FIBER OPTIC TRANSLATORS

2002 Product Brief

Third Millennium Engineering (TME) offers a semi-custom product line of fiber optic transmitter, receiver, and transceiver test instruments, collectively called fiber optic translators. These products are designed and made to order for customers involved with research, product development, manufacturing, deployment, operation, and maintenance of fiber optic telecom products. They provide the optics for electrical SONET/SDH, Bit Error Rate, or Agilent ParBERT™ equipment to test terrestrial, submarine, and airborne DWDM, Ethernet, Fibre Channel and other fiber optic telecom products. Some models provide transmitter and receiver optics with calibration data for use with electrical network analyzers to add O-O, E-O, and O-E test capability. Other models provide O-E-O wavelength conversion in 1R (linear analog), 2R (limiting analog), and 3R (CDR digital regeneration) configurations. See the TME Fiber Optic Trigger brochure for receiver models that provide single or multi-rate clock-recovered trigger signals for high-speed optical sampling oscilloscopes.

Instrument models are organized into fiber optic transmitters, receivers, transceivers, and specials with analog and digital combinations. Each semi-custom instrument model is configured with one or more TME standard fiber optic transmitter and/or receiver modules (and many related options) in a manual and/or GPIB, RS-232, or USB programmable, worldwide powerable, mainframe chassis. Customers can freely specify the exact model needed from literally millions of possibilities. Customers can originate and procure feasible and excellent test solutions, saving considerable money, time, space, risk, inventory, and manning. TME can modify any customized instrument at a later date if needed, as customer needs change or obsolescence occurs.

Wide Variety of Transmitter Modules

- Fixed or Tunable Laser Wavelengths
  - Single-mode (FC/SPC) 1310nM, and S, C, or L Bands (100, 50, or 25 GHz ITU Grid) Models
  - Multi-mode 850 nM and 1310 nM Models
  - Models with Output Power from –15 dBm to +10 dBm (add optical amplifier option for more power)
  - Cooled Fine Wavelength Control (DWDM) and Un-cooled Coarse Wavelength Models (CWDM, WWDM)
- Analog and Digital Models Using Direct, EA, or Lithium Niobate Modulation
- NRZ, RZ, CRZ, and Special Models with Programmable Extinction, Contrast, and Chirp Control
- Programmable Stimulated Brillouin Scattering Suppression Option (for long fiber span + optical amplifier tests)
- Programmable Channel ID Tone Generator Option (for Multi-Channel Testing)
- Output Leveling Attenuator with Optical Output Power Monitor Option (for DWDM channel matching)
- Output Variable Step Optical Attenuator and Tapped Coupler Power Monitor Options (for RX sensitivity tests)

Wide Variety of Receiver Modules

- PIN or APD Photodiode Detectors, Single-mode and Multimode Models
- Analog Outputs - Fixed Gain, Programmable Gain, Insertable Gain, AGC, or Limiter Models
- Digital Outputs - Data and Clock with Single or Multiple Rate Clock Recovery, ~Any Rate, Programmable Thresholds
- Receiver Photodiode or Tapped Coupler Power Monitor Options (makes Extinction Ratio tests possible with Agilent ParBERT™)
- Channel ID Tone Detector Read-back Option (for Multi-Channel Testing)
- Fixed, Tunable, or Lock-on Optical Channel Filter Options
- Simultaneous analog (optical eye patterns with electrical O'scope) and digital outputs (BER and sampling O'scope trigger) option
- Single or Multiple Insertable Low Pass Filters (for eye pattern mask testing)

Standard and FEC Data Rate Speeds

- Digital Rates from ~50 Mb/s to ~45 Gb/s for SONET OC-1 thru OC-768 (+ FEC) and Ethernet 1G and 10G (+ FEC)
- Analog Bandwidths from ~50 MHz to ~35 GHz

1, 2, 4, 8, or 16 Channels per Instrument

- Internally Modular TX and RX Modules, Any Mix of Module Types and Options Allowed
- Data or Data & Clock I/O, Inverting or Non-inverting Polarity, Single-Ended or Differential, AC or DC Coupling Options
- 19" Rack Mount or Bench Top Mainframe; GPIB, RS-232, or USB Controlled; Worldwide AC Powerable
- 2U to 6U High, Front Panel Mounted Optical and/or Microwave I/O Connectors, Rear Mounted or Special Connector Options

Many Special Options Offered

- Various Specialized Optical Amplifier, Attenuator, Coupler, and Power Monitor Arrangements
- Data and Clock Boost Amplifiers, Programmable Data to Clock Phase Shifter (for electrical SONET analyzers)
- Time or Wave Division Multiplexer and/or Demultiplexer, FEC Encoding and Decoding
- Optical and/or Microwave Channel Passthru, Bypass, Loop Back, and/or Selector Switches
- Special Optical or Microwave Connectors, SONET and Fibre Channel Filters, Customer Specified Components

Price and Delivery

There are literally millions of possible fiber optic translator models. Order exactly what you need! Call TME or a representative to discuss and refine your Fiber Optic Translator needs and request a quote. Terms are typically 50% due at order placement, 50% due after instrument acceptance. Delivery is typically 14 to 18 weeks ARO without expediting, depending on model and options. Visit Third Millennium Engineering at http://www.tmeplano.com for the latest information on TME products and services.

Third Millennium Engineering
Helping customers create and manufacture advanced technology products for our future

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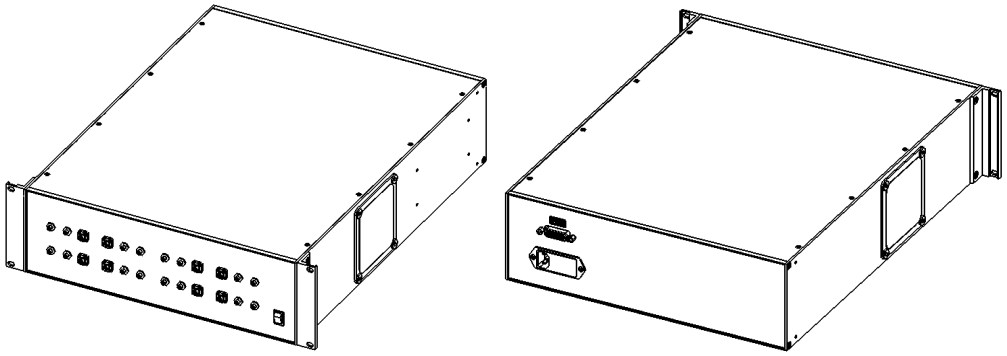

Typical Fiber Optic Translator Test Instrument (4 Channel Differential Transceiver shown)

Example Fiber Optic Translator Models

Brief Description (Single Mode Optical I/O, Single-Ended AC-Coupled Electrical I/O, Fixed Positive Polarity)	Price			Typically Used With
TX: OC3-NRZ, Direct Modulation, 1310 ±4% nM, Pout = -5 to 0 dBm RX: OC3-Analog, PIN-TIA-IGA, Pin = -36 to –3 dBm	4 Chan. $45,950	8 Chan. $75,400	16 Chan. $134,300	Agilent ParBERT™
TX: OC12-NRZ, Direct Modulation, 1310 ±4% nM, Pout = -3 to +2 dBm RX: OC12-Analog, PIN-TIA-IGA, Pin = -30 to –7 dBm	4 Chan. $49,600	8 Chan. $82,700	-	
TX: OC12-NRZ, Direct Modulation, 1310 ±4% nM, Pout = -3 to +2 dBm RX: OC192-Analog, PIN-TIA-IGA, Pin = -15 to 0 dBm	4 Chan. $111,850	8 Chan. $207,250	-	
TX: OC48-NRZ, Direct Modulation, 1310 ±4% nM, Pout = 0 to +3 dBm RX: OC48-Analog, PIN-TIA-IGA, Pin = -22 to –2 dBm	1 Chan. $33,550	2 Chan. $39,300	4 Chan. $62,100	
TX: OC48-NRZ, Direct Modulation, 1310 ±4% nM, Pout = 0 to +3 dBm RX: OC192-Analog, PIN-TIA-IGA, Pin = -15 to 0 dBm	1 Chan. $49,350	2 Chan. $67,650	4 Chan. $118,750	
TX: OC192-NRZ, LiNbO3 Modulation, 1550.52 nM or any ITU-100-C, Pout = +5 dBm min. RX: OC192-Analog, PIN-TIA-IGA, Pin = -15 to 0 dBm	1 Chan. $68,000	2 Chan. $104,000	4 Chan. $176,000	
TX: OC48-NRZ, Direct Modulation, 1550.52 nM or any ITU-100-C, Pout = 0 to +3 dBm RX: OC48-Digital, PIN-TIA-Limiter-CDR, Pin = -22 to -2 dBm, 2.488 or 2.666 Gb/s	1 Chan. $46,800	2 Chan. $60,550	4 Chan. $88,100	Bit Error Rate Tester (BERT)
TX: OC192-NRZ, LiNbO3 Modulation, 1550.52 nM or any ITU-100-C, Pout = +5 dBm min. RX: OC192-Digital, PIN-TIA-Limiter-CDR, Pin = -15 to 0 dBm, any 9.9 to 11 Gb/s	1 Chan. $93,800	2 Chan. $154,000	4 Chan. $274,500	
TX: OC192-RZ+NRZ, LiNbO3 Modulation, 1550.52 nM or any ITU-100-C, Pout = +5 dBm min.	1 Ch. $86,000		2 Ch. $139,500	
RX: OC192-Digital, PIN-TIA-Limiter-CDR, Pin = -15 to 0 dBm, Dual Rate, any 9.9 to 11 Gb/s	1 Ch. $87,250		2 Ch. $143,000	
TX: OC48-NRZ, Direct Modulation, 1550.52 nM or any ITU-100-C, Pout = 0 to +3 dBm RX: OC48-Digital, PIN-TIA-Limiter-CDR-D/C/Amps/Shift, Pin = -22 to -2 dBm, 2.488 or 2.666 Gb/s	1 Chan. $46,950	2 Chan. $60,850	4 Chan. $88,750	SONET Analyzer (electrical)
TX: OC192-NRZ, LiNbO3 Modulation, 1550.52 nM or any ITU-100-C, Pout = +5 dBm min. RX: OC192-Digital, PIN-TIA-Limiter-CDR-D&C/Amps/Shift, Pin = -15 to 0 dBm, any 9.9 to 11 Gb/s	1 Chan. $102,750	2 Chan. $172,000	4 Chan. $310,250	

Example Options, per channel prices (many others available)

Model Options	Price
TX/RX Channel ID	$2,500
TX SBS Suppression	$1,250
TX Optical Output Leveling – OC192	$7,000
TX Alternate Coarse Wavelength – OC3, 1550 ±2% nM	$1,350
TX Alternate Coarse Wavelength – OC12, 1550 ±2% nM	$150
TX Alternate Coarse Wavelength – OC48, 1550 ±2% nM	$2,000
TX/RX Differential Electrical I/O – OC1 thru OC48	$450

Model Options	Price
TX/RX Differential Electrical I/O – OC192	$12,500
TX Tunable Wavelength – OC192, whole C Band	$25,000
TX Alternate ITU-100 Fixed Wavelength – L Band	$250
TX Alternate ITU-50 Fixed Wavelength – C or L Band	$1,250
RX Fixed Optical Channel Filter	$2,400
RX Tunable Optical Channel Filter	$15,000
RX Lock-On Optical Channel Filter	$22,500

Abbreviations: TX = Transmitter Section, RX = Receiver Section, OC3 = 155 Mb/s or 120 MHz min, OC12 = 622 Mb/s or 415 MHz min, OC48 = 2.5 Gb/s or 1.5 GHz min, OC192 = 10 Gb/s or 8 GHz min., NRZ = Digital Non-Return to Zero, ITU-100-C = 100 GHz ITU Grid in C-band (~1528-1565 nM), PIN = PIN Photodiode, TIA = Trans-impedance Amplifier, IGA = 20 dBm Insertable Gain Amplifier, CDR = Clock-Data Recovery, D/C/Amps/Shift = Data to Clock phase shifter and boost amplifiers. **Note:** Listed prices (USD) and specifications may change without notice, made firm upon quote.

OTHER TME PRODUCTS

All TME semi-custom functional test instruments are GPIB, RS-232, or USB programmable, worldwide powerable, and ESD compliant.

- **FEC TRANSLATORS:** Electronic transmitter, receiver, and transceiver test instruments used for Forward Error Correction (FEC) of 2.5, 10, and 40 Gb/s telecom signals. 1 to 4 channels models offered for ~10 Gb/s SONET/SDH or Ethernet to G.975, G.709, or SuperFEC data rates.
- **FIBER OPTIC SPANS:** Programmable chromatic dispersion using one or more single mode fiber types, dispersion compensating fiber, dispersion compensators, optical switches, optical amplifiers, optical filters, etc. Programmable “telecom superhighway in a box”!
- **FIBER OPTIC TRIGGERS:** Fiber optic sampling oscilloscope trigger test instruments for 850, 1310, or 1550 nM. Models with 1 to 6 separate triggers, any rate between 9.5 Gb/s and 11.5 Gb/s or < 3 Gb/s. All-optical clock recovery models developed on request for > ~39 Gb/s trigger rates.
- **TELECOM SWITCH MATRICES:** Multi-channel, telecom specific RF, microwave, and optical switch matrices. Routes fiber optic, microwave, RF, DS3, DS1 signals between product and test equipment. Channel loop-back, daisy chain, daisy bypass, float, terminate, short, test access modes.
- **ELECTRONIC TRANSLATORS:** convert, split, or select one or more signals between common single-ended and differential 50, 75, and 100 ohm analog coax test equipment I/O and/or digital CMOS, TTL, ECL, and other logic levels and DS1, DS3, and other telecom formats.
- **“MR. HORIZON” FUNCTIONAL TEST FIXTURES:** Flexible, economical, recyclable functional test fixturing system, standardizes ~75%. Fixture quick-connects to a base with multiple DC power supplies, digital/analog I/O, fiber optics/RF/microwave I/O, pneumatics, and temperature control.
- **FULL CUSTOM PRODUCTS:** Technical and business consulting, multi-disciplinary engineering and design, low volume manufacturing and construction, system integration. Product Design, Prototype, and Pre-Production - hybrids, MCMs, sub-assemblies, modules, equipment, systems. Expertise with fiber optic, electronic, RF, microwave, sensors, analog, digital, interface, power, transmission lines, thermal, EMI/RFI, mechanical design, packaging, pcb assemblies, advanced packaging and technologies, etc. Functional Test Systems – consoles, fixtures (single or multiple head, precision, multi-technology, etc.), custom and commodity equipment, console-fixture interfaces, software, cabling, etc. for research, product development, or manufacturing.