Semight
INSTRUMENTS

10GHz Sampling Oscilloscope

DCA4201 V4.91

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1 Product Description

Semight Instruments DCA4201 sampling oscilloscope is based on equivalent-time sampling and reconstructed eye diagram technology, resulting in higher accuracy and better cost of measurement of high-speed optoelectronic digital signals. This is also recognized as the industry standard for verifying optical transmitter compliance to communications standards. The DCA4201 is designed for R&D and massive production test applications and supports NRZ signals testing. The DCA4201 supports 1 to 12.5 Gb/s measurements with both electrical & optical input options, which makes you be confident with your test results and never be questioned. DCA4201 also has a fast-tuning mode, in this mode, the extinction ratio and average power can be maintained at a refresh rate of 1Hz, thus greatly improving test efficiency and reducing test costs. Unlike the other Industry standard DCA solution, which uses host and modules to create a waveform analysis system, the DCA4201 is completely integrated instruments built in a small form factor.

As a low-noise, high-sensitivity calibrated reference receiver (compliant to industry standard tolerances), DCA4201 support an extremely high dynamic range, both multimode and single-mode signals at wavelengths between 750 to 1650 nm. In order to get consistent result comparing with other industry standard sampling

oscilloscope, DCA4201 support Extinction Ratio and Average Optical Power correction, dark current self-calibration algorithms. The user interface of the DCA4201 is similar as the industry standard sampling oscilloscope. Users can run the DCA4201 software on a PC and easily control the DCA4201 through the LAN/USB interface to support testing.

2 Key Features

- Fast sampling;
- Support extinction ration correction;
- Support traditional mask file;
- Flexible combination of different filters, which can cover 1-12.5Gb/s data rate;
- Consistent Result similar as Industry Standard DCA;
- Automated mask margin measurements.
- Automatic test: The remote command control mode is convenient and fast.

DCA4201 sampling oscilloscope support NRZ analysis.

NRZ
Bit Rate (Gbps)
Average Power (dBm, W)
Extinction Ratio (dB)
Jitter P-P/RMS (s)
Rise/Fall Time (s)
Crossing (%)
One Level/Zero Level (W, V)
OMA (dBm, W)
Eye Amplitude/Eye Height (W, V)
Eye Width (s)
Mask Margin[1] (%)

[1] Mask Margin support add，delete，customized template and Hit Ratio/ Count settings.

3 Technical Specifications

Optical Channel Specifications

Items	Specifications
Optical channel bandwidth [1]	12 GHz
Fiber input	62.5/125 μm FC/UPC (single-mode/multi-mode)
Wavelength range	750 ~ 1650 nm
Factory calibrated	850/1310/1550 nm ±10 nm

wavelengths [2]	
Items	Specifications
Support various data rate according to multi standards (Filters) [3]	1.25 Gbps 2.5 Gbps 3.125 Gbps 4.25 Gbps 6.25 Gbps 10.3125 Gbps 12.5 Gbps
ADC resolution	14 Bit
Sensitivity [4]	-10 dBm @typ.
Measurement consistency [5]	Average Power: ±0.1 dB, Extinction Ratio: ±0.3 dB Mask Margin: ±5 %(after correlation)
Max Input [6] (Non-Destruction, Peak)	2 mW (+5 dBm)
Max Input (Linearity)	0.5 mW (-3 dBm)
Monitor Average Power Range	-20 dBm ~ -3 dBm
Average power monitor accuracy [7]	Single-mode ±5% ±200 nW ±connector uncertainty Multimode (characteristic) ± 10% ± 200 nW ± connector uncertainty
Input return loss (FC/UPC)	> 20 dB@850 nm > 35 dB@1310 nm

[1] Optical channel bandwidth defines by optical power reduced by 3dB which is -3dBo bandwidth(-3dBo=-6dBe).

[2] Here the ±10 nm is the source optical wave length error.

[3] Only some of the application scenarios are listed, and other application scenarios can be found in the option Information section of the document or consult sales.

[4] Sensitivity is not a part of instrument specifications. It is calculated from characteristic value of noise. It means the power value when influenced only by oscilloscope's noise floor, test with ideal eye diagram mask and the mask margin to be close to 0%. The minimal power value is also related to the quality of signal under test in real scenario.

[5] This parameter is not used to describe instrument specification. It means the difference between test with ideal signal and the theoretical value. In real test scenario, the test consistency related to signal quality.

[6] This value is from damage test by increasing the input optical power step by step (0.1dBm step). In real applications, due to the instability of the optical source, please be aware that not to keep the input optical signal power at+5dBm or above, IT MAY CAUSE THE INSTRUMENTS PERFORMANCE REDUCTION OR EVEN DAMAGE.

[7] Due to variations in mode-filling conditions, the measured power in multimode fiber will vary more than the measured power in single-mode fiber. For users needing the most accurate power measurements, use an optical power meter for multimode power measurements.

Electrical Specifications

Items	Specifications
Electrical channel bandwidth	20 GHz [1]
Rise Time (10 %~90 %)	20 ps
Max Input Amplitude	<1 V
RMS noise	2 mV @typ.
Sensitivity	<24 mV
Impedance	50 Ω
Reflection	10 %
ADC resolution	14 Bit

Input connector	SMA Female

[1] It's the electrical channel -3dBe bandwidth. It is measured by frequency sweeping after removal of test system. (±uncertainty)

Mainframe Specifications

Items	Specifications
Sampling system	Waveforms 25~10000
Trigger sensitivity	200 mV
Maximum trigger input	< ±1.5 V
Trigger impedance	50 Ω
Connector type	SMA Female
Trigger frequency range	100 MHz ~ 15 GHz
Integrated temperature monitor	Support
Remote control	Ethernet Socket (SCPI Command) USB 2.0 (SCPI Command)

* Remarks: the test environment is 23 ± 5 ℃

Environmental Specifications

Items	Specifications
Working place	In-door
Working condition	Temperature:10℃ t 40 ℃ Humidity:30 % to 80 % Relative Humidity without condensation
Storage	Temperature:-30 ℃ to 70 ℃ Humidity:10 % to 90 % Relative Humidity without condensation

Altitude	Operation：0 m to 2000 m Storage：0 m to 4600 m
Items	Specifications
Power	Voltage range：100-240 VAC Frequency range：50/60 Hz Maximum power consumption：250 W
Warm-up	After 30 minutes warm-up and calibration, ambient temperature changes less than ± 3 ℃
Calibration interval	1 year
Dimensions（mm） (with foot pad/ handle)	Half rack：221(W)*450(L)*105(H)
Weight [1]	Net weight 5.0~6.5 kg

[1] Dimensions and weight may vary due to configuations and options.

4 Software Function

Remote Control

There are two ways to control the DCA4201 optical sampling oscilloscope

- Connect the PC directly to DCA4201 via USB cable or LAN, and run the Semight DCA GUI software and user ATE (Automatic Test Equipment system software) on the PC simultaneously.
- PC1 is directly connected to DCA4201 via USB cable or LAN. Semight DCA GUI software is running on PC1, and then PC2 with user automated test

software running is connected to PC1 via LAN. This eliminates most issues of compatibility between an existing test system PC and DCA4201 hardware.

Requirement for PC system configuration

- Intel i5 processor or better
- 8GB memory
- Window7/Window10(64-bit)

The communication API between the system controller and PC is SCPI through LAN. It is important to note that there is no need to do any USB programming. This is all handled by the Semight DCA GUI software.

A reference clock, synchronous with the signal being tested, is required to trigger the DCA4201. If the device under test cannot provide the synchronous reference clock, user can use a clock recovery unit (Semight Instruments CR4201). Be sure that the input trigger range is 500MHz to 15GHz.

Software

Intuitive and simple GUI, making it easy to configure the system， determine reference and perform measurement. Build-in analysis function to display eye diagram and all common optical test parameters.

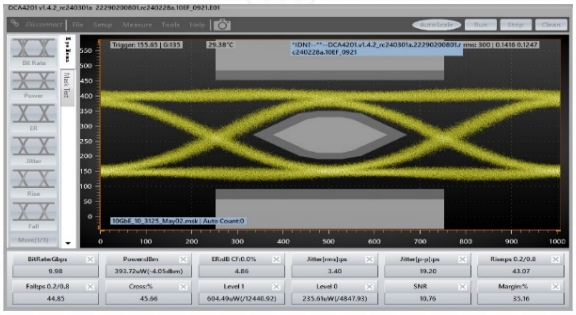

图 1 - 10G 光眼图

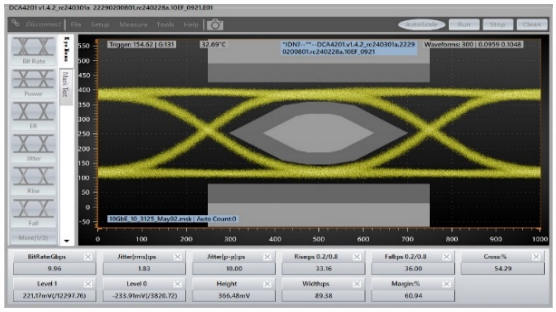

图 2 - 10G 电眼图

5 Ordering Information

Options category	Option number	Option description
Model	DCA4201	10 GHz optical channel; single-mode and multimode(750 to 1650 nm); 20 GHz electrical channel
Filter options [1]	140	GPON，1.244 Gbps， 1 Gb Ethernet，1.250 Gbps， CPRI 1.229 Gbps
	160	OC-48/STM-16，2.488 Gbps， 2 Gb Ethernet，2.500 Gbps， CPRI 2.458 Gbps
	180	10Gb Ethernet LX-4，3.125Gbps， CPRI 3.072 Gbps
	190	4.250 Gbps
	200	CPRI 6.144 Gbps，6.25 Gbps
	210	12.5 Gbps

	100	OC-192/STM-64，9.953 Gbps， 10Gb Ethernet，10.3125 Gbps， 10×Fiber Channel，10.51875 Gbps， OC-192/STM-64 FEC，10.664 Gbps ， OC- 192/STM-64 FEC，10.709 Gbps， 10Gb Ethernet FEC，11.0957 Gbps， 10×Fiber Channel FEC，11.317 Gbps
CDR options	CR	1.244 ~ 11.3 Gbps
Warranty [2]	R3C	Extend to 3 years warranty
	R5C	Extend to 5 years warranty

[1] The default filter options are 140/160/100; Up to 5 filter options can be selected.

[2] 1 year warranty by default.

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* The specifications and descriptions are subject to change without notice.