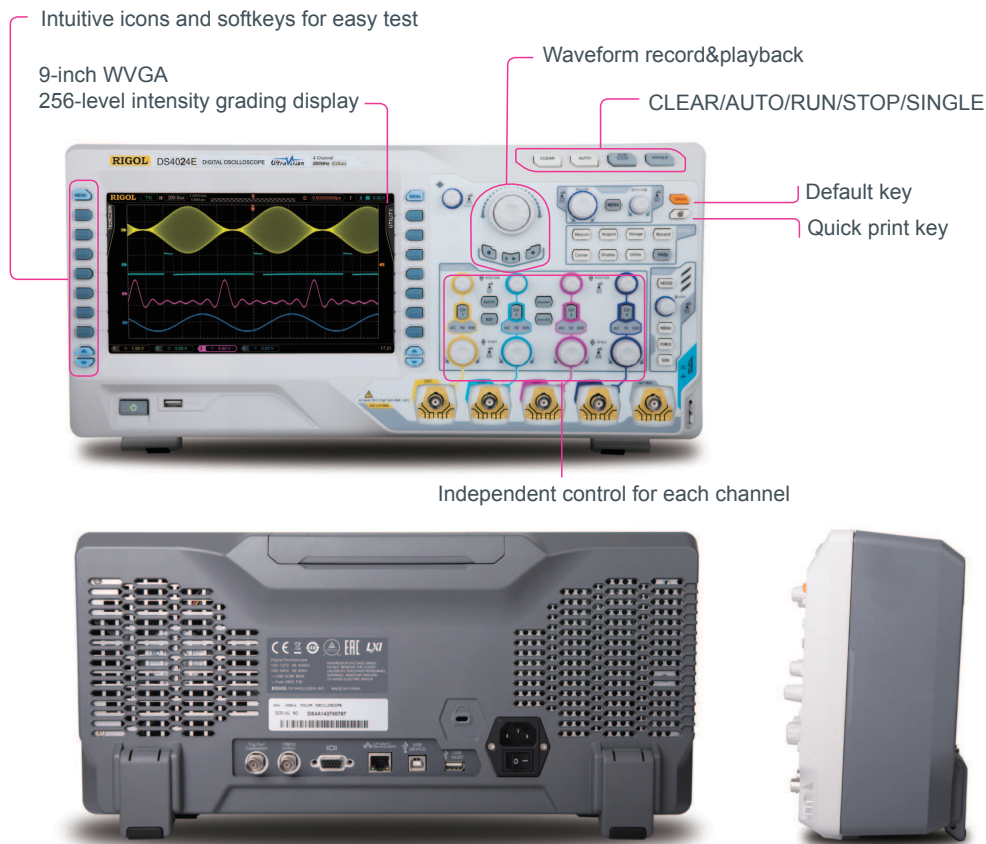# DS4000E Series
Digital Oscilloscope

- Bandwidth: 100 MHz, 200 MHz
- Real-time sample rate: up to 2 GSa/s for each channel
- Memory depth (standard): up to 14 Mpts for each channel
- 4 analog channels (standard)
- Waveform capture rate: up to 60,000 waveforms per second
- Waveform record, playback, and analysis functions
  (standard, up to 127,000 frames)
- Innovative "UltraVision" technology
- A variety of trigger and bus decoding functions
- Low noise floor, with the minimum vertical scale 1mV/div
- A variety of interfaces: USB HOST&DEVICE, LAN (LXI-C),
  VGA, AUX, USB-GPIB (optional)
- Novel and sophisticated industrial design, easy for operation
- 9-inch WVGA, 256-level intensity grading display

The DS4000E series is a high-performance digital oscilloscope designed to meet the demands of the mainstream market for the design, debugging, and testing purposes. Its 4-channel design and high cost-efficiency will invigorate new vitality to the market of the economical oscilloscopes, offering more choices for the low-cost testing and measurement solutions.

RIGOL TECHNOLOGIES, INC.

DS4000E Series Digital Oscilloscope

Intuitive icons and softkeys for easy test

9-inch WVGA
256-level intensity grading display

Waveform record&playback

CLEAR/AUTO/RUN/STOP/SINGLE

Default key

Quick print key

Independent control for each channel

Product Dimensions: Width×Height×Depth = 440.0 mm×218.0 mm×130.0 mm
Weight: 4.8 kg±0.2 kg (packaging excluded)

▶ Innovative UltraVision Technology

- Deep memory depth (standard, up to 14 Mpts)
- High waveform capture rate (up to 60,000 wfms/s)
- Real-time waveform record, playback, and analysis (up to 127,000 frames)
- Multi-level intensity grading display (up to 256 levels)

▶ Models and Key Specifications

| Model Number	DS4024E	DS4014E
Analog Bandwidth	200 MHz	100 MHz
Number of Analog Channels	4	4
Max. Real-time Sample Rate	2 GSa/s for each channel	
Max. Memory Depth	14 Mpts for each channel	
Max. Waveform Capture Rate	60,000 wfms/s	
Hardware Real-time Waveform Record, Playback and Analysis Functions	up to 127,000 frames (standard)	
Probe (Standard)	4 sets of RP3300A 350 MHz BW passive probes for all models	

www.valuetronics.com

▶ Design Features

Up to 60,000 wfms/s waveform capture rate
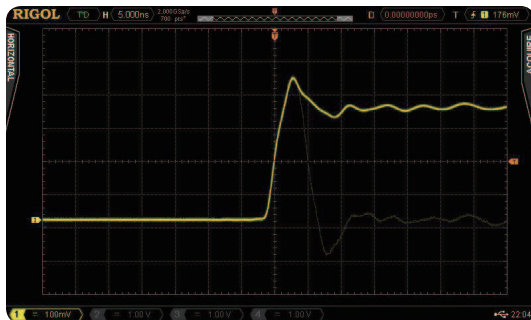
Locate the rare problem easily.

4 analog channels (standard)

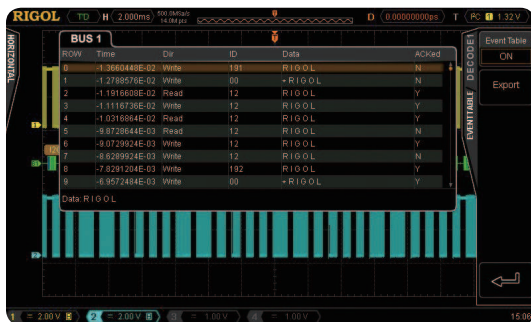### Up to 2 GSa/s real-time sample rate and 14 Mpts memory depth for each channel
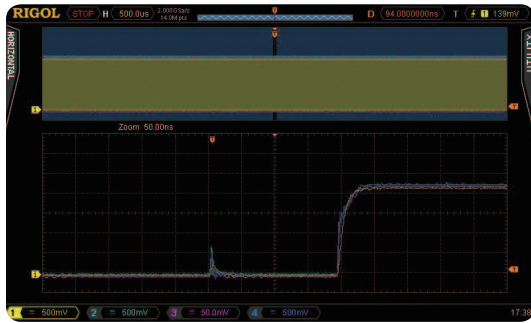
Provide the capability to see both the panorama and detail simultaneously.

Real-time waveform record, playback, and analysis functions (standard)

- Available to record up to 127,000 frames.
- Play back and analyze the recorded waveforms to locate the problem

Serial bus triggering (standard) and decoding (optional)

Mask test function (standard)

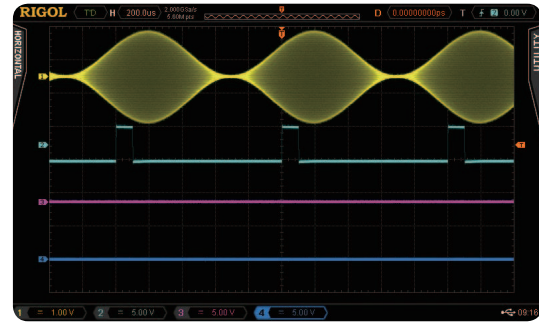User-defined mask, Pass/Fail counts, stop on fail, fail alarm

Advanced math function
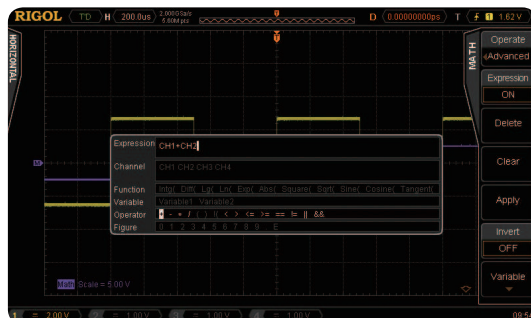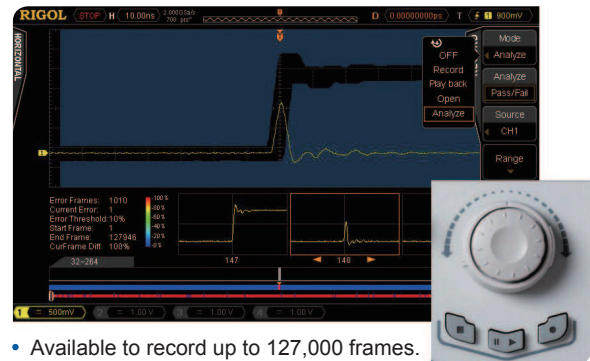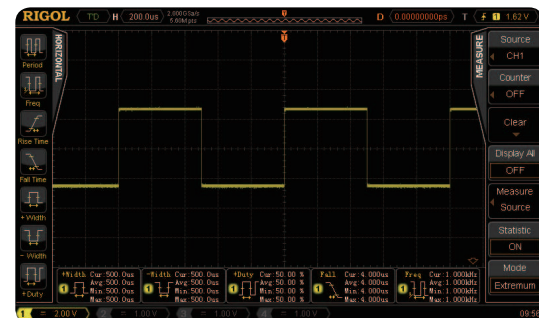

Math operation with formula editor, not just limited to the simple operation, such as add, subtract, multiply, and divide.

Automatic measurements with statistics

RIGOL Probes Supported by DS4000E Series

▶ RIGOL Passive Probes

Model Number	Tpye	Description
RP2200	High Z Probe	1X: DC to 7 MHz 10X: DC to 150 MHz Compatibility: all **RIGOL** scopes.
RP3300A	High Z Probe	10X: DC to 350 MHz Compatibility: all **RIGOL** scopes.
RP3500A	High Z Probe	DC to 500 MHz Compatibility: all **RIGOL** scopes.
RP5600A	High Z Probe	DC to 600 MHz Compatibility: DS4000E series, MSO/DS4000 series and DS6000 series.
RP6150A	Low Z Probe	DC to 1.5 GHz Compatibility: DS4000E series, MSO/DS4000 series and DS6000 series.
RP1300H	High Voltage Probe	DC to 300 MHz CAT I 2000 V (DC+AC), CAT II 1500 V (DC+AC) Compatibility: all **RIGOL** scopes.
RP1010H	High Voltage Probe	DC to 40 MHz DC: 0 to 10 kV DC, AC: pulse ⩽ 20 kVpp, AC: sine wave ⩽ 7 kVrms Compatibility: all **RIGOL** scopes.
RP1018H	High Voltage Probe	DC to 150 MHz DC+AC Peak: 18 kV AC RMS: 12 kV Compatibility: all **RIGOL** scopes.

▶ RIGOL Active&Current Probes

Model Number	Tpye	Description
RP7150	Differential /Single Eended Probe	BW: DC to 1.5 GHz Max. Input Voltage: 30 V peak, CAT I Compatibility: DS4000E series, MSO/DS4000 series, and DS6000 series.
RP1001C	Current Probe	BW: DC to 300 kHz Max. input: DC: ± 100 A AC P–P: 200 A AC RMS: 70 A Compatibility: all **RIGOL** scopes.
RP1002C	Current Probe	BW: DC to 1 MHz Max. input: DC: ± 70 A AC P–P: 140 A AC RMS: 50 A Compatibility: all **RIGOL** scopes.
RP1003C	Current Probe	BW: DC to 50 MHz Max. input: AC P–P: 50 A (non–continuous) AC RMS: 30 A Compatibility: all **RIGOL** scopes. RP1000P power supply required to be ordered
RP1004C	Current Probe	BW: DC to 100 MHz Max. input: AC P–P: 50 A (non–continuous) AC RMS: 30 A Compatibility: all **RIGOL** scopes. RP1000P power supply required to be ordered
RP1005C	Current Probe	BW: DC to 10 MHz Max. input: AC P–P: 300 A (non–continuous), 500 A (@ pulse width ⩽ 30 us) AC RMS: 150 A Compatibility: all **RIGOL** scopes. RP1000P power supply required to be ordered.
RP1000P	Power Supply	Power supply for RP1003C, RP1004C and RP1005C, support 4 channels.
RP1025D	High Voltage Differential Probe	BW: 25 MHz Max. voltage: ⩽ 1400 Vpp Compatibility: all **RIGOL** scopes.
RP1050D	High Voltage Differential Probe	BW: 50 MHz Max. voltage: ⩽ 7000 Vpp Compatibility: all **RIGOL** scopes.
RP1100D	High Voltage Differential Probe	BW: 100 MHz Max. voltage: ⩽ 7000 Vpp Compatibility: all **RIGOL** scopes.

▶ Specifications

All the specifications (except the parameters marked with "Typical") are guaranteed when the instrument has been working for more than 30 minutes under the specified operating temperature.

Sample

Sample Mode	Real-time sample
Max. Real-time Sample Rate	2.0 GSa/s for each channel
Max. Memory Depth	14 Mpts for each channel
Peak Detect	500 ps
Averaging	After all the channels finish N times of sampling at the same time, N can be 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, or 8192.
High Resolution	12 bits when ≥10 µs/div @ 2 GSa/s.

Input

Number of Channels	4 analog channels
Input Coupling	DC, AC, or GND
Input Impedance	(1 MΩ±1%) ‖ (15 pF±3 pF) or 50 Ω±1.5%
Probe Attenuation Coefficient	0.01X to 1000X, in 1-2-5 step
Maximum Input Voltage (1 MΩ)	CAT I 300 Vrms, CAT II 100 Vrms, transient overvoltage 1000 Vpk with RP2200 10:1 probe: CAT II 300 Vrms with RP3300A 10:1 probe: CAT II 300 Vrms with RP3500A 10:1 probe: CAT II 300 Vrms with RP5600A 10:1 probe: CAT II 300 Vrms

Horizontal

Time Base Scale	DS4024E: 2 ns/div to 1 ks/div DS4014E: 5 ns/div to 1 ks/div
Deviation between Channels	1 ns (typical), 2 ns (maximum)
Max. Recording Length	14 Mpts for each channel
Time Base Accuracy[1]	≤ ±4 ppm
Clock Drift	≤ ±2 ppm/year
Delay Range	Pre-trigger (negative delay): Memory Depth/Sample Rate Post-trigger (positive delay): 1 s to 100 ks
Time Base Mode	Y-T, X-Y, Roll, Delayed
Number of X-Ys	2 paths at the same time
Waveform Capture Rate[2]	60,000 wfms/s
Zero Offset	±0.5 div*minimum time base scale

Vertical

Bandwidth (-3 dB) (50 Ω)	DS4024E: DC to 200 MHz DS4014E: DC to 100 MHz
Single Bandwidth (50 Ω)	DS4024E: DC to 200 MHz DS4014E: DC to 100 MHz
Vertical Resolution	8 bits
Vertical Scale	1 MΩ input impedance: 1 mV/div to 5 V/div 50 Ω input impedance: 1 mV/div to 1 V/div
Offset Range	1 MΩ input impedance: 1 mV/div to 225 mV/div: ±2 V 230 mV/div to 5 V/div: ±40 V 50 Ω input impedance: 1 mV/div to 124 mV/div: ±1.2 V 126 mV/div to 1 V/div: ±12 V
Dynamic Range	±5 div

Bandwidth Limit[1]	DS4024E: 20 MHz/100 MHz DS4014E: 20 MHz
Low Frequency Response (AC coupling, -3 dB)	≤5 Hz (on BNC)
Calculated Rise Time[1]	DS4024E: 1.8 ns DS4014E: 3.5 ns
DC Gain Accuracy	±2% full scale
DC Offset Accuracy	200 mV/div to 5 V/div: ±0.1 div ± 2 mV ± 0.5% offset 1 mV/div to 195 mV/div: ±0.1 div ± 2 mV ± 1.5% offset
ESD Tolerance	±2 kV
Channel-to-Channel Isolation	DC to maximum bandwidth: >40 dB

Trigger

Trigger Level Range	Internal: ±6 div from the center of the screen EXT: ±0.8 V
Trigger Mode	Auto, Normal, Single
Holdoff Range	100 ns to 10 s
High Frequency Rejection[1]	50 kHz
Low Frequency Rejection[1]	5 kHz
Edge Trigger	
Edge Type	Rising, Falling, Rising&Falling
Pulse Trigger	
Pulse Condition	Positive Pulse Width (greater than, lower than, within the specific interval); Negative Pulse Width (greater than, lower than, within the specific interval)
Pulse Width Range	4 ns to 4 s
Runt Trigger	
Pulse Polarity	Positive, Negative
Qualifier	None, >, <, <>
Pulse Width Range	4 ns to 4 s
Nth Edge Trigger	
Edge Type	Rising, Falling
Idle Time	40 ns to 1 s
Number of Edges	1 to 65535
Slope Trigger	
Slope Condition	Positive Slope (greater than, lower than, within the specific interval); Negative Slope (greater than, lower than, within the specific interval)
Time Setting	10 ns to 1 s
Video Trigger	
Polarity	Positive, Negative
Synchrony	All Lines, Line Num, Odd Field, Even Field
Standard	NTSC, PAL/ECAM, 480P, 576P, 720P, 1080P, and 1080I
Pattern Trigger	
Pattern Setting	H, L, X, Rising Edge, Falling Edge
RS232/UART Trigger	
Polarity	Normal, Invert
Trigger Condition	Start, Error, Check Error, Data
Baud Rate	2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, 230400 bps, 460800 bps, 921600 bps, 1Mbps, User
Data Bits	5 bit, 6 bit, 7 bit, 8 bit
I2C Trigger	
Trigger Condition	Start, Restart, Stop, Missing ACK, Address, Data, A&D
Address Bits	7 bits, 8 bits, 10 bits
Address Range	0 to 127, o to 255, 0 to 1023

Byte Length	1 to 5
SPI Trigger	
Trigger Condition	CS, Timeout
Timeout Value	100 ns to 1 s
Data Bits	4 bit to 32 bit
Data	H, L, X
Clock Edge	Rising Edge, Falling Edge
CAN Trigger	
Signal Type	Rx, Tx, CAN_H, CAN_L, Differential
Trigger Condition	SOF, EOF, Frame Type, Frame Error
Baud Rate	10 kb/s, 20 kb/s, 33.3 kb/s, 50 kb/s, 62.5 kb/s, 83.3 kb/s, 100 kb/s, 125 kb/s, 250 kb/s, 500 kb/s, 800 kb/s, 1 Mb/s, User
Sample Point	5% to 95%
Frame Type	Data, Remote, Error, OverLoad
Error Type	Bit Fill, Answer Error, Check Error, Format Error, Random Error
FlexRay Trigger	
Baud Rate	2.5 Mb/s, 5 Mb/s, 10 Mb/s
Trigger Condition	Frame, Symbol, Error, TSS
USB Trigger	
Signal Speed	Low Speed, Full Speed
Trigger condition	SOP, EOP, RC, Suspend, Exit Suspend
LIN Trigger	
Version	1.X, 2.X, Both
Trigger Condition	Sync, Identifier, Data, ID&Data, Wakeup, Sleep, Error
ID Range	0 to 63
Data Comparison	=, ≠, <, >, ≤, ≥
Data Length	1 to 8
Data Level	H, L
Baud Rate	19200 bps, 10417 bps, 9600 bps, 4800 bps, 2400 bps, 1200 bps, User
Error Type	Sync, Even-Odd, Checksum

Measure

Cursor	Manual mode: Voltage deviation between cursors ($\triangle$V), time deviation between cursors ($\triangle$T), reciprocal of $\triangle$T (Hz) (1/$\triangle$T) Track mode: voltage and time values at the waveform point Auto mode: allow to display cursors during auto measurement
Auto Measurement	Maximum, Minimum, Peak-Peak Value, Top Value, Bottom Value, Amplitude, Average, Vrms–N, Vrms-1, Overshoot, Pre-shoot, Area, Period Area, Period, Frequency, Rise Time, Fall Time, Positive Pulse Width, Negative Pulse Width, Positive Duty Cycle, Negative Duty Cycle, Delay A↯→B↯, Delay A↳→B↳, Delay A↯→B↳, Delay A↳→B↯, Phase A↯→B↯, Phase A↳→B↳, Phase A↯→B↳, Phase A↳→B↯
Number of Measurements	Displays 5 measurements at the same time.
Measurement Range	Screen Region, Cursor Region
Statistic Mode	Extremum, Difference
Measurement Statistic	Average, Max, Min, Standard Deviation, Number of Measurements
FontSize	Normal, Large, UltraLarge
DisItem	ON, OFF
Frequency Counter	6-digit hardware frequency counters

Math Operation

Waveform Operation	A+B, A-B, A×B, A÷B, FFT, Digital Filter, Editable Advanced Operation, Logic Operation
FFT Window	Rectangle, Hanning, Blackman, Hamming

FFT Display	Split, Full Screen
FFT Vertical Scale	Vrms, dB
Logic Operation	AND, OR, NOT, XOR
Math Function	Intg, Diff, Lg, Ln, Exp, Abs, Square, Sqrt, Sine, Cosine, Tangent

Decoding

Number of Buses	2
Decoding Type	Parallel (standard), RS232/UART (optional), I2C (optional), SPI (optional), CAN (optional), FlexRay (optional), LIN (optional)
Parallel	Combines the sample data of the source channel waveforms as a parallel multi-channel bus and displays the data as a single bus value
RS232/UART	Displays the input signal(s) of the TX source channel or/and RX source channel as bus
I2C	Displays the input signal of the SDA source channel as bus
SPI	Displays the input signal(s) of the MISO source channel or/and MOSI source channel as bus
CAN	Displays the input signal of the source channel (Rx, Tx, CAN_H, CAN_L, or differential) as bus
FlexRay	Displays the input signal of the source channel (BP, BM, or RX/TX) as bus
LIN	Displays the input signal of the source channel of LIN as bus

Display

Display Type	9-inch (229 mm) TFT LCD display
Display Resolution	800 horizontal×RGB×480 vertical pixel
Display Color	160,000 colors
Persistence Time	Min, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s, Infinite
Display Type	Dots, Vectors
Real-time Clock	Time and Date (adjustable for users)

I/O

Standard Ports	Dual USB HOST, USB DEVICE, LAN, VGA Output, 10 MHz Input/Output, Aux Output (TrigOut, Fast, PassFail, GND)
Printer Compatibility	PictBridge

General Specifications

Probe Compensation Output	
Output Voltage[1]	About 3 V, peak-peak
Frequency[1]	1 kHz
Power	
Power Voltage	100 to 127 V, 45 to 440Hz 100 to 240 V, 45 to 65Hz
Power	Maximum 120 W
Fuse	3 A, T degree, 250 V
Environment	
Temperature Range	Operating: 0°C to +50°C
	Non-operating: -40°C to +70°C
Cooling Method	Fan cooled
Humidity Range	0°C to +30°C: ≤95% RH
	+30°C to +40°C: ≤75% RH
	+40°C to +50°C: ≤45% RH
Altitude	Operating: under 3,000 meters
	Non-operating: under 15,000 meters
Physical Characteristics	

Size[3]	Width×Height×Depth = 440.0 mm×218.0 mm×130.0 mm	
Weight[4]	Packaging Excluded	4.8 kg±0.2 kg
	Packaging Included	7.1 kg±1.0 kg

Adjustment Interval

The recommended calibration interval is one year.

Regulatory Information

EMC	2014/35/EU Execution standard EN 61326-1:2013
Safety	EN 61010-1:2010 EN 61010-2-030:2010 IEC 61010-1:2010 (Third Edition) CAN/CSA C22.2 No.61010-1-12 UL 61010-1:2012

Note[1]: Typical value.
Note[2]: Maximum value. Displayed in dots; a sine signal with 10 ns horizontal time base, 4 div input amplitude, and 10 MHz frequency; Edge trigger.
Note[3]: Supporting legs and handle folded, knob height included, front panel cover excluded.
Note[4]: Standard configuration.

▶ Ordering Information

	Description	Order Number
Model	DS4014E (100 MHz, 2 GSa/s, 14 Mpts, 4-analog-channel Digital Oscilloscope)	DS4014E
	DS4024E (200 MHz, 2 GSa/s, 14 Mpts, 4-analog-channel Digital Oscilloscope)	DS4024E
Standard Accessories	Power Cord conforming to the standard of the destination country	-
	Front Panel Cover	FPC-DS4000
	USB Data Cable	CB-USBA-USBB-FF-150
	4 Passive Probes (350 MHz)	RP3300A
	Quick Guide (Hard Copy)	-
Optional Accessories	Active Differential Probe (1.5 GHz)	RP7150
	Rack Mount Kit	RM-DS4000
	USB-GPIB Interface Converter	USB-GPIB
	TekProbe Interface Adapter	T2R1000
Decoding Options	RS232/UART Decoding Kit	SD-RS232-DS4000
	I2C/SPI Decoding Kit	SD-I2C/SPI-DS4000
	CAN Decoding/LIN Trigger/LIN Decoding Kit	SD-AUTO-DS4000
	FlexRay Decoding Kit	SD-FlexRay-DS4000

Warranty Period

Three years for the mainframe, excluding probes and accessories.

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May   2016