UX400-16G Module
1/2/4/8/10/16G Fibre Channel

VePAL UX400
Universal Test Platform

Next Generation Modular Platform for Transport, Carrier Ethernet, Mobile Backhaul, and Legacy Testing

VeEX® UX400 is the industry's most flexible, compact, and future-proof test solution for OTN, SDH, SONET, PDH, T-Carrier, Carrier Ethernet, Mobile Backhaul, Core, and Storage Area Networks[1].

16G Fibre Channel Test Module

The UX400 16G test module supports 1G, 2G, 4G, 8G, 10G and 16G Fibre Channel testing. The module can be housed in the UX400 Platform for portable, field test applications or it can be mounted into a UX400R 19" rack mount chassis for R&D lab or production environments where battery operation or display is not required. When equipped with dual port test option, up to two users can configure and run separate/simultaneous tests at different rates enabling more efficient use of the equipment.

New technology drivers such as multi-core processors, high-density servers, server virtualization and SSD storage arrays are driving the need for increased performance and bandwidth in Storage Area Networks. Considering Fibre Channel's stringent performance requirements and the fact that SANs often cover large distances, it is important to test at each phase of network deployment to verify service levels.

The UX400 16G test module provides wire-speed traffic generation at all commercially available FC rates in a single, multi-rate test module and supports FC-2 BER testing for link integrity measurements. This flexible module also supports latency, and buffer-to-buffer credit measurements for complete SAN installation, commissioning, and troubleshooting tasks.

[1] *Test interfaces, data rates, mappings, transmission protocols, and features depend on the availability of individual test modules*

Module Highlights

General

- Single-slot test module
- Dual SFP+ optical ports
- Up to two coupled or independent tests per module
- SCPI-based remote control and scripting commands

Fibre Channel

- Full line-rate traffic generation/analysis at 1.0625, 2.125, 4.25, 8.5, 10.52 and 14.025 Gbps
- Traffic generation from 0.01% to 100%
- FC-1 and FC-2 BERT, and Throughput testing
- RFC2544 Verification – Throughput, Latency, Frame Loss, Burstability (Back-to-Back Frames)
- Performance Measurements – Delay, Packet Jitter, Sequencing
- Frame Length configuration up to 2148 bytes
- Traffic shaping: Constant, Ramp, and Burst profiles
- FC-1 Test Patterns: CJTPAT, CRPAT, CSPAT
- FC-2 Test Patterns: ITU-T PRBS, 2^{11-1}, 2^{15-1}, 2^{23-1}, 2^{31-1}
- FC-2 Frame Header configuration
- Flow Control Support with configurable buffer-to-buffer credits
- Primitive Sequence Protocol support, link initialization, link reset, link failure
- Layer 1 and 2 Loopbacks including FC-2 Smart Loop mode
- Packet Capture and decode of error events with selectable triggers
- Automated Test Reports and Event Log based on Errors and Alarms
- Service Disruption Measurement

Specifications

Test Interfaces

Optical*

Dual SFP+ test ports

- 1G FC 1.0625 Gbps
- 2G FC 2.125 Gbps
- 4G FC 4.25 Gbps
- 8G FC 8.5 Gbps
- 10G FC 10.52 Gbps
- 16G FC 14.025 Gbps

**Note: Single port activated by default. Second port activation is optional.*

Fibre Channel Testing

1G/2G/4G/8G/10G/16G Functions

The UX400-16G module offers comprehensive test capabilities at multiple Fibre Channel rates. Wire speed traffic generation at the FC-0, FC-1 and FC-2 logical layers responsible for link initialization, switching and transfer of data quickly ensures service levels are achieved.

Test parameters include optical power level measurement and bit-error-rate testing (BER) for link integrity measurements - User defined bytes, fixed test patterns or industry-standard PRBS patterns can be selected and inserted into the payload field depending on test layer. Frame delimiters, frame transmission, bit errors, order sets, and the generation of primitive sequences is also possible while Bit error, CRC error and Code violation insertion are useful to verify Mux/Demux equipment for error monitoring and detection. To summarize:

- FC-0 addresses the physical layer such as the optical fiber, connectors and associated optical signal parameters
- FC-1 addresses the transmission protocol encoding and decoding, and special characters used for protocol management
- FC-2 addresses the signaling protocol layer, which comprises the framing protocol and flow control process

Key Features**

- 1G/2G/4G/8G/10G/16G Fibre Channel rates
- Terminate and Loopback test modes
- FC-0, FC-1 and FC-2 Layer testing
- RFC2544 compliance testing
- Traffic generation from 0.01% to 100%
- Flow Control with configurable buffer-to-buffer credits
- FC-2 Frame Header configuration
- Primitive Sequence Protocol support, link initialization, link reset, link failure
- Frame Length configuration up to 2148 bytes
- Traffic shaping: Constant, Ramp, and Burst profiles
- Performance Metrics – Delay, Packet Jitter, Sequencing
- Automated Test Reports and Error and Alarm Event Log
- Packet Capture & Decode
- Service Disruption Measurement
- FC-2 Smart Loop mode

Operating Modes

Terminate
Loopback

Fibre Channel Topology

Point-to-Point

Primitive Sequence Protocols

Link Protocols: Link initialization, link rest, link failure

Flow Control

Buffer-to-Buffer Credit Configuration: 1-65535

Traffic Generation

FC-1 (SOF and EOF frame delimiters) and FC-2 Frames
Class 3 Service frames
Configurable Header fields, EOF, SOF
Traffic Shaping: constant, ramp, burst
Frame Length Configuration: 2148 bytes maximum

Key Measurements

Errors: Bit, BER, CRC, symbol, Oversize, Undersize, Frame loss (count and %)
Alarms: LOS, pattern loss, service disruption
Traffic Statistics: Bandwidth utilization, data rate, frame count, byte count, frame size distribution, buffer-to-buffer credits, RR_RDY count, frame loss count, round trip delay
Rates (min, max, average and current): frame rate, bandwidth utilization, frame rate, line rate, data rate
Delay (min, max, average and current): round trip delay, inter frame gap

RFC2544 Compliance Testing

Automated RFC2544 tests with configurable threshold values and maximum transmit bandwidth settings
Throughput, Latency, Frame Loss, and Back-to-Back frames
Frame sizes: 64, 128, 256, 512, 1024, 1280, and 2000 bytes including 2 user configurable frames

Bit Error Rate Testing

NCITS-TR-25-1999 Patterns (FC-1): CRPAT, CSPAT, CJTPA
PRBS Patterns (FC-2): 2^{31}-1, 2^{23}-1, 2^{15}-1, 2^{11}-1, normal and inverted selections, and user defined patterns
Error Injection: Bit and CRC

Packet Capture/Decode**

Filters: S_ID,D_ID,SEQ_CNT, OX_ID
Triggers: Out of order frame errors, dropped frame errors, misdirected frame errors, and CRC errors.

*** Some test rates, test ports, features and functions described in this document are optional, may be linked to, or require the support of other software options. Please check the ordering information section for details.*

Loopback Mode

FC-1
FC-2 (Layer 2): swaps source/destination IDs (S-ID & D_ID)

Optical SFP+ Transceivers*

Application (Fiber Channel)	1/2/4/8 Gbps	8/10 Gbps	4/8/16 Gbps
VeEX Part No.	301-02-003G	301-02-005G	301-02-004G
Data Rate			
1.025 Gbps	Compatible	N/A	N/A
2.125 Gbps	Compliant	N/A	N/A
4.25 Gbps	Compliant	N/A	Compliant
8.5 Gbps	Compliant	Compliant	Compliant
10.52 Gbps	N/A	Compliant	N/A
14.025 Gbps	N/A	N/A	Compliant
Operating Temperature (°C)	-5 to +85	-5 to +75	0 to +70
Wavelength (nm)	1310	1310	850
Range (m or km as specified)			
1.025 Gbps	10 km (SMF)	10 km (SMF)	N/A
2.125 Gbps	10 km (SMF)	10 km (SMF)	N/A
4.25 Gbps	10 km (SMF)	10 km (SMF)	150m (MMF) 380m (MMF OM3)
8.5 Gbps	10 km (SMF)	10 km (SMF)	50m (MMF) 150m (MMF OM3)
10.52 Gbps	10 km (SMF)	10 km (SMF)	N/A
14.025 Gbps	10 km (SMF)	10 km (SMF)	35m (MMF) 100m (MMF OM3)
Connector	Duplex LC	Duplex LC	Duplex LC
Fiber Type (µm)	9/125	9/125, G.652	50/125
Modulation Type & Line Coding	NRZ, 8B/10B	NRZ, 64B/66B	NRZ, 64B/66B & 8B/10B
Tx Laser	DFB	DFB	VCSEL
Tx Power (dBm)			
2.125 Gbps	-8.4 to -3.0	N/A	N/A
4.25 Gbps	-8.4 to -3.0	N/A	-7.8
8.5 Gbps	-8.4 to +0.5	-6 to -1	-7.8
10.52 Gbps	N/A	-6 to -1	-7.8
14.025 Gbps	N/A	N/A	N/A
Rx Detector	PIN	PIN	PIN
Digital Diagnostics Interface (DDI)	Yes	Yes	Yes
Rx Sensitivity (OMA) in µw, mw or dBm as specified			
2.125 Gbps	0.015 mw	N/A	N/A
4.25 Gbps	0.029 mw	N/A	61 µw
8.5 Gbps	0.042 mw	-13.8 dBm	76 µw
10.52 Gbps	N/A	-12.6 dBm	89 µw
14.025 Gbps	N/A	N/A	N/A

Notes:

1. SFP+ transceivers conform to Multi Source Agreement (MSA) specifications
2. Optical Power Measurement: ± 2 dB accuracy, 1 dB resolution
3. Safety: Class 1, per FDA/CDRH, EN (IEC) 60825 eye safety regulations
4. ROHS compliant and Lead Free per Directive 2002/95/EC

**Data rates, performance, and supported transmission protocols are only guaranteed for SFPs and XFPs supplied by VeEX Inc. If selecting or using other vendors, users should exercise caution.*

Ordering Information

Z22-00-009P	UX400-16G Multi-rate Fibre Channel Test Module Dual SFP+ ports support 1G, 2G, 4G, 8G, 10G and 16G Fiber Channel rates (2nd test port optional, test protocols and SFP+ transceivers not included)

Software Options

Single Test Port	(Throughput/BERT, RFC2544, SFP+ not included)
499-05-285	UX400-16G 16G Fibre Channel
499-05-286	UX400-16G 10G Fiber Channel
499-05-287	UX400-16G 8G Fiber Channel
499-05-288	UX400-16G 1G/2G/4G Fibre Channel
499-05-289	UX400-16G 1G/2G Fiber Channel
499-05-290	UX400-16G 1G/2G/4G/8G/10G/16G Fiber Channel Test Rate Bundle (all FC rates above)
Dual Port Testing	(Throughput/BERT, RFC2544 and Pass-Through Monitor)
499-05-291	UX400-16G 16G Fibre Channel - 2nd Port Traffic Generation/Analysis and Pass-through Monitoring (requires single-port option for selected rate)
499-05-292	UX400-16G 10G Fibre Channel - 2nd Port Traffic Generation/Analysis and Pass-through Monitoring (requires single-port option for selected rate)
499-05-293	UX400-16G 8G Fibre Channel - 2nd Port Traffic Generation/Analysis and Pass-through Monitoring (requires single-port option for selected rate)
499-05-294	UX400-16G 1/2/4G Fibre Channel - 2nd Port Traffic Generation/Analysis and Pass-through Monitoring (requires single-port option for all selected rates)
499-05-295	UX400-16G 1/2G Fibre Channel - 2nd Port Traffic Generation/Analysis and Pass-through Monitoring (requires single-port option for all selected rates)
499-05-296	UX400-16G 1G/2G/4G/8G/10G/16G Fibre Channel Bundle - 2nd Port Traffic Generation/ Analysis and Pass-through Monitoring (requires single-port option for all rates)
Protocol Capture and Decode	
499-05-297	Single port capture
499-05-298	Second activation port for bi-directional capture
Optical SFP+ Transceiver Options	
301-02-003G	1/2/4/8 Gbps
301-02-005G	8/10 Gbps
301-02-004G	4/8/16 Gbps

General

Power Consumption	12 watts (max)
Environmental	
Operating temperature	0 to 40°C (32 to 104°F)
Storage temperature	-20 to 70°C (-4 to 158°F)
Humidity	5% to 90% non-condensing

ROHS compliant and Lead Free per Directive 2002/95/EC
CE Compliant

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