

PDH/T-Carrier Module for NIC Platform

With Optional Jitter and Wander Testing

PLATFORMS



NIC NXG

The Network Information Computer's (NIC) PDH/T-Carrier module with optional Jitter/Wander provides testing at these rates:

- DS1 (1.544 Mbps)
- E1 (2.048 Mbps)
- E3 (34.368 Mbps)
- DS3 (44.736 Mbps)
- E4 (139.264 Mbps)



NIC Plus

With industry-leading multiple/simultaneous testing capability, the module can run four tests at the same time, reducing overall test times and providing correlation of alarm/error conditions. The module will run two DS1/E1 tests, a DS3/E3 test and an E4 test simultaneously.



NIC EP

When combined with additional modules, the NIC supports drop/insert of PDH/T-Carrier to/from SONET/SDH/OTN rates of 51M/155M/622M/2.5G/2.66G/ 10G/10.7G/ 40G/43G.

MODULES



without optional Jitter/Wander interface



with optional Jitter/Wander interface

KEY FEATURES

- 1.5M/2M/34M/45M/139M interfaces
- Meets requirements of ANSI T1.102, ITU-T G.703, O.151, O.172, G.821, G.826, and M.2100
- Drop and insert from SONET/SDH with MSA 2020/2030 modules
- Multiple/simultaneous testing with All Test Status screen
- ATM mappings if equipped with ATM module + MSA 2020/2030
- Dual DS1/E1 simultaneous testing
- Event logs and graphs for long-term testing and analysis
- Investment protection. Existing NIC products can be upgraded with new PDH/T-Carrier Testing module
- Easy-to-use Digital Lightwave NIC

OPTIONAL JITTER AND WANDER TESTING FEATURES

- Perform Intrinsic Jitter, Jitter Transfer and Jitter Tolerance Testing in accordance with O.171 and O.172.
- T-Carrier and E-Carrier testing with Jitter/Wander options available in one module
- Extremely fast jitter and wander test results with repeatability

INTERFACE SPECIFICATIONS

<p>Line Rates</p> <p>DS1: 1.544 MHz ± 4.6 ppm with ± 100 ppm offset capability (Tx), 1.544 MHz ± 200 ppm (Rx)</p> <p>E1: 2.048 MHz ± 4.6 ppm with ± 100 ppm offset capability (Tx), 2.048 MHz ± 200 ppm (Rx)</p> <p>E3: 34.368 MHz ± 4.6 ppm with ± 100 ppm offset capability (Tx), 34.368 MHz ± 200 ppm (Rx)</p> <p>DS3: 44.736 MHz ± 4.6 ppm with ± 100 ppm offset capability (Tx), 44.736 MHz ± 200 ppm (Rx)</p>	<p>E4: 139.264 MHz ± 4.6 ppm with ± 100 ppm offset capability (Tx), 139.264 MHz ± 200 ppm (Rx)</p> <p>Clock Accuracy Stratum III compliant</p> <p>Connectors <u>DS1/E1 Bantam: 100/120 ohm $\pm 5\%$ balanced</u> <u>DS1/E1 BNC: 75 ohm $\pm 5\%$ unbalanced</u> <u>E3/DS3/E4: 75 ohm $\pm 5\%$ unbalanced</u></p> <p>Line Code <u>DS1: AMI, B8ZS; E1: AMI, HDB3; E3: HDB3; DS3: B3ZS, E4: CMI</u></p>
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DS1/E1 TESTING SPECIFICATIONS

<p>Framing DS1: SF(D4), ESF, SLC 96, unfr.; E1: PCM31, PCM31CRC, PCM30, PCM30CRC, unfr.</p> <p>Synchronization Internal Stratum III compliant, recovered, BITS (1.544Mbps), SETS (2.048 Mbps)</p> <p>Input Signal Level DS1: ± 0.1 Vp to ± 3.6 Vp</p> <p>Measurement E1: $+0.1$ Vp to $+7$ Vp</p> <p>Frequency Meas. Range DS1: 1.544 MHz, ± 200 ppm E1: 2.048 MHz, ± 200 ppm</p> <p>Measurement Patterns E1: $+0.1$ Vp to $+7$ Vp DS1: QRSS, 26-1, 26-1 INV, 29-1, 29-1 INV, 211-1, 211-1 INV, 215-1, 215-1 INV, 220-1, 220-1 INV, 223-1, 223-1 INV, 3 in 24, all 1's, all 0's, 1 in 8, 1010, 55 Daly, T1-2, T1-3, T1-5, 55 octet, ATM mapping (direct or PLCP) with ATM module, DDS 1-6, multi-pattern, bridge tap, 32-bit user-defined pattern Fractional T1: QRSS, 26-1, 26-1 INV, 29-1, 29-1 INV, 211-1, 211-1 INV, DDS 1-6, 32-bit user-defined pattern, all 1's, all 0's E1: 26-1, 26-1 INV, 29-1, 29-1 INV, 211-1, 211-1 INV, 215-1, 215-1 INV, 220-1, 220-1 INV, 223-1, 223-1 INV, ATM mapping (direct or PLCP) with ATM module, 32-bit user-defined pattern, all 1's, all 0's Fractional E1: 26-1, 26-1 INV, 29-1, 29-1 INV, 211-1, 211-1 INV, 215-1, 215-1 INV, 220-1, 220-1 INV, 223-1, 223-1 INV, 32-bit user-defined patt., all 1's, all 0's</p> <p>Error Measurement DS1: BPV (code), frame, CRC, Bit, excess 0's E1: BPV (code), frame, CRC, Bit, FEBE</p> <p>Error Injection DS1: BPV (code), Bit, frame, CRC E1: BPV (code), Bit, frame, CRC, FEBE</p> <p>Error Injection Rate DS1: BPV/Bit: single error, user programmable 10-5 to 10-3; CRC: single error, 10-4 to 10-2; Frame 10-6 to 1 in 2</p>	<p>E1: BPV/Frame/Bit: single error, user programmable 10-5 to 10-3; CRC/FEBE: single error, 10-4 to 10-2</p> <p>Performance Monitoring DS1: Per ANSI T1.231 E1: Per G.826, G.821, M.2100</p> <p>Alarm Detection DS1: OOF, pattern sync, LOS, AIS, yellow, LOF, idle, clock, E1: AIS, LOF, LOS, pattern sync, yellow, RM-FAI, CASML</p> <p>Alarm Generation DS1: AIS, yellow, idle, LOS, OOF, LOF E1: AIS, LOF, RAI, RMFAI, CASMFL, LOS</p> <p>Loop Codes Support DS0/64 Kbps: DDS latching and non-latching, OCU loopback, CSU loopback, DSU loopback DS1: Transmit: in-band, out-of-band, line loopback, payload loopback, 4-bit smart jack, 5-bit smart jack, 16-bit user-programmable; receive: Auto response on/off, display of current loopback status E1: Payload, line, loop-back</p> <p>Loop-back Line and payload loop-back (manual)</p> <p>DS0/64 Kbps Channels DS1: (Tx) 24 DS0 (64/56 Kbps) channels; (Rx) Monitor up to 24 DS0 (56/64 Kbps) channels, VF drop to speaker E1: (Tx) 30/31 Contiguous/non-contiguous individual 64 Kbps channels; (Rx) Monitor up to 31 individual 64 Kbps channels, VF drop to speaker</p> <p>DS0/64 Kbps Signaling DS1: AB (SF) and ABCD (ESF/SLC96) E1: (Tx) CAS Signaling bits, Global Spare bits, 8 bit sequence byte; (RX) Monitor all 30 CAS Signaling bits simultaneously, SMF I and SMF II</p>
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E3/DS3/E4 TESTING SPECIFICATIONS

Mapping/Drop Framing	E3/DS3: DS1, E1 (up to 2); E4: E3, E1 E3/E4: Framed, unframed DS3: M13, C-Bit parity, unframed	Error Measurement and Injection	E3: BPV, BIT, frame DS3: BPV, BIT, frame, P-Parity, C-Parity, FEBE E4: Bit, frame, LCV
Synchronization	DS3: Internal Stratum III compliant E3/E4: Internal Stratum III compliant, recov-ered, BITS (1.544 Mbps), SETS (2.048 Mbps)	Error Injection Rate	DS3: BPV/Frame/Bit: single error, user programmable 10-9 to 10-3; C-Parity/P-Parity: single error, 10-9 to 10-4; FEBE 10-9 to 10-6 E3/E4: single error, 10-9 to 10-3
Input Signal Level Measurement	E3: ± 0.31 Vp to ± 1.2 Vp DS3: ± 0.31 Vp to ± 1.2 Vp E4: ± 0.3 Vp to ± 0.7 Vp	Performance Monitor	DS3: Per ANSI T1.231 E3/E4: Per G.821, G.826, M.2100
Frequency meas. Range	E3: 34.368 MHz ± 200 ppm DS3: 44.736 MHz ± 200 ppm E4: 139.264 MHz ± 200 ppm	Alarm Detection	DS3: OOF, pattern sync, LOS, AIS, idle, X-Bit, yellow, LOF, Frame Mismatch E3/E4: LOS, OOF, pattern sync, AIS, RDI
Patterns	E3/E4: 26-1, 26-1 INV, 29-1, 29-1 INV, 211-1, 211-1 INV, 215-1, 215-1 INV, 220-1, 220-1 INV, 223-1, 223-1 INV, ATM mapping (direct or PLCP) with ATM module, 32-bit user-defined pattern DS3: QRSS, 215-1, 215-1 INV, 220-1, 220-1 INV, 223-1, 223-1 INV, ATM mapping (direct or PLCP) with ATM module, 32-bit user-defined pattern	Alarm Generation	DS3: AIS, idle, yellow, x-Bit, LOF E3/E4: LOS, LOF, AIS, RDI
		Channel Scan	DS3: Scans all 28 DS1 or all 21 E1 Channels for Framing and Payload Pattern E3: Scans all 16 E1 Channels for Framing and Payload Pattern
		FEAC Codes	DS3: Alarm/status codes, loop-back codes
		FEAC Loopback	DS3: DS3 Line, DS1 Line #1 to #28, all DS1 lines

JITTER AND WANDER TESTING SPECIFICATIONS

Jitter/Wander Related I/O

Demod. Jitter Output	Provides an analog output of the measured jitter
Secondary Clock	Provides the ability to measure clock wander
Reference Input	This BITS/SETS input can accept either a framed all 1's data signal or a sine wave clock as a master reference

Generic Jitter/Wander Specifications

Adjustable Jitter Hit Thresholds

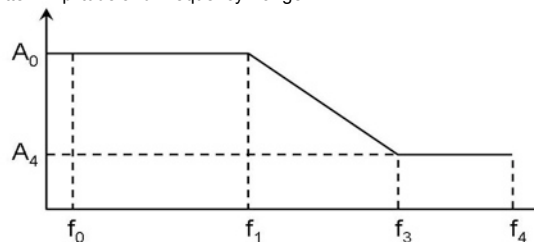
Jitter Statistics and Measurements	Jitter Hit Counts, Jitter Hit Seconds, Peak-to-Peak Jitter, +Peak Jitter, -Peak Jitter, RMS Jitter
RMS Averaging Interval	The RMS jitter averaging period shall have programmable values of 1s, 60s, and infinite

Simultaneous Filtering and Measurements of Jitter Hit Counters and measurement circuits to allow testing at all filter bandwidths simultaneously

Jitter Specifications

Standards Compliance DS1/E1/E3/DS3/E4 Jitter generation and Measurement exceed O.171 and O.172

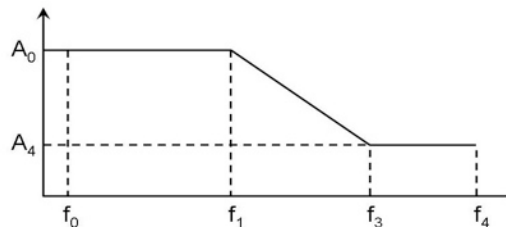
Jitter Amplitude and Frequency Range -



Bit Rate (Mbps)	A0 (UI)	A4 (UI)	f0 (hz)	f1 (hz)	f3 (hz)	f4 (hz)
1.544	100	1.5	2	400	8k	40k
2.048	100	1.5	10	900	18k	100k
34.368	100	1.5	100	1000	20k	800k
44.736	100	1.5	2	5000	100k	400k
139.264	100	1.5	100	500	10k	3500k

JITTER SPECIFICATIONS (Continued)

Jitter Amplitude and Frequency Range - Measurement



Bit Rate (Mbps)	A0 (UI)	A4 (UI)	f0 (hz)	f1 (hz)	f3 (hz)	f4 (hz)
1.544	100	1.5	10	400	8k	40k
2.048	100	1.5	20	900	18k	100k
34.368	100	1.5	100	1000	20k	800k
44.736	100	1.5	10	5000	100k	400k
139.264	100	1.5	200	500	10k	3.5M

Measurement Range Peak to Peak Minimum measurement range exceeds O.171 and O.172 (see table below)

Measurement Resolution 0.001 UI for peak-to-peak jitter; 0.0005 for RMS jitter

Jitter Modulation Frequency Resolution

Bit Rate (Mbps)	Modulation Frequency	Minimum Resolution
1.544/44.736	<10kHz	1Hz
	10 to 99.9kHz	10Hz
	100 to 400kHz	100Hz
2.048/34.368/ 139.264	<10kHz	1Hz
	10 to 99.9kHz	10Hz
	100 to 999.99kHz	100Hz
	1 to 3.5MHz	1000Hz

Jitter Measurement Accuracy As per O.171/O.172

Filtering

Bit Rate (Mbps)	Measurement Mode	High Pass	Low Pass
1.544	Wide Band	10Hz	40kHz
	High Band	8kHz	40kHz
2.048	Wide Band	20kHz	100kHz
	High Band 1	700Hz	100kHz
	High Band 2	18kHz	100kHz
34.368	Wide Band	100Hz	800kHz
	High Band	10kHz	800kHz
44.736	Wide Band	10Hz	400kHz
	High Band	30kHz	400kHz
139.264	Wide Band	200Hz	3.5MHz
	High Band	10kHz	3.5MHz

Wander Measurement Specifications

Wander Client A wander client software package running on Windows XP, 2000, 95 or 98 is required for performing wander measurement

Sampling Rate - Low 1000/s — 300Hz
Pass Filter - Test Duration

Amplitude Range ±1 nanoseconds to ±10 microseconds minimum

Measurement Accuracy As per O.172

Measurement Statistics A measurement/calculation of Time Interval Error Statistics (TIE), Maximum Time Interval Error (MTIE), Time Deviation (TDEV), Maximum Relative Time Interval Error (MRTIE), ADEV (per G.810) must be provided

Wander Generation Specifications

Note: A0 is defined between f0 and f1. A1 is defined at f2.

Bit Rate (Mbps)	f0 (µHz)	f1 (MHz)	f2 (Hz)	A0 (UIp-p)	A1 (UIp-p)
1.544	10	20	10	200K	800
2.048	10	20	10	200K	800
34.368	10	400	10	200K	16K
44.736	10	400	10	200K	16K
139.264	10	2000	10	200K	80K

Wander Accuracy As per O.172

Generated Wander Resolution 1µHz

ORDERING INFORMATION

A11 - DS0/1/3 E1/E3/4 and 56K/64K Fractional DS1/E1 testing functionality, no jitter/wander

A14 - DS0/1/3 E1/E3/4 and 56K/64K Fractional DS1/E1 testing functionality plus DS1/E1/E3/DS3/E4 Jitter Generation and Analysis

Test Option: - Wander Measurement and Generation



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