# Acute MSO3000

## 6-in-1 Instrument

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


150 x 123 x 33 mm³
Device Weight: 400g

- PC-based, USB3.0 interface / powered (Type-A / Type-C)
- Record length : 128 (256) Mpts / Analog (Digital) CH

❶ Data Logger : HDD / SSD Storage

❷ DSO : 4 Channels, 1 GS/s S/R, 200 MHz bandwidth

❸ Digital Voltmeter : 3 digits

❹ Frequency Counter : 5 digits

❺ Logic Analyzer : 16 Channels, 2 GS/s Timing Analysis, 250 MHz State Analysis

Protocol Decode : 10BASE-T1S[1], CAN 2.0B/CAN FD, DP_Aux[1], eSPI, I²C, I²S, MII, MIPI I3C 1.1, MIPI SPMI 2, SPI Flash, SVI3[2], SVID[3], UART, USB PD 3.1, ...(100+)

Protocol Trigger : 10BASE-T1S[1], CAN2.0B/CAN FD, eSPI, MIPI I3C 1.1, SVI3[2], SVID[3], ... (30+)

❻ Protocol Analyzer : 10BASE-T1S[1], CAN2.0B/CAN FD, eSPI, MIPI I3C 1.1, SVI3[2], SVID[3], ... (20+)

| Model | Vertical Resolution (DSO) | DSO Trigger / Protocol Trigger (DSO) | Protocol Trigger (Logic Analyzer) | Electrical Validation[*] |
|---|---|---|---|---|
| MSO3124E | 8 bits | I / - | I | - |
| MSO3124B | 8 bits | I, II / Yes | I, II | - |
| MSO3124H | 8, 12~16 bits | I, II / Yes | I, II, III | - |
| MSO3124V | 8, 12~16 bits | I, II / Yes | I, II, III | I2C, MIPI I3C, ... |

## Software Window


### System Requirements

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

* Free update by year end 2024.

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# DSO Specifications (Main Device)

| Model | | | MSO3124E | MSO3124B | MSO3124H | MSO3124V |
|---|---|---|---|---|---|---|
| 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 (8 \| 12 \| ≧14 bits) | @ 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 | |
| | | @ 4Ch | 250 MS/s | | 250 MS/s \| 125 MS/s \| 100 MS/s | |
| | Record length (8 \| ≧12 bits) | @ 1Ch | 512 Mpts | | 512 Mpts \| 256 Mpts | |
| | | @ 2Ch | 256 Mpts | | 256 Mpts \| 128 Mpts | |
| | | @ 4Ch | 128 Mpts | | 128 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℃~40℃ (41℉~104℉) / -10℃~65℃ (14℉~149℉) | | | |
| 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 | | | |
| | Bandwidth limit | | 20 MHz, 100 MHz or Full | | | |
| Horizontal | 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. | | | |
| | DSO I | | Edge, Either, External, Falling, Rising, Video, Width | | | |
| | DSO II | | --- | Runt, Pattern/State, Timeout, Transition, Setup/Hold, B-Trigger, B-Event, Window | | |
| Protocol Trigger & Decode | | | --- | 10BASE-T1S[1], BiSS-C, CAN 2.0B/CAN FD, DALI, DP_Aux[1], HID over I2C, I2C, I2S, LIN2.2, MDIO, Mini/Micro LED, MIPI I3C 1.1, MIPI RFFE 3, MIPI SPMI 2, Modbus, PMBus, ProfiBus, SENT, SMBus, SPI, SVI2, UART(RS232)[2], USB PD 3, USB1.1 | | |
| Protocol Decode | | | --- | 1-Wire, 3-Wire, AccMeter, APML, AVSBus, BSD, CEC, Closed Caption, CODEC_SSI, DDC(EDID), DMX512, FlexRay, HD Audio, HDLC, HDQ, HTSensor, I2C(EEPROM), IrDA, ISELED Digital RGB LED, JVC IR, LED_CTRL, M-Bus, MDDI, MHL CBUS, Microchip SWI, MICROWIRE, MIPI CSI LP, MIPI DSI LP, MIPI SoundWire, NEC IR, PCM, PDM, PECI, PS/2, PWM, QEI, QI, RC-5, RC-6, RT_SWI, S/PDIF, SDQ, Serialized IRQ, SGPIO, Smart Card (ISO7816), SMI, SSI, ST7669, SWIM, SWP, UNI/O, USB4/TBT3 SB, Wiegand | | |
| Measurement/ Processing | 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, lAl, √A, Log(A), Ln(A), ∫Adt, $e^A$ | | | |
| | FFT | | Rectangular, Blackman, Hann, Hamming, Harris, Triangular, Cosine, Lanczos, Gaussian. (Vertical Scale: dBm RMS, dbV RMS, Linear RMS) | | | |
| | Export data | | WORD, EXCEL, CSV, TEXT, HTML, MATLAB | | | |
| Electrical Validation (Protocol)[*] | | | --- | | | I2C, I2S, MIPI I3C, MIPI RFFE, MIPI SPMI, PDM, SPI, UART(RS232) |
| Cascade | Max. channels expand | | --- | | 16 Ch (4x Device, 1 Master & 3 Slaves) | |
| | Trigger source | | --- | | Main device only | |
| | Skew between Master & Slave | | --- | | ±2ns @ 1 GS/s ; ±4ns @ 500 MS/s ; ±8ns @ 250 MS/s | |

[1] Optional 10BASE-T1S / DP_Aux adapter needed.
[2] To measure RS422/485, need to optional the ADP high-voltage differential probe.
[*] Free update by year end

# Logic Analyzer Specifications (LA POD)

| Device<br>LA POD | | MSO3124E<br>LA16E | MSO3124B<br>LA16B | MSO3124H<br>LA16H | MSO3124V<br>LA16V |
|---|---|---|---|---|---|
| **Timing analysis** (Asynchronous, Max. sample rate) | | 2 GS/s | | | |
| **State clock rate** (Synchronous, external clock) | | 250MHz | | | |
| **Storage** | | Conventional Timing, Transitional Timing | | | |
| **Channels** | | 16 | | | |
| **Record length** | | 256 Mpts per channel | | | |
| **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 | | | |
| | Protocol I | 10BASE-T1S[1], BiSS-C, CAN2.0B/CAN FD, DP_Aux[1], HID over I2C, I2C, I2S, LIN2.2, MIPI I3C 1.1, SENT, SPI, UART, USB PD 3.1 | | | |
| | Protocol II | --- | DALI, LPC, MDIO, Mini/Micro LED, MIPI RFFE 3, MIPI SPMI 2, Modbus, PMBus, Profibus, SMBus, SVI2, USB1.1 | | |
| | Protocol III | --- | | eMMC 4.5, eSPI, MII, RGMII, RMII, SD 3.0 (SDIO 2.0), Serial Flash (SPI NAND), SVI3[2], SVID[3] | |
| **Protocol Analyzer** | I | 10BASE-T1S[1], BiSS-C, CAN2.0B/CAN FD, DP_Aux[1], HID over I2C, I2C, I2S, LIN2.2, MIPI I3C 1.1, SPI, UART, USB PD 3.1 | | | |
| | II | --- | DALI, MDIO, MIPI RFFE 3, Modbus, PMBus, Profibus, SMBus, USB1.1 | | |
| | III | --- | | eSPI, MII, RGMII, RMII, SVI3[2], SVID[3] | |
| **Protocol Decode** | | 1-Wire, 3-Wire, 7-Segment, 10BASE-T1S[1],, AccMeter, ADC, APML, AVSBus, BiSS-C, BSD, BT1120, CAN 2.0B/FD, Close Caption, CODEC_SSI, DALI, DMX512, DP_Aux[1], EDID, eMMC 4.5, eSPI, FlexRay, HD Audio, HDLC, HDQ, HID over I²C, HTSensor, HyperBus, I²C EEPROM, I²C, I²S (PCM, TDM), I80, IDE, IrDA, ISELED,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, Microchip SWI, 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, PECI 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, SVI3[2], SVID[3], SWD, SWIM, SWP, UART, ULPI, UNI/O, USB 1.1, USB4/TBT3 SB Channel, 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 | | | |

[1] Optional 10BASE-T1S / DP_Aux adapter needed.

[2] Upon request by user who is approved by AMD. SVI3 decode, trigger and protocol analyzer are supported ONLY by MSO3124H or MSO3124V.

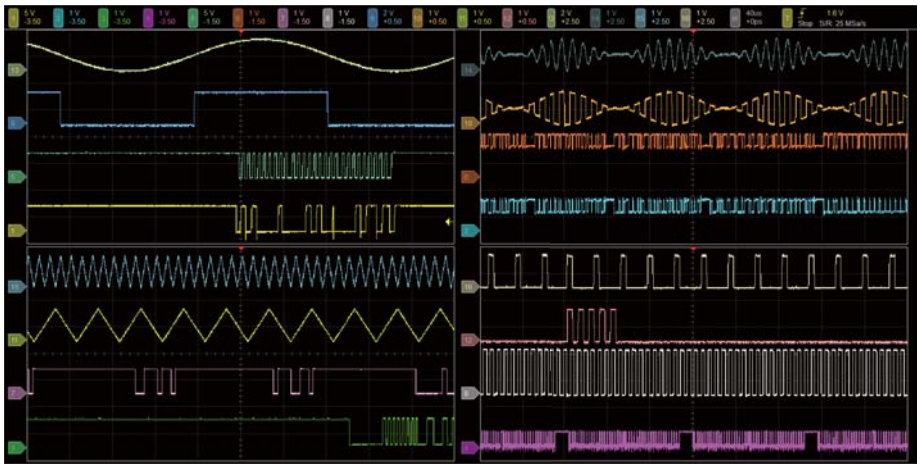
[3] Upon request by user who has signed CNDA with Intel. SVID decode, trigger and protocol analyzer are supported ONLY by MSO3124H or MSO3124V.

## DAQ

For real-time signal data monitoring.

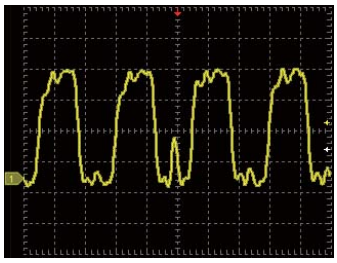
## DSO

**Multiple Devices Stack Mode：**
Support DSO stack mode, up to 4 devices (16 channels) can be stacked together in the same time.



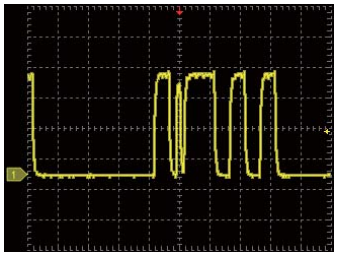
**Functions：**

- **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.

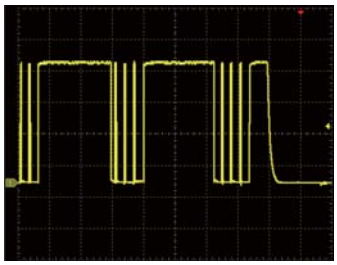


**Positive Runt**

**Negative Runt**

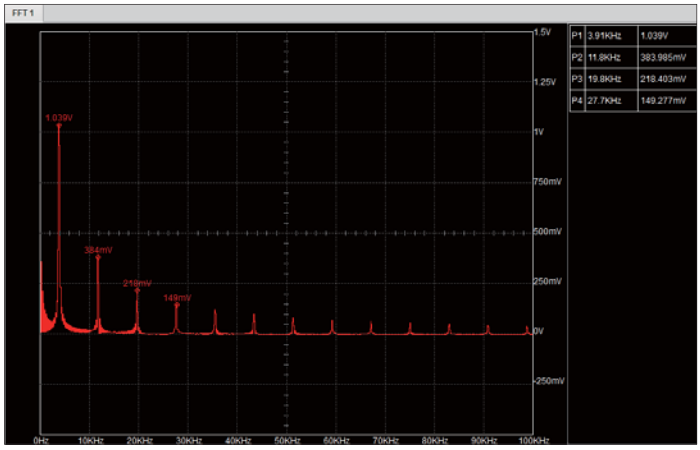


- **Pulse Width Trigger**
  Pulse width range from 8ns to 50s.



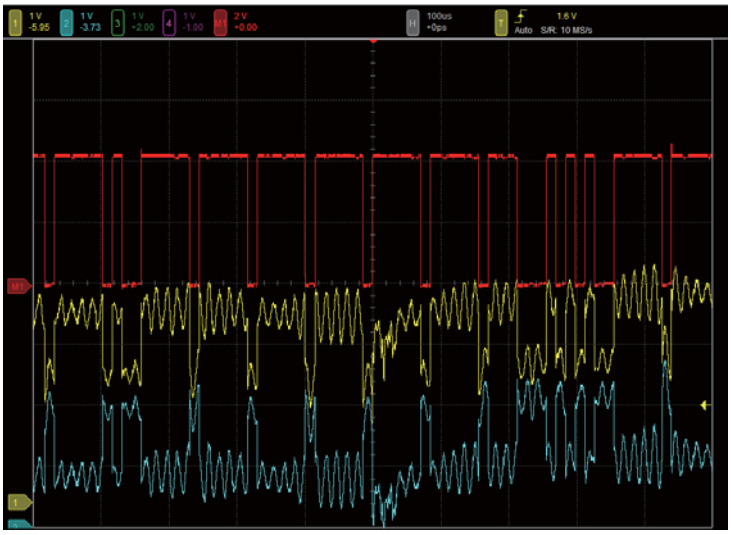
- **Timeout Trigger**
  Trigger when no pulse is detected within a specified time, range from 8ns to 50s.

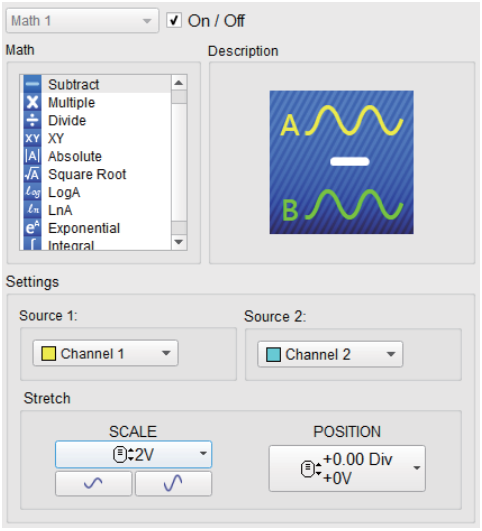
- **Spectrum analysis**
  **(Fast Fourier transform, FFT)**
  Apply FFT to the selected channel.



- **Math**

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

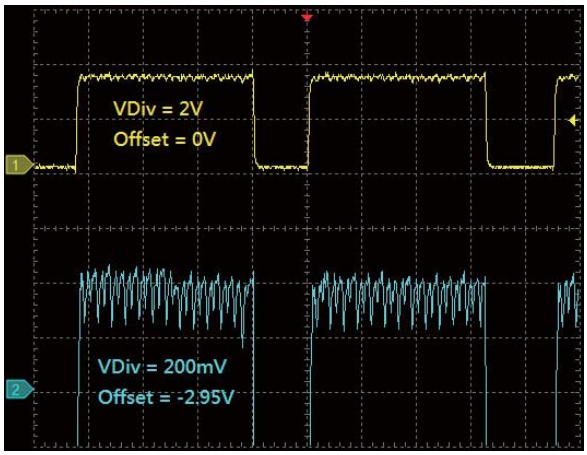





- **Vertical Offset**

  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:

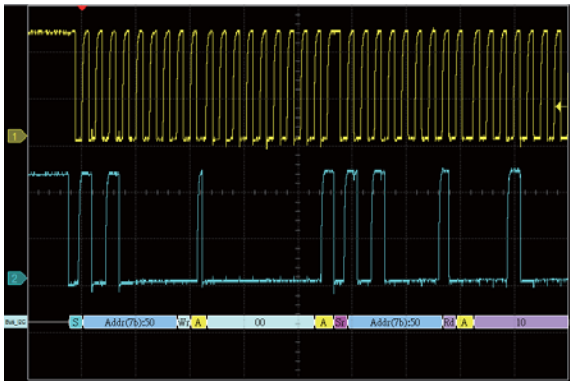
  LF Reject: Apply 50 kHz high pass filter to the signal before entering the Trigger circuit.

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

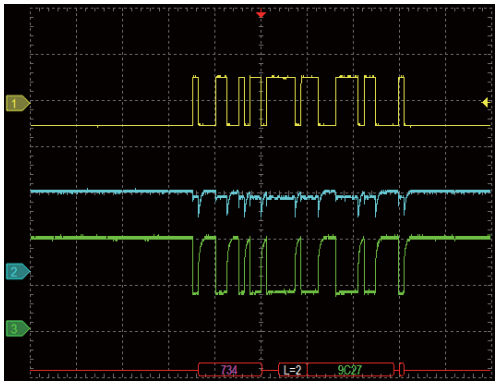
  Noise Reject: Lower the Trigger sensitivity to avoid false triggering.

- **Protocol Decode & Trigger Function**

  Provides, CAN/CAN-FD, I²C, 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...

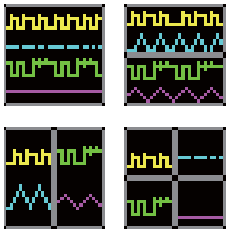


Decode the I²C waveforms



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**

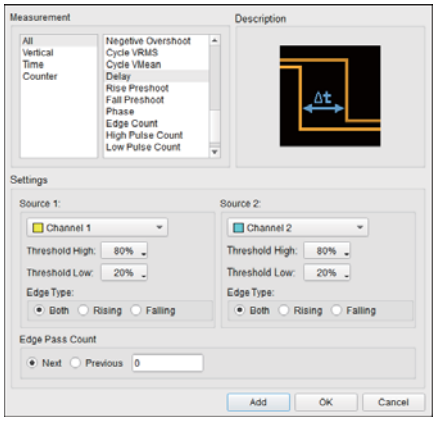


Multiple Window feature provides 4 display types (1x1, 2x1, 1x2, 2x2), which could displays 16 channels in maximum 4 different windows, provides clear waveform readability without lower the vertical resolution.

• **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.

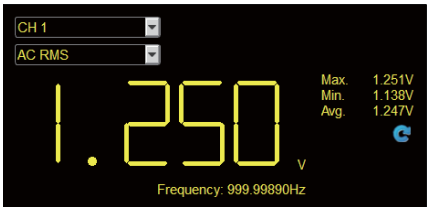
- Time: Frequency, Period, ±Duty, ±Period, Rise /Fall Time, Delay, Phase
- Vertical: VMax, VMin, VHigh, VLow, Vpp, VAmp, VMid, VMean, VRMS, ±Overshoot, Rise /Fall Preshoot
- Counter: Edge Count, ±Pulse Count




## 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

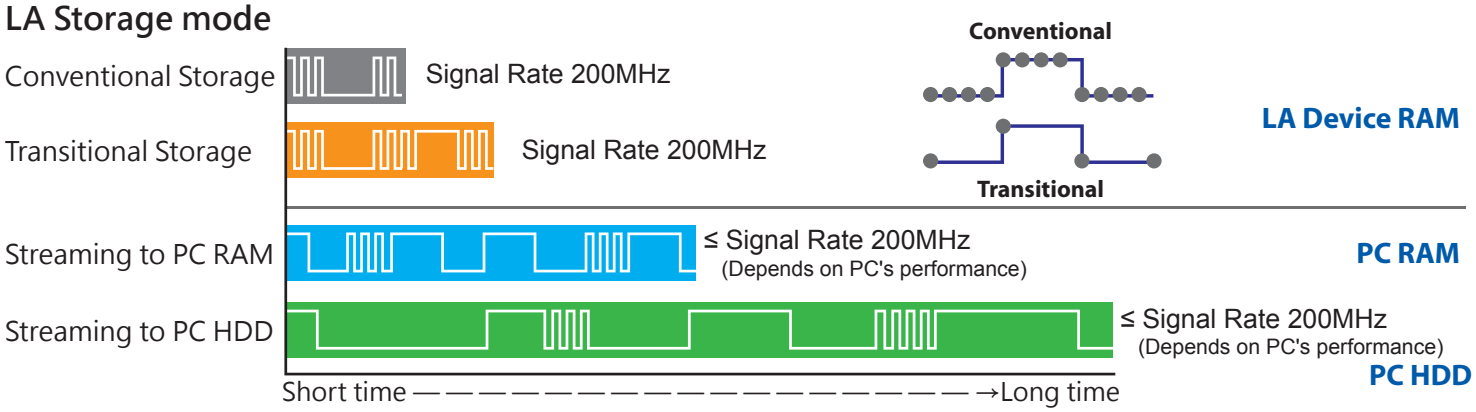

Handbag

# 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.**

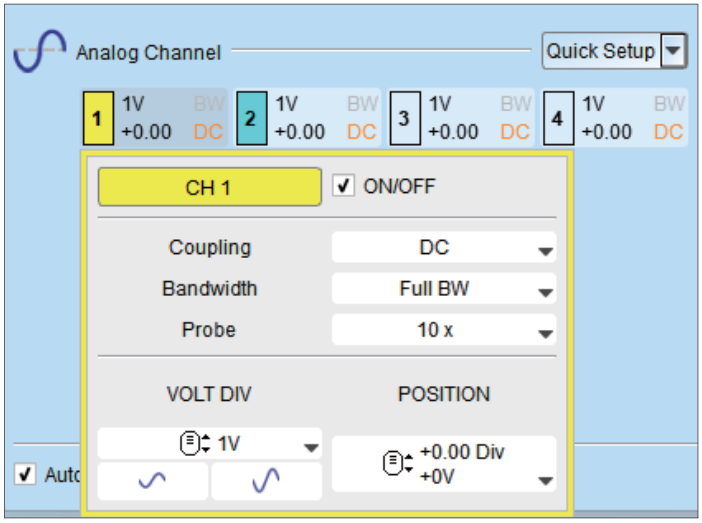
## LA Storage mode




## Analog waveform

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

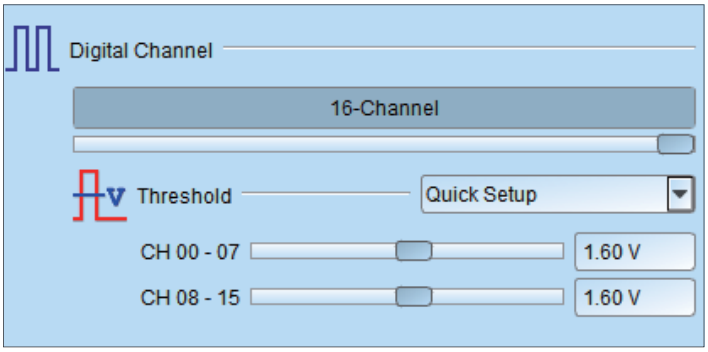
Can be used with High Voltage probe, Differential probe or Current probe.



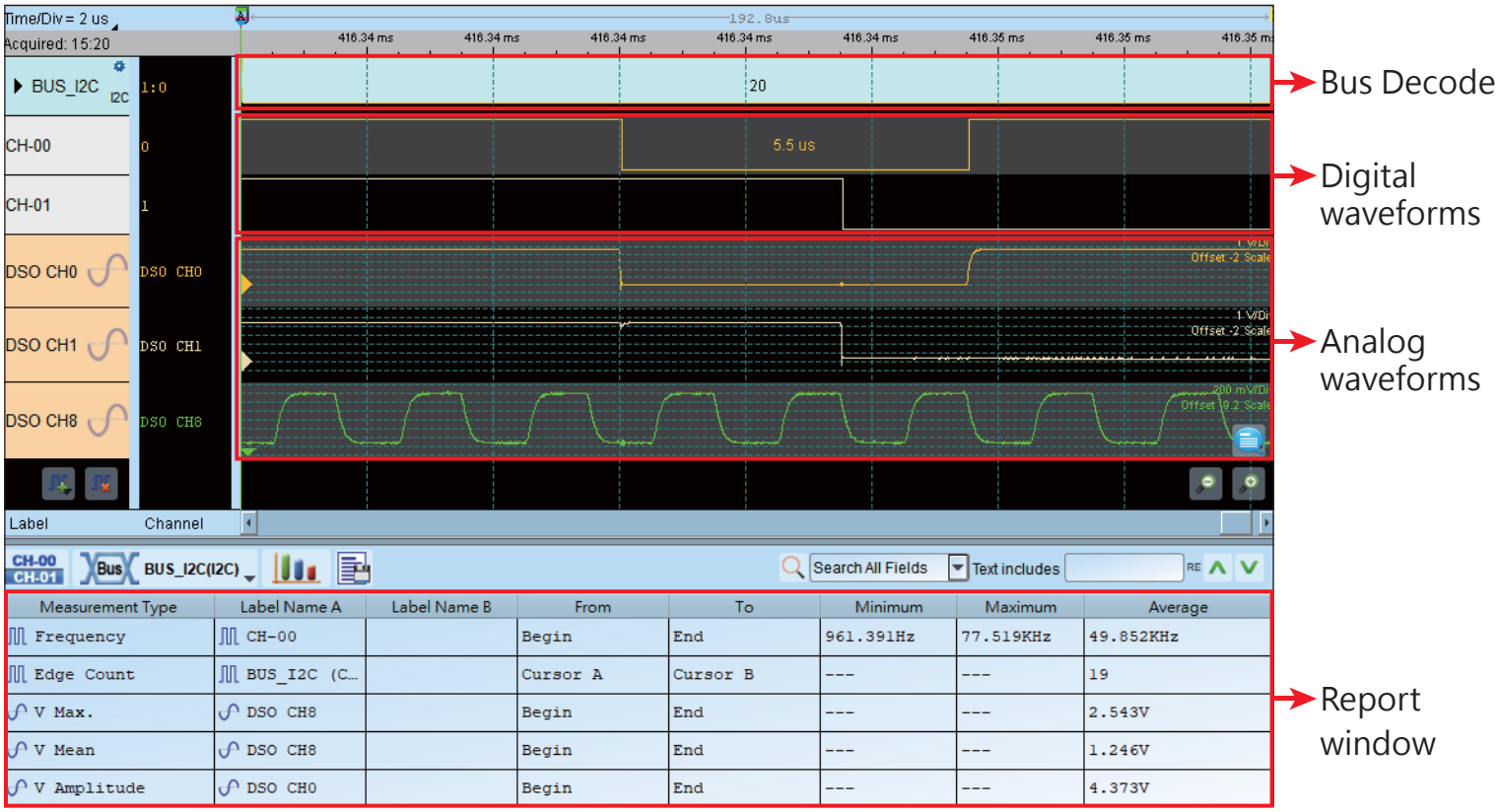

## Digital waveform

Operation Range: ±30V

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




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




| 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 |

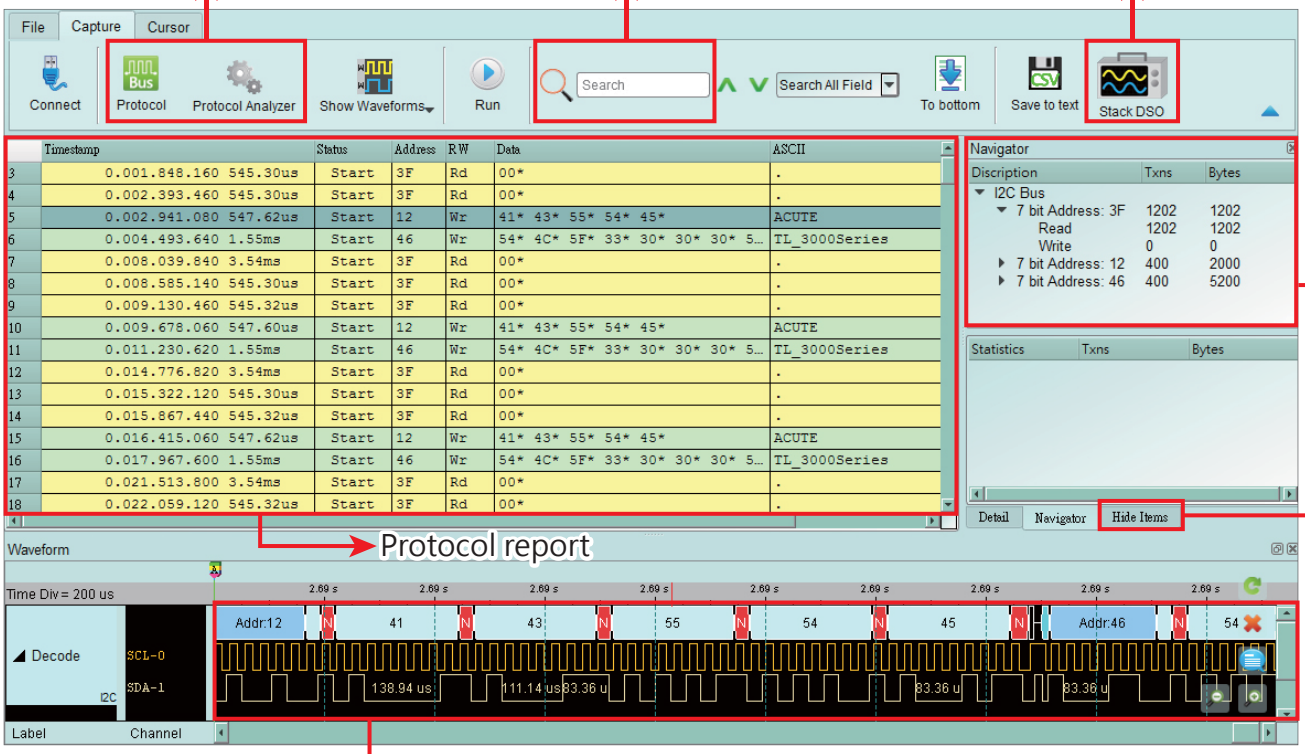
## Protocol Analyzer

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




Real-time data statistics

Hide items for easy view

Protocol report

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