DS70000 Series

High-End Digital Oscilloscope

DataSheet
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DS70000 Series

High-End Digital Oscilloscope

N-in-1
Integrated Digital Oscilloscope

In today's integrated design field, a highly integrated comprehensive digital oscilloscope has become an important tool for design engineers. RIGOL's DS70000 series oscilloscope **integrates 5 independent instruments into 1 including a digital oscilloscope, one spectrum analyzer, one digital voltmeter, one high precision frequency counter and totalizer, and one protocol analyzer.** The DS70000 series provides a comprehensive instrument that meets your actual test needs.

Digital Oscilloscope

- Bandwidth model: **3 GHz, 5 GHz**
- Up to 20 GSa/s real-time sample rate
- 4 analog channels and 1 EXT channel
- Up to **2 Gpts** memory depth
- Maximum waveform capture rate of 1,000,000 wfms/s

Digital Voltmeter

- 3-digit DC/ACRMS, AC+DCRMS voltage measurement
- Sounds an alarm for reaching or exceeding the limits

### High-precision Frequency Counter and Totalizer

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

Real-Time Spectrum Analyzer(Option)

- Standard configuration of enhanced FFT, real-time operation for max. 16 Mpts 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)

- Supports RS232/UART, I2C, SPI, CAN, LIN, I2S, FlexRay, and MIL-STD-1553 serial bus
- Supports analog channel trigger and decoding
- Works with waveform recording and pass/fail mask testing
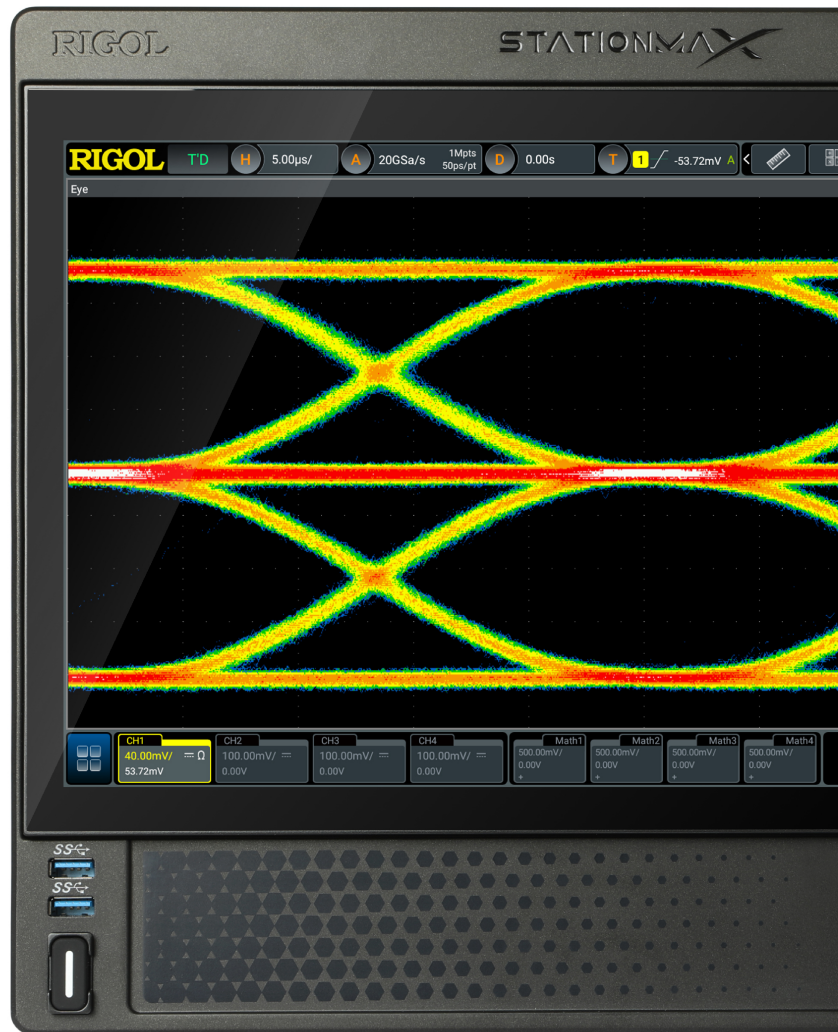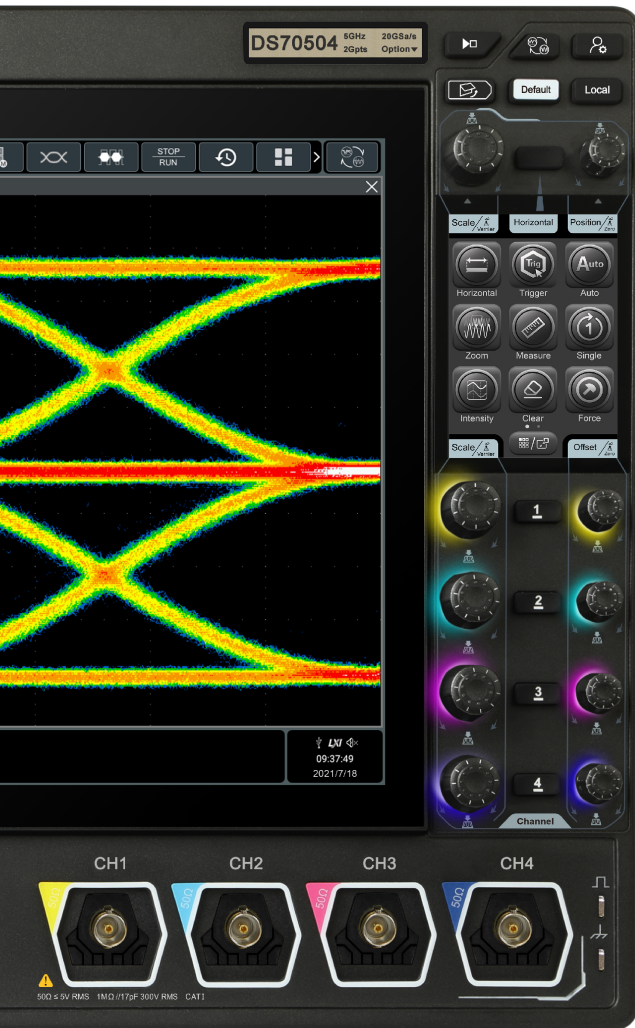
Unique UltraVision III Platform Delivers Industry-leading Performance

With RIGOL's unique UltraVision III platform built on our custom ASIC technology, the DS70000 series digital oscilloscope delivers industry leading performance specifications including **memory depth, waveform capture rate**, and **vertical resolution**. It supports analysis of serial data on computer, embedded, automotive, audio and additional bus types. UltraVision III also enables power integrity analysis as well as multi-domain debugging with simultaneous analysis of time domain and frequency domain signals. The DS70000 series fills an important need in high-speed signal integrity and debugging from R&D to industrial applications with capabilities including:

- **1 million wfms/s** update rate capable of capturing rare signal anomalies that you might otherwise miss.
- **Up to 2 Gpts memory depth** which makes long duration high speed captures possible.
- **8 to 16-bit** adjustable vertical resolution capable of accurately measuring low level signals.
- Real-time spectrum analysis (RTSA) capable of capturing up to **10,000 FFTs** per second so you don't miss small signal artifacts even in the RF domain.

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DS70000 Series

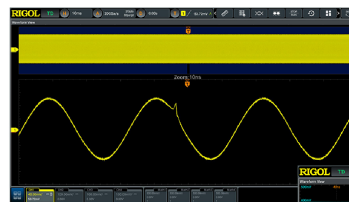## High-End Digital Oscilloscope

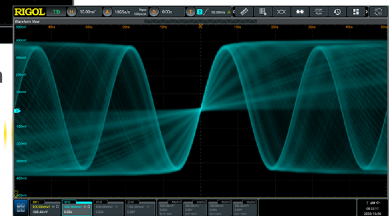## Unique UltraVision III Platform Delivers Industry-leading Performance
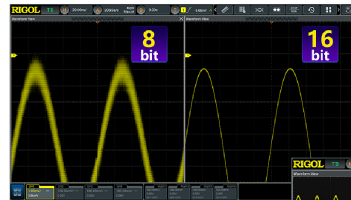
16-bit Vertical Resolution

10,000 Hardware Accelerated FFTs/s

Up to 2 Gpts Memory Depth

1,000,000 wfms/s Capture Rate

ASIC Chip Delivers Higher Bandwidth and Sample Rate

Phoenix Oscilloscope ASIC Chipset

UltraVision III Platform

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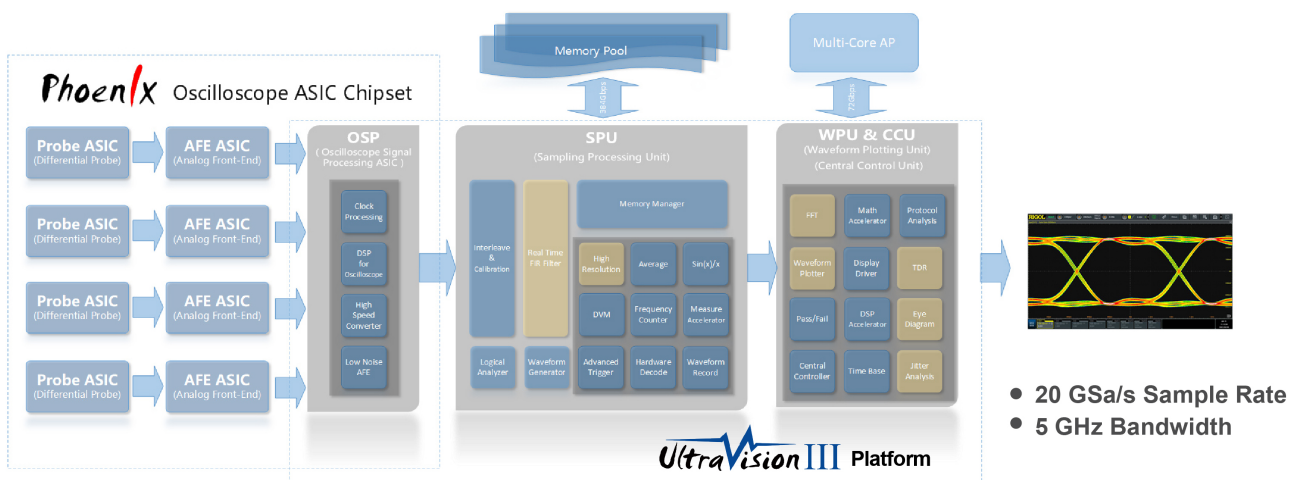
DS70000 series digital oscilloscope is equipped with "Phoenix" chip set, which delivers a max. of **20 GSa/s sample rate** and **5 GHz bandwidth** to better achieve signal fidelity, cover more application scenarios, and cater to the diversified application demands of the complex test system in the industry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

DS70000 Series

## High-End Digital Oscilloscope

Knob with Photoelectric Encoder Enables Long Service Life

The photoelectric encoder operating knob guarantees more than **100,000 times of pressing operation and 1 million times of rotation operation**, greatly improving the service life of the knob. As a frequently used component, the adjustment knobs are critical to reliability and longevity. With photoelectric encoders, you no longer have to worry about wear, ensuring reliable operation throughout the life of the instrument.


Multiple External Interfaces

The DS70000 series provides a variety of external interfaces that improve usability and data access including **USB 3.0 Host and Device, LAN (LXI), HDMI, AUX OUT, 10 MHz IN, 10 MHz Out and GPIB (option) via the USB-GPIB adaptor**. For remote control over LAN, the DS70000 includes complete web control with web-based screen recording, a SCPI command interface, and ftp access to files stored on the instrument. The HDMI output supports use of an external monitor or video display.
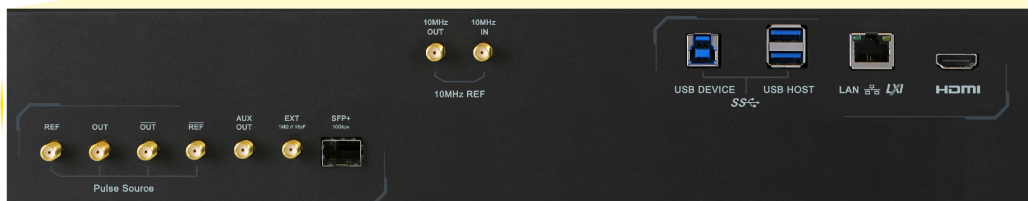
Brand New Appearance and User-friendly Design Bring an Extraordinary Human-Machine Interface Experience

The DS70000 series oscilloscope has a 7U full-rack structure that includes **two touch screens**. The main display is a 15.6-inch capacitive high-definition touch screen with one button electronic tilt. Multi-pane windowing supports a variety of simultaneous analysis tools, making it easier to view signals, measurements, and results. Meanwhile, the secondary 3.5-inch touch screen separates menus and functions from signals and analysis with a customized function and shortcut menu.
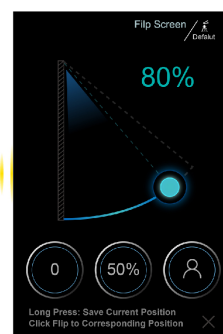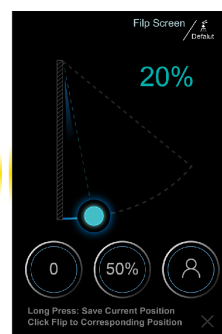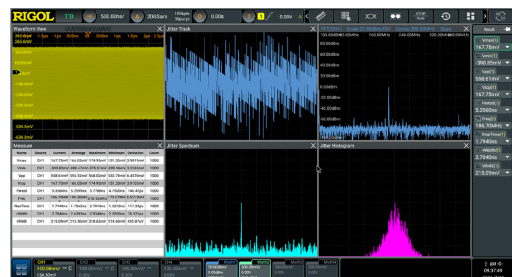
Excellent Eye Diagram Pre-test and Jitter Analysis

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.

After the DS70000-JITTER option has been purchased and activated, 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.
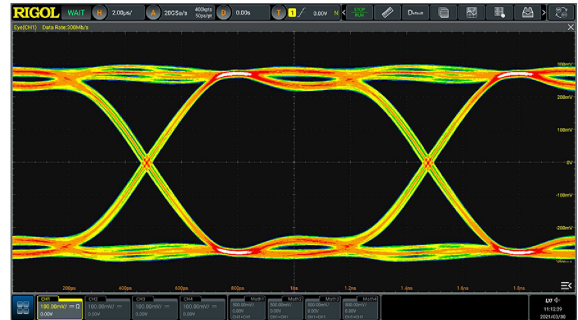
Jitter

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.

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

To help engineers easily and conveniently resolve the jitter components within their signals, jitter measurements can be analyzed in multiple formats including the trend graph, spectrum graph, and histogram. The jitter analysis function enables **measurement and statistical analysis of uninterrupted bit sequences** to efficiently debug signal jitter on large quantities of data. The jitter trend graph and histogram create a quick view of the nature and source of signal jitter, simplifying the engineer's work.

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.

Perform TIE measurements 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 even at power-off state**. 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.

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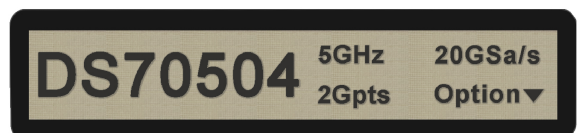
Product Features

- Analog channel bandwidth: Max. 5 GHz, 4 analog channels and 1 EXT channel
- Max. real-time sample rate: 20 GSa/s
- Max. memory depth: 2 Gpts
- 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 (option), 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, 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, and CAN-FD; 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
- Multiple interfaces available: USB HOST&DEVICE, LAN(LXI), HDMI, AUX OUT; Web Control supported
- Main 15.6'' HD capacitive multi-touch screen equipped with electronically controlled one-button screen inclination for signal visualization, analysis, and results; multi-window split screen display
- The photoelectric encoder operating knob prolongs its service life, guaranteeing more than 100,000 times of pressing operation and 1 million times of rotation operation, greatly improving its service life
- Secondary 3.5-inch touch screen separates menus and functions from signals and analysis with a customized function and shortcut menu
- 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)

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Product Features

DS70000 series digital oscilloscope utilizes 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, 8-16 bits adjustable resolution, and 10,000 FFTs/s. In addition to the improved hardware specifications, the DS70000 series digital oscilloscope has a main 15.6-inch HD capacitive multi-touch screen equipped with electronically controlled one-button screen inclination for signal visualization, analysis, and results; a secondary 3.5-inch small screen with a customized function and shortcut menu display; and other user-friendly designs, bringing users an extraordinary human-machine interface experience.

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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 to 350 MHz	100 MHz to 500 MHz	600 MHz to 2 GHz	3 GHz to 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 (option)
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	N/A
Power Analysis	Built-in UPA (option) + PC	Built-in UPA (option) + PC	Built-in UPA (option) + PC	N/A
Real-time Eye Diagram	N/A	N/A	Option	Option
Jitter Analysis	N/A	N/A	Option	Option
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, CAN, CAN-FD, LIN, FlexRay, I2S, MIL-STD-1553
Waveform Color Persistence	Standard	Standard	Standard	Standard
Histogram	Standard	Standard	Standard	N/A

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	MSO5000	**MSO/DS7000**	**MSO8000**	**DS70000**
FFT	FFT, standard	FFT, standard	FFT, standard	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

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RIGOL Probes and Accessories Supported by the DS70000 Series

RIGOL Passive Probes

Model	Type	Description
PVP2150	High-impedance Probe	• 1X BW: DC~35 MHz • 10X BW: DC~150 MHz • Compatibility: All models of **RIGOL**'s digital oscilloscopes
PVP2350	High-impedance Probe	• 1X BW: DC~35 MHz • 10X BW: DC~350 MHz • Compatibility: All models of **RIGOL**'s digital oscilloscopes
RP3500A	High-impedance Probe	• BW: DC~500 MHz • Compatibility: All models of **RIGOL**'s digital oscilloscopes
RP5600A	High-impedance Probe	• BW: DC~600 MHz • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series
RP6150A	Low-impedance Probe	• BW: DC~1.5 GHz • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series

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

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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**'s digital oscilloscopes
PHA0150	High-Voltage Differential Probe	• BW: DC~70 MHz • Max. voltage ≤ 1500 Vpp • Compatibility: All models of **RIGOL**'s digital oscilloscopes
PHA1150	High-Voltage Differential Probe	• BW: DC~100 MHz • Max. voltage ≤ 1500 Vpp • Compatibility: All models of **RIGOL**'s 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: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series

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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: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series
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: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series
RP1001C	Current Probe	• BW: DC~300 kHz • Maximum Input AC: ±100 A AC P-P: 200 A AC RMS: 70 A • Compatibility: All models of **RIGOL**'s digital oscilloscopes
RP1002C	Current Probe	• BW: DC~1 MHz • Maximum Input AC: ±70 A AC P-P: 140 A AC RMS: 50 A • Compatibility: All models of **RIGOL**'s digital oscilloscopes
RP1025D	High-Voltage Differential Probe	• BW: 25 MHz • Max. voltage ≤ 1400 Vpp • Compatibility: All models of **RIGOL**'s digital oscilloscopes
RP1050D	High-Voltage Differential Probe	• BW: 50 MHz • Max. voltage ≤ 7000 Vpp • Compatibility: All models of **RIGOL**'s digital oscilloscopes

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Model	Type	Description
RP1100D	High-Voltage Differential Probe	• BW: 100 MHz • Max. voltage ≤ 7000 Vpp • Compatibility: All models of **RIGOL**'s digital oscilloscopes

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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		
Model	DS70504	DS70304
Analog bandwidth (50 Ω, -3 dB)[1]	5 GHz	3 GHz
Analog bandwidth (1 MΩ, -3 dB)	500 MHz	
Calculated Rising Time under 50 Ω (single-channel[1]10%-90%, typical)	≤108 ps	≤130 ps
No. of Input Channels	4 analog channel inputs 1 EXT channel input	
Sampling Mode	Real-time Sampling	
Max. Sample Rate of Analog Channel	single-channel[1]: 20 GSa/s half-channel[2]/all-channel: 10 GSa/s	
Max. Memory Depth	Standard: 500 Mpts Option: 2 Gpts (single-channel[1]), 1 Gpts (half-channel[2]/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[1])	
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	

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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	
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	30 V_{rms} or ±40 V_{max}(DC + V_{peak})
	50 Ω	5 V_{rms}
	Remarks	The probe allows a higher voltage test technically. The standard probe RP3500A 10:1 supports 300 V_{rms} or ±400 V_{max}(DC + V_{peak}). Whether the probe is used, the 50 Ω or 1 MΩ route does not allow transient overvoltage to occur. Please use the instrument dedicated for the specified measurement category (not applicable to CAT II, III, and IV)
Vertical Resolution	8 bits 9-16 bits (selectable) (high-resolution sample mode)	
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, 250 MHz, 1 GHz or 2 GHz

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Vertical System Analog Channel	
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)
ESD Tolerance	±8 kV

Horizontal System--Analog Channel

Horizontal System--Analog Channel			
Range of Time Base		50 ps/div~1 ks/div	100 ps/div~1 ks/div
		Fine	
Time Base Resolution		0.5 ps	
Time Base Accuracy		±0.5 ppm ± 1 ppm/year	
Time Base Delay Range	before triggering	≥1/2 screen width	
	after triggering	1 s or 100 div, whichever is greater	
Time Interval (ΔT) Measurement (using Cursor)		±(Time Base Accuracy x Readout) ± (0.001 x Screen Width) ± 20 ps	
Inter-channel Offset Correction Range		Inter-channel Offset Calibration Range ±100 ns, Accuracy±1 ps	
Analog Channel-to-Channel Delay (Typical)		≤50 ps [5]	
Horizontal Mode	YT	Default	
	XY	Channel 1/2/3/4	
	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 (single-channel[1]), 10 GSa/s (half-channel[2]/all-channel)	
Max. Memory Depth of Analog Channel	Standard: 500 Mpts Option: 2 Gpts (single-channel[1]), 1 Gpts (half-channel[2]/all-channel)	
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

Vertical Resolution					
Resolution	9 bits	10 bits	12 bits	14 bits	16 bits
Bandwidth	20 GSa/s	2 GHz	1 GHz	500 MHz	200 MHz	75 MHz
	10 GSa/s	1 GHz	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 trigger only)
	Low Frequency Rejection	Low frequency rejection, cut-off frequency~75 kHz (internal trigger only)

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Trigger System

Noise Rejection		Increase delay for the trigger circuit (internal trigger only), on/off
Holdoff Range		8 ns to 10 s
Trigger Bandwidth	Internal Trigger	Analog Bandwidth
	External Trigger	200 MHz
Trigger Sensitivity	Internal Trigger	0.5 div, ≥50 mV/div enable the noise rejection, 0.7 div
	External Trigger	200 mVpp, DC~100 MHz 500 mVpp, 100 MHz~200 MHz
EXT TRIG	Input Impedance	1MΩ±1%, SMA connector
	Trigger Jitter (Typical)	<200 ps_{RMS}(single-channel[1]) Normal acquisition, Edge trigger, trigger level located near 50% of EXT input signal
Trigger Level Range	Internal Trigger	± 5 div from the center of the screen
	External Trigger	±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, Nth Edge trigger Option: RS232/UART, I2C, SPI, CAN, FlexRay, LIN, I2S, and MIL-STD-1553
Edge	Triggers 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

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Trigger Type	
Pulse	Triggers 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	Triggers 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	Triggers 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	Identifies 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	Triggers 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, and X. 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	Triggers 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	Triggers when the pulses pass through one threshold but fail to pass through another threshold. Source channel: CH1~CH4
Window	Triggers 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	Triggers 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

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Trigger Type	
Nth Edge	Triggers on the Nth edge that appears after the specified idle time. The edge can be specified as Rising or Falling. Source channel: CH1~CH4
RS232/UART (Option)	DS70000-EMBDA option Triggers 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-EMBDA option Triggers 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-EMBDA option Triggers 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-AUTOA option Triggers 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-AUTOA option Triggers 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-AUTOA option Triggers 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-AUDIOA option Triggers on 2's complement data of audio left channel, right channel, or either channel (=, ≠, >, <, <>, ><). The available alignment modes include I2S, LJ, and RJ. Source channel: CH1~CH4

MIL-STD-1553 (Option)	DS70000-AEROA option
	Triggers 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

Noise Floor

Noise floor at 50Ω

	5 GHz	3 GHz
1 mV/div	500 uV$_{rms}$	400 uV$_{rms}$
2 mV/div	500 uV$_{rms}$	400 uV$_{rms}$
5 mV/div	800 uV$_{rms}$	600 uV$_{rms}$
10 mV/div	900 uV$_{rms}$	680 uV$_{rms}$
20 mV/div	2 mV$_{rms}$	1.4 mV$_{rms}$
50 mV/div	5 mV$_{rms}$	3.5 mV$_{rms}$
100 mV/div	8 mV$_{rms}$	5.6 mV$_{rms}$
200 mV/div	20 mV$_{rms}$	15 mV$_{rms}$
500 mV/div	40 mV$_{rms}$	28 mV$_{rms}$
1 V/div	60 mV$_{rms}$	35 mV$_{rms}$

Noise floor at 1MΩ

1 mV/div	500 uV$_{rms}$
2 mV/div	500 uV$_{rms}$
5 mV/div	600 uV$_{rms}$
10 mV/div	900 uV$_{rms}$
20 mV/div	2 mV$_{rms}$
50 mV/div	4 mV$_{rms}$
100 mV/div	8 mV$_{rms}$
200 mV/div	25 mV$_{rms}$

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Noise floor at 1MΩ	
500 mV/div	30 mV$_{rms}$
1 V/div	60 mV$_{rms}$
2 V/div	110 mV$_{rms}$
5 V/div	300 mV$_{rms}$
10 V/div	600 mV$_{rms}$

Waveform Measurement

Waveform Measurement		
Cursor	Number of Cursors	2 pairs of XY cursors
	Manual Mode	Voltage deviation between cursors (ΔY) Time deviation between cursors (ΔX) Reciprocal of ΔX (Hz) (1/ΔX)
	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	Measures 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 14 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, Full-memory
	All Measurement	Displays 41 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, and Period Area.
	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↓)
	Statistics	Items: 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

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Waveform Calculation

FFT	Record Length	Max. 1 Mpts
	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

Enhanced FFT

Enhanced FFT	
Record Length	Max. 64 Kpts
FFT Capture Rate	10,000 wfms/s
RBW	Manual/Auto Set
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.e. 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

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 (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
	Eye Measurement Item	one level, zero level, eye height, eye width, eye amplitude, crossing percentage, Q Factor, etc.
Jitter Analysis (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
	Type	Fully automatic, semi automatic, and manual
	Jitter Analysis	Jitter separation, including TJ (Total Jitter), RJ (Random Jitter), DJ (Deterministic Jitter), PJ (Periodic Jitter), DDJ (Data Dependent Jitter), DCD (Duty Cycle Distortion), ISI (Inter-symbol Interference), BR (Bit Ratio), and TIE.
	Measurement Display	Trend, histogram, and spectrum

Serial Decoding

Serial Decoding

Number of Decodings	4, four protocol types can be decoded and enabled at the same time
Decoding Type	Standard: Parallel Option: RS232/UART, I2C, SPI, LIN, CAN, CAN-FD, FlexRay, I2S, and MIL-STD-1553

Serial Decoding

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-EMBDA option Decodes 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-EMBDA option Decodes the address (with or without the R/W bit) of the I2C bus, data, and ACK. Source channel: CH1~CH4
SPI	DS70000-EMBDA option Decodes the MISO/MOSI data (4-32 bits) of the SPI bus. The available mode includes "Timeout" and "CS". Source channel: CH1~CH4
LIN	DS70000-AUTOA option Decodes 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-AUTOA option Decodes 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. Supports CAN-FD decoding. Source channel: CH1~CH4
FlexRay	DS70000-AUTOA option Decodes 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

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Serial Decoding

I2S	DS70000-AUDIOA option Decodes 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
MIL-STD-1553	DS70000-AEROA option Decodes 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 bits
Limits Beeper	Sounds an alarm when the voltage value is within or outside of the limit range
Range Measurement	Displays 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 digit, user-defined
	Max. Frequency	Max. analog bandwidth
Totalizer		48-bit totalizer
		Counts the number of the rising edges
Time Reference		Internal reference

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Command Set

Command Set	
Common Commands Support	IEEE488.2 Standard
Error Message Definition	Error messages
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 vertical divisions) x 8 horizontal 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)

I/O		
AUX Out		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 M In/Out	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 Video Output		1 on the rear panel, HDMI 1.4, A plug. used to connect to an external monitor or projector
Probe Compensation Output		1 kHz, 3Vpp Square

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

Environment

Environment		
Temperature Range	Operating	-0℃~+50℃
	Non-operating	-30℃~+70℃

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Environment

Humidity Range	Operating	below +30℃: ≤90% RH (without condensation)
		+30℃ to +40℃, ≤75% RH (without condensation)
		+40℃ to +50℃, ≤45% RH (without condensation)
	Non-operating	below 65℃: ≤90% RH (without condensation)
Altitude	Operating	below 3,000
	Non-operating	below 15,000

Warranty and Calibration Interval

Warranty and Calibration Interval	
Warranty	Three years for the mainframe, excluding the probes and accessories.
Recommended Calibration Interval	18 months

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Regulations

Regulations		
Electromagnetic Compatibility	Compliant with EMC DIRECTIVE 2014/30/EU, compliant with or higher than the standards specified in IEC 61326-1:2013/EN 61326-1:2013 Group 1 Class A	
	CISPR 11/EN 55011	
	IEC 61000-4-2:2008/EN 61000-4-2	±4.0 kV (contact discharge), ±8.0 kV (air discharge)
	IEC 61000-4-3:2002/EN 61000-4-3	3 V/m (80 MHz to 1 GHz); 3 V/m (1.4 GHz to 2 GHz); 1 V/m (2.0 GHz to 2.7 GHz)
	IEC 61000-4-4:2004/EN 61000-4-4	1 kV power line
	IEC 61000-4-5:2001/EN 61000-4-5	0.5 kV (phase-to-neutral voltage); 1 kV (phase-to-earth voltage); 1 kV (neutral-to-earth voltage)
	IEC 61000-4-6:2003/EN 61000-4-6	3 V, 0.15-80 MHz
	IEC 61000-4-11:2004/EN 61000-4-11	Voltage dip: 0% UT during half cycle; 0% UT during 1 cycle ; 70% UT during 25 cycles short interruption: 0% UT during 250 cycles
Safety	EN 61010-1:2019	
	EN 61010-031:2015	
	IEC 61010-1:2016	
	IEC 61010-2-030:2017	
	UL 61010-1:2012 R7	
	UL 61010-2-31:2017 R2	
	CAN/CSA-22.2 No. 61010-1-12:2017	
	CAN/CSA-22.2 No. 61010-2-30:2018	
	CAN/CSA-22.2 No. 61010-031-07:201	
Vibration	Meets GB/T 6587; class 2 random	
	Meets MIL-PRF-28800F and IEC60068-2-6; class 3 random	

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Shock	Meets GB/T 6587-2012; class 2 random
	Meets MIL-PRF-28800F and IEC 60068-2-27; class 3 random
	In non-operating conditions: 30 g, half-sine wave, 11 ms duration, 3 shocks along the main axis, total of 18 shocks

Mechanical Characteristics

Mechanical Characteristics	
Size	439mm (W)×310 mm (H)×491 mm (D)
Rack Mount Kit	7U
Weight[6]	Package excluded: <22.5 kg
	Package included: <29.5 kg

Non-volatile Memory

Non-volatile Memory		
Data/File Storage	Setup/Image	setup (*.stp), image (*.png, *.bmp, *.jpg)
	Waveform Data	CSV waveform data (*.csv), binary waveform data (*.bin,), list data (*.csv), and reference waveform data (*.ref, *.csv, *.bin)
Reference Waveform		Displays 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 mode. 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 single-channel mode.

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

[3]: Maximum value. single-channel, 5 ns horizontal time base, set a sine wave signal with 1 kpts memory depth, 4 div input amplitude, 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.

[5]: For any channel, under the same input impedance with DC-coupled, the Volts/div setting is the same for 100mV/div and 200mV/div.

[6]: Standard configuration.

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Order Information and Warranty Period

Order Information

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)	PCA2030
Current Probe (100 MHz, 150A)	PCA1150
High-Voltage Differential Probe (75 MHz, 1400 V)	PHA0150
High-Voltage Differential Probe (100 MHz, 1400 V)	PHA1150
USB-GPIB Interface Converter	USB-GPIB
Upgrade Option	
2 Gpts Memory Depth Upgrade Option	DS70000-RL-20
Serial Protocol Analysis Option	
Embedded Serial Bus Trigger and Analysis (RS232/UART, I2C, and SPI)	DS70000-EMBDA
Auto Serial Bus Trigger and Analysis (CAN, CAN-FD, LIN, FlexRay)	DS70000-AUTOA
Audio Serial Bus Trigger and Analysis (I2S)	DS70000-AUDIOA
Aerospace Serial Bus Trigger and Analysis (MIL-STD-1553)	DS70000-AEROA
Measurement Application Option	
Advanced Eye Diagram and Jitter Analysis (Option)	DS70000-JITTA
Pre-compliance Test Software	
USB2.0 Pre-compliance Test	DS70000-USBC
100Base-T Ethernet Pre-compliance Test	DS70000-ENETC

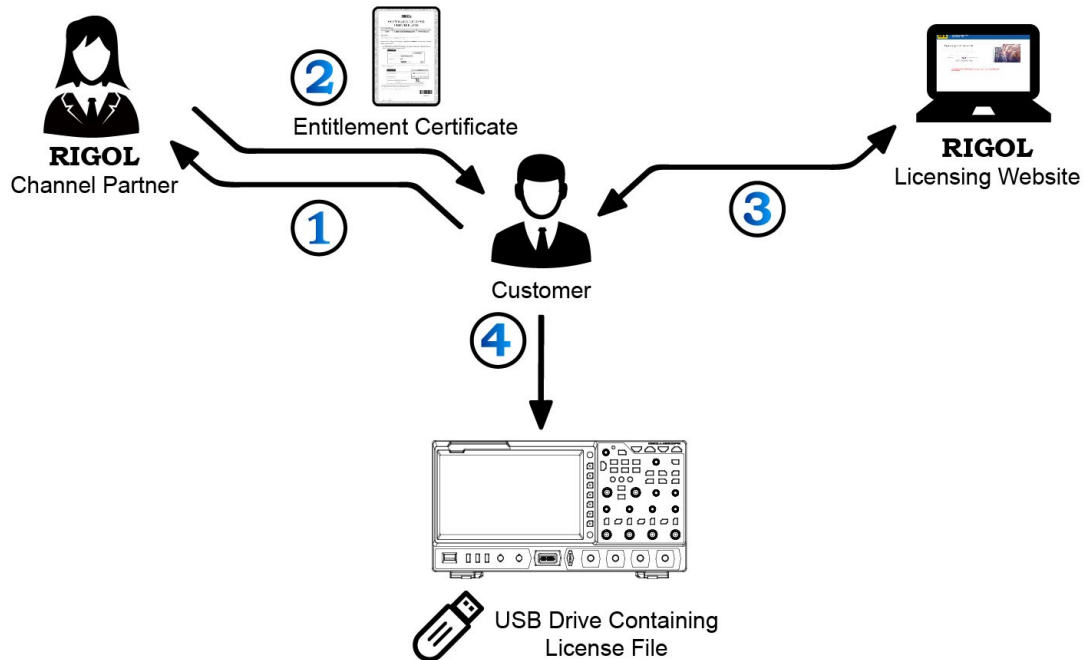| Order Information	Order No.
Real-Time Spectrum Analysis (RTSA)	
RTSA	DS70000-RTSA

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.

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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.

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