RIGOL

MHO2000 Series

Digital Oscilloscope

Data Sheet

DSA44100-1110

Mar. 2025

Product Features

Product Features

- Based on RIGOL's brand new self-developed Centaurus technical platform
- 12-bit resolution[1]
- Max. 350 MHz bandwidth, 4 analog channels, and 1 external trigger channel
- Standard configuration of 16 digital channels (required to purchase the logic analyzer probe)
- Real-time sample rate: up to 2 GSa/s
- Max. memory depth 500 Mpts
- Vertical sensitivity up to 200 μV/div
- Max. waveform capture rate of 1,000,000 wfms/s (in fast recording mode)
- Arbitrary/Function Waveform Generator (AFG)[2], power analysis, histogram, digital signal analysis, Bode plot, and protocol decodings
- Search and navigation functions enable users to quickly search for the signals with exceptions and locate them accurately
- 256-level intensity grading display, with digital real-time fluorescence technology
- 10.1" 1280*800 high-definition touch screen
- Brand new Flex knob brings friendly user experience
- Standard configuration of USB Device, USB Host, LAN, HDMI interfaces
- Battery pack-powered, convenient to charge anytime and anywhere, providing great feasibility for measurement
- Online upgrade
- Standard configuration of the photoelectric encoder operating knob to improve the service life of the instrument

The MHO2000 series is a high-resolution 4-CH digital oscilloscope designed for the vast mainstream digital oscilloscope market to meet the design, debugging, and test demands. It is developed based on RIGOL's brand new self-developed Centaurus technical platform. Its 1,000,000 wfms/s waveform capture rate (in fast recording mode), 500 Mpts memory depth, 12-bit resolution, excellent noise floor and vertical measurement accuracy can meet the test demands for higher accuracy. The MHO2000 series digital oscilloscope supports AFG, digital signal analysis, Bode plot, and other functions. It is powered by battery pack, applicable for various complex test scenarios.

Note:

[1]: Up to 16-bit in high resolution mode

[2]: AFG is the optional configuration.

Overview of RIGOL's Medium-end Series Products

	DHO1000U	DHO1000	DHO4000	MHO/ DHO5000	MHO2000
Analog channel	2/4 + EXT	2/4 + EXT	4 + EXT	4/6/8 + EXT	4 + EXT
Digital Channel	N/A	N/A	N/A	Standard for MHO5000 series	Standard
Analog Bandwidth	200 MHz	200 MHz	800 MHz	1 GHz	350 MHz
Max. Sample Rate	2 GSa/s	2 GSa/s	4 GSa/s	4 GSa/s	2 GSa/s
Max. Memory Depth	50 Mpts	100 Mpts (option)	500 Mpts (option)	500 Mpts	500 Mpts
Waveform Capture Rate	≤ 500,000 wfms/s	≤ 1,500,000 wfms/s	≤ 1,500,000 wfms/s	≤ 1,000,000 wfms/s	≤ 1,000,000 wfms/s
Max. Frames of Waveform Recording	500,000	500,000	500,000	500,000	500,000
LCD	10.1" High-Definition Touch Screen	10.1" High-Definition Touch Screen	10.1" High-Definition Touch Screen	10.1" High-Definition Touch Screen	10.1" High-Definition Touch Screen
Hardware Mask Test	Standard	Standard	Standard	Standard	Standard
Built-in Arbitrary Waveform Generator	N/A	N/A	N/A	Option	Option
Built-in Digital Voltmeter	Standard	Standard	Standard	Standard	Standard
Built-in Hardware Counter	6-digit frequency counter + totalizer	6-digit frequency counter + totalizer	6-digit frequency counter + totalizer	6-digit frequency counter + totalizer	6-digit frequency counter + totalizer
Search and Navigation	Supports table display	Supports table display	Supports table display	Supports table display	Supports table display
Power Analysis	N/A	N/A	Option	Option	Option
Histogram	N/A	N/A	N/A	Standard	Standard

	DHO1000U	DHO1000	DHO4000	MHO/ DHO5000	MHO2000
Serial Protocol Analysis	RS232/UART, I2C, SPI, CAN, CAN-FD, LIN, FlexRay, I2S, and MIL-STD-1553	RS232/UART, I2C, SPI, CAN, CAN-FD, LIN, FlexRay, I2S, and MIL-STD-1553	RS232/UART, I2C, SPI, CAN, CAN-FD, LIN, FlexRay, I2S, and MIL-STD-1553	RS232/UART, I2C, SPI, CAN, CAN-FD, LIN, FlexRay, I2S, and MIL-STD-1553	RS232/UART, I2C, SPI, CAN, CAN-FD, LIN, FlexRay, I2S, and MIL-STD-1553
Waveform Color Persistence	Standard	Standard	Standard	Standard	Standard
FFT	FFT, standard	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	Displays 4 functions at the same time
Connectivity	Standard: USB, LAN, and HDMI	Standard: USB, LAN, and HDMI	Standard: USB, LAN, and HDMI	Standard: USB, LAN, and HDMI	Standard: USB, LAN, and HDMI

RIGOL Probes and Accessories Supported by the Series

Model	Type	Description
Passive High-impedance Probe		
 PVP2150	Passive High-impedance Probe	• Attenuation Ratio: 10:1/1:1 • 1X BW: DC to 35 MHz • 10X BW: DC to 150 MHz • Compatibility: All models of RIGOL's digital oscilloscopes
 PVP2350	Passive High-impedance Probe	• Attenuation Ratio: 10:1/1:1 • 1X BW: DC to 35 MHz • 10X BW: DC to 350 MHz • Compatibility: All models of RIGOL's digital oscilloscopes
 PVP3150	Passive High-impedance Probe	• Attenuation Ratio: 10:1/1:1 • 1X BW: DC to 20 MHz • 10X BW: DC to 150 MHz • Compatibility: All models of RIGOL's digital oscilloscopes
 RP3500A	Passive High-impedance Probe	• Attenuation Ratio: 10:1 • BW: DC to 500 MHz • Compatibility: MSO/DS7000, MSO8000/A, DHO4000/1000, MHO/DHO5000, MHO2000, and DS70000/80000 series
High-voltage Single-ended Probe		
 RP1010H	High-voltage Probe	• Attenuation Ratio: 1000:1 • BW: DC to 40 MHz • DC: 0 to 10 kV DC • AC: pulse ≤20 kVp-p • AC: sine ≤7 kV_{rms} • Compatibility: All models of RIGOL's digital oscilloscopes

Model	Type	Description
 RP1018H	High-voltage Probe	• Attenuation Ratio: 1000:1 • BW: DC to 150 MHz • $DC+AC_{peak}$: 18 kV CAT II • AC_{rms}: 12 kV CAT II • Compatibility: All models of RIGOL's digital oscilloscopes
 RP1300H	High-voltage Probe	• Attenuation Ratio: 100:1 • BW: DC to 300 MHz • CAT I 2000 V (DC+AC) • CAT II 1500 V (DC+AC) • Compatibility: All models of RIGOL's digital oscilloscopes
High-voltage Differential Probe		
 PHA0150	High-voltage Differential Probe	• BW: DC to 70 MHz • Max. voltage ≤ 1500 Vpp • Compatibility: All models of RIGOL's digital oscilloscopes
 PHA1150	High-voltage Differential Probe	• BW: DC to 100 MHz • Max. voltage ≤ 1500 Vpp • Compatibility: All models of RIGOL's digital oscilloscopes
 PHA2150	High-voltage Differential Probe	• 50X BW: DC to 160 MHz • 500X BW: DC to 200 MHz • Max. voltage ≤ 1500 Vpp • Compatibility: All models of RIGOL's digital oscilloscopes
 RP1025D	High-voltage Differential Probe	• BW: DC to 25 MHz • Max. voltage ≤ 1400 Vpp (DC + AC P-P) • Compatibility: All models of RIGOL's digital oscilloscopes
 RP1050D	High-voltage Differential Probe	• BW: DC to 50 MHz • Max. voltage ≤ 7000 Vpp (DC + AC P-P) • Compatibility: All models of RIGOL's digital oscilloscopes

Model	Type	Description
 RP1100D	High-voltage Differential Probe	• BW: DC to 100 MHz • Max. voltage ≤ 7000 Vpp (DC + AC P-P) • Compatibility: All models of RIGOL's digital oscilloscopes
Low-voltage Differential Probe		
 RP7080	Low-voltage Differential Probe	• Input Dynamic Range: ±6.25 V • BW: DC to 800 MHz • 30 Vpeak CAT I • Compatibility: MSO/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series
 RP7150	Low-voltage Differential Probe	• Input Dynamic Range: ±6.25 V • BW: DC to 1.5 GHz • 30 Vpeak CAT I • Compatibility: MSO/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series
 PVA7250	Low-voltage Differential Probe	• Input Dynamic Range: ±2 V • BW: DC to 2.5 GHz • 30 Vpeak CAT I • Compatibility: MSO/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series
Low-voltage Single-ended Probe		
 RP7080S	Single-ended Active Probe	• Input Dynamic Range: ±6.25 V • BW: DC to 800 MHz • 30 Vpeak CAT I • Compatibility: MSO/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series
 RP7150S	Single-ended Active Probe	• Input Dynamic Range: ±6.25 V • BW: DC to 1.5 GHz • 30 Vpeak CAT I • Compatibility: MSO/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series

Model	Type	Description
 PVA8150S	High-impedance Single-ended Active Probe	• BW: ≥1.5 GHz • Input Impedance: 1 MΩ • Input Capacitance: ≤1 pF • Compatibility: MSO8000/A, DHO4000/1000, MHO/DHO5000, MHO2000, and DS70000/80000 series
Current Probe		
 PCA1030	Current Probe	• BW: DC to 50 MHz (-3 dB) • Max. continuous input range: 30 Arms • Max. peak-peak current value: 50 A peak, non-continuous • Compatibility: MSO/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series
 PCA1150	Current Probe	• BW: DC~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/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series
 PCA2030	Current Probe	• BW: DC to 100 MHz (-3 dB) • Max. continuous input range: 30 Arms • Max. peak-peak current value: 50 A peak, non-continuous • Compatibility: MSO/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series
 PCA1500	Current Probe	• BW: DC~2 MHz (-3 dB) • Max. continuous input range: 500 Arms • Max. peak-peak current value: 700 A peak, non-continuous • Compatibility: MSO/DS7000, MSO8000/A, DHO4000, MHO/DHO5000, MHO2000, and DS70000/80000 series

Model	Type	Description
 RP1001C	Current Probe	• BW: DC to 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 to 1 MHz • Maximum Input AC: ±70 A AC P-P: 140 A AC RMS: 50 A • Compatibility: All models of RIGOL's digital oscilloscopes
 RP1003C	Current Probe	• BW: DC to 50 MHz • Maximum Input AC P-P: 50 A (non-continuous) AC RMS: 30 A • Compatibility: All models of RIGOL's digital oscilloscopes • Required to order RP1000P power supply.
 RP1004C	Current Probe	• BW: DC to 100 MHz • Maximum Input AC P-P: 50 A (non-continuous) AC RMS: 30 A • Compatibility: All models of RIGOL's digital oscilloscopes • Required to order RP1000P power supply.
 RP1005C	Current Probe	• BW: DC to 10 MHz • Maximum Input AC P-P: 300 A (non-continuous), 500 A (@pulse width ≤ 30 us) AC RMS: 150 A • Compatibility: All models of RIGOL's digital oscilloscopes • Required to order RP1000P power supply.

Model	Type	Description
 RP1006C	Current Probe	• BW: DC to 2 MHz • Maximum Input AC P-P: 700 A peaks, non-continuous AC RMS: 500 A • Compatibility: All models of RIGOL's digital oscilloscopes • Required to order RP1000P power supply.
 RP1000P	4-CH Power Supply	Power supply for RP1003C, RP1004C, RP1005C, and RP1006C; supporting 4 channels.
Optical-fiber Isolated Probe		
 PIA1000	Optical-fiber Isolated Probe	• CMRR up to 180 dB • BW: DC to 1 GHz • 2-meter length fiber transmission cable (Std.) • Compatibility: MHO/DHO5000 and MHO2000 series
Logic Analyzer Probe		
 PLA3204	Active Logic Analyzer Probe	• No. of Input Channels: 4 • Threshold Range: ±15 V • Min. Voltage Swing: 500 mVpp • Min. Detectable Pulse Width: 5 ns • Max. Input Voltage: ±40 Vpp • Max. Input Dynamic Range: ±10 V + Threshold • Input Impedance: 100 kΩ ± 1% • Input Capacitance: about 11 pF • Compatibility: MHO5000 and MHO2000 series

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 MHO2000 Series Technical Specifications

General Technical Specifications		
Model	MHO2024	MHO2034
Analog bandwidth (50 Ω, -3 dB)	200 MHz	350 MHz
Analog bandwidth (1 MΩ, -3 dB)	200 MHz	350 MHz
Calculated Rising Time under 50 Ω (10%-90%, typical)	2 ns	1.4 ns
No. of Input Channels	4 analog channels + 1 EXT channel	
Max. Sample Rate of Analog Channel	2 GSa/s	
Max. Memory Depth	500 Mpts (half-channel[1]) 250 Mpts (full-channel[2])	
Sampling Mode	Real-time Sampling	
Max. Waveform Capture Rate	200,000 wfms/s (in Vector mode) 1,000,000 wfms/s (in Record mode)	
Vertical Resolution	12-bit (up to 16-bit in high resolution mode)	
Max. Frames of Waveform Recording	Max. 500,000 frames	
Peak Detection	Captures 500 ps glitches	
LCD Size and Type	10.1'' capacitive multi-touch screen	
Display Resolution	1280×800	

Vertical System Analog Channel

Vertical System Analog Channel		
Input Coupling		DC, AC, or GND
Input Impedance		1 MΩ ± 1%, 50 Ω ± 1%
Input Capacitance		19 pF ± 3 pF
Probe Ratio	Voltage Probe	0.001X, 0.002X, 0.003X, 0.005X, 0.01X, 0.02X, 0.03X, 0.05X, 0.1X, 0.2X, 0.3X, 0.5X, 1X, 2X, 3X, 5X, 10X, 20X, 30X, 50X, 100X, 200X, 300X, 500X, 1000X, 2000X, 3000X, 5000X, 10000X, 20000X, 30000X, 50000X, User
	Current Probe	0.001 V/A, 0.002 V/A, 0.003 V/A, 0.005 V/A, 0.01 V/A, 0.02 V/A, 0.03 V/A, 0.05 V/A, 0.1 V/A, 0.2 V/A, 0.3 V/A, 0.5 V/A, 1 V/A, 2 V/A, 3 V/A, 5 V/A, 10 V/A, User
Probe Recognition		Auto-recognized RIGOL probe
Maximum Input Voltage	1 MΩ	CAT I 300 V_{rms}, 400 V_{pk} (DC + V_{peak})
	50 Ω	5 V_{rms}
	Remarks	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	12-bit (up to 16-bit in high resolution mode)	
Vertical Sensitivity Range[3]	1 MΩ	200 μV/div to 10 V/div
	50 Ω	200 μV/div to 1 V/div
Offset Range	1 MΩ	±1 V (≥1 mV/div, ≤65 mV/div) ±10 V (>65 mV/div, ≤270 mV/div) ±20 V (>270 mV/div, ≤2.75 V/div) ±100 V (>2.75 V/div, ≤10 V/div)
	50 Ω	±1 V(≥1 mV/div, ≤135 mV/div) ±4 V(>135 mV/div)
Dynamic Range		±4 div (12-bit)

Vertical System Analog Channel	
Bandwidth Limit (Typical)	MHO2024: 20 MHz, FULL; selectable for each channel MHO2034: 20 MHz, 250 MHz, FULL; selectable for each channel • The bandwidth limit is automatically set to 250 MHz when the vertical scale is ≤500 μV. • The bandwidth limit is automatically set to 20 MHz when the vertical scale is ≤200 μV.
DC Gain Accuracy[3]	±2% (<5 mV); ±1% (≥5 mV)
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	MHO2024: ≥100:1 (DC to 200 MHz) MHO2034: ≥100:1 (DC to 350 MHz)
ESD Tolerance	±8 kV (on input BNCs)

Vertical System Digital Channel

Vertical System Digital Channel	
Number of Channels	16 input channels (D0 to D15) (D0 to D3, D4 to D7, D8 to D11, D12 to D15)
Threshold Range	±15.0 V, in 10 mV step
Threshold Accuracy	±(100.00 mV + 3% of threshold setting)
Threshold Selection	TTL(1.4 V), CMOS5.0(2.5 V), CMOS3.3(1.65 V), CMOS2.5(1.25 V), CMOS1.8(0.9 V), ECL(-1.3 V), PECL(3.7 V), LVDS(1.2 V), 0.0 V User (adjustable threshold for 4 channels in a group)
Max. Input Voltage	± 40 V peak CAT I; transient overvoltage 800 Vpk
Max. Input Dynamic Range	±10 V + threshold
Minimum Voltage Swing	500 mVpp
Input Impedance	100 kΩ ± 1%
Probe Load	≈11 pF
Vertical Resolution	1-bit

Horizontal System--Analog Channel

Horizontal System--Analog Channel		
Range of Time Base		MHO2024: 2 ns/div~500 s/div MHO2034: 1 ns~500 s/div
		Fine adjustment supported
Time Base Resolution		100 ps
Time Base Accuracy		±1.5 ppm ± 1 ppm/year
Time Base Delay Range	Pre-trigger	-5 div
	Post-trigger	1 s or 100 div, whichever is greater
Delta Time Accuracy		±(Time Base Accuracy x Readout) ± (0.001 x Screen Width) ± 20 ps
Channel-to-Channel Skew Correction		Channel-to-Channel Skew Correction Range ±100 ns, Accuracy ± 1 ps
Analog Channel-to-Channel Delay (Typical)		≤200 ps[4]
Horizontal Mode	YT	Default
	XY	Channel 1/2/3/4
	SCAN	Time base ≥ 200 ms/div
	ROLL	Time base ≥ 50 ms/div or ≥ 100 ms/div, available to enter or exit the ROLL mode by rotating the Horizontal SCALE knob

Acquisition System

Acquisition System	
Max. Sample Rate of Analog Channel	2 GSa/s (full-channel[2])
Max. Memory Depth of Analog Channel	500 Mpts (half-channel[1]), 250 Mpts (full-channel[2])

Acquisition System		
Acquisition Mode	Normal	Default
	Peak Detection	Captures 500 ps glitches
	Average Mode	2, 4, 8, 16...65536 are available for you to choose
	High Resolution	14-bit, 16-bit
	Waveform Recording	Waveform capture rate up to 1,000,000 wfms/s
	Vector Mode	Waveform capture rate ≤ 200,000 wfms/s

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, cut-off frequency to 16 kHz (internal trigger only)
	High Frequency Rejection	High frequency rejection, cut-off frequency~200 kHz (internal trigger only)
	Low Frequency Rejection	Low frequency rejection, cut-off frequency~180 kHz (internal trigger only)
Noise Rejection		Increases 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 System		
Trigger Sensitivity	Internal Trigger	0.50 div, ≥50 mV/div 0.7 div (with noise rejection enabled)
	External Trigger	200 mVpp, DC to100 MHz 500 mVpp, 100 MHz to 200 MHz
EXT TRIG	Input Impedance	1 MΩ ± 1%, BNC connector
	Trigger Jitter (Typical)	<1 ns_{rms} 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	Trigger level fixed between 40% and 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, I2C trigger, SPI trigger, RS232/ UART trigger, and CAN trigger Option: CAN-FD trigger, LIN trigger, FlexRay trigger, I2S trigger, and MIL-STD-1553 trigger
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 to CH4, D0 to D15, and AC Line
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 to CH4, D0 to D15.
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. Source channel: CH1 to CH4.

Trigger Type	
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/25Hz, 1080p/24Hz, 1080i/60Hz, and 1080i/50Hz. Source channel: CH1 to 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 to CH4, D0 to D15.
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 to CH4, D0 to D15.
Timeout	Triggers when duration of a certain event exceeds the specified time. The event can be specified as Rising, Falling, or Either. Source channel: CH1 to CH4, D0 to D15.
Runt	Triggers when the pulses pass through one threshold but fail to pass through another threshold. Source channel: CH1 to 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 to CH4.
Duration	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 to CH4, D0 to D15.
Setup/Hold	When the setup time or hold time between the input clock signal and the data signal is smaller than the specified time. Source channel: CH1 to CH4, D0 to D15.
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 to CH4, D0 to D15.
RS232/UART	Triggers on the Start, Error, Check Error, or Data frame of the RS232/UART bus (up to 20 Mb/s). Source channel: CH1 to CH4, D0 to D15.

Trigger Type	
I2C	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 to CH4, D0 to D15.
SPI	Triggers on the specified pattern of the specified data width (4~32) of SPI bus. CS and Timeout are supported. Source channel: CH1 to CH4, D0 to D15.
CAN	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 Error of the CAN signal (up to 5 Mb/s). The supported CAN bus signal types include CAN_H, CAN_L, TX/RX, and DIFF. Source channel: CH1 to CH4, D0 to D15.
CAN-FD (Option)	MHO2000-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 Error of the CAN-FD signal (up to 10 Mb/s). The supported CAN-FD bus signal types include CAN_H, CAN_L, TX/RX, and DIFF. Source channel: CH1 to CH4, D0 to D15.
FlexRay (Option)	MHO2000-FLEXA 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 to CH4, D0 to D15.
LIN (Option)	MHO2000-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 to CH4, D0 to D15.
I2S (Option)	MHO2000-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 to CH4, D0 to D15.
MIL-STD-1553 (Option)	MHO2000-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 to CH4, D0 to D15.

Search & Navigation

Search & Navigation	
Type	Edge, Pulse
Source	Analog channel
Copy	Copies the search settings from or to the trigger settings mutually, including threshold setting and search condition settings
Result Display	Displays in event table form; can be exported to the external or internal memory
Navigation	Time navigation: navigates to the acquired waveforms in time order.
	Event navigation: uses the navigation keys to scroll through the event search results and navigates to the specified event.

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	Fixes Y-axis to track X-axis waveform point's voltage and time values Fixes X-axis to track Y-axis waveform point's voltage and time values
	Auto Measurement	Allows 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, D0~D15, Math1~Math4
	Measurement Range (Region)	Main, Zoom
	All Measurement	Displays 33 measurement items (vertical and horizontal) for the current measurement channel; the measurement results are updated continuously.
	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	FFT supported

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, determined by the user-defined threshold and offset threshold

Waveform Analysis

Waveform Analysis		
Waveform Recording		Stores the signal under test in segments according to the trigger events, that is, saves all the sampled waveform data as a segment to the RAM for each trigger event. The maximum number of the sampled segments reaches 500,000.
	Source	All enabled analog channels and digital channels
	Analysis	Supports playing waveforms frame by frame or continuous playing; capable of calculating, measuring, and decoding the played waveforms
PassFail		Compares 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
Color Grade		Provides 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	Supports all modes

Serial Decoding

Serial Decoding	
Number of Decodings	Four protocol types can be decoded and enabled at the same time

Serial Decoding	
Decoding Type	Standard: Parallel, RS232/UART, I2C, SPI, and CAN Option: LIN, CAN-FD, FlexRay, I2S, and MIL-STD-1553
Parallel	Up to 4 bits of Parallel decoding, supporting any analog channel Supports user-defined clock and auto clock settings. Source channel: CH1 to CH4, D0 to D15
RS232/UART	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 to CH4, D0 to D15.
I2C	Decodes the address (with or without the R/W bit) of the I2C bus, data, and ACK. Source channel: CH1 to CH4, D0 to D15.
SPI	Decodes the MISO/MOSI data (4-32 bits) of the SPI bus. The available mode includes "Timeout" and "CS". Source channel: CH1 to CH4, D0 to D15.
CAN	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. Source channel: CH1 to CH4, D0 to D15, Math1 to Math4.
CAN-FD (Option)	MHO2000-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-FD bus (up to 10 Mb/s). The supported CAN-FD bus signal types include CAN_H, CAN_L, TX/RX, and DIFF. Source channel: CH1 to CH4, D0 to D15, Math1 to Math4.
LIN (Option)	MHO2000-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 to CH4, D0 to D15.
FlexRay (Option)	MHO2000-FLEXA 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 to CH4, D0 to D15.

Serial Decoding	
I2S (Option)	MHO2000-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 to CH4, D0 to D15.
MIL-STD-1553 (Option)	MHO2000-AEROA option Decodes the MIL-STD-1553 bus signal's data word, command word, and status word (address + last 11 bits). Source channel: CH1 to CH4, D0 to D15.

Bode Plot[5]

Bode Plot	
Start Freq	10 Hz to 3 MHz
Stop Freq[6]	100 Hz to 30 MHz
Points/Decade	10 to 100
Output Amplitude	20 mV to 10 V (1 MΩ); 10 mV to 5 V (50 Ω)

Arbitrary/Function Waveform Generator (AFG)[7]

AFG (technical specifications are typical values)	
Number of Channels	2
Output Mode	Normal (2-channel output)
Sample Rate	1 GSa/s
Vertical Resolution	16-bit
Max. Frequency	50 MHz
Output Waveform	Basic waveforms: Sine, Square, Pulse, Ramp, and Noise Built-in waveforms: DC, Sinc, Exp.Rise, Exp.Fall, ECG1, Gauss, Lorentz, and Haversine
2-CH Synchronization Accuracy	200 ps

AFG (technical specifications are typical values)		
Sine	Frequency Range	1 µHz to 50 MHz
	Flatness	±0.5 dB (relative to 1 kHz)
	Harmonic Distortion	-40 dBc
	Spurious (non-harmonics)	-40 dBc
	Total Harmonic Distortion	<1%
	S/N Ratio	40 dB
Square/Pulse	Frequency Range	1 µHz to 20 MHz
	Rise/Fall Time	≥9 ns(10%-90%), adjustable
	Overshoot	<4%
	Pulse Width	≥10 ns
	Duty	10%-90% or 10 ns, whichever is greater
	Jitter (rms)	500 ps
Ramp	Frequency Range	1 µHz to 2 MHz
	Linearity	1%
	Symmetry	0.1% to 99.9%
Noise	Cut-off Bandwidth	40 MHz
Freq	Accuracy	100 ppm
	Resolution	0.1 Hz or 4-bit, whichever is greater
Amplitude	Output Range	2 mVpp to 10 Vpp (1 MΩ); 1 mVpp to 5 Vpp (50 Ω)
	Resolution	100 µV or 3-bit, whichever is greater
	Accuracy	±(2% of setting + 1 mV) (Frequency = 1 kHz)

AFG (technical specifications are typical values)		
DC Offset	Range	-10 V to +10 V
	Resolution	100 µV or 3-bit, whichever is greater
	Accuracy	±(2% of offset setting + 5 mV + 0.5% of amplitude)
Modulation	AM	Modulating waveform: Sine, Square, Triangle, UpRamp, DnRamp, Noise Carrier waveform: Sine, Square, Ramp, and built-in waveforms Modulation Source: Internal Modulation Depth: 0% to 120% Modulation Frequency: 2 mHz to 1 MHz
	FM	Modulating Waveform: Sine, Square, Triangle, UpRamp, DnRamp, and Noise Carrier Waveform: Sine, Square, Ramp, and built-in waveforms Modulation Source: Internal Frequency Deviation: 0 Hz to 1 kHz (limited by the carrier frequency setting; the sum of the frequency deviation and carrier frequency shall not exceed the upper limit of the carrier frequency) Modulation Frequency: 2 mHz to 1 MHz
	PM	Modulating Waveform: Sine, Square, Triangle, UpRamp, DnRamp, Noise Carrier Waveform: Sine, Square, Ramp, and built-in waveforms Modulation Source: Internal Phase Deviation: 0° to 360°, default 90% Modulation Frequency: 2 mHz to 1 MHz

Auto

Auto	
AutoScale	Min voltage > 10 mVpp, duty cycle > 1%, frequency > 35 Hz

Digital Voltmeter

Digital Voltmeter	
Source	Any analog channel
Function	DC, AC+DC_{rms}, AC_{rms}
Resolution	ACV/DCV: 4 bits
Limits Beeper	Sounds an alarm when the voltage value is within or outside of the limit range

High-precision Frequency Counter

High-precision Frequency Counter		
Source		Any analog channel, digital channel, and EXT
Measure		Frequency, period, totalizer
Counter	Resolution	3-6 digits, 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
Support Status Report Mechanism	Status Reporting
Support Syn Mechanism	Synchronization

Display

Display	
LCD	10.1-inch capacitive multi-touch screen, gesture enabled operation
Resolution	1280×800 (Screen Region) 16:9

Display	
Graticule	(10 horizontal divisions) x (8 vertical divisions)
Persistence	Off, Infinite, variable persistence (100 ms to 10 s)
Brightness	256 intensity levels (LCD, HDMI)

Processor System

Processor System	
Processor	Cortex-A72 1.8GHz + Cortex-A53 1.4GHz 6-core
System Memory	4 GB RAM
Operating System	Android
Internal Non-volatile Memory	128 GB

I/O

I/O		
USB3.0 Host		1 on the front panel
USB3.0 Device		1 on the rear panel
LAN		1 on the rear panel, 10/100/1000 Base-T, supporting LXI-C
Web Remote Control		Supports Web Control interface (input the IP address of the oscilloscope into the Web browser to display the operation interface of the oscilloscope)
AUX Out		BNC 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	Outputs a pulse signal when the oscilloscope is triggered
	Pass/Fail	Outputs a pulse signal when a pass/fail event occurs. Supports user-defined pulse polarity and pulse time (100 ns to 10 ms)
	Rise Time	≤1.5 ns

I/O		
10 MHz Reference Clock Input/Output	Input Interface	1, BNC connector on the rear panel
	Output Interface	1, BNC connector on the rear panel
	Input Interface	50 Ω, with the amplitude 130 mVpp to 4.1 Vpp (-10 dBm, 20 dBm), frequency 10 MHz ± 10 ppm
	Output Interface	50 Ω, 1.5 Vpp sine waveform
HDMI HD	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 frequency, 0.3 V amplitude, Square

Power Supply

Power Supply	
Power Voltage	AC 100 V to 240 V, 50 Hz to 60 Hz
Power	Max. 400 VA (connect to various interfaces, USB, active probes)
Fuse	5 A, T degree, 250 V

Environment

Environment		
Temperature Range	Operating	-10℃ to +50℃
	Non-operating	-30℃ to +60℃
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 60℃: ≤90% RH (without condensation)
Altitude	Operating	below 3,000 m
	Non-operating	Below 15,000 m

Warranty and Calibration Interval

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

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

Regulations	
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
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	
Dimensions	335 mm (W) x 235 mm (H) x 154 mm (D)
Rack Mount Kit	5U
Weight[8]	Package excluded: 5.3 kg; package included: 6.3 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)
Internal Capacity		128 GB
Reference Waveform		Displays 10 internal waveforms
Setting		Storage is limited by the capacity

Non-volatile Memory	
USB Capacity	Supports the USB storage device that conforms to the industry standard

NOTE:

[1]: Half-channel: when CH1 and CH3 are both enabled; or when CH2 and CH4 are both enabled, it is called half-channel mode.

[2]: Full-channel mode: If all of the channels are enabled, it is called full-channel mode.

[3]: 500 μV/div is a magnification of 1 mV/div setting. For vertical accuracy calculations, use full scale of 8 mV.

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

[5]: The Bode plot is only available to use when you have installed the AWG option.

[6]: The stop frequency shall be greater than the start frequency.

[7]: optional configuration. It is only available when you have installed the Arbitrary/Function Waveform Generator (AFG) option.

[8]: Standard configuration.

Order Information and Warranty Period

Order Information

Order Information	Order No.
Model	
200 MHz, 2 GSa/s, 12-bit, 4-CH	MHO2024
350 MHz, 2 GSa/s, 12-bit, 4-CH	MHO2034
Standard Accessories	
Power Cord Conforming to the Standard of the Destination Country	— —
USB Cable	— —
Passive High-impedance Probe x4	PVP2350
Recommended Accessories	
4-Channel Logic Analyzer Probe x4	PLA3204
Protocol Decoding Option	
CAN-FD/LIN Bus Trigger and Decode Option	MHO2000-AUTOA
MIL-STD-1553 Bus Trigger and Decode Option	MHO2000-AEROA
FlexRay Serial Bus Trigger and Decode Option	MHO2000-FLEXA
I2S Bus Trigger and Decode Option	MHO2000-AUDIOA
Optional Accessories	
Built-in 2-CH 50 MHz AWG Option	MHO2000-AWG
Power Analysis Option	MHO2000-PWRA
Function and Application Bundle Options, including AUTOA/AEROA/FLEXA/AUDIOA/PWRA/AWG.	MHO2000-BND

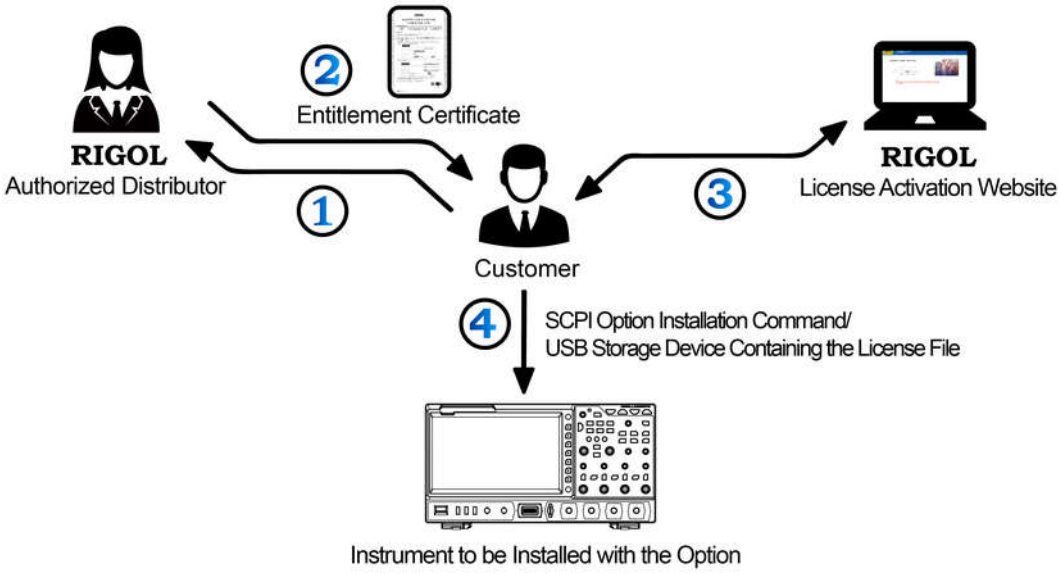
Note:

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 specified function options from **RIGOL Sales Personnel**, 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 for registration. Use the software key and instruments serial number provided in the entitlement certificate to obtain the option license code and the option license file.
4. Install the option by running the SCPI command concerning the option installation. You can also save the option license file to the root directory of the USB storage device. Then insert it to the instrument. After being recognized, follow the instructions to install the option.

NOTE:

If any problems occur during the option installation process, please contact **RIGOL** technical team.

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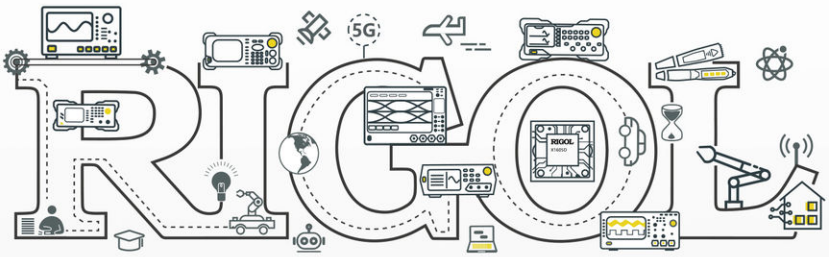




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