (DAC), point-to-point cable, 2.5-meter length.	✓	✓	1x400GE 2x200GE 4x100GE 8x50GE	2x100GE 4x50GE 8x25GE 2x40GE 8x10GE
Passive copper fan-out QSFP-DD cables					
QSFPDD2XQ56-2-5M-CBL	Ixia, QSFPDD2XQ56-2-5M-CBL QSFP-DD-to-2xQSFP-DD 400GBASE-R Direct Attached Copper cable (DAC), for 400GE to 2x200GE PAM4 fan-out, 2.5-meter length.	✓	✓	2x200GE 4x100GE 8x50GE	2x100GE 4x50GE 8x25GE 2x40GE 8x10GE
QSFPDD4XQ56-1-5M-CBL	Ixia, QSFPDD4XQ56-1-5M-CBL QSFP-DD-to-4xQSFP56 400GBASE-R Direct Attached Copper cable (DAC), for 400GE to 4x100GE PAM4 fan-out, 1.5-meter length.	✓	✓	4x100GE 8x50GE	4x50GE 8x25GE 8x10GE

Signaling and speed support
Copper cables, fiber cables, and optical transceivers

		PAM4 Signaling Support	NRZ Signaling Support	PAM4 Speed Support	NRZ Speed Support
Passive copper fan-out QSFP-DD cables					
QSFPDD8XQ56-1-5M-CBL	Ixia, QSFPDD8XQ56-1-5M-CBL QSFP-DD-to-8xSFP56 400GBASE-R Direct Attached Cable (DAC), for 400GE to 8x50GE PAM4 fan-out, 1.5-meter length.	✓	✓	8x50GE	8x25GE 8x10GE
QSFP-DD optical transceivers					
QSFP-DD-DR4-XCVR	Ixia, QSFP-DD-DR4-XCVR QSFP-DD 400GE 400GBASE-DR4 pluggable optical transceiver, SMF (single mode), 1310 nm, 500-meter reach.	✓	No	1x400GE	None
QSFP28-DR1-XCVR	Ixia, QSFP28-DR1-XCVR QSFP28 100GE 100GBASE-DR1 pluggable optical transceiver, SMF (single mode), 1310 nm, 500-meter reach. This QSFP28 transceiver converts PAM4 optical signaling to NRZ electrical signaling. It is used with the QSFP-DD-DR4-XCVR optical transceiver and the QSFP-DD-DR4-CBL MT-to-4x100GE LC fan-out, fiber cable for 4x100GE fan-out applications.	No	✓	None	1x100GE
QSFP-DD-FR4-XCVR	Ixia, QSFP-DD-FR4-XCVR QSFP-DD 400GE 400GBASE-FR4 pluggable optical transceiver, SMF (single mode), 1310 nm, 2-kilometer reach.	✓	No	1x400GE 2x200GE 4x100GE 4x50GE	None
QSFP-DD-LR4-XCVR	Ixia, QSFP-DD-LR4-XCVR QSFP-DD 400GE 400GBASE-LR4 pluggable optical transceiver, SMF (single mode), 1310 nm, 10-kilometer reach.	✓	No	1x400GE 2x200GE 4x100GE 4x50GE	None

Signaling and speed support
Copper cables, fiber cables, and optical transceivers

		PAM4 Signaling Support	NRZ Signaling Support	PAM4 Speed Support	NRZ Speed Support
QSFP-DD optical transceivers					
QSFP-DD-SR8-XCVR	Ixia, QSFP-DD-SR8-XCVR 400GE 400GBASE-SR8 pluggable optical transceiver, MMF (multimode), 850 nm, 100-meter reach.	✓	No	1x400GE 2x200GE 4x100GE 4x50GE 8x50GE	None
400G-ZR*	QSFP-DD 400GE 400G-ZR DWDM coherent 16QAM optical transceiver. *Note Keysight does not sell coherent optics.	✓	No	1x400GE 4x100GE (depending on manufacturer)	None
Passive copper point-to-point and fan-out QSFP28 and QSFP+ cables					
942-0088	QSFP28 passive copper DAC, point-to-point, 3-meter	No	✓	None	1x100G 2x50GE 4x25GE 1x40GE 4x10GE
942-0071	QSFP-to-QSFP 40GE 40GBASE-CR4 passive copper DAC, point-to-point cable, 3-meter length	No	✓	None	1x40GE 4x10GE
942-0093	QSFP28-to-2xQSFP28 passive copper, (DAC), 3-meter length	No	✓	None	2x50GE 4x25GE 4x10GE
942-0094	QSFP28-to-4xSFP28 passive copper, DAC, 3-meter length	No	✓	None	4x25GE 4x10GE
QSFP-DD, QSFP28 and QSFP+ optical transceivers for point-to-point NRZ Ethernet speeds					
QSFP28-SR4-XCVR	QSFP28 100GBASE-SR4 100GE pluggable optical transceiver, MMF (multimode), 850nm, 100m reach (948-0036)	No	✓	None	1x100GE 2x50GE 4x25GE
QSFP28-PSM4-XCVR (parallel)	QSFP28 100GBASE-PSM4 100GE pluggable optical transceiver, SMF (single mode fiber), 1310nm, 2km reach (948-0037)	No	✓	None	1x100GE 2x50GE 4x25GE

Signaling and speed support
Copper cables, fiber cables, and optical transceivers

		PAM4 Signaling Support	NRZ Signaling Support	PAM4 Speed Support	NRZ Speed Support
QSFP-DD, QSFP28 and QSFP+ optical transceivers for point-to-point NRZ Ethernet speeds					
QSFP28-CWDM4-XCVR	QSFP28 100GBASE CWDM4 pluggable optical transceiver, SMF (single mode fiber), 2km reach, LC connector (995-8036)	No	✓	None	1x100GE 2x50GE 4x25GE
QSFP28-LR4-XCVR	QSFP28 100GBASE-LR4 100GE pluggable optical transceiver, SMF (single mode fiber), 1310nm, 10km reach (948-0038)	No	✓	None	1x100GE 2x50GE 4x25GE
QSFP-PLR4-XCVR	QSFP+ 40GBASE-PLR4 40GE pluggable optical transceiver, SMF (single-mode), 1310nm, 10 km reach (948-0040)	No	✓	None	1x40GE 4x10GE
QSFP-DD, QSFP28 and QSFP optical transceivers for fan-out of the NRZ Ethernet speeds					
QSFP-DD-CWDM4-XCVR	Ixia, QSFP-DD-CWDM4-XCVR 2x100GE pluggable optical transceiver, SMF (single mode) 4 lambdas, Dual CS-connector, 2km reach (948-0076)	No	✓	None	2x100GE
QSFP28-SR4-XCVR	QSFP28 100GBASE-SR4 100GE pluggable optical transceiver, MMF (multimode), 850nm, 100m reach (948-0036)	No	✓	None	1x100GE 2x50GE 4x25GE
QSFP28-PSM4-XCVR (parallel)	QSFP28 100GBASE-PSM4 100GE pluggable optical transceiver, SMF (single mode fiber), 1310nm, 2km reach (948-0037)	No	✓	None	1x100GE 2x50GE 4x25GE

Signaling and speed support
Copper cables, fiber cables, and optical transceivers

QSFP-DD, QSFP28 and QSFP optical transceivers for fan-out of the NRZ Ethernet speeds					
		PAM4 Signaling Support	NRZ Signaling Support	PAM4 Speed Support	NRZ Speed Support
QSFP-PLR4-XCVR	QSFP+ 40GBASE-PLR4 40GE pluggable optical transceiver, SMF (single-mode), 1310nm, 10 km reach (948-0040)	No	✓	None	1x40GE 4x10GE

More information:

https://www.keysight.com/in/en/products/network-test/network-test-hardware/aresone-s-400ge.html