

# Acute MSO3000 series

## 6-in-1 Instruments

DAQ, DSO, DVM, Frequency Counter,  
Logic Analyzer, Protocol Analyzer



- PC-based, USB3.0 interface / powered (Type-A / Type-C)
- Total Memory : 4 Gb
- Data Logger (HDD / SSD Storage)
- DSO : 4 Channels (cascaded 4units up to 16 channels)  
1 GS/s S/R, 200 MHz bandwidth
- Digital Voltmeter : 3 digits
- Frequency Counter : 5 digits
- Logic Analyzer : 16 Channels, 2 GS/s Timing Analysis, 250 MHz State Analysis  
Bus Decode : CAN 2.0B/CAN FD, DP\_Aux<sup>1</sup>, eSPI, I<sup>2</sup>C, I<sup>2</sup>S, MII, MIPI I3C 1.1, MIPI RFFE 3, MIPI SoundWire, MIPI SPMI 2, SPI, SPI Flash, SVID<sup>2</sup>, UART, USB PD 3.1, ...(100+)  
Bus Trigger : CAN2.0B/CAN FD, eSPI, MII, MIPI I3C 1.1, RGMII, RMII, SVID<sup>3</sup>, ... (30+)
- Protocol Analyzer : CAN2.0B/CAN FD, eSPI, MII, MIPI I3C 1.1, RGMII, RMII, SVID<sup>3</sup>, ... (20+)

Model	Record Length/ch (Analog / Digital)	Vertical Resolution (Analog)	Trigger (Analog / Digital)
MSO3124E	128 / 256 Mpts	8 bits	Group I / I
MSO3124B	128 / 256 Mpts	8 bits	Group I, II, Bus / I, II
MSO3124H	128 / 256 Mpts	8,12,14,15,16 bits	Group I, II, Bus / I, II, III

## Software Window



## System Requirements

- USB 3.0 port
- Windows 7/8/10/11 (64-bit)  
Linux Ubuntu (64-bit)\*  
macOS\*
- PC RAM 16GB

\* Free update by year end

# Acute®

PC-based T&M Instruments

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# Analog Specifications (Main Device)

Model		MSO3124E	MSO3124B	MSO3124H
Power	Power source	USB bus-power (+5V)		
	Static power consumption	4.5W		
	Max power consumption	7.7W		
Acquisition	Mode	Sample, Average*, Envelope*, Peak detect*, High resolution*		
	Sampling @ 1Ch	1 GS/s	1 GS/s	500 MS/s 100 MS/s
	@ 2Ch	500 MS/s	500 MS/s	250 MS/s 100 MS/s
	(8 / 12 / ≥14 bits) @ 4Ch	250 MS/s	250 MS/s	125 MS/s 100 MS/s
	Record length @ 1Ch	512 Mpts	512 Mpts	256 Mpts 256 Mpts
@ 2Ch	256 Mpts	256 Mpts	128 Mpts 128 Mpts	
@ 4Ch	128 Mpts	128 Mpts	64 Mpts 64 Mpts	
Input	Input channels	4		
	Input coupling	AC/DC		
	Input impedance	1 MΩ    <19 pF		
	Overvoltage protection	± 100 V (DC+AC peak)		
	Ch-Ch isolation	50dB @DC to 100MHz; 40dB @ 100MHz to 200MHz		
	Ch-Ch skew	100 ps between two channels with the same scale & coupling settings		
Temperature	Operating / Storage	5°C~40°C (41°F~104°F) / -10°C~65°C (14°F~149°F)		
I/O port	Trig-In	Workable : 2.5V to 5V / Typical : TTL 3.3V (Rising/Falling)		
	Trigger pulse approval	> 8 ns		
	Trig-Out	TTL 3.3 V		
	Ref. Clock input	10MHz, Vpp=3.3 to 5V		
	Ref. Clock output	10MHz, TTL 3.3V		
	Connector type	MCX jack / female		
Vertical	Bandwidth	200 MHz		
	Rise time	1.75 ns @ 200 MHz; 3.5 ns @ 100 MHz; 7 ns @ 50 MHz		
	Resolution	8 bits	8, 12, 14, 15, 16 bits	
	Input sensitivity	2 mV/div to 10 V/div (Full-Scale: ±4 div/screen, ±1 div beyond screen)		
	Offset range	±150 V @ 2, 5, 10 V/div; ±1.5 V @ 0.2, 0.5, 1 V/div; ±1.5 V @ 2, 5, 10, 20, 50, 100 mV/div		
	DC accuracy	±3% of Full-Scale		
Horizontal	Bandwidth limit	20 MHz, 100 MHz or Full		
	Time scale	1 ns/div to 100 s/div (10 div/screen)		
	Time resolution	125 ps		
	Time accuracy	±10 ppm		
	Delay range	Pre-trigger: 0 to 100% of 1 screen; Post-trigger up to 50 sec.		
Trigger	Trigger mode	Auto, Normal, Single, Roll*		
	Source	Ch1, Ch2, Ch3, Ch4, Ext. (TTL only)		
	Coupling	DC, LF reject (50kHz), HF reject (50kHz), Noise reject		
	Trigger range	±4 div from window center		
	Vertical sensitivity	1 div or 5 mV @ <10 mV/div; 0.6 div @ ≥ 10 mV/div		
	Hold off range	~60 ns to 10 sec.		
	Group I	Edge, Either, External, Falling, Rising, Video, Width		
	Group II	---	Runt, Pattern/ State, Timeout, Transition, Setup/ Hold, B-Trigger, B-Event, Window	
Measurement/ Processing	Bus	---	BiSS-C, CAN 2.0B/CAN FD, DALI, DP_Aux <sup>1</sup> , I2C, I2S, LIN2.2, MIPI I3C 1.1, Modbus, Profibus, SENT, SPI, UART(RS232), USB1.1	
	Measurement	Frequency, Period, ±Duty, ±Period, Rise/ Fall Time, Delay, Phase; VMax, VMin, VHigh, VLow, Vpp, VAmp, VMid, VMean, VRMS, ±Overshoot, Rise/ Fall Preshoot; Edge Count, ±Pulse Count		
	Cursor	Time difference, Voltage difference		
	Math	+, -, x, ÷, XY,  A , √A, Log(A), Ln(A), fAdt, e <sup>A</sup>		
	FFT	Rectangular, Blackman, Hann, Hamming, Harris, Triangular, Cosine, Lanczos, Gaussian. (Vertical Scale: dBm RMS, dBV RMS, Linear RMS)		
Cascade	Export data	WORD, EXCEL, CSV, TEXT, HTML, MATLAB		
	Max. channels expand	---	16 Ch (4x MSO3000, 1 Master & 3 Slaves)	
	Trigger source	---	Master only	
	Skew between Master & Slave	---	±2ns @ 1 GS/s ±4ns @ 500 MS/s ±8ns @ 250 MS/s	
Packing List	Device (150x120x70mm)	1		
	USB3.0 Y cable (1.8M)	1		
	Type-C OTG Adapter	1		
	250 MHz Probe	4		
	Stack cable (30cm)	2		
	Handbag	1		

<sup>1</sup> Optional DP\_Aux adapter needed.

\* Free update by year end

# Digital Specifications (LA POD)

Device		MSO3124E	MSO3124B	MSO3124H
LA POD		LA16E	LA16B	LA16H
Timing analysis (Asynchronous, Max. sample rate)		2 GS/s		
State clock rate (Synchronous, external clock)		250MHz		
Storage		Conventional Timing, Transitional Timing		
Channels		16		
Total memory		4 Gb		
Timing vs. Channels vs. Memory	Timing analysis	Available channels (Conventional / Transitional Timing) - Memory per channel		
	2 GS/s	(8/7)-512 Mpts		
	1 GS/s	(16/14)-256 Mpts		
	500 MS/s	(16/16)-256 Mpts		
	250 MS/s	(16/16)-256 Mpts		
Channel to channel skew		< 1ns		
Input	Input channels	16		
	Input impedance	75KΩ    <2pF		
	Maximum (Non-destructive)	±50V		
	Operation	±30V		
Sensitivity		0.25Vpp @50MHz, 0.5Vpp @150MHz, 0.8Vpp @250MHz		
Threshold	Group	2 (D0~D7, D8~D15 & CK0)		
	Range	±30V		
	Resolution	50mV		
	Accuracy	±100mV + 5%*Vth		
Trigger	Resolution	500ps		
	Channels	16		
	States	8		
	Events	8		
	Pre / Post	Yes		
	Pass counter	Yes (0~1048575 times)		
	Types	External, Manual, Multi Level, Setup/Hold Violation, Single Level, Timeout, Width		
	Bus I	BiSS-C, CAN2.0B/CAN FD, DP_Aux <sup>1</sup> , HID over I2C, I2C, I2S, LIN2.2, MIPI I3C 1.1, SENT, SPI, UART, USB PD 3.1		
	Bus II	---	DALI, LPC, MDIO, Mini/Micro LED, MIPI RFFE 3, MIPI SPMI 2, Modbus, PMBus, Profibus, SMBus, SVI2, USB1.1	
	Bus III	---	eMMC 4.5, eSPI, MII, RGMII, RMII, SD 3.0 (SDIO 2.0), Serial Flash (SPI NAND), SVID <sup>3</sup>	
Protocol Analyzer	I	BiSS-C, CAN2.0B/CAN FD, DP_Aux <sup>1</sup> , HID over I2C, I2C, I2S, LIN2.2, MIPI I3C 1.1, SPI, UART, USB PD 3.1		
	II	---	DALI, MDIO, Mini/Micro LED, MIPI RFFE 3, Modbus, PMBus, Profibus, SMBus, USB1.1	
	III	---	eSPI, MII, RGMII, RMII, SVID <sup>3</sup>	
Bus Decode	1-Wire, 3-Wire, 7-Segment, A/D Mux Flash, AccMeter, ADC, APML, AVSBus, BiSS-C, BSD, BT1120, CAN 2.0B/FD, Close Caption, CODEC_SSI, DALI, DMX512, DP_Aux <sup>1</sup> , EDID, eMMC 5.1/MMC, eSPI, FlexRay, HD Audio, HDLC, HDQ, HID over I2C, HTSensor, HyperBus, I2C EEPROM, I2C, I2S (PCM, TDM), I80, IDE, IrDA, ITU-R BT.656 (CCIR656), JTAG, JVC IR, LCD1602, LED_Ctrl, LIN 2.2, Line Decoding, Line Encoding, Lissajous, LPC, LPT, Math, M-Bus, MDDI, MDIO, MHL CBUS, Microwire, MII, Mini/Micro LED, MIPI CSI LP, MIPI DSI LP, MIPI I3C 1.1, MIPI RFFE 3, MIPI SoundWire 1.2, MIPI SPMI 2, Modbus, NAND Flash, NEC IR, PDM, PECE 3.0, PMBus, Profibus, PS/2, PWM, QEI, QI, QSPI, RC-5, RC-6, RGB Interface, RGMII, RMII, S/PDIF, SD 3.0 (SDIO 2.0), SENT, Serial Flash, Serial IRQ, SGPIO, Smart Card, SMBus (SBS, SPD), SMI, SPI, SPI-NAND, SSI, ST7669, SVI2, SVID <sup>2</sup> , SWD, SWIM, SWP, UART, ULPI, UNI/O, USB 1.1, USB PD 3.1, Wiegand, ...			
Line Decoding	Biphase Mark, Differential-Manchester, Manchester (Thomas, IEEE802.3), Miller, Modified Miller, NRZI, ...			
Line Encoding	AMI(Standard, B8ZS, HDB3), Biphase Mark, CMI, Differential-Manchester, Manchester (Thomas, IEEE802.4), MLT-3, Miller, Modified Miller, NRZI, Pseudoternary, ...			
Packing List	LA POD	1		
	Flying lead cables (LA20P)	2		
	Gripper	20		

<sup>1</sup> Optional DP\_Aux adapter needed.

<sup>2</sup> Upon request ONLY by users who have signed CNDA with Intel, SVID decode supported by all MSO3000 models.

<sup>3</sup> Upon request ONLY by users who have signed CNDA with Intel, SVID trigger & PA supported by MSO3124H ONLY.

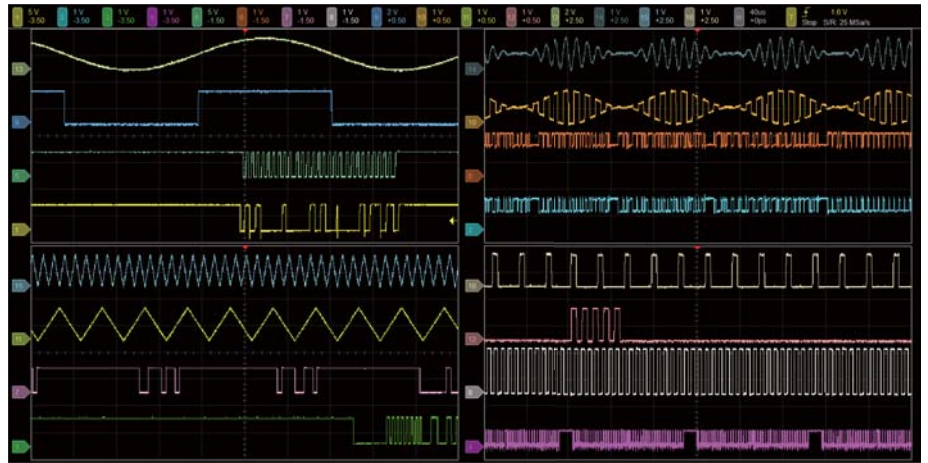
# DAQ

For real-time signal data monitoring.

# DSO

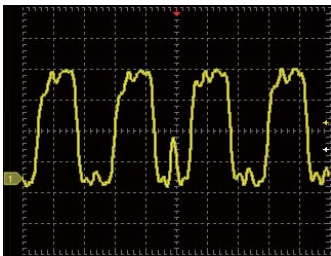
## Multiple Devices Stack Mode :

Support DSO stack mode, up to 4 devices (16 channels) can be stacked together in the same time.



## Functions :

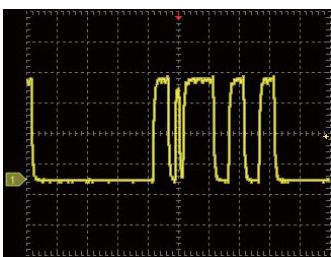
- **Edge Trigger** : Trigger on a rising/falling/either.
- **Pattern Trigger** : Trigger when logic inputs cause the selected function goes true.
- **Trigger Hold off** : Hold off time adjustable up to 10s.
- **Runt Trigger** : Use 2 voltage thresholds and pulse width to trigger on either/ positive or negative runt signals.



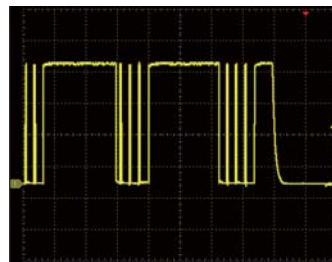
Positive Runt



Negative Runt

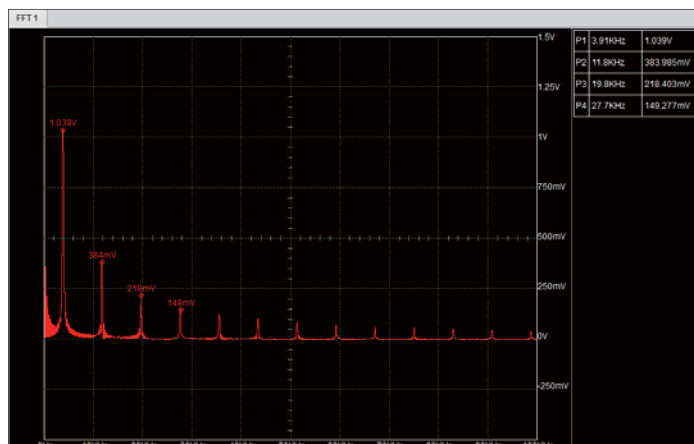


• **Pulse Width Trigger**  
Pulse width range from 8ns to 50s.



• **Timeout Trigger**  
Trigger when no pulse is detected within a specified time, range from 8ns to 50s.

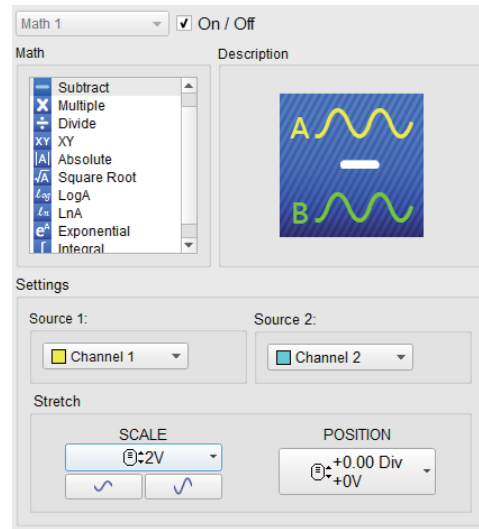
- **Spectrum analysis**  
(Fast Fourier transform, FFT)  
Apply FFT to the selected channel.





- **Math**

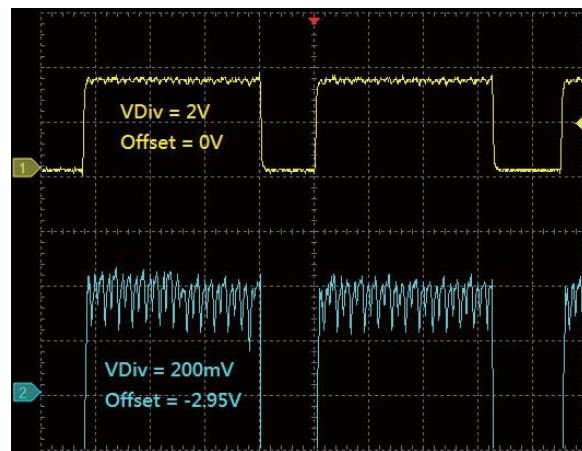
Add, Subtract, Multiple, Divide, XY, Absolute, Square Root, LogA, LnA, Exponential, Integral



- **Vertical Offset**

Right-press the mouse to offset the voltage vertically with the resolution from 2mV/Div to 10V/Div for both channels.

The 16-bits resolution MSO3124H provides more noise details for this vertical offset function.



- **Trigger Coupling Mode**

Provide DC Coupling, Low Frequency (LF) Reject, High Frequency (HF) Reject and Noise Reject function:

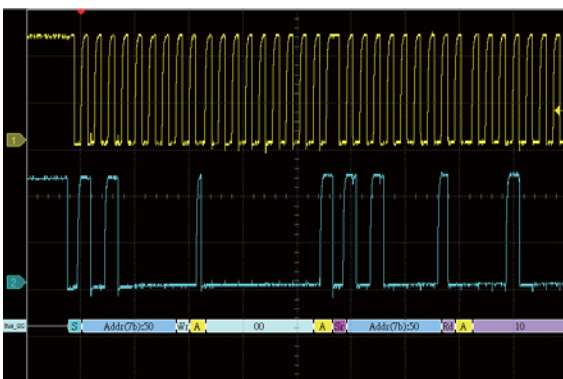
LF Reject: Apply 50 kHz high pass filter to the signal before entering the Trigger circuit.

HF Reject: Apply 50 kHz low pass filter to the signal before entering the Trigger circuit.

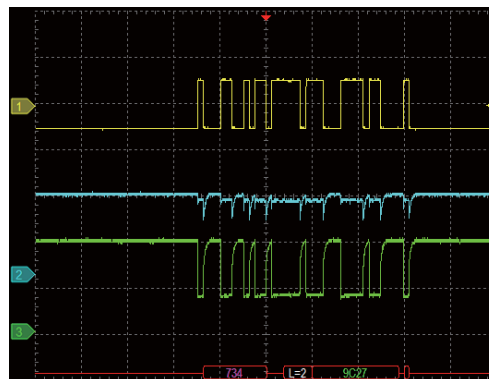
Noise Reject: Lower the Trigger sensitivity to avoid false triggering.

- **Protocol Decode & Trigger Function**

Provides, CAN/CAN-FD, I<sup>2</sup>C, LIN, MIPI I3C 1.1, ProfiBus, SPI, UART(RS232), USB1.1,... protocol decode and trigger function, which is able to trigger and decode on the specified Command/Address/Data...



Decode the I<sup>2</sup>C waveforms

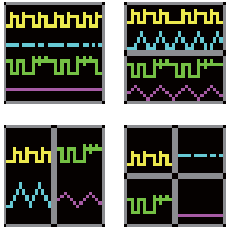


Decode the differential CAN signals with a differential probe.

(CH1: Differential Probe, CH2: CAN H, CH3: CAN L)

※ Supports CAN-FD, CAN2.0

## Multiple Windows

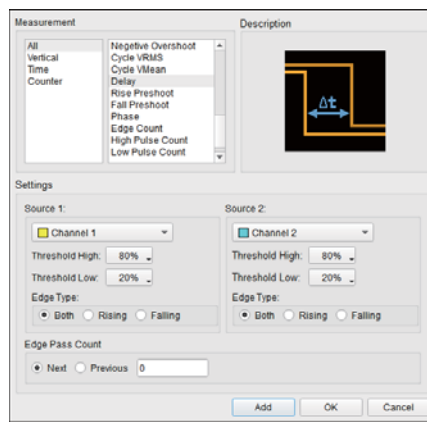


Multiple Window feature provides 4 display types (1x1, 2x1, 1x2, 2x2), which could displays 16 channels in maximum 4 different windows, provides clear waveform readability without lower the vertical resolution.

## Measurement :

More than 20 types of waveform measurements with customized threshold settings features, provides real-time update for vertical, time and channel to channel timing measurements with statistic features.

- Time: Frequency, Period,  $\pm$ Duty,  $\pm$ Period, Rise /Fall Time, Delay, Phase
- Vertical: VMax, VMin, VHigh, VLow, Vpp, VAmp, VMid, VMean, VRMS,  $\pm$ Overshoot, Rise /Fall Preshoot
- Counter: Edge Count,  $\pm$ Pulse Count



## Digital Voltmeter (DVM) & Frequency Counter

Provides voltage root-mean-square, voltage average and frequency counter function for the selected channel.



Measure 1 KHz, 2.5 Vpp square waveforms by the measurement function.



Measure 1 KHz, 2.5 Vpp square waveforms by the DVM function.

## Packing List



Device



USB3.0 Y cable (1.8M)  
Type-C OTG Adapter



250 MHz Probe



Stack cable



Handbag

# Logic Analyzer

Built-in DSO to capture analog waveforms to compare with the digital waveforms.

Provides multiple storage modes, users could select to have long time recording or precision acquisition.

### LA Storage mode

Conventional Storage: Signal Rate 200MHz

Transitional Storage: Signal Rate 200MHz

Streaming to PC RAM:  $\leq$  Signal Rate 200MHz (Depends on PC's performance)

Streaming to PC HDD:  $\leq$  Signal Rate 200MHz (Depends on PC's performance)

Short time -----> Long time

LA Device RAM

PC RAM

PC HDD

## Analog waveform

Input Sensitivity: 2mV/div to 10V/div; Max. Sampling Rate: 1GS/s @ 1Ch

Can be used with High Voltage probe, Differential probe or Current probe.

Analog Channel

Quick Setup

1 1V BW +0.00 DC 2 1V BW +0.00 DC 3 1V BW +0.00 DC 4 1V BW +0.00 DC

CH 1 ON/OFF

Coupling: DC

Bandwidth: Full BW

Probe: 10 x

VOLT DIV: 1V

POSITION: +0.00 Div +0V

Auto

## Digital waveform

Operation Range:  $\pm 30V$

Max. Timing Analysis: 2GS/s @ 8Ch

Digital Channel

16-Channel

Threshold: Quick Setup

CH 00 - 07: 1.60 V

CH 08 - 15: 1.60 V

## Compare digital and analog waveforms at the same channel for statistics.

Time/Div = 2 us

Acquired: 15:20

192.8us

416.34 ms 416.34 ms 416.34 ms 416.34 ms 416.34 ms 416.35 ms 416.35 ms 416.35 ms

BUS\_I2C 1:0 20

CH-00 0 5.5 us

CH-01 1

DSO CH0 DSO CH0

DSO CH1 DSO CH1

DSO CH8 DSO CH8

Bus Decode

Digital waveforms

Analog waveforms

Measurement Type	Label Name A	Label Name B	From	To	Minimum	Maximum	Average
Frequency	CH-00		Begin	End	961.391Hz	77.519KHz	49.852KHz
Edge Count	BUS_I2C (C...		Cursor A	Cursor B	---	---	19
V Max.	DSO CH8		Begin	End	---	---	2.543V
V Mean	DSO CH8		Begin	End	---	---	1.246V
V Amplitude	DSO CH0		Begin	End	---	---	4.373V

Report window

# Protocol Analyzer

It is hardware decoding, may log protocol data very long time if without waveforms.  
 Application timing: Preliminary protocol debug.

Support multiple protocols with different operating modes

Real-time data search

Stack with a DSO as an MSO in logic analyzer mode

The screenshot shows a logic analyzer software interface. At the top, there are buttons for 'Connect', 'Protocol', 'Protocol Analyzer', 'Show Waveforms', 'Run', 'Search', 'Search All Field', 'To bottom', 'Save to text', and 'Stack DSO'. Below these are three panels: a table of protocol data, a 'Navigator' panel with statistics, and a 'Waveform' panel showing bus decodes. Red arrows point from the text above to specific features: 'Protocol' and 'Protocol Analyzer' buttons, the 'Search' box, the 'Stack DSO' button, the 'Navigator' panel, and the 'Waveform' panel.

Timestamp	Status	Address	RW	Data	ASCII
0.001.848.160	545.30us	Start	3F	Rd	00*
0.002.393.460	545.30us	Start	3F	Rd	00*
0.002.941.080	547.62us	Start	12	Wr	41* 43* 55* 54* 45*
0.004.493.640	1.55ms	Start	46	Wr	54* 4C* 5F* 33* 30* 30* 30* 5...
0.008.039.840	3.54ms	Start	3F	Rd	00*
0.008.585.140	545.30us	Start	3F	Rd	00*
0.009.130.460	545.32us	Start	3F	Rd	00*
0.009.678.060	547.60us	Start	12	Wr	41* 43* 55* 54* 45*
0.011.230.620	1.55ms	Start	46	Wr	54* 4C* 5F* 33* 30* 30* 30* 5...
0.014.776.820	3.54ms	Start	3F	Rd	00*
0.015.322.120	545.30us	Start	3F	Rd	00*
0.015.867.440	545.32us	Start	3F	Rd	00*
0.016.415.060	547.62us	Start	12	Wr	41* 43* 55* 54* 45*
0.017.967.600	1.55ms	Start	46	Wr	54* 4C* 5F* 33* 30* 30* 30* 5...
0.021.513.800	3.54ms	Start	3F	Rd	00*
0.022.059.120	545.32us	Start	3F	Rd	00*

Real-time data statistics

Hide items for easy view

Show waveforms with bus decodes



## Protocol Analyzer

Show real-time protocol data  
 Application timing: massive protocol data with some idles in between



## Protocol Logger

Like data logger, save massive data into SSD hard drive  
 Application timing: massive protocol data



## Protocol Monitor

Like dash cameras, record protocol data by the device's memory only  
 Application timing: trigger event only happens in very long time

# Packing List



LA POD



Flying lead cables (LA20P)



Gripper