RIGOL

# DS80000 Series

## Digital Oscilloscope

## Data Sheet

DSA38100-1110

Sept. 2024

# Product Overview

DS80000 series high-bandwidth real-time digital oscilloscope is the 8th generation of RIGOL's self-developed oscilloscopes. It provides 13 GHz analog bandwidth, 40 GSa/s real-time sample rate, 4 Gpts memory depth. It supports the compliance analysis of various protocols, helping you locate the problem in high-speed design and address the verification problem.

# Customer Value

## High Performance

- Up to 13 GHz analog bandwidth, powerful high-speed signal analysis;
- Up to 40 Gsa/s real-time sample rate on each channel, powerful signal acquisition capability;
- Up to 4 Gpts memory depth, allowing signal details to be presented clearly.

## High Availability

- The tilt of the 15.6-inch high-definition large touch screen can be electronically adjusted with one button, supporting gesture-enabled operation, multi-pane windowing;
- High-definition smart and quick-responsive shortcut menu display can be extended as a secondary display with user-defined quick operation menu;
- Control with the SCPI command sets;
- Provides USB/LAN/HDMI® interfaces to meet diversified test application scenarios.

## Powerful Analysis Capability

Various advanced analysis functions, compliance analysis tests of various protocols, jitter analysis, etc.

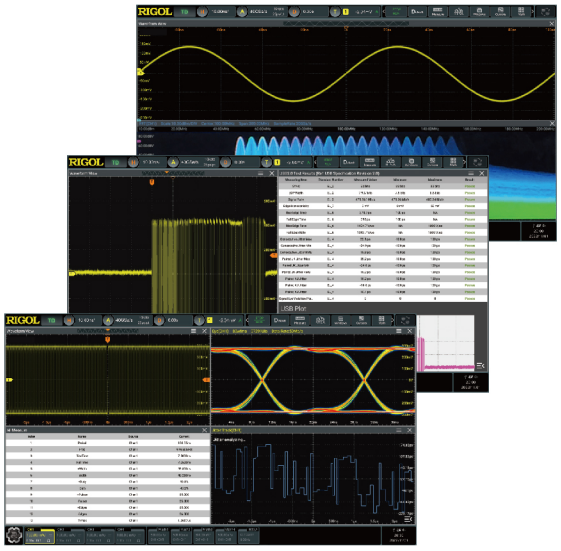
# Typical Application

## ❶ High-Speed Signal Protocol Compliance Analysis

With the 13 GHz bandwidth and 40 Gsa/s real- time sample rate, the DS80000 series digital oscilloscope can cover more high-speed signal protocol compliance analysis application scenarios, providing more compliance analysis tests such as PCIe, and USB2.0.

## ❷ High-Speed Components and System Performance Validation

DS80000 series provides advanced jitter and eye diagram analysis functions, which can be widely applied to the following scenarios such as complex embedded system debugging, high-speed serial and parallel bus performance test, clock jitter, signal integrity, and PLL performance validation.



# Product Features

## Product Features

- Built on RIGOL's brand new core module
- 4 analog channels, 1 EXT channel
- Analog channel bandwidth: Max. 13 GHz
- Up to 40 GSa/s sample rate
- Max. 2 Gpts or 4 Gpts memory depth (opt.)
- Max. waveform capture rate: 250,000 wfms/s
- Vertical resolution: 8-16 bits adjustable
- Vertical sensitivity range: 1 mV/div ~ 1 V/div (50Ω)
- Timebase range: 20 ps/div~1 ks/div
- N-in-1 instrument, including digital oscilloscope, digital voltmeter, 8-digit frequency counter and totalizer, and protocol analyzer (option)
- Various trigger functions: Zone trigger, Edge trigger, Pulse trigger, Slopetrigger, Video trigger, Pattern trigger, Duration trigger, Timeout trigger, Runttrigger, Window trigger, Delay trigger, Setup/Hold trigger, Nth Edge trigger, RS232/UART, I2C, SPI, CAN, FlexRay, LIN, I2S, and MIL-STD-1553
- Various serial bus decodings (opt.): RS232/UART, I2C, SPI, CAN, CAN-FD,FlexRay, LIN, I2S, MIL-STD-1553, USB2.0; 4 decode channels
- Support Ethernet, USB2.0, and other protocol compliance analysis functions
- Auto measurement of 41 waveform parameters; full-memory hardware measurement function
- Various math operations: 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 built-in peak search functions
- Real-time eye diagram and and jitter analysis (opt.)
- Recording and playback functions for a maximum of 2,000,000 frames of hardware real-time and ceaseless waveforms
- Multiple interfaces available: USB HOST&DEVICE, LAN(LXI), HDMI, AUX OUT; Web Control supported
- 15.6'' HD capacitive multi-touch screen with one-button electronic tilt; multi-pane windowing
- 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
- High-definition smart and quick-responsive shortcut menu display
- Support online upgrade

DS80000 series high-bandwidth real-time digital oscilloscope is the 8th generation of RIGOL's self-developed oscilloscopes. It provides 13 GHz analog bandwidth, 40 GSa/s real-time sample rate, 4 Gpts memory depth, and up to 250,000 wfms/s capture rate. It supports the compliance analysis of various protocols, helping you locate the problem in high-speed design and address the verification problem.

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

| | MSO8000/A | DS70000 | DS80000 |
|---|---|---|---|
| **Analog Channel** | 4 | 4 | 4 |
| **Digital Channel** | 16 | N/A | N/A |
| **Analog Bandwidth** | 600 MHz to 3 GHz | 3 GHz to 5 GHz | 6 GHz to 13 GHz |
| **Max. Sample Rate** | 10 GSa/s | 20 GSa/s | 40 GSa/s |
| **Max. Memory Depth** | 500 Mpts | 2 Gpts (option) | 2 Gpts or 4 Gpts (option) |
| **Waveform Capture Rate** | >600,000 wfms/s | >1,000,000 wfms/s | > 250,000 wfms/s |
| **Max. Frames of Waveform Recording** | 450,000 | 2,000,000 | 2,000,000 |
| **LCD** | 10.1'' capacitive multi-touch screen | 15.6'' capacitive multi-touch screen with one-button electronic tilt | 15.6'' Capacitive multi-touch screen with one-button electronic tilt |
| **Hardware Mask Test** | Standard | Standard | Standard |
| **Arbitrary Waveform Generator** | 2 CH, 25 MHz (opt.) | N/A | N/A |
| **Digital Voltmeter** | Standard | Standard | Standard |
| **Hardware Counter** | 6-digit frequency counter + totalizer | 8-digit frequency counter + totalizer | 8-digit frequency counter + totalizer |
| **Search and Navigation** | Support table display | N/A | Support table display |
| **Power Analysis** | Built-in UPA (opt.) + PC | N/A | N/A |
| **Real-time Eye Diagram** | Option | Option | Option |
| **Jitter Analysis** | Option | Option | Option |
| **Protocol Compliance Analysis** | N/A | USB2.0 (opt.), LAN (opt.) | USB2.0 (opt.), LAN (opt.) |
| **Serial Protocol Analysis (Option)** | RS232/UART, I2C, SPI, CAN, 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, MIL-STD-1553 and USB2.0 |
| **Waveform Color Persistence** | Standard | Standard | Standard |
| **Histogram** | Standard | N/A | Standard |
| **FFT** | FFT, standard | FFT, standard | FFT, standard |

| | MSO8000/A | DS70000 | DS80000 |
|---|---|---|---|
| **MATH** | 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 |

# RIGOL Probe Adapters Supported

## Probe Adapter

| Name | Type | Description |
| --- | --- | --- |
| BNC Adapter Input 50Ω | BNC Adapter | 50 Ω to 3.5 mm (F)-BNC(F) Connector |
| High Impedance Adapter | High-impedance Probe Adapter | 3.5 mm to BNC (1 MΩ) |

# 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 DS80000 Series Technical Specifications

| Overview of the DS80000 Series Technical Specifications | | | | |
|---|---|---|---|---|
| Model | DS80604 | DS80804 | DS81004 | DS81304 |
| No. of Analog Channels | 4 | 4 | 4 | 4 |
| Max. Analog Bandwidth[1] | 6 GHz | 8 GHz | 10 GHz | 13 GHz |
| Total Sample Rate | 160 GSa/s | | | |
| Channel Sample Rate | 40 GSa/s[1] | | | |
| Max. Memory Depth | Standard: 500 Mpts Option: 2 Gpts or 4 Gpts[1] | | | |
| Sampling Mode | Real-time sampling | | | |
| Rise Time | ≤73 ps (6 GHz); ≤55 ps (8 GHz); ≤44 ps (10 GHz); ≤33 ps (13 GHz)<br>(50 Ω impedance, 10%-90%, typ.) | | | |
| Max. Waveform Capture Rate | 250,000 wfms/s | | | |
| Vertical Resolution | 8-16 bits; selectable | | | |
| Max. Frames of Recording | Max. 2,000,000 frames | | | |
| Peak Detection | Captures 100 ps glitches | | | |
| LCD | Main display: 15.6'' capacitive multi-touch screen with one-button electronic tilt<br>Secondary display: 3.5'' capacitive multi-touch screen with user-defined shortcut key menu, supporting quick-responsive touch operation with vibration | | | |
| Display Resolution | Main display: 1920x1080; secondary display: 480x320 | | | |

## Vertical System--Analog Channel

| Vertical System--Analog Channel | | |
|---|---|---|
| Input Impedance | | 50 Ω ± 3% |
| Input Coupling | | DC[2] |
| Probe Attenuation Coefficient | Probe Ratio | 0.0001X, 0.0002X, 0.0005X, 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 |
| | Attenuation Ratio | ±60 dB |
| Maximum Input Voltage | 50 Ω | ≤10 mV/div Scale: 2 $V_{rms}$<br>>10 mV/div Scale: 5 $V_{rms}$ |
| | Remarks | The probe allows a higher voltage test technically. Transient overvoltage is not allowed whether the probe is used or not. Please use the instrument dedicated for the specified measurement category (not applicable to CAT II, III, and IV) |
| Vertical Resolution | | 8 bits<br>9-16 bits (selectable) (high-resolution mode) |
| Vertical Sensitivity Range[3] | 50 Ω | 1 mV/div to 1 V/div |
| Offset Range | 50 Ω | ±0.6 V (≤60 mV/div)<br>±2.5 V (>60 mV/div, ≤200 mV/div)<br>±4 V (>200 mV/div, ≤1 V/div) |
| Dynamic Range | | ±5 div (8-bit) |
| Bandwidth Limit (Typical) | 50 Ω | 500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, 7 GHz, 8 GHz, 9 GHz, 10 GHz, 11 GHz, and 12 GHz; independently selectable for each channel[4]<br>The bandwidth limit is automatically set to 500 MHz when the vertical scale is smaller than 5 mV. |
| DC Gain Accuracy[3] | | ± 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 | | ≥60 dB |

## Horizontal System--Analog Channel

| Horizontal System--Analog Channel | | | | | |
|---|---|---|---|---|---|
| Range of Time Base | | 6 GHz | 8 GHz | 10 GHz | 13 GHz |
| | | 100 ps/div to 1 ks/div | 50 ps/div to 1 ks/div | 50 ps/div to 1 ks/div | 20 ps/div to 1 ks/div |
| | | Fine | | | |
| Time Base Resolution | | 1 ps | 0.5 ps | 0.5 ps | 0.2 ps |
| Time Base Accuracy | | ±0.2 ppm (initial calibration accuracy) ± 1 ppm/year (aging rate) | | | |
| Time Base Delay Range | Pre-trigger | -5 div | | | |
| | Post-trigger | Acquisition Time for the Max. Memory Depth | | | |
| Time Interval (ΔT) Measurement (using Cursor) | | ±(Time Base Accuracy x Readout) ± (0.001 x Screen Width) ± 20 ps | | | |
| Inter-channel Offset Correction Range | | ±100 ns, Accuracy±1 ps | | | |
| Analog Channel-to-Channel Skew (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 | 40 GSa/s[1] |
| Max. Memory Depth of Analog Channel | Standard: 500 Mpts Option: 2 Gpts or 4 Gpts[1] |

| Acquisition System | | |
|---|---|---|
| Acquisition Mode | Normal | Default |
| | Peak Detection | Captures 100 ps glitches |
| | Average Mode | 2, 4, 8, 16...65536 are available for you to choose |
| | High Resolution | 9-16 bits |

## Vertical Resolution

| Vertical Resolution (@40 GSa/s) | | | | | |
|---|---|---|---|---|---|
| Effective Resolution (bitN) | 9-bit | 10-bit | 12-bit | 14-bit | 16-bit |
| High-Resolution Bandwidth (BW_bitN) (Typical)[6] | 4 GHz | 2 GHz | 800 MHz | 500 MHz | 200 MHz |

## Trigger System

| Trigger System | | |
|---|---|---|
| Trigger Source | | Analog channel (CH1~CH4), EXT TRIG |
| Trigger Mode | | Auto, Normal, Single |
| Trigger Coupling | DC | DC coupling trigger |
| | AC | AC coupling trigger |
| | High Frequency Rejection (Low Pass Filter) | High frequency rejection, cut-off frequency~75 kHz (internal trigger only) |
| | High Frequency Rejection (High Pass Filter) | Low frequency rejection, cut-off frequency~75 kHz (internal trigger only) |
| Noise Rejection | | Increases delay for the trigger circuit (internal trigger only), On/Off |

| Trigger System | | |
|---|---|---|
| Trigger Bandwidth | Internal Trigger | Analog Bandwidth |
| | External Trigger | 200 MHz |
| Trigger Sensitivity | Internal Trigger | 3 div, ≤ 2 mV/div<br>1.5 div, 2 mV/div to 5 mV/div<br>1 div, 5 mV/div to 50 mV/div<br>0.5 div, ≥ 50 mV/div<br>0.75 div or 0.8 div, @500mV/div |
| | External Trigger | 500 mVpp (DC to 200 MHz) |
| EXT TRIG | Input Impedance | 1 MΩ ± 1%, SMA connector |
| | Trigger Jitter (Typical) | ≤1 $ns_{rms}$<br>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 | ±4 V |

## 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<br>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 types can be Rising, Falling, or Either<br>Source channel: CH1 to CH4, or EXT |
| 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.<br>Source channel: CH1 to CH4 |

| Trigger Type | |
|---|---|
| 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 to 10 s).<br>Source channel: CH1 to 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<br>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, and Falling<br>Source channel: CH1 to 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.<br>Source channel: CH1 to CH4 |
| Timeout | Triggers when duration of a certain event exceeds the specified time (200 ps to 10 s). The event can be specified as Rising, Falling, or Either.<br>Source channel: CH1 to CH4 |
| Runt | Triggers when the pulses pass through one threshold but fail to pass through another threshold.<br>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.<br>Source channel: CH1 to CH4 |
| Delay | Triggers when the time difference between the specified edges of Source A and Source B meets the preset time. Delay is greater or smaller than a certain value, or within a certain time range, or outside a certain time range.<br>Source channel: CH1 to 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 to 10 s).<br>Source channel: CH1 to CH4 |

| 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.<br>Source channel: CH1 to CH4 |
| RS232/UART (Option) | DS80000-EMBDA option<br>Triggers on the Start, Error, Check Error, or Data frame of the RS232/UART bus (up to 20 Mb/s).<br>Source channel: CH1 to CH4 |
| I2C (Option) | DS80000-EMBDA option<br>Triggers on the Start, Stop, Restart, MissedACK, Address (7 bits, 8 bits, or 10 bits), Data, or Address Data of the I2C bus.<br>Source channel: CH1 to CH4 |
| SPI (Option) | DS80000-EMBDA option<br>Triggers on the specified pattern of the specified data width (4~32) of SPI bus. CS and Timeout are supported.<br>Source channel: CH1 to CH4 |
| CAN (Option) | DS80000-AUTOA option<br>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.<br>Source channel: CH1 to CH4 |
| FlexRay (Option) | DS80000-AUTOA option<br>Triggers on the specified position (TSS End, FSS_BSS End, FES End, DTS End), frame (null, Sync, 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).<br>Source channel: CH1 to CH4 |
| LIN (Option) | DS80000-AUTOA option<br>Triggers on the Sync, ID, Data (length settable), Data&ID, Wakeup, Sleep, and Error frame of the LIN bus signal (up to 20 Mb/s).<br>Source channel: CH1 to CH4 |

| Trigger Type | |
|---|---|
| I2S (Option) | DS80000-AUDIOA option<br>Triggers on 2's complement data of audio left channel, right channel, or either channel (=, ≠, >, <, <>, ><). The available alignment modes include I2S, LJ, and RJ.<br>Source channel: CH1 to CH4 |
| MIL-STD-1553 (Option) | DS80000-AEROA option<br>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.<br>Source channel: CH1 to CH4 |

## Waveform Measurement

| Waveform Measurement | | |
|---|---|---|
| Cursor | Number of Cursors | 2 pairs of XY cursors |
| | Manual Mode | Voltage deviation between cursors (ΔY)<br>Time deviation between cursors (ΔX)<br>Reciprocal of ΔX (Hz) (1/ΔX) |
| | Track Mode | Fix Y-axis to track X-axis waveform point's voltage and time values<br>Fix 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.<br>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 Mode | Normal (realized by software) and Precision (W); for Precision, only supported by analog channel |
| | Measurement Range | Main, Zoom, Cursor, 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↓) |
| | Analysis | Frequency counter, DVM, histogram, zone trigger, eye diagram (option), and jitter analysis (option) |
| | Statistics | Items: Current, Average, Max, Min, Standard Deviation, Count<br>Max. 1,000 times statistics supported |

## Waveform Calculation

| Waveform Calculation | |
|---|---|
| No. of Math Functions | 4, 4 math functions available to be displayed at one 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 |

| Waveform Calculation | | |
|---|---|---|
| FFT | Record Length | Max. 10 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 is2,000,000 | |
| | Source | All enabled analog channels |
| | Analysis | Supports playing frame by frame or continuous playing; capable of calculating, measuring, and decoding the played waveforms |
| Pass/Fail Test | 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 |
| Histogram | The waveform histogram provides a group of data, showing the number of times a waveform hits within the defined region range on the screen. The waveform histogram not only shows the distribution of hits but also the ordinary measurement statistics. | |
| | Source | Any analog channel |
| | Type | Horizontal and vertical |
| | Measure | Sum, Peaks, Max, Min, Pk_Pk, Mean, Mode, Bin width, Sigma, and XScale |
| 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 | Supports all modes |

| Waveform Analysis | | |
|---|---|---|
| Real-time Eye Diagram (Option) | Makes measurements for the clock or data signal over time, analyze the variance of the technical specifications. | |
| | 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 |
| | Eye Measurement Item | one level, zero level, eye height, eye width, eye amplitude, crossing percentage, Q Factor, extinction ration, DCD (duty cycle distortion), rise time, fall time, bit rate, etc. |
| Jitter Analysis (Option) | Makes measurements for the clock or data signal over time, analyzes the variance of the technical specifications. | |
| | Source | Any analog channel |
| | Clock Recovery | Constant, PLL, and Explicit |
| | Type | Fully automatic, semi automatic, and manual |
| | Jitter Measurement | TIE, Cycle to Cycle, +Width to +Width, –Width to -Width, Pk_Pk, 6-sigma, and RMS |
| | Jitter Analysis | Jitter separation, including TJ (Total Jitter), RJ (Random Jitter), DJ (Deterministic Jitter), PJ (Periodic Jitter), DDJ (Data Dependent Jitter), DCD (Duty Cycle Distortion), ISI (Inter-symbol Interference), and BR (Bit Ratio). Jitter analysis source: TIE, Cycle to Cycle, +Width to +Width, and –Width to -Width |
| | Measurement Display | Trend, Spectrum, Histogram, and BathCurve |

## Search&Navigation

| Search, Navigation, and Table | |
|---|---|
| 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 |

| Search, Navigation, and Table | |
|---|---|
| Result Display | Displays the result in the form of the mark table in the multi-pane window.<br>The search results such as the time, pulse width, data, and address of each event can be exported to the external storage device or internal memory as a file suffixed with "*.csv". |
| Navigation | Time navigation: navigates to view 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. |

## Serial Decoding

| Serial Decoding | |
|---|---|
| Number of Decodings | Four protocol types can be decoded and enabled at the same time |
| Decoding Type | Standard: GPIO<br>Option: RS232/UART, I2C, SPI, CAN, CAN-FD, FlexRay, LIN, I2S, MIL-STD-1553, USB2.0 |
| GPIO | Up to 4 bits of Parallel decoding, supporting any analog channel; supports user-defined clock and auto clock settings.<br>Source channel: CH1 to CH4 |
| RS232/UART (Option) | DS80000-EMBDA option<br>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).<br>Source channel: CH1 to CH4 |
| I2C (Option) | DS80000-EMBDA option<br>Decodes the address (with or without the R/W bit), data, and ACK of the I2C bus.<br>Source channel: CH1 to CH4 |
| SPI (Option) | DS80000-EMBDA option<br>Decodes the MISO/MOSI data (4-32 bits) of the SPI bus. CS and Timeout are supported.<br>Source channel: CH1 to CH4 |

| Serial Decoding | |
|---|---|
| CAN (Option) | DS80000-AUTOA option<br>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.<br>Supports 10 Mb/s CAN-FD baud.<br>Source channel: CH1 to CH4 |
| FlexRay (Option) | DS80000-AUTOA option<br>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.<br>Source channel: CH1 to CH4 |
| LIN (Option) | DS80000-AUTOA option<br>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.<br>Source channel: CH1 to CH4 |
| I2S (Option) | DS80000-AUDIOA option<br>Decodes I2S audio bus left channel data and right channel data, supporting 4-32 bits. The alignment modes include I2S, LJ, and RJ.<br>Source channel: CH1 to CH4 |
| MIL-STD-1553 (Option) | DS80000-AEROA option<br>Decodes the MIL-STD-1553 bus signal's data word, command word, and status word (address+last 11 bits).<br>Source channel: CH1 to CH4 |
| USB2.0 (Option) | Decodes the data frame such as SNYC, PID, and data packets, and completes the CRC check.<br>Source channel: CH1 to CH4 |

## Protocol Compliance Analysis

| Protocol Compliance Analysis (Option) | | |
|---|---|---|
| Protocols | USB 2.0 | DS80000-USBC option<br>Test Item: sync width, EOP width, signal rate, rise time, fall time, edge monotonicity, rise edge rate, fall edge rate, paired JK jitter, paired KJ jitter, consecutive jitter, eye diagram |
| | 100Base-T | DS80000-ENETC option<br>Test Item: Output Voltage, Amplitude Symmetry, Rise/Fall Time, Rise/Fall Time Symmetry, Overshoot, Distortion Based on Duty Cycle, Eye, and Jitter |
| | 1000Base-T | DS80000-ENETC option<br>Test Item in Test Mode1: Template/Volt/Droop<br>Test Item in Test Mode2: Master Mode Jitter<br>Test Item in Test Mode3: Slave Mode Jitter<br>Test Item in Test Mode4: Transmitter Distortion and Common-mode Output Voltage |
| Report | Measurement data include: test item, test results, data range, reference standards, pass/fail test results; supporting exporting the report in HTML format | |

## Auto

| Auto | |
|---|---|
| AutoScale | Min. voltage > 10 mVpp, duty cycle > 1% (35 Hz to 10 GHz period signal) |

## Digital Voltmeter

| Digital Voltmeter | |
|---|---|
| Source | Any analog channel |
| Function | DC, AC+$DC_{rms}$, $AC_{rms}$ |
| Resolution | ACV/DCV: 3-digit |
| 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 |
| Measure | | Frequency, period, totalizer |
| Counter | Resolution | 3-8 bits, user-defined |
| | Max. Frequency | Max. analog bandwidth |
| Totalizer | | 64-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 | 15.6'' capacitive multi-touch screen with one-button electronic tilt, supports gesture-enabled operation |
| Resolution | 1920x1080 (Screen Region) 16:9 |
| Graticule | (10 horizontal divisions) x (8 vertical divisions) |
| Persistence | Off, Infinite, variable persistence (100 ms to 10 s) |
| Brightness | 256 intensity levels (LCD, HDMI) |

## Processor System

| Processor System | |
|---|---|
| Processor | Dual-core Cortex-A72 up to 1.8 GHz |

| Processor System | |
|---|---|
| System Memory | 4 GB RAM |
| Operating System | Android |
| Internal Non-volatile Memory | 128 GB |

## I/O

| I/O | | |
|---|---|---|
| USB3.0 Host | | 2 (1 on the front panel and 1 on the rear panel) |
| USB3.0 Device | | 1 on the rear panel |
| LAN | | 1 on the rear panel, 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 | | Front-panel SMA output connector<br>Vo (H) ≥ 2.5 V open circuit, ≥1.0 V 50 Ω to GND<br>Vo (L) ≤ 0.7 V to load ≤ 4 mA, ≤0.25 V 50 Ω to GND |
| | 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 Interface | 50 Ω, with the amplitude 130 mVpp to 4.1 Vpp (-10 dBm, 20 dBm), frequency 10 MHz ± 1 ppm |
| | Output Interface | 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, 3 Vpp square waveform |

## Power Supply

| Power Supply | |
|---|---|
| Power Voltage | 100 V-127 V, 200 V- 240 V; 50/60 Hz |

| Power Supply | |
|---|---|
| Power | Max. 2000 W (connect to various interfaces, USB, active probes) |

## Environment

| Environment | | |
|---|---|---|
| Temperature Range | Operating | 0℃~+50℃ |
| | Non-operating | -30℃~+70℃ |
| 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 meters |
| | Non-operating | below 15,000 meters |

## 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<br>short interruption: 0% UT during 250 cycles |
| Safety | EN 61010-1:2019<br>EN 61010-031:2015<br>IEC 61010-1:2016<br>IEC 61010-2-030:2017<br>UL 61010-1:2012 R7<br>UL 61010-2-31:2017 R2<br>CAN/CSA-22.2 No. 61010-1-12:2017<br>CAN/CSA-22.2 No. 61010-2-30:2018<br>CAN/CSA-22.2 No. 61010-031-07:201 | |
| Vibration | Meets GB/T 6587; class 2 random<br>Meets MIL-PRF-28800F and IEC60068-2-6; class 3 random | |

| Regulations | |
|---|---|
| Shock | Meets GB/T 6587-2012; class 2 random<br>Meets MIL-PRF-28800F and IEC 60068-2-27; class 3 random<br>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 | 448 mm (W)×310 mm (H)×522.6 mm (D) | |
| Rack Mount Kit | 7U | |
| Weight[7] | Package excluded: 28 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) |
| Internal Capacity | | 125 GB |
| 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]: CH1, CH2, CH3, and CH4 channels are independent of each other. Whatever one or multiple channels are enabled, the maximum specifications of the instrument can be reached.

[2]: Only DC is available for input coupling under the input impedance of 50 Ω.

[3]: 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.

[4]: The following table shows the available bandwidth limits under different bandwidths.

| Bandwidth | BW Limit |
|---|---|
| 6 GHz | 500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz, and 5 GHz |
| 8 GHz | 500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, and 7 GHz |
| 10 GHz | 500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, 7 GHz, 8 GHz, or 9 GHz |

| Bandwidth | BW Limit |
| --- | --- |
| 13 GHz | 500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, 7 GHz, 8 GHz, 9 GHz, 10 GHz, 11 GHz, and 12 GHz |

[5]: For any two channels, with input impedance 50 Ω, DC-coupled, under the same vertical scale, the Volts/div setting is the same for 100 mV/div and 200 mV/div.

[6]: Formula of the high-resolution bandwidth@sample rates other than 40 GSa/s: BW_D = BW_bitN x Fs / 40 G. Wherein, Fs indicates the new sample rate (downsampling); BW_D indicates the new bandwidth.

[7]: Standard configuration.

# Order Information and Warranty Period

## Order Information

| Order Information | Order No. |
|---|---|
| **Model** | |
| 6 GHz, 40 GSa/s, 4-CH | DS80604 |
| 8 GHz, 40 GSa/s, 4-CH | DS80804 |
| 10 GHz, 40 GSa/s, 4-CH | DS81004 |
| 13 GHz, 40 GSa/s, 4-CH | DS81304 |
| **Standard Accessory** | |
| Power Cord Conforming to the Standard of the Destination Country | — — |
| USB Cable x1 | — — |
| Precision BNC Adapter, 3.5 mm to BNC (50 Ω) x2 | BNC Adapter Input 50Ω |
| **Adapter Option** | |
| High-impedance Probe Adapter, 3.5 mm to BNC (1 MΩ) | High Impedance Adapter |
| **Upgrade Option** | |
| 2 Gpts Memory Depth Upgrade Option | DS80000-RLU-20 |
| 4 Gpts Memory Depth Upgrade Option | DS80000-RLU-40 |
| **Measurement and Analysis Option** | |
| Advanced Eye Diagram and Jitter Analysis Option | DS80000-JITTA |
| **Pre-compliance Test Option** | |
| 100M/1000M Ethernet Compliance Test | DS80000-ENETC |
| USB2.0 Compliance Test | DS80000-USBC |
| **Serial Protocol Decoding Options** | |
| Embedded Serial Bus Trigger and Decoding (RS232/UART, I2C, and SPI) | DS80000-EMBDA |
| Auto Serial Bus Trigger and Decoding (CAN, CAN-FD, LIN, FlexRay) | DS80000-AUTOA |
| Audio Serial Bus Trigger and Decoding (I2S) | DS80000-AUDIOA |
| MIL-STD-1553 Serial Bus Triggers and Decodings | DS80000-AEROA |

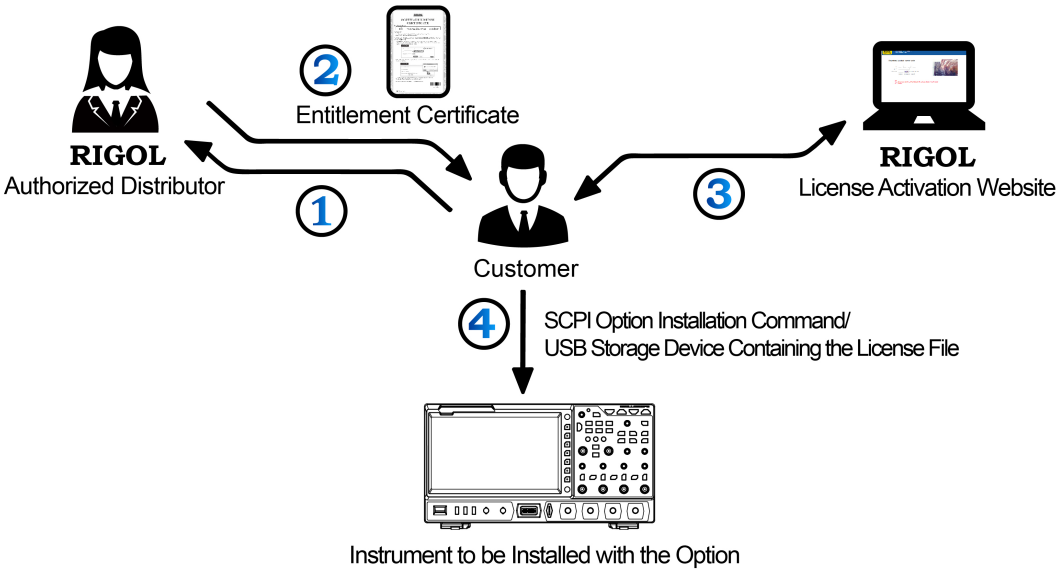
**NOTE:**

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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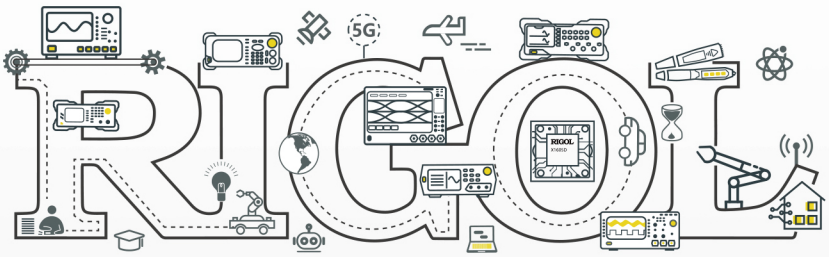


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**HEADQUARTER**

**RIGOL** TECHNOLOGIES CO., LTD.
No.8 Keling Road, New District,
Suzhou,JiangSu, P.R.China
Tel: +86-400620002
Email: info-cn@rigol.com

**EUROPE**

**RIGOL** TECHNOLOGIES EU GmbH
Carl-Benz-Str.11
82205 Gilching
Germany
Tel: +49(0)8105-27292-0
Email: info-europe@rigol.com

**NORTH AMERICA**

**RIGOL** TECHNOLOGIES, USA INC.
10220 SW Nimbus Ave.
Suite K-7
Portland, OR 97223
Tel: +1-877-4-**RIGOL**-1
Email: sales@rigol.com

**JAPAN**

**RIGOL** JAPAN CO., LTD.
5F,3-45-6,Minamiotsuka, Toshima-Ku,
Tokyo,170-0005,Japan
Tel: +81-3-6262-8932
Fax: +81-3-6262-8933
Email: info.jp@rigol.com

**KOREA**

**RIGOL** KOREA CO,. LTD.
5F, 222, Gonghang-daero,
Gangseo-gu, Seoul, Republic of Korea
Tel: +82-2-6953-4466
Fax: +82-2-6953-4422
Email: info.kr@rigol.com

**For Assistance in Other Countries**

Email: info.int@rigol.com