UX400-2.5G Module
OTN/SDH/SONET/PDH/DSn Testing

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].

2.5G Transport Test Module

The UX400 2.5G module's lower rate physical interfaces for OTU1, SDH, SONET, legacy PDH and DSn/T-carrier interfaces, is a perfect complement to the UX400 10G and 40/100G test modules, enabling a full range of link testing capabilities from DS1 to OTU4, in a single compact unit.

Installation, commissioning, monitoring and maintenance of OTN, SDH, SONET, PDH, DSn networks is simplified thanks to a combination of intuitive features and powerful test functions.

Fast troubleshooting and comprehensive analysis of transmission problems can be performed using intrusive, non-intrusive and monitoring test modes. Novice users will benefit from the easy-to-use auto-configuration and tributary scan test modes, while experienced users will appreciate the array of advanced features such as overhead monitoring and byte control, pointer test sequences, path trace generation, Tandem Connection Monitoring and much more.

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

Module Highlights

- Dual SFP optical ports supporting OTU1, STM-0/1/4/16, OC-1/3/12/48 bit rates
- Dual unbalanced ports (BNC) for E1, E3, E4, DS1, DS3, STS-1, STM-0e and STM-1e
- Dual balanced ports (RJ48 or Bantam) for E1 and DS1
- Single or dual BERT capabilities
- Each port can be independently configured and operated
- Coupled or independent Tx and Rx
- Flexible wavelength and bit rate options using industry standard SFPs
- Optical power, level and frequency measurements
- Payload mapping according to ITU-T G.707 rec.
- Concatenated payloads
- Full rate E1, DS1, fractional N/M x 64 kbps or 56 kbps testing
- PDH analysis with Sa bit generation
- Non-intrusive pulse mask analysis at E1, E3, DS1, DS3 bit rates
- Bit error and performance analysis per ITU standards
- Error and alarm generation and analysis
- Section and path overhead monitoring, byte decoding
- Path trace generatoin and analysis
- Tandem Connection Monitoring
- Pointer generation and analysis
- Service disruption testing and APS
- Histogram and event analysis for errors and alarms
- Round trip delay on all interfaces and payload mappings
- Jitter/Wander Analysis (E1, E3, DS1, DS3 and STM-1o, OC-3)

Specifications

Test Interfaces

Optical*

Dual SFP

- OTU1 2666 Mbps
- STM-16/OC-48 2488 Mbps
- STM-4/OC-12 622 Mbps
- STM-1/OC-3 155 Mbps
- STM-0/OC-1 51 Mbps

SFP transceivers conforming to Multi Source Agreement (MSA) specifications

Compliant to ITU-T G.957/G.691

Optical interfaces and systems relating to SDH

Optical Power Measurement:

± 2 dB accuracy, 1 dB resolution

Safety: Class 1, per FDA/CDRH, EN (IEC) 60825 eye safety regulations

Operating temperature range: -10˚C to 70˚C

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

**Specific data rates, performance and supported transmission protocols for the SFPs supplied by VeEX Inc. are listed in the ordering section.*

Electrical

Dual RJ-48 (120Ω) or Bantam (100Ω) balanced

Rates and line code

- 2.048 Mbps, HDB3 & AMI, 120Ω balanced
- 1.544 Mbps, AMI & B8ZS, 100Ω balanced

BNC (75Ω unbalanced)

Rates and line code

- 2.048 Mbps, HDB3 & AMI
- 8.448 Mbps, HDB3
- 34.368 Mbps, HDB3
- 44.736 Mbps, B3ZS
- 51.84 Mbps, B3ZS
- 139.264 Mbps, CMI
- 155.520 Mbps, CMI

Compliant to ITU-T G.703, G.823, G.824, G.772 and ANSI T1.102

Clock recovery (pulling range) per ITU-T G.703

Receiver Sensitivity

2.048 Mbps (E1)

- Terminate: ≤ 6 dB (cable loss only)
- Monitor (PMP): ≤ 26 dB (20 dB resistive, 6 dB cable loss)
- Bridge (Hi-Z): ≤ 6 dB (cable loss only)

8.448 Mbps (E2)

- Terminate: ≤ 6 dB (cable loss only)
- Monitor (PMP): ≤ 26 dB (20 dB resistive, 6 dB cable loss)

34.368 Mbps (E3)

- Terminate: ≤ 12 dB (cable loss only)
- Monitor (PMP): ≤ 26 dB (20 dB resistive, 6 dB cable loss)

1.544 Mbps (DS1)

- Terminate: ≤ 26 dB (cable loss only) at 0 dBdsx Tx
- Monitor (PMP): ≤ 26 dB (20 dB resistive, 6 dB cable loss)
- Bridge (Hi-Z): ≤ 6 dB (cable loss only)

44.736 Mbps (DS3) and 51.84 Mbps (STS-1/STM-0e) (Optional)

- Terminate: ≤ 10 dB (cable loss only)
- Monitor (PMP): ≤ 26 dB (20 dB resistive, 6 dB cable loss)

139.264 Mbps (E4) and 155.520 Mbps (STM-1e) (Optional)

- Terminate: ≤ 12 dB (E4), 12.7 dB (STM-1E) (coaxial cable loss only)

Automatic Configuration

Available for SDH, SONET, PDH and DSn signals

Configures the test port according to the incoming signal

Bit rate, framing, line code and test pattern are identified in accordance with ITU-T G.707, G.703, O.151 and O.181

TX Clock Source

Internal: ± 3.5 ppm stability per ITU-T G.812

Recovered: from the incoming signal

Tx Frequency Offset: Up to ±150 ppm (±25,000 for E1, ±50 ppm for OTN), in steps of 0.01 ppm

External Clock Input

- Connector: 75 Ohm BNC
- 2 MHz, 2 Mbps (AMI, HDB3)
- Terminated, Monitor, Bridge

Measurement Clock Reference

Internal: ± 3.5 ppm stability per ITU-T G.812

External Clock Input

- Connector: 75 Ohm BNC
- 2 MHz, 2 Mbps (AMI, HDB3)
- Terminated, Monitor, Bridge

OTN Functions

Key Features

- Synchronous and asynchronous mapping of SONET/SDH signals, including multiplexed PDH/DSn payloads
- OTU, ODU, OPU overhead manipulation and monitoring
- OTU, ODU and OPU layer alarms/errors generation and analysis
- OTU, ODU trace messages
- Forward error correction (FEC) testing
- Tandem Connection Monitoring
- Frequency offset generation of bit rates by ± 50 ppm

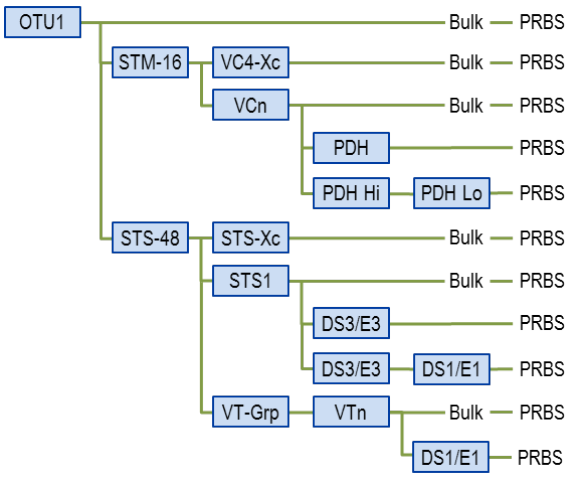
OTN

Standards: ITU-T G.709, ITU-T G.798, ITU-T G.872

Test rates: OTU1 (2.7 Gbps)

Payload types

- ODU1-Bulk (test pattern)
- ODU1-STM-16 or OC-48, synchronous and asynchronous, including all supported mappings and multiplexed tributaries, down to E1/DS1



OTU Layer
Errors: OTU-FAS, OTU-MFAS, OTU-BEI, OTU-BIP-8
Alarms: LOF, OOF, LOM, OOM, OTU-AIS, OTU-TIM, OTU-BDI, OTUIAE, OTU-BIAE
Trace Generation: 64-byte Trail Trace Identifier (TTI)

ODU Layer
Errors: ODU-BIP-8, ODU-BEI
Alarms: ODU-AIS, ODU-OCI, ODU-LCK, ODU-TIM, ODU-BDI
Trace Generation: 64-byte Trail Trace Identifier (TTI)

OPU Layer
Alarms: OPU-PLM
Payload Type (PT): Generates and displays received PT value

Tandem Connection Monitoring (TCM)
TCM Monitoring (1 through 6)
- LTC, AIS, OCI, LCK, BDI, BIAE, IAE; count
- IEC, BEI; count and rate

Trace Identifier Monitoring and Generation
- Programmable SAPI, DAPI and User traces
- Copy trace from RX
- TIM monitoring: ON and OFF

Forward Error Correction (FEC)
Errors: FEC-Correctable, FEC-Uncorrectable

SDH/SONET Functions

SDH/SONET signals can be used as physical layer or as OTU1 payloads, and can even contain multiplexed PDH clients, providing all the flexibility to address complex test scenarios

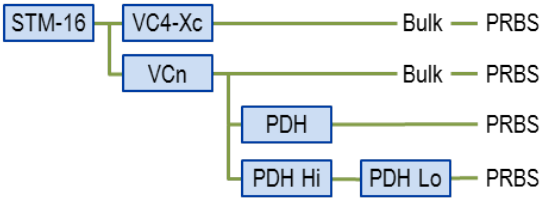
Key Features
- STM-16/4/1/0
- OC-48/12/3 and STS-1
- Bulk VC/STS/VT, PDH/DSn and multiplexed payloads
- Overhead manipulation and monitoring
- Alarms/errors generation and analysis
- Service Disruption and APS
- One-way Delay (dual mode)
- Round Trip Delay
- Tributary Scan
- Tandem Connection Monitoring
- Pointer Test Sequences

Operating Modes
Terminate mode
Monitor mode
Payload Through mode (Intrusive)
- Modification of selected SOH bytes
- Alarm Generation/Error Insertion of selectable defects/ anomalies

Line Through mode (transparent)
- Passes entire signal through without modifying overhead bytes

Signal Structure
VC-n or STS-n container equipped with
- Bulk TSS: Test patterns per ITU-T O.181
- Structured: Unframed or framed PDH/DSn structure, down to Nx64 kbps or Nx56 kbps, with test pattern per ITU-T O.150

SDH Mappings
(According to ITU-T G.707)
C-12 (Bulk or E1)
C-3 (Bulk, E3/DS3 or multiplexed E1/DS1/Nx64/Nx56) via AU-3 or AU-4
C-4 (Bulk or E4)
C-4-4c (Bulk)
C-4-16c (Bulk)
C-11 (Bulk or DS1)



SDH Overhead Analysis and Generation
Network Architectures supported
- Linear (per ITU-T G.783)
- Ring (per ITU-T G.841)

Analysis – Decode and Display
SOH/POH bytes in hexadecimal, binary or ASCII formats
- S1 synchronization status
- C2 HP signal label
- J0 trace identifier (1, 16 or 64 bytes) in ASCII format
- J1 trace identifier (16 or 64 bytes) in ASCII format
- J2 trace identifier (16 or 64 bytes) in ASCII format
- K1, K2 APS Control
- V5 LP signal label

Generation - Programmable Bytes
RSOH
- J0 trace: 1 byte (hex), 16-byte ASCII with CRC-7, or 64-byte ASCII with CR+LF sequences

MSOH
- K1, K2 APS bytes per ITU-T G.783 and G.841
- S1 synchronization status message

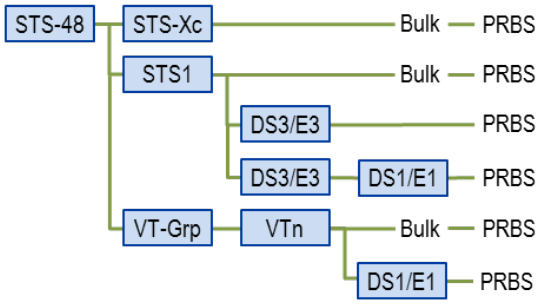
HO-POH (VC-4, VC-3)
- J1 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- C2 signal label
- H4 Sequence/Multiframe Indicator
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

LO-POH (VC-3)
- J1 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- C2 signal label
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

LO-POH (VC-12, VC-11)
- V5 (bits 5-7) LP signal label
- J2 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- K4 (bits 3-4) LP APS signaling

SONET Mappings

(According to Telcordia GR-253/ANSI T1.105)
VT-1.5 (Bulk or DS1)
STS-1 SPE (Bulk, E3/DS3 or multiplexed E1/DS1/Nx64/Nx56)
STS-3c SPE (Bulk or E4)
STS-12c SPE (Bulk)
STS-48c SPE (Bulk)
VT-2 (bulk or E1)



SONET Overhead Analysis and Generation

Network Architectures supported
- Linear (per ITU-T G.783)
- Ring (per ITU-T G.841)

Analysis – Decode and Display

SOH/POH bytes in hexadecimal, binary or ASCII formats
- S1 synchronization status
- C2 STS path signal label
- J0 trace identifier (1, 16 or 64 bytes) in ASCII format
- J1 trace identifier (16 or 64 bytes) in ASCII format
- J2 trace identifier (16 or 64 bytes) in ASCII format
- K1, K2 APS Control
- V5 VT path signal label

Generation - Programmable Bytes

Section Overhead
- J0 trace: 1 byte (hex), 16 -byte ASCII sequence with CRC-7

Line Overhead
- K1, K2 APS bytes per ITU-T G.783 and G.841
- S1 synchronization status message

STS-POH (STS-N SPE, STS-1 SPE)
- J1 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- C2 signal label
- H4 Sequence/Multiframe Indicator
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

STS-POH (STS-1 SPE)
- J1 trace: 16 byte ASCII with CRC-7 or 64 byte ASCII sequence
- C2 signal label
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

VT-POH (VT-1.5, VT-2)
- V5 (bits 5-7) VT signal label
- J2 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- K4 (bits 3-4) VT APS signaling

SDH/SONET Alarms

Monitoring and Detection
- SDH: LOS, LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HPUNEQ, HP-PLM, HP-TIM, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-UNEQ, LP-PLM, LP-TIM, LP-RDI, LP-RFI
- SONET: LOS, LOF-S, LOF-S, SEF-S, AIS-L, RDI-L, AIS-P, LOP-P, UNEQ-P, PLM-P, TIM-P, RDI-P, LOM-V, AIS-V, LOP-V, UNEQ-V, PLM-V, TIM-V, RDI-V, RFI-V

Generation
- SDH: LOS, LOF, MS-AIS, MS-RDI, RS-TIM, AU-LOP, AU-AIS, HP-UNEQ, HP-PLM, HP-RDI, HP-TIM, TU-LOM, TU LOP, TU-AIS, LP-UNEQ, LP-PLM, LP-RDI, LP-RFI, LP-TIM
- SONET: LOS, LOF, AIS-S, RDI-S, TIM-P, LOP-P, AIS-P, UNEQ-P, PLM-P, RDI-P, LOM-V, LOP-V, AIS-V, UNEQ-V, PLM-V, RDI-V, RFI-V, TIM-V
- Modes: Continuous, Burst (0.1s to 100s)

SDH/SONET Errors

Detection
- SDH: FAS, B1, B2, MS-REI, B3, HP-REI, LP-BIP, LP-REI, slips and bit errors
- SONET: FAS, S-BIP, L-BIP, REI-L, P-BIP, REI-P, REI-V, BIP-V, and bit errors

Insertion
- SDH: FAS, B1, B2, MS-REI, B3, HP-REI, LP-REI, LP-BIP, and bit errors
- SONET: FAS, B1, B2, REI-L, B3, REI-P, REI-V, BIP-V, slips and bit
- Mode: Single, Burst (1 to 1000), and Rate ($1x10^{-3}$ to $5x10^{-6}$)

Tributary Scan

Automatically scans VC-12/VC-11 and VT1.5/VT2 for errors, alarms and events using a sequential BER tests

PDH/DSn Functions

While telecommunications network technologies have evolved to include long-distance high-capacity OTN and SDH/SONET trunks, PDH links and clients are frequently retained for access, service delivery, and other economic reasons. As such, testing PDH payloads continue to play an important role in test and measurement.

The UX400-2.5G Module provides PDH interfaces, payload generation, access and testing capabilities for 140 Mbps (E4), 45 Mbps (DS3), 34 Mbps (E3), 2 Mbps (E1), 1.544 Mbps (DS1), down to N×64 and Nx56 kbps. PDH clients can be multiplexed into a higher PDH signal, mapped into SDH/SONET containers, and then mapped into ODU1-OTU1, giving it the flexibility to address complex test scenarios.

Operating Modes

Terminated
Monitor
Bridge (E1 and DS1)

Signal Structure

2.048 Mbps (E1)
- Unframed or Framed with/without CRC per ITU-T G.704 (PCM30, PCM30C, PCM31, PCM31C)
- Test signal in N/M x 64 kbps where N=1 to 30/31

8.448 Mbps (E2)
- Unframed or Framed according to ITU-T G.742

34.368 Mbps (E3)
- Unframed or Framed according to ITU-T G.751

139.264 Mbps (E4)
- Unframed or Framed per ITU-T G.751

1.544 Mbps (DS1)
- Unframed or Framed SF (D4), ESF per ANSI/Telcordia standards
- Test signal in N x 64 kbps, N x 56 kbps where N=1 to 24/30/31

44.736 Mbps (DS3)
- Unframed or Framed M13 & C-Bit Parity per ITU-T G.752/G.704

PDH/DSn Errors

Monitoring and Detection

- 2.048 Mbps (E1): Code, FAS, CRC, EBIT and Bit errors
- 8.448 Mbps (E2): Code, FAS, Bit errors
- 34.368 Mbps (E3): Code, FAS, Bit errors
- 139.264 Mbps (E4): FAS, Bit errors
- 1.544 Mbps (DS1): Code, FAS, Bit, Frame, CRC
- 44.736 Mbps (DS3): Code, FAS, MFAS, P/C-Parity, Bit errors

Insertion

- 2.048 Mbps (E1): Code, FAS, CRC, EBIT, Bit errors
- 8.448 Mbps (E2): Code, 8M FAS, 2M FAS, 2M CRC, 2M RDI, Bit errors
- 34.368 Mbps (E3): Code, 34M FAS, 8M FAS, 2M FAS, 2M CRC, 2M RDI, Bit errors
- 139.264 Mbps (E4): Code, FAS, Bit errors
- 1.544 Mbps (DS1): Code, FAS, Bit, Frame, CRC
- 44.736 Mbps (DS3): Code, FAS, MFAS, P/C-Parity, Bit errors
- Modes: Single, Burst (1 to 1000), or Continuous rate (1×10^{-3} to 5×10^{-6})

PDH/DSn Alarms

Monitoring and Detection

- 2.048 Mbps (E1): LOS, AIS, LOF, LOMF, RDI, and LSS
- 8.448 Mbps (E2): LOS, AIS, LOF, RDI, and LSS
- 34.368 Mbps (E3): LOS, AIS, LOF, RDI, and LSS
- 139.264 Mbps (E4): LOS, AIS, LOF, RDI
- 1.544 Mbps (DS1): AIS, yellow, idle, LOS, LOF, LSS
- 44.736 Mbps (DS3): LOS, LOF, OOF, AIS, Parity, LSS

Generation

- 2.048 Mbps (E1): LOS, AIS, LOF, RDI
- 8.448 Mbps (E2): 8M AIS, 8M LOF, 8M RDI, 2M AIS, 2M LOF, 2M RDI
- 34.368 Mbps (E3): 34M LOS, 34M AIS, 34M LOF, 34M RDI, 8M, AIS, 8M LOF, 8M RDI, 2M AIS, 2M LOF, 2M RDI
- 1.544 Mbps (DS1): AIS, yellow, idle, LOS, LOF
- 44.736 Mbps (DS3): LOS, LOF, OOF, AIS, Parity
- 139.264 Mbps (E4): AIS, FAS RDI
- Modes: Continuous, Burst (0.1s to 100s)

Measurement Functions

Test Results

Error count, ES, %ES, SES, %SES, UAS, %UAS, EFS, %EFS, AS, %AS, and rate for all events: errors, alarms and pointer events

Performance Analysis

Measurements according to:

- ITU-T G.821: ES, EFS, SES and UAS with HRP 1% to 100%
- ITU-T G.826: EB, BBE, ES, EFS, SES, UAS; HRP of 1% to 100%
- In Service Measurement (ISM) using B1, B2, B3, FAS, CRC or Code (E1)
- Out of Service measurement (OOS) using bit errors (Test Sequence Error)
- ITU-T G.828: ES, EFS, SES, BBE, SEP, UAS with HRP 1% to 100%
- ITU-T G.829: ES, EFS, SES, BBE, UAS on RSOH (B1), MSOH (B2) or TSE
- ITU-T M.2100: ES, EFS, SES, UAS with HRP 1% to 100%
- User defined thresholds for Maintenance (MTCE) and Bringing into Service (BIS) objectives
- ITU-T M.2101: ES, EFS, SES, BBE, SEP, UAS with HRP 1% to 100%
- User defined thresholds for Maintenance (MTCE) and Bringing into Service (BIS) objectives. In service measurements on both near and far ends of path using TSE, HP-BIP (B3), MS-BIP (B2), RS-BIP (B1) and LP-BIP (V5)

Pulse Mask Analysis

PDH

- Bit rates: 2.048 Mbps (E1) and 34.368 Mbps (E3)
- Conformance Mask: ITU-T G.703

DSn

- Bit rates: 1.544 Mbps (DS1) and 44.736 Mbps (DS3)
- Conformance Masks: ITU-T G.703, ANSI T1.102, T1.403, T1.404

Mode: Non-Intrusive

Display: Positive and negative pulse shapes with Conformance Mask verification

Parameters: Width, Rise/Fall time, Overshoot/Undershoot

E1 Frame Words

Monitor and Generates Sa bits

- SA4 to SA8
- Raw SSM Quality level message

V.54 Loops

Mode: E1 Nx64

Commands: Loop up, loop down

Common Functions & Measurements

Signal and Frequency Measurements

All Optical and Electrical Interfaces

Signal level

- Optical power in dBm and graph
- Electrical level in Volts peak-to-peak, dB and dBm

Frequency (Line and Payloads)

- Resolution: 1 bit/s (bps)

Frequency Offset

- Resolution: 0.1 ppm
- Current, Minimum and Maximum

Clock Slips (E1 and DS1)

Round Trip Delay

Available for SDH, SONET, PDH and DSn signals

Measurement Range: 1 µs to 10 seconds

Resolution: ±1 µs or 1 U.I.

Test Patterns

The following test sequences can be generated

- PRBS: 2^{31}-1 , 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, 2^{9}-1, 2^{7}-1, QRSS
- Fixed: 0000, 1111, 1010, 1100, 1in8, 2in8, 3in24, DALY, NET55 and OCT55
- 10 user programmable words: up to 32 bits
- Normal or inverted generation

Events Log

Date and time stamped record of all events occurred during a tests, presented in tabular format

Includes event name, time, duration and count/severity

Histogram and Bar Graphs

Histogram: Display of related Errors and Alarms versus time

Bar Graph: Error or Alarm severity versus time

Resolution: Seconds, minutes, hours and days

Soft LED Indicators

Fixed indicators for Signal, Framing, Pattern and Errors/Alarms

Display historical events and conditions

Measurement Options

Service Disruption and APS Testing

SDH Sensors
- LOS, LOF, FAS
- B1, MS-AIS, MS-RDI, MS-REI, B2, AU-AIS, AU-LOP, B3, HP-RDI, HP-REI, TU-AIS
- PDH payload-related triggers
- LSS

SONET Sensors
- LOS, LOF, FAS
- S-BIP, AIS-L, RDI-L, REI-L, L-BIP, AIS-P, LOP-P, P-BIP, RDI-P, REI-P, AIS-V
- PDH payload-related triggers
- LSS

PDH (E1) Sensors
- E1-LOF, E1-AIS
- LSS

Pass/Fail range: 50 to 200 ms
Gate Time: 20 to 4000 ms
Resolution: 1 ms
Test Modes: Single and Continuous
SDH/SONET APS Byte (K1/K2) capture and decode

Pointer Analysis and G.783 Test Sequences

Pointer movements monitoring and generation for SDH and SONET

Monitor
- Current value, increments, decrements, sum, difference
- New Data Flags (NDF)
- Tributary frequency offset (ppm of AU/TU or STS/VT)

Generation
- Pointer sequences: ITU-T G.783, Telcordia GR-253
- Pointer Types: AU, TU, STS, VT
- Single pointer, increment, decrement, or increment/decrement
- Sequence: Basic, Single Alternating, Regular Additive, Regular Cancel, Double Alternating, Burst, Transient Burst, 87/3, 87/3 Additive, 87/3 Cancel, Periodic Additive, Periodic Cancel
- Programming of SS bits
- Adjustments: Increment, Decrement, New Value
- Parameters: N, T1, T2, T3, T4

Tandem Connection Monitoring (TCM)

Generation and analysis of N1 and N2 bytes
Errors generated: TC-IEC, TC-BIP, TC-REI, OEI
Alarms generated: TC-RDI, TC-UNEQ, TC-LTC, TC-AIS, TC-ODI
Detection, display, analysis and storage of events:
- TC-IEC, TC-AIS, TC-REI, TC-RDI, TC-OEI, TC-LTC, TC-UNEQ, TCODI, TC-TIM
- Analysis and generation of APId (Access Point Identifier)

VF Measurements

VF (Talk, Tone) drop/insert via headset
- Dual 2.5mm TRS audio jacks for headsets

Time Slot: Independent channel selection for TX and RX
- E1 channel: 1 to 30 or 31
- DS1 channel: 1 to 24

Codec: µ-Law or A-Law
Tone Generation/Measurement

Setup
- Transmitted Frequency: 50 to 3950 Hz
- Transmitted Level: -60 to 3 dBm
- Programmable ABCD: Manual edit AB, ABCD or ON-HOOK, OFF-HOOK, WINK for DS1, and IDLE, SEIZE for E1

Results
- Measure signal frequency and level in selected timeslot
- Listen to the audio channel in selected timeslot via external headsets
- AB/ABCD bits monitor and View Data in selected T/S channel

Jitter/Wander Analysis

Jitter Measurements

Fully compliant to ITU-T O.171 and O.172
HP1+LP (Wide-band Jitter) filter
- E1 (2M) (20 Hz to 100 kHz)
- E3 (34M) (100 Hz to 800 kHz)
- DS1 (1.5M) (10 Hz to 40 kHz)
- DS3 (45M) (10 Hz to 400 kHz)
- STM-1 (155M Optical) (500 Hz to 1.3 MHz)

HP2+LP (High-band Jitter) filter
- E1 (2M) (18 Hz to 100 kHz)
- E3 (34M) (10 Hz to 800 kHz)
- DS1 (1.5M) (18 Hz to 100 kHz)
- DS3 (45M) (30 Hz to 400 kHz)
- STM-1 (155M Optical) (65 Hz to 1.3 MHz)

Parameters: Current peak-peak, Maximum peak-peak
Complete Jitter Test Suite
- Output Jitter measurement
- Jitter generation (1 Hz to 40 kHz)
- Maximum Jitter Tolerance test
- Jitter Transfer Function test

Color-coded Pass/Fail indication according to ITU-T limits
Standard Pass/Fail masks
Units: UI (Unit Interval)
Resolution: 0.01 UI
Accuracy: Per ITU-T O.171 and O.172
Test Duration: Continuous

Wander Measurement

Fully compliant to ITU-T O.171 and O.172
Test Interfaces: E1 (2M), E3 (34M), DS1 (1.5M), DS3 (45M), and STM-1 (155M Optical)
Reference Clock
- Clock Port: SMA and Balanced RX2
- Clock Source: 2 Mbps (or 1.5 Mbps) signal or 2 MHz (or 1.5 MHz), 64 kbps Co-directional

Parameters
- Real Time Measurements
- Time Interval Error (TIE), Maximum TIE (MTIE) per O.171

MTIE/TDEV Wander Data Logging Option

Saves long-term real-time TIE samples directly to a USB memory for further MTIE and TDEV post-analysis, using VeEX's Wander Analysis PC software
Sample rates: 1, 5, 10, 30 samples/s
Resolution: Down to 7 ns
Standard masks included
User-defined masks

Ordering Information

Z22-00-002P	UX400 2.5G Test Module (Bantam) Dual port 2.5G, supports DS1 to OC48
Z22-00-003P	UX400 2.5G Test Module (RJ45) Dual port 2.5G, supports E1 to STM-16

Software Options

499-05-100	2.048 Mbps (E1) Testing with VT-2 Mapping
499-05-101	34 Mbps (E3) Testing
499-05-040	1.544 Mbps (DS1) and C-11 Mapping
499-05-041	45 Mbps (DS3) Testing
499-05-042	155 Mbps Electrical Testing
499-05-046	Service Disruption and APS
499-05-047	Tandem Connection Monitoring
499-05-048	ITU-T G.783 Pointer Test Sequences
499-05-052	139 Mbps Testing
499-05-227	OTU1 OTN Testing
Z88-00-014G	VF Measurements
499-05-097	DS1/E1 Jitter Measurement, Max Jitter, Jitter Transfer
499-05-098	DS3/E3 Jitter Measurement, Max Jitter, Jitter Transfer
499-05-099	Basic STM-1, E3 Wander Measurement
499-05-140	STM-1/OC-3 Jitter Measurement, Max Jitter, Jitter Transfer
499-05-149	DS1/E1 Jitter Measurement
499-05-152	DS3/E3 Jitter Measurement
499-05-168	STM-1/OC-3 Jitter Measurement
499-05-169	Basic E1 Wander Measurement

General

Power Consumption	20 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

***Some of the test rates, mappings, features and fuctions described in this document are optional, may be linked to, or require the support of other software options.*

Optical SFP Options

Transceiver	SFP		
Data rate	STM-0/1/4/16; OC-1/3/12/48 (51/155/622/2488 Mbps) OTU1 (2666 Mbps)		
Part No.	301-01-007G	301-01-008G	301-01-009G
Wavelength (nm)	1310	1310	1550
Range (km)	15	40	80
Connector	LC	LC	LC
Line coding	NRZ	NRZ	NRZ
Tx Laser	DFB	DFB	DFB
Tx Spectral width (nm)	1	1	1
Tx Power (dBm)	-5 to 0	-2 to +3	-2 to +3
Rx Detector	PIN	APD	APD
Rx Sensitivity			
155 Mbps	-23 to -10	-30 to -15	-30 to -15
622 Mbps	-22 to 0	-29 to -9	-29 to -9
2488 Mbps	-18 to 0	-27 to -9	-28 to -9
2666 Mbps	-18 to 0	-27 to -9	-28 to -9

**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.*

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