Communications Signal Analyzer

▶ CSA8000

▶ Features & Benefits

Automatic Communication Measurements
- Q-factor
- Extinction Ratio
- Optical Power
- Signal-to-noise Ratio
- Jitter

Wide Bandwidth (DC to 50 GHz 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 <1 ps RMS – Typical)

FrameScan™ Acquisition Mode
- Isolate Data Dependent Faults
- Examine Low-power PRBS Signals

▶ Applications

Manufacturing/Testing for ITU/ANSI Conformance

Designing/Verification of Telecom and Datacom Elements

Digital Communications Analysis Solutions

Specifically designed for high-performance communications applications, the CSA8000 Communications Signal Analyzer is the ideal tool for design evaluation and manufacturing test of datacom and telecom components, transceiver sub-assemblies and transmission systems.

The CSA8000 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.

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

Modularity and Flexibility

The CSA8000 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.

Tektronix

The available optical modules provide complete optical test solutions for both telecom (622 Mb/s to 40 Gb/s) and datacom (Fibre Channel 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, one or more reference receiver filters, a full bandwidth path and a low-noise electrical sampler. In addition, clock recovery is available as an option for all optical modules.

The electrical plug-ins include a variety of modules with bandwidths up to 50 GHz and specialized features such as TDR. High bandwidth probes are also available for constructing a total acquisition and measurement solution.

Superior Performance

With its industry-best horizontal stability, trigger jitter, signal sensitivity and noise performance, the CSA8000 ensures the most accurate acquired signal for high-speed optical communications testing.

The CSA8000's multi-processor architecture, with dedicated per channel Digital Signal Processors (DSP), also provides industry-best waveform acquisition rates that shorten test times.

The CSA8000'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 the 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 CSA8000 is built on Tektronix' new 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).

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.

▶ 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.

Time Interval Accuracy –
Horizontal sensitivity < 21 ps: 1 ps + 1% of interval.
Horizontal sensitivity ≥21 ps:
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, 500, 1,000, 2,000, 4,000 samples.

Magnification Views – In addition to the main timebase, the CSA8000 supports two magnification views. These magnifications are independently acquired using separate timebase settings.

Maximum Trigger Rate – 200 kHz.

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-selected trigger input:
800 mV, 2 to 3 GHz (guaranteed).
600 mV, 3 to 10 GHz (guaranteed).
1000 mV, 10 to 12, 5 GHz (typical).

Jitter –
Short-term jitter optimized mode:
1.0 ps +5 ppm (typical).
≤1.5 ps +10 ppm (max.).
Locked to 10 MHz reference:
1.6 ps +0.05 ppm of position (typical).
≤2.5 ps +0.1 ppm of position (max.).

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 2 ns increments.

Display Features

Touchscreen 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 CSA8000 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 –
Amplitude Measurements: High, Low, Amplitude, Max, Mid, Min, Peak-to-peak, + Overshoot, – Overshoot, Mean, Cycle Mean, RMS, Cycle RMS, AC RMS, Gain.
Timing Measurements: Rise, Fall, Period, Frequency, + Cross, – Cross, + Width, – Width, + Duty Cycle, – Duty Cycle, Burst Width, Delay, Phase.
Area Measurements: Area, Cycle Area.
Eye Pattern/Optical Measurements: Extinction Ratio (Ratio, %, dB), Eye Width, Eye Height, Crossing %, Duty Cycle Distortion, Jitter (p-p, RMS), Noise (p-p, RMS), Q-Factor, SNR, Average Optical Power.

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:

▶ Mask Testing

Standard	Rate (Mb/s)
OC-1	51.84
OC-3/STM-1	155.52
OC-9	466.56
OC-12/STM-4	622.08
OC-18	933.12
OC-24	1244.2
OC-36	1866.2
OC-48/STM-16	2488.3
OC-192/STM-64*1	9953.3
OC-768/STM-256	39813.12
FEC 10.66 Gb/s	10664.0
FEC 42.66 Gb/s	42656.0
FC-133	132.81
FC-266	265.6
FC-531	531.2
FC-1063	1062.5
Gigabit Ethernet	1250.0

*1 OC192/STM-64 Mask is per ITU-T, 691 recommendation.

Power Requirements

Line-Voltage Ranges – 90 to 132 V_{RMS}, 180 to 250 V_{RMS}.

Line Frequency – 48 to 440 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

Cabinet

Dimensions	mm	in.
Width	457	18.0
Height	343	13.5
Depth	419	16.5
Weight	**kg**	**lb.**
Net	20.8	46
Shipping	36.7	81

▶ Ordering Information

CSA8000

Communications Signal Analyzer.

Includes: User manual, quick reference card, MS Windows 98 compatible keyboard, MS Windows 98 compatible mouse, WaveStar™ driver, touchscreen stylus, online help, programmer online guide, power cord.

CSA8000 Options

Option C3 – Three years of Calibration Service.

Option D1 – Calibration data report.

Option D3 – Three years of calibration data reports.

Option R3 – Extended repair warranty to three years.

Option 1K – Cart.

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

International Power Plug Options

Option A1 – Universal Euro 220 V, 50 Hz.

Option A2 – UK 240 V, 50 Hz.

Option A3 – Australian 240 V, 50 Hz.

Option A5 – Switzerland 220 V, 50 Hz.

Option A99 – No power cord.

Option AC – China 240 V, 50 Hz.

8000 Series Sampling Oscilloscope Optical Modules

80C01 Multi-rate Telecom Sampling Module with Optional Clock Recovery – Supports waveform compliance testing of long wavelength (1,100 to 1,650 nm) signals at 622, 2,488 and 9,953 Mb/s, as well as general purpose testing w/up to 20 GHz optical bandwidth.

80C02 High Performance Telecom Sampling Module with Optional Clock Recovery – Supports waveform compliance testing of long wavelength (1,100 to 1,650 nm) signals at 9.953 Gb/s, as well as general purpose testing w/up to 28 GHz optical bandwidth.

80C03 Multi-rate, High Sensitivity Datacom Module with Optional Clock Recovery – Supports waveform compliance testing of short and long wavelength (700 to1,650 nm) signals at 1,063, 1,250, 2,488 and 2,500 Mb/s, as well as general purpose testing w/up to 2.3 GHz optical bandwidth.

80C04 High-performance Telecom Sampling Module with Optional Forward Error Correction Clock Recovery – Supports waveform compliance testing of long wavelength (1100 - 1650 nm) signals at either 9.953 Gb/s or 10.664 Gb/s as well as general purpose testing with up to 28 GHz optical bandwidth.

80C05 40 GHz Multi-rate Telecom Sampling Module – Supports waveform testing of long wavelength (1530 - 1580 nm) low-powered telecom signals at 9.953 Gb/s and 40 Gb/s with selectable bandwidth settings of 20, 30 and 40 GHz.

80C06 50 GHz Telecom Sampling Module – Supports waveform testing with the highest optical bandwidth for communications signal analysis available today of long wavelength (1530 - 1580 nm) high-powered telecom signals at 40 Gb/s rates and 50 GHz bandwidth.

8000 Series Sampling Oscilloscope Electrical Modules

80E01 – 50 GHz single-channel electrical sampling module.

80E02 – 12.5 GHz dual-channel, low-noise electrical sampling module.

80E03 – 20 GHz dual-channel electrical sampling module.

80E04 – 20 GHz dual-channel electrical sampling module with TDR.

Other Accessories

Calibration Step Generator –

Universal Euro: Order 067-1338-01.
UK: Order 067-1338-02.
Australian: Order 067-1338-03.
North American: Order 067-1338-04.
Switzerland: Order 067-1338-05.
Japanese: Order 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 015-1001-00.

5X Attenuator (male-to-female) – Order 015-1002-00.

Power Divider – Order 015-1014-00.

Rackmount – Order 016-1791-00.

P6209 – 4 GHz active FET probe.

P6150 – 9 GHz passive probe.

K4000 Mobile Workstation.

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