FTB-8115 Transport Blazer

SONET/SDH TEST MODULE

EXFO Connect Compatible

FROST & SULLIVAN

2011 BEST PRACTICES AWARD

GLOBAL GIGABIT ETHERNET TEST EQUIPMENT GROWTH EXCELLENCE AWARD

SPEC SHEET

Fully integrated test solution supporting SONET/SDH test functions

KEY FEATURES

DS0/E0 to OC-48/STM-16 testing in a single module

Supports SONET, SDH, DSn and PDH

SmartMode automatic signal structure discovery with real-time simultaneous monitoring of all discovered STS/AU and user-selected VT/TU channels

Intuitive, feature-rich user interface with available automated test scripting and multi-user remote management capabilities

EXFO Connect-compatible: automated asset management; data goes through the cloud and into a dynamic database

PLATFORM COMPATIBILITY
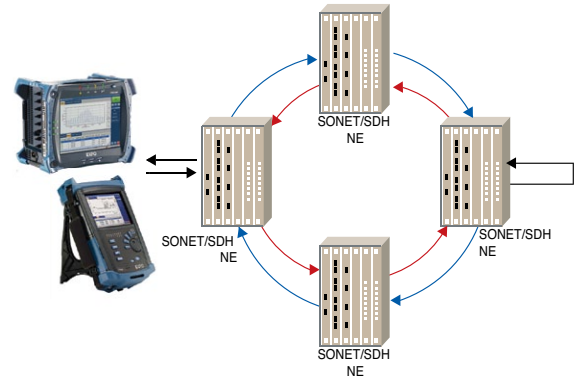

Platform FTB-200

Platform FTB-500

EXFO

ADVANCED SONET/SDH ACCESS AND METRO TESTING

EXFO's FTB-8115 Transport Blazer test module combines advanced DSn/PDH and SONET/SDH test functions in a single unit, eliminating the need for multiple, purpose-built test platforms for the commissioning or troubleshooting of T1/E1 to OC-48/STM-16 circuits. The extensive list of DSn, SONET, PDH and SDH features available on the FTB-8115 Transport Blazer allows users to perform a wide range of tests from simple bit-error-rate (BER) analysis to more advanced network characterization and troubleshooting. These functions include:

KEY FEATURES

› Mixed and bulk payload generation and analysis from 64 kbit/s to 2.5 Gbit/s

› High-order mappings: STS-1/3c/12c/48c and AU-3/AU-4/AU-4-4c/16c

› Low-order mappings: VT1.5/2/6, TU-11/12/2/3

› Section, line, high-order (HO) and low-order (LO) path overhead manipulation and monitoring

› Section, line, high-order and low-order path alarm/error generation and monitoring

› High-order and low-order pointer generation and monitoring

› Performance monitoring: G.821, G.826, G.828, G.829, M.2100, M.2101

› Frequency analysis and power measurement

› Frequency offset generation

› Automatic protection switching and service disruption time measurements

› Round-trip delay measurements

› DS1/DS3 auto detection of line code, framing and test parttern

› Dual DS1/DS3 receiver testing

› Independent transmitter and receiver testing

› Through mode analysis

› Programmable error/alarm injection

› DS1 FDL

› DS1 loopcodes and NI/CSU loopback emulation

› Fractional T1/E1 testing

› DS3 FEAC

› Tandem connection monitoring

Housed in the FTB-500 or FTB-200 platform, the FTB-8115 module enables field circuit turn-up and troubleshooting.

SmartMode: Real-Time Signal Structure Discovery and Monitoring

EXFO's FTB-8115 Transport Blazer supports a unique feature called SmartMode. This provides users with full visibility of all high-order (STS/AU) and low-order (VT/TU) mixed mappings within the incoming SONET/SDH test signal.

SmartMode automatically discovers the signal structure of the OC-n/STM-n line, including mixed mappings. In addition to this in-depth multichannel visibility, SmartMode performs real-time monitoring of all discovered high-order paths and user selected low-order paths simultaneously, providing users with the industry's most powerful SONET/SDH multichannel monitoring and troubleshooting solution. Real-time monitoring allows users to easily isolate network faults, saving valuable time and minimizing service disruption. SmartMode also provides one-touch test case start, allowing users to quickly configure a desired test path.
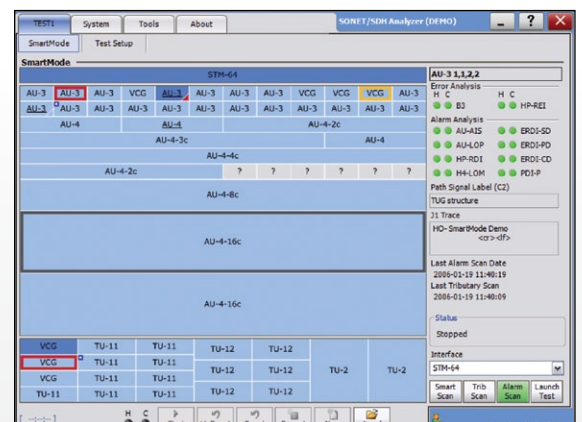
FTB-8115 SmartMode: multichannel signal discovery with real-time alarm scan (shown in the FTB-500 user interface).

EXFO

UNSURPASSED CONFIGURATION AND OPERATIONAL FLEXIBILITY

Multiplatform Support and Versatility

The FTB-8115 Transport Blazer module is supported and interchangeable on the FTB-500 Platform or the FTB-200 Compact Platform. This cross-platform support provides users with added flexibility by enabling them to select the appropriate platform that suits their testing needs. EXFO is the first and only test solution provider to offer this versatility, delivering single to multi-application test solutions with the same hardware module, which in turn dramatically reduces capital expenditures.

Inserted in the FTB-200 Compact Platform, the FTB-8115 Transport Blazer module delivers SONET/SDH test functions in a small, lightweight platform, ideal for field technicians' installation and commissioning needs. When combined with the FTB-200's optional integrated high-precision power meter, visual fault locator and fiber scope, this solution provides all the critical test tools required for day-to-day activities, eliminating the need to carry and manage multiple test sets.

The FTB-8115 module is supported in the FTB-200 and FTB-500 platforms.
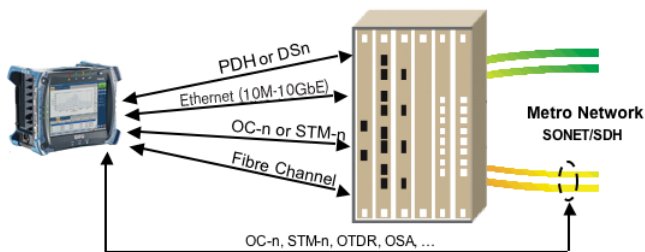
With its modular, multislot design, the FTB-500 platform enables users to configure and upgrade their systems in the field according to their testing needs, minimizing capital expenditures.

Using the FTB-500 platform provides users with an all-in-one solution supporting a mix of SONET/SDH/OTN, Ethernet, Fibre Channel and optical-layer test modules, making it the industry's first truly integrated network testing platform. This modularity enables users to upgrade their systems in the field according to their testing needs. This multiservice test platform is the ideal solution for field, central office and lab applications.

Remote Management

Through the optical Visual Guardian Lite™ management software, the FTB-8115 Transport Blazer module allows users to perform remote testing and data analysis, as well as remote monitoring via standard Ethernet or remote dial-up connections.

Automated Test Scripting

When configured for the FTB-500 platforms, the FTB-8115 Transport Blazer comes with a built-in macrorecorder, allowing users to easily record their test actions and automatically create test scripts. This also allows them to build standard test routines that can be easily accessed and run by field technicians with little or no manual intervention.

Test Logger and Reporting

EXFO's FTB-8115 Transport Blazer module supports a detailed test logger and test reporting tools, enabling users to view any errors/alarms that occurred during the test interval, which can then be used for post-processing of results or SLA conformance validation.

Total Events				
17				View Details
ID	Date/Time	Data Path	Event	Duration
1	00:00:00	TEST 1	StartEvent	
2	00:00:01	Optical	AlarmLos	00:01:31
3	00:00:01	STS-1	AlarmLop	00:00:01
4	00:01:32	OC-12	AlarmLof	00:00:01
5	00:01:53	Optical	AlarmFrequency	00:00:08
6	00:02:13	STS-1	AlarmLop	00:00:01
7	00:02:13	OC-12	AlarmLof	00:00:05
8	00:03:34	STS-1	ErrorB3	00:00:05
9	00:03:49	STS-1	AlarmAis	00:00:09
10	00:06:46	STS-1	ErrorB3	00:00:01
11	00:07:36	OC-12	ErrorB1	00:00:06
12	00:07:42	STS-1	AlarmLop	00:00:01
13	00:07:42	OC-12	AlarmLof	00:00:03
14	00:07:54	STS-1	AlarmLop	00:00:01
15	00:07:54	OC-12	AlarmLof	00:00:02
16	00:08:02	STS-1	AlarmLop	00:00:01
17	00:08:02	OC-12	AlarmLof	Pending.

Test logger: a detailed, time-stamped list of all events occurring during test execution.

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EXFO Connect

EXFO|Connect

AUTOMATED ASSET MANAGEMENT. PUSH TEST DATA IN THE CLOUD. GET CONNECTED.

EXFO Connect pushes and stores test equipment and test data content automatically in the cloud, allowing you to streamline test operation from build-out to maintenance.

EXPERT TEST TOOLS ON THE FTB-200 PLATFORM

EXpert Test Tools is a series of platform-based software testing tools that enhance the value of the FTB-200 platform, providing additional testing capabilities without the need for additional modules or units.

EXpert TEST TOOLS

EXpert VoIP TEST TOOLS

EXpert VoIP generates a voice-over-IP call directly from the test platform to validate performance during service turn-up and troubleshooting.

› Supports a wide range of signaling protocols, including SIP, SCCP, H.248/Megaco and H.323

› Supports MOS and R-factor quality metrics

› Simplifies testing with configurable pass/fail thresholds and RTP metrics

EXpert IP TEST TOOLS

EXpert IP integrates six commonly used datacom test tools into one platform-based application to ensure that field technicians are prepared for a wide range of testing needs.

› Rapidly performs debugging sequences with VLAN scan and LAN discovery

› Validates end-to-end ping and traceroute

› Verifies FTP performance and HTTP availability

EXpert IPTV TEST TOOLS

This powerful IPTV quality assessment solution enables set-top-box emulation and passive monitoring of IPTV streams, allowing quick and easy pass/fail verification of IPTV installations.

› Real-time video preview

› Analyzes up to 10 video streams

› Comprehensive QoS and QoE metrics including MOS score

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ELECTRICAL INTERFACES

The following section provides detailed information on all supported electrical interfaces.

ELECTRICAL INTERFACES

	DS1	E1/2M	E2/8M	E3/34M	DS3/45M	STS-1e/ STM-0e/52M	E4/140M	STS-3e/ STM-1e/155M
Tx pulse amplitude	2.4 to 3.6 V	3.0 V	2.37 V	2.37 V	1.0 ± 0.1 V	0.36 to 0.85 V	1.0 ± 0.1 Vpp	0.5 V
Tx pulse mask	GR-499 Figure 9.5	G.703 Figure 15	G.703 Figure 15	G.703 Figure 16	G.703 Figure 17	DS-3 GR-499 Figure 9-8 / 45-M G.703 Figure 14	G.253 Figure 4-10/4-11	GR-703 Figure 18/19	STM-3e GR-253 Figure 4-12/ 4-13/4-14 / STM-1e/155M G.703 Figure 22-23
Tx LBO preamplification	Power dBdsx +0.6 dBdsx (0-133 ft) +1.2 dBdsx (133-266 ft) +1.8 dBdsx (266-399 ft) +2.4 dBdsx (399-533 ft) +3.0 dBdsx (533-655 ft)					0 to 225 ft 255 to 450 ft	0 to 225 ft 255 to 450 ft	0 to 225 ft
Cable simulation	Power dBdsx −22.5 dBdsx −15.0 dBdsx −7.5 dBdsx 0 dBdsx					450 to 900 (927) ft	450 to 900 (927) ft	
Rx level sensitivity (dynamic range)	For 772 kHz: TERM: ≤26 dB (cable loss only) at 0 dBdsx Tx DSX-MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only) Note: measurement units = dBdsx (Vref = 6 Vpp)	For 1024 kHz: TERM: ≤6 dB (cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only) Note: measurement units = dBm	For 1024 kHz: TERM: ≤6 dB (cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only) Note: measurement units = dBm	For 4224 kHz: TERM: ≤6 dB (cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	For 17.184 MHz: TERM: ≤12 dB (coaxial cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	For 22.368 MHz: TERM: ≤10 dB (cable loss only) DSX-MON: ≤26.5 dB (21.5 dB resistive loss + cable loss ≤ 5 dB) Note: measurement units = dBm (Vref = 1.21 Vpp)	For 25.92 MHz: TERM: ≤10 dB (cable loss only) MON: ≤25 dB (20 dB resistive loss + cable loss ≤ 5 dB) Note: measurement units = dBm	For 70 MHz: TERM: ≤12 dB (coaxial cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	For 78 MHz: TERM: ≤6 dB (coaxial cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm
Transmit bit rate	1.544 Mbit/s ± 4.6 ppm	2.048 Mbit/s ± 4.6 ppm	2.048 Mbit/s ± 4.6 ppm	8.448 Mbit/s ± 4.6 ppm	34.368 Mbit/s ± 4.6 ppm	44.736 Mbit/s ± 4.6 ppm	51.84 Mbit/s ± 4.6 ppm	139.264 Mbit/s ±4.6 ppm	155.52 Mbit/s ± 4.6 ppm
Receive bit rate	1.544 Mbit/s ± 140 ppm	2.048 Mbit/s ± 100 ppm	2.048 Mbit/s ± 100 ppm	8.448 Mbit/s ± 100 ppm	34.368 Mbit/s ± 100 ppm	44.736 Mbit/s ± 100 ppm	51.84 Mbit/s ± 100 ppm	139.264 Mbit/s ± 100 ppm	155.52 Mbit/s ± 100 ppm
Measurement accuracy (uncertainty) — Frequency	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm
Measurement accuracy (uncertainty) — Electrical power	Normal: ±1.0 dB Monitor: ±2.0 dB	Normal: ±1.0 dB Monitor: ±2.0 dB	Normal: ±1.0 dB Monitor: ±2.0 dB	Normal: ±1.0 dB Monitor: ±2.0 dB	Normal: ±1.0 dB Monitor: ±2.0 dB	DSX range: ±1.0 dB DSX-MON range: ±2.0 dB	DSX range: ±1.0 dB DSX-MON range: ±2.0 dB	Normal: ±1.0 dB Monitor: ±2.0 dB	Normal: ±1.0 dB Monitor: ±2.0 dB
Peak-to-peak voltage	±10 % down to 500 mVpp	±10 % down to 500 mVpp	±10 % down to 500 mVpp	±10 % down to 400 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp
Frequency offset generation	1.544 Mbit/s ± 140 ppm	2.048 Mbit/s ± 70 ppm	2.048 Mbit/s ± 70 ppm	8.448 Mbit/s ± 50 ppm	34.368 Mbit/s ± 50 ppm	44.736 Mbit/s ± 50 ppm	51.84 Mbit/s ± 50 ppm	139.264 Mbit/s ± 50 ppm	155.52 Mbit/s ± 50 ppm
Intrinsic jitter (Tx)	ANSI T1.403 section 6.3 GR-499 section 7.3	G.823 section 5.1	G.823 section 5.1	G.823 section 5.1	G.823 section 5.1 G.751 section 2.3	GR-449 section 7.3 (categories I and II)	GR-253 section 5.6.2.2 (category II)	G.823 section 5.1	G.825 section 5.1 GR-253 section 5.6.2.2
Input jitter tolerance	AT&T PUB 62411 GR-499 section 7.3	G.823 section 7.1	G.823 section 7.1	G.823 section 7.1	G.823 section 7.1	GR-449 section 7.3 (categories I and II)	GR-253 section 5.6.2.2 (category II)	G.823 section 7.1 G.751 section 3.3	G.825 section 5.2 GR-253 section 5.6.2.3
Line coding	AMI and B8ZS	AMI and HDB3	AMI and HDB3	HDB3	HDB3	B3ZS	B3ZS	CMI	CMI
Input impedance (resistive termination)	100 ohms ± 5 %, balanced	120 ohms ± 5 %, balanced	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced	75 ohms ± 10 %, unbalanced	75 ohms ± 5 %, unbalanced
Connector type	BANTAM and RJ-48C	BANTAM and RJ-48C	BNC	BNC	BNC	BNC	BNC	BNC	BNC

SYNCHRONISATION INTERFACES

	External Clock DS1/1.5M	External Clock E1/2M	External Clock E1/2M	Trigger 2 MHz
Tx pulse amplitude	2.4 to 3.6 V	3.0 V	2.37 V	0.75 to 1.5 V
Tx pulse mask	GR-499 figure 9.5	G.703 figure 15	G.703 figure 15	G.703 figure 20
Tx LBO preamplification	Typical power dBdsx +0.6 dBdsx (0-133 ft) +1.2 dBdsx (133-266 ft) +1.8 dBdsx (266-399 ft) +2.4 dBdsx (399-533 ft) +3.0 dBdsx (533-655 ft)			
Rx level sensivity (dynamic range)	TERM: ≤6 dB (cable loss only) (at 772 kHz for T1) DSX-MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only)	TERM: ≤6 dB (cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only)	TERM: ≤6 dB (cable loss only) MON: ≤26 dB (resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only)	≤6 dB (cable loss only)
Transmission bit rate	1.544 Mbit/s ± 4.6 ppm	2.048 Mbit/s ± 4.6 ppm	2.048 Mbit/s ± 4.6 ppm	
Reception bit rate	1.544 Mbit/s ± 50 ppm	2.048 Mbit/s ± 50 ppm	2.048 Mbit/s ± 50 ppm	
Intrinsic jitter (Tx)	ANSI T1.403 section 6.3 GR-499 section 7.3	G.823 section 6.1	G.823 section 6.1	G.703 table 11
Input jitter tolerance	AT&T PUB 62411 GR-499 SECTION 7.3	G.823 section 7.2 G.813	G.823 section 7.2 G.813	
Line coding	AMI and B8ZS	AMI and HDB3	AMI and HDB3	
Input impedance (resistive termination)	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced
Connector type	BNC [a]	BNC [a]	BNC	BNC

Note

a. Adaptation cable required for BANTAM.

OPTICAL INTERFACES

The following section provides detailed information on all supported SONET/SDH/OTN optical interfaces.

OPTICAL INTERFACES		OC-3/STM-1				OC-12/STM-4				OC-48/STM-16			
		15 km; 1310 nm	40 km; 1310 nm	40 km; 1550 nm	80 km; 1550 nm	15 km; 1310 nm	40 km; 1310 nm	40 km; 1550 nm	80 km; 1550 nm	15 km; 1310 nm	40 km; 1310 nm	40 km; 1550 nm	80 km; 1550 nm
Tx level		−5 to 0 dBm	−2 to 3 dBm	−5 to 0 dBm	−2 to 3 dBm	−5 to 0 dBm	−2 to 3 dBm	−5 to 0 dBm	−2 to 3 dBm	−5 to 0 dBm	−2 to 3 dBm	−5 to 0 dBm	−2 to 3 dBm
Rx operating range		−23 to −10 dBm	−30 to −15 dBm	−23 to −10 dBm	−30 to −15 dBm	−22 to 0 dBm	−27 to −9 dBm	−22 to 0 dBm	−29 to −9 dBm	−18 to 0 dBm	−27 to −9 dBm	−18 to 0 dBm	−28 to −9 dBm
Transmit bit rate		155.52 Mbit/s ± 4.6 ppm				622.08 Mbit/s ± 4.6 ppm				2.48832 Gbit/s ± 4.6 ppm			
Receive bit rate		155.52 Mbit/s ± 100 ppm				622.08 Mbit/s ± 100 ppm				2.48832 Gbit/s ± 100 ppm			
Operational wavelength range		1261 to 1360 nm	1263 to 1360 nm	1430 to 1580 nm	1480 to 1580 nm	1270 to 1360 nm	1280 to 1335 nm	1430 to 1580 nm	1480 to 1580 nm	1260 to 1360 nm	1280 to 1335 nm	1430 to 1580 nm	1500 to 1580 nm
Spectral width		1 nm (−20 dB)				1 nm (−20 dB)				1 nm (−20 dB)			
Frequency offset generation		±50 ppm				±50 ppm				±50 ppm			
Measurement accuracy (uncertainty)	Frequency	±4.6 ppm				±4.6 ppm				±4.6 ppm			
	Optical power	±2 dB				±2 dB				±2 dB			
Maximum Rx before damage [a]		3 dBm				3 dBm				3 dBm			
Jitter compliance		G.957 (SDH) GR-253 (SONET) G.958 (SDH)				GR-253 (SONET) G.958 (SDH)				GR-253 (SONET) G.958 (SDH)			
Line coding		NRZ				NRZ				NRZ			
Eye safety		SFP/XFP transceivers comply with IEC 60825 and 21 CFR 1040.10 (except for deviations pursuant to Laser Notice No. 50, dated July 2001), for Class 1 or 1M lasers.											
Connector [b]		Dual LC				Dual LC				Dual LC			
Transceiver type		SFP				SFP				SFP			

Notes

a. In order not to exceed the maximum receiver power level before damage, an attenuator must be used.

b. SFP compliance: The FTB-8115 selected SFP shall meet the requirements stated in the "Small Form-Factor Pluggable (SFP) Transceiver Multisource Agreement (MSA)".
   The FTB-8115 selected SFP shall meet the requirements stated in the "Specification for Diagnostic Monitoring Interface for Optical Xcvrs".

EXFO

FUNCTIONAL SPECIFICATIONS

SONET AND DSn		SDH AND PDH	
Optical interfaces	OC-3, OC-12, OC-48	Optical interfaces	STM-1, STM-4, STM-16
Available wavelengths (nm)	1310, 1550	Available wavelengths (nm)	1310, 1550
Electrical interfaces	DS1, DS3, STS-1e, STS-3e	Electrical interfaces [a]	1.5M (DS1), 2M (E1), 8M (E2), 34M (E3), 45M (DS3), 140M (E4), STM-0e, STM-1e
DS1 framing	Unframed, SF, ESF	2M framing	Unframed, PCM30, PCM31, PCM30 CRC-4, PCM31 CRC-4
DS3 framing	Unframed, M13, C-bit parity	8M, 34M, 140M framing	Unframed, framed
Clocking	Internal, loop-timed, external (BITS), inter-module	Clocking	Internal, loop-timed, external (MTS/SETS), 2 MHz, inter-module
Mappings [b]		Mappings [b]	
VT1.5	Bulk, DS1, GFP	TU-11-AU-3, TU-11-AU-4	Bulk, 1.5M
VT2	Bulk, E1, GFP	TU-12-AU-3, TU-12-AU-4	Bulk, 1.5M, 2M
VT6	Bulk, GFP	TU-3-AU-4	Bulk, 34M, 45M
STS-1 SPE	Bulk, DS3, GFP	TU-2-AU-3, TU-2-AU-4	Bulk
STS-3c	Bulk, E4, GFP	AU-4	Bulk, 140M
STS-12c/48c/192c, SPE	Bulk, GFP	AU-4-4c/16c	Bulk
SONET overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, E2, J1, C2, G1, F2, H4, Z3, Z4, Z5, N1, N2, Z6, Z7	SDH overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, G1, F2, F3, K3, N1, N2, K4, E2, J1, C2, H4
Error insertion		Error insertion	
DS1	Framing bit, BPV, CRC-6, bit error	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, FEBE, bit error	E2 (8M), E3 (34M), E4 (140M)	Bit error, FAS, CV
STS-1e, STS-3e	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV, FAS, bit error	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, CV, FAS, bit error
OC-3, OC-12, OC-48, OC-192	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, FAS, bit error	STM-1, STM-4, STM-16	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, CV, FAS, bit error
Error measurement		Error measurement	
DS1	Framing bit, BPV, CRC-6, excess zeros, bit error	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, FEBE, bit error	E2 (8M), E3 (34M), E4 (140M)	Bit error, FAS, CV
STS-1e, STS-3e	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV, FAS, bit error	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, CV, FAS, bit error
OC-3, OC-12, OC-48, OC-192	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, FAS, bit error	STM-1, STM-4, STM-16	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, FAS, bit error
Alarm insertion		Alarm insertion	
DS1	LOS, RAI, AIS, OOF, pattern loss	E1 (2M)	LOS, LOS Mframe, LOS CRC Mframe, LOF, AIS, TS16 AIS, RAI, RAI Mframe, pattern loss
DS3	LOS, RDI, AIS, OOF, DS3 idle, pattern loss	E2 (8M), E3 (34M), E4 (140M)	LOS, LOF, RAI, AIS, pattern loss
STS-1e, STS-3e, OC-3, OC-12, OC-48, OC-192	LOS, LOF, SEF, AIS-L, RDI-L, AIS-P, LOP-P, LOM, PDI-P, RDI-P, ERDI-PCD, ERDI-PPD, ERDI-PSD, UNEQ-P, AIS-V, LOP-V, RDI-V, ERDI-VCD, ERDI-VPD, ERDI-VSD, RFI-V, UNEQ-V, pattern loss	STM-0e, STM-1e, STM-1, STM-4, STM-16	LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-PDI, ERDI-PSD, ERDI-PCD, ERDI-PPD, HP-UNEQ, TU-AIS, LP-RFI, LP-RDI, ERDI-VCD, ERDI-VPD, ERDI-VSD, LP-RFI, LP-UNEQ, pattern loss
Alarm detection		Alarm detection	
DS1	LOS, loss of clock (LOC), RAI, AIS, OOF, pattern loss	E1 (2M)	LOS, LOS Mframe, LOS CRC Mframe, LOC, LOF, AIS, TS16 AIS, RAI, RAI Mframe, pattern loss
DS3	LOS, LOC, RDI, AIS, OOF, DS3 idle, pattern loss	E2 (8M), E3 (34M), E4 (140M)	LOS, LOC, LOF, RAI, AIS, pattern loss
STS-1e, STS-3e, OC-3, OC-12, OC-48, OC-192	LOS, LOC, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, LOM, PDI-P, RDI-P, ERDI-PCD, ERDI-PSD, PLM/SLM-P, UNEQ-P, TIM-P, AIS-V, LOP-V, RDI-V, ERDI-VCD, ERDI-VCD, ERDI-VPD, ERDI-VSD, RFI-V, UNEQ-V, TIM-V, PLM/SLM-V, pattern loss	STM-0e, STM-1e, STM-1, STM-4, STM-16	LOS, LOF, LOC, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-RDI, ERDI-PSD, ERDI-PCD, ERDI-PPD, HP-PLM/SLM, HP-UNEQ, HP-TIM, TU-AIS, LP-RFI, LP-RDI, ERDI-VPD, ERDI-VSD, LP-RFI, LP-UNEQ, LP-TIM, LP-PLM/SLM, pattern loss
	Frequency alarm on all supported interfaces.		
Patterns		Patterns	
DS0	2E9-1, 2E11-1, 2E20-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors	E0 (64K)	2E9-1, 2E11-1, 2E20-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
DS1	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, QRSS, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), T1-DALY, 55-Octet, bit errors	E1 (2M)	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
DS3	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors	E2 (8M), E3 (34M), E4 (140M)	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24 d, 32 bit programmable (inverted or non-inverted), bit errors
VT1.5/2/6	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, QRSS, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors	TU-11/12/2/3	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors
STS-1, STS-3c/12c/48c/192c	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors	AU-3/AU-4/AU-4-4c/16c	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors
	Pattern loss and bit error generation and analysis supported on all patterns.		

Notes

a. 1.5M (DS1) and 45M (DS3) interfaces described under SONET and DSn column.

b. Not supported for E4 (140M).

EXFO

ADDITIONAL TEST AND MEASUREMENT FUNCTIONS

Power measurements	Supports power measurements, displayed in dBm (dBdsx for DS1), for optical and electrical interfaces.
Frequency measurements	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency), displayed in ppm and b/s (bps), for optical and electrical interfaces.
Frequency offset generation	Supports offsetting the clock of the transmitted signal on a selected interface to exercise clock recovery circuitry on network elements.
Dual DSn receivers	Supports two DS1 or DS3 receivers, allowing users to simultaneously monitor two directions of a circuit under test in parallel, resulting in quick isolation of the source of errors.
Performance monitoring	The following ITU-T recommendations, and corresponding performance monitoring parameters, are supported on the FTB-8120NGE/8130NGE.

ITU-T recommendation	Performance monitoring statistics
G.821	ES, EFS, EC, SES, UAS, ESR, SESR, DM
G.826	ES, EFS, EB, SES, BBE, UAS, ERS, SESR, BBER
G.828	ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI
G.829	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER
M.2100	ES, SES, UAS, ESR, SESR
M.2101	ES, SES, BBE, UAS, ESR, SESR, BBER

Pointer adjustment and analysis	Generation and analysis of HO/AU and LO/TU pointer adjustments as per GR-253, and ITU-T G.707

Generation	Analysis
› Pointer increment and decrement	› Pointer increments
› Pointer jump with or without NDF	› Pointer decrements
› Pointer value	› Pointer jumps (NDF, no NDF)
	› Pointer value and cumulative offset

Programmable error/alarm injection	Ability to inject errors/alarms in the following modes: Manual, Constant Rate, Burst, Periodic Burst and Continuous.
Service disruption time (SDT) measurements	The service disruption time test tool measures the time during which there is a disruption of service due to the network switching from the active channels to the backup channels. User-selectable triggers: all supported alarms and errors. Measurements: last disruption, shortest disruption, longest disruption, average disruption, total disruption, and service disruption count.
Round-trip delay (RTD) measurements	The round-trip delay test tool measures the time required for a bit to travel from the FTB-8120NGE/8130NGE transmitter back to its receiver after crossing a far-end loopback. Measurements are supported on all supported FTB-8120NGE/8130NGE interfaces and mappings. Measurements: last RTD time, minimum, maximum, average, measurement count (no. of successful RTD tests), failed measurement count.
APS message control and monitoring	Ability to monitor and set up automatic protection switching messages (K1/K2 byte of SONET/SDH overhead).
Synchronization status	Ability to monitor and set up synchronization status messages (S1 byte of SONET/SDH overhead).
Signal label control and monitoring	Ability to monitor and set up payload signal labels (C2, V5 byte of SONET overhead).
Through mode	Ability to perform Through mode analysis of any incoming electrical (DSn, PDH) and optical line (OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, OC-192/STM-64, OTU1, OTU2, OTU1e and OTU2e) either transparently or intrusively.
M13 mux/demux	Ability to multiplex/demultiplex a DS1 signal into/from a DS3 signal. (Note: E1 to DS3 mux/demux available with G.747 software option.)
DS1 FDL	Support for DS1 Facility Data Link testing.
DS1 loopcodes	Support for generation of DS1 in-band loopcodes with the availability of up to 10 pairs of user-defined loopcodes.
NI/CSU loopback emulation	Ability to respond to DS1 in-band/out-of-band loopcodes.
DS3 FEAC	Support for DS3 for-end alarms and loopback codewords.
DS1/DS3 auto detection	Ability to automatically detect DS1/DS3 line coding, framing and test pattern.
Tandem connection monitoring (TCM) [a]	Tandem connection monitoring (TCM), Option 2 [b], is used to monitor the performance of a subsection of a SONET/SDH path routed via different network providers. The FTB-8120NGE/8130NGE supports transmitting and receiving alarms and errors on a TCM link; also, transmission and monitoring of the tandem connection (TC) trace can be generated to verify the connection between TCM equipment. Error generation: TC-IEC, TC-BIP, TC-REI, OEI Error analysis: TC-IEC, TC-REI, OEI, TC-VIOL Alarm generation: TC-RDI, TC-UNEQ, ODI, TC-LTC, TC-IAIS Alarm analysis: TC-TIM, TC-RDI, TC-UNEQ, ODI, TC-LTC, TC-IAIS

Notes

a. HOP and LOP supported.
b. G.707 option 2.

ADDITIONAL FEATURES

Scripting	The built-in scripting engine and embedded macro-recorder provide a simple means of automating test cases and routines. Embedded scripting routines provide a powerful means of creating advanced test scripts. Available for the FTB-500 platform.
Reports	Supports generation of test reports in .html, .csv, .txt, .pdf formats. Contents of reports are customizable by the user.
Power-up and restore	In the event of a power failure to the unit, the active test configuration and test logger are saved and restored upon bootup.
Store and load configurations	Ability to store and load test configurations to/from non-volatile memory.
Alarm hierarchy	Alarms are displayed according to a hierarchy based on root cause. Secondary effects are not displayed. This hierarchy serves to facilitate alarm analysis.
Configurable test views	This allows users to customize their test views; i.e., to dynamically insert or remove test tabs/windows, in addition to creating new test windows, so as to accurately match their testing needs.
Configurable test timer	Provides the ability for a user to set pre-defined test start and stop times.
Remote control	Remote management software. This allows users to remotely monitor and control the FTB-8115 module via standard Ethernet connection.

EXFO

SPECIFICATIONS

FTB-8115

SONET/SDH 155 Mbit/s, 622 Mbit/s and 2.5 Gbit/s

Analyzer module supporting up to OC-48/STM-16 optical rates, as well as electrical DSn/PDH interfaces

Test Interfaces

SONET: STS-1e, STS-3e, OC-3, OC-12, OC-48

SDH: STM-0e, STM-1e, STM-1, STM-4, STM-16

DSn: DS1, DS3, Dual DS1 Rx, Dual DS3 Rx

PDH: E1, E2, E3, E4

GENERAL SPECIFICATIONS

Weight (without transceiver)	0.9 kg (2.0 lb)
Size (H x W x D)	96 mm x 51 mm x 288 mm (3 $^3/_4$ in x 2 in x 11 $^3/_8$ in)
Temperature operating storage	0 °C to 40 °C (32 °F to 104 °F) −40 °C to 60 °C (−40 °F to 140 °F)

ORDERING INFORMATION

FTB-8115-XX-XX-XX-XX

Models

Test options
SONET = SONET-BASE-SW
SDH = SDH-BASE-SW
SONET/SDH = Option for combined SONET/SDH functionality

Rate Options [a]
155 = 155 Mbit/s (OC-3/STM-1) [c]
622 = 622 Mbit/s (OC-12/STM-4)
2.5G = 2.5 Gbit/s (OC-48/STM-16)

Options [c]
G.747 [b]
DS1-FDL
DS3-FEAC
DUAL-RX
TCM = Tandem connection monitoring
SMART_MODE

Test options
00 = Without SFP modules
8190 = SFP modules 155 Mbit/s to 2.7 Gbit/s at 1310 nm, 15 km
8191 = SFP modules 155 Mbit/s to 2.7 Gbit/s at 1310 nm, 40 km
8192 = SFP modules 155 Mbit/s to 2.7 Gbit/s at 1550 nm, 80 km
8193 = SFP modules 155 Mbit/s to 2.7 Gbit/s at 1550 nm, 40 km
8194 = SFP modules 155/622 Mbit/s at 1310 nm, 15 km [d]
8195 = SFP modules 155/622 Mbit/s at 1310 nm, 40 km [d]
8196 = SFP modules 155/622 Mbit/s at 1550 nm, 80 km [d]

Example: FTB-8115-SONET-155-622-8194-DUAL-RX

Notes
a. Multiple options can be purchased to suit the required test application.
b. Enables E1/2M in DS3/45M analysis and generation, as per ITU-T G.747 recommendation.
c. Always included.
d. Not available with 2.5 Gbit/s.