

4456 Series Digital Phosphor Oscilloscope

4456 C/CM, 4456 D/DM, 4456 E/EM



**Any Acquire Phosphor Technique
-Oscilloscope Experience Redefined**

Ceyear Technologies Co., Ltd

www.saltako.by

Product Overview

4456 Series Digital Phosphor Oscilloscope has six models, 350MHz-1GHz bandwidth, 5GSa/s sample rate, up to 500Mpts/CH memory depth, up to 1,000,000 wfms/s waveform capture rate. The originally developed *Any Acquire Phosphor* technique provides brand-new use experiences of oscilloscope for clients.

4456 Series Oscilloscope Integrates Digital Oscilloscope, logic analyzer, function generator, protocol analyzer and digital voltmeter, has many functions including waveform auto set, automatic measurement of waveform parameter, cursor measurement, histograms measurement, arithmetic operation, FFT analysis, serial protocol trigger and analysis, limit and mask test, power measurement and analysis, waveform record and replay, mixed signal analysis, arbitrarily function generator and so on. To supporting Ethernet remote control, integrated development and application are easy and convenient.

The 4456 series digital phosphor oscilloscope includes the standard type 4456C/D/E and the economical type 4456CM/DM/EM. The oscilloscope and digital voltmeter are standard, and the logical analyzer, function generator and protocol analyzer are optional.

Model Index		Standard Model			Economic Model		
		4456C	4456D	4456E	4456CM	4456DM	4456EM
Oscilloscope	Analog channels	4					
	Bandwidth	350MHz	500MHz	1GHz	350MHz	500MHz	1GHz
	Sample rate	5GSa/s (1ch), 2.5GSa/s (4ch)			5GSa/s (1ch), 1.25GSa/s (4ch)		
	Memory depth	500Mpts/CH			200Mpts/CH		
	Waveform capture rate	1,000,000 wfms/s					
	Vertical resolution	8bit					
	Grey grade	Level 256					
	Waveform color	Normal, inverted, temperature, spectral					
Logical analyzer	Digital channels	16					
	Sample rate	2.5GSa/s					
	Memory depth	500Mpts/CH			200Mpts/CH		
Function generator	Channels	1					
	Bandwidth	25MHz					
	Sample rate	200MSa/s					
Protocol analyzer		I ² C, SPI, CAN, LIN, Flex Ray, RS232, USB, Audio, MIL-STD-1553					

Digital voltmeter	Voltage, frequency
Display screen	10.4-inch capacitive touch screen
Standard probe	4 passive voltage probes

Main Characteristics

- **Five-in-one instrument**

This instrument integrates oscilloscope, logical analyzer, function generator, protocol analyzer and digital voltmeter, and will help you cope with all kinds of challenges easily.

- ***Any Acquire Phosphor* technology**

The unique *Any Acquire Phosphor* technology can provide you with higher sampling rate, faster waveform capture rate, more glaring display, deeper memory depth, more precise digital trigger and more comprehensive analysis.

- **Rich probe options**

It supports passive voltage probe, high voltage single end probe, high voltage differential probe, current probe, logic probe and active probe to satisfy the test requirements of probes in different cases.

- **Color display and capacitive touch screen**

10.4-inch color square LCD with resolution up to 1,024×768. The capacitive touch screen supports single-touch and multi-touch, which can realize waveform and menu operation quickly.

- **Small size, light weight, portability**

With portable structure, 6U standard frame installation, rich external interfaces, maximum weight 6 kg.

Oscilloscope

- **1000,000 wfms/s waveform capture rate, fast identify and capture accidental events.**

1000,000 wfms/s waveform capture rate and 5GSa/s sample rate, glitches and contingency capture rate can be greatly improved. Users can review more waveform details in a longer sample period.



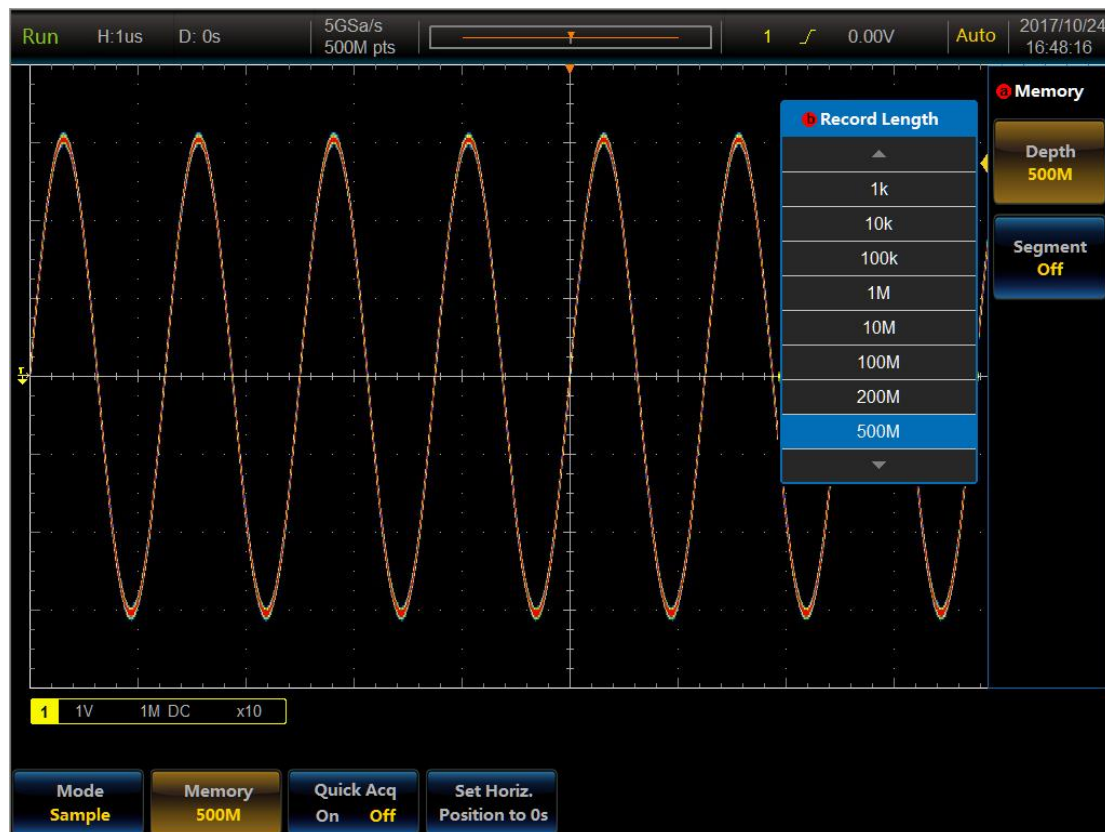
1000,000 wfms/s waveform capture rate, fast identification of contingency.



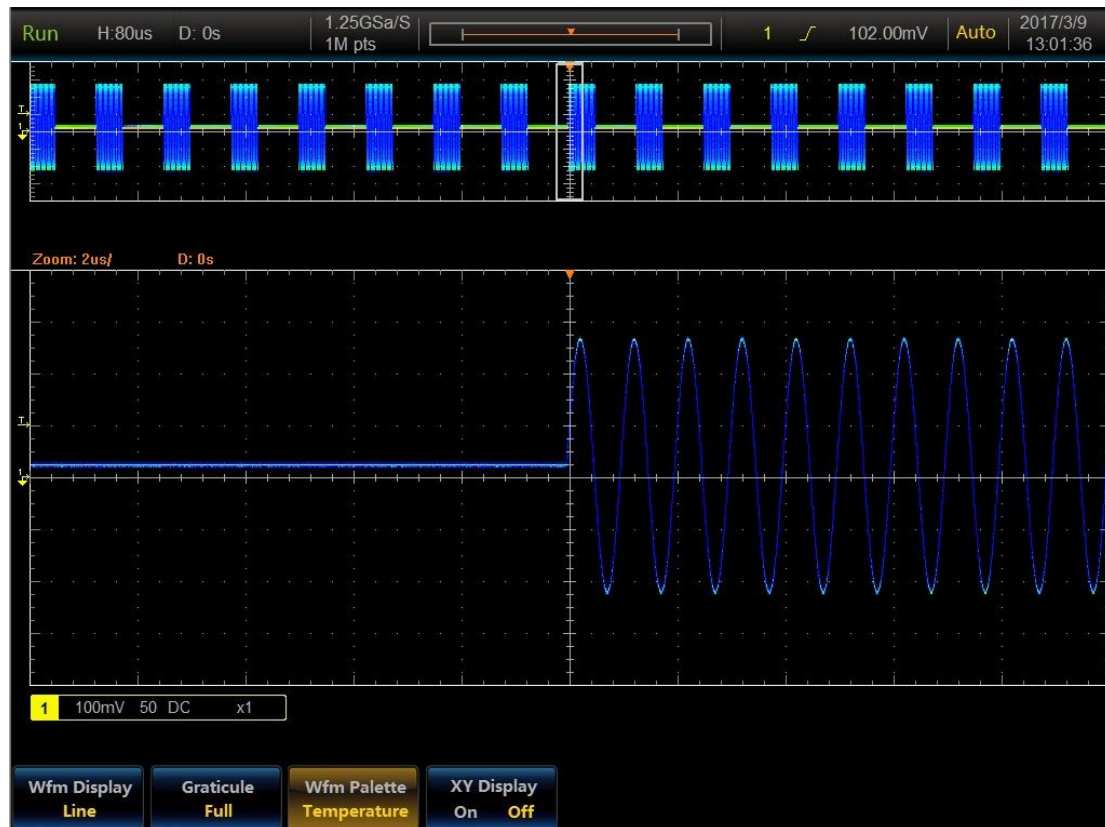
5GSa/s sample rate, precisely rebuilt waveform.

- **500Mpts/CH deep storage, window expansion based on hardware, synchronous display of overall situations and details.**

500Mpts/CH deep storage maintains high sample rate in a long sample period. Window expansion based on hardware can partially zoom in on waveform details under review; offer you synchronous display of overall situations and details.



500Mpts/CH deep storage, maintains high sample rate in a long sample period.



Window expansion based on hardware; zoom in on waveform details under review

- **With standard segmented memory acquisition, it can capture and store important signals more efficiently**

The 4456 series oscilloscope is equipped with segmented memory acquisitions standard, so that, even though the oscilloscope works under the deep storage mode, it can keep a high response speed and screen update rate. In addition, it supports the waveform recording and playback functions.



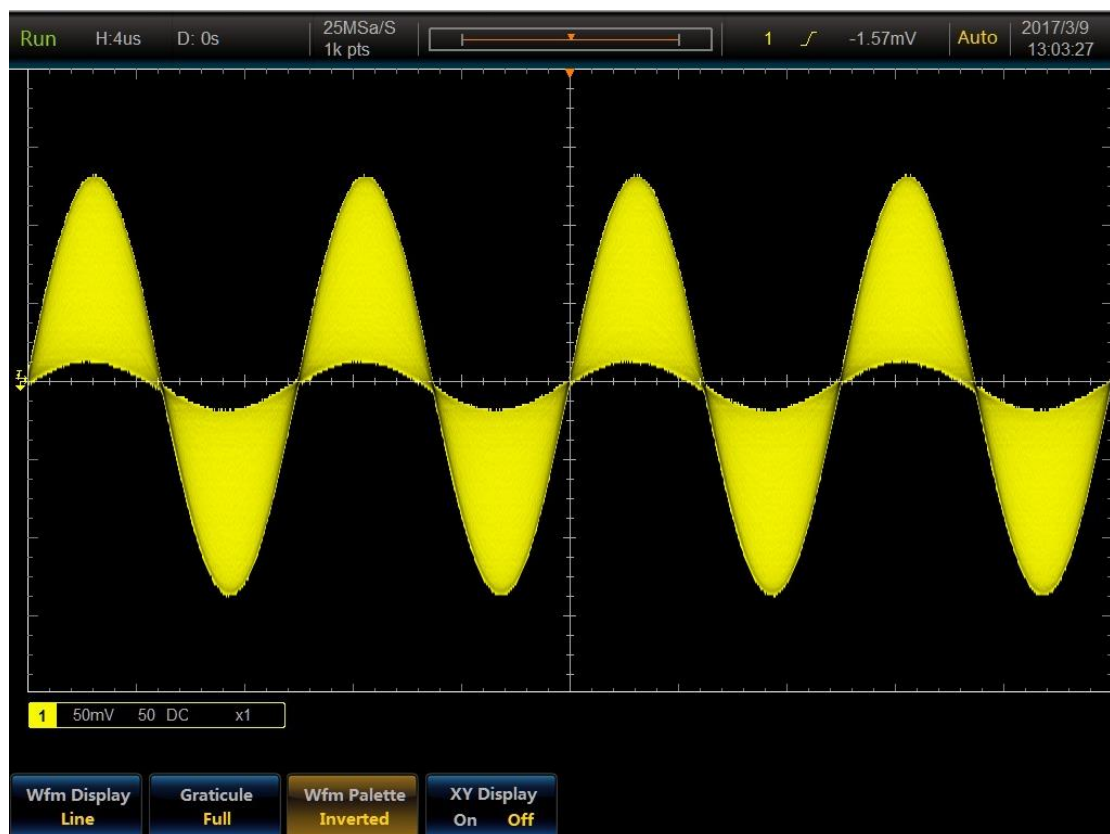
It supports up to 131072 storage segments

- **256-grade gray scale and four types of waveform palettes for display, gives you extraordinary visual experience.**

4456 series oscilloscope implements digital phosphor three-dimensional display technique, to tell probability of event occurrence through lightness of color (256-grade gray scale) or temperature change (color grade) , and to provide 4 types of waveform palettes including normal, inverted, temperature and spectral, which enhances the capability of contingency view for superior visual experience.



Normal: indicates event probability by default channel color and gray scale. Bright color indicates events of high occurrence probability.



Inverted: indicates probability of event occurrence by default channel color and gray scale. Dark color indicates events of high occurrence probability.



Temperature: uses color grade to indicate event occurrence probability. Warm color (red or yellow) indicates events of high occurrence probability.

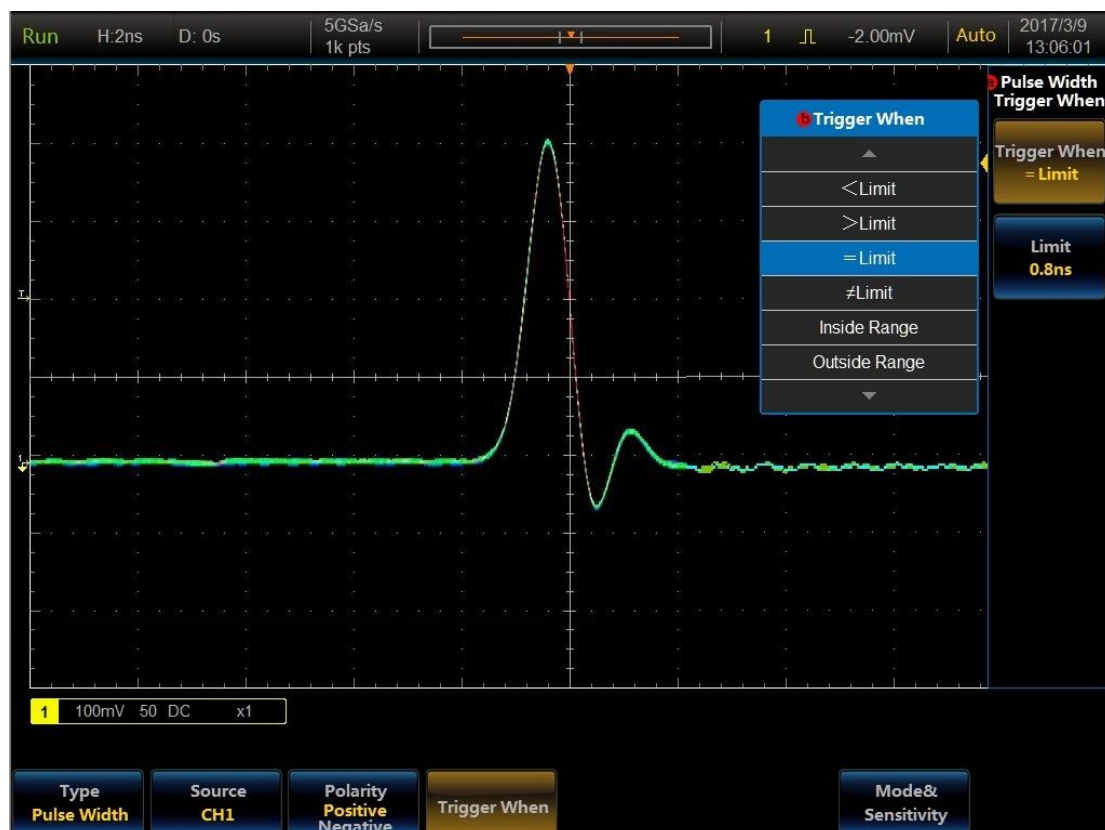


Spectral: uses color grade to indicate event occurrence probability.

Cold color (blue or green) indicates events of high occurrence probability.

- **Multiple trigger functions, precise digital trigger locks up triggered events accurately.**

4456 series oscilloscope supplies users with rich trigger functions, including zone, edge, pulse width, video, runt pulse, logic, sequence, setup and hold time, rise and fall time, HD digital video, serial protocol trigger, which help users locate events in which they have interest out of complicated sample information.



Fundamental trigger: edge, pulse width, video.



Advanced trigger: runt pulse, logic, sequence, setup and hold time, rise and fall time.



HD digital video: 480p, 576p, 720p, 1080p/i.

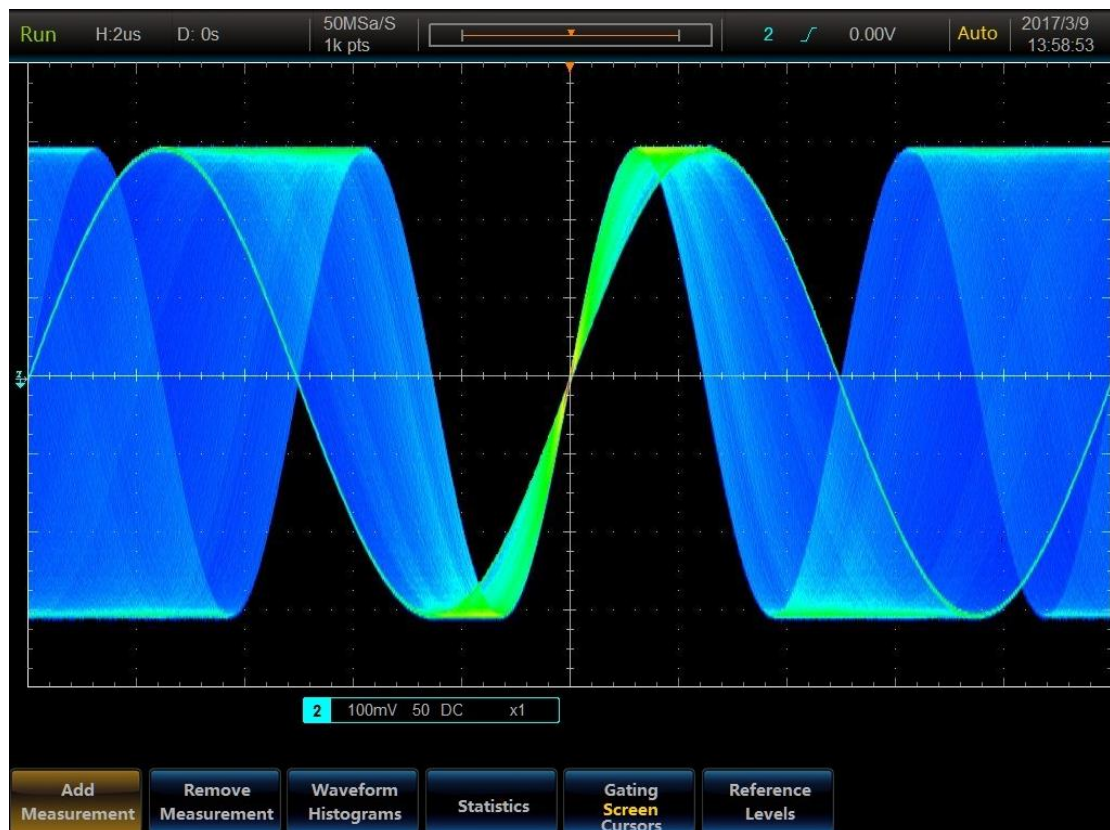


Serial protocol trigger: I2C, SPI, RS232, CAN, LIN, Flex Ray, Audio, USB.

4456 series oscilloscope implies the technique of precise digital trigger to perform trigger point determination against ADC samples collected, to restrain impact of interference signals, and to locate trigger events fast, to lay the foundation for accurate display and signal analysis of oscilloscope. Trigger jitter of the digital trigger is as low as $\pm 1\text{ps}$, highest trigger sensitivity reaches 0.1 div, narrowest pulse test width is 200ps, and channel delay calibration step is 400ps.

Advantages of digital trigger:

- more precise trigger
- more flexible trigger
- higher trigger sensitivity
- lower trigger jitter
- narrower pulse test width
- more precise channel delay calibration



Multi-phase digit interpolation: precise location of trigger point is at 1 difference point. Lowest trigger jitter reaches $\pm 1\text{pix}$.



Trigger sensitivity can be adjusted continuously, the highest reaches 0.1 div.



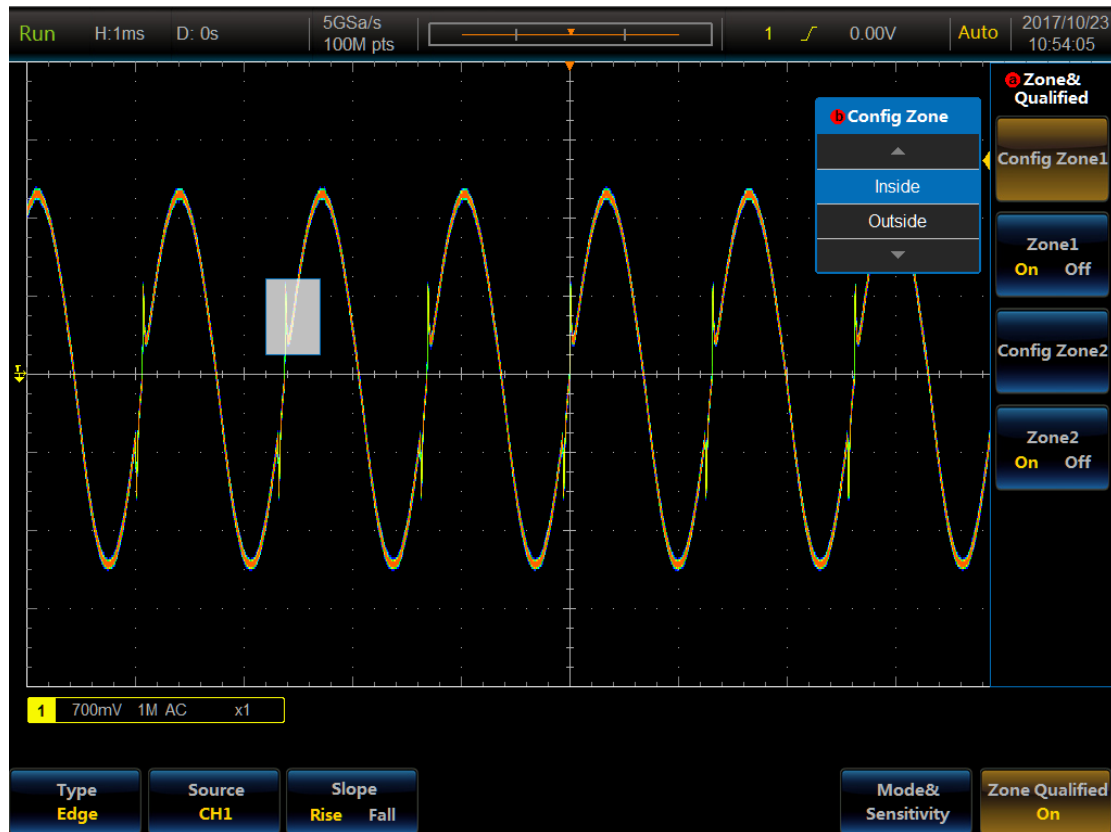
The smallest pulse capture width is 200ps.



Channel to channel deskew range is ± 150 ns, step is 400ps.

The 4456 series is adopted with the brand-new visible trigger technology, so that the

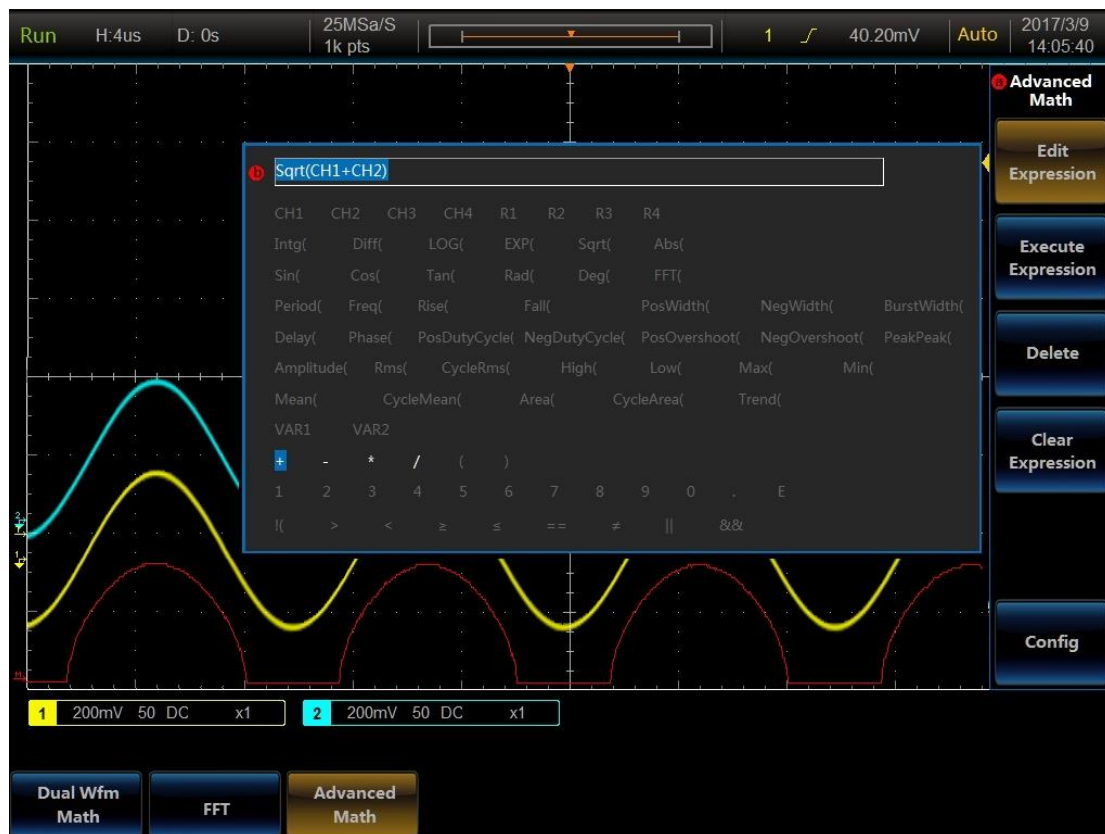
oscilloscope can scan all waveform acquisitions, compare them with the waveform area on the screen, and quickly and easily identify target trigger events by simply observing interested signals on the screen and drawing an zone around it.



Zone trigger: Quickly isolate target events by zone definition

- **Strong calculation and analysis tools enable deep data digging and analysis.**

4456 series oscilloscope provides a complete set of analysis tools for users, including cursors based on waveform and screen, 29 kinds of parameter automatic measurements, mathematical operation, FFT analysis, advanced mathematics, waveform histogram, statistics, limit and mask measurement and analysis, serial protocol trigger and analysis, etc.



Advanced mathematics: with equation editor, users can free edit.



FFT analysis: observe frequency domain and characteristics of signals.



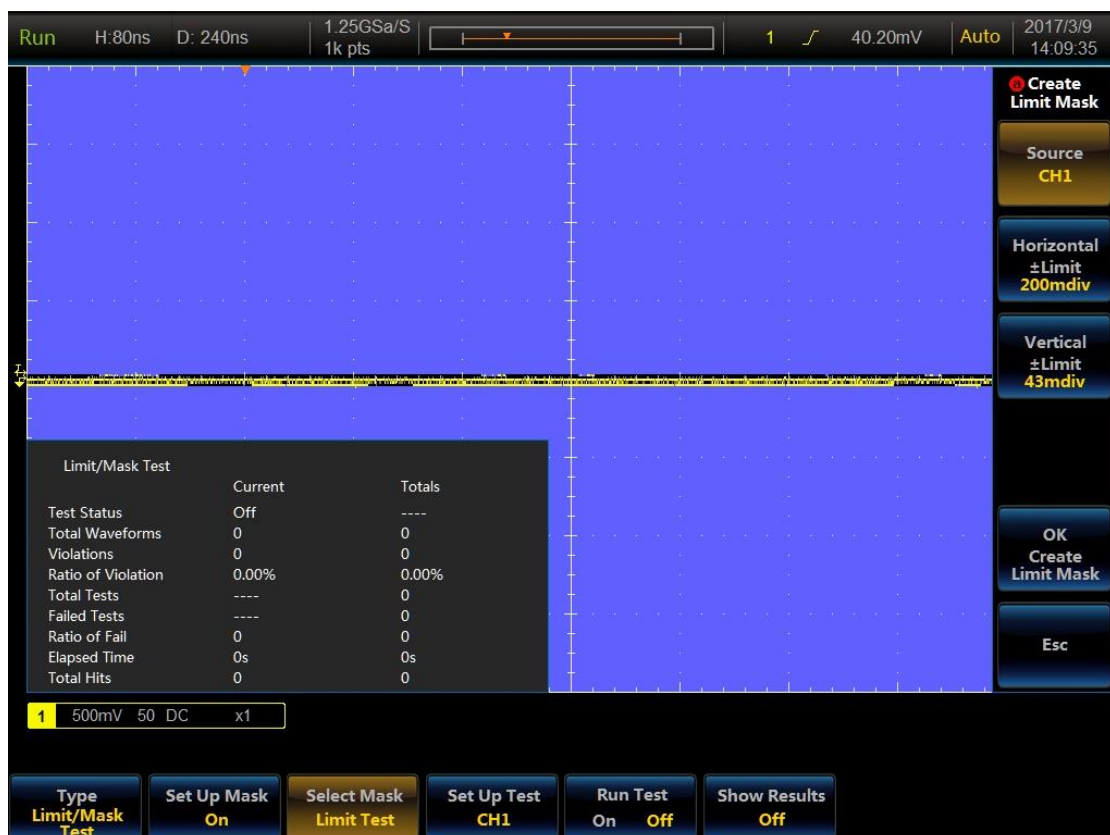
Waveform record and replay: It can be used for real-time record of waveforms, replay and viewing of waveform details



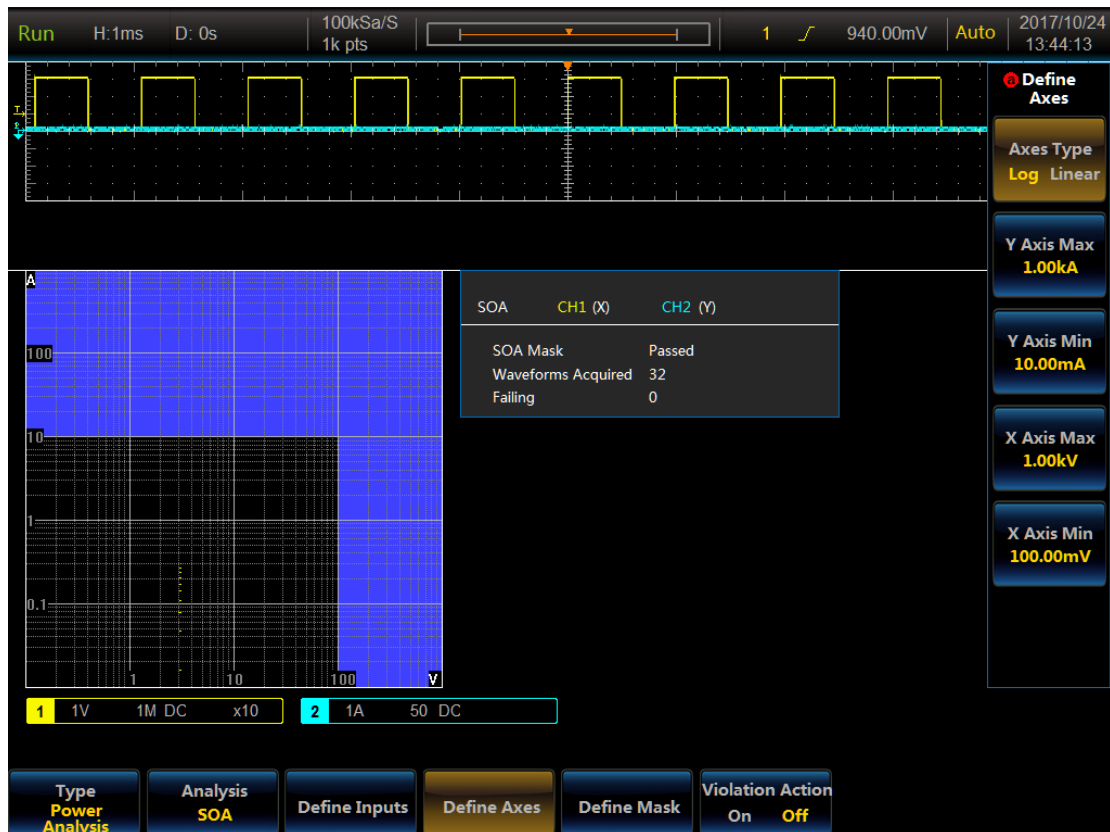
Vertical histogram: to observe noise and noise distribution of signals.



Horizontal histogram: to observe jitter and jitter distribution of signals.



Limit and mask test: standard and custom mask, pass/fail test, result display.



Power measurement (option S02): It can be used for tests including power supply quality, switching loss, harmonic wave, ripple and modulation

Logical analyzer (optional)

The logical analyzer (option H01) provides 16 digital channels highly integrated with the oscilloscope user interface, so as to simplify the operation, and quickly solve the design and analysis problems including analog-digital signals.

- **With 2.5GSa/s high sampling rate, it can provide more precise timing resolution**

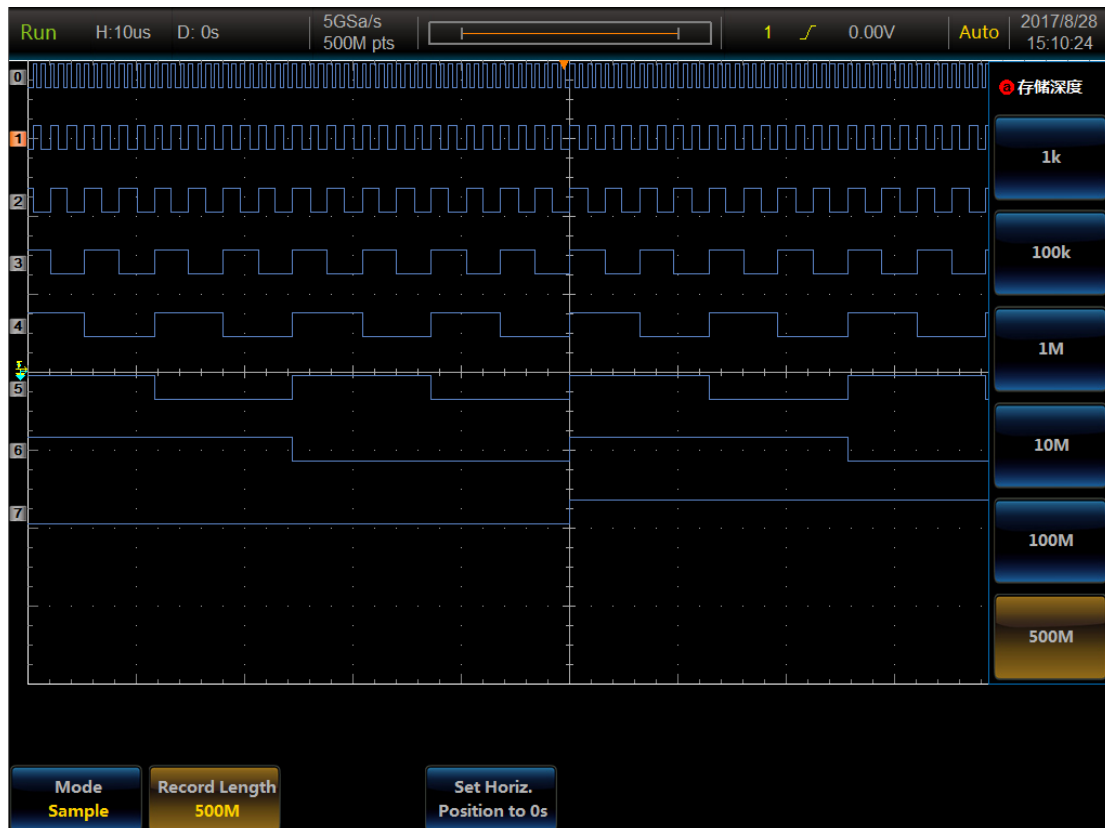
The logical analyzer can provide 2.5GSa/s timing sampling rate, which can provide up to 400ps time resolution for all digital channels, and can reflect the timing sequence relationship of the measured signals more truly.



Higher sampling rate and more precise timing resolution

- **With up to 500Mpts memory depth, it can provide the long time tracking and recording capability**

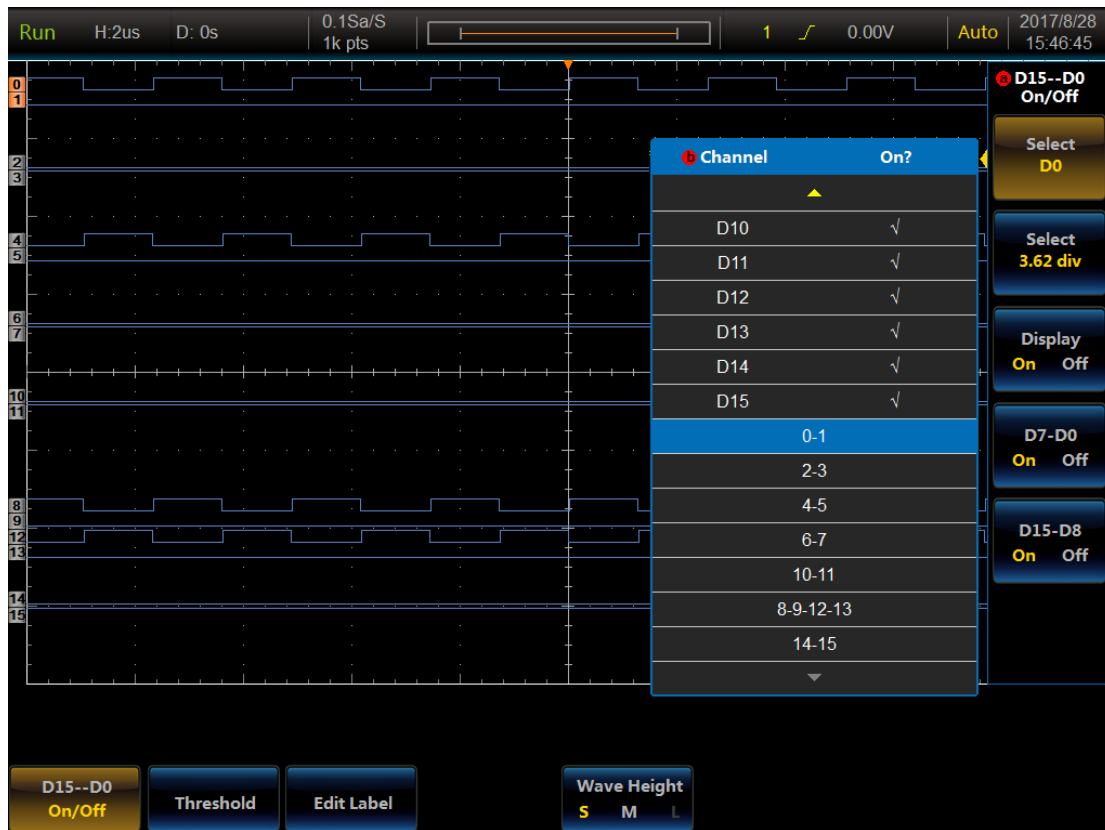
With up to 500Mpts/CH memory depth, the logical analyzer can keep a high sampling rate when capturing long time records. With hardware window extension technology, it can partially enlarge and observe the details of the waveform.



With deeper memory depth, it can provide longer time recording capability

- **Intuitive digital waveform and grouping display**

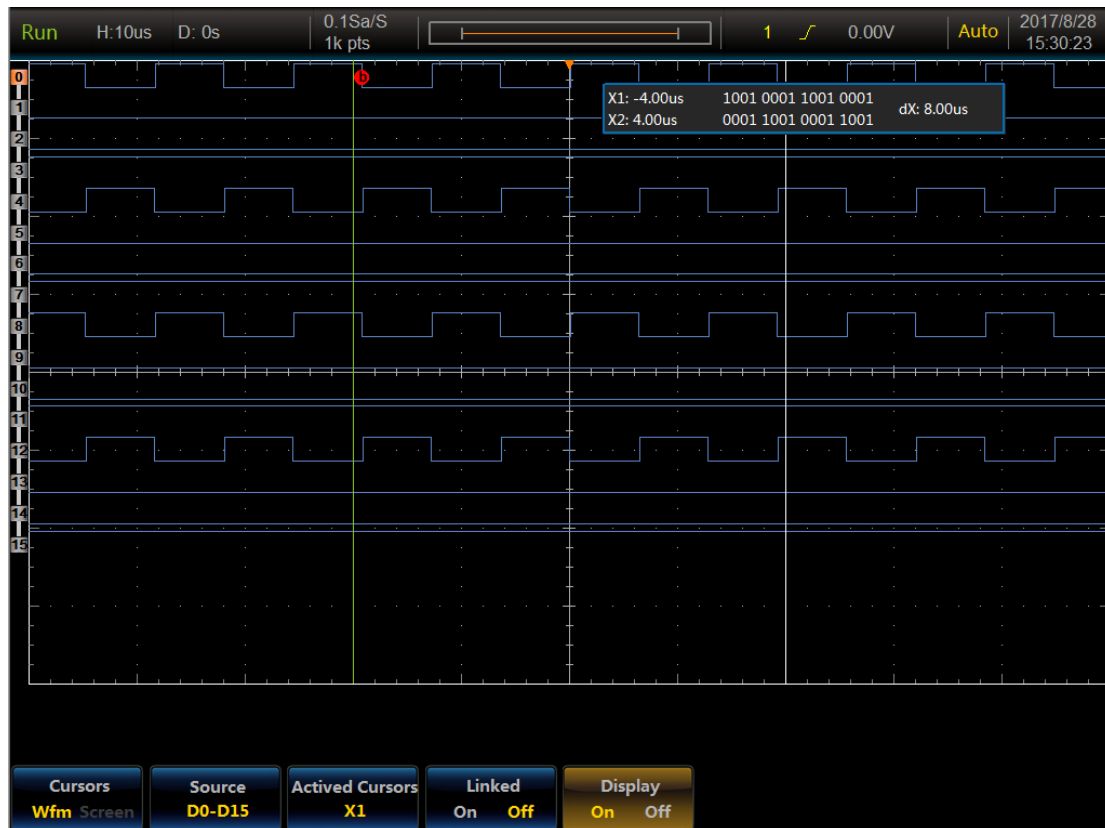
The logical analyzer option supports waveform color display of 16 digital channels, and you can change the height of each channel waveform and its display position on the screen. You can also flexibly group digital channels and display them with labels. After the grouping, all channels in the group can be positioned, so as to shorten the setting time required for traditional channel positioning one by one.



Flexible grouping settings and random label settings

- **Wide measurement and analysis functions**

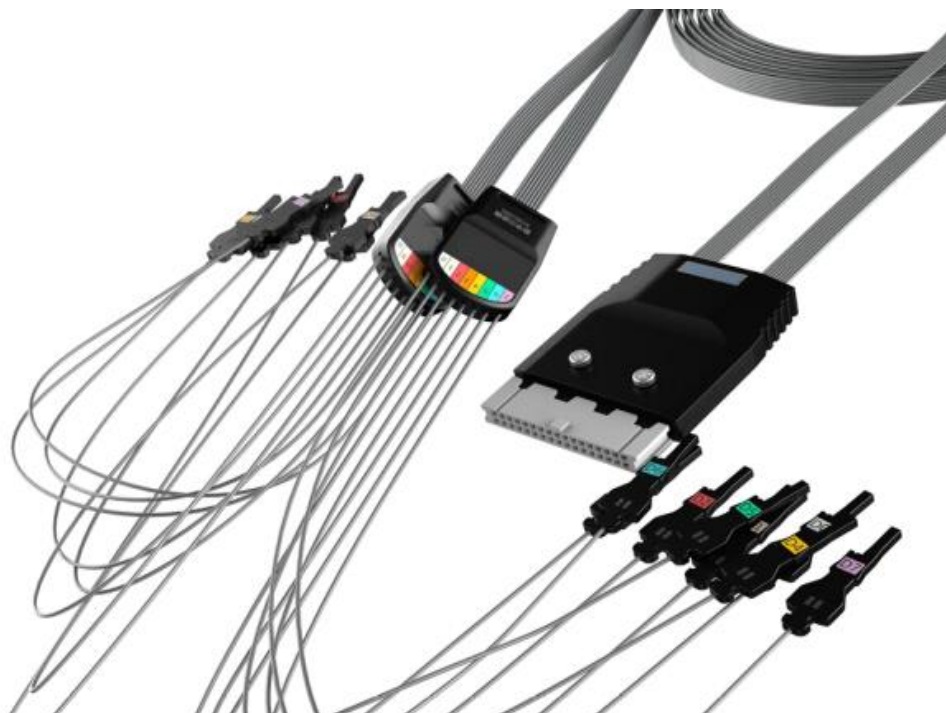
The logical analyzer option supports automatic measurement and statistical analysis of the time-related parameters, supports to view values of all the digital channels with markers, and supports trigger and decoding analysis of all kinds of serial buses.



Marker measurement function

● Logic probe

The logic probe provides two 8-channel separation seats and simplifies the connection to the tested device, therefore, you can use the provided lead set or claw to attach to the chip equipment or test point. The input impedance of the logic probe is 100kΩ.



Function generator (optional)

The function generator (option H02) can help you simulate the sensor signal or add noise to the signal in the design, so as to carry out allowance test. In addition, the analog or digital signal captured by the oscilloscope can be transmitted to arbitrary waveform memory, and the signal captured by the oscilloscope can also be reproduced by the function generator.

- **A number of predefined waveform outputs up to 25 MHz**

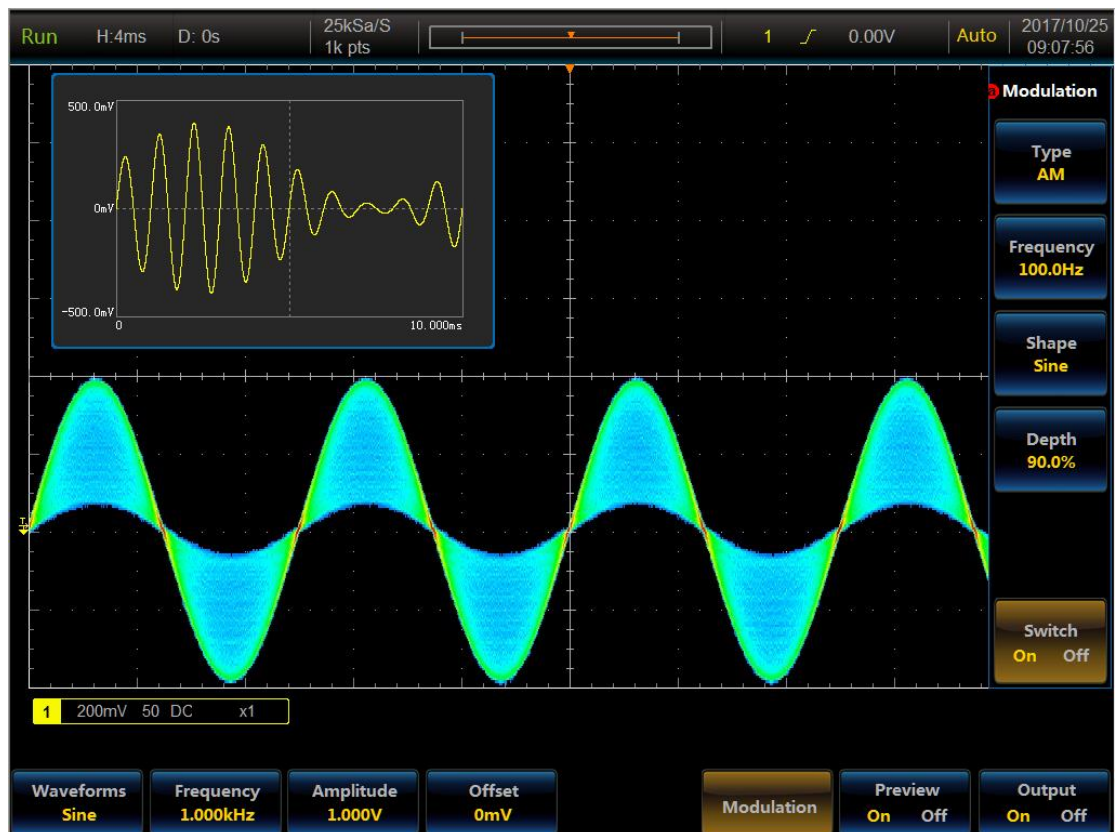
The function generator option provides a number of predefined waveform outputs up to 25 MHz, including sine wave, square wave, Ramp wave, pulse, DC, noise, arbitrary wave, SinC, Exponential Rise/Decay, Gaussian, Lorentz curve and haversine curve, and it also supports output of modulation waveforms including FM, AM and FSK.



Standard waveform output: Sine wave, square wave, ramp wave, pulse, DC, noise and arbitrary wave



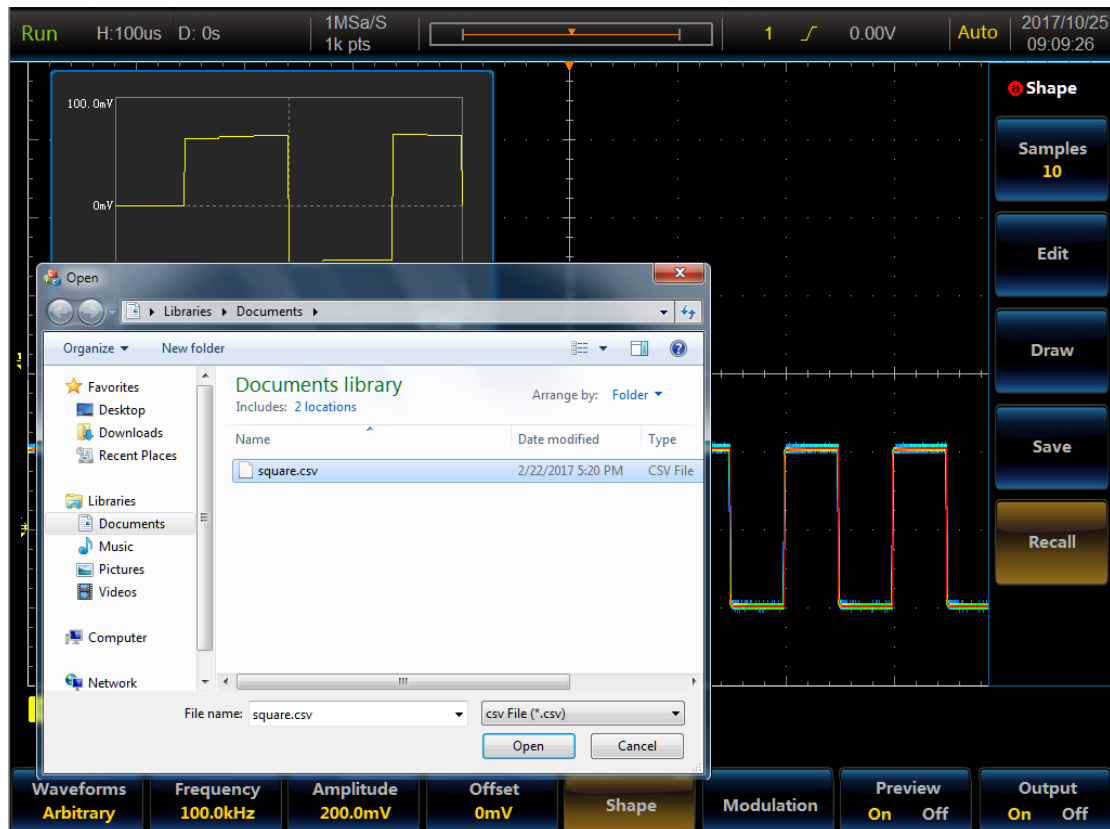
Built-in waveform output: SinC, Exponential Rise/Decay, Gaussian, Lorentz curve and haversine curve



Modulation waveform: FM, AM and FSK

- It has arbitrary waveform output up to 16k points, and supports the waveform capacitive screen touch input

The function generator option provides arbitrary waveform output function of 16k-point record length, which is used to reproduce the waveform of the analog input end, internal document save position and U disk or external PC from the waveform generator. You can also freely edit and modify the output waveform through the capacitive touch screen, so as to quickly generate the waveform you need.



The saved waveform will be copied and generated from the function generator



The capacitive screen can draw arbitrary waveform output quickly

Protocol analyzer (optional)

The protocol analyzer (options S04~S12) can be used to trigger and decode the content of the packet level of the commonly used serial bus (I2C, SPI, CAN, LIN, FlexRay, RS232, USB, Audio, MIL-STD-1553) standards, and export the decoding table and save the test results.

- **It supports full hardware triggering and decoding of a number of buses**

4456 series oscilloscope supplies a powerful set of serial protocol analysis tools, which support auto trigger and analysis of many buses like I2C, SPI, CAN, LIN, FlexRay, RS232, USB, Audio and MIL-STD-1553, provide serial bus test solutions of embedded, auto, computer, audio and other serial protocols. Based on FPGA hardware decoding technique, 4456 series oscilloscope improves the acquisition probability of random serial communication error codes.



Embedded bus: I2C, SPI



Auto bus: CAN, LIN, FlexRay



Computer bus: RS232, USB



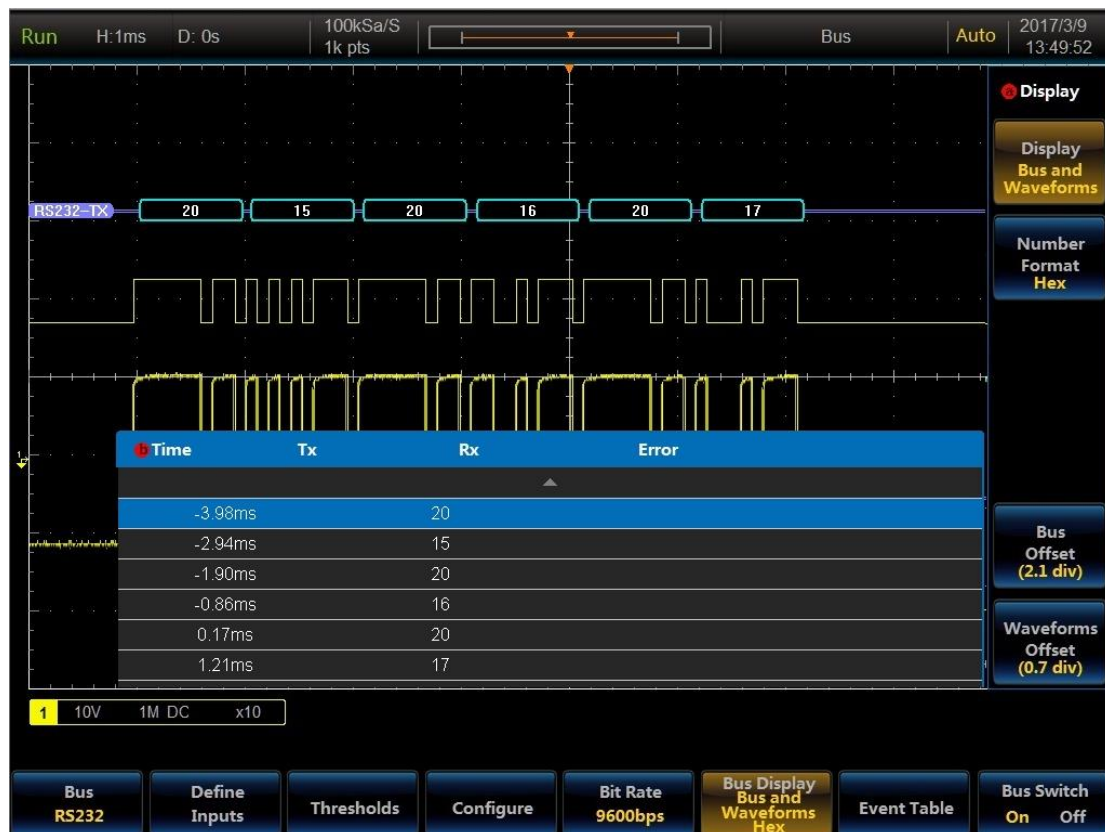
Audio bus: I2S, LJ, RJ, TDM



Aviation bus: MIL-STD-1553

- **It supports the display of a number of views**

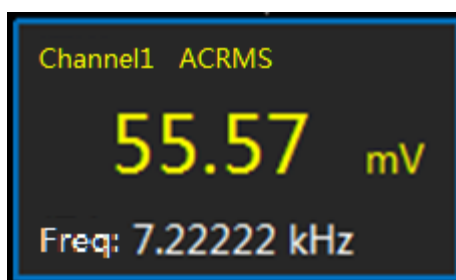
The bus analyzer option provides traditional digital view as well as a higher level of bus view display, so as to facilitate identifying a number of bus package types, such as package start, address, data and package end. You can also view the captured bus package with an event list with a time stamp.



Display of a number of views: Digital view, bus view, event list

Digital voltmeter

The 4456 series oscilloscope provides you with a 4-bit digital voltmeter and a 6-bit frequency counter. The voltage and frequency measurement functions can be by multiplexing the oscilloscope channel, and its probe is the same as that of the general oscilloscope.



4-bit voltage measurement and 6-bit frequency measurement

Oscilloscope probe (optional)

The 4456 series oscilloscope supports passive high resistance probe, high voltage single end probe, high voltage differential probe, current probe and logic probe to satisfy the test requirements of probe in different cases.

- **Passive voltage probe**

The 4456 series oscilloscope supports 4 types of passive voltage probes, including P9350A, P9550A, P9551 and P9600A. The passive voltage probe is a standard probe of the oscilloscope, which can be purchased by users additionally, and it is a kind of most commonly used probe type of the oscilloscope.

The P9350A passive voltage probe has a bandwidth of 350 MHz, fixed attenuation of 10:1 and input impedance of 10 M Ω , which supports automatic identification functions. It is a standard probe of 4456C/CM, which can be purchased by users additionally. The option number is 4456-H14.



P9350A passive voltage probe

The P9550A passive voltage probe has a bandwidth of 500 MHz, fixed attenuation of 10:1 and input impedance of 10 M Ω , which supports automatic identification functions. It is a standard probe of 4456D/DM/E/EM, which can be purchased by users additionally. The option number is 4456-H12.



P9550A passive voltage probe

The P9551 passive voltage probe has a bandwidth of 500 MHz, fixed attenuation of 10:1 or 1:1 and input impedance of 10 M Ω , which doesn't support automatic identification functions. It can be purchased by users additionally. The option number is 4456-H12.



P9551 passive voltage probe

The P9600A passive voltage probe has a bandwidth of 600 MHz, fixed attenuation of 10:1 and input impedance of 10 M Ω , which supports automatic identification functions. It can be purchased by users additionally. The option number is 4456-H15.



P9600A passive voltage probe

- **High voltage single-ended probe (optional)**

The 4456 series oscilloscope supports 3 types of high voltage single-ended probes, including P9558, P3258 and P4220. The high voltage single end probe is an option of the oscilloscope, which shall be purchased by users additionally.

The P9558 high voltage single-ended probe has a bandwidth of 250 MHz, fixed attenuation of 100:1, input impedance of 100 M Ω and maximum input voltage of 3,000 V (DC+ACpk), which doesn't support automatic identification functions.



P9558 high voltage single-ended probe (H03)

The P3258 high voltage single-ended probe has a bandwidth of 100 MHz, fixed attenuation of 100:1, input impedance of 100 M Ω and maximum input voltage of

1500V (DC+ACpk), which doesn't support automatic identification functions.



P3258 high voltage single-ended probe (H04)

The P4220 high voltage single-ended probe has a bandwidth of 220 MHz, fixed attenuation of 1,000:1, input impedance of 900 M Ω and maximum input voltage of 39 kV (DC+ACpk), which doesn't support automatic identification functions.



P4220 high voltage single-ended probe (H20)

- **High voltage differential probe (optional)**

The 4456 series oscilloscope supports 5 kinds of high voltage differential probes, including P8050, P8100, P7100, P6100 and P5020. The high voltage differential probe is an option of the oscilloscope, which shall be purchased by users additionally. It is mainly used for floating ground isolation measurement, which has high safety.

The P8050 high voltage differential probe has a bandwidth of 50 MHz, fixed

attenuation of 50:1 and 500:1, measurement precision of $\pm 2\%$ and maximum input voltage of 1,300 V (DC+ACpk), which is equipped with 9 VDC external adapter for power supply.



P8050 high voltage differential probe (H05)

The P8100 high voltage differential probe has a bandwidth of 100 MHz, fixed attenuation of 50:1 and 500:1, measurement precision of $\pm 2\%$ and maximum input voltage of 1,300 V (DC+ACpk), which is equipped with 9 VDC external adapter for power supply.



P8100 high voltage differential probe (H06)

The P7100 high voltage differential probe has a bandwidth of 100 MHz, fixed

attenuation of 100:1 and 1,000:1, measurement precision of $\pm 1\%$ and maximum input voltage of 7,000 Vpp, which is equipped with 6 VDC external adapter or built-in 4×AA alkaline batteries for power supply.



P7100 high voltage differential probe (H19)

The P6100 high voltage differential probe has a bandwidth of 100 MHz, fixed attenuation of 100:1 and 1,000:1, measurement precision of $\pm 1\%$ and maximum input voltage of 14 kVpp, which is equipped with 6 VDC external adapter or built-in 4×AA alkaline batteries for power supply.



P6100 high voltage differential probe (H18)

The P5020 high voltage differential probe has a bandwidth of 20 MHz, fixed

attenuation of 500:1 and 5,000:1, measurement precision of $\pm 2\%$ and maximum input voltage of 40 kV (DC+ACpk-pk), which is equipped with 9 VDC external adapter for power supply.



P5020 high voltage differential probe (H17)

- **Current probe (optional)**

The 4456 series oscilloscope supports 5 kinds of current probes, including AP622, AP202, AP621, AP622D and AP204A. The current probe is an option of the oscilloscope, which shall be purchased by users additionally. It is mainly used for current test.

The AP622 is a kind of AC/DC current probe, which has a bandwidth of the DC~100 kHz. For the current probe with a range of 10 mV/A, the peak current measurement range is 1 A~100 A; for the current probe with a range of 100 mV/A, the peak current measurement range is 50 mA~10 A. Its measurement precision is $\pm 4\%$, which is equipped with built-in 4×AA alkaline batteries for power supply.



AP622 current probe (H07)

The AP202 is a kind of AC/DC current probe, which has a bandwidth of the DC~25 MHz. For the current probe with a range of 100 mV/A, the peak current measurement range is 20 A (DC+ACpk). Its measurement precision is $\pm 3\%$, which is equipped with 9 VDC external adapter for power supply.



AP202 current probe (H08)

The AP622 is a kind of AC current probe. Its bandwidth is 10 Hz~100 kHz. For the current probe with a range of 100 mV/A, the peak current measurement range is 0.1 A~20 A; for the current probe with a range of 10 mV/A, the peak current measurement range is 1 A~200 A; for the current probe with a range of 1 mV/A, the peak current measurement range is 10 A~2,000 A, with the output errors of $\pm (3\%+10 \text{ mV})$.



AP621 current probe (H21)

The AP622D is a kind of AC/DC current probe, which has a bandwidth of the DC~1.5 MHz. For the current probe with a range of 100 mV/A, the peak current measurement range is 80 App; for the current probe with a range of 1 V/A, the peak current measurement range is 8 App. Its measurement precision is $\pm 4\%$, which is equipped with 9 VDC external adapter or built-in 4×AA alkaline batteries for power supply.



AP622D current probe (H22)

The AP204A is a kind of AC/DC current probe, which has a bandwidth of the DC~50MHz. For the current probe with a range of 50mV/A, the peak current measurement range is 40 A (DC+ACpk). Its measurement precision is $\pm 3\%$, which is equipped with 9 VDC external adapter for power supply.

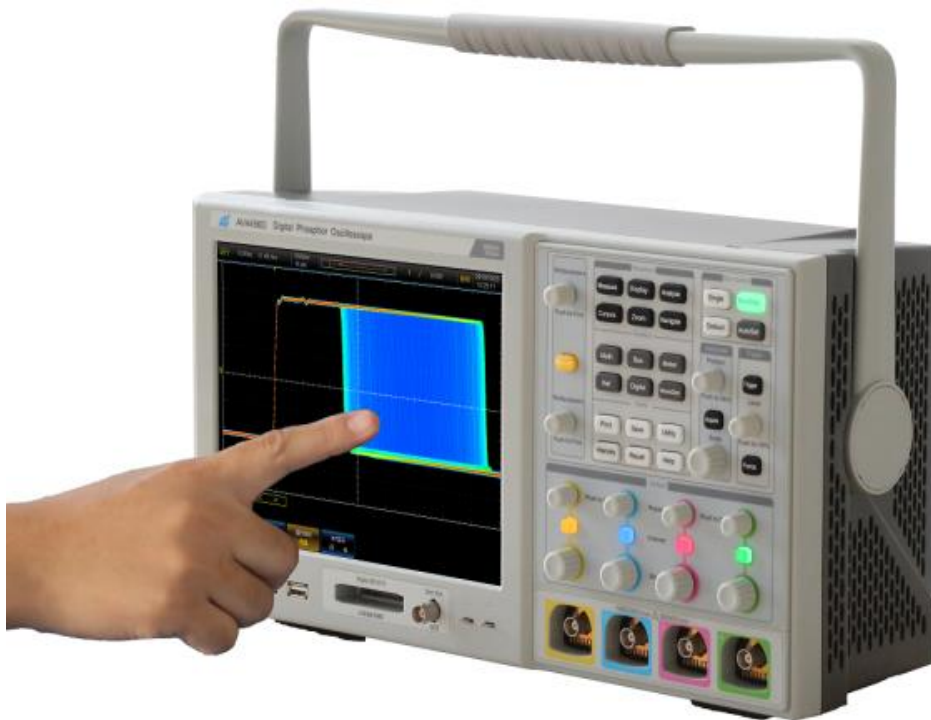


AP204A current probe (H23)

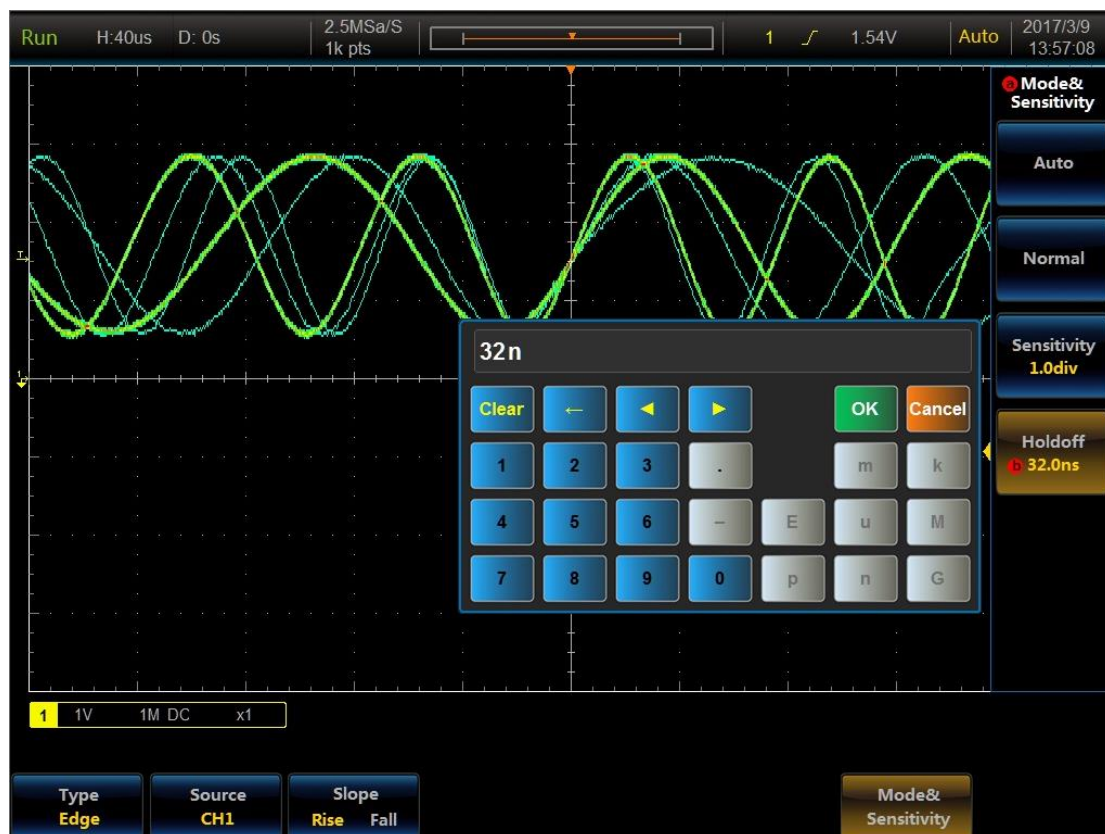
Easy to use

- **Brand-new capacitance touch screen, user-friendly design gives you excellent experience.**

10.4 inch capacitance touch screen supports single-point and multi-point touch, can perform waveform scaling and movement swift. One-key zeroing design enables zeroing at horizontal, vertical and triggering positions. Digit and bus keypad greatly facilitates input speed. 4456 series oscilloscope supports touch operation and mouse, push-buttons operation at the same time.



Multi-point capacitance touch screen performs waveform scaling and movement fast.



User-friendly keypad facilitates input speed greatly

- **Over 20 types of built-in training signal output help educators equip and upgrade labs.**

4456 series oscilloscope provides over 20 types of free built-in training signals for educators, including sine wave, square wave, triangle wave, saw-tooth wave, runt pulse, repeated pulse, RF, digital burst, RS232, CAN, LIN, FlexRay and so on, which can help educators equip and upgrade labs.



Test signal: runt pulse signal

- **Standard 6U racket, multiple peripheral interfaces, convenient for system buildup.**

Two front/rear USB2.0 main control ports can easily transmit the screenshots, instrument settings and waveform data to the U disk, and can connect the USB keyboard or mouse to a USB host port for input. In addition, it can be connected with a USB printer for printing screen images. The video output port at the back of the instrument can export the displayed image to the external monitor or projector, so as to facilitate teaching application or demonstration of the oscilloscope.



Rear panel interface

With the 6U or 7U standard rack, the standard 10/100/1,000BASE-T Ethernet port at the back of the instrument can be easily connected to the network, thus realizing the remote program control of the network, and facilitating the function expansion and system construction.

Typical applications

4456 series Digital Phosphor Oscilloscope is a multi-functional test instrument integrating oscilloscope, logic analyzer, function generator, protocol analyzer and digital voltmeter. As a most extensively used debugging and verification instrument, it can help you fast discover, locate, analyze and solve problems. It is widely applied in such fields, for instance design and debugging of analog and digital circuits, circuits diagnosis and transient signals capture, design of power components and power electronics, embedded design and debugging, test of automotive electronics, design, test and quality control of visual systems, education and training and repair service.

Technical Specifications

model index		Standard Model			Economic Model		
		4456C	4456D	4456E	4456CM	4456DM	4456EM
Vertical system	Channels	4					
	Bandwidth Note: >5mV/div	350MHz	500MHz	1GHz	350MHz	500MHz	1GHz
	Rise time	<1ns	<700ps	<450ps	<1ns	<700ps	<450ps
	Bandwidth limits	20MHz、250MHz					
	Input impedance	1M Ω ±1%、50 Ω ±1%					
	Input coupling	DC、AC					
	Input sensitivity range	1M Ω : 1mV/div~10V/div					
		50 Ω : 1mV/div~1V/div					
	Amplitude accuracy	±3% (Note: > 5mV/div)					
	Max. input voltage	1M Ω : 300Vrms、50 Ω : 5Vrms					
	Vertical resolution	8bit					
	Offset range	±1V (1mV/div~100mV/div)					
		±10V (200mV/div~1V/div)					
		±100V (2V/div~10V/div)					
	Channel isolation	≥40dB					
	Sample rate	5GSa/s (1ch,2ch)、2.5GSa/s (3ch, 4ch)			5GSa/s (1ch)、2.5GSa/s (2ch) 1.25GSa/s (3ch, 4ch)		
	Record length	500Mpts/CH			200Mpts/CH		

Horizontal system	Acquisition modes	Normal: acquire sampled values	
		Peak Detect: capture glitches as narrow as 200ps	Peak Detect: capture glitches as narrow as 800ps
		Hi Res: 11digits resolution, can reduce random noise	
		Envelope: min-max envelope reflecting peak detect data over multiple acquisitions	
		Average: from 2 to 512 waveforms included in average	
		Roll: scroll waveforms right to left across the screen, time-base: 100ms/div~1000s/div	
		Segmentation: The economical acquisition memory can be divided into 131,072 segments maximally	
	Max. duration at highest sample rate	100ms	40ms
	Maximum waveform capture rate	Fast sample model: 1,000,000 wfms/s	
		Segment model: 700,000 wfms/s	
	Time base range	200ps/div~1000s/div	400ps/div~1000s/div
	Time base accuracy	±5ppm	
	Time base delay time range	-10 divisions to 5000s	
	Ch to ch deskew range	±150ns, resolution: 400ps	±150.4ns, resolution: 800ps
	Trigger source	analog (CH1~CH4)、EXT、digital (D0~D15)、220V _{AC}	
	Trigger modes	Auto, normal, single	
	Trigger hold off range	6.4ns to 12.8s	
	Trigger level ranges	Int (CH1~CH4): ±4 divisions	
		Ext: ±0.4V、exterior/10: ±4V	

Trigger system	Trigger sensitivity	Int (CH1~CH4): users can adjust, step by 0.1 div
		Ext: 50mV、Ext /10: 500mV
	Trigger types	Zone trigger (visual trigger): Trigger on a user-defined zone drawn on the display
		Edge: trigger at positive or negative edge in any channel or auxiliary input .
		Sequence: prepare at a chosen edge, trigger at a chosen time or other chosen edge of the event .
		Runt: trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again.
		Pulse width: trigger on width of positive or negative pulses that are >, <, =, ≠, or inside/outside a specified period of time. pulse width range: 0.8ns~10s, resolution: 0.8ns.
		Logic: trigger when any logical pattern of channels goes false or stays true for specified period of time. Any input can be used as a clock to look for the pattern on a clock edge. Pattern (AND, OR, NAND, NOR) specified for all input channels defined as High, Low, or Don't Care.
		Setup and hold: trigger on violations of both setup time and hold time between clock and data present on any of the input. channels .
		Rise/Fall Time: trigger on pulse edge rates that are faster or slower than specified.
		Video: trigger on all lines, odd, even, or all fields on NTSC, PAL, and SECAM video signals .
		HD video (Option S03) : trigger on 480p/60、576p/50、720p/50、720p/60、1080i/50、1080i/60、1080p/24、1080p/25、1080p/30.
	Auto measurement	30, of which up to eight can be displayed on-screen at any one time. Measurements include: period, frequency, delay, top drop, rise Time, fall Time, positive duty cycle, negative duty cycle, positive pulse width, negative pulse width, burst width, phase, positive overshoot, negative overshoot , peak to peak, amplitude, high, low, max, min, mean, cycle mean, RMS, cycle RMS, positive pulse count, negative pulse count, rising edge count, falling edge count, area and cycle area.
	Cursors	Waveform and screen

Measurement and analysis system	Measurement statistics	Mean, min, max, standard deviation
	Reference levels	User-definable reference levels for automatic measurements can be specified in either percent or units.
	Gating	Isolate the specific occurrence within an acquisition to take measurements on, using either the screen or waveform cursors.
	Waveform histogram measurements	A waveform histogram provides an array of data values representing the total number of hits inside of a user-defined region of the display.
		Source: CH1~CH4, REF1~REF4, math.
		Type: vertical, horizontal.
		Measurement types: 12, of which up to eight can be displayed on-screen at any one time. waveform count, hits in box, peak hits, median, max, min, peak-to-peak, mean, standard deviation, sigma 1, sigma 2, sigma 3.
	Waveform mathematics	Arithmetic: add, subtract, multiply and divide waveforms.
		Math functions: integrate, differentiate, FFT
		FFT: set FFT vertical scale to Linear RMS or dBV RMS, and FFT window to rectangular, hamming, hanning or blackman-harris.
		Advanced math: define extensive algebraic expressions including waveforms, reference waveforms, math functions, scalars, up to two user-adjustable variables and results of parametric measurements.
	Limit and mask test (Option S01)	Included standard masks: ITU-T, ANSI T1.102, USB
		Mask test source: CH1~CH4
		Limit test source: CH1~CH4、REF1~REF4
		Mask creation: Limit test vertical tolerance from 0 to 1 division; limit test horizontal tolerance from 0 to 500 m division. Load standard mask and custom mask from text file.
		Mask scaling: lock to source on, lock to source off.

		Test criteria run until: Minimum number of waveforms (from 1 to 1,000,000 and Infinity). The shortest time (1 s-48 h; infinity)
		Violation threshold: 1~1000000.
		Actions on test failure: stop acquisition, save screen image to file, save waveform to file, trigger out pulse.
		Actions on test complete: trigger out pulse.
		Result display: test status, total waveforms, number of violations, violation rate, total tests, failed tests, test failure rate, elapsed time, total hits for each mask segment.
	Power measurement and analysis (Option S02)	Power quality test: V_{RMS} , $V_{crest\ factor}$, frequency, I_{RMS} , $I_{crest\ factor}$, active power, apparent power, reactive power, power factor, phase angle
		Switching loss measurement: Power loss and energy loss, including T_{on} , T_{off} , conduction, total loss
		Harmonics: THD-F, THD-R, RMS measurement, harmonic graphic display and table display
		Ripple measurement: V_{ripple} and I_{ripple}
		Modulation analysis: Graphic display of modulation types including +pulse width, -pulse width, period, frequency, +duty ratio and -duty ratio
		Safety operation area: Graphic display of measurement of safety operation areas of switching equipment and template test
		Measurement of dV/dt and dI/dt : Conversion rate marker measurement
	Decode channel	1
	Display format	Binary, hexadecimal
	Display types	Bus, digital, event list with time scale information.
	I2C (Option S04)	Trigger on start, repeated start, stop, missing ACK, address, data, or address and data on I2C buses up to 10 Mb/s.
		Signal rate: $\leq 10\text{Mbps}$; Protocol type: 7 digits / 10 digits address

Protocol analysis Option	RS232 (Option S05)	Trigger on Tx start bit, Rx start bit, Tx end of packet, Rx end of packet, Tx data, Rx data, Tx parity error, and Rx parity error up to 2Mbps.
		Signal rate: 50bps~2Mbps
	SPI (Option S06)	Trigger on start of frame, MOSI, MISO, or MOSI and MISO on SPI buses up to 10 Mb/s.
		Signal rate: ≤10Mbps
	CAN (Option S07)	Trigger on start of frame, frame type, identifier, data, identifier and data, end of frame, missing ACK, or bit stuffing error on CAN signals up to 1 Mb/s.
		Signal rate: 10kbps~1Mbps
	LIN (Option S08)	Trigger on sync, identifier, data, identifier and data, wakeup frame, sleep frame, errors, up to 100 kb/s.
		Signal rate: 800bps~100kbps; Protocol standard: 1.x、2.x
	FlexRay (Option S09)	Trigger on start of frame, type of frame, identifier, cycle count, complete header field, data, identifier and data, end of frame or errors, up to 10 Mb/s.
		Signal rate: 2.5Mbps、5Mbps、10Mbps
	Audio (Option S10)	Trigger on word select, frame sync, or data. Maximum data rate for I2S/LJ/RJ/TDM is 10 Mb/s.
		Signal rate: ≤10Mbps; Protocol type: I ² S、LJ、RJ、TDM
	USB (Option S11)	Trigger on sync active, start of frame, reset, suspend, resume, end of packet, token packet, data packet, handshake packet, special packet, error. Low speed is 1.5Mbps and full speed is 12Mbps.
		Signal rate: low speed 1.5Mbps, full speed 12Mbps
	MIL-STD-1553(Option S12)	Trigger on synchronization, word type, command word, data word, error and idle time, with a rate of 1 Mbps
		Signal rate: 1Mbps

Logical analyzer Option H01	Number of digital channels	16	
	Threshold grouping	Pod 1: D7~D0; Pod2: D15~D8	
	Threshold selection	TTL (1.4 V), 5VCMOS (2.5 V), 3.3VCMOS (1.65 V), 2.5VCMOS (1.25 V), ECL (-1.3 V), PECL (3.7 V), user-defined	
	User-defined threshold range	± 20 V, with an increment of 10 mV	
	Threshold precision	$\pm (150 \text{ mV} + 3\% \text{ of threshold setting})$	
	Maximum input voltage	± 40 V peak-peak value	
	Input dynamic range	± 10 V relative to the threshold	
	Minimum voltage amplitude	400mVpp	
	Maximum input switching rate	400MHz	
	Input impedance	100 k Ω $\pm 1\%$	
	Vertical resolution	1bit	
	Timing sample rate	2.5GSa/s	
	Memory depth	500Mpts/CH (C/D/E)	200Mpts/CH (CM/DM/EM)
	Minimum detection pulse width	2ns	
	Inter channel delay error	3.2ns	
	Number of channels	1	
	Max output frequency	25MHz	

	Built-in waveform frequency	0.1 Hz~1 MHz
	Arbitrary waveform	Waveform length: 1~16,384
		Frequency range: 0.1 Hz~10MHz
	Frequency	Precision: 100 ppm
		Resolution: 0.1 Hz or 4 digits (the larger one prevails)
	Amplitude	Output range: 50 mVpp~2.5 Vpp (50Ω)
		Precision: $\pm[1.5\% \text{ peak to peak amplitude setting} + 1.5\% \text{ DC offset setting}] + 1 \text{ mV}$
	DC offset	Offset range: $\pm 1.25 \text{ V}$ (50Ω)
		Offset resolution: 1 mV (50Ω)
		Offset precision: $\pm 2\%$ of the offset setting value
Digital voltmeter	Measurement source	CH1、CH2、CH3、CH4
	Measurement types	AC RMS, DC, DC+AC RMS, frequency
	Resolution	Digital voltmeter: 4 digits
		Frequency counter: 6 digits
Display system	Display type	10.4 inch color LCD
	Display resolution	1024 horizontal × 768 vertical pixels
	Graticules	full, grid, crosshair, frame
	Touch screen	Capacitive, supports waveform and menu operation.
	Waveform styles	Dots, vectors, persistence.

	Display format	YT、XY
	Grey grade	256
	Waveform color	Normal, inverted, temperature and spectral
	Language	Chinese, English
	Brightness	The waveform, scale and screen brightness can be freely adjusted
Input and output ports	USB host port	Two ports on front and two ports on rear of instrument.
	USB device port	One port on rear of instrument.
	LAN port	RJ-45 connector, supports 10/100/1000 Mb/s
	Video output port	DB-15 female connector, connect to show the oscilloscope display on an external monitor or projector.
	Auxiliary input	Rear panel BNC, 1M Ω impedance, max. input: 300Vrms.
	Auxiliary output	Rear panel BNC, used for trigger pulse signal output, event output of limit mask test, or built-in training signal output
	Reference input/output	Rear panel BNC, time base systems is used for input or output of reference clock, frequency is 10MHz.
	Probe compensator	Front panel pins, frequency is 1kHz, amplitude is approx. 3 V.
Physical characters	Structural style	Portable
	Power source	100V~240V _{AC} 、50Hz~60Hz
		Max. power consumption: 150 W
	Operating temperature	0℃~+50℃
	Dimensions (W×H×D)	426mm×221.5mm×160mm
	Max. weight	6kg

Ordering Information

● Host

Standard model:

4456C Digital Phosphor Oscilloscope: 4CH, 350MHz, 5GSa/s(1ch), 2.5GSa/s(4ch)

4456D Digital Phosphor Oscilloscope: 4CH, 500MHz, 5GSa/s(1ch), 2.5GSa/s(4ch)

4456E Digital Phosphor Oscilloscope: 4CH, 1GHz, 5GSa/s(1ch), 2.5GSa/s(4ch)

Economic model:

4456CM Digital Phosphor Oscilloscope: 4CH, 350MHz, 5GSa/s(1ch), 1.25GSa/s(4ch)

4456DM Digital Phosphor Oscilloscope: 4CH, 500MHz, 5GSa/s(1ch), 1.25GSa/s(4ch)

4456EM Digital Phosphor Oscilloscope: 4CH, 1GHz, 5GSa/s(1ch), 1.25GSa/s(4ch)

● Standard accessories

No.	Designation	Remarks
1	Passive voltage probe	4
2	Power cord	1, standard three-prong power cord
3	User manual	1
4	Programming manual	1
5	Certificate of conformity	1

● Options

Option No.	Designation	Function	Remarks
4456-H01	Logical analyzer option	Necessary for the mixed signal oscilloscope, 16 digital channels, including 1 logic probe	
4456-H02	Function generator option	1 channel and 25 MHz function generator	
4456-H03	P9558 Passive voltage probe	Bandwidth: DC~250MHz Attenuation: 100:1 Max. voltage: 3000V Length: 200cm	
4456-H04	P3258 Passive voltage probe	Bandwidth: DC~100MHz Attenuation: 100:1 Max. voltage: 1500V Length: 130cm	

4456-H05	P8050 High voltage differential probe	Bandwidth: DC~50MHz Attenuation: 50:1、500:1 Accuracy: $\pm 2\%$ Max. voltage: 1300 (DC+ACpk) Power: 9VDC	
4456-H06	P8100 High voltage differential probe	Bandwidth: DC~100MHz Attenuation: 50:1、500:1 Accuracy: $\pm 2\%$ Max. voltage: 1300 (DC+ACpk) Power: 9VDC	
4456-H07	A622 Current probe	Bandwidth: DC~100kHz Scale: 50mA~100A peak Range: 10mV/A、100mV/A Supply: 9V alkaline batteries	
4456-H08	AP202 Current probe	Bandwidth: DC~25MHz Accuracy: $\pm 3\%$ Max. current: 20A (DC+ACpk) Range: 100mV/A Power: 9VDC	
4456-H09	Rack mount kit	Rack mount kit	
4456-H10	Hard transit case	Hard transit case	
4456-H11	English front panel	English front panel label	
4456-H12	P9550A Passive voltage probe	Bandwidth: DC~500 MHz Attenuation: 10:1 Input impedance: 10 M Ω //10pF ± 2 pF Maximum voltage: 300 V (DC+ACpk) Automatic identification functions	
4456-H13	P9551 Passive voltage probe	Bandwidth: DC~500 MHz Attenuation: 10:1, 1:1 Input impedance: 10 M Ω //10pF ± 2 pF Maximum voltage: 300 V (DC+ACpk)	
4456-H14	P9350A Passive voltage probe	Bandwidth: DC~350MHz Attenuation: 10:1 Input impedance: 10 M Ω //10pF ± 2 pF Maximum voltage: 300 V (DC+ACpk) Automatic identification functions	
4456-H15	P9600A Passive voltage probe	Bandwidth: DC~600MHz Attenuation: 10:1 Input impedance: 10 M Ω //12pF ± 2 pF Maximum voltage: 300 V (DC+ACpk) Automatic identification functions	
4456-H16	LAP500 Logic probe	Number of channels: 16 Input impedance: 100 k Ω $\pm 2\%$ Maximum voltage: ± 40 Vpk	

4456-H17	P5020 High voltage differential probe	Bandwidth: DC~20MHz Attenuation: 500:1, 5000:1 Precision: $\pm 2\%$ Maximum voltage: 40 kV (DC+AC Pk-Pk)	
4456-H18	P6100 High voltage differential probe	Bandwidth: DC~100MHz Attenuation: 100:1, 1000:1 Precision: $\pm 1\%$ Maximum voltage: 14 kVpp	
4456-H19	P7100 High voltage differential probe	Bandwidth: DC~100MHz Attenuation: 100:1, 1000:1 Precision: $\pm 1\%$ Maximum voltage: 7000 Vpp	
4456-H20	P4220 High voltage single end probe	Bandwidth: DC~220MHz Attenuation: 1000:1 Precision: $\pm 3\%$ Maximum voltage: 39 kV (DC+ACpk)	
4456-H21	AP621 Current probe	Bandwidth: 10 Hz~100 kHz Measurement range: 2,000 A peak Range: 100 mV/A, 10 mV/A, 1 mV/A	
4456-H22	AP622D Current probe	Bandwidth: DC~1.5MHz Measurement range: 1 mA~40A peak Range: 100 mV/A, 1 V/A	
4456-H23	AP204A Current probe	Bandwidth: DC~50MHz Precision: $\pm 3\%$ Maximum current: 40 A (DC+ACpk) Range: 50 mV/A	
4456-H24	PL-50 matcher	Impedance: $50\Omega \pm 1\%$ Bandwidth: DC~2GHz	
4456-H25	PL-75 matcher	Impedance: $75\Omega \pm 1\%$ Bandwidth: DC~1GHz	
4456-H26	PL-93 matcher	Impedance: $93\Omega \pm 1\%$ Bandwidth: DC~1GHz	

Option No.	Designation	Function	Remarks
4456-S01	Limit mask test module	Support ITU-T、ANSI T1.102、USB and other standard mask or user creation.	--
4456-S02	Power measurement and analysis module	It supports power supply quality, switching loss, harmonic wave, ripple and modulation tests	--
4456-S03	HD video trigger module	Support 480p, 576p, 720p, 1080p, 1080i and other formats	--

4456-S04	I2C trigger and analysis module	Signal rate: $\leq 10\text{Mbps}$ Protocol type: 7 digits/10 digits address Signal type: single-ended	--
4456-S05	RS232 trigger and analysis module	Signal rate: 50~2Mbps Signal type: single-ended	--
4456-S06	SPI trigger and analysis module	Signal rate: $\leq 10\text{Mbps}$ Signal type: single-ended	--
4456-S07	CAN trigger and analysis module	Signal rate: 10kbps~1Mbps Signal type: single-ended, differential CAN_L, CAN_H	--
4456-S08	LIN trigger and analysis module	Signal rate: 800bps~100kbps Protocol standard: 1.X、2.X Signal type: single-ended	--
4456-S09	FlexRay trigger and analysis module	Signal rate: 2.5Mbps、5Mbps、10Mbps Signal type: BP、BM、TX/RX	--
4456-S10	Audio trigger and analysis module	Signal rate: $\leq 10\text{Mbps}$ Protocol standard: I2S、LJ、RJ、TDM Signal type: single-ended	--
4456-S11	USB trigger and analysis module	Signal rate: 1.5Mbps、12Mbps Signal type: single-ended, differential	--
4456-S12	MIL-STD-1553 trigger and analysis module	Signal rate: 1 Mbps Signal type: Single end and differential	--

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Частное предприятие «Салтако»

220012, г.Минск ул.Чернышевского 10А, ком.408

WhatsApp: +375 25 7716426

Viber: +375 29 5445506

Fax: +375 17 2809649

saltakominsk@gmail.com



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www.saltako.by