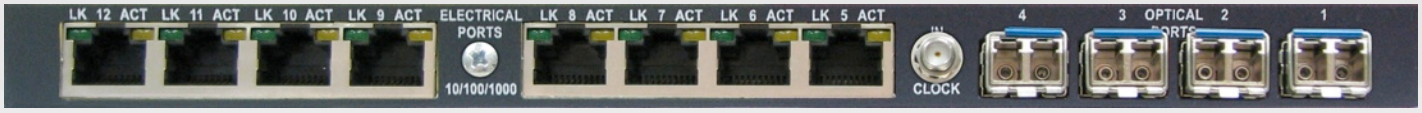
High-Density Ethernet Module for NIC Platform

Testing multiple Ethernet and Fibre Channel ports simultaneously can shorten overall test time, reduce your implementation time and save money. With the HD Ethernet module for the NIC platform, you can test up to eight 10/100/1000 ports plus four Gigabit Ethernet or 1 / 2 Gb/s Fibre Channel ports on a single module. Up to four of these modules can be installed in the NIC Plus or NIC EP chassis enabling even higher density. Add 10GigE LAN/WAN testing to fully test Ethernet systems at today's highest datarates.

Streamline your Ethernet and Fibre Channel testing with the HD Ethernet module for the Digital Lightwave NIC Platform.



PLATFORMS

NIC NXG

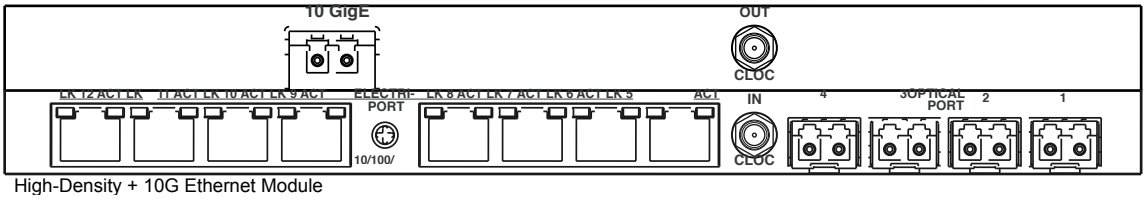
NIC Plus

NIC EP

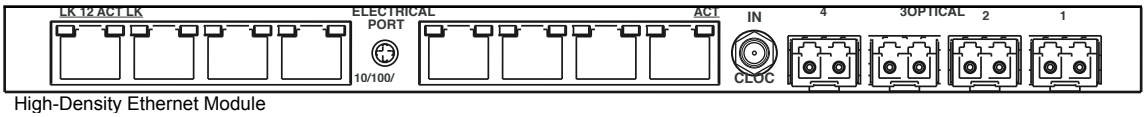
KEY FEATURES

- Simultaneous and multiple-stream testing on all ports
- 8 Electrical Ethernet interfaces.
- 4 Gigabit Ethernet interfaces.
- Optional support for 4 1G/2G Fibre Channel interfaces.
- With multiple modules in NIC Plus or NIC EP, test up to 48 ports simultaneously
- Supports use of hot-swappable SFP and XFP optical transceiver modules, 850 nm, 1310 nm, 1550 nm plus custom configurations
- Port-to-Port testing capability
- Generate up to 32 completely unique traffic profiles per Ethernet port.
- Supports RFC 2544 and RFC 1242 Benchmarking
- Throughput, Frame Loss, Latency, Back-to-Back Burst and Round-Trip Delay testing
- 10 Gig LAN and WAN support
- IP reflection mode enables loopback testing through Ethernet switches and routers
- Support for up to 4 stacked VLAN tags (Q in Q)
- Configurable Class of Service per Ethernet traffic stream.
- Support for Fibre Channel switch fabric login.
- Buffer to buffer credit analysis.

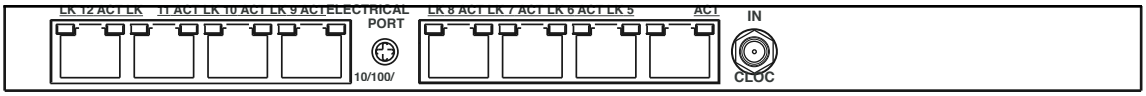
CONNECTOR PANEL LAYOUTS



High-Density + 10G Ethernet Module

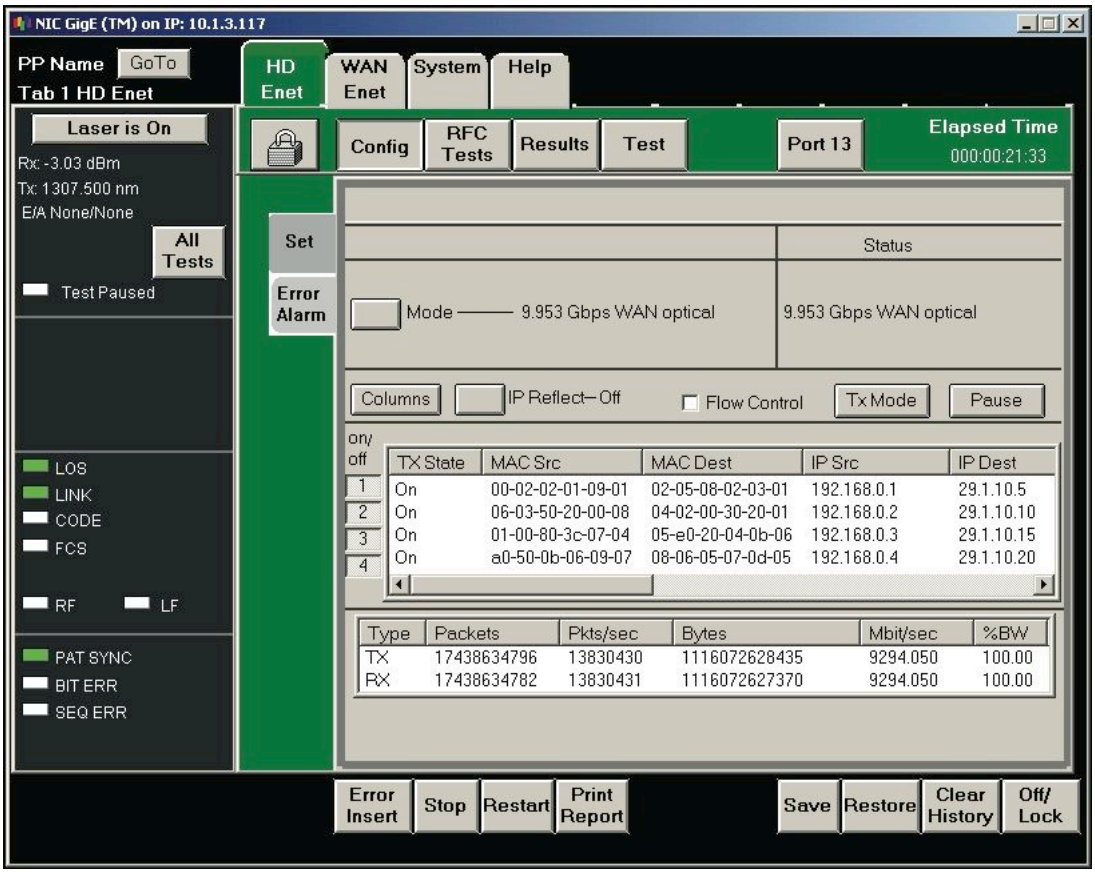


High-Density Ethernet Module



High-Density BaseT Ethernet Module

Ethernet GUI CONFIG. SCREEN



INTERFACES

10-Gigabit Ethernet	Ports: 1 XFP user-pluggable module with LC connector; Data Rate: 10 Gbps; Line Rate: 10.3125 Gbps (LAN), 9.95328 Gbps (WAN); Duplex Mode: Full duplex
	Optional XFP modules available for 10GBaseLW, 10GBaseEW, 10GBaseLR, 10GBaseER in accordance with 802.3ae and custom configurations; Tx Level, Tx Wavelength, Rx Level, Rx Spectral
	Range, and Input Signal Measurement are dependant upon XFP module selected
	External Eye Clock: SMA, AC coupled PECL (line rate/64)
Gigabit Ethernet	Ports: 4 SFP user-pluggable modules with LC connector; Duplex Mode: Full duplex; Data Rate: 1 Gbps
	Optional SFP modules available; Tx Level, Tx Wavelength, Rx Level, Rx Spectral Range, and Input Signal Measurement are dependant upon SFP module selected
10/100/1000 BaseT	Ports: 8 ports, fully independent, RJ-45 connectors; Data Rate: 10 Mbps/100 Mbps/1 Gbps; Duplex Mode: Full or half duplex

PACKET SPECIFICATIONS

Frame Type	Statistics and generation of Ethernet frames with UDP/IP, IPv4
Results/Statistics	Received optical power, LOS, link state, jabber, collision (10/100/1000 electrical only) code violation error counts, current rate, average rate, errored seconds; each port accumulates statistics in real time; event log result analysis with time stamp; user-defined test duration time
All Ether Ports Results	Displays all activity, alarms and errors for all ports simultaneously in single screen for easier testing analysis with the option to rearrange rows and columns
LED Indicators	LOS, link state and pattern sync alarms, FCS, code, and payload BIT errors, sequence errors, remote fault/link fault (10 Gig only)
Traffic Stream Generation/Analysis	4 independently configurable traffic generation and analysis streams, reply to link fault (10 Gig only)
Configurable Stream Parameters	Destination port, transmitted bandwidth 0.01% to 100%; Frame length: 64 to 9600 bytes, acceptable bit-error rate, acceptable out-of-sequence rate, acceptable loss rate; MAC source/IP source/ destination addresses, UDP source/destination Addresses, VLAN tagging 802.1q,p, VLAN enabled/ disabled, VLAN ID 0 to 4095, VLAN QoS levels 0 to 7, UDP payload pattern (all ones, all zeros, PRBS 31, user-defined 32-bit), IP TOS, IP TTL, and IP Fragment Flag
Flow Control	Generation of pause frames with a user specified time of 0 to 65535 Quantas; response to pause packets can be enabled or disabled
Per-Port Tx Statistics	Transmitted packets, packets per second, transmitted bytes, Mbps, % bandwidth of transmitted packets/bytes
Per-Port Receive Statistics	Received Mbps and bandwidth % rates, received packets/bytes count, received jumbo frames, received pause packets, pause end packets, pause Quantas taken, count of received IP, ICMP, TCP,
	UDP, and IGMP packets, count of received VLAN tagged frames and VLAN tagged frames per QoS levels 0 to 7, latency (minimum, maximum and average), broadcast, multicast and unicast packets, packet-size distribution
Per-Stream Transmit Statistics	Transmitted bandwidth %, transmitted packet bytes count
Per-Stream Receive Statistics	Received bandwidth %, Received packets/byte Recount, out-of-sequence packets, bit errors, latency (minimum, maximum, and average in ms)
Alarm Detection	LOS, link fault, pattern sync, jabber, link fault (10 Gig only), remote fault (10Gig only)
Error Measurements	FCS, IP checksum, code errors, collisions, sequence, Bit, line code, runt, oversized/undersized frame error counts: current rates,average rates, and errored seconds
Error Insertion	FCS, IP checksum, sequence: single, 1e-2 to 1e-7; bit: single, 1e-3 to 1e-10; line code: single
APS Measurements	Maximum, minimum, average, and current protection switch times in ms; user-definable guard band thresholds for filtering receive traffic
Advanced Ping Functionality	Selectable MAC source, IP source and IP destination, number of Ping attempts, Timeout (1-5 sec.), Packet size (64-9600 bytes), Time to live (1-255); Last 4 responses displayed in Ping response window; Full statistics of Ping operation displayed in the Ping Statistics section
Rates and Negotiation	Supports autonegotiation at applicable rates with status display, including pending link, line rate, full-duplex or half duplex, and master/slave timing mode
	1G optical rates: supports “1G full duplex mode” with negotiation enabled or disabled; 10/100/1000: supports autonegotiation for all rates – configures to fastest data rate and duplex mode; 1000 Electrical Only: Line control Auto, Master or Slave
IP Reflection	User-selectable, can reflect all unicast packets or only packets created by Digital Lightwave test instrument
Port-to-Port Testing	Ping, bi-directional bit-error-rate and stream testing; RFC 2544 testing for throughput, frame loss, and latency
RFC 2544 Throughput Test	Measurements are provided for 64, 128, 256, 512, 1024, 1280, and 1518 byte frame standard lengths plus custom lengths, user-defined trial duration time (1 to 600 secs), acceptable loss rate (0 to 100%); resolution rate (1 to 100%) parameters; Results: passing rate %, number of transmitted/received packets, and min/max/average latency values in microseconds
RFC 2544 Loss Test	Measurements are provided for 64, 128, 256, Frame 512, Test 1024, 1280, & 1518 byte frame standard lengths plus custom lengths, User-defined trial duration time (1 to 600 secs); Results: Tested frame rate %, number of transmitted/received frames, % loss
RFC 2544 Back-to-Back Burst Test	Measurements are provided for 64, 128, 256, 512, Test 1024, 1280, & 1518 byte frame standard lengths plus custom lengths, User-defined trial duration time (1 to 600 secs); Results: Number of packets that can be forwarded in a burst per user-specified parameters and number of repetitions

INTERFACES

Rates	1 Gbps, 2 Gbps, 4 Gbps, 8 Gbps, 10 Gbps
Ports	SFP user-pluggable, hot-swappable independently configurable for 1G, 2G or 4G, 4 ports (HDE), 2 ports (MSA)
	XFP user-pluggable, hot-swappable configuratble for 8G or 10G, 1 port (MSA only)
Wavelength	1G/2G/4G - 850nm, 1310nm, 1550nm avail. 8G - 850nm, 1550nm avail. 10G - 850nm, 1310nm, 1550nm avail.
Interface Specifications	Optional SFP/XFP modules avail.; Tx Level,Tx Wavelength, Rx Level, Rx Spectral Range, and Input Signal Measurement are dependant upon module selected
Port Modes	Stresses F-Ports of Fibre Channel switches Supports Point to Point modes (with and without Logins)
	Supports Link State monitoring and status messages including: Active, Failure(LF1), Failure(LF2), Reset(LF1), Reset(LF2), Reset(LF3), Offline(OL1), Offline (OL2), or Offline(OL3)
	Supports Fabric Login and Name Server Login/ Registration control with status messages including: Unknown, Not Logged in, Waiting for Response, Logged in, and Login Rejected

PACKET SPECIFICATIONS

Frame Type	Statistics and generation of Fibre Channel frames, including Extended Link Service Requests to support Fabric (LOGIN)
Results/Statistics	Received optical power, LOS, link state, code violation error counts, current rate average rate, errored seconds. Each port accumulates statistics in real time.; event log result analysis with time stamp; user-defined test duration time
LED Indicators	LOS, link state and pattern sync alarms; CRC, code and payload BIT errors
Flow Control	Supports Buffer to Buffer Credit flow control.
	Specify the number of credits to report during login (0 to 65535). Displays the amount of credit (R_RDYs) that is currently pending for return to the far end device and the amount of Buffer to Buffer credit that is currently available for sending frames to the far end device
Traffic Stream Generation	Configurable FC-2 traffic generation; Class of Service 3
Configurable Stream Parameters	WWN Source and Destination addresses; Frame Length (68 to 2090 bytes)
	Transmit Bandwidth Rate: 0.01% to 100%
	Payload pattern (PRBS 31, PRBS 31 INV and user defined pattern)
	SOF (Start of Frame), D_ID (Destination Identifier), S_ID (Source Identifier), R_CTL, CS_CTL, TYPE, F_CTL, SEQ_ID, DF_CTL, SEQ_CNT, OX_ID, RX_ID, and PARM, EOF (End of Frame)
R_T_TOV timeout threshold	0.01 to 655.35 ms

RESULTS/STATISTICS

Per-Port Tx statistics	Transmitted frame count, frames/sec, byte count, Mbit/sec, % Bandwidth, count of transmitted R_RDY's
Per-Port Rx Statistics	Received frame count, frames/sec, byte count, Mbit/sec, % Bandwidth, count of received R_RDY's
Per-Stream Tx Statistics	Transmitted frame count, byte count, and bandwidth %
Per-Stream Statistics	Received frame count, byte count, bandwidth Rx %, Payload Bit error count and average error rate. Supports user defined thresholds for determining the acceptable frame loss and bit error rate thresholds. Latency (minimum, maximum, average in ms),
Alarm Detection	LOS, link State and Pattern Sync Seconds;
Error measurements	Code, Alignment, Disparity, EOF, EOFa, CRC, Payload Bit, Oversized frame, Undersized frame Supports Error Counts, Errored Seconds, Average and Current error rates
Buffer to Credit	R_RDY Credit pending information
	R_RDY Transmitted count
	R_RDY Received count

ERROR AND ALARM GENERATION

Error Insertion	Code: single error insert CRC: single error insert, rates 1e-3 to 1e -9 Payload Bit: single error insert, rates 1e-3 to 1e -9
Alarm Insertion	LOS

PRIMITIVE SEQUENCE GENERATION

Supports the generation of Primitive Sequences including:

NOS Ordered Set: K28.5 D21.2 D31.5 D5.2
OLS Ordered Set: K28.5 D21.1 D10.4 D21.1
LR Ordered Set: K28.5 D9.2 D31.5 D9.2
LRR Ordered Set: K28.5 D21.1 D31.5 D9.2
Duration: Supports the generation of 1 to 10 consecutive sequences or continuous sequence generation

10G WAN SPECIFICATIONS

Requirements	Meets the requirements of GR-253 (OC-192) and ITU-T G.707 (STM-64)
Mapping	10G WAN PHY per IEEE 802.3
Synchronization	Internal, received SONET or SDH signal
Error Measurement	OC-192: B1, B2, REI-L, B3, REI-P, NDF errors STM-64: B1, B2, MS-REI, B3, HP-REI, NDF errors (performance measurements per G.821, G.826, M.2101.1)
Alarm Detection	OC-192: LOF, LOS, SEF, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, UNEQ-P, concatenation: RS-TIM, HP-TIM, HP-PLM; STM-64: LOF, LOS, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ, RS-TIM, HP-TIM, HP-PLM, concatenation
Alarm Generation	OC-192: LOF, LOS, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, UNEQ-P; STM-64: LOF, LOS, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ
Pointer Control	New value, single adjustments (increment or decrement), burst (2-8) adjustments, NDF control
Control and Monitoring	OC-192: Overhead: Transmit control over bytes: Transport OH: A1, A2, C1, Z0, D1-D12, E1, E2, F1, K1, K2, J0 (Trace), Z1, Z2; Path OH: C2, F2, G1, J1 (Trace), Z3, Z4, Z5; Receive monitor: Transport OH: All bytes; Path OH: All bytes STM-64: Overhead: Transmit control over bytes: MSOH: A1, A2, Z0, D1-D12, E1, E2, F1, K1, K2, J0 (Trace), Z1, Z2; HP OH: C2, F2, G1, J1 (Trace), F3, K3, N1; Receive monitor: RSOH: All bytes HP OH: All bytes
Error Injection	OC-192: B1, B2, REI-L, B3, REI-P STM-64: B1, B2, MS-REI, B3, HP-REI
Error Injection Rate	Single
Switch to Protect Measurement	Measure on B1, SEF, OOF, AIS-L, MS-AIS, AIS-P and AU-AIS; 125 microsecond resolution
Round-Trip Delay (RTD) Measurement	Measurement ranges: 125 microseconds resolution

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