RIGOL

Distribution in the UK & Ireland

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HDO4000 Series

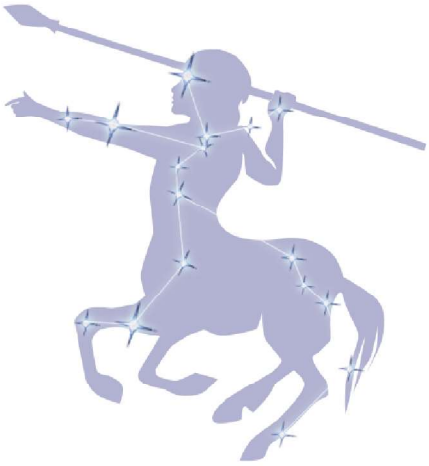
Digital Oscilloscope

Data Sheet

DSA33101-1110

Aug.2022

HDO4000 Series
Digital Oscilloscope



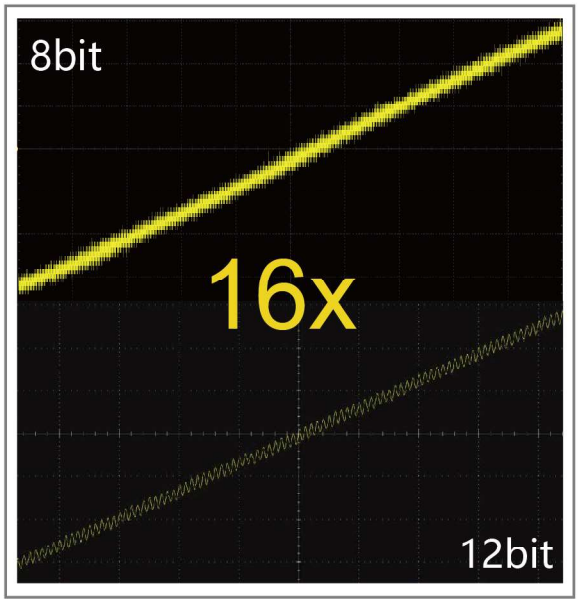
Adopting RIGOL's

Brand New Self-developed

Chipset "Centaurus"

Highlights

- Ultra-low noise floor: 18 μVrms in minimum for cleaner signals, measuring small signals more accurately
- High resolution of 12 bits (2^{12}=4096) to see the most signal detail
- Up to 4 GSa/s real-time sample rate
- High sensitivity: 100 μV vertical scale, allowing capture of small signals in the microvolt (μV) range
- Wide vertical sensitivity range: 100 μV/div to 10 V/div, capable of handling the smallest to the largest signals
- Front-panel Flex Knobs, bringing smoother interaction and easier measurements
- Optional battery pack in a highly portable package for you to enjoy unlimited freedom

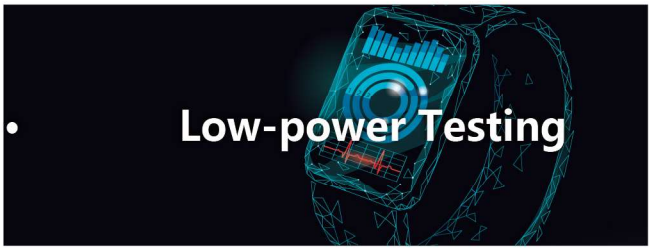


High Resolution

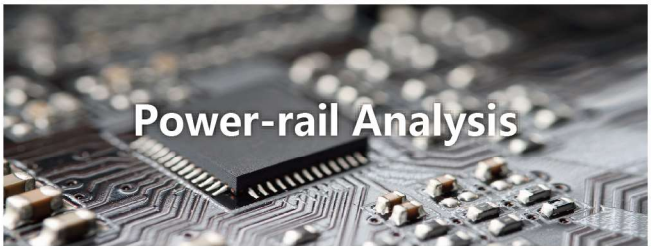
Digital Oscilloscopes, "See" the Most Signal Detail

Applications

An oscilloscope is an important tool for making power supply measurements. With up to 12-bit vertical resolution, the HDO4000 series makes it easy for you to perform ripple measurement and quality test.



This series digital oscilloscope provides a minimum vertical scale of 100 μV/div, 18 μVrms low noise floor, together with 12-bit high resolution to capture low-power small signals effectively.



It sees intricate signal details by providing up to 4 GSa/s sample rate, 12-bit vertical resolution as well as higher DC gain accuracy.

The testing for the third generation of semiconductor materials represented by gallium nitride (GaN) usually has higher requirements for reduced quantization error of T&M equipment. The 12-bit high resolution and improved DC gain accuracy make it a perfect choice for semiconductor testing.

Product Features

Product Features

- Brand-new chipset "Centaurus" developed by RIGOL
- Ultra-low noise floor at 18 μVrms in minimum
- 12-bit vertical resolution[1]
- 200/400/800 MHz analog bandwidth (selectable), 4 analog channels, and 1 EXT channel
- Up to 4 GSa/s real-time sample rate
- Max. memory depth: 500 Mpts (optional)
- Min. vertical sensitivity: 100 μV/div
- Up to 1,500,000 wfms/s waveform capture rate with the UltraAcquire mode
- 10.1'' 1280*800 HD touch display
- User-friendly Flex Knobs, bringing smoother interaction
- Standard photoelectric encoder operating knobs, effectively prolonging its service life
- Standard USB Device & Host, LAN, and HDMI interfaces
- Optional battery pack in a highly portable package for unlimited freedom
- Support online version upgrade

HDO4000 series digital oscilloscope is designed to meet the requirements for the design, debug, and test of the mainstream oscilloscope market. Adopting the brand-new chipset "Centaurus" developed by RIGOL, this series achieves a fast waveform capture rate of 1,500,000 wfms/s with the UltraAcquire mode, 500 Mpts memory depth, 12-bit vertical resolution, all combined with excellent noise floor performance and vertical accuracy to meet your requirements for more accurate measurements, bringing extraordinary T&M experience for you.

NOTE:

[1]: 16 bits in High Resolution mode.

RIGOL Probes and Accessories Supported by the Series

RIGOL Passive Probes

Model	Type	Description
High-impedance Probe		
 PVP2150	High-impedance Probe	• Attenuation: 10:1/1:1 • 1X BW: DC~35 MHz • 10X BW: DC~150 MHz • Compatibility: All models of RIGOL's digital oscilloscopes
 PVP2350	High-impedance Probe	• Attenuation: 10:1/1:1 • 1X BW: DC~35 MHz • 10X BW: DC~350 MHz • Compatibility: All models of RIGOL's digital oscilloscopes
 PVP3150	High-impedance Probe	• Attenuation: 10:1/1:1 • 1X BW: DC~20 MHz • 10X BW: DC~150 MHz • Compatibility: All models of RIGOL's digital oscilloscopes
 RP3500A	High-impedance Probe	• Attenuation: 10:1 • BW: DC~500 MHz • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000/2000/1000, and DS70000 series
High Voltage Single-ended Probe		
 RP1010H	High Voltage Probe	• Attenuation: 1000:1 • BW: DC~40 MHz • DC: 0~10 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: 1000:1 • 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
 RP1300H	High Voltage Single-ended Probe	• Attenuation: 1000:1 • BW: DC~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~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
 PHA2150	High Voltage Differential Probe	• 50X BW: DC~160 MHz • 500X BW: DC~200 MHz • Max. voltage ≤ 1500 Vpp • Compatibility: All models of RIGOL's digital oscilloscopes
 RP1025D	High Voltage Differential Probe	• BW: DC~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~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~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 Range: ±6.25 V • BW: DC~800 MHz • 30 V peak CAT I • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000, and DS70000 series
 RP7150	Low Voltage Differential Probe	• Input Range: ±6.25 V • BW: DC~1.5 GHz • 30 V peak CAT I • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000, and DS70000 series
 PVA7250	Low Voltage Differential Probe	• Input Range: ±2 V • BW: DC~2.5 GHz • 30 V peak CAT I • Compatibility: MSO/DS7000, MSO8000, HDO4000, and DS70000 series
Low Voltage Single-ended Probe		
 RP7080S	Single-ended Active Probe	• Input Range: ±6.25 V • BW: DC~800 MHz • 30 V peak CAT I • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000, and DS70000 series
 RP7150S	Single-ended Active Probe	• Input Range: ±6.25 V • BW: DC~1.5 GHz • 30 V peak CAT I • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000, and DS70000 series

Model	Type	Description
Current Probe		
 PCA1030	Current Probe	• BW: DC~50 MHz (-3 dB) • Max. continuous input range: 30 A_{rms} • Max. peak-peak current value: 50 A peak, non-continuous • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000, and DS70000 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/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000, and DS70000 series
 PCA2030	Current Probe	• BW: DC~100 MHz (-3 dB) • Max. continuous input range: 30 A_{rms} • Max. peak-peak current value: 50 A peak, non-continuous • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000, and DS70000 series
 PCA1500	Current Probe	• BW: DC~2 MHz (-3 dB) • Max. continuous input range: 500 A_{rms} • Max. peak-peak current value: 700 A peak, non-continuous • Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, HDO4000, 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

Model	Type	Description
 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
 RP1003C	Current Probe	• BW: DC~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~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~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.
 RP1006C	Current Probe	• BW: DC~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.

Model	Type	Description
 RP1000P	4CH Power Supply	Four-channel power adapter for RP1003C, RP1004C, RP1005C, and RP1006C Current Probes.

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 HDO4000 Series Technical Specifications

Overview of the HDO4000 Series Technical Specifications			
Model	HDO4204	HDO4404	HDO4804
Analog Bandwidth (50 Ω, -3 dB)	200 MHz	400 MHz	800 MHz
Analog Bandwidth (1 MΩ, -3 dB)	200 MHz	400 MHz	500 MHz
Calculated Rise Time under 50 Ω (10% to 90%, typical)	≤1.75 ns	≤875 ps	≤437 ps
Input Channels	4 analog channel inputs, 1 EXT channel input		
Sampling Mode	Real-time sampling		
Max. Sample Rate of Analog Channels	4 GSa/s (single channel[1]), 2 GSa/s (half channels[2]), 1 GSa/s (all channels[3])		
Max. Memory Depth	Standard: 250 Mpts (single channel[1]), 125 Mpts (half channels[2]), 62.5 Mpts (all channels[3]) Optional: 500 Mpts (single channel[1]), 250 Mpts (half channels[2]), 125 Mpts (all channels[3])		
Max. Waveform Capture Rate	50,000 wfms/s (Vector Mode) 1,500,000 wfms/s (UltraAcquire Mode)		
Vertical Resolution	12 bits		
Hardware Real-time Waveform Recording and Playing	Up to 500,000 frames		
Peak Detect	Capture glitches as narrow as 500 ps		
Display Size and Type	10.1-inch capacitive multi-touch display		
Display Resolution	1280×800		

Vertical System Analog Channels

Vertical System Analog Channels		
Input Coupling		DC, AC, or GND
Input Impedance		1 MΩ ± 1%, 50 Ω ± 1%
Input Capacitance		19 pF ± 3 pF
Probe Attenuation Ratio		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
Probe Recognition		Auto-recognized RIGOL probe
Maximum Input Voltage	1 MΩ	CAT I 300 V_{rms}, 400 V_{pk} (DC + V_{peak}) Frequency derating (assumes sine wave input): 400 V_{pk} until 40 kHz. Then derates at 20 dB/dec until 6 V_{pk}.
	50 Ω	5 V_{rms}
	Remarks	No transient overvoltage allowed for 50 Ω or 1 MΩ routes whether the probe is used or not. Use this instrument only for measurements within its specified measurement category (not rated for CAT II, III, IV).
Vertical Resolution		12 bits
Effective Number of Bits (ENOB, Typical))		> 8
Input Sensitivity Range[4]	1 MΩ	100 μV/div to 10 V/div
	50 Ω	100 μV/div to 1 V/div
Offset Range	1 MΩ	± 0.5 V (<500 μV/div) ± 1 V (≥500 μV/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 (≤135 mV/div) ±4 V (>135 mVdiv)
Dynamic Range		±4 div (12 bits)

Vertical System Analog Channels	
Bandwidth Limits (Typical)	20 MHz, 250 MHz, FULL; selectable for each channel
DC Vertical Gain Accuracy[4]	± 2% full scale
DC Vertical Offset Accuracy	≤200 mV/div (± 0.1 div ± 2 mV ± 1.5% of offset setting) >200 mV/div (± 0.1 div ± 2 mV ± 1.0% of offset setting)
Channel-to-channel Isolation	≥100:1 (from DC to 500 MHz), ≥30:1 (> 500 MHz to full bandwidth)
ESD Tolerance	±8 kV (for input BNC)

Horizontal System Analog Channels

Horizontal System Analog Channels		
Time Base Range		500 ps/div to 1 ks/div
		Time base fine adjustment setting available
Time Base Resolution		100 ps
Time Base Accuracy		±1.5 ppm ± 1 ppm/year
Time-base Delay Time Range	Pre-trigger	-5 div
	Post-trigger	1 s or 100 div, whichever is greater
Δ Time Accuracy		± (time base accuracy x reading) ± (0.001 x screen width) ± 20 ps
Channel-to-channel Deskew		Channel-to-channel deskew range: ±100 ns, accuracy: ±1 ps
Analog Channel-to-Channel Delay (Typical)		≤500 ps [5]

Horizontal System Analog Channels		
Horizontal Mode	YT	Default mode
	XY	On channel 1/2/3/4
	SCAN	Time base ≥ 200 ms/div
	ROLL	Time base ≥ 50 ms/div or ≥ 100 ms/div (selectable), available to enter or exit the ROLL mode by turning the horizontal timebase knob

Acquisition System

Acquisition System		
Max. Sample Rate of Analog Channels	4 GSa/s (single channel[1]), 2 GSa/s (half channels[2]), 1 GSa/s (all channels[3])	
Max. Memory Depth of Analog Channels	Standard: 250 Mpts (single channel[1]), 125 Mpts (half channels[2]), 62.5 Mpts (all channels[3]) Optional: 500 Mpts (single channel[1]), 250 Mpts (half channels[2]), 125 Mpts (all channels[3])	
Acquisition Mode	Normal	Default mode
	Peak Detect	Capture glitches as narrow as 500 ps
	Average	Selectable from 2, 4, 8, 16...to 65,536
	High Resolution	14 bits, 16 bits
	UltraAcquire	Up to 1,500,000 wfms/s waveform capture rate

Trigger System

Trigger System	
Trigger Sources	Analog channel (1~4), EXT TRIG, AC Line
Trigger Mode	Auto, Normal, and Single

Trigger System		
Trigger Coupling	DC	DC coupled trigger
	AC	AC coupled trigger
	HF Reject	High frequency reject, cutoff frequency ~75 kHz (internal trigger only)
	LF Reject	Low frequency reject, cutoff frequency ~75 kHz (internal trigger only)
Noise Rejection		Increase delay for the trigger circuit (internal trigger only), on/off
Trigger Holdoff Range		8 ns to 10 s
Trigger Bandwidth	Internal	Analog bandwidth
	External	200 MHz
Trigger Sensitivity	Internal	0.50 div, ≥50 mV/div 0.7 div (with noise rejection enabled)
	External	200 mVpp, from DC to 100 MHz 500 mVpp, from 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	±5 div from center 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, Nth Edge trigger, I2C, SPI, RS232/UART, CAN Optional: CAN-FD, LIN, FlexRay, I2S, MIL-STD-1553

Trigger Type	
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
Pulse Width	Triggers on the positive or negative pulse, whose time duration is less than a value, greater than a value, or inside a time range. Source channel: CH1~CH4
Slope	Triggers on the positive or negative slope of the specified time, whose time is less than a value, greater than a value, or inside a time range. Source channel: CH1~CH4
Video	Trigger on all lines, specified line, odd/even fields that conform 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~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 less than a value, greater than a value, inside a time range, or outside a time range. Source channel: CH1~CH4
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~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 delay time is less than a value, greater than a value, inside a time range, or outside a time range. Source channel: CH1~CH4

Trigger Type	
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~CH4
Nth Edge	Triggers on the Nth edge after the specified idle time. The edge can be specified as Rising or Falling. Source channel: CH1~CH4
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~CH4
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~CH4
SPI	Triggers on the specified pattern of the specified data width (4 to 32) of SPI bus. CS and Timeout are supported. Source channel: CH1~CH4
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 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~CH4
CAN-FD (Optional)	HDO4000-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-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~CH4
FlexRay (Optional)	HDO4000-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~CH4
LIN (Optional)	HDO4000-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

Trigger Type	
I2S (Optional)	HDO4000-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 (Optional)	HDO4000-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

Search & Navigate

Search & Navigate	
Type	Edge, pulse width
Source	Analog channels
Copy	Copy to/from trigger; independent settings including threshold and trigger condition setup
Result Display	Event lister or be exported to external/internal memory
Navigate	Time: view acquired waveforms in time order
	Event: use the navigation controls to go to found search events
	Segment: use the navigation controls to play through the acquired segments in UltraAcquire mode

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 to CH4, Math1 to Math4
	Measurement Range	Main, Zoom
	All Measurements	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, Period Area, and AC RMS.
	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 Math

Waveform Math	
Number of Math Functions	4, displays 4 math functions simultaneously
Arithmetic	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, and BandStop
Color Grade	FFT supported

Waveform Math		
FFT	Record Size	Up to 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

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 500,000.
	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
Color Grade		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	All modes available

Serial Decoding

Serial Decoding	
No. of Decodings	4, decodes and enables/disables four protocol types simultaneously

Serial Decoding	
Decoding Type	Standard: Parallel, RS232/UART, I2C, SPI, CAN Optional: LIN, CAN-FD, FlexRay, I2S, MIL-STD-1553
Parallel	Up to 4 bits of Parallel decoding, available for any analog channel User-defined clock and auto clock settings are supported. Source channel: CH1~CH4
RS232/UART	Decodes the RS232/UART (up to 20 Mb/s) bus's TX/RX data (5 to 9 bits), parity (Odd, Even, or None), and stop bits (1 to 2 bits) Source channel: CH1~CH4
I2C	Decodes the address (with or without the R/W bit) of the I2C bus, data, and ACK. Source channel: CH1~CH4
SPI	Decodes the MISO/MOSI data (4 to 32 bits) of the SPI bus. Timeout and CS are supported. Source channel: CH1~CH4
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~CH4
CAN-FD (Optional)	HDO4000-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~CH4
LIN (Optional)	HDO4000-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
FlexRay (Optional)	HDO4000-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~CH4

Serial Decoding	
I2S (Optional)	HDO4000-AUDIOA option Decodes I2S audio bus left channel data and right channel data, supporting 4 to 32 bits. The available alignment modes include I2S, LJ, and RJ. Source channel: CH1~CH4
MIL-STD-1553 (Optional)	HDO4000-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	Minimum voltage greater than 10 mVpp, duty cycle greater than 1%, and frequency over 35 Hz

Digital Voltmeter

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

Precision Counter

Precision Counter		
Source		Any analog channel and EXT
Measurement		Frequency, period, totalize
Totalizer	Resolution	3 to 6 digits, user-defined
	Max. Frequency	Maximum analog bandwidth
Totalizer		48-bit totalizer
		Counts the number of the rising edges
Time Reference		Internal Reference

Command Set

Command Set	
Common Commands Support	Standard SCPI commands
Error Message Definition	Error Message
Support Status Report Mechanism	Status Reporting
Support Sync Mechanism	Synchronization

Display

Display	
LCD	10.1-inch capacitive multi-touch gesture-enabled display
Resolution	1280×800 (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)

Processor System

Processor System	
Processor	Cortex-A72, 1.8 GHz, hexa-core
System Memory	4 GB RAM
Operating System	Android
Internal Non-volatile Memory	8 GB

I/O

I/O	
USB3.0 Host	2 on the front panel
USB3.0 Device	1 on the rear panel
LAN Port	1 on the rear panel, 10/100/1000 Base-T, supporting LXI-C
Web 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		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	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 to 10 ms)
	Rise Time	≤ 1.2 ns
10 MHz Reference Clock In/Out	Input Interface	1, BNC connector on the rear panel
	Output Interface	1, BNC connector on the rear panel
	Input Mode	50 Ω, with the amplitude 130 mVpp to 4.1 Vpp (-10 dBm, 20 dBm), frequency 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 an external monitor or projector
Probe Compensation Output		1 kHz frequency, 0 to 3 V amplitude, Square

Power

Power	
Power Voltage	100 to 240 V, 45 to 440 Hz
Power	Up to 200 W (connect to various interfaces, USB, and active probes)
Fuse	3.15 A, T degree, 250 V

Environment

Environment		
Temperature Range	Operating	0℃ to +50℃
	Non-operating	-30℃ to +60℃

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 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
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	

Regulations	
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	358.14 mm (W)×214.72 mm (H)×120.62 mm (D)
Rack Mount Kit	4U
Weight[6]	Net: 3.8 kg
	Shipping: 5.37 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		8 GB
Reference Waveform		Displays 10 internal waveforms
Setting		Limited by size of USB drive
USB Capacity		Industry standard flash drives

NOTE:

[1]: If any one of the channels is enabled, it is called single channel mode.

[2]: If two of the channels are enabled, it is called half channels mode.

[3]: If any three channels or all four channels are enabled, it is called all channels mode.

[4]: 100 µV/div, 200 µV/div, and 500 µV/div are a magnification of 1 mV/div setting. For vertical accuracy calculations, use full scale of 8 mV for sensitivity setting.

[5]: 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 setting.

[6]: Standard configuration.

Order Information and Warranty Period

Order Information

Order Information	Order No.
Base Unit	
200 MHz, 4 GSa/s, 250 Mpts, 4CH DHO	HDO4204
400 MHz, 4 GSa/s, 250 Mpts, 4CH DHO	HDO4404
800 MHz, 4 GSa/s, 250 Mpts, 4CH DHO	HDO4804
Standard Accessories	
Power cord (based on destination country)	— —
USB Cable	— —
4 Passive HighZ Probes (350 MHz), Standard for HDO4204	PVP2350
4 Passive HighZ Probes (500 MHz), Standard for HDO4404/ HDO4804	RP3500A
Bandwidth Upgrade Option	
200 MHz to 400 MHz Upgrade Option	HDO4000-BWU2T4
200 MHz to 800 MHz Upgrade Option	HDO4000-BWU2T8
400 MHz to 800 MHz Upgrade Option	HDO4000-BWU4T8
Memory Depth Upgrade Option	
500 Mpts Memory Depth Upgrade Option	HDO4000-RLU-05
Serial Protocol Analysis Option	
Automotive Serial Triggering and Analysis (CAN-FD/LIN)	HDO4000-AUTOA
Aerospace Serial Triggering and Analysis (MIL-STD-1553)	HDO4000-AEROA
Automotive Serial Triggering and Analysis (FlexRay)	HDO4000-FLEXA
Audio Serial Triggering and Analysis (I2S)	HDO4000-AUDIOA
Others	
Power Analysis Option	HDO4000-PWRA
Battery Pack Option	HDO4000-BPACK

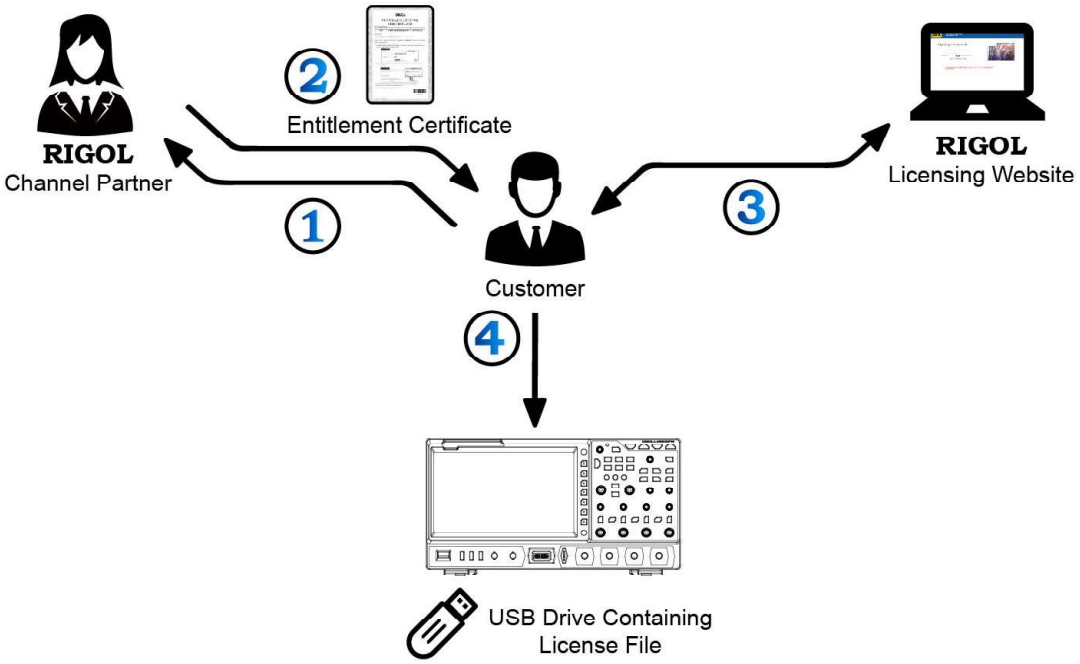
NOTE:

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

Distribution in the UK & Ireland

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