

Chapter 5 Specifications

5.1 Technical Specifications

All specifications herein mentioned apply to the DSO4000 series oscilloscopes. Before checking an oscilloscope from your seller to see if it complies with these specifications, make sure it meets the following conditions:

- The oscilloscope must have been operating continuously for twenty minutes under the specified operating temperature.
- The Do Self Cal operation must be performed through the Utility menu if the operating temperature changes by more than 5°C.
- The oscilloscope must be within the factory calibration interval.

All specifications are guaranteed unless noted 'typical'.

Oscilloscope Specifications

Horizontal

Sample Rate Range	1GS/s	
Waveform Interpolation	(sin x)/x	
Record Length	Maximum 40K samples per single-channel; maximum 20K samples per dual-channel (4K, 20K optional)	
SEC/DIV Range	DSO4072 DSO4102	DSO4202
	4ns/div to 40s/div, in a 2, 4, 8 sequence	2ns/div to 40s/div, in a 2, 4, 8 sequence
Sample Rate and Delay Time Accuracy	±50ppm over any ≥1ms time interval	
Delta Time Measurement Accuracy (Full Bandwidth)	Single-shot, Normal mode ± (1 sample interval + 100ppm × reading + 0.6ns)	
	>16 averages ± (1 sample interval + 100ppm × reading + 0.4ns)	
	Sample interval = s/div ÷ 200	
Position Range	DSO4072 DSO4102	
	20ns/div to 80µs/div	(-8div × s/div) to 40ms
	200µs/div to 40s/div	(-8div × s/div) to 400s
	DSO4202	
	2ns/div to 10ns/div	(-4div × s/div) to 20ms

Vertical

A/D Converter	8-bit resolution, each channel sampled simultaneously		
VOLTS/DIV Range	2mV/div to 5V/div at input BNC		
Position Range	2mV/div to 200mV/div, $\pm 2V$ >200mV/div to 5V/div, $\pm 50V$		
Analog Bandwidth in Normal and Average modes at BNC or with probe, DC Coupled	2mV/div to 20mV/div, $\pm 400mV$ 50mV/div to 200mV/div, $\pm 2V$ 500mV/div to 2V/div, $\pm 40V$ 5V/div, $\pm 50V$		
Selectable Analog Bandwidth Limit, typical	20MHz		
Low Frequency Response (-3db)	$\leq 10Hz$ at BNC		
Rise Time at BNC, typical	DSO4072	DSO4102	DSO4202
	$\leq 5.0ns$	$< 3.5ns$	$< 1.8ns$
DC Gain Accuracy	$\pm 3\%$ for Normal or Average acquisition mode, 5V/div to 10mV/div		
	$\pm 4\%$ for Normal or Average acquisition mode, 5mV/div to 2mV/div		
DC Measurement Accuracy, Average Acquisition Mode	Measurement Type: Average of ≥ 16 waveforms with vertical position at zero Accuracy: $\pm (3\% \times \text{reading} + 0.1\text{div} + 1mV)$ when 10mV/div or greater is selected		
	Measurement Type: Average of ≥ 16 waveforms with vertical position not at zero Accuracy: $\pm [3\% \times (\text{reading} + \text{vertical position}) + 1\% \text{ of vertical position} + 0.2\text{div}]$ Add 2mV for settings from 2mV/div to 200mV/div; add 50mV for settings from 200mV/div to 5V/div		
Volts Measurement Repeatability, Average Acquisition Mode	Delta volts between any two averages of ≥ 16 waveforms acquired under same setup and ambient conditions		

Note: Bandwidth reduced to 6MHz when using a 1X probe.

Trigger

	Coupling	Sensitivity		
	Trigger Sensitivity (Edge Trigger Type)	DC	Source	DSO4072, DSO4102
CH1 CH2			1div from DC to 10MHz; 1.5div from 10MHz to Full	1.5div from 10MHz to 100MHz; 2div from 100MHz to Full
EXT			200mV from DC to 100MHz	200mV from DC to 100MHz; 350mV from 100MHz to 200MHz

		EXT/5	1V from DC to 100MHz	1V from DC to 100MHz; 1.75V from 100MHz to 200MHz
	AC	Attenuates signals below 10Hz		
	HF Reject	Attenuates signals above 80kHz		
	LF Reject	Same as the DC-coupled limits for frequencies above 150kHz; attenuates signals below 150kHz		
Trigger Level Range	Source	Range		
	CH1, CH2	±8 divisions from center of screen		
	EXT	±1.2V		
	EXT/5	±6V		
Trigger Level Accuracy, typical (Accuracy is for signals having rise and fall times ≥20ns)	Source	Accuracy		
	CH1, CH2	0.2div × volts/div within ±4 divisions from center of screen		
	EXT	± (6% of setting + 40mV)		
	EXT/5	± (6% of setting + 200mV)		
Set Level to 50%, typical	Operates with input signals ≥50Hz			

Note: Bandwidth reduced to 6MHz when using a 1X probe.

Video Trigger Type	Source	Range
	CH1, CH2	Peak-to-peak amplitude of 2 divisions
	EXT	400mV
	EXT/5	2V
Signal Formats and Field Rates, Video Trigger Type	Supports NTSC, PAL and SECAM broadcast systems for any field or any line	
Holdoff Range	100ns to 10s	

Pulse Width Trigger	
Pulse Width Trigger Mode	Trigger when < (Less than), > (Greater than), = (Equal), or ≠ (Not Equal); Positive pulse or Negative pulse
Pulse Width Trigger Point	<p>Equal: The oscilloscope triggers when the trailing edge of the pulse crosses the trigger level.</p> <p>Not Equal: If the pulse is narrower than the specified width, the trigger point is the trailing edge. Otherwise, the oscilloscope triggers when a pulse continues longer than the time specified as the Pulse Width.</p> <p>Less than: The trigger point is the trailing edge.</p> <p>Greater than (also called overtime trigger): The oscilloscope triggers when a pulse continues longer than the time specified as the Pulse Width.</p>
Pulse Width Range	Selectable from 20ns to 10s

Slope Trigger	
Slope Trigger Mode	Trigger when < (Less than), > (Greater than), = (Equal), or ≠ (Not Equal); Positive slope or Negative slope
Slope Trigger Point	Equal: The oscilloscope triggers when the waveform slope is equal to the set slope. Not Equal: The oscilloscope triggers when the waveform slope is not equal to the set slope. Less than: The oscilloscope triggers when the waveform slope is less than the set slope. Greater than: The oscilloscope triggers when the waveform slope is greater than the set slope.
Time Range	Selectable from 20ns to 10s
Overtime Trigger	The leading edge: Rising edge or Falling edge; Time Setting: 20-10s

Swap Trigger	
CH1	Internal Trigger: Edge, Pulse Width, Video, Slope
CH2	Internal Trigger: Edge, Pulse Width, Video, Slope

Trigger Frequency Counter	
Readout Resolution	6 digits
Accuracy (typical)	±30ppm (including all frequency reference errors and ±1 count errors)
Frequency Range	AC coupled, from 4Hz minimum to rated bandwidth
Signal Source	Pulse Width or Edge Trigger modes: all available trigger sources The Frequency Counter measures trigger source at all times, including when the oscilloscope acquisition pauses due to changes in the run status, or acquisition of a single shot event has completed. Pulse Width Trigger mode: The oscilloscope counts pulses of significant magnitude inside the 1s measurement window that qualify as triggerable events, such as narrow pulses in a PWM pulse train if set to < mode and the width is set to a relatively small time. Edge Trigger mode: The oscilloscope counts all edges of sufficient magnitude and correct polarity. Video Trigger mode: The Frequency Counter does not work.

Acquisition

Acquisition Modes	Normal, Peak Detect, and Average	
Acquisition Rate, typical	Up to 2000 waveforms per second per channel (Normal acquisition mode, no measurement)	
Single Sequence	Acquisition Mode	Acquisition Stop Time
	Normal, Peak Detect	Upon single acquisition on all channels simultaneously
	Average	After N acquisitions on all channels simultaneously, N can be set to 4, 8, 16, 32, 64 or 128

Inputs

Inputs		
Input Coupling	DC, AC or GND	
Input Impedance, DC coupled	1MΩ±2% in parallel with 20pF±3pF	
Probe Attenuation	1X, 10X	
Supported Probe Attenuation Factors	1X, 10X, 100X, 1000X	
Maximum Input Voltage	Overvoltage Category	Maximum Voltage
	CAT I and CAT II	300V _{RMS} (10×), Installation Category
	CAT III	150V _{RMS} (1×)
	Installation Category II: derate at 20dB/decade above 100kHz to 13V peak AC at 3MHz* and above. For non-sinusoidal waveforms, peak value must be less than 450V. Excursion above 300V should be of less than 100ms duration. RMS signal level including all DC components removed through AC coupling must be limited to 300V. If these values are exceeded, damage to the oscilloscope may occur.	

Measurements

Cursors	Voltage difference between cursors: ΔV Time difference between cursors: ΔT Reciprocal of ΔT in Hertz ($1/\Delta T$)
Automatic Measurements	Frequency, Period, Mean, Peak-to-peak, Cycle RMS, PRMS, Minimum, Maximum, Rise Time, Fall Time, + Width, - Width, + Duty, - Duty, Base, Top, Middle, Amplitude, Overshoot, Preshoot, Pmean, FOVShoot, RPREShoot, BWidth, Delay 1-2 ↑, Delay 1-2 ↓, LFF, LFR, LRF, LRR, FFR, EFRF

General Specifications

Display	
Display Type	7 inch 64K color TFT (diagonal liquid crystal)
Display Resolution	800 horizontal by 480 vertical pixels
Display Contrast	Adjustable (16 gears) with the progress bar
Probe Compensator Output	
Output Voltage, typical	About 5Vpp into $\geq 1\text{M}\Omega$ load
Frequency, typical	1kHz
Power Supply	
Supply Voltage	100-120VAC _{RMS} (±10%), 45Hz to 440Hz, CAT II 120-240VAC _{RMS} (±10%), 45Hz to 66Hz, CAT II
Power Consumption	<30W
Fuse	2A, T rating, 250V

Environmental		
Temperature	Operating: 32°F to 122°F (0°C to 50°C)	
	Nonoperating: -40°F to 159.8°F (-40°C to +71°C)	
Cooling Method	Convection	
Humidity	+104°F or below (+40°C or below): ≤90% relative humidity	
	106°F to 122°F (+41°C to 50°C): ≤60% relative humidity	
Altitude	Operating and Nonoperating	3,000m (10,000 feet)
	Random Vibration	0.31g _{RMS} from 50Hz to 500Hz, 10 minutes on each axis
	Nonoperating	2.46g _{RMS} from 5Hz to 500Hz, 10 minutes on each axis
Mechanical Shock	Operating	50g, 11ms, half sine
Mechanical		
Size	Length	313mm
	Height	142mm
	Depth	108mm
Weight	exclusive of packing and accessories	2.08Kg

Arbitrary Waveform Generator Mode

Waveform Frequency	DC~25MHz
DAC	2K~200MHz adjustable
Frequency Resolution	0.10%
Channel	1CH waveform output
Waveform Depth	4KSa
Vertical Resolution	12 bit
Frequency Stability	<30ppm
Wave Amplitude	±3.5V Max.
Output Impedance	50 Ω
Output Current	50mA, I _{peak} =50mA
System BW	25M
Harmonic Distortion	-50dBc(1KHz), -40dBc(10KHz)





Power Amplifier(Optional)

Maximum power output	7W(8 Ω), 1W(50 Ω)
Maximum output voltage	22V _{pp}
Frequency bandwidth	1Hz~200KHz

5.2 Accessories

All the following accessories are available.

Standard Accessories

Sketch	Description
	<p>X1, X10 two passive probes. The passive probes have a 6MHz bandwidth (rated 100Vrms CAT III) when the switch is in the X1 position, and a maximum bandwidth (rated 300Vrms CAT II) when the switch is in the X10 position. Each probe consists of all necessary fittings.</p>
	<p>A USB A-B line, used to connect external devices with USB-B interface like a printer or to establish communications between PC and the oscilloscope.</p>
	<p>A power cord special for this product. In addition to the power cord shipped with your instrument, you may purchase another one certified for the country of use.</p>
	<p>A software installation CD. It contains the user manual of DSO4000, giving particular descriptions on the DSO4000 series oscilloscopes.</p>