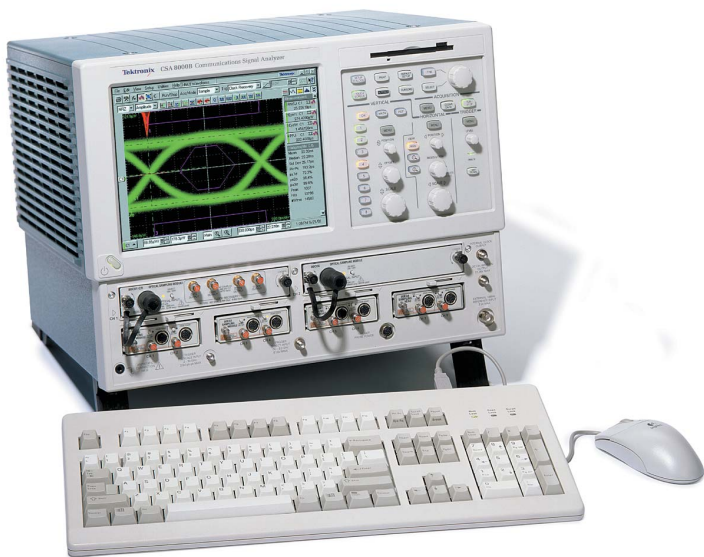


# Communications Signal Analyzer

► CSA8000B



## Communications Signal Analysis Solutions

Specifically designed for high-performance communications applications, the CSA8000B Communications Signal Analyzer is the ideal tool for design evaluation and manufacturing test of datacom and telecom components, transceiver subassemblies and transmission systems.

The CSA8000B generates measurement results, not just raw data, with time and amplitude histograms, mask testing and statistical measurements. It provides a communications-tailored measurement set that includes jitter, noise, duty cycle, overshoot, undershoot, extinction ratio, Q-factor, mean optical power and amplitude measurements for both RZ and NRZ signals.

In addition, mask testing of SDH/SONET, Gigabit Ethernet and other standards simplifies conformance testing.

A large, full color display helps you to discriminate waveform details. Color-grading of waveform data adds a third dimension, sample density, to your signal acquisitions and analyses.

### Modularity and Flexibility

The CSA8000B supports a large and growing family of optical and electrical plug-in modules. This modular architecture lets you configure the instrument with the right features for your application both now and in the future.

The available optical modules provide complete optical test solutions for both telecom (155 Mbps to 43 Gbps) and datacom (Fibre Channel, InfiniBand and Gigabit Ethernet) applications.

Each optical module includes all of the elements necessary for communications testing, including an optical to electrical converter, an average power monitor, up to five data rate filters, a full bandwidth path and a low-noise electrical sampler. In addition, clock recovery is available as an option for most optical modules.

The electrical plug-ins include a variety of modules with bandwidths up to 70+ GHz and specialized features such as Time Domain Reflectometry (TDR). High bandwidth probes are also available for constructing a total acquisition and measurement solution.

### ► Features & Benefits

Automatic Communication Measurements (RZ and NRZ)

- Q-factor
- Extinction Ratio
- Optical Power
- Signal-to-Noise Ratio
- Jitter

Wide Bandwidth (DC to 70+ GHz\*1 with up to 12.5 GHz Trigger)

Automatic ITU/ANSI Mask Testing

Normal, Infinite, Variable Persistence and Color Graded Display Modes

Intuitive User Interface

- Large Color Display (10 in.)
- MS Windows Operating System

Modular Architecture

Fast Acquisition Rate

Excellent Signal Fidelity (Jitter <800 fsec RMS - Typical)

FrameScan™ Acquisition Mode

- Isolate Data Dependent Faults
- Examine Low-power PRBS Signals
- Eliminate Random Noise and Jitter Via Averaging

### ► Applications

Manufacturing/Testing for ITU/ANSI Conformance

Designing/Verification of Telecom and Datacom Elements

\*1 Bandwidth is determined by plug-in modules and may exceed 70 GHz should higher speed modules become available in the future.

COMPUTING

COMMUNICATIONS

VIDEO

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## Superior Performance

With its industry-best horizontal timebase stability, trigger jitter, signal sensitivity and noise performance, the CSA8000B ensures the most accurate acquired signal for high-speed optical communications testing.

The CSA8000B's multi-processor architecture, with dedicated per channel digital signal processors (DSP), also provides industry-best waveform acquisition rates that shorten test times.

The CSA8000B's FrameScan™ acquisition mode can be used with a variety of BERTs and/or protocol analyzers to isolate pattern dependent effects in transmitters or show the bit sequence leading up to a mask violation. FrameScan acquisition mode also allows averaging of eye diagrams. This can be used to extract a clean eye diagram from noisy low-level signals.

## 8000 Series Sampling Oscilloscope Platform

The CSA8000B is built on Tektronix' sampling oscilloscope platform that combines familiar MS Windows-based PC technologies with world-class waveform acquisition technology. This platform provides a wide array of standard instrumentation and communications interfaces (such as GPIB, Parallel Printer Port, RS-232-C and USB Serial Ports and an Ethernet LAN connection). In addition, the platform includes several mass storage devices (floppy disk, removable hard drive and CD-ROM). Gated triggering, a feature that allows the exclusion of selected time periods from being measured, is offered as an option.

Finally, because the system supports an Open Windows environment, new levels of data analysis can be done directly on the instrument using commercially available software packages.

Additionally, TekVISA™, a standard software accessory, allows the instrument to be placed under the control of software applications (e.g., LabView, LabWindows, Visual Basic, Microsoft Excel, C, etc.) running on the instrument, or on external PC workstations network connected to the instrument, without the need for a GPIB hardware interface. Plug and play drivers for LabView and other programs are also supplied.

## 8000 Series Sampling Oscilloscope Optical Modules

### 80C01 Multi-rate Telecom Sampling

**Module** – The 80C01 module supports waveform conformance testing of long-wavelength (1100 to 1650 nm) signals at 622, 2488 Mbps and 9.953 Gbps 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 Mbps 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 Gbps (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 Gbps telecom standards.

### 80C05 40 GHz Optical Sampling

**Module** – The 80C05 module is optimized for testing long-wavelength (1520 to 1580 nm) telecom signals at 40 Gbps and with reference receiver filtering provided for 9.953 Gbps. The 80C05, with its selectable bandwidth, lets the user choose optimal noise vs. bandwidth performance to accurately characterize the signal. With its high optical bandwidth

(40 GHz), it is also well-suited for general purpose, high-performance optical component testing.

### 80C06 55 GHz Optical Sampling

**Module** – The 80C06 module is optimized for testing long-wavelength (1520 to 1580 nm), high-power, high-bandwidth optical signals that are typical of transmission tests for 40 Gbps NRZ and RZ systems. With its high optical bandwidth, 55 GHz (typical), it is also well-suited for general-purpose, high-performance optical component testing.

### 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 Mbps. 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 Mbps 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 10 GbE applications at 9.953, 10.3125, 11.0957 Gbps and 10G Fibre Channel applications at 10.51875 Gbps. The 80C08C also provides telecom rate testing at 9.953, 10.664, and 10.709 Gbps. 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 Gbps.

**80C10 65 GHz 40 Gbps Optical Sampling Module with 43 Gbps 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 Gbps (OC-768/STM-256) and 43.018 Gbps (43 Gbps 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 Gbps datacom and telecom standard rates at 9.953, 10.3125, 10.51875, 10.664, 10.709, and 11.0957 Gbps. With its high optical bandwidth of up to 30 GHz (typical) it is well-suited for general purpose high-performance 10 Gbps 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 Gbps.

**8000 Series Sampling Oscilloscope Electrical Modules**

**80E01 Sampling Module** – The 80E01 is a single-channel, 50 GHz bandwidth sampling module. The 80E01 has a measured bandwidth of 50 GHz or more and a calculated rise time of 7.0 ps or less. Displayed noise is typically 1.8 mV<sub>RMS</sub>. The front-panel connector is female 2.4 mm and an adapter is provided (2.4 mm male to 2.92 mm female) to maintain compatibility with SMA connector systems.

**80E02 Low-noise Sampling Module**

– The 80E02 is a dual-channel, 12.5 GHz sampling module specifically designed for low-noise measurements in digital communications and device characterization applications. It provides an acquisition rise time of 28 ps and typically 400 μV<sub>RMS</sub> of displayed noise. The 80E02 is the ideal instrument for low-noise applications. Common applications for the 80E02 are capturing and displaying switching characteristics of high-speed communications circuits, making accurate statistical measurements of signal noise and signal timing jitter or obtaining stable timing measurements of fast digital ICs.

**80E03 Sampling Module**

– The 80E03 is a dual-channel, 20 GHz sampling module. This sampling module provides an acquisition rise time of 17.5 ps.

**80E04 TDR Sampling Module**

– The 80E04 is a dual-channel, 20 GHz sampling module with TDR capability. This sampling module provides an acquisition rise time of 17.5 ps, with a typical 20 GHz equivalent bandwidth. The TDR feature provides high resolution with true differential capability and fast 35 ps reflected rise time of the TDR slope.

**80E06 70+ GHz Sampling Module**

– The 80E06 is a single channel, 70+ GHz (typical bandwidth) sampling module with 5.0 ps calculated rise time. Typical RMS noise is 1.8 mV. This sampling module provides a 1.85 mm (Type V) front-panel connector and a precision adapter to 2.92 mm with a 50 Ω SMA termination. 1 meter or 2 meter length Extender Cables can be ordered for remote operation of the sampling module from the sampling oscilloscope mainframe.

► **Characteristics**

**Signal Acquisition**

**Acquisition Modes** – Sample (normal), envelope and average.

**Number of Sampling Modules Accommodated** – Up to four, dual-channel electrical and two, single-channel optical sampling modules.

**Number of Simultaneously Acquired Inputs** – Eight channels maximum (eight electrical or two optical and six electrical).

**Vertical Systems**

**Rise Time/Bandwidth** – Determined by the sampling modules used.

**Vertical Resolution** – 14 bits over the sampling modules' dynamic range.

**Horizontal System**

**Main and Magnification View Timebases** – 1 ps/div to 5 ms/div in 1-2-5 sequence or 1 ps increments.

**Maximum Trigger Rate** – 200 kHz.

**Typical Acquisition Rate** – 150 Ksamples/sec per channel.

**Time Interval Accuracy**

Horizontal scale: <21 ps/div: 1 ps + 1% of interval.  
Horizontal scale: ≥21 ps/div:  
8 ps + 0.1% of interval (short-term optimized mode).  
8 ps + 0.01% of interval (locked to 10 MHz mode).  
Horizontal Deskew Range: –500 ps to +100 ns on any individual channel in 1 ps increments.

**Record Length** – 20, 50, 100, 250, 500, 1000, 2000 or 4000 samples.

**Magnification Views** – In addition to the main timebase, the CSA8000B supports two magnification views. These magnifications are independently acquired using separate timebase settings which enable higher resolution sampling.

**Trigger System**

**Trigger Sources**

External direct trigger.  
External pre-scaled trigger.  
Internal clock trigger: Internally connected to direct trigger.  
Clock recovery triggers (from optical sampling modules): Internally connected to pre-scaled trigger.

**Trigger Sensitivity**

External direct trigger output:  
50 mV, DC –4 GHz (typical).  
100 mV, DC –3 GHz (guaranteed).  
Pre-scaled trigger input:  
800 mV, 2 to 3 GHz (guaranteed).  
600 mV, 3 to 10 GHz (guaranteed).  
1000 mV, 10 to 12, 5 GHz (typical).

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## Jitter –

Short-term jitter optimized mode:  
 $\leq 0.8$  ps RMS + 5 ppm (typical).  
 $\leq 1.2$  ps RMS + 10 ppm (max.).

Locked to 10 MHz reference:

1.6 ps RMS + 0.04 ppm of position (typical).  
 $\leq 2.5$  ps RMS + 0.01 ppm of position (max.).

**Internal Clock** – Adjustable from 25 to 200 kHz (drives TDR, internal clock output and calibrator).

**Trigger Level Range** –  $\pm 1.0$  V.

**Trigger Input Range** –  $\pm 1.5$  V.

**Trigger Holdoff** – Adjustable 5  $\mu$ s to 100 ms in 2 ns increments.

**External Trigger Gate (optional)** – TTL logic 1 enables gate, a TTL logic 0 disables gate, maximum non-destruct input level  $\pm 5$  V.

## Display Features

**Touch Screen Display** – 10.4 in. diagonal, color.

**Colors** – 16,777,216 (24 bits).

**Video Resolution** – 640 horizontal by 480 vertical displayed pixels.

## Math/Measurement System Measurements –

The CSA8000B supports up to eight simultaneous measurements, updated three times per second with optional display of per measurement statistics (min, max, mean and standard deviation).

## Measurement Set –

Automated Measurements include RZ, NRZ, and Pulse signal types and the following:

**Amplitude Measurements:** High, Low, Amplitude, Max, Mid, Min, +Width, Eye Height, Eye Opening Factor, Pulse Symmetry, Peak-to-Peak, Pk-Pk, +Overshoot, –Overshoot, Mean, +Duty Cycle, Cycle Mean, RMS, Cycle RMS, AC RMS, Gain, Extinction Ratio (Ratio, %, dB), Suppression Ratio (Ratio, %, dB), Peak-to-Peak Noise, RMS Noise, Q-Factor, SNR, Average Optical Power, (dBm, watts), Phase, Optical Modulation Amplitude.

**Timing Measurements:** Rise, Fall, Period, Bit Rate, Bit Time, Frequency, Crossing (% Level, Time), +Cross, –Cross, Jitter (pk-pk, RMS), Eye Width, +Width, –Width, Burst Width, +Duty Cycle, –Duty Cycle, Duty Cycle Distortion, Delay, Phase.

**Area Measurements:** Area, Cycle Area.

**Cursors** – Dot, vertical bar and horizontal bar cursors.

**Waveform Processing** – Up to eight math waveforms can be defined and displayed using the following math functions: Add, Subtract, Multiply, Divide, Average, Differentiate, Exponentiate, Integrate, Natural Log, Log, Magnitude, Min, Max, Square Root and Filter.

In addition, measurement values can be utilized as scalars in math waveform definitions.

**Mask Testing** – In addition to user-defined masks, the following predefined masks are built-in:

Standard	Rate (Gbps) unless otherwise noted
STM-0/OC-1	51.84 Mbps
STM-1/OC-3	155.52 Mbps
STM-4/OC-12	622.08 Mbps
STM-16/OC-48	2.4883
STM-64/OC-192	9.9533
STM-256/OC-768	39.81312
FEC 2.666	2.66606
FEC 10.66	10.6642
FEC 10.709	10.709
FEC 43 Gbps G.709	43.018
FEC 42.66	42.656914
FC-10 G	10.51875
FC-133	132.813 Mbps
FC-266	265.6 Mbps
FC-531	531.2 Mbps
FC-1063	1.0625
FC-2125	2.125
FC-4250	4.250
10 G BASE-X4	3.125
10 G BASE-W	9.95328
10 G BASE-R	10.3125
10 GbE FEC	11.097
InfiniBand	2.500
Gigabit Ethernet	1.2500

## Power Requirements

### Line Voltage and Frequency –

100 to 240 VAC  $\pm 10\%$  50/60 Hz.  
 115 VAC  $\pm 10\%$  400 Hz.

## Environmental

### Temperature –

Operating: +10 °C to +40 °C.  
 Nonoperating: –22 °C to +60 °C.

### Relative Humidity –

Operating: Floppy disk and CD-ROM not installed: 20% to 80% at or below 40 °C (upper limit derates to 45% relative humidity at 40 °C).

Nonoperating: 5% to 90% at or below 60 °C (upper limit de-rates to 20% relative humidity at +60 °C).

### Altitude –

Operating: 3,048 m (10,000 ft.).  
 Nonoperating: 12,190 m (40,000 ft.).

**Electromagnetic Compatibility** – 89/336/EEC.

**Safety** – UL3111-1, CSA1010.1, EN61010-1, IEC61010-1.

## Physical Characteristics for Optical Sampling Modules

	Dimensions (mm/inches)			Weight (kg/lbs.)
	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
80C05	165/6.5	25/1.0	305/12.0	>2.61/>5.75
80C06	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 Sampling Module Characteristics** (Refer to Optical Sampling Module User Manual for more detailed information)

	Application Type	Standards and Supported Filter Rates	Number of Input Channels	Effective Wavelength Range	Calibrated Wavelengths
80C01	Tributary Telecom	OC-12/STM-4 (622 Mbps), OC-48/STM-16 (2.488 Gbps), OC-192/STM-64 (9.953 Gbps)	1	1100 nm to 1650 nm	1310 nm and 1550 nm (±20 nm)
80C02	10 Gbps Telecom	OC-192/STM-64 (9.953 Gbps) 10GBASE-W (9.953 Gbps)	1	1100 nm to 1650 nm	1310 nm and 1550 nm (±20 nm)
80C05	40 Gbps Telecom	OC-192/STM-64 (9.953 Gbps)	1	1520 nm to 1580 nm	1550 nm (±20 nm)
80C06	40 Gbps Telecom	—	1	1520 nm to 1580 nm	1550 nm (±20 nm)
80C07B	Tributary Datacom/Telecom	Standard Included: OC-48/STM-16 (2.488 Gbps), InfiniBand, 2 GbE (2.500 Gbps); Optional (choose any two): OC-3/STM-1 (155 Mbps), OC-12/STM-4 (622 Mbps), Fibre Channel (1.063 Gbps), GbE (1.250 Gbps), 2G Fibre Channel (2.125 Gbps)	1	700 nm to 1650 nm	780 nm, 850 nm, 1310 nm, 1550 nm (±20 nm)
80C08C	10 Gbps Datacom/Telecom	OC-192/STM-64 (9.953 Gbps), 10GBASE-W (9.95328 Gbps), 10GBASE-R (10.31 Gbps), 10G Fibre Channel (10.52 Gbps), ITU-T G.975 FEC (10.664 Gbps), ITU-T G.709 (10.709 Gbps), 10 GbE FEC (11.1 Gbps)	1	700 nm to 1650 nm	780 nm, 850 nm, 1310 nm, 1550 nm (±20 nm)
80C10	40 Gbps Telecom	OC-768/STM-256 (39.813 Gbps), ITU-T G.709 FEC (43.018 Gbps)	1	1310 nm and 1550 nm	1310 nm and 1550 nm (±20 nm)
80C11	10 Gbps Datacom/Telecom	OC-192/STM-64 (9.953 Gbps), 10GBASE-W (9.95328 Gbps), 10GBASE-R (10.31 Gbps), 10G Fibre Channel (10.52 Gbps), ITU-T G.975 FEC (10.664 Gbps), ITU-T G.709 (10.709 Gbps), 10 GbE FEC (11.1 Gbps)	1	1100 nm and 1650 nm	1310 nm and 1550 nm (±20 nm)

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## ▶ Optical Sampling Module Characteristics (continued)

	<b>Clock Recovery (optional)</b>	<b>Clock Recovery Outputs</b>	<b>Unfiltered Optical Bandwidth*<sup>1</sup></b>	<b>Absolute Maximum Nondestructive Optical Input</b>	<b>Internal Fiber Diameter</b>
80C01	Option CR: 622 Mbps, 2.488 Gbps	±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 Gbps	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
80C05	Not Available	Not Available	40 GHz	20 mW average; 60 mW peak power at wavelength of highest relative responsivity	9 μm/125 μm single-mode
80C06	Not Available	Not Available	<i>55 GHz</i>	20 mW average; 60 mW peak power at wavelength of highest relative responsivity	9 μm/125 μm single-mode
80C07B	Option CR1: 155 Mbps, 622 Mbps, 1.063 Gbps, 1.250 Gbps, 2.125 Gbps, 2.488 Gbps, 2.500 Gbps, 2.66 Gbps	±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 Gbps, 10.31 Gbps; Option CR2: 10.31 Gbps, 10.52 Gbps; Option CR4: Continuous from 9.8 Gbps to 12.6 Gbps	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 Gbps; Option CR2: 9.953 Gbps, 10.664 Gbps; Option CR3: 9.953 Gbps, 10.709 Gbps; Option CR4: Continuous between 9.8 Gbps to 12.6 Gbps	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

\*<sup>1</sup> 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 $\mu$ W at 622.08 Mbps, 2.488 Gbps, 9.953 Gbps, 12.5 GHz; 15.0 $\mu$ W at 20 GHz	12.0 $\mu$ W at 622 Mbps, 2.488 Gbps, 9.953 Gbps 12.5 GHz; 25 $\mu$ W at 20 GHz	Standard
80C02	>30 dB	Single-mode	6.0 $\mu$ W at 9.953 Gbps, 12.5 GHz; 10.0 $\mu$ W at 20 GHz; 15.0 $\mu$ W at 30 GHz	10.0 $\mu$ W at 9.953 Gbps, 12.5 GHz mode; 15 $\mu$ W at 20 GHz; 30 $\mu$ W at 30 GHz	Standard
80C05	>30 dB	Single-mode	10.0 $\mu$ W at 9.953 Gbps; 15 $\mu$ W at 20 GHz; 25 $\mu$ W at 30 GHz; 70 $\mu$ W at 40 GHz	15 $\mu$ W at 9.953 Gbps; 25 $\mu$ W at 20 GHz; 35 $\mu$ W at 30 GHz; 70 $\mu$ W at 40 GHz	Standard
80C06	>30 dB	Single-mode	150 $\mu$ W at 55 GHz	192 $\mu$ W at 55 GHz mode	Standard
80C07B	>14 dB (multi-mode) >24 dB (single-mode)	Single- or Multi-mode	0.50 $\mu$ W at 155 Mbps, 622 Mbps; 1063 Mbps, 1250 Mbps; 0.70 $\mu$ W at 2.488/2.500 Gbps	1.0 $\mu$ W at 155 Mbps, 622 Mbps, 1063 Mbps, 1250 Mbps; 1.5 $\mu$ W at 2.488/2.500 Gbps	Standard
80C08C	>14 dB (multi-mode) >24 dB (single-mode)	Single- or Multi-mode	1.7 $\mu$ W at all filter rates	3.0 $\mu$ W at all filter rates	Standard
80C10	>30 dB	Single-mode	40 $\mu$ W at 39.813 Gbps, 43.018 Gbps (1550 nm); 75 $\mu$ W at 39.813 Gbps, 43.018 Gbps (1310 nm); 30 $\mu$ W at 30 GHz mode (1550 nm); 55 $\mu$ W at 30 GHz mode (1310 nm); 85 $\mu$ W at 65 GHz mode (1550 nm); 150 $\mu$ W at 65 GHz mode (1310 nm)	60 $\mu$ W at 39.813 Gbps, 43.018 Gbps (1550 nm); 110 $\mu$ W at 39.813 Gbps, 43.018 Gbps (1310 nm); 50 $\mu$ W at 30 GHz mode (1550 nm); 90 $\mu$ W at 30 GHz mode (1310 nm); 120 $\mu$ W at 65 GHz mode (1550 nm); 220 $\mu$ W at 65 GHz mode (1310 nm)	Standard
80C11	>30 dB	Single-mode	5.5 $\mu$ W at all filter rates; 10.0 $\mu$ W at 20 GHz 20.0 $\mu$ W at 30 GHz	8.0 $\mu$ W at all filter rates; 14.0 $\mu$ W at 20 GHz 30.0 $\mu$ W at 30 GHz	Standard

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## ▶ 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 Mbps, 2.488 Gbps, 9.953 Gbps; -5.0 dBm at 20 GHz
80C02	Standard	Standard	+4 dBm to -30 dBm	5% of reading	-9 dBm at 9.953 Gbps; -7 dBm at 20 GHz; -4 dBm at 30 GHz
80C05	Standard	Standard	+13 dBm to -21 dBm	5% of reading	-7 dBm at 9.953 Gbps; -5 dBm at 20 GHz; -3 dBm at 30 GHz; 0 dBm at 40 GHz
80C06	Standard	Standard	+13 dBm to -21 dBm	5% of reading	+5 dBm at 55 GHz mode
80C07B	Standard	Standard	+4 dBm to -30 dBm	5% of reading	-22 dBm at 155 Mbps, 622 Mbps; -20 dBm at 2488/2500 Mbps
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 Gbps, 43.018 Gbps; 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 filters rates; -7 dBm at 20 GHz; -4 dBm at 30 GHz mode

\*2Smallest 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/lbs.)
	Width	Height	Depth	Net
80E01	79/3.1	25/1.0	135/5.3	0.4/0.87
80E02	79/3.1	25/1.0	135/5.3	0.4/0.87
80E03	79/3.1	25/1.0	135/5.3	0.4/0.87
80E04	79/3.1	25/1.0	135/5.3	0.4/0.87
80E06	79/3.1	25/1.0	135/5.3	0.4/0.87



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

	Application Type	Channels	Input Impedance	Channel Input Connector	Bandwidth* <sup>3</sup>
80E01	Microwave General Purpose	1	50 ±0.5 Ω	2.4 mm female precision adapter to 2.92 mm included with 50 Ω SMA termination	50 GHz
80E02	Low-level Signals	2	50 ±0.5 Ω	3.5 mm female	12.5 GHz* <sup>4</sup>
80E03	Device Characterization	2	50 ±0.5 Ω	3.5 mm female	20 GHz* <sup>4</sup>
80E04	TDR Impedance Characterization with single-ended, common, differential TDR capability	2	50 ±0.5 Ω	3.5 mm female	20 GHz* <sup>4</sup>
80E06	High-speed Electrical Device Characterization	1	50 ±0.5 Ω	1.85 mm female precision adapter to 2.92 mm included with 50 Ω SMA termination	70+ GHz

\*<sup>3</sup> Values shown are warranted unless printed in an italic typeface which represents a non-warranted characteristic value that the instrument will typically perform to.

\*<sup>4</sup> Rise time is calculated from the formula Rise Time = 0.35/Bandwidth; Bandwidth is calculated from the formula Bandwidth = 0.35/Rise Time.

▶ **Electrical Sampling Module Characteristics (continued)**

	Rise Time (10% to 90%)	Dynamic Range	Offset Range	Maximum Input Voltage	Vertical Number of Digitized Bits
80E01	7 ps* <sup>4</sup>	1.0 V <sub>p-p</sub>	±1.6 V	±2.0 V	14 bits full scale
80E02	≤28 ps	1.0 V <sub>p-p</sub>	±1.6 V	±3.0 V	14 bits full scale
80E03	≤17.5 ps	1.0 V <sub>p-p</sub>	±1.6 V	±3.0 V	14 bits full scale
80E04	≤17.5 ps	1.0 V <sub>p-p</sub>	±1.6 V	±3.0 V	14 bits full scale
80E06	5.0 ps* <sup>4</sup>	1.0 V <sub>p-p</sub>	±1.6 V	±2.0 V	14 bits full scale

\*<sup>4</sup> Rise time is calculated from the formula Rise Time = 0.35/Bandwidth; Bandwidth is calculated from the formula Bandwidth = 0.35/Rise Time.

# Communications Signal Analyzer

► CSA8000B

## ► Electrical Sampling Module Characteristics (continued)

	Vertical Sensitivity Range	DC Vertical Voltage Accuracy, Single Point, Within $\pm 2$ °C of Compensated Temperature	Typical Step Response Aberrations* <sup>5</sup>	RMS Noise* <sup>5</sup>
80E01	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 3\%</math> or less over the zone 10 ns to 20 ps before step transition; +12%, -5% or less for the first 300 ps following step transition; +5.5%, -3% or less over the zone 300 ps to 3 ns following step transition; <math>\pm 1\%</math> or less over the zone 3 ns to 100 ns following step transition; <math>\pm 0.5\%</math> after 100 ns following step transition</i>	1.8 mV $\leq 2.3 \text{ mV}$ (maximum)
80E02	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 3\%</math> or less over the zone 10 ns to 20 ps before step transition; +10%, -5% or less for the first 300 ps following step transition; <math>\pm 3\%</math> or less over the zone 300 ps to 5 ns following step transition; <math>\pm 1\%</math> or less over the zone 5 ns to 100 ns following step transition; <math>\pm 0.5\%</math> after 100 ns following step transition</i>	400 $\mu\text{V}$ $\leq 800 \mu\text{V}$ (maximum)
80E03	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 3\%</math> or less over the zone 10 ns to 20 ps before step transition; +10%, -5% or less for the first 300 ps following step transition; <math>\pm 3\%</math> or less over the zone 300 ps to 5 ns following step transition; <math>\pm 1\%</math> or less over the zone 5 ns to 100 ns following step transition; <math>\pm 0.5\%</math> after 100 ns following step transition</i>	600 $\mu\text{V}$ $\leq 1.2 \text{ mV}$ (maximum)
80E04	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 3\%</math> or less over the zone 10 ns to 20 ps before step transition; +10%, -5% or less for the first 300 ps following step transition; <math>\pm 3\%</math> or less over the zone 300 ps to 5 ns following step transition; <math>\pm 1\%</math> or less over the zone 5 ns to 100 ns following step transition; 0.5% after 100 ns following step transition</i>	600 $\mu\text{V}$ $\leq 1.2 \text{ mV}$ (maximum)
80E06	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 5\%</math> or less for first 300 ps following step transition</i>	1.8 mV $\leq 2.4 \text{ mV}$ (maximum)

\*<sup>5</sup> Values shown are warranted unless printed in an italic typeface which represents a non-warranted characteristic value that the instrument will typically perform to.

► **TDR System (80E04 only)**

	80E04*6
Channels	2
Input Impedance	50 ±0.5 Ω
Channel Input Connector	3.5 mm
Bandwidth	20 GHz
TDR Step Amplitude	250 mV (polarity of either step may be inverted)
TDR System Reflected Rise Time	≤35 ps each polarity
TDR System Incident Rise Time	28 ps (typical)
TDR Step Maximum Repetition Rate	200 kHz
TDR System Step Response Aberrations	<i>±3% or less over the zone 10 ns to 20 ps before step transition; +10%, -5% or less typical for the first 400 ps following step transition; ±3% or less over the zone 400 ps to 5 ns following step transition; ±1% or less after 5 ns following step transition</i>

\*6 Values shown are warranted unless printed in an italic typeface which represents a non-warranted characteristic value that the instrument will typically perform to.

► **Ordering Information**

**CSA8000B**

**Communications Signal Analyzer.**

**Includes:** User manual, quick reference card, MS Windows 98 compatible keyboard, MS Windows 98 compatible mouse, touch screen stylus, online help, programmer online guide, power cord.

With OpenChoice™ software, Tektronix provides enhanced test and measurement analysis with the capability of full integration of third-party software on the Open Windows oscilloscopes. By working with the industry leaders, National Instruments and The MathWorks, examples of software programs from these companies are featured on all Tektronix Open Windows oscilloscopes.

**CSA8000B Options**

- Opt. C3** – Three years of Calibration Service.
  - Opt. D1** – Calibration data report.
  - Opt. D3** – Three years of Calibration data reports.
  - Opt. GT** – Gated Trigger.
  - Opt. R3** – Extended repair warranty to three years.
  - Opt. 1K** – Cart.
  - Opt. 1R** – Rackmount kit (includes: hardware, tooling and instructions for converting bench model to rackmount configuration).
- International Power Plug Options**
- Opt. A0** – North America power.
  - Opt. A1** – Universal EURO power.
  - Opt. A2** – United Kingdom power.
  - Opt. A3** – Australia power.
  - Opt. A4** – 240 V, North America power.
  - Opt. A5** – Switzerland power.
  - Opt. A99** – No power cord or AC adapter.
  - Opt. AC** – China power.

**Other Accessories**

**Calibration Step Generator with Power Cords –**

- Std, US: 067-1338-00.
- A1, Europe: 067-1338-01.
- A2, UK: 067-1338-02.
- A3, Australia: 067-1338-03.
- A4, North America: 067-1338-04.
- A5, Switzerland: 067-1338-05.
- A6, Japan: 067-1338-06.

**SIU800 Static Isolation Unit – Order SIU800.**

**Sampling Module Extender Cable (1 meter) – Order 012-1568-00.**

**Sampling Module Extender Cable (2 meter) – Order 012-1569-00.**

**2X Attenuator (SMA male-to-female) – Order 015-1001-01.**

**5X Attenuator (male-to-female) – Order 015-1002-01.**

**Adapter (2.4 mm male to 2.92 mm female) – Order 011-0157-01.**

**Power Divider – Order 015-1014-00.**

**Rackmount Kit – Order 016-1791-01.**

**P6209** – 4 GHz Active FET Probe.

**P6150** – 9 GHz Passive Probe.

**P7225** – 2.5 GHz Active Probe.

**80A01** – Pre-scaled Trigger Amplifier: The 80A01 Pre-scaled Trigger Amplifier provides enhanced triggering capability on low-level signals up to 12.5 Gbps. This module plugs into any of the four available electrical sampling module slots on the TDS8000B and the CSA8000B mainframes. It is ideally suited for component designers and manufacturers who are verifying the performance of optical and electrical components that run at non-standard clock rates up to 12.5 GHz.

**80A03** – TekConnect™ Probe Interface Module. The 80A03 TekConnect Probe Interface Module provides an interface to Tektronix P7000 series high-performance active and differential probes with 3 GHz bandwidths and higher. The 80A03 accepts up to two P7000 series probes and one electrical sampling module. It plugs into any of the four available electrical sampling module slots on the TDS8000B and CSA8000B mainframes. The 80A03 and P7000 series probes are ideally suited for probing directly on IC pins, traces, or test points that are not accessible through a connector.

**K4000 Mobile Workstation.**

# Communications Signal Analyzer

▶ CSA8000B

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Updated 20 September 2002

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