

Optical Sampling Modules

▶ 80C01 • 80C02 • 80C07B • 80C08C • 80C10 • 80C11



CSA/TDS8000B Series Sampling Oscilloscope Optical Modules

The CSA/TDS8000B Series Sampling Oscilloscopes, when configured with one or more optical sampling modules, provide complete optical test solutions for Telecom (155 Mb/s to 43.018 Gb/s) or Datacom (Fibre Channel, Gigabit Ethernet, 10 GbE and InfiniBand) applications, as well as general purpose optical component testing. Each optical module includes all the elements necessary for optical testing:

- ▶ Optical to electrical converter
- ▶ Average power monitor
- ▶ One or more reference receiver filters
- ▶ A full bandwidth optical path
- ▶ A low-noise electrical sampler
- ▶ Optional clock recovery
- ▶ Universal optical input connector

80C01 Multi-rate Telecom Sampling

Module – The 80C01 module supports waveform conformance testing of long-wavelength (1100 to 1650 nm) signals at 622, 2488 Mb/s and 9.953 Gb/s as well as general-purpose testing with up to 20 GHz optical bandwidth. With its clock recovery option, the 80C01 provides testing solutions for 622 and 2488 Mb/s telecom applications.

80C02 High-performance Telecom Sampling

Module – The 80C02 module is optimized for testing of long-wavelength (1100 to 1650 nm) signals at 9.953 Gb/s (SONET OC-192/SDH STM-64). With its high optical bandwidth of 30 GHz (typical), it is also well-suited for general purpose, high-performance optical component testing. The 80C02 can be optionally configured with clock recovery that supports 9.953 Gb/s telecom standards.

▶ Features & Benefits

- 10 Gb/s Telecom & Datacom
 - 80C08C Low-noise, High Optical Sensitivity and Broad Wavelength Conformance Testing for 10 GbE LAN, WAN, and FEC, 10G Fibre Channel, and 10 Gb/s Telecom Rates
 - 80C11 30 GHz Optical Bandwidth Conformance Testing and Characterization for 10 Gb/s Telecom and Datacom Standards
 - 80C08C and 80C11 Integrated Clock Recovery Supports Standard or User Defined Rate from 9.8 to 12.6 Gb/s

- 40 Gb/s Telecom
 - 80C10 Provides Highest Optical Bandwidth Capability for Performance Testing and Signal Characterization of 40 Gb/s RZ or NRZ Data Formats
 - 80C10 Provides 65 GHz Optical Bandwidth and Reference Receivers for Conformance Testing of 39.813 Gb/s (OC-768/STM-256) and 43.018 Gb/s (ITU-T G.709 FEC)
 - All 40 Gb/s Telecom Optical Sampling Modules Are Optionally Available In Bundled Module Ordering Configurations which Include a High-bandwidth Electrical Sampling Channel

- Tributary Telecom & Datacom
 - 80C07B Provides Excellent Optical Sensitivity and Broad Wavelength Test Capability
 - 80C01 and 80C07B Multi-rate Telecom Conformance Testing Solutions from 155 Mb/s (OC-3/STM-4) through 9.953 Gb/s (OC-192/STM-64) and Multi-rate Datacom Conformance Testing Solutions for Fibre Channel, Gigabit Ethernet, and InfiniBand Standards

▶ Applications

- High-speed Optical Communications Testing
- Extinction Ratio and Q-factor Measurements
- Eye-pattern and Pulse Shape Analysis
- Relaxation Oscillation Testing
- Optical Signal Analysis
- Conformance Testing
- NRZ and RZ Pulse Characterization

COMPUTING

COMMUNICATIONS

VIDEO

Optical Sampling Modules

▶ 80C01 • 80C02 • 80C07B • 80C08C • 80C10 • 80C11

80C07B Multi-rate, Datacom & Telecom Optical Sampling Module

– The 80C07B module is a broad wavelength (700 to 1650 nm) multi-rate optical sampling module optimized for testing datacom/telecom signals from 155 to 2500 Mb/s. With its amplified O/E converter design, this module provides excellent signal-to-noise performance, allowing users to examine low-power optical signals. The 80C07B can be optionally configured with clock recovery that supports 155, 622, 1063, 1250, 2125, 2488, 2500 and 2666 Mb/s rates.

80C08C Multi-rate, Datacom & Telecom Optical Sampling Module with 10 GbE Forward Error Correction

– The 80C08C module is a broad wavelength (700 to 1650 nm) multi-rate optical sampling module providing datacom rate testing for 10GbE applications at 9.953, 10.3125, 11.0957 Gb/s and 10G Fibre Channel applications at 10.51875 Gb/s. The 80C08C also provides telecom rate testing at 9.953, 10.664, and 10.709 Gb/s. With its amplified O/E converter design, this module provides excellent signal-to-noise performance and high optical sensitivity, allowing users to examine low power level optical signals. The 80C08C can be optionally configured with clock recovery options that can support any standard or user-defined rate in the continuous range from 9.8 to 12.6 Gb/s.

80C10 65 GHz 40 Gb/s Optical Sampling Module with 43 Gb/s ITU-T G.709 Forward Error Correction

– The 80C10 module provides integrated and selectable reference receiver filtering, enabling conformance testing at either 1310 nm or 1550 nm for 39.813 Gb/s (OC-768/STM-256) and 43.018 Gb/s (43 Gb/s ITU-T G.709 FEC) rates. In addition to the filter rates, the user may also choose selectable bandwidths of 30 GHz or 65 GHz for optimal noise vs. bandwidth performance for accurate signal characterization.

80C11 Multi-rate, Datacom & Telecom Optical Sampling Module

– The 80C11 module is a long wavelength (1100 to 1650 nm) multi-rate optical sampling module optimized for testing 10 Gb/s datacom and telecom standard rates at 9.953, 10.3125, 10.51875, 10.664, 10.709, and 11.0957 Gb/s. With its high optical bandwidth of up to 30 GHz (typical) it is well-suited for general purpose high-performance 10 Gb/s optical component testing. The 80C11 can be optionally configured with clock recovery options that can support any standard or user-defined rate in the continuous range from 9.8 to 12.6 Gb/s.

▶ **Characteristics**

▶ **Optical Sampling Module Characteristics (Refer to Optical Sampling Module User Manual for more detailed information)**

	Application Type	Standard and Supported Data Filtering Rates	Number of Input Channels	Effective Wavelength Range	Calibrated Wavelengths
80C01	Tributary Telecom	OC-12/STM-4 (622 Mb/s), OC-48/STM-16 (2.488 Gb/s), OC-192/STM-64 (9.953 Gb/s)	1	1100 nm to 1650 nm	1310 nm and 1550 nm (± 20 nm)
80C02	10 Gb/s Telecom	OC-192/STM-64 (9.953 Gb/s) 10GBASE-W (9.953 Gb/s)	1	1100 nm to 1650 nm	1310 nm and 1550 nm (± 20 nm)
80C07B	Tributary Datacom/Telecom	Standard Included: OC-48/STM-16 (2.488 Gb/s), InfiniBand, 2 GbE (2.500 Gb/s); Optional (choose any two): OC-3/STM-1 (155 Mb/s), OC-12/STM-4 (622 Mb/s), Fibre Channel (1.063 Gb/s), GbE (1.250 Gb/s), 2G Fibre Channel (2.125 Gb/s)	1	700 nm to 1650 nm	780 nm, 850 nm, 1310 nm, and 1550 nm (± 20 nm)
80C08C	10 Gb/s Datacom/Telecom	OC-192/STM-64 (9.953 Gb/s), 10GBASE-W (9.953 Gb/s), 10GBASE-R (10.31 Gb/s), 10G Fibre Channel (10.52 Gb/s), ITU-T G.975 FEC (10.664 Gb/s), ITU-T G.709 (10.709 Gb/s), 10 GbE FEC (11.1 Gb/s)	1	700 nm to 1650 nm	780 nm, 850 nm, 1310 nm, and 1550 nm (± 20 nm)
80C10	40 Gb/s Telecom	OC-768/STM-256 (39.813 Gb/s), ITU-T G.709 FEC (43.018 Gb/s)	1	1310 nm and 1550 nm	1310 nm and 1550 nm (± 20 nm)
80C11	10 Gb/s Datacom/Telecom	OC-192/STM-64 (9.953 Gb/s), 10GBASE-W (9.953 Gb/s), 10GBASE-R (10.31 Gb/s), 10G Fibre Channel (10.52 Gb/s), ITU-T G.975 FEC (10.664 Gb/s), ITU-T G.709 (10.709 Gb/s), 10 GbE FEC (11.1 Gb/s)	1	1100 nm and 1650 nm	1310 nm and 1550 nm (± 20 nm)

Optical Sampling Modules

► 80C01 • 80C02 • 80C07B • 80C08C • 80C10 • 80C11

► Optical Sampling Module Characteristics (continued)

	Clock Recovery (Optional)	Clock Recovery Outputs	Unfiltered Optical Bandwidth* ¹	Absolute Maximum Nondestructive Optical Input	Internal Fiber Diameter
80C01	Option CR: 622 Mb/s, 2.488 Gb/s	±Clock, ±Data	20 GHz	5 mW average; 10 mW peak power at wavelength of highest relative responsivity	9 μm/125 μm single-mode
80C02	Option CR: 9.953 Gb/s	Clock, Clock/16, Data	28 GHz	5 mW average; 10 mW peak power at wavelength of highest relative responsivity	9 μm/125 μm single-mode
80C07B	Option CR1: 155 Mb/s, 622 Mb/s, 1.063 Gb/s, 1.250 Gb/s, 2.125 Gb/s, 2.488 Gb/s, 2.500 Gb/s, 2.666 Gb/s	±Clock, ±Data	<i>2.5 GHz</i>	5 mW average; 10 mW peak power at wavelength of highest responsivity	62.5 μm/125 μm multi-mode
80C08C	Option CR1: 9.953 Gb/s, 10.31 Gb/s; Option CR2: 10.31 Gb/s, 10.52 Gb/s; Option CR4: Continuous from 9.8 Gb/s to 12.6 Gb/s	Clock, Clock/16	<i>10 GHz</i>	1 mW average; 10 mW peak power at wavelength of highest responsivity	Single-mode and multi-mode fibers up to core diameter of 62.5 μm
80C10	Future Upgradeable	Future	<i>65 GHz</i>	20 mW average; 60 mW peak power at wavelength of highest relative responsivity	9 μm/125 μm single-mode
80C11	Option CR1: 9.953 Gb/s; Option CR2: 9.953 Gb/s, 10.664 Gb/s; Option CR3: 9.953 Gb/s, 10.709 Gb/s; Option CR4: Continuous between 9.8 Gb/s to 12.6 Gb/s	CR1: Clock, Clock/16, Data; CR2, CR3, CR4: Clock, Clock/16	28 GHz	5 mW average; 10 mW peak power at wavelength of highest responsivity	9 μm/125 μm single-mode

*¹ Values shown are warranted unless printed in an italic typeface which represents a typical value.

▶ Optical Sampling Module Characteristics (continued)

	Optical Return Loss	Fiber Input Accepted	RMS Optical Noise (typical)	RMS Optical Noise (maximum)	Independent Channel Deskew
80C01	>30 dB	single-mode	8.0 μ W at 622 Mb/s, 2.488 Gb/s, 9.953 Gb/s, 12.5 GHz; 15.0 μ W at 20 GHz	12.0 μ W at 622 Mb/s, 2.488 Gb/s, 9.953 Gb/s, 12.5 GHz; 25 μ W at 20 GHz	Standard
80C02	>30 dB	single-mode	6.0 μ W at 9.953 Gb/s, 12.5 GHz; 10.0 μ W at 20 GHz; 15.0 μ W at 30 GHz	10.0 μ W at 9.953 Gb/s, 12.5 GHz mode; 15 μ W at 20 GHz; 30 μ W at 30 GHz	Standard
80C07B	>14 dB (multi-mode) >24 dB (single-mode)	single- or multi-mode	0.50 μ W at 155 Mb/s, 622 Mb/s, 1063 Mb/s, 1250 Mb/s; 0.70 μ W at 2.488/2.500 Gb/s	1.0 μ W at 155 Mb/s, 622 Mb/s, 1063 Mb/s, 1250 Mb/s; 1.5 μ W at 2.488/2.500 Gb/s	Standard
80C08C	>14 dB (multi-mode) >24 dB (single-mode)	single- or multi-mode	1.7 μ W at all filter rates	3.0 μ W at all filter rates	Standard
80C10	>30 dB	single-mode	40 μ W at 39.813 Gb/s, 43.018 Gb/s (1550 nm); 75 μ W at 39.813 Gb/s, 43.018 Gb/s (1310 nm); 30 μ W at 30 GHz mode (1550 nm); 55 μ W at 30 GHz mode (1310 nm); 85 μ W at 65 GHz mode (1550 nm); 150 μ W at 65 GHz mode (1310 nm)	60 μ W at 39.813 Gb/s, 43.018 Gb/s (1550 nm); 110 μ W at 39.813 Gb/s, 43.018 Gb/s (1310 nm); 50 μ W at 30 GHz (1550 nm); 90 μ W at 30 GHz (1310 nm); 120 μ W at 65 GHz (1550 nm); 220 μ W at 65 GHz (1310 nm)	Standard
80C11	>30 dB	single-mode	5.5 μ W at all filter rates; 10.0 μ W at 20 GHz 20.0 μ W at 30 GHz	8.0 μ W at all filter rates; 14.0 μ W at 20 GHz 30.0 μ W at 30 GHz	Standard

Optical Sampling Modules

► 80C01 • 80C02 • 80C07B • 80C08C • 80C10 • 80C11

► Optical Sampling Module Characteristics (continued)

	Offset Capability	Power Meter	Power Meter Range	Power Meter Accuracy	Mask Test Optical Sensitivity**2
80C01	Standard	Standard	+4 dBm to -30 dBm	5% of reading	-8 dBm at 622 Mb/s, 2.488 Gb/s, 9.953 Gb/s; -5.0 dBm at 20 GHz
80C02	Standard	Standard	+4 dBm to -30 dBm	5% of reading	-9 dBm at 9.953 Gb/s; -7 dBm at 20 GHz; -4 dBm at 30 GHz
80C07B	Standard	Standard	+4 dBm to -30 dBm	5% of reading	-22 dBm at 155 Mb/s, 622 Mb/s; -20 dBm at 2488/2500 Mb/s
80C08C	Standard	Standard	0 dBm to -30 dBm	5% of reading	-15 dBm at all filter rates
80C10	Standard	Standard	+13 dBm to -21 dBm	5% of reading	0 dBm at 39.813 Gb/s, 43.018 Gb/s; 0 dBm at 30 GHz; +3 dBm at 65 GHz
80C11	Standard	Standard	+4 dBm to -30 dBm	5% of reading	-10 dBm at all filter rates; -7 dBm at 20 GHz; -4 dBm at 30 GHz

** Smallest power level for mask test. Values represent theoretical typical sensitivity of NRZ eyes for competitive comparison purposes. Assumes instrument peak-peak noise consumes most of the mask margin.

Physical Characteristics for Electrical Sampling Modules

	Dimensions (mm/inches)			Weight (kg/lb)
	Width	Height	Depth	Net
80C01	165/6.5	25/1.0	305/12.0	<2.61/<5.75
80C02	165/6.5	25/1.0	305/12.0	<2.61/<5.75
80C07B	165/6.5	25/1.0	305/12.0	<1.36/<3.0
80C08C	165/6.5	25/1.0	305/12.0	<1.22/<2.7
80C10	165/6.5	25/1.0	305/12.0	>2.61/>5.75
80C11	165/6.5	25/1.0	305/12.0	<1.22/<2.7

► Optical Module Application Summary

Filter Rate	Optical Sampling Module
SONET/SDH	
155 Mb/s (OC-3/STM-1)	80C07B
622 Mb/s (OC-12/STM-4)	80C01, 80C07B
2.488 Gb/s (OC-48/STM-16)	80C01, 80C07B
9.953 Gb/s (OC-192/STM-64)	80C01, 80C02, 80C08C, 80C11
10.66423 Gb/s (ITU-T G.975 FEC)	80C08C, 80C11
10.709225 Gb/s (ITU-T G.709 FEC)	80C08C, 80C11
39.813 Gb/s (OC-768/STM-256)	80C10
43.018 Gb/s (ITU-T G.709 FEC 43.02 Gb/s)	80C10
Gigabit Ethernet	
1.250 Gb/s (GbE)	80C07B
2.500 Gb/s (2GbE)	80C07B
9.95328 Gb/s (10GBASE-W)	80C08C, 80C11, 80C02
10.3125 Gb/s (10GBASE-R)	80C08C, 80C11
11.0957 Gb/s (10 GbE FEC)	80C08C, 80C11
Fibre Channel	
1.063 Gb/s (FC)	80C07B
2.125 Gb/s (2G FC)	80C07B
10.51875 Gb/s (10G FC)	80C08C, 80C11
InfiniBand	
2.500 Gb/s (InfiniBand)	80C07B

► Ordering Information

80C01

Optical Sampling Module.

Includes: User manual, FC/PC optical connector.

Frequency response curves for 622, 2488 and 9953 Mb/s filter rates.

Opt. CR – 622 and 2488 Mb/s clock recovery.

80C02

Optical Sampling Module.

Includes: User manual, FC/PC optical connector.

Frequency response curves for 9.953 Gb/s filter rates.

Opt. CR – 9.953 Gb/s clock recovery.

80C07B

Multi-rate Datacom & Telecom Optical Sampling Module.

Includes: User Manual, FC/PC Optical Connector.

Frequency response curves for 2.488, 2.500 Gb/s data rates plus selected filter option data rates.

Opt. CR1 – 155/622/1063/1250/2125/2488/2500/2666 Mb/s clock/data recovery.

User must select any one (1) of the following filter options:

Opt. F1 – 155, 622 Mb/s.

Opt. F2 – 155, 1063 Mb/s.

Opt. F3 – 155, 1250 Mb/s.

Opt. F4 – 155, 2125 Mb/s.

Opt. F5 – 622, 1063 Mb/s.

Opt. F6 – 622, 1250 Mb/s.

Opt. F7 – 622, 2125 Mb/s.

Opt. F8 – 1063, 1250 Mb/s.

Opt. F9 – 1063, 2125 Mb/s.

Opt. F10 – 1250, 2125 Mb/s.

80C08C

Multi-rate Datacom & Telecom Optical Sampling Module.

Includes: User Manual, FC/PC optical connector.

Frequency response curves for 9.953, 10.31, 10.52, 10.66, 10.71, 11.1 Gb/s filter rates.

Opt. CR1 – 9.953, 10.31 Gb/s clock recovery.

Opt. CR2 – 10.31, 10.52 Gb/s clock recovery.

Opt. CR4 – Continuous rate clock recovery supporting any standard or user-definable rate in the range from 9.8 to 12.6 Gb/s.

80C10

Multi-rate Optical Sampling Module.

Includes: User manual, FC/PC optical connector.

Frequency response curves for 39.813 and 43.108 Gb/s filter rates.

80C10E1 – Bundled ordering configuration includes 80C10 plus one 80E06 single-channel 70+ GHz electrical module.

80C11

Multi-rate Datacom & Telecom Optical Sampling Module.

Includes: User Manual, FC/PC optical connector.

Frequency response curves for 9.953, 10.31, 10.52, 10.66, 10.71, 11.1 Gb/s filter rates.

Opt. CR1 – 9.953 Gb/s clock recovery.

Opt. CR2 – 9.953, 10.66 Gb/s clock recovery.

Opt. CR3 – 9.953, 10.71 Gb/s clock recovery.

Opt. CR4 – Continuous rate clock recovery supporting any standard or user-definable rate in the range from 9.8 to 12.6 Gb/s.

Service

Opt. C3 – Three years of Calibration Service.

Opt. C5 – Five years of Calibration Service.

Opt. D1 – Calibration data report.

Opt. D3 – Three years of calibration data reports (requires Opt. C3).

Opt. D5 – Five years of calibration data reports (requires Opt. C5).

Opt. R3 – Extended repair warranty to three years.

Opt. R5 – Extended repair warranty to five years.

Optical Connector Accessories

While the FC/PC connector is standard with the 8000 Series optical sampling modules, the input connector type can be interchanged with any of the following standard adapters:

ST/PC – Order 119-4513-00.

D4/PC – Order 119-4514-00.

Biconic – Order 119-4515-00.

FC/APC – Order 119-5115-00.

SMA 2.5 – Order 119-4517-00.

SC/APC – Order 119-5116-00.

DIN/PC 47256 – Order 119-4546-00.

HP/PC – Order 119-4556-00.

SMA – Order 119-4557-00.

DIAMOND 3.5 – Order 119-4558-00.

Optical Sampling Modules

▶ 80C01 • 80C02 • 80C07B • 80C08C • 80C10 • 80C11

Contact Tektronix:

ASEAN / Australasia / Pakistan (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 81 (3) 3448-3010

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 & Eire +44 (0) 1344 392400

USA 1 (800) 426-2200

USA (Export Sales) 1 (503) 627-1916

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

Updated 20 September 2002

Our most up-to-date product information is available at:
www.tektronix.com

Product(s) are manufactured
in ISO registered facilities.



Copyright © 2003, Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks or registered trademarks of their respective companies.

10/03 HB/WWW

85W-15964-3