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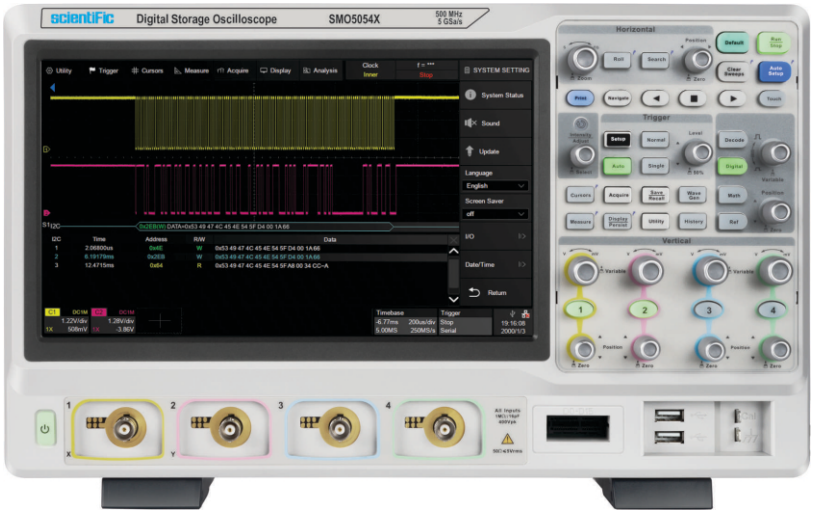
Since 1963

Digital Storage Oscilloscope
SMO5000X Series



Advance Features

- 1 GHz, 500 MHz, 350 MHz models with real-time sample rate up to 5 GSa/s
- Waveform Capture rates up to 110,000 wfm/s (normal mode) and 480,000 wfm/s (sequence mode)
- Supports 256-level intensity grading and color temperature display modes
- Record length up to 250 Mpts/ch, 500 Mpts in total for all 4 channels
- Digital trigger system
- Intelligent trigger: Edge, Slope, Pulse, Window, Runt, Interval, Dropout, Pattern, Qualified and Video (HDTV supported). Trigger zone helps to simplify advanced triggering
- Serial bus triggering and decoder, supports protocols I^2C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I^2S and MIL-STD-1553B
- Low background noise, supports 0.5 mV/div to 10 V/div voltage scales
- Segmented acquisition (Sequence) mode, dividing the maximum record length into multiple segments (up to 100,000), according to trigger conditions set by the user, with a very small dead time between segments to capture the qualifying event
- History waveform record (History) function, the maximum recorded waveform length is 100,000 frames
- Automatic measurement function on 39 parameters, supports statistics with histogram, Gating measurement, Math measurement, History measurement and Ref measurement
- Math function (2 Mpts FFT, addition, subtraction, multiplication, division, integration, differential, square root), supports math on math
- Search and Navigate
- Digital Voltmeter
- Waveform Histogram
- High Speed hardware-based Average, Eres (Enhanced Resolution)
- High Speed hardware-based Mask Test function, with Mask Editor tool for creating user-defined masks
- 16 digital channels (optional) with sample rate up to 1.25 GSa/s, record length up to 62.5 Mpts
- 25 MHz function/arbitrary waveform generator, built-in multiple predefined waveforms
- Large 10.1" TFT-LCD display with 1024 * 600 resolution; Capacitive touch screen supports multi-touch gestures
- Supports external mouse and keyboard
- 10 types of one-button shortcuts
- Multiple interfaces: USB Host, USB Device (USBTMC), LAN (VXI-11, telnet, socket, web), Pass/Fail, Trigger Out, 10 MHz In, 10 MHz Out, VGA output
- Built-in web server supports remote control by the LAN port using a web browser
- Supports SCPI remote control commands

Technical Specification	SMO5034X / SMO5032X	SMO5054X / SMO5052X	SMO5104X / SMO5102X
Bandwidth	350 MHz	500 MHz	1 GHz
Sample Rate	5 GSa/s (interleaving mode), 2.5 GSa/s (non-interleaving mode)		
Memory Depth	250 Mpts (interleaving mode), 125 Mpts (non-interleaving mode)		
Peak detect	400 ps		
Average	4, 16, 32, 64, 128, 256, 512		
Eres	Enhanced bit : 0.5, 1, 1.5, 2, 2.5, 3		
Sequence	Up to 100,000 segments, dead time = 2 µs min		
History	Up to 100,000 frames		
Interpolution	Sinx/x, x		

Technical Specification		SMO5034X / SMO5032X	SMO5054X / SMO5052X	SMO5104X / SMO5102X
Vertical System				
Analog Channels		4/2 + EXT		
Bandwidth (- 3dB) @ 50 Ω		350 MHz*	500 MHz**	1 GHz**
Rise Time (Typical) @ 50 Ω		1.0 ns	0.7 ns	0.4 ns
Vertical Range		8 divisons		
Vertical Resolution		8 bits		
Vertical Scale		1 MΩ : 500 µV/div to 10 V/div (setting range), 1 mV/div to 10 V/div (specified range)		
		50 Ω : 500 µV/div to 1 V/div (setting range), 1 mv/div to 1 V/div (specified range)		
DC Gain Accuracy		≤ 3.0%		
Offset Range		500 µV/div to 100 mV/div : ± 1 V 102 mV/div -1 V/div : ± 10 V 1.02 V/div to 10 V/div : ± 100 V		
Offset Accuracy		± (1.5% x offset + 1.5% x full scale + 1 mV)		
Bandwidth Limit		20 MHz (± 40%) 200 MHz (± 40%)		
Low frequency response (AC coupling -3dB)		5 Hz (Typical)		
Coupling		DC, AC, GND		
Impedance		(1 MΩ ± 2%) || (16 pF ± 2 pF), 50 Ω : 50 Ω ± 1%		
Max. Input voltage		1 MΩ : ≤ 400 Vpk (DC + AC), (DC – 10 kHz) 50 Ω : ≤ 5 Vrms, ± 10 V Peak		
Probe Attenuation		1X, 10X, 100X, Custom		
* Below 1 mv/div (included) the bandwidth is limited to 200 MHz ** Below 2.45 mv/div (included) the bandwidth is limited to 200 MHz				
Horizontal System				
Time Scale		1 ns/div to 1000 s/div	500 ps/div to 1000 s/div	200 ps/div to 1000 s/div
Waveform update rate		Up to 110,000 wfm/s		
Intensity grading		256 level		
Display Format		Y–T, X–Y, Roll		
Roll mode		≥ 50 ms / div		
Skew (CH1 to CH4)		< 150 ps		
Time base Accuracy		± 1ppm initial; ± 1ppm 1st year aging; ± 3.5 ppm 10 year aging		
Trigger System				
Trigger Mode		Auto, Normal, Single		
Trigger Level Range		Internal : ± 4.1 div from screen center EXT : ± 0.61 V EXT/5 : ± 3.05 V		
Hold off Ranges		By time : 8 ns to 30 s (8 ns step) By event : 1 to 10^8		
Trigger Coupling	(CH1 to CH4)	DC : Passes all components of the signal AC : Blocks DC components and attenuates signals below 8 Hz LFRJ : Attenuates the frequency component below 1.2 MHz HFRJ : Attenuates the frequency component above 740 kHz Noise RJ : Increase the trigger hysteresis		
	(EXT)	DC : Passes all components of the signal AC : Blocks DC components and attenuates signals below 10 Hz LFRJ : Attenuates the frequency components below 400 kHz HFRJ ; Attenuates the frequency components above 1.6 MHz		
Accuracy (Typical)		CH1 to CH4 ± 0.2 div, EXT : ± 0.3 div		
Sensitivity	(CH1 to CH4)	>10 mV/div : 0.3 div (Noise RJ = OFF), 0.7 div (Noise RJ = ON)		
		5 mV/div - 10mV/div : 0.5 div (Noise RJ = OFF), 0.7 div (Noise RJ = ON)		
		≤ 2 mV/div : 1 div (Noise RJ = OFF), 1.5 div (Noise RJ = ON)		
	EXT :	200 mVpp (DC - 10 Mhz), 300 mVpp (10 MHz - bandwidth)		
	EXT/5 :	1 Vpp (DC - 10 MHz) 1.5 Vpp (10 MHz - bandwidth)		
Jitter		< 100 ps (CH1 to CH4)		
Displacement		Pre-Trigger : 0 to 100% memory Delay-Trigger : 0 to 5,000 div		
Edge Trigger				
Source		CH1 to CH4 / EXT / (EXT/5) / AC Line / D0 to D15		
Slope		Rising, Falling, Rising & Falling		
Slope Trigger				
Source		CH1 to CH4		
Slope		Rising, Falling		
Limit Range		<, >, < >, > <		
Time Range		2 ns to 20 s		
Resolution		1 ns		

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Pulse Width Trigger			
Source	CH1 to CH4 / D0 to D15		
Polarity	+ wid, - wid		
Limit Range	<, >, < >, > <		
Pulse Range	2 ns to 20 s		
Resolution	1 ns		
Video Trigger			
Source	CH1 to CH4		
Signal Standard	NTSC, PAL, 720p/50, 720p/60,1080p/50, 1080p/60,1080i/50,1080i/60, Custom		
Sync	ANY, Select		
Trigger Condition	Line, Field		
Window Trigger			
Source	CH1 to CH4		
Window Type	Absolute, Relative		
Interval Trigger			
Source	CH1 to CH4 / D0 to D15		
Slope	Rising, Falling		
Limit Range	≤, ≥ , < >, > <		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Dropout Trigger			
Source	CH1 to CH4 / D0 to D15		
Timeout Type	Edge, State		
Slope	Rising, Falling		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Runt Trigger			
Source	CH1 to CH4		
Slope	Rising, Falling		
Limit Range	≤, ≥ , < >, < >		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Pattern Trigger			
Source	CH1 to CH4 / D0 to D15		
Pattern Setting	Don't Care, Low, High		
Logic	AND, OR, NAND, NOR		
Limit Range	≤, ≥ , < >, > <		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Qualified Trigger			
Type	State, State with Delay, Edge, Edge with Delay		
Qualified Source	CH1 to CH4 / D0 to D15		
Edge Trigger Source	CH1 to CH4 / D0 to D15		
Serial Trigger			
Source	CH1 to CH4 / D0 to D15		
Protocol	I^2C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I^2S, MIL-STD-1553B		
I^2C Trigger	Type : Start, Stop, Restart, No Ack, EEPROM, Address & Data, Data Length		
SPI Trigger	Type : Data		
UART Trigger	Type : Start, Stop, Data, Parity Error		
CAN Trigger	Type : All, Remote, ID, ID+Data, Error		
LIN Trigger	Type : Break, Frame ID, ID+Data Error		
CAN FD Trigger	Type : Start, Remote, ID, ID+Data, Error		
Flex Ray Trigger	Type : TSS, Frame, Symbol, Errors		
I^2S Trigger	Type : Data, Mute, Clip, Glitch, Rising Edge, Falling Edge		
Serial Decoder			
Decoders	2		
Decoder Type	Full duplex		
Threshold	- 4.1 to 4.1 div		
List	1 to 7 lines		

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I2C			
Signal	SCL, SDA		
Address	7 bit, 10 bit		
SPI			
Signal	CLK, MISO, MOSI, CS		
Edge Select	Rising, Failing		
Chip Select	Active high, Active low, Clock timeout		
Bit Order	LSB, MSB		
UART			
Signal	RX, TX		
Data Width	5 bit, 6 bit,7 bit, 8 bit		
Parity Check	None, Odd, Even		
Stop Bit	1 bit,1.5 bit, 2 bit		
Idle Level	Low, High		
Bit Order	LSB, MSB		
CAN			
Source	CH1 to CH4 / D0 to D15		
LIN			
LIN Specification Package Revision	Ver 1.3, Ver 2.0		
Baud Rate	5kbps, 10kbps, 20kbps, 50kbps, 100kbps, 125kbps, 250kbps, 500kbps, 800kbps, 1Mbps, Custom		
CAN FD			
Source	CH1 to CH4 / D0 to D15		
Nominal Baud Rate	10kbps, 25kbps, 50kbps, 100kbps, 250kbps, 1Mbps, Custom		
Data Baud Rate	500kbps, 1Mbps, 2Mbps, 5Mbps, 8Mbps, 10Mbps, Custom		
Flex Ray			
Source	CH1 to CH4 / D0 to D15		
Data Baud Rate	2.5 Mbps, 5 Mbps, 10 Mbps, Custom		
I2S			
Signal	BCLK, WS, DATA		
Audio Variant	Audio-I2S, Audio L-J, Audio RJ		
Start Bits	0 to 32		
Data Bits	0 to 32		
MIL-STD-1553B			
Source	CH1 to CH4		
Measurement			
Source	CH1 to CH4, Math, Ref, History, Zoom		
No. of Measurement	Display 5 measurements at the same time		
Range	Screen, Gating		
Measurement Parameters			
Vertical	Max, Min, Pk-Pk, Top, Base, Amplitude, Mean, Cycle Mean, Stdev, Cycle Stdev, RMS, Cycle RMS, FOV FPRE, ROV, RPRE, L@T		
Horizontal	Period, Freq, +Width, -Width, Rise, Fall, BWidth, + Duty, - Duty, Delay, T@M, CCJ		
Delay	Phase, FRFR, FRFF, FFFR, FFFF, FRLR, FRLF, FFLR, FFLF, Skew		
Cursors	Manual : Time X1, X2, (X1-X2), (1/ΔT) Voltage / Current : Y1, Y2, (Y1-Y2) Track : Time X1, X2, (X1-X2)		
Statistics	Current, Mean, Min, Max, Sdev, Count, Histogram		
Frequency Counter	7 digits		
Math			
Mode	f(x), g[f(x)]		
Operation	+, -, *, /, FFT, d/dt, ∫dt, square root		
FFT	Window : Rectangular , Blackman, Hanning, Hamming, Flattop Display : Full Screen, Split, Exclusive Mode : Normal, Max hold Average		
Function/Arbitrary Waveform Generator (Optional)			
Channels	1		
Max. output frequency	25 MHz		
Sampling Rate	125 MSa/s		
Frequency Resolution	1 μHz		
Frequency Accuracy	± 50 ppm		
Vertical Resolution	14-bit		

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Amplitude Range	-1.5 V to + 1.5 V (into 50 Ω) - 3 V +3 V (into Hi-Z)		
Waveforms	Sine, Square, Ramp, Pulse, DC, Noise, 45 Arbs		
Output Impedance	50 Ω ± 2 %		
Protection	Over voltage protection, Current limit		
Insulation Voltage	± 42 Vpk		
Sine			
Frequency	1 μHz to 25 MHz		
Offset Accuracy (10 kHz)	± (1% offset setting value + 3 mVpp)		
Amplitude flatness	± 0.3dB, compare to 10 kHz, 5 Vpp		
SFDR	DC - 1 MHz - 60 dBC 1 MHz - 5 MHz - 55 dBC 5 MHz - 25 MHz - 50 dBC		
Harmonic distortion	DC - 5 MHz - 50 dBC 5 MHz - 25 MHz - 45 dBC 5 MHz - 25 MHz - 50 dBC		
Sequence / Pulse			
Frequency	1 μHz to 10 MHz		
Duty cycle	1% to 99%		
Edge	< 24 ns (10% to 90%)		
Overshoot	< 3% (typical, 1 kHz, 1 Vpp)		
Pulse width	> 50 ns		
Jitter (cycle-cycle)	< 500 ps + 10 ppm		
Ramp			
Frequency	1 μHz to 300 kHz		
Linearity	< 0.1% of Pk-Pk (typical, 1 kHz, 1 Vpp, 50% symmetry)		
Symmetry	0% to 100%		
DC			
Offset Range	±1.5 V (into 50 Ω) ± 3 V (into Hi-Z)		
Accuracy	± (|setting value| * 1% + 3 mV)		
Noise			
Bandwidth	> 25 MHz (-3dB)		
Arb			
Frequency	1 μHz to 5 MHz		
Waveform Memory	16 kpts		
Sample Rate	125 MSa/s		
Wave Import	From Easy Wave or U-disk		
Digital Channels (Optional)			
No. of Channels	16		
Max. Sampling Rate	1.25 GSa/s		
Memory Depth	62.5 Mpts/ch		
Min. Detectable Pulse Width	3.3 ns		
Level Group	D0 to D7, D8 to D15		
Level Range	-10 V to 10 V		
Logic Type	TTL, CMOS, LVCMOS3.3 , LVCMOS2.5, Custom		
Skew	D0 to D15 : ±1 Sampling Interval Digital to Analog : ± (1 sampling interval +1 ns)		
I/O			
Standard	3 USB Hosts, 1 USB Device, LAN, AUX(Pass/Fail+Trigger Out), 10 MHz In/ Out		
Pass/Fail	3.3 V TTL Output		
Display			
Display Type	10.1 TFT LCD		
Resolution	1024 × 600		
Range	8 x 10 grid		
Touch Screen Type	Capacitive		
Waveform Display			
Type	Dot, Vector		
Persistence Time	OFF, 1 s, 5 s, 10 s, 30 s, infinite		
Color Display	Normal, Color		

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General Specifications			
Input Voltage & Frequency	100 to 240 Vrms 50/60 Hz 100 to 120 Vrms 400 Hz		
Power Consumption	100 W Max, 70 W Typical, 4 W typical standby mode		
Humidity	Operating : 85% RH, 40˚C , 24 hours Non-operating : 85% RH, 65˚C, 24 hours		
Temperature	0˚C to 50˚C		
Electromagnetic Compatibility	EN 61326-1:2013		
Safety	EN 61010-1:2010		
Dimension	W : 370 mm, D : 144 mm, H : 231 mm		
Weight	N.W : 3.9 Kg, G.W. : 5.4 Kg (2 Channel Model) N.W : 4.0 Kg, G.W. : 5.6 Kg (4 Channel Model)		
Standard Accessories	USB cable, Passive probe : 2 (2 Channel Model) / 4 (4 Channel Model), CD, Power Cord, SP2035A for 350 MHz models and SP3050A for 500 MHz / 1 GHz models		
Available Options	Description		Option No.
	16 channel MSO Function for SMO5000X series (inclusive of MSO Function Software + 16 channel Logic Analyzer Probe SPL2016)		SMO5000X-16LA
	USB AWG Option forSMO5000X series inclusive of USB AWG Software + USB Isolated AWG Module Hardware (SAG1021I)		SMO5000X-FG
	I2S Trigger & Decode Software		SMO5000X-I2S
	MIL-STD-1553B Trigger & Decode Software		SMO5000X-1553B
	Flexray Trigger & Decode Software		SMO5000X-FlexRay
	CANFD Trigger & Decode Software		SMO5000X-CANFD
	350 MHz to 500 MHz BW upgrade for SMO5032X		SMO5000X-2BW05
	350 MHz to 500 MHz BW upgrade for SMO5034X		SMO5000X-4BW05
	500 MHz to 1 GHz BW upgrade for SMO5052X		SMO5000X-2BW10
	500 MHz to 1 GHz BW upgrade for SMO5054X		SMO5000X-4BW10

Subject to change

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