

Optical Transmitter and Receiver

► OI1125 • OI2125



A High-performance Optical Interface for Bit Error Rate Testing of Optical Systems, Subsystems and Components up to 12.5 Gb/s

The Tektronix high-performance OI1125 E/O transmitter and OI2125 O/E receiver offer a simple and cost-effective solution for generating and receiving SONET/SDH compliant optical signals for bit error rate (BER) testing and optical signal analysis up to 12.5 Gb/s. Both include a remote port for easy integration and remote monitoring and control in a test system environment. Users can completely control instrument settings, monitor instrument status and access additional features through the remote port.

Transmitter Generates SONET/SDH Compliant Optical Waveforms up to 12.5 Gb/s for Testing Optical Subsystems and Components

Using the internal 1550 nm DFB laser or an external C-band tunable laser, the OI1125 is excellent for generating optical signals modulated by a high-performance pattern generator and is designed so most commercial generators connect directly to the modulation input.

The input voltage range (250 mV to 1.5 V) accommodates most commercial pattern generators for bit error ratio (BER) testing of optical components and receiver testing. The adjustable extinction ratio allows testing the receiver sensitivity at worst-case conditions without complex test setups. The OI1125 also generates optical signals for optical signal analysis of components, systems and subsystems using a CSA8000 sampling oscilloscope.

Receiver Clock Recovery and Multi-data Rate Support Simplify Testing of High-performance Optical Transmitters, Laser Diodes, Optical Components and Fiber Loops

The OI2125 O/E Receiver receives modulated optical signals up to 12.5 Gb/s from transmission systems, including SONET/SDH compatible systems, and converts them to electrical signals for further testing by equipment such as a bit error rate tester (BERT). The OI2125 electrical output can be connected

► Features & Benefits

OI1125 E/O Transmitter

Generates SONET/SDH Compliant Optical Waveforms up to 12.5 Gb/s

Internal DFO Laser at 1550.9 nm

Adjustable Extinction Ratio from 5 dB to >12 dB (>12 dB nominal) to Test with Worst-case Conditions

Accepts a Wide Range of Input Voltage Levels from 0.25 to 1.5 V_{p-p}

Remote Operation and Monitoring

OI2125 O/E Receiver

High Performance Receiver Supports Data Rates up to 12.5 Gb/s

User-installable Modules for Clock Recovery at 10.664 Gb/s, 9.953 Gb/s, 2.666 Gb/s, 2.488 Gb/s, 622 Mb/s and 155 Mb/s Data Rates with a Single O/E Receiver

Broad Wavelength from 1100 to 1620 nm

High Sensitivity (-16 dBm) to Detect Low-level Optical Input Signals

Amplified Electrical Output to Connect Directly to Most Commercial Error Analyzers

► Applications

Bit Error Rate Testing

Optical Receiver and Transmitter Testing

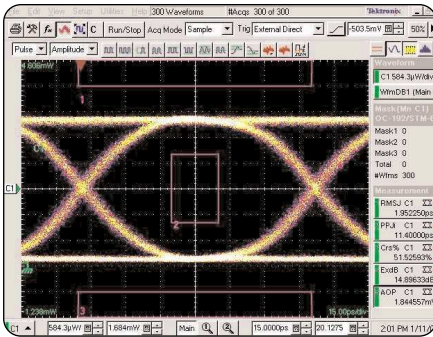
Optical Component and Fiber Loop Testing

Optical Signal Analysis

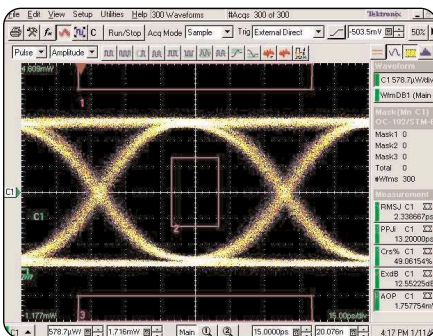
Remote Operation for System Integration

Optical Transmitter and Receiver

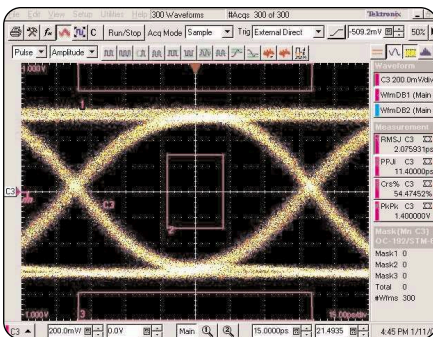
► OI1125 • OI2125



► OI1125 eye diagram at 9.953 Gb/s with OC-192 mask.



► OI1125 eye diagram at 12.5 Gb/s with scaled OC-192 mask.



► OI2125 eye diagram at 9.953 Gb/s with an OC-192 mask.

directly to most commercial error analyzers, and does not require an external amplifier. The data and clock output voltage ranges (0.5 to 1.5 V_{p-p}) make the OI2125 an excellent optical interface for most commercial error analyzers.

► OI1125 E/O Transmitter Specifications

Specification	Min	Typ	Max	Units	Comments
Data Rate* ¹	2.4		12.5	Gb/s	
Data Input Voltage	0.25		1.5	V_{p-p}	
Int. (DFB) Wavelength	1550.82	1550.92	1551.02	nm	± 1 nm adjustment range
Ext. (Modulator) Wavelength Range* ²	1530		1565	nm	
Input Power	+ 5		+ 12	dBm	
Extinction Ratio	12			dB	Up to OC-192
	10			dB	Rates > OC-192
Adjustable Extinction Ratio* ³	< 5		> 12	dB	(typical)
Peak-to-peak Jitter		15	0.15	UI	Up to OC-192
			18	ps	Rates > OC-192
Random Jitter			0.02 UI		2 ps_{RMS}
			up to OC-192		Rates > OC-192
Output Power	+ 0	+ 2	+ 4	dBm	Using the internal laser
Insertion Loss			8	dB	
Percent Crossing	45		55	%	
Eye Mask Testing* ⁴					GR-1377-CORE GR-253-CORE

*¹Data rates down to 622 Mb/s are achievable, but specifications are not guaranteed at rates below 2.4 Gb/s.

*²Wavelength range from 1565 nm to 1600 nm is achievable, but specifications are not guaranteed above 1565 nm.

*³The range of adjustment for the extinction ratio may vary from unit to unit, but is typically 5 dB to > 12 dB. The OI1125 is calibrated with the adjustable extinction ratio disabled. Specifications are guaranteed at the calibrated (fixed) position.

*⁴No mask hits with 5% mask margin for OC-48, OC-192, and 12.5 Gb/s (scaled OC-192 mask).

With the optional OM1420 and OM1200 modules, the receiver can extract the clock on signals up to 10.664 Gb/s (OC-192 FEC). The recovered clock signal can then be used to trigger a CSA8000 sampling oscilloscope or serve as the clock input to an error analyzer. Used with the Tektronix TDS/CSA8000 series sampling oscilloscope and a pattern generator, the OI1125 can create modulated optical signals for high-speed optical communications testing, extinction ratio measurements, eye-pattern analysis and optical signal analysis. The optical signal is passed through the DUT and received by the appropriate 80Cxx sampling head on the oscilloscope.

A single receiver with the OM1420 and

OM1200 modules supports a broad range of signal bit rates. The OM1420 OC-192 Dual-rate Clock Recovery Module supports standard OC-192 (9.953 Gb/s) and OC-192 FEC (10.664 Gb/s). The OM1200 OC-48 Multi-rate Clock Recovery Module supports OC-48 (2.488 Gb/s), OC-48 FEC (2.666 Gb/s), OC-12 (622 Mb/s) and OC-3 (155 Mb/s) rates.

▶ OI2125 O/E Receiver Specifications

Specification	Min	Typ	Max	Units	Comments
Data Rate	2.4		12.5	Gb/s	
Wavelength (typical) ^{*5}	1100		1620	nm	
Input Power	-16		+0	dBm	
Loss of Signal Threshold	-27	-25	-23	dBm	
Input Fiber Size		9		μm	
Data Output Voltage	0.05		1.5	V _{p-p}	-8 to +0 dBm input power
	0.2		1.5	V _{p-p}	-16 to -8 dBm input power
Upper Bandwidth	7.5			GHz	
Lower Bandwidth			50	MHz	
Jitter (rms)			1.5	ps _{RMS}	-8 to +0 dBm input power
Percent Crossing	45		55	%	
Eye Mask Testing ^{*6}					GR-1377-CORE GR-253-CORE

^{*5}Manufacturer specifications for the photodiode are 1100 to 1620 nm. The OI2125 specifications are tested and verified for 1530 to 1565 nm, but are not verified beyond this range.

^{*6}No mask hits with 5% mask margin for OC-48, OC-192 and 12.4 Gb/s (scaled OC-192 mask) at an input power of 0 to -8 dBm. For input power levels down to -16 dBm, a minimum BER of 10⁻¹² is typical for rates up to OC-192, and 10⁻¹⁰ for rates above OC-192.

▶ Characteristics

Environment

Temperature –
Operating: 0°C to +40°C.
Nonoperating: -40°C to +71°C.

Humidity –
Operating: 5% to 95% RH (up to +30°C).
5% to 45% RH (30°C to +50°C).
Nonoperating: 5% to 95% RH (up to +30°C).
5% to 45% RH (30°C to +50°C).

Altitude –
Operating: Up to 3000 m (10,000 ft.).
Nonoperating: Up to 12,000 m (40,000 ft.).

EMC Compliance – Meets or exceeds EN55011 Class A Radiated and Conducted Emissions; FCC47 CFR, Part 15, Subpart B, Class A.

Safety – UL3111-1; CSA1010.1; EN61010-1; IEC61010-1.

Power Supply

Rating – 100 to 240 VAC.
Range – 90 to 265 VAC.
Maximum Power and Current – 40 W Max.
Frequency – 47 to 63 Hz.

I/O Interface

OI1125 E/O Transmitter –
Laser In (Optical) FC/APC PMF.
Modulator Data In (Electrical SMA).
Low-Frequency Direct Modulation (Electrical SMA).
Laser Out (Optical) FC/APC PMF.
Modulator Out (Optical) FC/APC: Universal.
Remote Interface/Laser Interlock (DB25).
OI2125 O/E Receiver –
Optical Input (Optical) FC: Universal.
Data Out (Electrical SMA).
Attenuated Data Out (Electrical SMA).
Remote Interface (DB25).

Physical Characteristics

OI1125 E/O TRANSMITTER

Dimensions	mm	in.
Height	45	1.75
Width	204	8
Depth	331	13
Weight	kg	lbs.
Instrument only	1.72	3.79

OI2125 O/E RECEIVER

Dimensions	mm	in.
Height	45	1.75
Width	204	8
Depth	331	13
Weight	kg	lbs.
Instrument only	1.91	4.20
With slot cover installed	2.09	4.62
With OM1420 installed	2.26	4.99
With OM1200 installed	2.26	4.99

SHIPPING WEIGHT WITH PACKAGING

Instrument/Module	kg	lbs.
OI1125	5.12	11.39
OI2125	5.49	12.22

RACKMOUNT

Dimensions	mm	in.
Height	89	3.5
Width	483	19
Depth	477	18.75

▶ Ordering Information

OI1125 E/O Transmitter

Instrument – OI1125.

Service Options

Opt. C3 – 3 years of calibration services.
Opt. C5 – 5 years of calibration services.
Opt. R3 – Repair warranty extended to cover 3 years.
Opt. R5 – Repair warranty extended to cover 5 years.
Opt. D1 – Calibration data report.
Opt. D3 – Calibration data report; must order with C3.
Opt. D5 – Calibration data report, must order with C5.

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Included Accessories

071-1052-00 – User Reference: English only.
006-8018-01 – Important Documents Folder.
Certificate of Calibration: NIST, MIL-STD-45662A and ISO Calibration Certificate.
Placed inside “Important Documents Folder.”
119-5155-00 – Optical Adapter (FC).
015-1022-01 – Terminator (1 each).
131-7350-00 – Laser Safety Interlock.
174-4664-00 – Polarization Maintaining Single-mode Fiber Cable (FC/APC) (< 1 ft. long).
174-4727-00 – Optical Cable (FC/APC-FC/PC) (2 m long).
015-0561-00 – Electrical Cable, SMA, (1 m long).
006-8217-00 – Optical Cleaning Kit.

Recommended Accessories

174-4725-00 – Optical Cable, Polarization Maintaining, (FC/APC Narrow Key) (2 m long).
TVGF13 – Dual Rackmount Kit.
119-5115-00 – FC/APC Optical Adapter.
119-5888-00 – ST/APC Optical Adapter.
119-5116-00 – SC/APC Optical Adapter.
119-5887-00 – DIN/APC 47256 Optical Adapter.

Power Cord Options

A1 – Universal European power cord (220 V, 50 Hz).
A2 – UK power cord (240 V, 50 Hz).
A3 – Australia power cord (240 V, 50 Hz).
A5 – Switzerland power cord (220 V, 50 Hz).
AC – China power cord (240 V, 50 Hz).
A99 – No power cord.

OI2125 O/E Receiver

Instrument – OI2125.

Service Options

Opt. C3 – 3 years of calibration services.
Opt. C5 – 5 years of calibration services.
Opt. R3 – Repair warranty extended to cover 3 years.
Opt. R5 – Repair warranty extended to cover 5 years.
Opt. D1 – Calibration data report.
Opt. D3 – Calibration data report; must order with C3.
Opt. D5 – Calibration data report, must order with C5.

Included Accessories

071-1053-00 – User Reference: English only.
006-8018-01 – Important Documents Folder.
Certificate of Calibration: NIST, MIL-STD-45662A and ISO Calibration Certificate.
Placed inside “Important Documents Folder.”
119-5155-00 – Optical Adapter (FC).
015-1022-01 – Terminator (2 each).
174-3922-00 – Optical Cable (FC/PC-FC/PC) (2 m long).
015-0561-00 – Electrical Cable, SMA, (1 m long).
006-8217-00 – Optical Cleaning Kit.
119-6690-00 – Module Assy, Clock Recovery Slot Cover.

Recommended Accessories

OM1420 – OC-192 Dual-rate Clock Recovery Module.
OM1200 – OC-48 Multi-rate Clock Recovery Module.
TVGF13 – Dual Rackmount Kit.
131-7368-00 – Optical Attenuator, 5 dB.
119-5115-00 – FC/PC Optical Adapter.
119-5888-00 – ST/PC Optical Adapter.
119-5116-00 – SC/PC Optical Adapter.
119-5887-00 – DIN/PC 47256 Optical Adapter.
119-4517-00 – SMA 2.5 Optical Adapter.
119-4556-00 – Diamond Optical Adapter.
119-4557-00 – SMA Optical Adapter.
119-4558-00 – Diamond 3.5 Optical Adapter.

Power Cord Options

A1 – Universal European power cord (220 V, 50 Hz).
A2 – UK power cord (240 V, 50 Hz).
A3 – Australia power cord (240 V, 50 Hz).
A5 – Switzerland power cord (220 V, 50 Hz).
AC – China power cord (240 V, 50 Hz).
A99 – No power cord.



Contact Tektronix:

ASEAN Countries & Pakistan (65) 6356 3900

Australia & New Zealand (65) 6356 3900

Austria +43 2236 8092 262

Belgium +32 (2) 715 89 70

Brazil & South America 55 (11) 3741-8360

Canada 1 (800) 661-5625

Central Europe & Greece +43 2236 8092 301

Denmark +45 44 850 700

Finland +358 (9) 4783 400

France & North Africa +33 (0) 1 69 86 80 34

Germany +49 (221) 94 77 400

Hong Kong (852) 2585-6688

India (91) 80-2275577

Italy +39 (02) 25086 1

Japan (Sony/Tektronix Corporation) 81 (3) 3448-3111

Mexico, Central America & Caribbean 52 (55) 56666-333

The Netherlands +31 (0) 23 569 5555

Norway +47 22 07 07 00

People's Republic of China 86 (10) 6235 1230

Poland +48 (0) 22 521 53 40

Republic of Korea 82 (2) 528-5299

Russia, CIS & The Baltics +358 (9) 4783 400

South Africa +27 11 254 8360

Spain +34 (91) 372 6055

Sweden +46 8 477 6503/4

Taiwan 886 (2) 2722-9622

United Kingdom & Ire +44 (0) 1344 392400

USA 1 (800) 426-2200

For other areas contact Tektronix, Inc. at: 1 (503) 627-7111

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