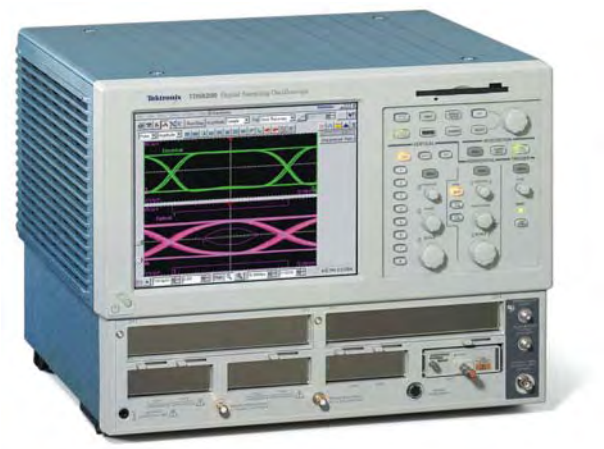
8200 Series Sampling Oscilloscopes

▶ **CSA8200 Communications Signal Analyzer • TDS8200 Digital Sampling Oscilloscope**



State-of-the-art Acquisition System

The CSA8200 and TDS8200 Sampling Oscilloscopes are comprehensive acquisition and measurement instruments for research, design evaluation and manufacturing test in the fields of datacom and telecom components, transceiver subassemblies, and transmission systems, computer and storage-based high speed electrical serial data, semiconductor test, TDR-based impedance characterization and other applications requiring bandwidths into tens of GHz.

The 8200 Series 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, OMA, extinction ratio, Q-factor, mean optical power, and amplitude measurements for both RZ and NRZ signals. Compliance-based mask testing of high speed optical and electrical communications, and computer standards such as SDH/SONET, Ethernet, Fibre Channel is included. Color-grading and gray-scale grading of waveform data adds a third dimension, sample density, to signal acquisition and analyses. The industry's first variable persistence database allows exact data and measurement aging on all of the functions, and facilitates dynamic update on DUTs under adjustment.

The 8200 Series combines very low time-base jitter with very fast acquisition rate. It can acquire the data in several time windows, each with its own acquisition parameters and display window. It provides a comprehensive suite of measurement capabilities to evaluate the data, as well as acquisition math and waveform math functionality to further process the results with histograms, mask testing and statistics.

The 8200 Series provides great data storage flexibility with four 3D databases available simultaneously; the databases offer an industry-first variable persistence with accurate data aging. Color-grading of waveform data adds a third dimension, sample density, to signal acquisitions and analyses.

The CSA8200 and TDS8200 models share the same capabilities; either model, for example, may be configured with any combination of sampling modules.

▶ Features & Benefits

DC to 70+ GHz[*1] Bandwidth

Industry-leading Timebase Accuracy
- Jitter <200 fs_{RMS} with 82A04
- 800 fs_{RMS} Standard

Modular Architecture with Up to Eight Acquisition Channels

Advanced Jitter, Noise and BER analysis
- Analysis of High-speed Serial Data Rates from 1 Gb/s to 60 Gb/s Provides Insight Into Precise Causes of Eye Closure
- Separation of Both Jitter and Noise Provides Highly Accurate Extrapolation of BER and Eye Contour

High performance TDR/TDT
- True Differential Step Generator and Signal Acquisition
- <28 ps Reflected Rise Time
- Up to 4 Differential Pairs (8 channels)
- High Fidelity Differential and Single-ended Probing

Automated Standards Mask Testing
- Communications Standards Including Sonet/SDH, Ethernet, OIF and Fibre Channel
- Computer Standards Including SATA, SAS, PCI Express and Rapid IO

Automated Measurement System with Over 100 NRZ, Pulse and RZ Measurements

FrameScan® Acquisition Mode
- Isolate Data Dependent Faults
- Signal Averaging to Examine Low-power Signal

Four Color Graded Variable Persistence Waveform Databases

Microsoft Windows 2000 Operating System

▶ Applications

Signal Integrity, Advanced Jitter, Noise and BER Analysis

Characterization of Next-generation Digital Designs

Design Characterization and Manufacturing Compliance Test of Telecom, Datacom, Storage Area Network, Computer and High-speed Backplane Designs

TDR, Impedance Characterization, and Cross Talk Measurements for PCBs, Cables and IC Packages

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

Tektronix
Enabling Innovation

Powerful Jitter, Noise and BER Analysis Capabilities

When equipped with the available 80SJNB Advanced Jitter, Noise and BER Analysis software, the 8000, 8000B or 8200 Series oscilloscopes become a comprehensive serial data signal impairment characterization tool. 80SJNB speeds up the identification of the underlying causes of both horizontal and vertical eye closure through separation of both jitter and noise. With its unique insight into the constituent components of both jitter and noise, 80SJNB provides highly accurate and complete BER extrapolations and eye contour.

When you combine Jitter, Noise and BER Analysis with the 8000 Series' modular flexibility, uncompromised performance and unmatched signal fidelity you get the ideal solution for next generation high-speed serial data design and validation, from 1 Gb/s to 60 Gb/s.

Modularity and Flexibility

The CSA8200 and TDS8200 oscilloscopes support a large and growing family of electrical and optical plug-in modules. This modular architecture lets you configure the instrument to meet your needs today and protects your investment by allowing you to add additional modules in the future. With its differential clock recovery module, the instrument can be used for acquisition of differential electrical signals even when there is no trigger available. Electrical modules are available with bandwidths up to 70 GHz. Differential and single-ended passive hand probes are available with bandwidths up to 18 GHz. An adapter for the popular TekConnect® probing system brings the performance of Tektronix' state-of-the-art high impedance differential and single-ended probes to the 8200 Series Sampling Oscilloscope. A differential electrical clock recovery module covering most popular data rates between 50 Mb/s and 12.6 Gb/s is also available. Optical modules provide complete optical test solutions for both telecom (SONET/SDH) and Datacom (Ethernet, and Fibre Channel) applications with data rates from 155 Mb/s to 43 Gb/s. Integrated clock recovery is also available on most optical modules.

Extremely Low Trigger Jitter, Flexible Signal Acquisition Solution

The 82A04 Phase Reference Module extends the capability of the 8200 Series Sampling Platform by providing extremely low jitter/low drift sample position information to the mainframe. This sample position information is based on the phase of a clock the user provides to the 82A04 input. The benefits of using the sample position information based on a clock signal are two-fold – an extremely low Jitter of <200 fs_{RMS} (typical), and the possibility of a trigger-less acquisition. Typical application is the acquisition and analysis of very high speed optical and electrical signals in high-speed communication devices and systems, and similar areas.

The 82A04, together with the CSA/TDS8200, implements the phase reference timebase functionality in a novel way, giving the user the freedom to select from timebase and acquisition modes without compromises; any phase-reference frequency within the operating range is accommodated, and even advanced features, such as FrameScan,® remain available. The separate DSP per acquisition slot architecture of the CSA/TDS8200 enables the acquisition rate in the phase reference mode to reach over 40 kS/s*1.

*1 Typical performance, some settings will lower the throughput.

Superior Performance

With its industry-best horizontal timebase stability, signal sensitivity and noise performance, the 8200 Series ensures the most accurate representation of your signal.

The 8200 Series' True differential TDR with 28 ps reflected rise time enables complete TDR/TDT/Crosstalk measurements on complex assemblies. With system capacity of up to four dual channel modules, four differential signal pairs can be driven simultaneously. For TDR probing, the P8018 single-ended probe and the new P80318 differential probes support full TDR bandwidth, while the 80A02 module provides protection from damage by electrostatic discharge. These features enable even measurements performed in the manufacturing environment to achieve highly precise results, while protecting the TDR module itself.

Add the available IConnect® software and you have an efficient, easy-to-use and cost-effective solution for measurement-based performance evaluation of gigabit interconnect links and devices, including signal integrity analysis, impedance, S-parameter and eye diagram compliance testing and fault isolation. IConnect provides an integrated simulate-and-compare link between SPICE/IBIS simulators and TDR/T or VNA S-parameter measurements. This capability allows the designer to quickly extract and validate gigabit interconnect models and to predict eye-diagram degradation, jitter, losses, crosstalk, reflections and ringing in PCBs and flex-boards, packages, sockets, connectors, cable assemblies and at the input die capacitance.

The CSA/TDS8200 implements the popular FrameScan® acquisition mode, which can be used for scanning of the data bits to isolate pattern-dependent effects, viewing sub-harmonic interference or capturing the sequence leading to a mask violation. Innovative features such as averaging of eye diagrams allow the user to view an averaged eye diagram for applications such as evaluating Inter-Symbol Interference or separating pattern-related Deterministic Jitter from Random Jitter.

8200 Series Sampling Oscilloscope Platform

The 8200 Series is built on Tektronix' sampling oscilloscope platform that combines familiar Microsoft Windows 2000-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 also available. Because the system supports an Open Windows environment, new levels of data analysis can be performed 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 (for example, LabVIEW, LabWindows, Visual Basic, Microsoft Excel, C, etc.) running on the instrument, or on external PC workstation networks connected to the instrument, without the need for a GPIB hardware interface. Plug-and-Play drivers for LabVIEW and other programs are also supplied.

8200 Series Sampling Oscilloscope Optical Modules

80C02 High-performance Telecom Optical 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 28 GHz, it is also well suited for high-performance optical component testing. The 80C02 can be configured with integrated clock recovery that supports 9.953 Gb/s standards. A superset of this module's functionality has been integrated into the flexible new 80C11 module.

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

The 80C07B module is a broad wavelength (700 to 1650 nm), single-mode/multi-mode, multi-rate, high sensitivity optical sampling module optimized for the testing of telecom and datacom signals. Support for OC-48/STM-16 (2.488 Gb/s), InfiniBand 2 GbE (2.500 Gb/s), is standard; the user may select two additional reference receiver filters from the following list to be included in the product: 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), or 2G Fibre Channel (2.125 Gb/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 configured with integrated multi-rate clock recovery that supports rates between 155 Mb/s and 2700 Mb/s.

80C08C Multi-rate, Datacom and Telecom Optical Sampling Module for 10 Gb/s

The 80C08C module is a broad wavelength (700 nm to 1650 nm), single-mode/multi-mode, multi-rate optical sampling module providing datacom rates testing for 10 GbE applications at 9.953 Gb/s (10 G BASE-W), 10.3125 Gb/s (10 G BASE-R), 10.51875 Gb/s (10 G Fibre Channel), 10 GbE FEC (11.1 Gb/s) and telecom rates testing for STM-64/OC-192 (9.953Gb/s), ITU-T G.975 FEC (10.664 Gb/s), ITU-T G.709 (10.709 Gb/s). With its amplified optical-to-electrical (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 configured with a number of integrated clock recovery solutions, including continuous rate clock recovery from 9.8 Gb/s to 12.5 Gb/s.

80C10 65 GHz 40 Gb/s Optical Sampling Module

The 80C10 module provides long-wavelength, single-mode fiber support at 1310 nm and 1550 nm and integrated and selectable reference receiver filtering for conformance testing at 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 65 GHz or 30 GHz for optimal noise versus bandwidth performance for accurate signal characterization.

80C11 High-performance Multi-rate Optical Sampling Module

The 80C11 module is optimized for testing of long-wavelength (1100 to 1650 nm) signals on single-mode fiber, for all telecom and datacom rates around 10 Gb/s. Additionally, the high optical bandwidth of 30 GHz (typical) is well suited for general-purpose high-performance optical component testing. The 80C11 can be configured with integrated continuous rate clock recovery from 9.8 to 12.5 Gb/s that supports all current rates in the 10 Gb/s band (9.953 Gb/s, 10.3125 Gb/s, 10.51875 Gb/s, 10.664 Gb/s, 10.709 Gb/s and others).

80C12 High Flexibility Multi-rate Optical Sampling Module

The 80C12 module is a broad wavelength (700 to 1650 nm), single-mode/multi-mode, multi-rate, high sensitivity optical sampling module optimized for the testing of telecom and datacom signals. Several reference receiver filter options are available. Filter selections include OC-3/STM-1 (155 Mb/s), OC-12/STM-4 (622 Mb/s), Fibre Channel (1.063 Gb/s), 2G Fibre Channel (2.125 Gb/s) and 4G Fibre Channel (4.25 Gb/s), GbE (1.250 Gb/s), OC-48/STM-16 (2.488 Gb/s), InfiniBand 2 GbE (2.500 Gb/s, 10 GbE by four (10GBASE-x4 at 3.125 Gb/s), as well as 10GFC by four at 3188 Gb/s. Clock recovery for the 80C12 is provided by the 80A05. The 80C12 provides an electrical output that can be used as an input for the 80A05 Electrical Clock Recovery module.

8200 Series Sampling Oscilloscope Electrical Modules

80E01 50 GHz Electrical Sampling Module

The 80E01 is a single channel 50 GHz bandwidth sampling module with a measured rise time of 7.0 ps or less. Displayed noise is typically 1.8 mV_{RMS}. 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 12.5 GHz Low-noise Electrical 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 measured rise time of 28 ps and typically 400 μV_{RMS} of displayed noise. The 80E02 is the ideal instrument for low-power 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 and obtaining stable timing measurements of fast digital ICs.

80E03 20 GHz Electrical 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 20 GHz TDR Electrical Sampling Module

The 80E04 is a dual-channel 20 GHz sampling module with a TDR step generator for each channel. The TDR step generators operate in either positive or negative polarity, allowing for simultaneous operation for true differential and true common mode measurements. The 17 ps (typical) incident rise time and 28 ps (typical) reflected rise time enable superior timing and special resolution. 80E04 acquisition capabilities match those of the 80E03 module.

80E06 70+ GHz Electrical Sampling Module

The 80E06 is a single channel 70+ GHz (typical) sampling module with 5 ps calculated rise time. Typical RMS noise is 2.0 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.

Extender Cables

1 meter and 2 meter length extender cables are available for remote operation of the electrical sampling modules. Use of extender cables allows the electrical module to be located near the DUT, and minimizes cable length between the DUT and the electrical module.

8200 Series Sampling Oscilloscope Accessory Modules & Probes

80A02 EOS/ESD Protection Module

The 80A02 EOS/ESD Protection module protects the sampling bridge of Tektronix electrical sampling module inputs from damage by electrostatic charge. The 80A02 is intended for use in applications such as electrical TDR circuit board testing and cable testing where large static charges can accumulate on the DUT.

The 80A02 can be powered in two ways – by plugging it into one of four small plug-in slots on the CSA/TDS8200 oscilloscope, or by using a SlotSaver adapter cable. The unit provides a front panel SMA connector for connecting the SMA test cable or probe signal from the DUT. The 80A02 passes the acquired DUT signal to a connected electrical sampling module input for measurement after an actuating control signals the 80A02 that the DUT has been discharged.

The 80A02 provides superior EOS/ESD protection when used with the P80318 and P8018 high-bandwidth differential and single-ended handheld probes.

P80318 Differential Handheld TDR Probe

The P80318 is an 18 GHz 100 Ω input impedance differential TDR hand probe. This probe enables high fidelity impedance measurements of differential transmission lines. The adjustable probe pitch enables a wide variety of differential line spacing and impedances. The P80318 probe also includes two precision SMA cables with parallel control lines that provide the 80A02 the control for EOS/ESD protection.

P8018 Single-ended Handheld TDR Probe

The P8018 Handheld TDR Probe is a greater than 20 GHz, 50 Ω input impedance, single-ended passive probe that provides a high performance solution for electrical sampling, TDR circuit board impedance characterization and high-speed electrical signal analysis applications. The P8018 probe also includes a precision SMA cable and parallel control line that provides the 80A02 the control for EOS/ESD protection.

80A03 TekConnect® Probe Interface Module

The 80A03 enables the use of two Tektronix P7000 Series probes on the CSA/TDS8200 Series sampling oscilloscopes. The 80A03 plugs into any of the mainframe's four small sampling module slots. The 80A03 is powered through the oscilloscope and requires no user adjustments or external power cords. An electrical sampling module can be plugged directly into the slot on the 80A03 to provide the optimum signal fidelity and a short electrical path. The signal from the probe can also be connected to another input such as the mainframe trigger input, or a module plugged into the mainframe.

The 80A03 enables design engineers to access the benefits of Tektronix' industry-leading active and differential probes for measuring signals on SMD pins and other challenging circuit features.

82A04 Phase Reference Module

The 82A04 module enables a sub-200 fs_{RMS} extremely low jitter timebase on the 8200 Series mainframes. This capability requires the use of a user-provided reference clock source. Input frequency range of the reference clock is continuous from 2 to 60+ GHz. An external filter may be required for non-sinusoidal clocks below 8 GHz.

The module operates in any small module slot. The 82A04 supports both the *Triggered* mode of operation, which is similar to traditional acquisition, and an un-triggered *Free Run* mode in which all timing information comes from a customer-supplied clock (no trigger signal necessary). When an external clock is not available the module can accept the clock signal from the clock recovery output of the 80Cxx modules, as well as from the 80A05 clock recovery module.

80A05 Electrical Clock Recovery Module

The 80A05 Electrical Clock Recovery Module provides clock recovery for electrical signals and internal triggering on the recovered clock. The module recovers clock from serial data streams for all of the most common electrical standards from 50 Mb/s to 12.6 Gb/s. Option 10G adds support for standard rates up to 12.6 Gb/s. The module accepts either single-ended or differential signals as its input. The signal is then split, with half of the signal being routed to clock recovery circuitry and half being routed out the front of the module to be used as input to an electrical module.

This module also serves as the clock recovery module for the 80C12. The 80C12 has an electrical signal output that may be routed to the 80A05 for clock recovery purposes.

80A06 PatternSync Trigger Module

The 80A06 PatternSync Trigger Module extends the capability of the CSA/TDS8200 mainframe by creating a pattern trigger from any data-related clock: a recovered clock, user-supplied clock, sub-rate clock or super-rate clock. The module is required for advanced jitter, noise and BER analysis using the 80SJNB software package.

SlotSaver Small Module Extender Cable

This cable can be used to power and operate one 80A01, 80A02 or 80A06 accessory module, eliminating the need to consume a small form factor mainframe slot. The SlotSaver extender cable plugs into the 'Trigger Power' connector on the mainframe or into the 'Probe Power' connector on most electrical sampling modules.

8200 Series Sampling Oscilloscope Application Software

80SJNB Advanced Jitter, Noise and BER Analysis

80SJNB is a comprehensive jitter, noise and bit error ratio (BER) analysis application for serial data signal impairment characterization. 80SJNB is the first oscilloscope-based application software package that goes beyond jitter analysis to provide jitter, noise and BER analysis for today's high-speed serial data rates from 1 Gb/s to 60 Gb/s. 80SJNB speeds up the identification of the underlying causes of both horizontal and vertical eye closure through separation of jitter and noise. With its unique insight into the constituent components of both jitter and noise, 80SJNB provides highly accurate and complete BER extrapolation and eye- contour analysis.

80SICON IConnect® Interconnect Analysis and Modeling Software

IConnect software is the efficient, easy-to-use and cost-effective solution for measurement-based performance evaluation of gigabit interconnect links and devices, including signal integrity analysis, impedance, S-parameter and eye-diagram compliance tests and fault isolation. IConnect provides an integrated simulate-and-compare link between SPICE/IBIS simulators and TDR/T, and allows the designer to quickly extract and validate gigabit interconnect models and to predict eye-diagram degradation, jitter, losses, crosstalk, reflections and ringing in PCBs and flexboards, packages, sockets, connectors, cable assemblies and at the input die capacitance.

IConnect provides simple and efficient algorithms for computing single-ended and differential S-parameters, insertion and return loss from TDR/T measurement, which enable very cost-effective and efficient specification compliance testing for gigabit interconnects. Eye mask, eye opening and jitter measurements allow easy eye analysis. IConnect true impedance profile improves the oscilloscope resolution and accuracy, and helps locate failures more easily.

80SICMX IConnect Interconnect MeasureXtractor™ Model Extraction Software

IConnect MeasureXtractor automatic model extraction tool then converts TDR/T or S-parameters into an exact interconnect model, compatible with any SPICE or IBIS simulator. These models then allow the designer to quickly perform system level analysis of the interconnect link with transmitter and receiver. 80SICMX includes both IConnect and MeasureXtractor.

80SSPAR IConnect S-Parameter

IConnect S-parameters is the efficient and easy-to-use tool for digital designers, operating at gigabit speeds, to perform single-ended, differential and mixed-mode S-parameter measurements of their interconnects, measure insertion loss, return loss and frequency domain crosstalk and conduct interconnect electrical compliance testing. IConnect S-parameters is the most cost-efficient and fast-throughput approach for S-parameter measurements in digital design, signal integrity analysis and interconnect compliance testing, providing 50 percent cost savings compared to traditional S-parameter measurement equipment of the same bandwidth, and dramatically speeding up the measurements. The simplicity of S-parameter calibration using a reference waveform (open, short or through), or an optional 50 Ω load waveform make the measurement itself, fixture de-embedding and moving the reference plane a snap.

▸ Optical Modules

Optical Modules

Module	Opt.	Bandwidth (GHz)	Wavelength Range (nm)	Fiber Input (µm)	Mask Test Sensitivity (dBm)	# of channels	155 M/bs	622 M/bs	1063 M/bs	1250 M/bs	2125 M/bs	2488 M/bs	2500 M/bs	3.125 G/bs	3.188 G/bs	3.32 G/bs	4.25 G/bs	9.95 G/bs	10.31 G/bs	10.52 G/bs	10.66 G/bs	10.71 G/bs	11.1 G/bs	39.81 G/bs	43.02 G/bs
80C02	—	30	1100 to 1650	9	–9	1												■							
	CR	30	1100 to 1650	9	–9	1												◆							
80C07B	F1	2.5	700 to 1650	9 & 62.5	–22	1	■	■				■	■												
	F2	2.5	700 to 1650	9 & 62.5	–22	1	■		■			■	■												
	F3	2.5	700 to 1650	9 & 62.5	–22	1	■			■		■	■												
	F4	2.5	700 to 1650	9 & 62.5	–22	1	■				■	■	■												
	F5	2.5	700 to 1650	9 & 62.5	–22	1		■	■			■	■												
	F6	2.5	700 to 1650	9 & 62.5	–22	1		■		■		■	■												
	F7	2.5	700 to 1650	9 & 62.5	–22	1		■			■	■	■												
	F8	2.5	700 to 1650	9 & 62.5	–22	1			■	■		■	■												
	F9	2.5	700 to 1650	9 & 62.5	–22	1			■		■	■	■												
	F10	2.5	700 to 1650	9 & 62.5	–22	1				■	■	■	■												
	CR1	2.5	700 to 1650	9 & 62.5	–22	1	◆	◆	◆	◆	◆	◆	◆												
80C08C	—	10	700 to 1650	9 & 62.5	–16	1												■	■	■	■	■	■		
	CR1	10	700 to 1650	9 & 62.5	–16	1												◆	◆						
	CR2	10	700 to 1650	9 & 62.5	–16	1													◆	◆					
	CR4	10	700 to 1650	9 & 62.5	–16	1												◆	◆	◆	◆	◆	◆		
80C10	—	65	1290 to 1330 1539 to 1570	9	0	1																		■	■
80C11	—	30	1100 to 1650	9	–9	1												■	■	■	■	■	■		
	CR1	30	1100 to 1650	9	–9	1												◆							
	CR2	30	1100 to 1650	9	–9	1												◆			◆				
	CR3	30	1100 to 1650	9	–9	1												◆				◆			
	CR4	30	1100 to 1650	9	–9	1												◆	◆	◆	◆	◆	◆		
80C12	F1	4.25	700 to 1650	9 & 62.5	–15	1			■		■						■								
	F2	9	700 to 1650	9 & 62.5	–15	1					■						■								
	F3	9	700 to 1650	9 & 62.5	–15	1			■		■														
	F4	4.25	700 to 1650	9 & 62.5	–15	1					■			■	■		■								
	F5	9	700 to 1650	9 & 62.5	–15	1								■	■		■								
	F6	9	700 to 1650	9 & 62.5	–15	1					■			■	■										
	FC	9	700 to 1650	9 & 62.5	–15	1								■	■	■									
	10G	10	700 to 1650	9 & 62.5	–12	1												■	■	■	■	■	■		
	(80C12 CR using 80A05)						◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆								
	(80C12 CR using 80A05 with Opt. 10G)						◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	
Electrical Clock Recovery																									
80A05							⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕								
	10G						⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕		

Electrical Modules

	80E01	80E02	80E03	80E04	80E06
Bandwidth	50	12.5	20	20	70
Number of Channels	1	2	2	2	1

Rates Supported: ■=Filter
◆=Optical Clock Recovery
⊕=Electrical Clock Recovery

▸ Characteristics

CSA8200 and TDS8200 Sampling Oscilloscope Characteristics

Signal Acquisition

Acquisition Modes –
Sample (normal), Envelope and Average.

Number of Sampling Modules Accommodated –
Up to four dual-channel electrical; up to two optical sampling modules. (Both single- and dual-channel modules appropriate the two channels associated with the slot).

Population of the Ch 1/Ch 2 large slot with any module other than the one requiring *power only* displaces functionality of the Ch 1/Ch 2 small slot; population of the Ch 3/Ch 4 large slot with any module other than one requiring *power only* displaces functionality of the Ch 3/Ch 4 small slot.

Number of Simultaneously Acquired Inputs –
Eight channels maximum.

Vertical Systems

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

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

Horizontal System

Four timebase modes are available:

Triggered Phase Reference[*1] Timebase Mode – Timing information extracted from a user-supplied phase reference (clock) signal significantly improves timebase accuracy and jitter performance of the triggered acquisition. Horizontal position is referenced to the trigger signal as with a traditional timebase.

Free Run Phase Reference[*1] **Timebase Mode –** All timing is based on a phase reference signal; accuracy and jitter as above; no trigger is needed, and correspondingly there is no timing relation to trigger signal.

Short Term Optimized Sequential[*2] Timebase Mode – Best short-delay performance for acquisitions without the external phase reference signal.

Locked to 10 MHz Reference Sequential Timebase **–** Provides the best long-delay performance for acquisitions without the external phase reference signal. The Lock is selectable between *Lock to Internal 10 MHz* and *Lock to External 10 MHz* for highest frequency accuracy.

Main and Magnification View Timebases –
100 fs/div to 5 ms/div in 1-2-5 sequence or 100 fs increments.

Maximum Trigger Rate –
200 kHz; in Phase Reference mode: 50 kHz.

Typical Acquisition Rate –
150 kS/s per channel (standard sequential timebase); 50 kS/s (Phase Reference modes).

[*1] When using the 82A04 *Phase Reference Module.*

[*2] Conventional mode – *not* using the 82A04 *Phase Reference Timebase Module.*

Time Interval Accuracy (Standard Timebase) and Timing Deviation (Phase Reference Modes)

Phase Reference Timebase –
Triggered: maximum timing deviation relative to phase reference signal:

Horizontal position >40 ns after trigger event:
0.2% of phase reference signal period (typical).

Horizontal position ≤40 ns after trigger event:
0.4% of phase reference signal period (typical).

Phase Reference Timebase –
Free Run: maximum timing deviation relative to phase reference signal:

0.1% or better of phase reference signal period (typical).

Sequential Timebase[*2] –
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 available (Sequential Timebase Only) –
–500 ps to +100 ns on any individual channel in 100 fs increments.

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

Magnification Views –
In addition to the main timebase, the CSA/TDS8200 supports two magnification views. These magnifications are independently acquired using separate timebase settings which allow same or faster time/div than that of the main timebase.

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 and from the 80A05 electrical clock recovery module – signal from the module (pre-scaled above 2.7 Gb/s) internally connected.
Phase Reference[*1] timebase supports acquisitions without a trigger signal in its Free Run mode.

Trigger Sensitivity

External Direct Trigger Output –
50 mV, DC to 4 GHz (typical).
100 mV, DC to 3 GHz (guaranteed).
Pre-scaled Trigger Input –
200 $mV_{pk\text{-}pk}$ to 800 $mV_{pk\text{-}pk}$,
2 to 12.5 GHz (guaranteed).

Jitter

Phase Reference[*1] Timebase –
System jitter of 200 fs_{RMS} typical on a 10 GHz or faster acquisition module, with f ≥8 GHz, 0.6V ≤ ≤VREF ≤1.8 V Phase Reference Signal.
Jitter: system jitter of 280 fs_{RMS} typical on a 10 GHz or faster acquisition module, in CSA/TDS8200 mainframe, with 2 GHz ≤f ≤8 GHz, 0.6V ≤VREF ≤ ≤1.8 V Phase Reference Signal.
The Phase Reference timebase remains operational to 100 mV (typical) with increased jitter.
Short-term Jitter Optimized Sequential Mode –
≤0.8 ps RMS +5 ppm of position (typical).
≤1.2 ps RMS +10 ppm of position (max.).
Locked to 10 MHz Reference Sequential Mode –
≤1.6 ps RMS +0.04 ppm of position (typical).
≤2.5 ps RMS +0.01 ppm of position (max.).

[*1] When using the 82A04 *Phase Reference Module.*

Internal Clock –
Adjustable from 25 to 200 kHz (drives TDR, internal clock output and calibrator).
Trigger Level Range – ±1.0 V.
Trigger Input Range – ±1.5 V.
Trigger Holdoff –
Adjustable 5 µs to 100 ms in 0.5 ns increments.
External Trigger Gate (Optional) –
TTL logic 1 enables gate, a TTL logic 0 disables gate, maximum non-destruct input level ±5 V.

Display Features

Touch Screen Display –
264 mm/10.4 in. diagonal, color.
Colors – 16,777,216 (24 bits).
Video Resolution –
640 horizontal by 480 vertical displayed pixels.
Monitor Type – LCD monitor.

Math/Measurement

System Measurements

The CSA/TDS8200 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, OMA, +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), OMA.
Timing Measurements –
Rise, Fall, Period, Bit Rate, Bit Time, Frequency, Crossing (%, Level, Time), +Cross, –Cross, Jitter (Peak-to-Peak, 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 (Gb/s) unless otherwise noted –
STM-0/OC-1 51.8 Mb/s.
STM-1/OC-3 155 Mb/s.
STM-4/OC-12 622 Mb/s.
STM-16/OC-48 2.488.
STM-64/OC-192 9.953.
STM-256/OC-768 39.813.
FEC 2.666 2.666.
FEC 10.66 10.664.
FEC 10.709 10.709.
FEC 43 Gb/s G.709 43.018.
FEC 42.66 42.657.
FC-10 G 10.51875.
FC-133 132.8 Mb/s.
FC-266 265.6 Mb/s.
FC-531 531.2 Mb/s.
FC-1063 1.063.
FC-2125 2.125.
FC-4250 4.250.
10 G BASE-X4 3.125.
10 G BASE-W 9.953.
10 G BASE-R 10.3125.
InfiniBand 2.500.
Gigabit Ethernet 1.2500.
XAUI 3.125.

Optical Sampling Module Characteristics

▸ Optical Sampling Module Characteristics (Refer to Optical Sampling Modules User Manual for more detailed information)

	Application Type	Standards and Supported Filtering Rates	Number of Input Channels	Effective Wavelength Range	Calibrated Wavelengths
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), FibreChannel (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 (10.310 Gb/s), 10G Fibre Channel (10.520 Gb/s), ITU-T G.975 FEC (10.664 Gb/s), ITU-T G.709 (10.709 Gb/s),10 GbE FEC (11.100 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 (10.310 Gb/s), 10G Fibre Channel (10.520 Gb/s), ITU-T G.975 FEC (10.664 Gb/s), ITU-T G.709 (10.709 Gb/s), 10 GbE FEC (11.100 Gb/s)	1	1100 nm and 1650 nm	1310 nm and 1550 nm (±20 nm)
80C12	1 to 4.5 Gb/s Datacom/Telecom	FibreChannel (1.063 Gb/s), 2G FibreChannel (2.125 Gb/s), 4G FibreChannel (4.250 Gb/s) 10GBase-X4 (3.125 Gb/s) 10GFC-X4 (3.1875 Gb/s) VSR5-3318 (3.318 Gb/s)	1	700 nm to 1650 nm	850 nm, 1310 nm and 1550 nm (±20 nm)
	10 Gb/s Datacom/ Telecom	OC-192/STM-64 (9.953 Gb/s), 10GBASE-W (9.953 Gb/s), 10GBASE-R (10.310 Gb/s), 10G Fibre Channel (10.520 Gb/s), ITU-T G.975 FEC (10.664 Gb/s), ITU-T G.709 (10.709 Gb/s), 10 GbE FEC (11.100 Gb/s)			

▶ Optical Sampling Module Characteristics (continued)

	Clock Recovery (Optional)	Clock Recovery Outputs	Unfiltered Optical Bandwidth[*1]	Absolute Maximum Nondestructive Optical Input	Internal Fiber Diameter
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	*2.5 GHz*	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, 10.310 Gb/s; Option CR2: 10.310 Gb/s, 10.520 Gb/s; Option CR4: Continuous from 9.800 Gb/s to 12.600 Gb/s	Clock, Clock/16	*10 GHz*	1 mW average; 10 mW peak power at wavelength of highest responsivity	62.5 µm/125 µm multi-mode
80C10	Future Upgradeable	Future	*65 GHz*	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 9.800 Gb/s to 12.600 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
80C12	Provided by 80A05 (sold separately)	ELECTRICAL SIGNAL OUT	*9 GHz* (for all options except 10G) *10 GHz* (Option 10G)	1 mW average; 10 mW peak power at wavelength of highest responsivity	62.5 µm/125 µm multi-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
80C02	>30 dB	Single-mode	6.0 µW at 9.953 Gb/s, 12.5 GHz; 10.0 µW at 20 GHz; 15.0 µW at 30 GHz	10.0 µW at 9.953 Gb/s, 12.5 GHz mode; 15 µW at 20 GHz; 30 µW at 30 GHz	Standard
80C07B	>14 dB (multi-mode) >24 dB (single-mode)	Single- or multi-mode	0.50 µW at 155 Mb/s, 622 Mb/s, 1063 Mb/s, 1250 Mb/s; 0.70 µW at 2.488/2.500 Gb/s	1.0 µW at 155 Mb/s, 622 Mb/s, 1063 Mb/s, 1250 Mb/s; 1.5 µW at 2.488/2.500 Gb/s	Standard
80C08C	>14 dB (multi-mode) >24 dB (single-mode)	Single- or multi-mode	1.7 µW at all filter rates	3.0 µW at all filter rates	Standard
80C10	>30 dB	Single-mode	40 µW at 39.813 Gb/s, 43.018 Gb/s (1550 nm); 75 µW at 39.813 Gb/s, 43.018 Gb/s (1310 nm); 30 µW at 30 GHz mode (1550 nm); 55 µW at 30 GHz mode (1310 nm); 85 µW at 65 GHz mode (1550 nm); 150 µW at 65 GHz mode (1310 nm)	60 µW at 39.813 Gb/s, 43.018 Gb/s (1550 nm); 110 µW at 39.813 Gb/s, 43.018 Gb/s (1310 nm); 50 µW at 30 GHz (1550 nm); 90 µW at 30 GHz (1310 nm); 120 µW at 65 GHz (1550 nm); 220 µW at 65 GHz (1310 nm)	Standard
80C11	>30 dB	Single-mode	5.5 µW at all filter rates; 10.0 µW at 20 GHz 20.0 µW at 30 GHz	8.0 µW at all filter rates; 14.0 µW at 20 GHz 30.0 µW at 30 GHz	Standard
80C12	>14 dB (multi-mode) >24 dB (single-mode)	Single- or multi-mode	1.7 µW (all filters except Option 10G) 3.4 µW (Full BW and Option 10G filters)	3.0 µW (all filters except Option 10G) 6.0 µW (Full BW and Option 10G filters)	Standard

► Optical Sampling Module Characteristics (continued)

	Offset Capability	Power Meter	Power Meter Range	Power Meter Accuracy	Mask Test Optical Sensitivity*1
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	–16 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
80C12	Standard	Standard	0 dBm to -30 dBm	5% of reading	–15 dBm (for all options except Option 10G) –12 dBm (for Option 10G)

*1 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 Optical Sampling Modules

	Dimensions (mm/inches)			Weight (kg/lb)
	Width	Height	Depth	Net
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
80C12	165/6.5	25/1.0	305/12.0	<2.61/<5.75

► Electrical Sampling Module Characteristics

	Application Type	Channels	Input Impedance	Channel Input Connector	Bandwidth[*1]
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[*2]
80E03	Device Characterization	2	50 ±0.5 Ω	3.5 mm female	20 GHz[*2]
80E04	TDR Impedance Characterization with single-ended, common, differential TDR capability	2	50 ±0.5 Ω	3.5 mm female	20 GHz[*2]
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*

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

[*2] Calculated from 0.35 bandwidth rise time product.

► 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 (typical)[*3]	1.0 V_{p-p}	±1.6 V	±2.0 V	14 bits full scale
80E02	≤28 ps	1.0 V_{p-p}	±1.6 V	±3.0 V	14 bits full scale
80E03	≤17.5 ps	1.0 V_{p-p}	±1.6 V	±3.0 V	14 bits full scale
80E04	≤17.5 ps	1.0 V_{p-p}	±1.6 V	±3.0 V	14 bits full scale
80E06	5.0 ps[*4]	1.0 V_{p-p}	±1.6 V	±2.0 V	14 bits full scale

[*3] Calculated from 0.35 bandwidth rise time product.

[*4] 80E06 rise time is calculated from formula rise time = 0.35/(typical bandwidth).

▶ Electrical Sampling Module Characteristics (continued)

	Vertical Sensitivity Range	Vertical Voltage DC Accuracy, Single Point, Within ±2 °C of Compensated Temperature	Typical Step Response Aberrations*1	RMS Noise*1
80E01	10 mV to 1.0 V full scale	± [2 mV + 0.007 (Offset) + 0.02 (Vertical Value – Offset)]	*±3% 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; ±1% or less over the zone 3 ns to 100 ns following step transition; ±0.5% after 100 ns following step transition*	*1.8 mV* ≤2.3 mV (maximum)
80E02	10 mV to 1.0 V full scale	± [2 mV + 0.007 (Offset) + 0.02 (Vertical Value – Offset)]	*±3% 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; ±3% or less over the zone 300 ps to 5 ns following step transition; ±1% or less over the zone 5 ns to 100 ns following step transition; ±0.5% after 100 ns following step transition*	*400 µV* ≤800 µV (maximum)
80E03	10 mV to 1.0 V full scale	± [2 mV + 0.007 (Offset) + 0.02 (Vertical Value – Offset)]	*±3% 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; ±3% or less over the zone 300 ps to 5 ns following step transition; ±1% or less over the zone 5 ns to 100 ns following step transition; ±0.5% after 100 ns following step transition*	*600 µV* ≤1.2 mV (maximum)
80E04	10 mV to 1.0 V full scale	± [2 mV + 0.007 (Offset) + 0.02 (Vertical Value – Offset)]	*±3% 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; ±3% or less over the zone 300 ps to 5 ns following step transition; ±1% or less over the zone 5 ns to 100 ns following step transition; 0.5% after 100 ns following step transition*	*600 µV* ≤1.2 mV (maximum)
80E06	10 mV to 1.0 V full scale	± [2 mV + 0.007 (Offset) + 0.02 (Vertical Value – Offset)]	*±5% or less for first 300 ps following step transition*	1.8 mV ≤2.4 mV (maximum)

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

▶ Physical Characteristics for Electrical Sampling Modules

	Dimensions (mm/in.)			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 TDR System (80E04 only) Characteristics

	80E04[*1]
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	28 ps typical
TDR System Incident Rise Time	17 ps typical
TDR Step Maximum Repetition Rate	200 kHz
TDR System Step Response Aberrations	±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

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

► 80A05 Electrical Clock Recovery Module

Enumerated Standards (Basic equipment)	**Standard**	**Rate**
	OC3/STM1	155.52 Mb/s
	OC12/STM4	622.08 Mb/s
	Fibre Channel	1.063 Gb/s
	Gigabit Ethernet	1.250 Gb/s
	Gigabit Fibre Channel	2.125 Gb/s
	OC48/STM16	2.488 Gb/s
	2 Gigabit Ethernet	2.500 Gb/s
	Infiniband	2.500 Gb/s
	2.5G G.709 FEC	2.666 Gb/s
	4 Gigabit Fibre Channel	4.250 Gb/s
Clock Recovery Ranges (Basic equipment, for user-specified rates)	**Range**	**Emerging Standards**
	50 Mb/s to 2.700 Gb/s	VSR5
	3.00 Gb/s to 3.188 Gb/s	PCI Express, SATA, SATA-2, XAUI, 4-Lane 10FC
Enumerated Standards (Added with Option 10G)	**Standard**	**Rate**
	OC192/STM64	9.953 Gb/s
	10GBase-W	9.953 Gb/s
	10GBase-R	10.31 Gb/s
	10G Fibre Channel	10.51 Gb/s
	G.975 FEC	10.66 Gb/s
	G.709 FEC	10.71 Gb/s
	10 GbE with FEC	11.10 Gb/s
Clock Recovery Ranges (Added with Option 10G, for user-specified rates)	**Range**	**Emerging Standards**
	2.7 Gb/s to 3.0 Gb/s	SATA-3, 2x XAUI, PCI Express 2,
	3.267 Gb/s to 4.250 Gb/s	OC192 Super FEC
	4.900 Gb/s to 6.375 Gb/s	
	9.800 Gb/s to 12.60 Gb/s	
Sensitivity	**Differential**	**Single-ended**
50 Mb/s to 2.70 Gb/s	≤8 mV_{p-p} on each input	10 mV_{p-p}
2.70 Gb/s to 11.19 Gb/s	≤12 mV_{p-p} on each input	15 mV_{p-p}
11.19 Gb/s to 12.60 Gb/s	≤15 mV_{p-p} on each input	20 mV_{p-p}

Power Requirements

Line Voltage and Frequency –
100 to 240 VAC ±10% 50/60 Hz.
115 V AC ±10% 400 Hz.

Environmental characteristics

Temperature –
Operating: +10 ºC to +40 ºC.
Nonoperating: -22 ºC to +60 ºC.
Relative Humidity –
Operating (Floppy disk and CD-ROM not installed): 20% to 80% at or below 40 ºC (upper limit de-rates to 45% relative humidity at 40 ºC).
Nonoperating:
5% to 90% at or below 60 ºC (upper limit de-rates to 20% relative humidity at +60 ºC).
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.

► Ordering Information

8200 Series Mainframes

TDS8200 Digital Sampling Oscilloscope

Includes: User manual, quick reference card, Microsoft Windows 2000 compatible keyboard and 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.

CSA8200 Communications Signal Analyzer

Includes: User manual, quick reference card, Microsoft Windows 2000 compatible keyboard and 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.

8200 Series Mainframe Options

Option 1K – Cart.

Option 1R – Rackmount kit (includes: hardware, tooling and instructions for converting bench model to rackmount configuration).

Option GT – Gated Trigger.

Option JNB – Advanced Jitter, Noise and BER Analysis Software.

Option ICON – Interconnect Analysis and Modeling Software.

Option IMESX – Model Extraction Software.

Option ISPAR – S-Parameter Software.

Service Options

Opt. C3 – Calibration Service 3 Years.

Opt. C5 – Calibration Service 5 Years.

Opt. D1 – Calibration Data Report.

Opt. D3 – Calibration Data Report 3 Years (with Option C3).

Opt. D5 – Calibration Data Report 5 Years (with Option C3).

Opt. R3 – Repair Service 3 Years.

Opt. R5 – Repair Service 3 Years.

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. A10 – China Power.

Opt. A99 – No Power Cord.

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.

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

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

SlotSaver: Small Module Extender Cable – (380 mm/15 inch) – Order 174-5230-00. This cable can be used to power and operate one 80A01, 80A02 or 80A06 accessory module without consuming a small form factor mainframe slot. The SlotSaver extender cable plugs into the "Trigger Power" connector on the mainframe, or into the "Probe Power" connector on most electrical sampling modules.

82A04 Filter 2GHz – Filter kit for non-sinusoidal phase reference clock signal with frequency between 2 GHz and 4 GHz. Order 020-2566-00.

82A04 Filter 4GHz – Filter kit for non-sinusoidal phase reference clock signal with frequency between 4 GHz and 6 GHz. Order 020-2567-00.

82A04 Filter 6GHz – Filter kit for non-sinusoidal phase reference clock signal with frequency between 6 GHz and 8 GHz. Order 020-2568-00.

2X Attenuator (SMA male-to-female) – DC to 18 GHz. Order 015-1001-01.

5X Attenuator (SMA male-to-female) – DC to 18 GHz. Order 015-1002-01.

Connector Adapter – (2.4 mm or 1.85 mm male, to 2.92 mm female) DC to 40 GHz. Order 011-0157-00.

Power Divider – 50 Ω, impedance matching power divider, SMA male to two SMA females. Order 015-0705-00.

Rackmount Kit – Order 016-1791-01.

Wrist Strap (antistatic) – Order 006-3415-04.

P6209 – 4 GHz Active FET Probe.

P7260 – 6 GHz Active FET Probe. Requires 80A03 interface module (see below).

P7350 – 5 GHz Active FET Probe. Requires 80A03 interface module (see below).

P7350SMA – 5 GHz 50 Ω Differential-to-Single-ended Active Probe. Requires 80A03 interface module (see below). Note that the P7380 probes are recommended over the P7350 probes for sampling purposes due to their higher bandwidth and signal fidelity.

P7380SMA – 8 GHz 50 Ω Differential-to-Single-ended Active Probe. Requires 80A03 interface module (see below).

P6150 – 9 GHz Passive Probe; the probe consists of a very high quality cca, 20 GHz probe tips plus an extremely flexible SMA cable. For higher frequency performance, the 015-0560-00, or some of the accessory cables listed below, can be used.

P8018 – 20 GHz Single-ended TDR Probe. 80A02 module (below) recommended for static protection of the sampling or TDR module.

80A02 – CSA/TDS8200 Series EOS/ESD Protection Module (1 channel). P8018 TDR probe (above) recommended.

80A03 – TekConnect®

82A04 – Phase Reference Module for low jitter acquisition (with or without trigger). Accepts signal from 2 GHz to 25 GHz (external filter might be required below 8 GHz), or to 60 GHz with Option 60G.

80A05 – Electrical clock recovery module/clock recovery for the 80C12.

The standard version of 80A05 supports signals in the following ranges: 50 Mb/s to 2.700 Gb/s, 2.700 Gb/s to 3.188 Gb/s and the rate of 4 Gigabit FibreChannel 4.250 Gb/s. The Option 10G adds the ranges of 3.267 Gb/s to 4.250 Gb/s, 4.900 Gb/s to 6.375 Gb/s and 9.800 Gb/s to 12.60 Gb/s.

80A06 – PatternSync Trigger module. Provides user-programmable divide ratios to optimize high-speed recovered clocks for CSA/TSA82000 sample rate range.

K4000 – Mobile Workstation.

Interconnect Cables

015-0560-00 (450 mm/18 inch; 1 dB loss at 20 GHz) cable is a high-quality cable recommended for work to 20 GHz.

Interconnect Cables (Third Party)

Tektronix recommends using quality high performance interconnect cables with these high bandwidth products in order to minimize measurement degradation and variations. The W.L. Gore & Associates' cable assemblies listed below are compatible with the 2.92 mm, 2.4 mm and 1.85 mm connector interface of the 80E0x modules. Assemblies can be ordered by contacting Gore by phone at (800) 356-4622 or on the web at www.goreelectronics.com (click on "Contact Us").

Bench Top Test Cable Assemblies

TEK40PF18PP – Frequency: 40 GHz; Connectors: 2.92 mm male; Length: 18.0 inches.

TEK50PF18PP – Frequency: 50 GHz; Connectors: 2.4 mm male; Length: 18.0 inches.

TEK65PF18PP – Frequency: 65 GHz; Connectors: 1.85 mm male; Length: 18.0 inches.

High Frequency Interconnect Cables for Electrical Sampling Modules

TEK40HF06PP – Frequency: 40 GHz; Connectors: 2.92 mm male; Length: 6.0 inches.

TEK40HF06PS – Frequency: 40 GHz; Connectors: 2.92 mm male; 2.92 mm female; Length: 6.0 inches.

TEK50HF06PP – Frequency: 50 GHz; Connectors: 2.4 mm male; Length: 6.0 inches.

TEK50HF06PS – Frequency: 50 GHz; Connectors: 2.4 mm male; 2.4 mm female; Length: 6.0 inches.

TEK65HF06PP – Frequency: 65 GHz; Connectors: 1.85 mm male; Length: 6.0 inches.

TEK65HF06PS – Frequency: 65 GHz; Connectors: 1.85 mm male, 1.85 mm female; Length: 6.0 inches.

8200 Series Sampling Oscilloscopes

- CSA8200 Communications Signal Analyzer
  TDS8200 Digital Sampling Oscilloscope

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

Product(s) are manufactured in ISO registered facilities.

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