NEXT-GENERATION SONET/SDH TEST MODULES

FTB-8120/8130 Transport Blazer

NETWORK TESTING—TRANSPORT AND DATACOM

Fully integrated test solution supporting next-generation SONET/SDH and optical transport network (OTN) test functions

- DS0/E0 to OC-192/STM-64 testing in a single module
- Supports SONET, SDH, DSn, PDH, next-generation SONET/SDH and OTN testing
- Ethernet-over-SONET/SDH (EoS) testing via optional support for GFP, VCAT and LCAS
- SmartMode signal structure discovery for rates of up to 10 Gb/s, with simultaneous monitoring of all discovered STS/AU and user selected VT/TU channels
- Intuitive, feature-rich user interface with automated test scripting and available multi-user remote management capabilities

Platform Compatibility

- *FTB-400 Universal Test System*
- *FTB-200 Compact Platform*

The Next Step in SONET/SDH Testing

The increased demand for data and video services continues to drive the need for more cost-effective networks. Technologies such as next-generation SONET/SDH are becoming more important to service providers as they offer an economical means of introducing new revenue-generating, Ethernet-based transport services on existing SONET/SDH infrastructures. In addition, implementation of OTN (ITU-T G.709) will also help reduce the cost of operating DWDM networks by achieving higher transmission quality with longer optical links through the use of forward error correction (FEC).

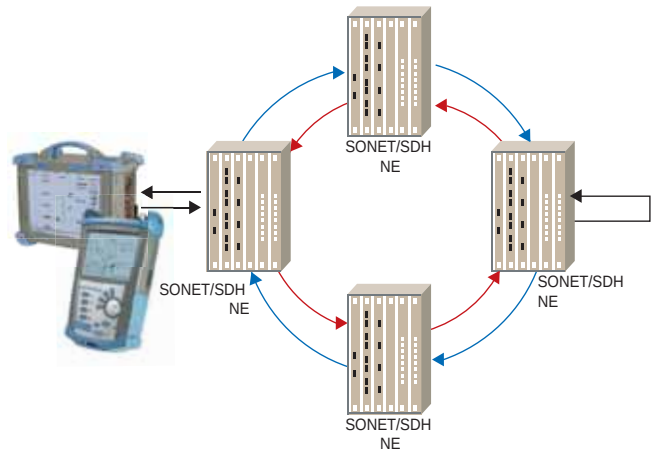
This opportunity creates the need for test solutions that can help ensure proper deployment, operation and maintenance of standard SONET/SDH, OTN and new Ethernet-based transport networks.

EXFO's FTB-8120 (2.5/2.7 Gb/s) and FTB-8130 (10/10.7 Gb/s) Transport Blazer test modules provide advanced DSn/PDH, SONET/SDH, next-generation SONET/SDH and OTN test functions in a single unit, eliminating the need for multiple purpose-built test platforms when commissioning or troubleshooting SONET/SDH, OTN and new data-aware SONET/SDH circuits.

SONET/SDH SERVICE TURN-UP AND TROUBLESHOOTING

The FTB-8120/8130 Transport Blazer modules offer a wide range of SONET/SDH test functions, allowing users to perform tests ranging from simple bit error rate (BER) testing to advanced characterization and troubleshooting procedures. These functions include:

- Mixed and bulk payload generation and analysis from 64 Kb/s to 10 Gb/s
- High-order mappings: STS-1/3c/6c/9c/12c/24c/48c/96c/192c and AU-3/AU-4/AU-4-2c/3c/4c/8c/16c/32c/64c
- Low-order mappings: VT1.5/2/6, VC-11/12/2/3
- Section/RS, Line/MS, high-order (HO) and low-order (LO) path overhead manipulation and monitoring
- Section/RS, Line/MS, high-order and low-order path alarm/error generation and monitoring
- High-order and low-order pointer generation and monitoring
- Tandem connection 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
- Dual DS1/DS3 receiver testing
- Independent transmitter and receiver testing
- Through mode analysis
- DS1 FDL
- DS1 in-band loopcodes
- Fractional T1/E1 testing



Housed in either the FTB-400 or FTB-200 platform, the FTB-8120/8130 modules offer the solution for field circuit turn-up and troubleshooting.

OPTICAL TRANSPORT NETWORK TESTING

With OTN deployments rapidly increasing, so does the need for smaller field-oriented OTN test equipment. The FTB-8120/8130 Transport Blazer modules offer OTN test capabilities for verifying compliancy with ITU-T G.709 standards. The tests include:

- OTU1 (2.7 Gb/s) and OTU2 (10.7 Gb/s) bit rates
- Synchronous and asynchronous mapping of SONET/SDH signals within OTN
- Forward error correction (FEC) generation and analysis
- OTU, ODU (including ODU TCM), OPU layer alarms and errors
- OTU, ODU (including ODU TCM) trace messages

Scalable, High-Performance Testing

NEXT-GEN SONET/SDH TESTING

Available next-generation SONET/SDH test functionalities include generic framing procedure (GFP), virtual concatenation (VCAT) and link capacity adjustment scheme (LCAS).

GFP

- Generation and analysis of frame types (client management/client data)
- Alarm/error generation and monitoring
- Overhead manipulation and monitoring
- Transmission and reception statistics monitoring
- Supported over contiguous or VCAT containers

VCAT

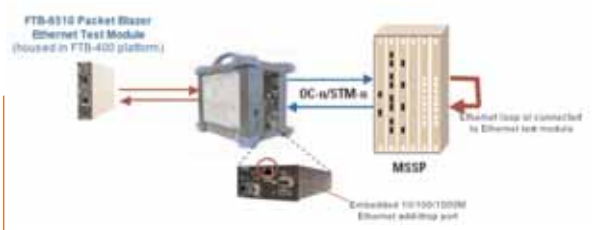
- High-order and low-order VCAT support
- Simultaneous manipulation and monitoring of each member
- Alarm/error generation and monitoring
- Sequence-indicator manipulation and processing
- Group-summary monitoring
- Differential delay analysis and insertion

LCAS

- Emulation and analysis of LCAS protocol (Automatic and Manual modes)
- Source and sink state machines control and monitoring
- Real-time generation and monitoring of LCAS control fields
- Real-time insertion and monitoring of LCAS alarms/errors

ETHERNET ADD/DROP INTERFACE

In addition to its internal PRBS generator, each FTB-8120NG and FTB-8130NG Transport Blazer module includes one 10/100/1000M Ethernet (RJ-45 interface) and one Gigabit Ethernet (SFP) interface. These interfaces can be used to interconnect with an FTB-8510 Packet Blazer Ethernet test module or an external Ethernet device (e.g., switch, router, etc.), delivering the industry's first data-integrated next-generation SONET/SDH test solution for advanced Ethernet-over-SONET/SDH service emulation and analysis–ideal for lab or field test applications.



The FTB-8120NG/8130NG module's embedded 10/100/1000M Ethernet and Gigabit Ethernet interfaces allow users to extract and insert Ethernet payload to/from a GFP-mapped OC-n/STM-n line, providing a powerful test solution for Ethernet-over-SONET/SDH service validation.

MULTISERVICE QoS TESTING

Next-generation SONET/SDH networks are being deployed to transport a mix of services, such as voice, video and data access services. Used in conjunction with the FTB-8510 Packet Blazer Ethernet Test Module, EXFO's FTB-8120NG/8130NG Transport Blazer test modules allow for the generation and analysis of multiple Ethernet test streams over a GFP-enabled SONET/SDH link. Each stream's quality-of-service setting is user-configurable (via IP TOS, Diffserv, Ethernet 802.1 priority bits), providing a means of prequalifying delivery of multiple services over their multiservice provisioning platforms (MSPPs) and corresponding next-generation SONET/SDH networks.

Combining the FTB-8510's Ethernet multiple-streaming capablitities and the FTB-8120NG/8130NG embedded Ethernet interfaces creates a powerful solution for testing multiple services over SONET/SDH.

SMARTMODE: REAL-TIME SIGNAL STRUCTURE DISCOVERY AND MONITORING

EXFO's FTB-8120/8130 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/OTN test signal.

SmartMode automatically discovers the signal structure of the OC-n/STM-n line including mixed mappings and virtual concatenation (VCAT) members. 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/OTN 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-8120/8130 SmartMode: multichannel signal discovery with real-time alarm scan (shown in the FTB-400 user interface).

Unsurpassed Configuration and Operational Flexibility

MULTIPLATFORM SUPPORT AND VERSATILITY

EXFO's Transport Blazer series offers four hardware configurations:

- FTB-8120 and FTB-8130 modules, which support SONET/SDH and OTN test functions
- FTB-8120NG and FTB-8130NG modules, which support next-generation SONET/SDH and OTN capabilities

FTB-8130NG with next-generation SONET/SDH and OTN hardware including optical and electrical Ethernet add/drop interfaces.

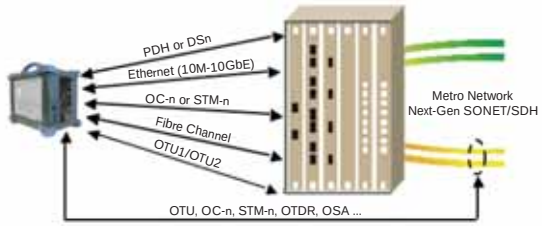
FTB-8130 module with SONET/SDH and OTN test functions.

The FTB-8120/8120NG and FTB-8130/8130NG Transport Blazer modules share a unique architecture that allows them to be supported and interchangeable on both the FTB-400 Universal Test System and 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.

Once inserted into the FTB-200 Compact Platform, the FTB-8120/FTB-8120NG or FTB-8130/FTB-8130NG Transport Blazer modules deliver DSn/PDH, SONET/SDH and OTN 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.

FTB-8120/8130 modules supported on both the FTB-200 and the FTB-400 platforms.

The FTB-400 platform configuration–used with either the four-slot (GP-404) or eight-slot (GP-408) receptacle–provides users with an all-in-one solution supporting a mix of Transport Blazer modules (FTB-8120/FTB-8120NG and FTB-8130/FTB-8130NG), Packet Blazer modules (FTB-8510G 10 Gigabit Ethernet, FTB-8510 Ethernet, FTB-8520 Fibre Channel) and optical-layer test modules, making it the industry's first truly integrated network testing platform. The resulting modularity enables users to upgrade their systems in the field according to their testing needs. This multitechnology test platform is the ideal solution for field, central office and lab applications.



With its modular, multislot design, the FTB-400 platform enables users to configure and upgrade their systems in the field according to their testing needs, minimizing capital expenditures.

Product Option Flexibility

The Transport Blazer series provides customers with the flexibility to purchase SONET/SDH-only configurations and upgrade to next-Generation SONET/SDH and/or OTN test functions to meet evolving needs. This avoids having to perform complete hardware and/or platform retrofits, therefore significantly decreasing capital and training expenses.

In addition, with the FTB-8120NG and FTB-8130NG Transport Blazer modules, users can purchase one or more next-generation options (e.g., GFP, VCAT, LCAS) and/or OTN options (OTU1, OTU2) to customize their configuration as new needs arise. At any point, additional next-generation options are available via simple field upgrades.

Remote Management

Through the optional Visual Guardian™ Lite management software, the FTB-8120/FTB-8120NG and FTB-8130/FTB-8130NG Transport Blazer modules allow you to perform remote testing and data analysis, as well as remote monitoring via standard Ethernet.

Automated Test Scripting

The FTB-8120/8120NG and FTB-8130/8130NG Transport Blazer modules come with a built-in macro recorder 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.

Electrical Interface

The following section provides detailed information on all supported 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	GR-253 Figure 4-10/4-11	G.703 Figure 18/19	STS-3e GR-253 Figure 4-12/4-13/4-14 / STM-1e/155M G.703 Figure 4-14/22, 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 225 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		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	For 1024 kHz: TERM: ≤ 6 dB (cable loss only) MON: ≤ 25 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	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: ≤ 12.7 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 Mb/s ± 4.6 ppm	2.048 Mb/s ± 4.6 ppm	2.048 Mb/s ± 4.6 ppm	8.448 Mb/s ± 4.6 ppm	34.368 Mb/s ± 4.6 ppm	44.736 Mb/s ± 4.6 ppm	51.84 Mb/s ± 4.6 ppm	139.264 Mb/s ±4.6 ppm	155.52 Mb/s ± 4.6 ppm
Receive Bit Rate		1.544 Mb/s ± 140 ppm	2.048 Mb/s ± 100 ppm	2.048 Mb/s ± 100 ppm	8.448 Mb/s ± 100 ppm	34.368 Mb/s ± 100 ppm	44.736 Mb/s ± 100 ppm	51.84 Mb/s ± 100 ppm	139.264 Mb/s ± 100 ppm	155.52 Mb/s ± 100 ppm
Measurement Accuracy	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
	Electrical Power	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	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 Mb/s ± 140 ppm	2.048 Mb/s ± 70 ppm	2.048 Mb/s ± 70 ppm	8.448 Mb/s ± 50 ppm	34.368 Mb/s ± 50 ppm	44.736 Mb/s ± 50 ppm	51.84 Mb/s ± 50 ppm	139.264 Mb/s ± 50 ppm	155.52 Mb/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	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 Mb/s ± 4.6 ppm	2.048 Mb/s ± 4.6 ppm	2.048 Mb/s ± 4.6 ppm	
Reception Bit Rate	1.544 Mb/s ± 140 ppm	2.048 Mb/s ± 100 ppm	2.048 Mb/s ± 100 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

ETHERNET ADD/DROP INTERFACE

10/100/1000 Base-T (Add/Drop)	
Compliance	10 Mb/s: IEEE 802.3 section 14. 100 Mb/s: IEEE 802.3 section 25. 1000 Mb/s: IEEE 802.3 section 40.
Connector	RJ-45 Ethernet

Gigabit Ethernet (Add/Drop)

Interface/connector	SFP/Dual LC
Compliance	1000 Mb/s: IEEE 802.3 Section 40 [b]
Wavelength/Max Tx level	850, 1310 nm/–3 dBm 1550 nm/+5 dBm

Ref-Out Interface

Parameter	Value
Tx pulse amplitude	400 to 500 mVpp
Transmission frequency	
Clock divider = 16	622.08 MHz
Clock divider = 32	311.04 MHz
Clock divider = 64	155.52 MHz
Output configuration	AC coupled
Load impedance	50 ohms
Maximum cable length	3 meters
Connector Type	SMA

NOTES

a. Adaptation cable required for BANTAM.

b. SFP/XFP transceivers comply with IEC 60825 and 21 CFR 1040.10 (except for deviations pursuant to Laser Notice 50, dated July, 2001), for Class 1 or 1M lasers.

Optical Interface

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

		OC-3/STM-1o				OC-12/STM-4o				OC-48/STM-16o/OTU1				OC-192/STM-64o/OTU2		
		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	10 km; 1310 nm	40 km; 1550 nm	80 km; 1550 nm
Level Tx		–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	–6 to –1 dBm	–1 to +2 dBm	–2 to +4 dBm
Rx Level Sensitivity		–18 to –10 dBm	–27 to –15 dBm	–18 to –10 dBm	–28 to –15 dBm	–18 to 0 dBm	–27 to –9 dBm	–18 to 0 dBm	–28 to –9 dBm	–18 to 0 dBm	–27 to –9 dBm	–18 to 0 dBm	–28 to –9 dBm	–11 to –1 dBm	–14 to –1 dBm	–26 to –9 dBm
Transmit Bit Rate		155.52 Mb/s ± 4.6 ppm				622.08 Mb/s ± 4.6 ppm				2.48832 Gb/s ± 4.6 ppm 2.66606 Gb/s ± 4.6 ppm (OTU1)				9.95328 Gb/s ± 4.6 ppm 10.70922 Gb/s ± 4.6 ppm (OTU2)		
Receive Bit Rate		155.52 Mb/s ± 100 ppm				622.08 Mb/s ± 100 ppm				2.48832 Gb/s ± 100 ppm 2.66606 Gb/s ± 100 ppm (OTU1)				9.95328 Gb/s ± 100 ppm 10.70922 Gb/s ± 100 ppm (OTU2)		
Operational Wavelength Range		1260 to 1360 nm		1430 to 1580 nm		1274 to 1356 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	1290 to 1330 nm	1530 to 1565 nm	1530 to 1565 nm
Spectral Width		< 1 nm (–20 dB from center)				< 1 nm (–20 dB from center)				< 1 nm (–20 dB from center)				1 nm (20 dB from center)		
Frequency Offset Generation		155.52 Mb/s ± 50 ppm				622.08 Mb/s ± 50 ppm				2.48832 Gb/s ± 50 ppm				9.95328 Gb/s ± 50 ppm		
Measurement Accuracy	Frequency	± 4.6 ppm				± 4.6 ppm				± 4.6 ppm				± 4.6 ppm		
	Optical Power	± 2 dB				± 2 dB				± 2 dB				± 2 dB		
Maximum Rx before damage [a]		± 3 dB				± 3 dB				± 3 dB				± 2 dB		
Jitter Compliance		GR-253 (SONET) G.958 (SDH)				GR-253 (SONET) G.958 (SDH)				GR-253 (SONET) G.958 (SDH)				GR-253 (SONET) G.825 (SDH)		
Line Coding		NRZ				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		Dual LC				Dual LC				Dual LC				Dual LC		
Transceiver Type [b]		SFP				SFP				SFP				XFP		

NOTES

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

b. SFP/XFP compliance: The FTB-8120/8130 selected SFP/XFP shall meet the requirements stated in the “Small Form-Factor Pluggable (SFP) Transceiver Multisource Agreement (MSA)”. The FTB-8120/8130 selected SFP/XFP shall meet the requirements stated in the “Specification for Diagnostic Monitoring Interface for Optical Xcvrs”.

FUNCTIONAL SPECIFICATIONS

SONET and DSn		SDH and PDH	
Optical interfaces	OC-3, OC-12, OC-48, OC-192	Optical interfaces	STM-1, STM-4, STM-16, STM-64
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 [c]	TU-11-AU-3, TU-11-AU-4	Bulk, 1.5M, GFP [c]
VT2	Bulk, E1, GFP [c]	TU-12-AU-3, TU-12-AU-4	Bulk, 1.5M, 2M, GFP [c]
VT6	Bulk, GFP [c]	TU-3-AU-3, TU-3-AU-4	Bulk, 34M, 45M, GFP [c]
STS-1 SPE	Bulk, DS3, GFP [c]	TU-2	Bulk, GFP [c]
STS-3c/6c/9c/12c/24c/48c/96c/192c, SPE	Bulk, GFP [c]	AU-4 AU-4-2c/3c/4c/8c/16c/32c/64c	Bulk, 140M, GFP [c] Bulk, GFP [c]
SONET overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, E2, J1, E2, J1, C2, C2, G1, F2, H4, Z3, Z4, Z5, N1, N2	SDH overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, G1, F2, F3, K3, N1, N2
Error insertion		Error insertion	
DS1	Framing bit, BPV, CRC-6	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, framing bit, FEBE	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	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, bit error, CV
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	STM-1, STM-4, STM-16, STM-64	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, bit error
Error measurement		Error measurement	
DS1	Framing bit, BPV, CRC-6, excess zeros	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, framing bit, FEBE	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	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, bit error, CV
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	STM-1, STM-4, STM-16, STM-64	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, bit error
Alarm insertion		Alarm insertion	
DS1	LOS, RAI, AIS, OOF	E1 (2M)	LOS, LOS Mframe, LOS CRC Mframe, LOF, AIS, TS16 AIS, RAI, RAI Mframe, pattern loss
DS3	LOS, RDI, AIS, OOF, DS3 idle	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, PLM/SLM-P, UNEQ-P, AIS-V, LOP-V, RDI-V, ERDI-VCD, ERDI-VPD, ERDI-VSD, RFI-V, UNEQ-V, TIM-V, PLM/SLM-V	STM-0e, STM-1e, STM-1, STM-4, STM-16, STM-64	LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-PDI, ERDI-PSD, ERDI-PCD, ERDI-PPD, HP-PLM/SLM, HP-UNEQ, TU-AIS, LP-RFI, LP-RDI, ERDI-VCD, ERDI-VPD, ERDI-VSD, LP-RFI, LP-UNEQ, LP-PLM/SLM
Alarm detection		Alarm detection	
DS1	LOS, loss of clock (LOC), RAI, AIS, OOF	E1 (2M)	LOS, LOS Mframe, LOS CRC Mframe, LOC, LOF, AIS, TS16 AIS, RAI, RAI Mframe
DS3	LOS, LOC, RDI, AIS, OOF, DS3 idle	E2 (8M), E3 (34M), E4 (140M)	LOS, LOC, LOF, RAI, AIS
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-PPD, 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	STM-0e, STM-1e, STM-1, STM-4, STM-16, STM-64	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
Frequency alarm on all supported interfaces.			
Patterns		Patterns	
DS0	2E9-1, 2E11-1, 2E20-1, User defined	E0 (64K)	2E9-1, 2E11-1, 2E20-1, User defined
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, QRSS, 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, 2E23-1, 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, STS-6c, STS-9c, STS-12c, STS-24c, STS-48c, STS-96c, STS-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/AU4-2c/3c/4c/8c/16c/32c/64c	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
LSS (loss of signal synchronization or loss of pattern) 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. VCAT mappings are also available. Please refer to the VCAT section of this document for details.

c. GFP supported only with purchase of GFP-F option.

d. Not supported for E4 (140M).

FUNCTIONAL SPECIFICATIONS (CONT'D)

Next-Gen SONET		Next-Gen SDH	
Generic framing procedure (GFP)		Generic framing procedure (GFP)	
Standards compliance	As per ITU-T G.7041, and ANSI T1.105.02	Standards compliance	As per ITU-T G.7041, G.707, and ANSI T1.105.02
Payload	PRBS pattern; Ethernet	Payload	PRBS pattern; Ethernet
Ethernet add/drop	Ability to add/drop Ethernet payload to/from GFP mapped OC-n/OTU signal	Ethernet add/drop	Ability to add/drop Ethernet payload to/from GFP mapped STM-n/OTU signal
Error insertion	Correctable core HEC, uncorrectable core HEC, correctable type HEC, uncorrectable type HEC, correctable extension HEC, uncorrectable extension HEC, payload FCS	Error insertion	Correctable core HEC, uncorrectable core HEC, correctable type HEC, uncorrectable type HEC, correctable extension HEC, uncorrectable extension HEC, payload FCS
Error monitoring	Correctable core HEC, uncorrectable core HEC, correctable type HEC, uncorrectable type HEC, correctable extension HEC, uncorrectable extension HEC, payload FCS	Error monitoring	Correctable core HEC, uncorrectable core HEC, correctable type HEC, uncorrectable type HEC, correctable extension HEC, uncorrectable extension HEC, payload FCS
Alarm insertion	Loss of client signal (LOCS) and loss of client character synchronization (LOCCS) with configurable time interval between 10 and 1200 ms, and loss of frame delineation (LFD)	Alarm insertion	Loss of client signal (LOCS) and loss of client character synchronization (LOCCS) with configurable time interval between 10 and 1200 ms, and loss of frame delineation (LFD)
Alarm monitoring	Loss of client signal (LOCS), loss of client character synchronization (LOCCS) and loss of frame delineation (LFD)	Alarm monitoring	Loss of client signal (LOCS), loss of client character synchronization (LOCCS) and loss of frame delineation (LFD)
Statistics	Transmit: client data frames (including payload bytes), client management frames, total frames, idle frames, GFP bandwidth usage (%), GFP mapping efficiency (%) Receive: client data frames (including payload bytes), client management frames, total frames, idle (control) frames, reserved (control) frames, invalid frames, discarded frames, EXI mismatches, UPI mismatches, CID mismatches, GFP bandwidth usage (%), GFP mapping efficiency (%)	Statistics	Transmit: client data frames (including payload bytes), client management frames, total frames, idle frames, GFP bandwidth usage (%), GFP mapping efficiency (%) Receive: client data frames (including payload bytes), client management frames, total frames, idle (control) frames, reserved (control) frames, invalid frames, discarded frames, EXI mismatches, UPI mismatches, CID mismatches, GFP bandwidth usage (%), GFP mapping efficiency (%)
Header manipulation	PTI, PFI, EXI, UPI, CID and spare (extension header) fields	Header manipulation	PTI, PFI, EXI, UPI, CID and spare (extension header) fields
Header monitoring	PLI, PTI, PFI, EXI, UPI, CID, spare (extension header) fields, cHEC, tHEC, eHEC	Header monitoring	PLI, PTI, PFI, EXI, UPI, CID, spare (extension header) fields, cHEC, tHEC, eHEC
Virtual concatenation (VCAT)		Virtual concatenation (VCAT)	
Standards compliance	Supports high-order and low-order virtual concatenation as per ANSI T1.105	Standards compliance	Supports high-order and low-order virtual concatenation as per ITU G.707
Mappings	High-order STS-1-Xv (X = 1 to 21) STS-3-Xv (X = 1 to 7) Low-order VT1.5-Xv (X = 1 to 64) VT-2-Xv (X = 1 to 64)	Mappings	High-order VC-3-Xv (X = 1 to 21) VC-4-Xv (X = 1 to 7) Low-order VC-11-Xv (X = 1 to 64) VC-12-Xv (X = 1 to 64) VC-3-Xv in AU-4 (X = 1 to 21)
Alarm insertion	LOM, OOM1, OOM2, SQM VCAT alarms can be generated independently on any member of a VCG	Alarm insertion	LOM, OOM1, OOM2, SQM VCAT alarms can be generated independently on any member of a VCG
Alarm monitoring	LOM, OOM1, OOM2, SQM, LOA	Alarm monitoring	LOM, OOM1, OOM2, SQM, LOA
Differential delay	Analysis Range: 0 to 256 ms Display: numerical and graphical Insertion Range: 0 to 256 ms	Differential delay	Analysis Range: 0 to 256 ms Display: numerical and graphical Insertion Range: 0 to 256 ms
Sequence number manipulation and processing	Sequence range: 0 to 63 Sequence number monitoring: current AcSQ (accepted SQ) monitored against the ExSQ (expected SQ); SQM alarm raised on mismatch	Sequence number manipulation and processing	Sequence range: 0 to 63 Sequence number monitoring: current AcSQ (accepted SQ) monitored against the ExSQ (expected SQ); SQM alarm raised on mismatch

FUNCTIONAL SPECIFICATIONS (CONT'D)

Next-Gen SONET/SDH (Cont'd)

Link capacity adjustment scheme (LCAS)	
Standards compliance	As per ITU G.7042; supported for both low-order and high-order VCAT groups
Test functions	- Emulation of source and sink state machines - Automatic and manual control of source and sink state machines - Independent overwrite capability at the source and sink for each member - Automatic SQ management
Source state machine control	- Add/remove member(s) - Configure: RS-ACK timeout, remote DUT, PLCT threshold - Statistics count: received RS-ACK, unexpected RS-ACK - Error/alarm generation: CRC errors, group ID (GID) mismatch - Error/alarm monitoring: loss of partial transport capacity, loss of total transport capacity, failure of protocol transmission, CRC errors, unexpected member status
Sink state machine control	- Add/remove member(s) - Configure Hold-Off and Wait-to-Restore timers, PLCR threshold - Toggle RS-ACK - Statistics count: transmitted RS-ACK - Error/alarm generation: CRC errors, group ID (GID) mismatch - Error/alarm monitoring: loss of partial transport capacity, loss of total transport capacity, failure of protocol reception, CRC errors, unexpected member status

OTN

Standards compliance	ITU-T G.709, ITU G.798, ITU G.872
Interfaces	OTU1 (2.7 Gb/s) and OTU2 (10.7 Gb/s)
Client types	All supported SONET/SDH mappings, including next-generation SONET/SDH (GFP, VCAT, LCAS)

OTU Layer

Errors	FEC-Correctable (Codeword), FEC-Uncorrectable (Codeword), FEC-Correctable (Symbol), FEC-Correctable (Bit), FEC-Stress (Codeword), OTU-FAS, OTU-MFAS, OTU-BEI , OTU-BIP-8
Alarms	LOF, OOF, LOM, OOM, OTU-AIS, OTU-TIM, OTU-BDI, OTU-IAE, OTU-BIAE
Traces	64-bytes Trail Trace Identifier (TTI) as defined in ITU-T G.709.

ODU TCM Layer

Errors	TCMi-BIP-8, TCMi-BEI (i = 1 to 6)
Alarms	TCMi-AIS, TCMi-LTC, TCMi-OCI, TCMi-LCK, TCMi-TIM, TCMi-BDI, TCMi-IAE, TCMi-BIAE
Traces	64-bytes Trail Trace Identifier (TTI) as defined in ITU-T G.709.

ODU Layer

Errors	ODU-BIP-8, ODU-BEI
Alarms	ODU-AIS, ODU-OCI, ODU-LCK, ODU-TIM, ODU-BDI, ODU-FSF, ODU-BSF, ODU-FSD, ODU-BSD
Traces	Generates 64-bytes Trail Trace Identifier (TTI) as defined in ITU-T G.709.

OPU Layer

Alarm	OPU-PLM
Payload type (PT) label	PT value

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 IQS-8100 product line.

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

- Pointer increment and decrement
- Pointer jump with or without NDF
- Pointer value

Analysis

- Pointer increments
- Pointer decrements
- Pointer jumps (NDF, no NDF)
- Pointer value and cumulative offset

Service disruption time 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 measurements	The round-trip delay test tool measures the time required for a bit to travel from the FTB-8120/8130 transmitter back to its receiver after crossing a far-end loopback. Measurements are supported on all supported FTB-8120/8130 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 bytes 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, and OC-192/STM-64).
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.
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-8120/8130 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 only on the FTB-400.
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. Available only on the FTB-400 user interface.
Configurable test timer	Provides the ability for a user to set pre-defined test start and stop times.
Remote control	Available with Windows-based remote management software known as Visual Guardian Lite (optional software package). This allows users to remotely monitor and control the FTB-8120/8130 modules via standard Ethernet connection.

SPECIFICATIONS

FTB-8120	FTB-8120NG	FTB-8130	FTB-8130NG
SONET/SDH 2.5 Gb/s and OTN 2.7 Gb/s	Next-generation SONET/SDH 2.5 Gb/s and OTN 2.7 Gb/s	SONET/SDH 10 Gb/s and OTN 10.7 Gb/s	Next-generation SONET/SDH 10 Gb/s and OTN 10.7 Gb/s
Analyzer module supporting up to 2.5/2.7 Gb/s optical rates, as well as electrical DSn/PDH interfaces	Analyzer module supporting up to 2.5/2.7 Gb/s optical rates, as well as electrical DSn/PDH interfaces.	Analyzer module supporting up to 10/10.7 Gb/s optical rates, as well as electrical DSn/PDH interfaces	Analyzer module supporting up to 10/10.7 Gb/s optical rates, as well as electrical DSn/PDH interfaces
Test Interfaces			
OTN: OTU1 (2.7 Gb/s)	OTN: OTU1 (2.7 Gb/s)	OTN: OTU1 (2.7 Gb/s), OTU2 (10.7 Gb/s)	OTN: OTU1 (2.7 Gb/s), OTU2 (10.7 Gb/s)
SONET: STS-1e, STS-3e, OC-3, OC-12, OC-48	SONET: STS-1e, STS-3e, OC-3, OC-12, OC-48	SONET: STS-1e, STS-3e, OC-3, OC-12, OC-48, OC-192	SONET: STS-1e, STS-3e, OC-3, OC-12, OC-48, OC-192
SDH: STM-0e, STM-1e, STM-0, STM-4, STM-16	SDH: STM-0e, STM-1e, STM-0, STM-4, STM-16	SDH: STM-0e, STM-1e, STM-0, STM-4, STM-16, STM-64	SDH: STM-0e, STM-1e, STM-0, STM-4, STM-16, STM-64
DSn: DS1, DS3, Dual DS1 Rx, Dual DS3 Rx	DSn: DS1, DS3, Dual DS1 Rx, Dual DS3 Rx	DSn: DS1, DS3, Dual DS1 Rx, Dual DS3 Rx	DSn: DS-1, DS-3, Dual DS1 Rx, Dual DS3 Rx
PDH: E1, E2, E3, E4	PDH: E1, E2, E3, E4	PDH: E1, E2, E3, E4	PDH: E1, E2, E3, E4
	Ethernet: 10/100/1000M and GbE		Ethernet: 10/100/1000M and GbE

GENERAL SPECIFICATIONS

		FTB-8120 and FTB-8120NG	FTB-8130 and FTB-8130NG
Weight (without transceiver)		0.9 kg (2.0 lb)	0.9 kg (2.0 lb)
Size (H x W x D)		51 mm x 76 mm x 254 mm (2 in x 3 in x 10 in)	51 mm x 76 mm x 254 mm (2 in x 3 in x 10 in)
Temperature	operating	0 °C to 40 °C (32 °F to 104 °F)	0 °C to 40 °C (32 °F to 104 °F)
	storage	–40 °C to 60 °C (–40 °F to 140 °F)	–40 °C to 60 °C (–40 °F to 140 °F)

ORDERING INFORMATION

FTB-81XX-XX-XX-XX-XX-XX-XX-XX

Model
See models listed above.

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

Rate options
155 = 155 Mb/s (OC-3/STM-1)
622 = 622 Mb/s (OC-12/STM-4)
2.5G = 2.5/2.7 Gb/s (OC-48/STM-16, OTU1)
10G = 10/10.7 Gb/s (OC-192/STM-64, OTU2) [a]

All rate enablers are included as standard for FTB-8130 and FTB-8130NG modules

Transceivers SFP Telecom [e]
FTB-8190 = Multirate (155/622 Mb/s, 2.5/2.7 Gb/s, GigE/FC/2FC) optical SFP transceiver module with LC connector; 1310 nm; short reach
FTB-8191 = Multirate (155/622 Mb/s, 2.5/2.7 Gb/s, GigE/FC/2FC) optical SFP transceiver module with LC connector; 1310 nm; intermediate reach
FTB-8192 = Multirate (155/622 Mb/s, 2.5/2.7 Gb/s, GigE/FC/2FC) optical SFP transceiver module with LC connector; 1550 nm; long reach
FTB-8193 = Multirate (155/622 Mb/s, 2.5/2.7 Gb/s, GigE/FC/2FC) optical SFP transceiver module with LC connector; 1550 nm; Intermediate reach

10Gb/s transceivers XFP Telecom [e, g]
FTB-81900 = Multirate (10/10.7 Gb/s) optical XFP transceiver module with LC connector; 1310 nm; 10 km reach
FTB-81901= Multirate(10/10.7 Gb/s) optical XFP transceiver module with LC connector; 1550 nm; 40 km reach
FTB-81902 = Multirate(10/10.7 Gb/s) optical XFP transceiver module with LC connector; 1550 nm; 80 km reach

Optical Ethernet transceivers SFP Datacom [e, f, h]
FTB-8590 = GigE/FC/2FC optical SFP transceiver module with LC connector; 850 nm; MMF, < 500 m reach
FTB-8591 = GigE/FC/2FC optical SFP transceiver module with LC connector; 1310 nm; 10 km reach
FTB-8592 = GigE/FC/2FC optical SFP transceiver module with LC connector; 1550 nm; 90 km reach

Next-Generation options [c, e]
00 = Without Next-Gen software
HO-VCAT = High-order virtual concatenation
LO-VCAT = Low-order virtual concatenation
LCAS = Link capacity adjustement scheme [c,i]
GFP-F = Generic framing procedure–framed
EoS = Ethernet-over-SONET/SDH [d, f, j]

Options [e]
G.747 [b]
DS1-FDL
DUAL RX
SMART-MODE
TCM = Tandem connection monitoring
OTU1 = OTN optical rate 2.7 Gb/s
OTU2 = OTN optical rate 10.7 Gb/s

NOTES

a. Applies only to FTB-8130 and FTB-8130NG models.
b. Enables E1/2M in DS3/45M analysis, as per ITU-T G.747 recommendation.
c. These options are available for FTB-8120NG and FTB-8130NG modules.
d. Enables Ethernet add/drop interface. This option is only applicable for FTB-8120NG and FTB-8130NG modules.
e. Multiple options can be purchased to suit the required test application.
f. SFP transceiver must be purchased with EoS software option.
g. Applies only to FTB-8130 and FTB-8130NG modules.
h. FTB-8120NG and FTB-8130NG models only.
i. Can be combined with the HO-VCAT or LO-VCAT option.
j. Can be combined with the GFP-F option.

Example: FTB-8120NG-SONET-155-622-2.5G-FTB-8190-DUAL RX-HO-VCAT

FTB-8080 SYNC ANALYZER

The FTB-8080 Synch Analyzer is a comprehensive test solution for telecom network synchronization assurance, monitoring and troubleshooting applications. It offers a full range of wander and sync testing functionalities, including graphical display of TIE, MTIE and TDEV parameters, as well as comparison to ITU/ANSI/TS standards and user-definable masks. The companion Sync View software suite allows remote data retrieval and test case setup, eliminating the need to visit test sites during prolonged monitoring periods. The FTB-8080 can be used in conjunction with an FTB-8120/8130 module to provide wander measurements up to OC-192/STM-64 rates.

For more information on the FTB-8080, please refer to its detailed product specification sheet at http://documents.EXFO.com/specsheets/FTB-8080-ang.pdf

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EXFO is certified ISO 9001 and attests to the quality of these products. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. EXFO has made every effort to ensure that the information contained in this specification sheet is accurate. All of EXFO's manufactured products are compliant with the European Union's WEEE directive. For more information, please visit www.EXFO.com/recycle. However, we accept no responsibility for any errors or omissions, and we reserve the right to modify design, characteristics and products at any time without obligation. Units of measurement in this document conform to SI standards and practices. Contact EXFO for prices and availability or to obtain the phone number of your local EXFO distributor.

For the most recent version of this spec sheet, please go to the EXFO website at http://www.EXFO.com/specs

In case of discrepancy, the Web version takes precedence over any printed literature.

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