

Oscilloscope/ Spectrum Analyzer/ Data Recorder

1 GHz analog input bandwidth

Arbitrary Waveform Generator

10 mHz to 150 MHz output frequency

Logic Analyzer

200 MHz clock rate

16 channels, 16 X 512K buffer memory

Pattern Generator

1 mHz to 100 MHz frequency range

16 X 512k pattern length

Frequency & Phase Meter

Frequency Range: 10 Hz to 1 GHz

Custom API to control all features

No external power supply required

Intuitive application software with an assortment of features



Introduction

SL Series is a 7-in-1 complete USB-powered test instrument. It includes an oscilloscope, a spectrum analyzer, a data recorder, an AWG function generator, a frequency and phase meter, a logic analyzer, and a pattern generator. This compact device has been developed for professionals with a limited budget. Engineers and researchers can also benefit from the many features of the instruments. The oscilloscope offers a bandwidth of 1 GHz, and a real sampling rate of up to 250 MHz (125 MHz/channel) with an effective sampling rate of 100 GHz. The AWG generates over 25 standard functions with frequencies of up to 150 MHz. Arbitrary wave-forms can also be generated with sampling rates of 1 to 100 MHz and memory depths of 1 to 64K. Its graphical editor makes generation of any signal seamless. The logic analyzer and the pattern generator of **SL Series** feature a complete protocol analyzer, a powerful pattern generator editor, and an intuitive interface. **SL Series** is an ideal lab for any user.

Applications

- Power supply gain and phase analysis
- Electronic filter design and test
- Speaker and amplifier test
- Mechanical vibration analysis
- Electro-Mechanical control loop analysis
- Data Acquisition Development

Technical Specifications

Oscilloscope/ Spectrum Analyzer/ Data Recorder

Model	SL987	SL957	SL937	SL917
Oscilloscope				
Bandwidth	1 GHz	500 MHz	300 MHz	100 MHz
Rise time	0.5 nS	1.0 nS	2.5 nS	5.0 nS
Input channels	2			
Vertical resolution	8 bits			
DC accuracy	< ±3%			
Input characteristics	1 MΩ in parallel with 5 pF			
Common Mode Rejection Ratio	> 70 dB (@ 100 MHz)			
Input type	Single-ended, BNC connector			
Input coupling	Software selectable AC/DC			
Input Ranges (full scale)				
10X probe	±80 mV to ±80 V in 10 ranges			
1X probe	±8 mV to ±8 V in 10 ranges			
Overload protection	±150 V (DC+AC peak)			
Sampling rate (each channel)				
Real / per channel	125 MHz			100 MHz
Effective / per channel	100 GHz			25 GHz
Vertical Sensitivity				
1X probe	2 mV - 2 V / DIV			
10X probe	20 mV - 20 V / DIV			
Buffer memory size				
One channel in use	1024 KB			
Two channels in use	512 KB			
Time Base	1 ns/div to 100 ms/div			5 ns/div to 100 ms/div
Time base (Data Recorder)	500 nS to 365 days with data recorder			
Timing accuracy	50 ppm	100 ppm		200 ppm
Trigger modes	Normal, auto, one shot, single, CH1, CH2			
Trigger threshold				
Internal	Adjustable, ± range setting (variable) 8 bits			
External	1.2 Volts			
Basic triggers	External/ CH1/ CH2/ Alternative/Rising edge/ Falling edge/ Auto/ Normal/ Single			
External trigger bandwidth	1 GHz	500 MHz	300 MHz	100 MHz

Model	SL987	SL957	SL937	SL917
Spectrum Analyzer (Typical)				
Common features between the Oscilloscope and the spectrum analyzer have the same specifications.				
Frequency Bandwidth	1 GHz	500 MHz	300 MHz	100 MHz
Display Span	204.8 KHz to 60 MHz			
Minimum Span (at selected Display Bandwidth)	100 KHz (display bandwidth of 51.2 MHz) 5 KHz (display bandwidth of 2.56 MHz) 400 Hz (display bandwidth of 204.8 MHz)			
Resolution	$(\text{Span}/2^{18})$ 0.78 Hz to 195 Hz			
Spectrum Flatness	1dB			
Frequency Error [6]	50 ppm		100 ppm	200 ppm
Relative Frequency Accuracy	> 1 ppm			
Maximum number of bins	1M			
Dynamic Range	8 bits (< 65 dB)			
Spurious Free Range	< 70 dB (@ 10 MHz, 2 V range)			
Frequency Response	± 0.5 dB			
Reference Levels (10 ranges)				
1X probe	- 35 dBV to 25 dBV (0.6 to 5.623 VRMS)			
10X probe	- 25 dBV to 35 dBV (0.06 to 56.23 VRMS)			
Display modes	Sampling, peak hold, average, history			
Windowing types	Rectangular, Bartlett, Gaussian (2.5, 3.5, 4.5), Triangular, Blackman, Blackman–Harris, Hamming, Hanning, Welch, Kaiser Bessel, Flat Top,			
Frequency Analyzer (Typical)				
The same specifications apply to the common features of the oscilloscope and the frequency and phase analyzer in the model.				
Frequency Range	1 GHz	500 MHz	300 MHz	100 MHz
Resolution	0.1Hz			
Tolerance [6]	50 ppm		100 ppm	200 ppm
Relative Tolerance	0.01 ppm		0.1 ppm	1 ppm
Data Recorder (Typical)				
The same specifications apply to the common features of the oscilloscope and the data recorder in the model.				
Sampling Interval	102 MHz to 10 pHz			
Time Base	500 nS to 365 days			
Timing Accuracy	50 ppm		100 ppm	200 ppm

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Arbitrary Waveform Generator				
Arbitrary waveform length	2 to 64K adjustable			
Ram (Memory)	64K			
Amplitude resolution	12-bits (with 14-bits optional)			
Sample rate (sine wave)	400MHz	300MHz	200 MHz	100MHz
Sample rate	100 MHz			50MHz
Sample rate (Arbitrary)	1MHz to 100 MHz			1-MHz to 50MHz
Frequency adjustment resolution	10 mHz (with 1 μ Hz optional)			
Standard waveforms	DC, Sine, square, pulse, triangle, rising ramp, falling ramp, noise, rising exponent, falling exponent, sinc, cardiac, gated burst, single burst, log continuous sweep, linear continuous sweep, gated ASK, gated FSK, gated PSK AM (modulating signals; pulse, square, rising ramp, falling ramp, triangle, sinc, cardiac, rising exponent, falling exponent, noise, edited waveforms) FM (modulating signals; pulse, square, rising ramp, falling ramp, triangle, sinc, cardiac, rising exponent, falling exponent, noise, edited waveforms) burst (carrier signals; pulse, square, rising ramp, falling ramp, triangle, sinc, cardiac, rising exponent, falling exponent, noise, edited waveforms)			
Output Amplitude (Frequencies < 5MHz) Open circuit 50 Ω	0 to \pm 3.5V(7 Vpp) 0 to \pm 1.75V(3.5 Vpp)			
(5MHz > Freq. < 15MHz) Open circuit 50 Ω	0 to \pm 3.0V(6 Vpp) 0 to \pm 1.5V(3.0 Vpp)			
(15MHz > Freq. < 50MHz) Open circuit 50 Ω	0 to \pm 2.0V(4 Vpp) 0 to \pm 1.0V(2.0 Vpp)			
(50MHz > Freq. < 100MHz) Open circuit 50 Ω	0 to \pm 1.5V(3 Vpp) 0 to \pm 0.75V(1.5 Vpp)			
(100MHz > Freq. < 150MHz) Open circuit 50 Ω	0 to \pm 1.0V(2 Vpp) 0 to \pm 0.5V(1.0 Vpp)			
Accuracy (up to 100 kHz)	.1% of the specified output			
Adjustment resolution	\pm 5mV 3 digits (1mv)			

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Open offset				
Open circuit	0 to $\pm 2.2V(7 V_{pp})$			
500	0 to $\pm 2.2V(3.5 V_{pp})$			
Accuracy	2% $\pm 5mV$ (0.1% Optional)			
Adjustment resolution	3 digits(1mv)			
Output Impedance	500			
Output Current	60 mA (With the standard 50 O impedance)			
Sync	TTL compatible			
Frequencies Ranges				
Sine Wave	10 mHz to 150 MHz	10 mHz to 100 MHz	10 mHz to 50 MHz	10 mHz to 10 MHz
Square	10 mHz to 15 MHz			10 mHz to 5 MHz
Pulse	10 mHz to 15 MHz			10 mHz to 5 MHz
Triangle	10 mHz to 100 KHz			10 mHz to 100 KHz
Ramp	10 mHz to 100 KHz			10 mHz to 100 KHz
Sinc	1 Hz to 5 MHz			1 Hz to 1 MHz
Noise (White) Bandwidth	25 MHz			10 MHz
AM (Carrier)	1 Hz to 5 MHz			1 Hz to 1 MHz
FM (Carrier)	1 Hz to 5 MHz			1 Hz to 1 MHz
Sweep	DC to 15 MHz (start & stop frequency)			DC to 5 MHz
Burst (Burst Rate)	100 Hz to 2 MHz			100 Hz to 1 MHz
Digital (shift keying rate)	1 kHz to 2 MHz			1 kHz to 1 MHz
Exponent	1 Hz to 5 MHz			1 Hz to 1 MHz
Cardiac	1 Hz to 1 MHz			1 Hz to 1 MHz
Resolution	10 mHz (1 μ Hz optional)			
Accuracy	2% $\pm 5mV$ (.1% optional) At room temperature			
Temp Coefficient	20 pm/ $^{\circ}C$			
Aging	10 ppm/yr			

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Waveform Characteristics				
Sine Wave Output Flatness				
< 1 MHz		0.1 dB		0.1 dB
< 10 MHz		0.5 dB		0.2 dB
< 100 MHz		1 dB		-
Sine Wave (2Vpp) Adjustment resolution	10 mHz (1 μ Hz optional)			
Harmonic Distortion				
DC to 100 kHz	-70 dBc			
100 kHz to 1 MHz	-65 dBc			
1 MHz to 10 MHz	-60 dBc			
10 MHz to 50 MHz	-55 dBc (when applicable)			
50 MHz to 100 MHz	-50 dBc (when applicable)			
100 MHz to 150 MHz	-45 dBc (when applicable)			
Spurious				
Dc to 100 kHz	-70 dBc			
100 kHz to 1 MHz	-60 dBc			
1 MHz to 10 MHz	-60 dBc			
10 MHz to 50 MHz	-55 dBc (when applicable)			
50 MHz to 100 MHz	-55 dBc (when applicable)			
100 MHz to 150 MHz	-50 dBc (when applicable)			
Noise				
Dc to 100 kHz	-60 dBc			
100 kHz to 1 MHz	-60 dBc			
1 MHz to 10 MHz	-55 dBc			
10 MHz to 50 MHz	-50 dBc (when applicable)			
50 MHz to 100 MHz	-40 dBc (when applicable)			
100 MHz to 150 MHz	-35 dBc (when applicable)			
Phase noise	< -60 dBc in a 50 kHz band			

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Sine Wave (2Vpp)				
Frequency	10 mHz - 15 MHz			10 mHz - 5 MHz
Adjustment resolution	10 mHz (1 μ Hz optional)			
Rise/ Fall time	< 4 nS			
Overshoot	1%			
Settling time	10 nS to .5% of final value			
Asymmetry	< 2 nS			
Duty cycle	5% to 95% (1MHz)			
Adjustment resolution	10nS			
Jitter	< 10pS (rms)			
Triangle, Ramp (2Vpp)				
Frequency	10 mHz- 15 MHz			10 mHz - 5 MHz
Adjustment resolution	10 mHz (1 μ Hz optional)			
Linearity	.1% of peak output			
Asymmetry	< 2 nS			
Duty cycle	5% to 95%			
Adjustment resolution	10nS			
Jitter	< 10pS (rms)			
Exponential (2Vpp)				
Frequency	10 mHz- 5 MHz			10 mHz - 1 MHz
Adjustment resolution	10 mHz (1 μ Hz optional)			
Rise/ Fall time	< 4 nS			
Damping factor	-1,000 to 1,000			
Jitter	< 10pS (rms)			
Sinc (sin(x)/x) (2Vpp)				
Frequency	10 mHz- 5 MHz			10 mHz - 1 MHz
Adjustment resolution	10 mHz (1 μ Hz optional)			
Zero crossings	2 to 1,000			

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Cardiac (2Vpp)				
Frequency	10 mHz- 1 MHz			
Adjustment resolution	10 mHz (1 μ Hz optional)			
Zero crossings	2 to 1,000			
Noise				
Type	White			White
Bandwidth	50MHz			20MHz
AM (2Vpp)				
Carrier (-3dB)	10 mHz to 5 MHz			10 mHz - 1 MHz
Modulating signal	any internal waveform including Arb			
Frequency	10 mHz to 1MHz			
Modulation depth	0% to 150%			
Source	internal (external optional)			
External AM modulation	(optional)			
FM (2Vpp)				
Carrier (-3dB)	10 mHz to 5 MHz			10 mHz - 1 MHz
Modulating signal	any internal waveform including Arb			
Frequency	10 mHz to 1MHz			
Modulation depth	0% to 100%			
Source	internal (external optional)			
ASK (2Vpp)				
Frequency	10 MHz to 5 MHz			10 mHz - 1 MHz
Modulating signal	any internal waveform including Arb			
Getting signal	5(TTL, CMOS) to 1.2 V (CMOS, TTL, LVTTTL)			
FSK (2Vpp)				
Frequency	10 MHz to 5 MHz			10 mHz - 1 MHz
Modulating signal	any internal waveform including Arb			
Gating signal	5(TTL, CMOS) to 1.2 V (CMOS, TTL, LVTTTL)			

Model	SL987	SL957	SL937	SL917
PSK (2Vpp)				
Frequency	10 MHz to 5 MHz			10 mHz - 1 MHz
Modulating signal	any internal waveform including Arb			
Gating signal	5(TTL, CMOS) to 1.2 V (CMOS, TTL, LVTTTL)			
Burst (2Vpp)				
Carrier (-3dB)	10 mHz to 5 MHz			10 mHz - 1 MHz
Source	any internal waveform including Arb			
Rate	100 Hz to 2 MHz			
Count	variable			10 mHz - 1 MHz
Gate source	internal (external optional)			
Trigger	single, internal rate, external(optional)			
Sweep				
Type	Linear or log (exponential)			
Direction	up or down			
Start frequency	0to15MHz			0 to 1 MHz
Stop frequency	0to15MHz			0 to 1 MHz
Sweep time	1 uS to1mS			1 uS to1mS
Editing Tools				
Math operation	Addition, subtraction, multiplication, gain, clip, absolute, resize, invert, mirror, expand to fit			
Filtering	smoothing, ideal low pass, first order low pass			
Windowing	Gaussians, Blackman, Blackman-Harris, Cosine, Hanning, Hamming, Flat-Top, Kaiser-Bessel, Welch, Triangular			
Signal library	sine, square, triangle, falling ramp, rising ramp, rising exponent, falling exponent, sinc, cardiac, noise			
GUI Editors	pen, line, manual, insert			
Options	save / recallin.txt & .csv format			
Units				
Frequency	Hz, kHz, MHz			
Amplitude	mVpp, Vpp			
Offset	mV, V			

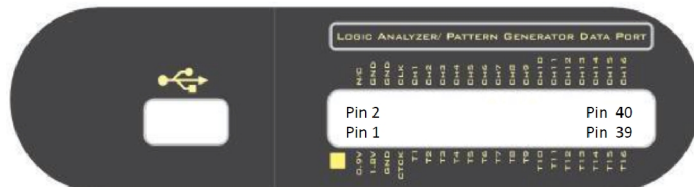
Model	SL987	SL957	SL937	SL917
Protection	short circuit			
Configuration time				
Arbitrary save	10 mS			
Arbitrary Recall	100 mS			
Setting save	10 mS			
Setting Recall	100 mS			
Function	100 mS			
Logic Analyzer/ Pattern Generator				
Logic Analyzer				
Internal Clock The internal clock makes the memory address counter follow the rising edges of the internally generated programmable clock.				
Range	100 KHz - 100 MHz		100 KHz - 50 MHz	
Resolution	1 Hz		5 Hz	
Period	10 nS - 1 uS		20 nS - 1 uS	
Period Accuracy	± 0.01%		±0. 1%	
External Clock The external clock makes the memory address counter follow the rising edges of the externally generated clock.				
Range Logic	100 KHz - 100 MHz		100 KHz - 50 MHz	
Input Logic	TTL, CMOS (1.8 V, 2.5 V, 3.3 V, 5 V)			
Maximum Sample Rate				
8 Channels	200 MHz		100 MHz	
16 Channels	100 MHz		50 MHz	
Minimum Sample Rate				
Internal Clock	1 MHz		1 MHz	
External Clock	100 KHz		100 KHz	
Minimum Detectable Pulse Width	15 nS		25 nS	
Input/ Output Channels				
Number of Channels	16			
Input Levels	TTL, CMOS (1.8 V, 2.5 V, 3.3 V, 5 V)			

Model	SL987	SL957	SL937	SL917
Output Levels - Logic Analyzer	1.8 LVCMOS			
Channel-to-Channel Skew	1 nS			
Input Impedance	100 kO, parallel 2 pF			
Maximum External Voltage	-2V to 5 V			
Coupling	DC			
Pulse / Level Parameters				
Output	1.8 LVCMOS			
Amplitude Accuracy	± (5% Amplitude + 10 mV)			
Offset Accuracy	± 20 mV			
Overshoot / pre-shoot / ringing	± 2% ± 10 mV			
Rise / Fall Time	< 2ns			
Source Impedance	200 O [7]			
Short Circuit Current	± 30mA			
Timing accuracy	100 ppm			
Trigger Types	Edge, pattern, pulse width, pattern width			
Memory/ Channel Parameters				
Number of Input Channels	16/ 8			
Data Length (16 channels)	524 K			
Data Length (8 channels)	1048 K			
Protocols	I2C, SIM, 1-Wire,SPI, Quad SPI (includes data wizard)			
Patten Generator (Typical)				
The output is a pattern event. The pattern is programmable, or may be selected from a library of pre-configured patterns. The graphical and the math editor enables the user to seamlessly create any desired pattern.				
Internal Clock				
The internal clock makes the memory address counter follow the rising edges of the internally generated programmable clock.				
Range	100 KHz - 100 MHz		100 KHz - 50 MHz	
Resolution	1 Hz		5 Hz	
Period	10 nS - 1 uS		20 nS - 1 uS	
Period Accuracy	± 0.01%		±0. 1%	

Model	SL987	SL957	SL937	SL917
External Clock The external clock makes the memory address counter follow the rising edges of the externally generated clock.				
Range Logic	100 KHz - 100 MHz		100 KHz - 50 MHz	
Input Logic	TTL, CMOS (1.8 V, 2.5 V, 3.3 V, 5 V)			
Maximum Sample Rate				
16 Channels	100 MHz		50 MHz	
Minimum Sample Rate				
Internal Clock	1 MHz		1 MHz	
External Clock	100 KHz		100 KHz	
Minimum Detectable Pulse Width	15 nS		25 nS	
Input/ Output Channels				
Number of Channels	16			
Source Impedance	200 O, selectable			
Output Levels	1.8 LVCMOS			
Input Levels	TTL, CMOS (1.8 V, 2.5 V, 3.3 V, 5 V)			
Channel-to-Channel Skew	1 nS			
Input Impedance	100 kO parallel 2 pF			
Maximum External Voltage	-2V to 5 V			
Coupling	DC			
Pulse / Level Parameters				
Output	1.8 LVCMOS			
Amplitude Accuracy	$\pm (5\% \text{ Amplitude} + 10 \text{ mV})$			
Offset Accuracy	$\pm 20 \text{ mV}$			
Overshoot / pre-shoot / ringing	$\pm 2\% \pm 10 \text{ mV}$			
Rise / Fall Time	< 2ns			
Source Impedance	200 O [8]			
Short Circuit Current	$\pm 30\text{mA}$			
Timing accuracy	100 ppm			
Trigger Types	Edge, pattern, pulse width, pattern width			
Memory/ Channel Parameters				
Number of Output Channels	16/ 8			
Data length (16 channels)	524 K			

Model	SL987	SL957	SL937	SL917
Protocols	I2C, SIM, 1-Wire,SPI, Quad SPI (includes data wizard)			
Editor - Pattern Generator	Graphical, Line, Math, and function			

Logic Analyzer/ Pattern Pin Assignment



Logic Analyzer/ Pattern Generator Back panel

Pin No.	Pin Name	Pin Assignment	Pin No.	Pin Name	Pin Assignment
1	0.9V	Open	2	N/C	Ground [8]
3	1.8V	Open	4	GND	Ground
5	GND	Ground	6	GND	Ground
7	CTCK	Clock In/ Out [9]	8	CLK	Clock In/ Out
9	T1	Channel 1	10	CH1	Channel 1
11	T2	Channel 2	12	CH2	Channel 2
13	T3	Channel 3	14	CH3	Channel 3
15	T4	Channel 4	16	CH4	Channel 4
17	T5	Channel 5	18	CH5	Channel 5
19	T6	Channel 6	20	CH 6	Channel 6
21	T7	Channel 7	22	CH 7	Channel 7
23	T8	Channel 8	24	CH8	Channel 8
25	T9	Channel 9	26	CH 9	Channel 9
27	T10	Channel 10	28	CH 10	Channel 10
29	T11	Channel 11	30	CH 11	Channel 11
31	T12	Channel 12	32	CH 12	Channel 12
33	T13	Channel 13	34	CH 13	Channel 13
35	T14	Channel 14	36	CH 14	Channel 14
37	T15	Channel 15	38	CH 15	Channel 15
39	T16	Channel 16	40	CH 16	Channel 16

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Physical Properties				
Dimensions	128.0 x 77.0 x 31.6 (mm), 5.0 x 3.0 x 1.2 (inches)			
Weight	340 grams, 12 Ounces			
Other				
PC Requirements Recommended	Operating system: 32/ 64-bit edition of Microsoft Windows XP (SP3), Vista, Windows 7/ Windows 8/ Windows 10 Ports: USB 2.0/ 3.0 compliant port			
Environmental				
Operating environment	0 °C to 40 °C for normal operation			
Temperature range	15 °C to 32 °C for quoted accuracy			
Humidity	5% to 80% RH, non-condensing			
Storage environment				
Temperature range	-20 °C to +60 °C			
Humidity	5% to 95% RH, non-condensing			
Software	Save setting, recall setting, save plot, recall/print plot, zoom in vertical, zoom in horizontal, pen editor, line editor, DSP, variable sampling rate			