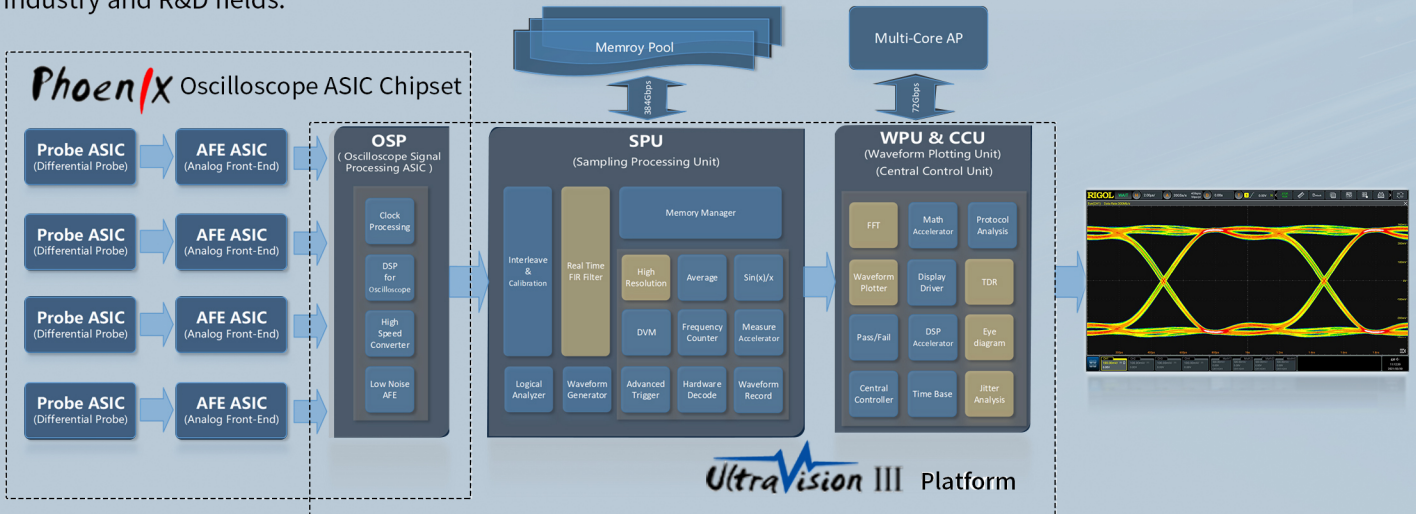# **DS70000** Series
Digital Oscilloscope

DataSheet

DS70000 Series High-End Digital Oscilloscope

ASIC Chip Delivers Higher Bandwidth and Sample Rate

DS70000 series digital oscilloscope is equipped with " Phoenix" chip set, which delivers a max. of 20 GSa/s sample rate and 5 GHz bandwidth to better achieve signal fidelity, cover more application scenarios, and cater to the diversified application demands of the complex test system in the industry and R&D fields.

- **20 GSa/s Sample Rate**
- **5 GHz Bandwidth**

Unique UltraVision III Platform Delivers Industry-leading Performance

With the brand new unique UltraVision III platform, DS70000 series digital oscilloscope delivers industry-leading performance for its key specifications such as memory depth, waveform capture rate, and vertical resolution. It can support computer, embedded, automotive electronics, and other serial bus analysis; meet the lower noise requirements of power integrity analysis; improve the efficiency for time-domain and frequency-domain joint analysis. With its excellent specification performance, DS70000 series is bound to exercise its important role in the test and measurement industry in various fields such as industry and R&D.

- **1 million wfms/s update rates capable of capturing all the signals, making occasional signals nowhere to hide**
- **2 Gpts memory depth capable of capturing waveforms in a long period of time under the high sample rate to cater to application scenarios where to observe waveforms for a long time**
- **8 to 16-bit adjustable vertical resolution capable of accurately measuring even the tiny signals**
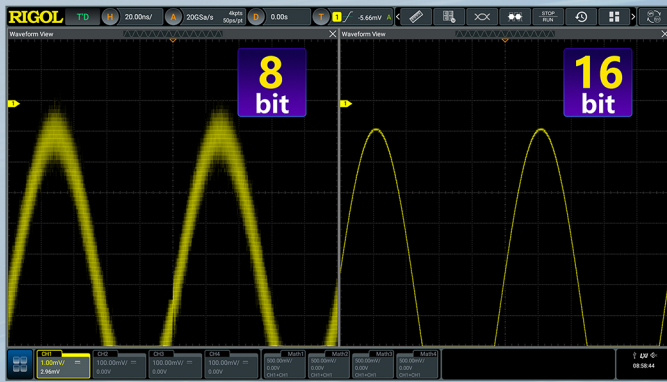- **Hardware acceleration capable of processing 10,000 FFTs/s, offering real-time spectrum measurement experience**
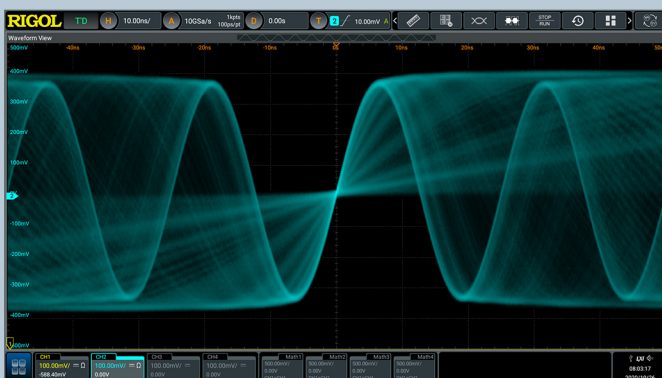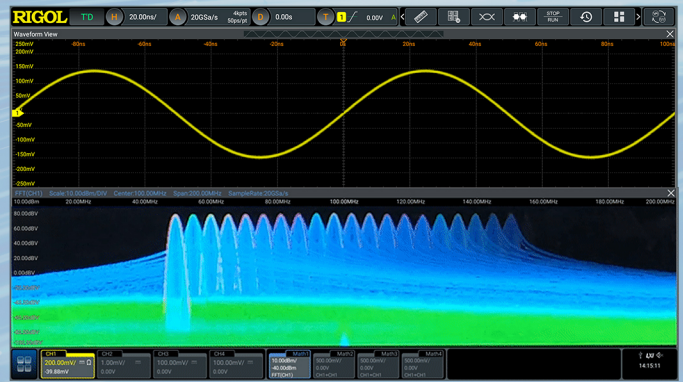

1,000,000 wfms/s Capture Rate
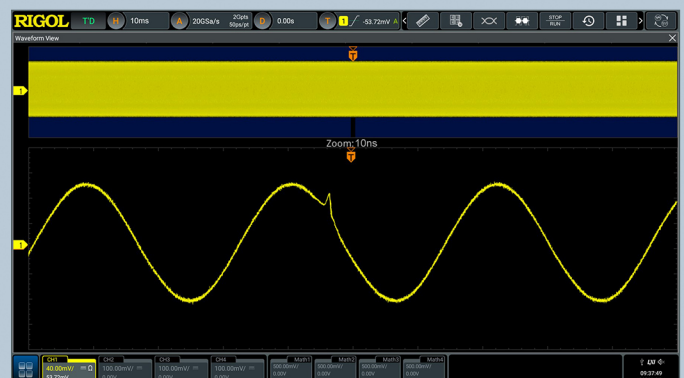
Up to 2 Gpts Memory Depth

16-bit Vertical Resolution

10,000 Hardware Accelerated FFTs/s

Brand New Appearance and User-friendly Design Bring an Extraordinary Human-Machine Interaction Experience

DS70000 series oscilloscope has a 7U full-rack structure and delicate industry design, and it supports two touch screens. The main touch screen is a 15.6-inch capacitive angle-adjustable high definition touch screen. It supports displaying various types of information in different windows. The split-screen display mode enables users to observe the signals efficiently and get better view effects. The 3.5-inch minor touch screen can be served as a customized high-definition smart and quick-responsive keyboard, enabling users to customize the shortcut menu according to their own habits and open the desired menu quickly. When observing multiple items of measurement data in one time, users can use this small screen as an extended screen to view data on two screens, thus more measurement items can be seen.
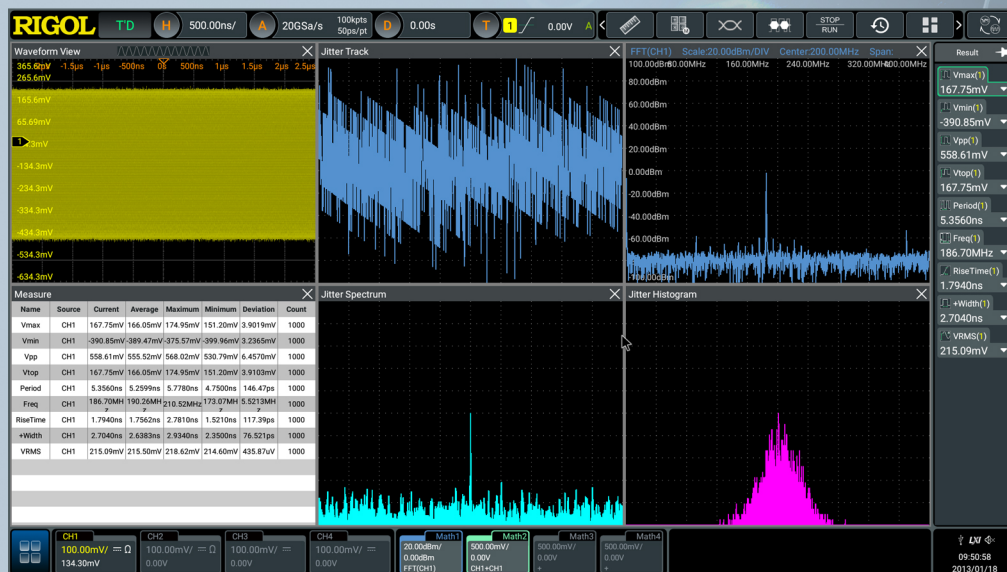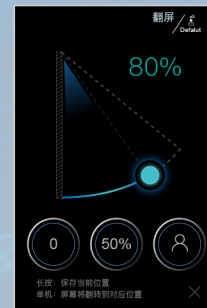
Excellent Eye Diagram Pre-test and Jitter Analysis

Eye Diagram

Based on the excellent bandwidth and sample rate, DS70000 series oscilloscope provides the real-time eye plot and measurement with the clock recovery function, which can be applied to protocol conformance analysis.

DS70000 series supports the eye measurement for all the analog channels, and also provides measurement for several parameters of the eye diagram: eye height, eye width, eye amplitude, crossing percentage, and Q Factor. It also supports various clock recovery methods, such as Constant (automatic, semi-automatic, and manual), First-order PLL, Second-order PLL, and Explicit, to meet the demands of customers for different application scenarios.
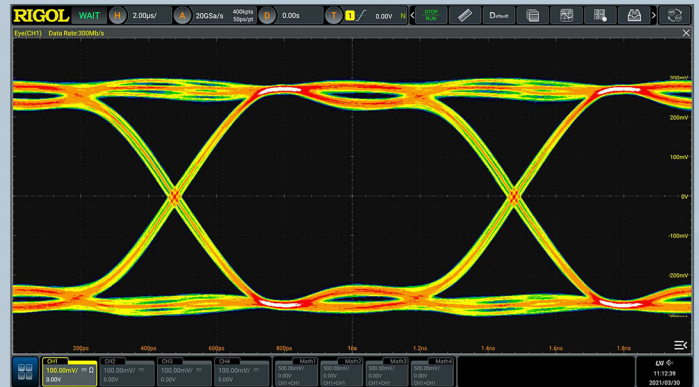
Jitter

DS70000 series oscilloscope provides flexible and convenient jitter measurement and analysis. After purchasing and activating the DS70000-JITTER option, you can accurately and quickly make deterministic jitter measurements for serial clock signals or parallel bus signals.

The jitter analysis is mainly used to measure and analyze the clock jitter. The DS70000 series can accomplish the following jitter analysis items. Among the items, TIE is the most commonly used jitter specification.

Support various clock recovery methods, including
- **Constant: Fully automatic, semi automatic, and manual**
- **First-order PLL**
- **Second-order PLL**
- **Explicit**

- **TIE**
- **Cycle to Cycle**
- **+Width to +Width**
- **-Width to -Width**

To help engineers easily and conveniently find out the jitter components from the signal, the jitter measurement results can be visualized in various ways: trend graph and histogram. The jitter analysis function enables you to measure several uninterrupted bits at one time and make statistics, efficiently accomplishing the jitter analysis for the large quantity of data. From the jitter trend graph and histogram, you can get a quick view of the jitter nature and source, greatly improving the work efficiency of the engineers.
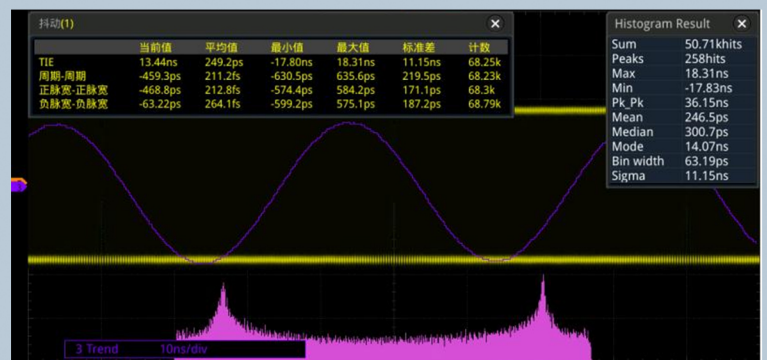
Perform TIE measurement on the clock signal with the jitter and analyze the results through the trend graph and histogram.

Electronic Label

The product model and its main parameters are displayed on the electronic label, sustaining its contents up to 20 years. The parameters will be updated automatically after upgrade to keep the information displayed on the electronic label consistent with that of the current instrument. Users can get the updated product information in a timely manner through the electronic label.

DS70504
Digital Oscilloscope

UltraVision III
5GHz 20GSa/s

N-in-1 Integrated Digital Oscilloscope

In today's integrated design field, a highly integrated comprehensive digital oscilloscope has become a useful tool for design engineers. The DS70000 series digital oscilloscope launched by RIGOL this time integrates 5 independent instruments into 1, including one digital oscilloscope, one spectrum analyzer, one digital voltmeter, one high-precision frequency counter and totalizer, and one protocol analyzer. The DS70000 series offers you an optimal choice to address your actual needs.

Digital Voltmeter

- 3-digit DC/ACRMS, AC+DCRMS voltage measurement
- Sound an alarm for reaching or exceeding the limits
- Display the latest measurement results in the form of a diagram, and display the extrema over the last 3 seconds

High-precision Frequency Counter and Totalizer

- 3 to 8-digit (selectable) high-precision frequency counter
- Support the statistics on the maximum and minimum values of the frequency
- 48-bit totalizer (standard)

Multiple External Interfaces

The DS70000 series provides a variety of external interfaces, including USB3.0 HOST&DEVICE, LAN(LXI), HDMI, AUX OUT, 10 G SFP+, 10 MHz In, 10 MHz Out, and USB-GPIB (option). The oscilloscope is in compliance with the standards specified in LXI Device Specification 2011. It can access to the LXI webpage via the LAN interface. You can purchase the USB-GPIB interface converter from RIGOL to enjoy the reliable GPIB communication service. It also provides HDMI video output interface.

The unique SFP+ optical interface supports 10 Gbit/s data transmission. The 10 GE optical communication technology has increased the transmission rate by 10 times on the basis of the original Gigabit Ethernet. It has strong anti-electromagnetic interference capability and good transmission quality, and can effectively support the long-distance transmission of massive data. In addition, the optical fiber is compact and light, energy-saving and environmentally friendly, and is easy to build networks and convenient for cable maintenance in the later stage. It is currently widely used in various fields.

Digital Oscilloscope

- Bandwidth model: 2.5 GHz, 4 GHz, 5 GHz
- Up to 20 GSa/s real-time sample rate
- 4 analog channels and 1 EXT channel
- Up to 2 Mpts memory depth
- Maximum waveform capture rate of 1,000,000 wfms/s

Spectrum Analyzer

- Standard configuration of enhanced FFT, real-time operation for max. 64 Kpts waveform data
- Max. frequency range: oscilloscope analog bandwidth
- Up to 4 groups of operations can be displayed at the same time
- Independent FFT color persistence view supported
- Up to 15 peaks available for the peak search function; event table available to be exported

Protocol Analyzer (Option)

- Support RS232/UART, I2C, SPI, CAN, LIN, I2S, FlexRay, and MIL-STD-1553 serial bus
- Support analog channel trigger and decode
- RS232/UART, I2C, and SPI support waveform search function
- Work with waveform recording, pass/fail, and zone trigger

Knob with Photoelectric Encoder Enables Long Service Life

The photoelectric encoder operating knob guarantees more than 100,000 times of rotation + pressing operations, greatly improving the service life of the knob. As a frequently used component, the knob for adjustment is made based on the photoelectric encoder, making it endurable to use. You no longer have to worry about wear, ensuring reliable operation during the entire life cycle of the instrument.

Product Features

- Max. 5 GHz bandwidth, 4 analog channels and 1 EXT channel

- Up to 20 GSa/s sample rate

- Max. 2 Gpts memory depth

- Waveform capture rate 1,000,000 wfms/s

- Vertical sensitivity range: 1 mV/div~10 V/div (1 MΩ), 1 mV/div~1 V/div (50 Ω)

- Timebase range: 50 ps/div~1000 s/div

- Up to 2,000,000 frames of hardware real-time and ceaseless waveforms recording and playback functions

- Integrates 5 independent instruments into 1, including digital oscilloscope, real-time spectrum analyzer, digital voltmeter, 8-digit frequency counter and totalizer, and protocol analyzer (option)

- Standard trigger functions: Edge trigger, Pulse trigger, Slope trigger, Video trigger, Pattern trigger, Duration trigger, Timeout trigger, Runt trigger, Window trigger, Delay trigger, Setup/Hold trigger, Nth Edge trigger, zone trigger, RS232, I2C, SPI, CAN, FlexRay, LIN, I2S, and MIL-STD-1553

- A variety of serial decoding functions (option): RS232, I2C, SPI, CAN, FlexRay, LIN, I2S, MIL-STD-1553, CAN-FD, SENT, and ARINC 429; supporting 4 decoding channels

- Auto measurement of 41 waveform parameters; full-memory hardware measurement function

- A variety of math operations: A+B, A-B, A×B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Lg, Ln, Exp, Sqrt, Abs, AX+B, LowPass, HighPass, BandPass, BandStop, built-in enhanced FFT analysis and peak search function

- Eye diagram and jitter analysis (option)

- Unique UltraVision III technical platform

- TDR measurement and differential pulse source output

- Multiple interfaces available: USB HOST&DEVICE, LAN(LXI), HDMI, AUX OUT, and USB-GPIB; Web Control supported

- 15.6" HD capacitive multi-touch screen; adjust the inclination of the screen electrically; multi-window split screen display

- The photoelectric encoder operating knob prolongs its service life, guaranteeing more than 100,000 times of rotation + pressing operations, greatly improving its service life

- High-definition smart and quick-responsive keyboard, enabling users to customize the shortcut menu according to their own habits, and making the keypads quickly responsive

- Electronic label display of the model and main parameters of the product, sustaining the display contents up to 20 years, and capable to be updated when any option is upgraded

- Support online version upgrade

- 7 GHz high-end active differential probe PVA8700 (Option)

Product Features

DS70000 series digital oscilloscope adopts RIGOL's chipset "Phoenix", delivering excellent performance with a maximum sample rate of 20 GSa/s, 5 GHz bandwidth. RIGOL's brand new UltraVison III technical platform guarantees the specifications to reach the advanced level in the industry, with the capture rate up to millions of waveforms per second, 2 Gpts memory depth, 8-to-16 bits adjustable resolution, and 10,000 FFTs/s. In addition to the improved hardware specifications, the DS70000 series digital oscilloscope is also equipped with a 15.6-inch HD capacitive multi-touch screen that can auto-adjusts its screen inclination electrically; high-definition smart and quick-responsive keyboard; and other user-friendly designs, bringing users an extraordinary human-machine interaction experience.

Overview of RIGOL's Medium and High-end Series Products

	MSO5000	MSO/DS7000	MSO8000	DS70000
Analog channel	2/4	4	4	4
Digital Channel	16	16	16	N/A
Analog Bandwidth	70 MHz-350 MHz	100 MHz-500 MHz	600 MHz-2 GHz	3 GHz-5 GHz
Max. Sample Rate	8 GSa/s	10 GSa/s	10 GSa/s	20 GSa/s
Max. Memory Depth	200 Mpts (option)	500 Mpts (option)	500 Mpts	2 Gpts
Waveform Capture Rate	>500,000 wfms/s	>600,000 wfms/s	>600,000 wfms/s	≥ 1,000,000 wfms/s
Max. Frames of Waveform Recording	450,000	450,000	450,000	2,000,000
LCD	9" capacitive multi-touch screen	10.1" capacitive multi-touch screen	10.1" capacitive multi-touch screen	15.6" capacitive multi-touch flip screen
Hardware Mask Test	Standard	Standard	Standard	Standard
Built-in Arbitrary Waveform Generator	2 CH, 25 MHz (option)	2 CH, 25 MHz (option)	2 CH, 25 MHz (option)	N/A
Built-in Digital Voltmeter	Standard	Standard	Standard	Standard
Built-in Hardware Counter	6-digit frequency counter + totalizer	6-digit frequency counter + totalizer	6-digit frequency counter + totalizer	8-digit frequency counter + totalizer
Search and Navigation	Standard, supporting table display	Standard, supporting table display	Standard, supporting table display	Standard, supporting table display
Power Analysis	Built-in UPA (option) + PC	Built-in UPA (option) + PC	Built-in UPA (option) + PC	Built-in UPA (option) + PC
Real-time Eye Diagram	N/A	N/A	Option	Option
Jitter Analysis	N/A	N/A	Option	Option

	MSO5000	MSO/DS7000	MSO8000	DS70000
Serial Protocol Analysis	RS232/UART, I2C, SPI, CAN, LIN, FlexRay, I2S, and MIL-STD-1553	RS232/UART, I2C, SPI, CAN, LIN, FlexRay, I2S, and MIL-STD-1553	RS232/UART, I2C, SPI, CAN, LIN, FlexRay, I2S, and MIL-STD-1553	RS232/UART, I2C, SPI, I2S, CAN, LIN, FlexRay, I2S, MIL-STD-1553, CAN-FD, SENT, and ARINC429
Waveform Color Persistence	Standard	Standard	Standard	Standard
Histogram	Standard	Standard	Standard	Standard
FFT	Enhanced FFT, standard	Enhanced FFT, standard	Enhanced FFT, standard	Enhanced FFT, standard
MATH	Displays 4 functions at the same time	Displays 4 functions at the same time	Displays 4 functions at the same time	Displays 4 functions at the same time
Connectivity	Standard: USB, LAN, and HDMI Option: USB-GPIB	Standard: USB, LAN, and HDMI Option: USB-GPIB	Standard: USB, LAN, and HDMI Option: USB-GPIB	Standard: USB, LAN, and HDMI Option: USB-GPIB

RIGOL Probes and Accessories Supported by the DS70000 Series

RIGOL Passive Probes

Model	Type	Description
PVP2150	High-impedance Probe	• 1X: DC~35 MHz • 10X: DC~150 MHz • Compatibility: All models of **RIGOL** digital oscilloscopes
PVP2350	High-impedance Probe	• 1X: DC~35 MHz • 10X: DC~350 MHz • Compatibility: All models of **RIGOL** digital oscilloscopes
RP3500A	High-impedance Probe	• DC~500 MHz • Compatibility: All models of **RIGOL** digital oscilloscopes
RP5600A	High-impedance Probe	• DC~1.5 GHz • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series
RP6150A	Low-impedance Probe	• DC~1.5 GHz • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series

Model	Type	Description
RP1300H	High-Voltage Probe	• DC~300 MHz • CAT I 2000 V (DC+AC) • CAT II 1500 V (DC+AC) • Compatibility: All models of **RIGOL** digital oscilloscopes
RP1010H	High-Voltage Probe	• DC~40 MHz • DC: 0~10 kV DC • AC: pulse≤20 kVp-p • AC: sine wave≤7 kVrms • Compatibility: All models of **RIGOL** digital oscilloscopes
RP1018H	High-Voltage Probe	• DC~150 MHz • DC+AC Peak: 18 kV CAT II • AC RMS: 12 kV CAT II • Compatibility: All models of **RIGOL** digital oscilloscopes

RIGOL Active&Current Probes

Model	Type	Description
PVA8700	Bandwidth Differential Probe	• BW: DC~7 GHz • 30 V peak CAT I • Compatibility: All models of DS70000 series
PVA7250	Single-ended/Differential Active Probe	• BW: DC~2.5 GHz • 30 V peak CAT I • Compatibility: MSO/DS7000, MSO8000, and DS70000 series
RP7150	Single-ended/Differential Active Probe	• BW: DC~1.5 GHz • 30 V peak CAT I • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series

Model	Type	Description
RP7080	Single-ended/Differential Active Probe	• BW: DC~0.8 GHz • 30 V peak CAT I • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series
RP1000D	High-Voltage Differential Probe	• BW: DC~25 MHz • Max. voltage ≤ 7000 Vpp • Compatibility: All models of **RIGOL** digital oscilloscopes
PHA0150	High-Voltage Differential Probe	• BW: DC~70 MHz • Max. voltage ≤ 1500 Vpp • Compatibility: All models of **RIGOL** digital oscilloscopes
PHA1150	High-Voltage Differential Probe	• BW: DC~100 MHz • Max. voltage ≤ 1500 Vpp • Compatibility: All models of **RIGOL** digital oscilloscopes
RP7150S	Single-ended Active Probe	• BW: DC~1.5 GHz • 30 V peak CAT I • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series
RP7080S	Single-ended Active Probe	• BW: DC~0.8 GHz • 30 V peak CAT I • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series
PCA1030	Current Probe	• BW: DC to 50 MHz (-3 dB) • Max. continuous input range: 30ARMS • Max. peak-peak current value: 50 A peak, non-continuous • Compatibility: All models of **RIGOL** digital oscilloscopes

Model	Type	Description
 PCA2030	Current Probe	• BW: DC to 100 MHz (-3 dB) • Max. continuous input range: 30ARMS • Max. peak-peak current value: 50 A peak, non-continuous • Compatibility: All models of **RIGOL** digital oscilloscopes
 PCA1150	Current Probe	• BW: DC to 10 MHz (-3 dB) • Max. continuous input range: 150 A • Max. peak-peak current value: 300 A (non-continuous), 500 A (pulse width ≤ 30 µs) • Compatibility: All models of **RIGOL** digital oscilloscopes
 RP1001C	Current Probe	• BW: DC~300 kHz • Maximum Input DC: ±100 A AC P-P: 200 A AC RMS: 70 A • Compatibility: All models of **RIGOL** digital oscilloscopes
 RP1002C	Current Probe	• BW: DC~1 MHz • Maximum Input DC: ±70 A AC P-P: 140 A AC RMS: 50 A • Compatibility: All models of **RIGOL** digital oscilloscopes
 RP1025D	High-Voltage Differential Probe	• BW: 25 MHz • Max. voltage ≤ 1400 Vpp • Compatibility: All models of **RIGOL** digital oscilloscopes
 RP1050D	High-Voltage Differential Probe	• BW: 50 MHz • Max. voltage ≤ 7000 Vpp • Compatibility: All models of **RIGOL** digital oscilloscopes
 RP1100D	High-Voltage Differential Probe	• BW: 100 MHz • Max. voltage ≤ 7000 Vpp • Compatibility: All models of **RIGOL** digital oscilloscopes

Specifications

All the specifications are guaranteed except the parameters marked with "Typical" and the oscilloscope needs to operate for more than 30 minutes under the specified operation temperature.

Overview of the DS70000 Series Technical Specifications

Overview of the DS70000 Series Technical Specifications	
Analog bandwidth (50 Ω, -3 dB)[1]	3 GHz, 5 GHz
Analog bandwidth (1 MΩ, -3 dB)	500 MHz
Calculated Rising Time under 50 Ω (single-channel mode, 10%-90%, typical)	≤130 ps (3 GHz) ≤95 ps (5 GHz)
No. of Input Channels	4 input analog channels 1 input EXT channel
Sampling Mode	Real-time sampling
Max. Sample Rate of Analog Channel	Half-channel[2]: 20 GSa/s All-channel: 10 GSa/s **Note:** When all the channels are enabled, the sample rate is 10 GSa/s, and the analog bandwidth can reach up to 4 GHz.
Max. Memory Depth	Analog channel: 2 Gpts (half-channel[2]), 1 Gpts (all-channel)
Max. Waveform Capture Rate[3]	≥ 1,000,000 wfms/s
Vertical Resolution	(selectable) 8-16 bits
Hardware real-time waveform recording and playing	Max. 2,000,000 frames (single-channel)
Peak Detection	capture 200 ps glitches
LCD Size and Type	15.6-inch capacitive multi-touch flip screen/gesture enabled operation, 3.5-inch user-defined keyboard control touch screen
Display Resolution	1920×1080, 480×320

Vertical System Analog Channel

Vertical System Analog Channel	
Input Coupling	DC, AC, or GND
Input Impedance	1 MΩ ± 1%, 50 Ω ± 2.5%
Input Capacitance	17 pF ± 3 pF

Vertical System Analog Channel

Probe Attenuation Coefficient		0.001X, 0.002X, 0.005X, 0.01X, 0.02X, 0.05X, 0.1X, 0.2X, 0.5X, 1X, 2X, 5X, 10X, 20X, 50X, 100X, 200X, 500X, 1000X, 2000X, 5000X, 10000X, 20000X, and 50000X
Probe Recognition		Auto-recognized RIGOL probe
Maximum Input Voltage	1 MΩ	CAT I 300 V_{rms}, 400 Vpk, Transient Overvoltage 1600 Vpk
	50 Ω	5 V_{rms}
Vertical Resolution		8-16 bits (selectable)
Vertical Sensitivity Range[4]	1 MΩ	1 mV/div~10 V/div
	50 Ω	1 mV/div~1 V/div
Offset Range	1 MΩ	±1 V (1 mV/div~50 mV/div) ±30 V (51 mV/div~260 mV/div) ±100 V (265 mV/div~10 V/div)
	50 Ω	±1 V (1 mV/div~100 mV/div) ±4 V (102 mV/div~1 V/div)
Dynamic Range		±5 div (8 bits)
Bandwidth Limit (Typical)	1 MΩ	20 MHz, 250 MHz
	50 Ω	20 MHz, 1 GHz
DC Gain Accuracy[4]		± 2% of full scale
DC Offset Accuracy		>200 mV/div (±0.1 div±2 mV±1.5% of offset value)
		>200 mV/div (±0.1 div±2 mV±1.0% of offset value)
Channel-to-Channel Isolation		≥100:1 (from DC to 1 GHz), ≥30:1 (1 GHz to maximum rated bandwidth)
ESD Tolerance		±8 kV

Horizontal System--Analog Channel

Horizontal System--Analog Channel

	3 GHz	5 GHz
Range of Time Base	100 ns/div~1 ks/div	50 ps/div~1 ks/div
	Fine	
Time Base Resolution	0.5 ps	
Timebase Accuracy	±0.5 ppm ± 1 ppm/year	

Horizontal System--Analog Channel

Time Base Delay Range	before triggering	≥1/2 screen width
	after triggering	1 s or 100 div, whichever is greater

Time Interval (△T) Measurement	±(1 sample interval) ± (2 ppm×readout) ± 50 ps

Inter-channel Offset Correction Range	±100 ns

Horizontal Mode	YT	Default
	XY	CH 1/ 2/3/4
	XYZ	X/Y = CH 1/2/3/4; Z is a blanking signal
	SCAN	Time base ≥200 ms/div
	ROLL	Time base ≥50 ms/div, available to enter or exit the ROLL mode by adjusting the horizontal timebase knob

Acquisition System

Acquisition System

Max. Sample Rate of Analog Channel	20 GSa/s (half-channel), 10 GSa/s (all-channel[2]) **Note:** When all the channels are enabled, the sample rate is 10 GSa/s, and the analog bandwidth can reach up to 4 GHz.

Max. Memory Depth of Analog Channel	2 Gpts (single-channel), 1 Gpts (half-channel[2])

Acquisition Mode	Normal	Default
	Peak Detection	capture 200 ps glitches
	Average Type	2, 4, 8, 16…65536 are available for you to choose
	High Resolution	9-16 bits

Vertical Resolution

Resolution		9 bits	10 bits	12 bits	14 bits	16 bits
Bandwidth	20 GSa/s	2000 MHz	1000 MHz	500 MHz	200 MHz	75 MHz
	10 GSa/s	1000 MHz	500 MHz	250 MHz	100 MHz	50 MHz

Trigger System

Trigger System		
Trigger Source		Analog channel (1~4), EXT TRIG, AC Line
Trigger Mode		Auto, Normal, Single
Trigger Coupling	DC	DC coupling trigger
	AC	AC coupling trigger
	High Frequency Rejection	High frequency rejection, cut-off frequency~75 kHz (internal only)
	Low Frequency Rejection	Low frequency rejection, cut-off frequency~75 kHz (internal only)
Noise Rejection		Increase delay for the trigger circuit (internal only), on/off
Holdoff Range		6.4 ns ~ 10 s, with a step size accuracy of 3.2 ns
Trigger Bandwidth	Internal	Analog Bandwidth
	External	200 MHz
Trigger Sensitivity (Internal)		0.35 div, ≥50 mV/div enable the noise rejection, 0.7 div
Trigger Sensitivity (External)		200 mVpp, DC~100 MHz 500 mVpp, 100 MHz~200 MHz
EXT TRIG	Input Impedance	50Ω±1%, SMA connector
	Trigger Jitter (Typical)	<200 ps$_{RMS}$(extremum < 250 ps) Normal acquisition, Edge trigger, trigger level located near 50% of EXT input signal
Trigger Level Range	Internal	± 5 div from the center of the screen
	External	±5 V
	AC Line	fixed 40%-60%

Trigger Type

Trigger Type	
Trigger Type	Standard: Edge trigger, Pulse trigger, Slope trigger, Video trigger, Pattern trigger, Duration trigger, Timeout trigger, Runt trigger, Window trigger, Delay trigger, Setup/ Hold trigger, and Nth Edge trigger
	Option: RS232/UART, I2C, SPI, CAN, FlexRay, LIN, I2S, and MIL-STD-1553

Trigger Type	
Edge	Trigger on the threshold of the specified edge of the input signal. The edge types can be Rising, Falling, or Either. Source channel: CH1~CH4, EXT, or AC Line
Pulse	Trigger on the positive or negative pulse with a specified width. The pulse width is greater or smaller than a certain value or within a certain time range. Source channel: CH1~CH4
Slope	Trigger on the positive or negative slope of the specified time. The slew time is greater or smaller than a certain value or within a certain time range (200 ps~10 s). Source channel: CH1~CH4
Video	Trigger on all lines, specified line, add field, or even field that conforms to the video standards. The supported video standards include NTSC, PAL/SECAM, 480p/60Hz, 576p/50Hz, 720p/60Hz, 720p/50Hz, 720p/30Hz, 720p/25Hz, 720p/24Hz, 1080p/60Hz, 1080p/50Hz, 1080p/30Hz, 1080p/25Hz, 1080p/24Hz, 1080i/60Hz, and 1080i/50Hz. Source channel: CH1~CH4
Pattern	Identify a trigger condition by searching for a specified pattern. The pattern is a combination of multiple selected channel sources. The logic pattern of each channel is H, L, X, Rising, or Falling. Source channel: CH1~CH4
Duration	Trigger when the specified pattern meets the specified duration condition. The pattern is a combination of multiple selected channel sources. The logic pattern of each channel is H, L, X, Rising, or Falling. The duration is greater or smaller than a certain value, or within a certain time range, or outside a certain time range. Source channel: CH1~CH4
Timeout	Trigger when duration of a certain event exceeds the specified time (200 ps~10 s). The event can be specified as Rising, Falling, or Either. Source channel: CH1~CH4
Runt	Trigger when the pulses pass through one threshold but fail to pass through another threshold. Source channel: CH1~CH4
Window	Trigger in a specified window state when the rising edge of the signal crosses the upper threshold or the falling edge crosses the lower threshold. The window state can be Enter, Exit, or Time. Source channel: CH1~CH4
Delay	Trigger when the time difference between the specified edges of Source A and Source B meets the preset time. The duration is greater or smaller than a certain value, or within a certain time range, or outside a certain time range. Source channel: CH1~CH4
Setup/Hold	When the setup time or hold time between the input clock signal and the data signal is smaller than the specified time (200 ps~10 s). Source channel: CH1~CH4
Nth Edge	Trigger on the Nth edge that appears after the specified idle time. The edge can be specified as Rising or Falling. Source channel: CH1~CH4

Trigger Type	
Zone Trigger	Trigger in the rectangle area drawn manually, supporting trigger zone A and trigger zone B. The trigger conditions can be "Intersect" or "Not intersect"
	Source channel: CH1~CH4; only one analog channel is triggered each time
RS232/UART (Option)	DS70000-COMP option
	Trigger on the Start, Error, Check Error, or Data frame of the RS232/UART bus (up to 20 Mb/s).
	Source channel: CH1~CH4
I2C (Option)	DS70000-EMBD option
	Trigger on the Start, Stop, Restart, MissedACK, Address (7 bits, 8 bits, or 10 bits), Data, or Address Data of the I2C bus.
	Source channel: CH1~CH4
SPI (Option)	DS70000-EMBD option
	Trigger on the specified pattern of the specified data width (4~32) of SPI bus. CS and Timeout are supported.
	Source channel: CH1~CH4
CAN (Option)	DS70000-AUTO option
	Trigger on the start of a frame, end of a frame, Remote ID, Overload, Frame ID, Frame Data, Data&ID, Frame Error, Bit Fill, Answer Error, Check Error, Format Error, and Random of the CAN signal (up to 10 Mb/s). The supported CAN bus signal types include CAN_H, CAN_L, TX/RX, and DIFF.
	Source channel: CH1~CH4
FlexRay (Option)	DS70000-FLEX option
	Trigger on the specified position (TSS End, FSS_BSS End, FES End, DTS End), frame (null, Syn, Start, All), symbol (CAS/MTS and WUS), error (Head CRC Err, Tail CRC Err, Decode Err, and Random Err) of the FlexRay signal (up to 10 Mb/s).
	Source channel: CH1~CH4
LIN (Option)	DS70000-AUTO option
	Trigger on the Sync, ID, Data (length settable), Data&ID, Wakeup, Sleep, and Error of the LIN bus signal (up to 20 Mb/s).
	Source channel: CH1~CH4
I2S (Option)	DS70000-AUDIO option
	Trigger on 2's complement data of audio left channel, right channel, or either channel ($=, \neq, >, <, <>, ><$). The available alignment modes include I2C, LJ, and RJ.
	Source channel: CH1~CH4
MIL-STD-1553 (Option)	DS70000-AERO option
	Trigger on Sync (Data Sync, Cmd/Status Sync, and All Sync), Data, RTA, RTA+11Bit, and Error (Sync Error and Check Error) of the MIL-STD-1553 bus.
	Source channel: CH1~CH4

Search&Navigation

Search, Navigation, and Table	
Type	Edge, Pulse, Runt, Slope, RS232, I2C, and SPI

Search, Navigation, and Table

Source	Analog channel
Copy	Copy the search settings from or to the trigger settings mutually, including threshold setting and search condition settings
Result Display	Display in event table form; can be exported to the external or internal memory
Navigation	Memory playing: view the memory waveforms with the navigation keys by scrolling through stored waveform data, supporting viewing at three speeds.
	ZOOM playing: view the details of waveforms with the navigation keys by panning the ZOOM window automatically, supporting viewing at three speeds
	Recording playback: play back the recorded waveforms with the navigation keys.
	Event navigation: use the navigation keys to scroll through the event search results.

Waveform Measurement

Waveform Measurement

Cursor	Number of Cursors	2 pairs of XY cursors
	Manual Mode	Voltage deviation between cursors (△Y)
		Time deviation between cursors (△X)
		Reciprocal of △X (Hz) (1/△X)
	Track Mode	Fix Y-axis to track X-axis waveform point's voltage and time values
		Fix X-axis to track Y-axis waveform point's voltage and time values
	Auto Measurement	Allow to display cursors during auto measurement
	XY Mode	Measure the voltage parameters of the corresponding channel waveforms in XY time base mode.
		X = Channel 1, Y = Channel 2

Waveform Measurement

Auto Measurement	Number of Measurements	41 auto measurements; and up to 20 measurements can be displayed at a time.
	Measurement Source	CH1-CH4, Math1-Math4
	Measurement Mode	Normal (realized by software, ≥1 Mpts) and Precision (W); for Precision, only supported by analog channel
	Measurement Range	Main, Zoom, Cursor, Full-memory
	All Measurement	Display 33 measurement items for the current measurement channel; the measurement results are updated continuously; you can switch the measurement channel.
	Vertical	Vmax, Vmin, Vpp, Vtop, Vbase, Vamp, Vupper, Vmid, Vlower, Vavg, VRMS, Per. VRMS, Overshoot, Preshoot, Area, Period Area, and Std Dev.
	Horizontal	Period, Frequency, Rise Time, Fall Time, +Width, -Width, +Duty, -Duty, Positive Pulse Count, Negative Pulse Count, Rising Edge Count, Falling Edge Count, Tvmax, Tvmin, +Slew Rate, and -Slew Rate
	Others	Delay(A↑-B↑), Delay(A↑-B↓), Delay(A↓-B↑), Delay(A↓-B↓), Phase(A↑-B↑), Phase(A↑-B↓), Phase(A↓-B↑), and Phase(A↓-B↓)
	Analysis	Frequency counter, DVM, histogram, zone trigger, eye diagram (option), and jitter analysis (option)
	Statistics	Current, Average, Max, Min, Standard Deviation, Count Statistical times settable

Waveform Calculation

Waveform Calculation

No. of Math Functions	4; 4 math functions available to be displayed at a time
Operation	A+B, A-B, A×B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs, AX+B, LowPass, HighPass, BandPass, and BandStop
Color Grade	Supporting FFT

Real-Time Spectrum Analyzer

Real-Time Spectrum Analyzer		
Enhanced FFT	Record Length	Max. 64 Kpts
	Window Type	Rectangular, Blackman-Harris, Hanning (default), Hamming, Flattop, and Triangle.
	Peak Search	A maximum of 15 peaks, confirmed by the settable threshold and offset threshold set by users

Waveform Analysis

Waveform Analysis		
Waveform Recording		Store the signal under test in segments according to the trigger events, i.g. save all the sampled waveform data as a segment to the RAM for each trigger event. The maximum number of the sampled segments reaches 2 million.
	Source	All enabled analog channels
	Analysis	Support playing frame by frame or continuous playing; capable of calculating, measuring, and decoding the played waveforms
Pass/Fail Test		Compare the signal under test with the user-defined mask to provide the test results: the number of successful tests, failed tests, and the total number of tests. The pass/fail event can enable immediate stop, beeper, and the screenshot.
	Source	Any analog channel, FFT, eye diagram, auto measurement item, or jitter measurement
	Type	Horizontal, vertical, and measure
	Measure	Sum, Peaks, Max, Min, Pk_Pk, Mean, Median, Mode, Bin width, Xscale, and Sigma
	Mode	Support all modes, except the Zoom, XY, and ROLL modes
Histogram		The waveform histogram provides a group of data, showing the number of times a waveform hits within the defined region range on the screen. The waveform histogram not only shows the distribution of hits, but also the ordinary measurement statistics.
	Source	Any analog channel, eye diagram, auto measurement item, or jitter measurement
	Type	Horizontal, vertical, and measure
	Measure	Sum, Peaks, Max, Min, Pk_Pk, Mean, Median, Mode, Bin width, Sigma, and XScale
	Mode	Support all modes, except the Zoom, XY, and ROLL modes

Waveform Analysis

Color Grade		Provide a dimensional view for color grade waveforms, color grade >16, 256-level color scale display
	Source	Any analog channel
	Color Theme	Temperature and intensity
	Mode	Support all modes
Real-time Eye Diagram (JITTER Option)	Source	Any analog channel
	Clock Recovery	Clock recovery for software, constant clock, first-order PLL, second-order PLL, and explicit clock
	Type	Fully automatic, semi automatic, and manual
	Data Rate	1Mpts
	Template	User-defined template, support rhombus, square, hexagon, and octagon
	Template Size	Set the height and width manually
	Template Drawing	Support standard norm and user-defined rule, support adjustment of 8 directions
	Eye Measurement Item	Extinction ratio, one level, zero level, eye height, eye width, eye amplitude, crossing percentage, Q Factor, DCD (duty cycle distortion), rise time, fall time, bit rate, etc.
Jitter Analysis (JITTER Option)		Make measurements for the clock or data signal over time, analyze the variance of the technical specifications.
	Source	Any analog channel
	Clock Recovery	Constant, PLL, and Explicit
	Data Rate	Fully automatic, semi automatic, and manual
	Jitter Measurement	TIE, Cycle to Cycle, +Width to +Width, –Width to -Width, Pk_Pk, 6-sigma, and RMS
	Jitter Analysis	Jitter separation, including TJ (Total Jitter), PJ (Periodic Jitter), DJ (Deterministic Jitter), DDJ (Data Dependent Jitter), ISI (Inter-symbol Interference), and DCD (Duty Cycle Distortion).
	Measurement Display	Trend, histogram, bathcurve, spectrum

Serial Decoding

Serial Decoding

No. of Decodings	4, four protocol types can be decoded and enabled at the same time

Serial Decoding

Decoding Type	Standard: Parallel Option: RS232/UART, I2C, SPI, LIN, CAN, FlexRay, I2S, MIL-STD-1553, CAN-FD, SENT, ARINC 429, USB HS
Parallel	Up to 4 bits of Parallel decoding, supporting any analog channel Support user-defined clock and auto clock settings. Source channel: CH1~CH4
RS232/UART	DS70000-COMP option Decode the RS232/UART (up to 20 Mb/s) bus's TX/RX data (5-9 bits), parity (Odd, Even, or None), and stop bits (1-2 bits) Source channel: CH1~CH4
I2C	DS70000-EMBD option Decode the address (with or without the R/W bit) of the I2C bus, data, and ACK. Source channel: CH1~CH4
SPI	DS70000-EMBD option Decode the MISO/MOSI data (4-32 bits) of the SPI bus. The available mode includes "Timeout" and "CS". Source channel: CH1~CH4
LIN	DS70000-AUTO option Decode the protocol version (1.X or 2.X) of the LIN bus (up to 20 Mb/s). The decoding displays sync, ID, data, and check sum. Source channel: CH1~CH4
CAN	DS70000-AUTO option Decode the remote frame (ID, byte number, CRC), overload frame, and data frame (standard/extended ID, control domain, data domain, CRC, and ACK) of the CAN bus (up to 5 Mb/s). The supported CAN bus signal types include CAN_H, CAN_L, TX/RX, and DIFF. Source channel: CH1~CH4
FlexRay	DS70000-FLEX option Decode the frame ID, PL (payload), Header CRC, Cycle Count, Data, Tail CRC, and DTS of the FlexRay bus (up to 10 Mb/s). The supported signal types include BP, BM, and RX/TX. Source channel: CH1~CH4
I2S	DS70000-AUDIO option Decode I2S audio bus left channel data and right channel data, supporting 4-32 bits. The alignment modes include I2S, LJ, and RJ. Source channel: CH1~CH4

Serial Decoding

Serial Decoding	
MIL-STD-1553	DS70000-AERO option
	Decode the MIL-STD-1553 bus signal's data word, command word, and status word (address+last 11 bits).
	Source channel: CH1~CH4

Auto

Auto	
AutoScale	Min voltage greater than 10 mVpp, duty cycle 1%, frequency over 35 Hz

Digital Voltmeter

Digital Voltmeter	
Source	Any analog channel
Function	DC, AC+DC$_{RMS}$, AC$_{RMS}$
Resolution	ACV/DCV: 3.5 bits
Limits Beeper	Sound an alarm when the voltage value is within or outside of the limit range
Range Measurement	Display the latest measurement results in the form of a diagram, and display the extrema over the last 3 seconds; support Trend

High-precision Frequency Counter

High-precision Frequency Counter		
Source		Any analog channel and EXT
Measure		Frequency, period, totalizer
Counter	Resolution	3-8 bits, user-defined
	Max. Frequency	Max. analog bandwidth
Totalizer		48-bit totalizer
		Counts the number of the rising edges
Time Reference		Internal reference

Command Set

Command Set	
Common Commands Support	IEEE488.2 Standard
Error Message Definition	Error messages

Command Set

Support Status Report Mechanism	Status reporting
Support Syn Mechanism	Synchronization

Display

Display	
LCD	15.6-inch capacitive multi-touch flip screen/gesture enabled operation
Resolution	1920×1080 (Screen Region) 16:9
Graticule	(10 horizontal divisions) x (8 vertical divisions)
Persistence	Off, Infinite, variable persistence (100 ms to 10 s)
Brightness	256 intensity levels (LCD, HDMI)

I/O

I/O		
USB3.0 Host		4 (2 on the front panel and 2 on the rear panel)
USB3.0 Device		1, supporting TMC protocol
LAN		1 on the rear panel, 10/100/1000 Mbps, supporting LXI-C
Web Remote Control		Support Web Control interface (input the IP address of the oscilloscope into the Web browser to display the operation interface of the oscilloscope)
AUX Output		SMA output on the rear panel Vo (H)≥2.5 V open circuit, ≥1.0 V 50 Ω to GND Vo (L)≤0.7 V to load ≤4 mA; ≤0.25 V 50 Ω to GND
	Trig Out	Output a pulse signal when the oscilloscope is triggered
	Pass/Fail	Output a pulse signal when a pass/fail event occurs. Support user-defined pulse polarity and pulse time (10 ns~10 ms)
	Rise Time	≤1 ns
10 MHz In/Out Input/Output	Input Interface	1, SMA connector on the rear panel
	Output Interface	1, SMA connector on the rear panel
	Input Mode	50 Ω, with the amplitude 130 mVpp to 4.1 Vpp (-10 dBm, 20 dBm), the input accuracy 10 MHz ± 10 ppm
	Output Mode	50 Ω, 1.5 Vpp sine waveform
HDMI HD Video Output		1 on the rear panel, HDMI 2.0b, A plug. Used to connect to an external monitor or projector

I/O

Probe Compensation Output	1 kHz, voltage 0-3 V

Power

Power	
Power Voltage	100 V-240 V, 45 Hz-440 Hz
Power	Max. 500 W (connect to various interfaces, USB, active probes)
Fuse	3.15 A, T degree, 250 V

Mechanical Characteristics

Mechanical Characteristics	
Size	439mm (W)×310 mm (H)×491 mm (D)
Rack Mount Kit	7U

Non-volatile Memory

Non-volatile Memory		
Data/File Storage	Setup/Image	setup (*.stp), image (*.png, *.bmp, and *.jpg)
	Waveform Data	CSV waveform data (*.csv), binary waveform data (*.bin, *.wfm), list data (*.csv), and reference waveform data (*.ref, *.csv, *.bin)
Reference Waveform		Display 10 internal waveforms
Setting		Storage is limited by the capacity
USB Capacity		Supports the USB storage device that conforms to the industry standard

Note:

[1]: 5 GHz bandwidth is only applicable to single-channel or half-channel mode.

[2]: CH1 and CH2 are considered as a group; CH3 and CH4 are considered as another group. If one of the two channels in each group is enabled, it is called half-channel mode. If two channels in either one of the groups are enabled, it is called half-channel mode.

[3]: Maximum value. single-channel, 10 ns horizontal time base, input amplitude 4 div, sine wave signal with 10 MHz frequency. Others are default settings.

[4]: 1 mV/div and 2 mV/div are a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 1 mV/div and 2 mV/div sensitivity setting.

Order Information and Warranty Period

Order Information	Order No.
Model	
3 GHz, 20 GSa/s, 500 Mpts, 4CH High-End DS	DS70304
5 GHz, 20 GSa/s, 500 Mpts, 4CH High-End DS	DS70504
Standard Accessories	
Power Cord Conforming to the Standard of the Destination Country	——
USB Cable	——
4 Passive HighZ Probes (500 MHz)	RP3500A
Recommended Accessories	
Active Differential Probe (3.5 GHz BW)	PVA8350
Active Differential Probe (5 GHz BW)	PVA8500
Active Differential Probe (7 GHz BW)	PVA8700
Current Probe (50 MHz, 30A)	PCA1030
Current Probe (100 MHz, 30A)	PCA0150
Current Probe (100 MHz, 150A)	PCA1150
High-Voltage Differential Probe (75 MHz, 1400 V)	PHA0150
High-Voltage Differential Probe (100 MHz, 1400 V)	PHA1150
Power Analysis Phase Difference Correction Jig	RPA246
USB-GPIB Interface Converter	USB-GPIB
Upgrade Option	
2 Gpts Memory Depth Upgrade Option	DS70000-2RL
Bundle Option	
Function and Application Bundle Option, including DS70000-EMBD, DS70000-AUTO, DS70000-AUDIO, DS70000-AERO	DS70000-BND
Serial Protocol Analysis Option	

Order Information	Order No.
Embedded Serial Bus Trigger and Analysis (RS232/UART, I2C, SPI, and I2S)	DS70000-EMBD
Auto Serial Bus Trigger and Analysis (CAN, CAN-FD, LIN, FlexRay, and SENT)	DS70000-AUTO
Aerospace Serial Bus Trigger and Analysis (MIL-STD_1553 and ARINC429)	DS70000-AERO
USB2.0 Bus Trigger and Analysis (USB1.x/2.0)	DS70000-USBP
10/100/1000 Mb/s Ethernet Bus Trigger and Analysis	DS70000-ETHP
Measurement Application Option	
Built-in Power Analysis (required to purchase the RPA246 phase deviation correction jig)	DS70000-PWR
Real-time Eye Diagram and Jitter Analysis (Option)	DS70000-JITTER
Pre-compliance Test Software	
USB2.0 Pre-compliance Test	DS70000-USBC
10/100/1000 Mb/s Ethernet Pre-compliance Test	DS70000-ETHC

Note:

For all the mainframes, accessories and options, please contact the local office of **RIGOL.**

Warranty Period

Three years for the mainframe, excluding the probes and accessories.

Option Ordering and Installation Process
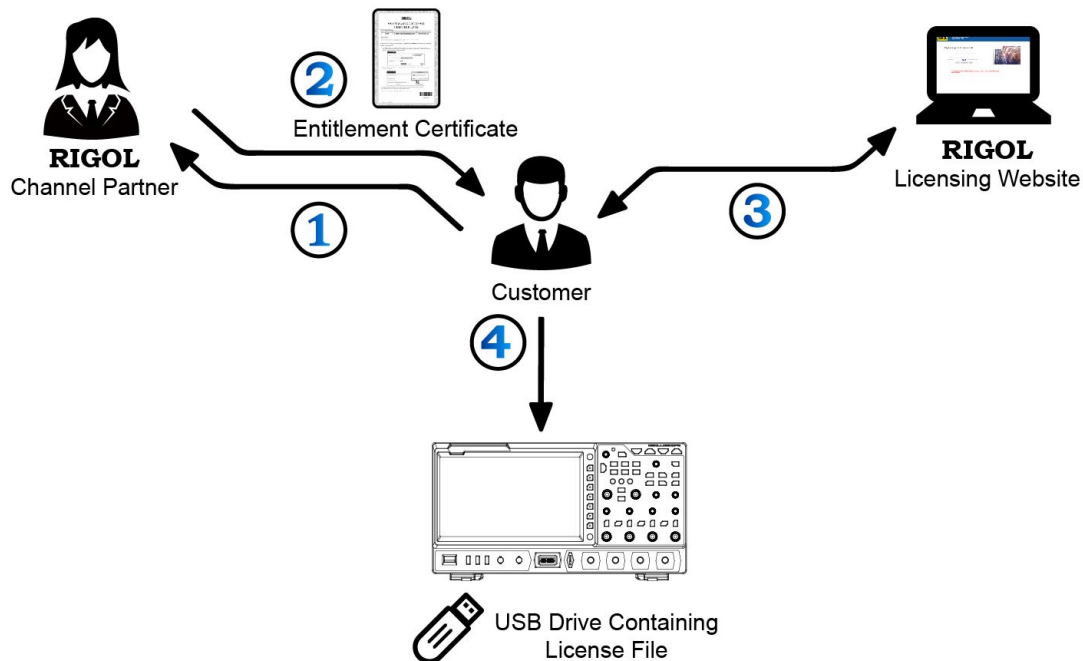
1. According to the usage requirements, please purchase the corresponding functional options from your local **RIGOL Channel Partner,** and provide the serial number of the instrument that needs to install the option.

2. After receiving the option order, the RIGOL factory will mail the paper software product entitlement certificate to the address provided in the order.

3. Log in to **RIGOL** official website (www.rigol.com) for registration. Use the software key and oscilloscope serial number provided in the entitlement certificate to obtain the option license code and the option license file.

4. Download the option license file to the root directory of the USB storage device, and connect the USB storage device to the oscilloscope properly. After the USB storage device is successfully recognized, the **Option install** key is activated. Press this menu key to start installing the option.