Description

The 7024 is a digital storage oscilloscope with 200 MHz bandwidth and 4 analogue channels. It has a maximum sample rate of 1 GSa/s and a standard record length of 14 Mpts. For ease-of-use, the most commonly used functions can be accessed with its user-friendly front panel design with quick-key single press buttons for common functions and settings.

The 7024 employs a new generation of SPO (Super Phosphor Oscilloscope) technology from Siglent, that provides excellent signal fidelity and performance. The system noise is low, with a minimum vertical input range of 500 uV/div and an innovative digital trigger system with high sensitivity and low jitter. Waveform capture rates are up to 100,000 wfm/s (normal mode), and 400,000 wfm/s (sequence mode).

The oscilloscope supports 38 parameters measurements and common mathematical operations to speed up complex / repetitive measurements. Further functions include on-screen bode plot, search and navigation.

Basic Specifications

|	
Display	7 inch TFT-LCD (800x480)
Bandwidth	200 MHz
Sampling Rate (Max.)	1 GSa/s
Channels	4
Memory Depth	Max 14 Mpts/Ch (single ch/pair), 7 Mpts/Ch (two ch/pair)
Trigger Types	Edge, Slope, Pulse Width, Window, Runt, Interval, Dropout, Pattern, Video
Waveform Capture Rate (Max.)	100,000 wfm/s (normal mode) 400,000 wfm/s (sequence mode)
Serial Trigger and decoder	IIC, SPI, UART, CAN, LIN
Interfaces	USB Host, USB Device, LAN, Pass/Fail, Trigger Out
Supplied Probe	2x passive probe (200 MHz, 1X/10X, 1M/10 Mohm, 300 V/600 V)
Module width	400 mm (primary or secondary console fitting)
Ordering Information	7024 Super Phosphor Oscilloscope Module

Features

- 200 MHz bandwidth, 4 channel

- Real-time sampling rate up to 1 GSa/s

- Memory Depth: 7 Mpts/Ch (not interleave mode); 14 Mpts/Ch (interleave mode)

- Intelligent trigger: Edge, Slope, Pulse Width, Window, Runt, Interval, Timeout (Dropout), and Pattern

- Waveform capture rate up to 100,000 wfm/s (normal mode), and 400,000 wfm/s (sequence mode)

- Low background noise with V scales from $500\,\mu V$/div to 10 V/div

- Automatic measurement function for 38 parameters

- Math functions: FFT, addition, subtraction, multiplication, division, integration, differential, square root

- Supports 256-level intensity grading and color display modes

- High Speed hardware based Pass/Fail function

- Bode plot, measuring power supply control loop response

- Search and navigate functions

- Single press shortcut buttons: Auto Setup, Default, Cursors, Roll Measure, History, Display/Persist, Clear Sweep, Zoom, Print

- Multiple interface types: USB Host, USB Device (USB-TMC), LAN, Pass / Fail, Trigger Out

- Optional USB 25 MHz AWG module

- 7 inch TFT-LCD display with 800 * 480 resolution

Due to continuous development Time Electronics reserves the right to change specifications without prior notice.

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Functions & Characteristics

When all channels are enabled, each channel has a maximum sample rate of 500 MSa/s. When a single channel per pair is active, that channel has sample rate of 1 GSa/s
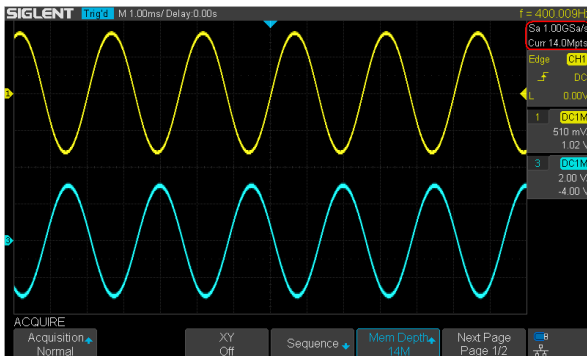
The oscilloscope has two 1 GSa/s ADC chips (channel 1 and 2 share one, channel 3 and 4 share another), so that each channel can achieve sample rates up to 500 MSa/s and work on bandwidths of 200 MHz when all channels are enabled.

Record Length of up to 14 Mpts (single channel/ pair mode), 7 Mpts/CH (two channels/pair mode)
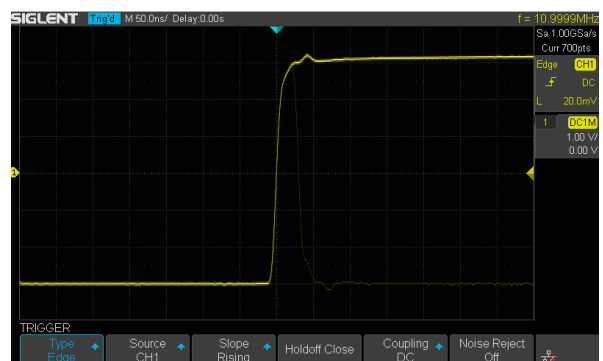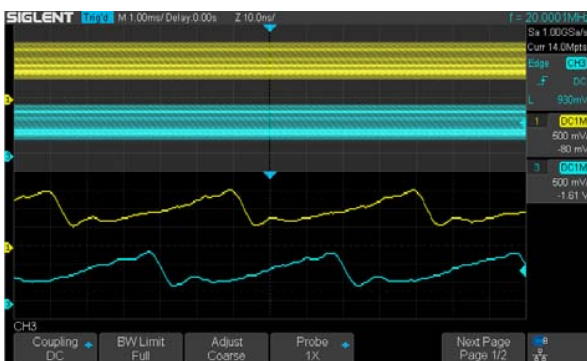
Using hardware-based Zoom technologies and max record length of up to 14 Mpts, users are able to oversample to capture for longer time periods at higher resolution and use the zoom feature to see more details within each signal.

Waveform Capture Rate up to 400,000 wfm/s

With a waveform capture rate of up to 400,000 wfm/s (sequence mode), the oscilloscope can easily capture the unusual or low-probability events.

**256 -Level Intensity Grading and Color Temperature Display**
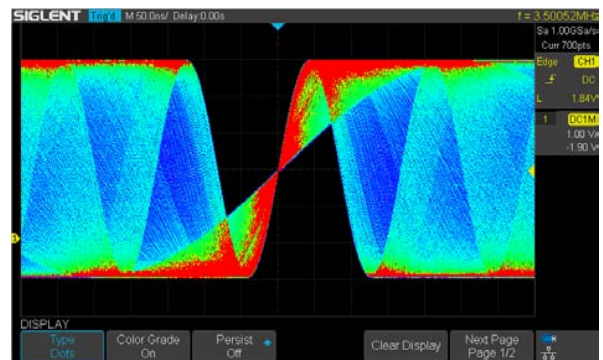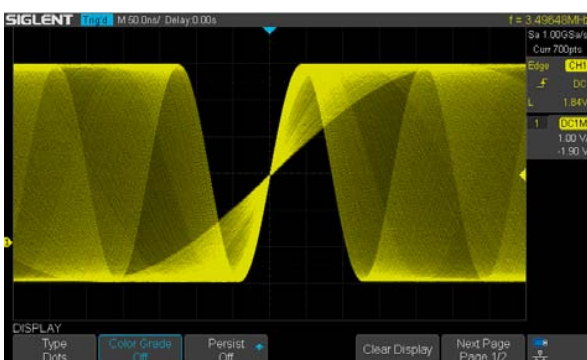
SPO display technology provides fast refresh rates. The resulting intensity-graded trace is brighter for events that occur with more frequency and dims when the events occur with less frequency.

The color temperature display is similar to the intensity-graded trace function, but the trace occurrence is represented by different colors (color "temperature") as opposed to changes in the intensity of one color. Red colors represents the more frequent events, while blue is used to mark points that occur lest frequently.
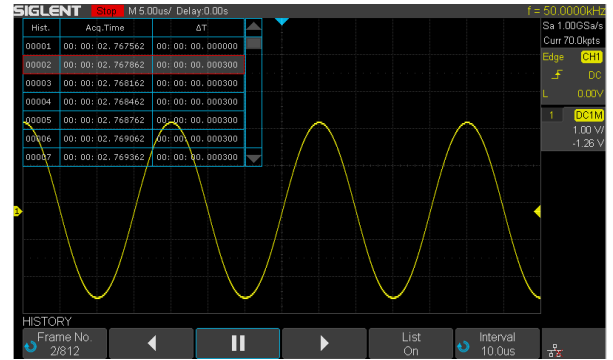
Serial Bus Decoding Function (Standard)
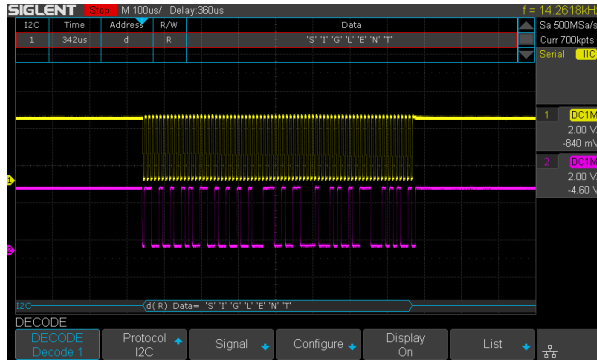
The scope displays the decoding through the events list. Bus protocol information can be quickly and intuitively displayed in a tabular format.

History Waveforms (History) Mode and Segmented Acquisition (Sequence)


Playback the latest triggered events using the history function. Segmented memory collection will store trigger events into multiple (Up to 80,000) memory segments, each segment will store triggered waveforms and timestamp of each frame.

True measurement to 14 M points
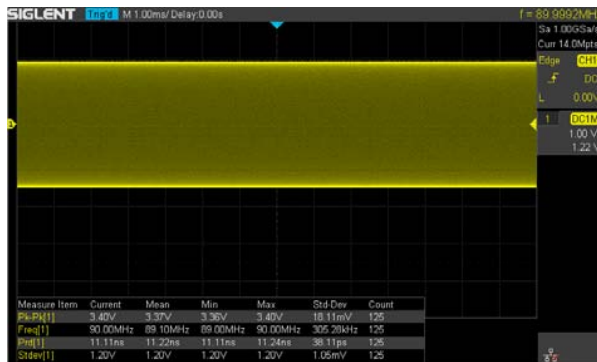
The 7024 can measure all sampled data points up to 14 Mpts. This ensures the accuracy of measurements while the math co-processor decreases measurement time and increases ease-of-use.

Gate and Zoom Measurement
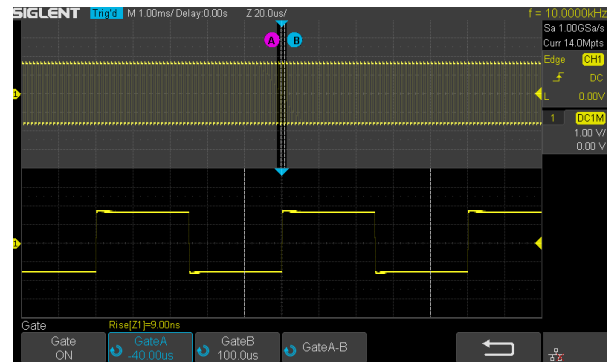
Through Gate and Zoom measurement, the user can specify an arbitrary interval of waveform data analysis and statistics. This helps avoid measurement errors that can be caused by invalid or extraneous data, greatly enhancing the measurements' validity and flexibility.

1 M point used to calculate the FFT
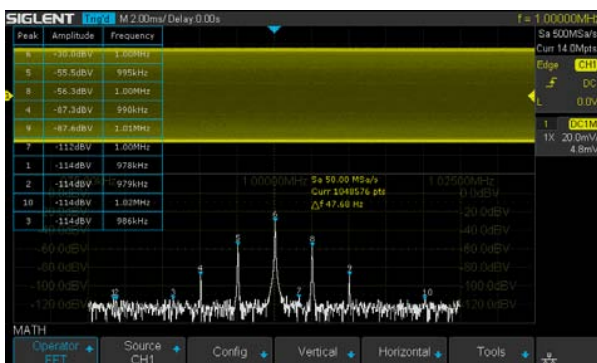
The new math co-processor enables FFT analysis of incoming signals using up to 1 M samples per waveform. This provides high frequency resolution with a fast refresh rate. The FFT function also supports a variety of window functions so that it can adapt to different spectrum measurement needs. Four-channel series support Peaks, Markers, a variety of numbers.

Hardware-Based High Speed Pass/ Fail function
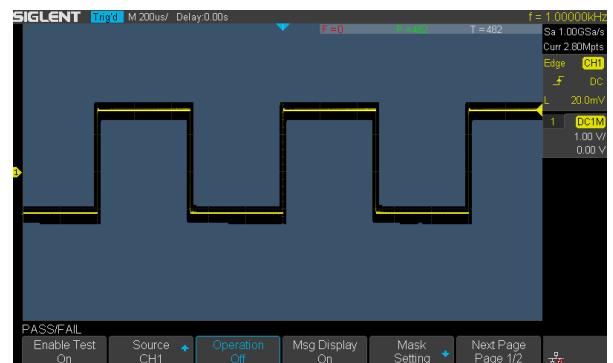
The 7024 utilizes a hardware-based Pass/Fail function, performing up to 40,000 Pass / Fail decisions each second. Easily generate user defined test templates provide trace mask comparison making it suitable for long-term signal monitoring or automated production line testing.

Customizable Default Key
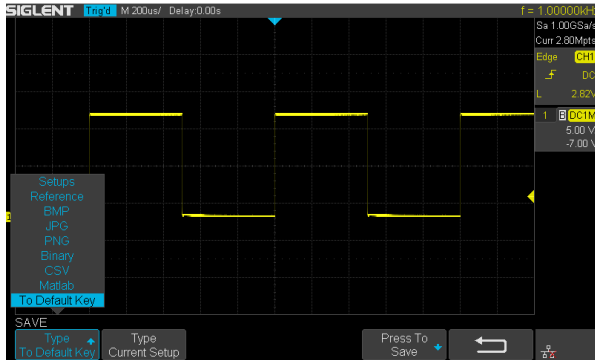
The current parameters of the oscilloscope can be preset to Default Key through the Save menu.

16 Digital Channels/MSO
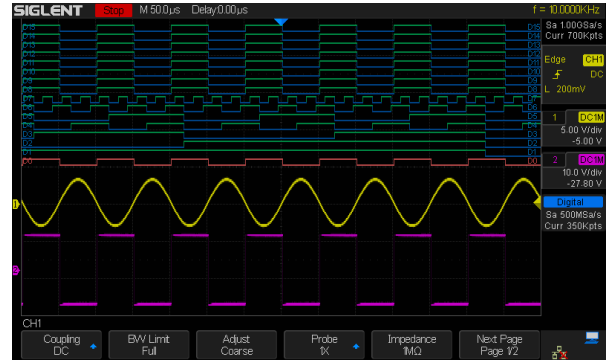
16 digital channels enables users to acquire and trigger on the waveforms then analyze the pattern, simultaneously with one instrument.

Search and Navigate
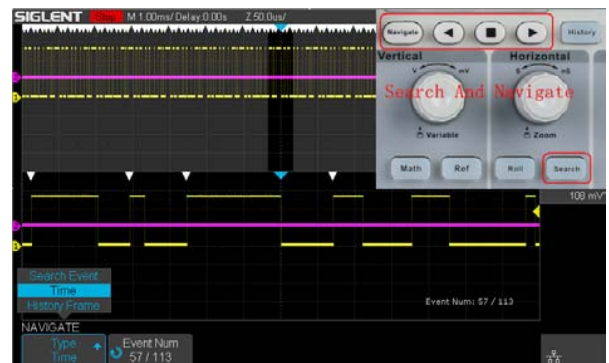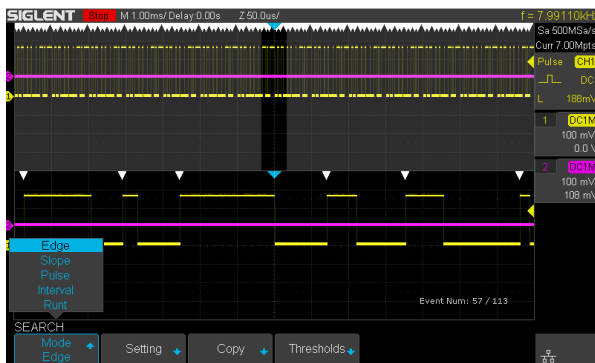
The 7024 can search events specified by the user in a frame. It can also navigate by time (delay position) and historical frames.

Bode Plot
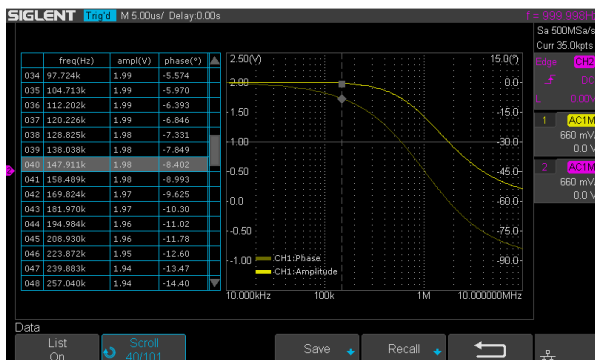
The 7024 can control the optional USB AWG module, scan a devices amplitude and phase frequency response, and display the data as a Bode Plot.
There is also a Vari-level Mode for accurately measuring Power Supply Control Loop Response (PSRR). It can also show the result lists, and export the data to a USB disk.

Specifications

Acquire System	
Sampling Rate	1 GSa/s (single channel/pair), 500 MSa/s (two channels/pair)
Memory Depth	Max 14 Mpts/Ch (single channel/pair), 7 Mpts/Ch (two channels/pair)
Peak Detect	2 ns (Four channel series)
	4 ns (Two channel model - 7024/2CH)
Average	Averages: 4, 16, 32, 64, 128, 256, 512, 1024
Eres	Enhance bits: 0.5, 1.5, 2, 2.5, 3
Waveform interpolation	Sin(x)/x, Linear

Input	
Channels	4 (Four channel series) 2+EXT (Two channel series)
Coupling	DC, AC, GND
Impedance	DC: (1 MΩ±2%) || (15 pF ±2 pF) *DC: (1 MΩ±2%) || (18 pF ±2 pF) (Two channel model - 7024/2CH)*
Max.Input voltage	1 MΩ: ≤400 Vpk(DC + Peak AC <=10 kHz)
CH to CH Isolation	DC-Max BW: >40 dB
Probe attenuation	0.1X, 0.2X, 0.5X, 1X, 2X, 5X, 10X......1000X, 2000X, 5000X, 10000X

Vertical System	
Bandwidth (-3 dB)	200 MHz
Vertical Resolution	8-bit
Vertical Scale (Probe 1X)	500 µV/div - 10 V/div (1-2-5 sequence)
Offset Range (Probe 1X)	500uV~118mV: ±2V
	120mV~1.18V: ±20V
	1.2V~10V: ±200V
Bandwidth Limit	20 MHz ±40%
Bandwidth Flatness	DC- 10% (BW): ± 1 dB
	10%- 50% (BW): ± 2 dB
	50%- 100% (BW): + 2 dB/-3 dB
Low Frequency Response (AC -3 dB)	≤2 Hz (at input BNC)
Noise	ST-DEV ≤0.5 division (<1 mV/div)
	ST-DEV ≤0.2 division (<2 mV/div)
	ST-DEV ≤0.1 division (≥2 mV/div)
SFDR including harmonics	≥35 dB
DC Gain Accuracy	≤±3.0%: 5 mV/div-10 V/div
	≤±4.0%: ≤2 mV/div
Offset Accuracy	±(1%* Offset+1.5%*8*div+2 mV): ≥2 mV/div
	±(1%* Offset+1.5%*8*div+500 uV): ≤1 mv/div
Risetime	Typical 1.8 ns
	Typical 3.5 ns
Overshoot (500 ps Pulse)	<10%

Horizontal System

Timebase Scale	1.0 ns/div-100 s/div
Channel Skew	<100 ps
Waveform Capture Rate	Up to 100,000 wfm/s (normal mode), 400,000 wfm/s (sequence mode)
Intensity grading	256 Levels
Display Format	Y-T, X-Y,Roll
Timebase Accuracy	±25 ppm
Roll Mode	50 ms/div-100 s/div (1-2-5 sequence)

Trigger System

Trigger Mode	Auto, Normal, Single
Trigger Level	Internal: ±4.5 div from the center of the screen
	EXT: ±0.6 V (Two channel model 7024-2CH)
	EXT/5: ±3 V (Two channel model 7024-2CH)
Holdoff Range	80 ns- 1.5 s
Trigger Coupling	AC DC LFRJ HFRJ Noise RJ
Coupling Frequency Response	DC: Passes all components of the signal
	AC: Blocks DC components and attenuates signals below 8 Hz
	LFRJ: Blocks the DC component and attenuates the low-frequency components below 2 MHz
	HFRJ: Attenuates the high-frequency components above 1.2 MHz
Coupling Frequency Response (EXT, Two channels series)	DC: Passes all components of the signal
	AC: Blocks DC components and attenuates signals below 20 Hz
	LFRJ: Blocks the DC components and attenuates low-frequency components below 7 khz
	HFRJ: Attenuates high-frequency components above 160 khz
Trigger Accuracy (typical)	Internal: ±0.2 div
	EXT (Two channel model 7024-2CH): ±0.4 div
Trigger Sensitivity	DC - Max BW 0.6 div
	EXT (Two channel model 7024-2CH): 200 mVpp DC– 10 MHz
	300 mVpp 10 MHz - BW frequency
	EXT/5 (Two channel model 7024-2CH): 1 Vpp DC – 10 MHz
	1.5 Vpp 10 MHz -BW frequency
Trigger Jitter	< 100 ps
Trigger Displacement	Pre-Trigger: 0 - 100% Memory
	Delay Trigger: 0 to 10,000 div

Edge Trigger

Slope	Rising, Falling, Rising&Falling
Source	All channels/ AC Line All channels/ EXT/ (EXT/5)/ AC Line (Two channel model 7024-2CH)

Slope Trigger

Slope	Rising, Falling
LimitRange	$<$, $>$, $<>$, $><$
Source	All channels
TimeRange	2 ns- 4.2 s
Resolution	1 ns

Pulse Trigger	
Polarity	+wid , -wid
Limit Range	< , > , <> , ><
Source	All channels
Pulse Range	2 ns ～ 4.2 s
Resolution	1 ns
Video Trigger	
Signal Standard	NTSC, PAL, 720p/50, 720p/60, 1080p/50, 1080p/60, 1080i/50, 1080i/60, Custom
Source	All channels
Sync	Any, Select
Trigger condition	Line, Field
Window Trigger	
Window Type	Absolute, Relative
Source	All channels
Interval Trigger	
Slope	Rising, Falling
Limit Range	< , > , <> , ><
Source	All channels
Time Range	2 ns ～ 4.2 s
Resolution	1 ns
Dropout Trigger	
Timeout Type	Edge, State
Source	All channels
Slope	Rising, Falling
Time Range	2 ns ～ 4.2 s
Resolution	1 ns
Runt Trigger	
Polarity	+wid , -wid
Limit Range	< , > , <> , ><
Source	All channels
Time Range	2 ns ～ 4.2 s
Resolution	1 ns
Pattern Trigger	
Pattern Setting	Invalid, Low, High
Logic	AND, OR, NAND, NOR
Source	All channels
Limit Range	< , > , <> , ><
Time Range	2 ns ～ 4.2 s
Resolution	1 ns

Serial Trigger	
I2C Trigger	
Condition	Start, Stop, Restart, No Ack, EEPROM, 7 bits Address & Data, 10 bits Address & Data, Data Length
Source (SDA/SCL)	All channels
Data format	Hex
Limit Range	EEPROM: =, >, <
Data Length	EEPROM: 1 byte Addr & Data: 1 ~ 2 byte Data Length: 1 ~ 12 byte
R/W bit	Addr & Data: Read, Write, Do not care
SPI Trigger	
Condition	Data
Source (CS/CL/Data)	All channels
Data format	Binary
Data Length	4 ~ 96 bit
Bit Value	0, 1, X
Bit Order	LSB, MSB
UART Trigger	
Condition	Start, Stop, Data, Parity Error
Source (RX/TX)	All channels
Data format	Hex
Limit Range	=, >, <
Data Length	1 byte
Data Width	5 bit, 6 bit, 7 bit, 8 bit
Parity Check	None, Odd, Even
Stop Bit	1 bit, 1.5 bit, 2 bit
Idle Level	High, Low
Baud Rate (Selectable)	600/1200/2400/4800/960019200/38400/57600/115200 bit/s
Baud Rate (Custom)	300 bit/s ~ 5000000 bit/s
CAN Trigger	
Condition	Start Remote, ID, ID + Data, Error
Source	All channels
ID	STD (11 bit), EXT (29 bit)
Data Format	Hex
Data Length	1~2 byte
Baud Rate	5 k/10 k/20 k/50 k/100 k/125 k/250 k/500 k/800 k/1 M bit/s
LIN Trigger	
Condition	Break, Frame ID, ID+Data, Error
Source	All channels
ID	1 byte
Data Format	Hex
Data Length	1 ~ 2 byte
Baud Rate (Selectable)	600/1200/2400/4800/9600/19200 bit/s
Baud Rate (Custom)	300 bit/s ~ 20 kbit/s

Serial Decoder	
Number of Decoders	2
I2C Decoder	
Signal	SCL, SDA
Address	7 bits, 10 bits
Threshold	-4.5 ~ 4.5 div
List	1 ~ 7 lines
SPI Decoder	
Signal	SCL,MISO, MOSI, CS (7024-2CH 2 channel scope can only use 2 signal identifiers)
Edge Select	Rising, Falling
Bit Order	MSB, LSB
Threshold	-4.5 ~ 4.5 div
List	1 ~ 7 lines
UART Decoder	
Signal	RX, TX
Data Width	5 bit, 6 bit, 7 bit, 8 bit
Parity Check	None, Odd, Even
Stop Bit	1 bit, 1.5 bit, 2 bit
Idle Level	Low, High
Threshold	-4.5 ~ 4.5 div
List	1 ~ 7 lines
CAN Decoder	
Signal	CAN_H, CAN_L
Source	CAN_H, CAN_L, CAN_H-CAN_L
Threshold	-4.5 ~ 4.5 div
List	1 ~ 7 lines
LIN Decoder	
LIN Specification Package Revision	Ver1.3, Ver2.0
Threshold	-4.5 ~ 4.5 div
List	1 ~ 7 lines

Measurement

Source	All channels, All channels in Zoom, Math, All References, History
Number of Measurements	Display 4 measurements at the same time . 5 measurements displayed in statistics table.
Measurement Range	Screen region, Gate region

Measurement Parameters (38 Types)

Vertical (Voltage)	Max	Highest value in input waveform
	Min	Lowest value in input waveform
	Pk-Pk	Difference between maximum and minimum data values
	Ampl	Difference between top and base in a bimodal signal, or between max and min in an unimodal signal
	Top	Value of most probable higher state in a bimodal waveform
	Base	Value of most probable lower state in a bimodal waveform
	Mean	Average of all data values
	Cmean	Average of data values in the first cycle
	Stdev	Standard deviation of all data values
	Cstd	Standard deviation of all data values in the first cycle
	VRMS	Root mean square of all data values
	Crms	Root mean square of all data values in the first cycle
	FOV	Overshoot after a falling edge; (base-min)/Amplitude
	FPRE	Overshoot before a falling edge; (max-top)/Amplitude
	ROV	Overshoot after a rising edge; (max-top)/Amplitude
	RPRE	Overshoot before a rising edge; (base-min)/Amplitude
	Level@X	the voltage value of the trigger point
Horizontal (Time)	Period	Time between the middle threshold points of two consecutive, like-polarity edges
	Freq	Reciprocal of period
	+Wid	Time difference between the 50% threshold of a rising edge to the 50% threshold of the next falling edge of the pulse
	-Wid	Time difference between the 50% threshold of a falling edge to the 50% threshold of the next rising edge of the pulse
	Rise Time	Duration of rising edge from 10-90%
	Fall Time	Duration of falling edge from 90-10%
	Bwid	Time from the first rising edge to the last falling edge, or the first falling edge to the last rising edge at the 50% crossing
	+Dut	Ratio of positive width to period
	-Dut	Ratio of negative width to period
	Delay	Time from the trigger to the first transition at the 50% crossing
	Time@Level	Time from the trigger to each rising edge at the 50% crossing. When Statistics is Off, it shows the time from the trigger to the last rising edge at the 50% crossing. When Statistics is On, it shows the Current, Mean, Min, Max, Standard Deviation of time from the trigger to each rising edge at the 50% crossing in multiple frames (number = Count).
Delay	Phase	Phase difference between two edges
	FRR	Time from the first rising edge of channel A to the following first rising edge of channel B
	FRF	Time from the first rising edge of channel A to the following first falling edge of channel B
	FFR	Time from the first falling edge of channel A to the following first rising edge of channel B
	FFF	Time from the first falling edge of channel A to the following first falling edge of channel B
	LRR	Time from the first rising edge of channel A to the last rising edge of channel B
	LRF	Time from the first rising edge of channel A to the last falling edge of channel B
	LFR	Time from the first falling edge of channel A to the last rising edge of channel B
	LFF	Time from the first falling edge of channel A to the last falling edge of channel B
	Skew	Time of source A edge minus time of nearest source B edge

Measurement

Cursors	Manual : Time X1, X2, (X1-X2), (1/ΔT) Voltage Y1, Y2, (Y1-Y2) Track: Time X1, X2, (X1-X2)
Statistics	Current, Mean, Min, Max, Stdev, Count
Counter	Hardware 6 bit 6-digit counter（channels are selectable）

Math Function

Operation	+ , - , * , / , FFT , d/dt , ∫dt , √
FFT window	Rectangular, Blackman, Hanning, Hamming, Flattop
FFT display	Full Screen, Split, Exclusive

USB AWG Module (option)

Channel	1
Max. Output Frequency	25 MHz
Sampling Rate	125 MSa/s
Frequency Resolution	1 µHz
Frequency Accuracy	±50 ppm
Vertical Resolution	14-bit
Amplitude Range	-1.5 ~ +1.5 V (50Ω load)
	-3 ~ +3 V (High-Z load)
Waveform Type	Sine, Square, Ramp, Pulse, Noise, DC and 45 built-in waveforms
Output impedance	50 Ω±2%
Protection	Over-Voltage Protection, Current-Limiting Protection

Sine

Frequency	1 µHz ~ 25 MHz
Offset Accuracy (10 kHz)	±(1%*Offset Setting Value +3 mVpp)
Amplitude flatness (10 kHz, 5 Vpp)	±0.3 dB
SFDR	DC ~ 1 MHz -60 dBc
	1 MHz ~ 5 MHz -55 dBc
	5 MHz ~ 25 MHz -50 dBc
HD	DC ~ 5 MHz -50 dBc
	5 MHz ~ 25 MHz -45 dBc

Square/Pulse

Frequency	1 µHz ~ 10 MHz
Duty Cycle	1% ~ 99%
Rise/Fall time	< 24 ns (10% ~ 90%)
Overshoot (1 kHz,1 Vpp, Typical)	< 3% (typical 1 kHz, 1 Vpp)
Pulse Width	> 50 ns
Jitter	< 500 ps + 10 ppm

Ramp

Frequency	1 µHz ~ 300 kHz
Linearity (Typical)	< 0.1% of Pk-Pk (Typical, 1 kHz, 1 Vpp, 50% Symmetry)
Symmetry	0% ~ 100%

DC

Offset range	±1.5 V (50 Ω load)
	±3 V (High-Z load)
Accuracy	±(|offset|*1%+3 mV)

Noise

Bandwidth	>25 MHz (-3 dB)

Arbitrary Wave

Frequency	1 µHz ~ 5 MHz
Wave Length	16 kpts
Sampling Rate	125 MSa/s
Lead in	EasyWave and U-Disk

Digital Channels (option)

No. of Channels	16
Max. Sampling Rate	1 GSa/s
Memory Depth	14 Mpts/CH
Min. Detectable Pulse Width	4 ns
Level Group	D0~D7, D8~D15
Level Range	-8 V ~ 8 V
Logic Type	TTL, CMOS, LVCMOS3.3, LVCMOS2.5, custom
Skew	D0~D15: ±1 sampling interval Digital to Analog: ± (1 sampling interval +1 ns)

I/O

Standard	USB Host (1 for two channel series, and 2 for four channel series), USB Device, LAN, Pass/Fail, Trigger Out
Pass/Fail	3.3 V TTL Output

Display (Screen)

Display Type	7-inch TFT LCD
Display Resolution	800×480
Display Color	24 bit
Contrast (Typical)	500:1
Backlight	300 nit
Range	8 x 14 divisions

Display (Waveform)

Display Mode	Dot, Vector
Persist Time	Off, 1 Sec, 5 Sec, 10 Sec, 30 Sec, Infinite
Color Display	Normal, Color
Screen Saver	1 min, 5 min, 10 min, 30 min, 1 hour, Off
Language	Simplified Chinese, Traditional Chinese, English, French, Japanese, Korean, German, Russian, Italian, Portuguese