



# Hantek



# DPO8000 series

Digital oscilloscope

Data Manual

202410

## **Warranties and Declarations**

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### **Product certification**

Hantek certified DPO series oscilloscope to meet China's national industry standards and has passed the CE certification.

### **Contact us**

If you have any questions when using the products of Qingdao Hantek Electronic Co., LTD., you can obtain service and support through the following ways:

Email: [service@hantek.com](mailto:service@hantek.com), [support@hantek.com](mailto:support@hantek.com)

Website: <http://www.hantek.com>

# 1 Product Overview

## Product features

- Set 8 independent instruments in one, including: oscilloscope /16-channel logic analyzer/spectrum analyzer/arbitrary wave generator/digital voltmeter / 6-bit frequency meter and accumulator/protocol analyzer/protocol generator;
- Real-time sampling rate up to 8GSa/s, 2G memory depth, hardware real-time waveform recording and playback up to 2 million frames;
- UART, I2C, SPI, LIN, CAN protocol generation function;
- Built in two 200MHz signal sources, with a vertical resolution of 12 bits and a maximum output frequency of 200MHz;
- 10.1-inch multi touch capacitive screen, 256 level waveform grayscale and color temperature display;
- The waveform capture rate is higher than 600000 waveforms per second;
- Rich serial protocol triggering and decoding functions;
- Up to 51 waveform parameters can be automatically measured, and full memory hardware measurement function is also provided;
- Multiple data analysis and processing functions: independent search, navigation buttons and event lists, histograms, Bode plots, power analysis, counters;
- The entire series comes standard with LAN and USB remote communication functions, and supports optional RS232 and HDMI interfaces;
- Wide range, low background noise, vertical sensitivity range: 500  $\mu$  V/div~10 V/div, all levels support full bandwidth;
- Li Shayu waveform supports dual screen display and cursor measurement in XY mode;

10.1 inch multi-touch capacitive screen, 256 level waveform gray scale and color temperature display, 1GHz bandwidth, 8GSa/s sampling rate, 2G memory depth, 600.000wfms/s waveform capture rate; Built in two 200MHz waveform generator, supporting arbitrary wave output; 51 kinds of automatic measurement, providing full memory hardware measurement function; Rich serial protocol triggering and decoding functions; Multiple data analysis and processing functions; Integrate the functions of 8 instruments, significantly simplify the measurement system and speed up the measurement; Rich configuration interfaces are provided for more convenient use; It is a reliable oscilloscope that can provide you with professional measurement.

## 2 Specifications

All technical specifications are applicable to the DPO8000 series oscilloscope, as detailed in the last part of this chapter. To verify whether the oscilloscope meets technical specifications, the oscilloscope must first meet the following conditions:

- Within the specified operating temperature, the oscilloscope must have been operating continuously for more than twenty minutes.
- If the operating temperature changes by more than 5 degrees Celsius, a self calibration operation must be performed, which can be done through the **[Utility]** menu.
- The oscilloscope must be within the factory calibration period.

### Model

Model	Analog Bandwidth	Channels	Max. Memory Depth	real-time sample rate	High waveform capture rate
DPO8104E	1GHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8084E	800MHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8054E	500MHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8034E	350MHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8024E	200MHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8104C	1GHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8084C	800MHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8054C	500MHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8034C	350MHz	4	2Gpts	8GSa/s	600,000wfms/s
DPO8024E	200MHz	4	2Gpts	8GSa/s	600,000wfms/s

### Specifications

No. of Input Channels	4 analog channel input 1 EXT channel input 16 input digital channels
Sampling Mode	Real-time sampling
Max. Sample Rate of Analog Channel	8GSa/s(single-channel) 8GSa/s(half-channel)

	4GSa/s(all channels) (Half-channel mode: CH1 and CH2 are considered as a group; CH3 and CH4 are considered as another group. Each group share the same ADC sample, and either one of the channels in each group is enabled.)
Max. Memory Depth	2Gpts(single-channel), 1Gpts(two-channel), 500Mpts(three or all-channel)
Max. Waveform Capture Rate	600,000wfms/s [5ns point display single channel automatic storage depth]
Peak Detection	Under all the time base settings, capture 0.25ns glitches
LCD Size and Type	10.1-inch capacitive multi-touch screen
Display Resolution	1024*600

#### Vertical System Analog Channel

Input Coupling	DC, AC, GND	
Input Impedance	1 M $\Omega$ $\pm$ 1%, 50 $\Omega$ $\pm$ 1%	
Input Capacitance	21pF $\pm$ 3 pF	
Maximum Input Voltage	1M $\Omega$	CAT I 300 VRMS, 400Vpk; Transient overvoltage1600Vpk
	50 $\Omega$	5 VRMS
Vertical Resolution	8bit	
Vertical Sensitivity Range	1M $\Omega$	500uV/div ~ 10 V/div
	50 $\Omega$	500uV/div ~ 1 V/div
Offset Range	1M $\Omega$	$\pm$ 1V (500uV/div ~ 50 mV/div) $\pm$ 10V(100mV/div ~ 500 mV/div) $\pm$ 100 V (1V/div ~ 10 V/div)
	50 $\Omega$	$\pm$ 1V(500uV/div ~ 50 mV/div) $\pm$ 10V(100mV/div ~ 500 mV/div) $\pm$ 100V(1 V/div )
Dynamic Range	$\pm$ 5 div ( 8 bit )	
Bandwidth Limit	350MHz	20MHz, 100MHz, 200MHz, 350MHz
	500MHz	20MHz, 100MHz, 200MHz, 350MHz
	800MHz	20MHz, 100MHz, 200MHz, 350MHz
	1GHz	20MHz, 100MHz, 200MHz, 350MHz
DC Gain Accuracy	$\pm$ 3% FullScale	

DC Offset Accuracy	<200 mV/div ( $\pm 0.1$ div $\pm 2$ mV $\pm 1.5\%$ of offset value)
	>200 mV/div ( $\pm 0.1$ div $\pm 2$ mV $\pm 1.0\%$ of offset value)
Channel-to-Channel Isolation	40dB, from DC to maximum rated bandwidth of each model
ESD Tolerance	$\pm 8$ kV (on input BNCs)

#### Vertical System Digital Channel

Number of Channels	16 input channels: D1.0~D1.3, D2.0~D2.3, D3.0~D3.3, D4.0~D4.3
Threshold Range	$\pm 7.0$ V, 10 mV step
Threshold Accuracy	$\pm (100 \text{ mV} + 3\% \text{ of the threshold setting})$
Threshold Selection	(1.4V)TTL, (2.5V)CMOS5.0, (1.65V)CMOS3.3, (1.25V)CMOS2.5, (0.9V)CMOS1.8, (-1.3 V)ECL, (3.7V)PECL, (1.2V)LVDS, 0V, User
Max. Input Voltage	$\pm 25$ V peak CAT I; transient overvoltage 800 Vpk
Max. Input Dynamic Range	$\pm 10$ V + threshold
Minimum Voltage Swing	500mVpp
Input Impedance	>10M $\Omega$
Probe Load	8 pF $\pm$ 3pF
Vertical Resolution	1 bit

#### Horizontal System--Analog Channel

Range of Time Base	200MHz	350MHz	500MHz	800MHz	1GHz
	2ns/div~ 1 ks/div	1ns/div~ 1 ks/div	500ps/div ~1 ks/div	500ps/div ~1 ks/div	200ps/div ~1 ks/div
Time Base Accuracy	$\pm 1$ ppm $\pm 1$ ppm/year				
Time Base Delay Range	before triggering	$\geq 1/2$ screen width			

	after triggering	1 s or 100 div, whichever is greater
Time Interval( $\Delta T$ )	$\pm(1 \text{ sample interval}) \pm (2 \text{ ppm} \times \text{readout}) \pm 50 \text{ ps}$	
Inter-channel Offset Correction Range	$\pm 100 \text{ ns}$	
Horizontal Mode	YT	Default
	XY	1 = Channel 1, 2 = Channel 2 3 = Channel 3, 4 = Channel 4
	SCAN	Time base $\geq 100 \text{ ms/div}$ , available to enter or exit the SCAN mode by rotating the Horizontal SCALE knob
	ROLL	Time base $\geq 100 \text{ ms/div}$ , available to enter or exit the ROLL mode by rotating the Horizontal SCALE knob (enable the auto ROLL mode at first)

#### Horizontal System--Digital Channel

Min. Detectable Pulse Width	1 ns
Maximum Input Frequency	500 MHz (accurately copied as the sine wave of the maximum frequency of the logic square wave; input amplitude is the minimum swing; the shortest the ground cable is required for the logic probe)
Inter-channel Time Delay	1ns (typical), 2ns (maximum)

#### Acquisition System

Max. Sample Rate of Analog Channel	2GSa/s(single-channel), 2GSa/s(half-channel), 1GSa/s(all channels) (Half-channel mode: CH1 and CH2 are considered as a group; CH3 and CH4 are considered as another group. Each group share the same ADC sample, and either one of the channels in each group is enabled.)	
Max. Memory Depth	8Gpts(single-channel), 8Gpts(two-channel), 4Gpts(three or all-channel)	
Max. Sample Rate of Digital Channel	2GSa/s(all Channels)	
Acquisition Mode	Normal	Default
	Peak Detection	Capture 1ns glitches
	Average Mode	2, 4, 8, 16...1024 are available for you to choose, averaging point by point



	High Resolution	12 bits (max.)
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### Trigger System

Trigger Source	Analog channel(CH1-CH4), EXT	
Trigger Mode	Auto, Normal, Single	
Holdoff Range	8ns-10s	
Trigger Bandwidth	CH1-CH4	Analog bandwidth
	EXT	200MHz
Trigger Sensitivity	CH1-CH4	1 div or 5 mVpp, whichever is larger, <10mV/div 0.5 div, ≥10mV/div Enable the noise rejection, with trigger sensitivity reducing half
	EXT	CMOS voltage
Trigger Level Range	CH1-CH4	± 4 div from the center of the screen
	EXT	± 1V

### Trigger Type

Trigger Type	Edge trigger, Pulse trigger, Video trigger, Slope trigger, Overtime trigger, Window trigger, Runt trigger, Superamp trigger, Pattern trigger, Delay trigger, Setup/Hold trigger, UART trigger, LIN trigger, CAN trigger, SPI trigger, I2C trigger
Edge trigger	Identify triggering by searching for specified edges (rising edge, falling edge, either edge) and voltage levels on the waveform. Source channel: CH1~CH4, EXT.
Pulse trigger	Set the oscilloscope to trigger on a positive or negative pulse of a specified width. You can set the trigger source, polarity (positive pulse width, negative pulse width), limiting conditions, and pulse width in this menu. Source channel: CH1~CH4, EXT.
Video trigger	Triggered on scan lines, number of lines, odd fields, even fields, and all fields that meet video standards. The supported video standards include NTSC, PAL/SECAM. Source channel: CH1~CH4.
Slope trigger	Set the positive or negative slope of the oscilloscope to trigger from one level to another within a specified time. Source channel: CH1~CH4.
Overtime trigger	Triggered when the time interval ( $\Delta T$ ) from the rising edge (or falling edge) of the input signal to the end of the adjacent falling edge (or rising edge) through the triggering level is greater than the set timeout time.



	Source channel: CH1~CH4, EXT.
Window trigger	Window triggering provides high and low trigger levels. When the input signal passes the high or low trigger level, the oscilloscope triggers. Source channel: CH1~CH4.
Runt trigger	Used to trigger pulses that cross one trigger level but do not cross another trigger level. Source channel: CH1~CH4.
Superamp trigger	Superamp trigger provides a high trigger level and a low trigger level. The instrument triggers when the input signal passes through the high trigger level or the low trigger level. Source channel: CH1~CH4.
Pattern trigger	Logic triggering requires setting the logical values of each channel and the logical relationships between channels (OR, AND). When the logical relationship is met and the set time conditions are met, triggering occurs when the edges of any channel change. Source channel: CH1~CH4.
Delay trigger	You need to set up source A and source B separately. When the time difference ( $\Delta T$ ) between the edge set by source A (edge A) and the edge set by source B (edge B) meets the preset time limit, the oscilloscope triggers, where edge A and edge B must be adjacent edges. Source channel: CH1~CH4, EXT.
Setup/Hold trigger	The establishment time starts from the time when the data channel crosses the power generation level and ends when the designated clock channel edge arrives; The holding time starts when the designated clock channel edge arrives and ends when the data channel crosses the touch generator again. When the establishment time or holding time is less than the preset time, the oscilloscope will trigger. Source channel: CH1~CH4, EXT.
UART(Optional)	Triggered when detecting frame start, frame end, data, checksum error, or error of UART signal. Source channel: CH1~CH4, EXT.
LIN(Optional)	Triggered on the synchronous field of the LIN signal, it can also be triggered on a specified identifier, data, or frame. Source channel: CH1~CH4, EXT.
CAN(Optional)	Triggered at the beginning of the CAN signal frame, at a specified type of frame (such as remote frame, data frame, etc.), or at a specified type of error frame. Source channel: CH1~CH4, EXT.

SPI(Optional)	When the selection or timeout conditions are met, the oscilloscope triggers when it searches for the specified data. Source channel: CH1~CH4, EXT.
I2C(Optional)	Triggered on the start, stop, restart, loss confirmation, address (7 bits, 8 bits, or 10 bits), data, or address data of the I2C bus. Source channel: CH1~CH4, EXT.

### Waveform Measurement

Cursor	Number of Cursors	2 pairs of XY cursors
	Manual Mode	Voltage deviation between cursors ( $\Delta Y$ ) Time deviation between cursors ( $\Delta X$ ) Reciprocal of $\Delta X$ (Hz) ( $1/\Delta X$ )
	Track Mode	Fix Y-axis to track X-axis waveform point's voltage and time values Fix X-axis to track Y-axis waveform point's voltage and time values
	XY Mode	Measure the voltage parameters of the corresponding channel waveforms in XY time base mode. X = Channel 1, Y = Channel 2
Auto Measurement	Number of Measurements	Up to 7 measurements can be displayed at a time.
	Measurement Source	CH1-CH4, Math, D0-D15
	All Measurement	Display 51 measurement items for the current measurement channel; the measurement results are updated continuously; you can switch the measurement channel.
	Horizontal	Freq, Period, RiseT, FallT, PosPW, NegPW, PDuty, NDuty, BWidth, MaxTime, MinTime, +Edges, -Edges, +Pulses, -Pulses, TrigCnt, +slope, -slope
	Vertical	VMean, VMax, VMin, PkPk, VTop, VMid, VBase, VAmp, VRms, Vovr, Vper, PVRms, PVMeas, Vfov, Vrpr
	Others	FRR, FFF, FRF, FFR, LRR, LRF, LFR, LFF, +Phase, -Phase, +AreaDC, -AreaDC, perAreaDC, absAreaDC, +AreaAC, -AreaAC, perAreaAC, absAreaAC
	Statistics	Cur, Avg, Max, Min, Dev, Cnt
	Analyze	Frequency Counter, DVM, Power Analysis, Histogram, Bode Plot

### Waveform Calculation

Operation	A+B, A-B, A*B, A/B, FFT, A&&B, A  B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs, LowPass, HighPass, BandPass, BandStop, AX+B, Expression	
Color Grade	Support Math and FFT	
Source	CH1-CH4, REF	
FFT	Window Type	Rectangular, Blackman-Harris, Hanning (default), Hamming, Flattop, and Triangle
	Peak Search	A maximum of 15 peaks

### 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.	
	Source	All enabled analog channels and digital channels
	Analysis	Support playing frame by frame or continuous playing
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 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	CH1-CH4
	Type	Horizontal, Vertical
	Measure	Sum, Peaks, Max, Min, Pk_Pk, Mean, Median, Mode, Bin width, Sigma
	Mode	Support all modes, except the Zoom, XY, and ROLL modes

### Serial Decoding

Decoding Type	UART, I2C, SPI, LIN, CAN
UART	Decode the data of 20 Mb/s UART bus TX/RX signals (5-9 bits), supporting check bit (no parity, odd parity, and even parity) and stop bit (1bit, 1.5bit, 2bit) settings.
I2C	Decode the address (with or without read/write bits), data, and ACK of the I2C bus.

SPI	Decode data from SPI bus MISO/MOSI. The mode supports timeout and film selection.
LIN	Decode 1. X or 2. X or two versions of LIN bus, with a maximum speed of 20Mb/s.
CAN	Decode remote frames, overloaded frames, and data frames from a 5 Mb/s CAN bus. CAN bus signal types include CAN_ H, CAN_ L, Rx, Tx, Diff.

### Frequency Counter

Source	CH1-CH4
Measure	None, frequency, period, totalizer

### DVM

Source	CH1-CH4
Mode	DC, AC+DC RMS, and AC RMS
Limits Beeper	Sound an alarm when the voltage value is within or outside of the limit range.

### Bode Plot(Optional)

Input Source	CH1-CH4
Output Source	CH1-CH4
Start Frequency	10Hz-10MHz
Stop Frequency	100Hz-25MHz
Display Type	Line chart, table

### Arbitrary Waveform Generator(Optional)

Sample Rate	200MSa/s
Vertical Resolution	12bit
Max. Frequency	200MHz
Standard Waveform	Sine, Square, Ramp, Pulse, DC, Noise, Sinc, Exp.Rise, Exp.Fall, ECG, Gauss, Lorentz, Haversine
Arb Waveform	Arb

Sine	Frequency Range	0.1Hz-200MHz
Square	Frequency Range	0.1Hz-20MHz
Ramp	Frequency Range	0.1Hz-5MHz
Pulse	Frequency Range	0.1Hz-20MHz
Sinc	Frequency Range	0.1Hz-5MHz
Exp.Rise	Frequency Range	0.1Hz-5MHz
Exp.Fall	Frequency Range	0.1Hz-5MHz
ECG	Frequency Range	0.1Hz-1MHz
Gauss	Frequency Range	0.1Hz-1MHz
Lorentz	Frequency Range	0.1Hz-1MHz
Haversine	Frequency Range	0.1Hz-1MHz
Arb	Frequency Range	0.1Hz-10MHz
Waveform Length	2KSa	
Frequency	Accuracy	100 ppm (<10 kHz), 50 ppm (>10 kHz)
	Resolution	100 mHz or 4 bits (whichever is greater)
Amplitude	Output Range	10mVpp-14Vpp(HighZ)
		5mVpp-7Vpp(50Ω)
DC Offset	Range	±7V, HighZ
		±3.5V, 50Ω
	Resolution	100 uV or 3 bits (whichever is greater)
	Accuracy	2%(1KHz)
Output Impedance	50Ω±1%	
Modulation	AM, FM, PM	
	AM	Modulating Waveforms: Sine, Square, Triangle, and Noise
		Modulation Frequency: 1Hz-50KHz
		Modulation Depth: 0%-120%
	FM	Modulating Waveforms: Sine, Square, Triangle, and Noise
		Modulation Frequency: 1Hz-50KHz

	PM	Modulation Offset:0.1Hz-1KHz
		Modulating Waveforms: Sine, Square, Triangle, and Noise
		Modulation Frequency:1Hz-50KHz
		Modulation Depth: 0%-360%
Burst	N Cycle, Infinite	
	Cycle Count	1-10
	Trigger Source	Internal, Manual
	Burst Period	2ms-500s

### QuickAction

Screenshot	Quickly save the screen image to the specified path based on the current image storage menu settings.
Waveform Save	Quickly save the screen or memory waveforms to the specified path based on the current waveform storage menu settings.
Save Settings	Quickly save the setup file to the specified path based on the current setup storage menu settings.
All Measurement	Display all the prompt message windows for all the measurement of the waveforms.
Reset of Statistics	Quickly reset all the measurement statistics data and measurement counts.
	Quickly reset all the statistics information in PassFail function.
Waveform Recording	Quickly start or stop the waveform recording.
Group Saving	Quickly perform the group saving function based on the currently selected item for saving.

### Display

LCD	10.1-inch capacitive multi-touch screen 256-level intensity grading display
Resolution	1024*600
Graticule	(10 vertical divisions) x (8 horizontal divisions)
Persistence	Off, Infinite, variable persistence (100 ms to 10 s)
Display Type	vector or point
Waveform Intensity	adjustable
Screen Grid	Dot, Line, and Close

Grid Brightness	adjustable
Screen Brightness	adjustable

**I/O**

USB HOST	1 on the front panel
USB DEVICE	1 on the rear panel
LAN	1 on the rear panel
RS232/485	1 on the rear panel
HDMI	1 on the rear panel

**Power**

Power Voltage	100-120V, 50/60/400Hz; 100-240V, 50/60Hz
Power	Max.50W
Fuse	4 A, T degree, 250 V

**Environment**

Temperature Range	Operating	0℃~+50℃
	Non-operating	-30℃~+70℃
Humidity Range	Operating	Below +30℃, ≤90%RH (without condensation) +30℃ ~+40℃, ≤75%RH (without condensation) +40℃ ~+50℃, ≤45%RH (without condensation)
	Non-operating	Below 65℃, ≤90%RH (without condensation)
Altitude	Operating	Below 3,000
	Non-operating	Below 15,000

**Mechanical Characteristics**

Dimensions	372mm(L)*138mm(W)*231.5mm(H)	
Weight	Package Excluded	4.05kg



### 3 Order Information and warranty period

#### 3.1 Order Information

Order Information	Order No.
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##### Model

8GSa/S, 2Gpts, 1GHz 4-channel oscilloscope + LA + AWG	DPO8104E
8GSa/S, 2Gpts, 800MHz 4-channel oscilloscope + LA + AWG	DPO8084E
8GSa/S, 2Gpts, 500MHz 4-channel oscilloscope	DPO8054E
8GSa/S, 2Gpts, 350MHz 4-channel oscilloscope	DPO8354E
8GSa/S, 2Gpts, 1GHz 4-channel oscilloscope + LA + AWG	DPO8104C
8GSa/S, 2Gpts, 800MHz 4-channel oscilloscope + LA + AWG	DPO8084C
8GSa/S, 2Gpts, 500MHz 4-channel oscilloscope	DPO8054C
8GSa/S, 2Gpts, 350MHz 4-channel oscilloscope	DPO8354C

Order Information	Order No.
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##### Standard Accessories

Oscilloscope probe (two for 2-channel series, four for 4-channel series)	PP-100(100MHz)
	PP-200(200MHz)
	HT300B(350MHz)
	HT500B(500MHz)
USB cable	--
Power cord conforming to the standard of the destination country	--

## 3.2 Warranty Period

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Mainframe warranty for 3 years, excluding probes and accessories.



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Addr: #35 Building, No. 780 Baoyuan Road, High-tech Zone, Qingdao, Shandong, China 266114

Switchboard: 400-036-7077

Email: [service@hantek.com](mailto:service@hantek.com)

Tel: (0086)532-55678770 & 55678772 & 55678773

Zip code: 266114

Website: [www.hantek.com](http://www.hantek.com)

Qingdao Hantek Electronic Co., LTD