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Datasheet

MSO2000X Series Mixed Signal Oscilloscope

V1.0

2024.05

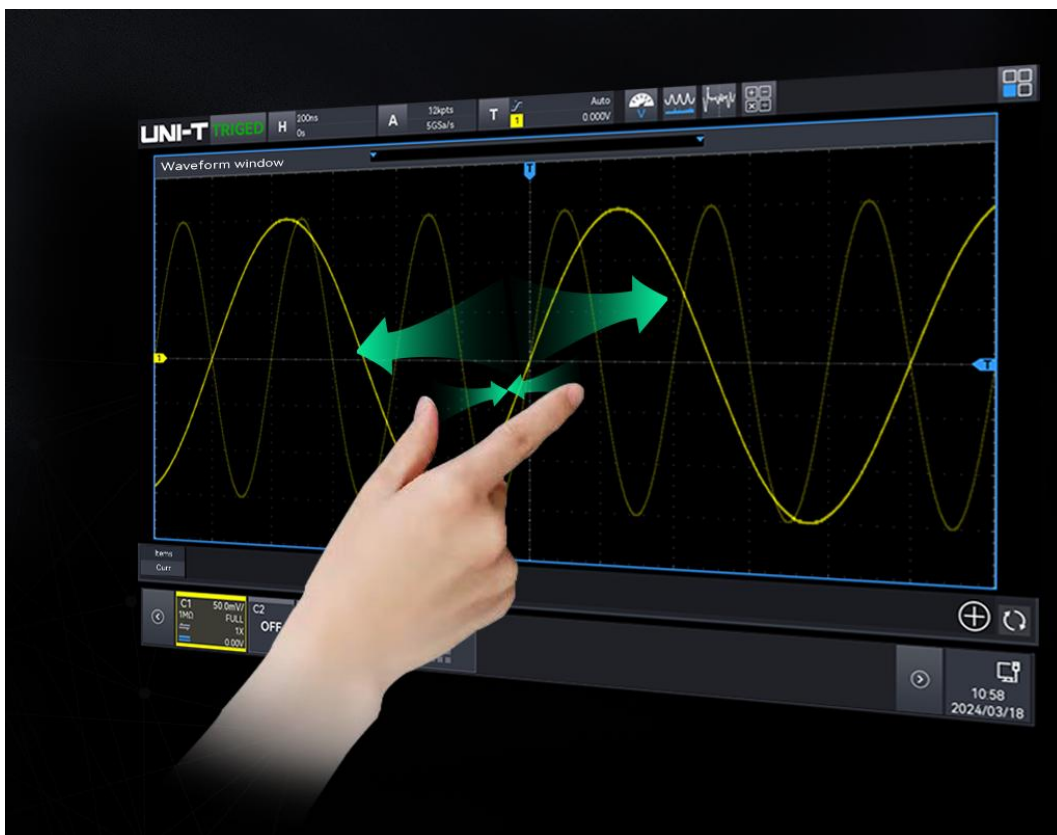
Product Introduction

MSO2000X series mixed signal oscilloscope with the maximum bandwidth of 500 MHz, maximum sampling rate of 5 GSa/s and equipped with 4 analog channels and 16 digital channels, the memory depth up to 100 Mpts/CH. MSO2000X has unique Ultra Phosphor 3.0 technology, the waveform capture rate is up to 2,000,000 wfms/s, 256 grey temperature color, innovative digital trigger system with high trigger sensitivity and low jitter. This oscilloscope supports multiple advanced triggers, serial bus trigger and decoding, and supports the advanced sampling and analysis mode of spectrum analyzing, power analysis, histogram, waveform recording, enhanced resolution (ERES), hardware acceleration template testing , Search and Navigate. In addition, this oscilloscope has multiple measurements and mathematical operations. MSO2000X series adopts 10.1 - inch capacitive touch screen that supports multiple gestures for common waveform operations, and combined with multiple one-touch keys on the front panel, this greatly optimizes the efficiency of oscilloscope operation and improves the user experience.



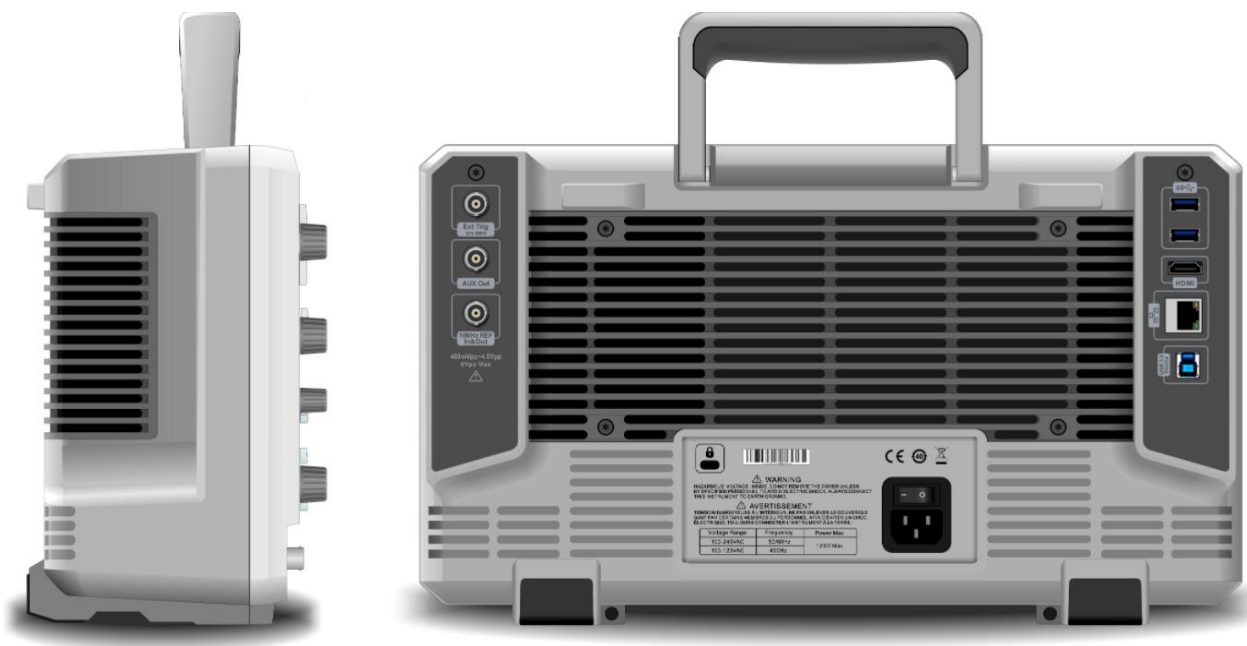
Mainstream touchscreen design, intelligent interactive experience

Featuring a 10.1-inch HD capacitive multi-touch screen, it supports a variety of gesture operations, such as touch, drag, zoom and rectangle drawing, making operation more convenient and smooth, and helping the user can master the instrument more easily. It retains the traditional key and knob operation while supporting mouse and keyboard, making instrument operation more versatile and greatly improving the interactive experience.



Brand new appearance design

Innovative appearance of the instrument, double-sided thinning design; display and panel level, to enhance the touch operation and visibility range; display edge black frame margin + metal grey and black body, to enhance the overall sense of the instrument.



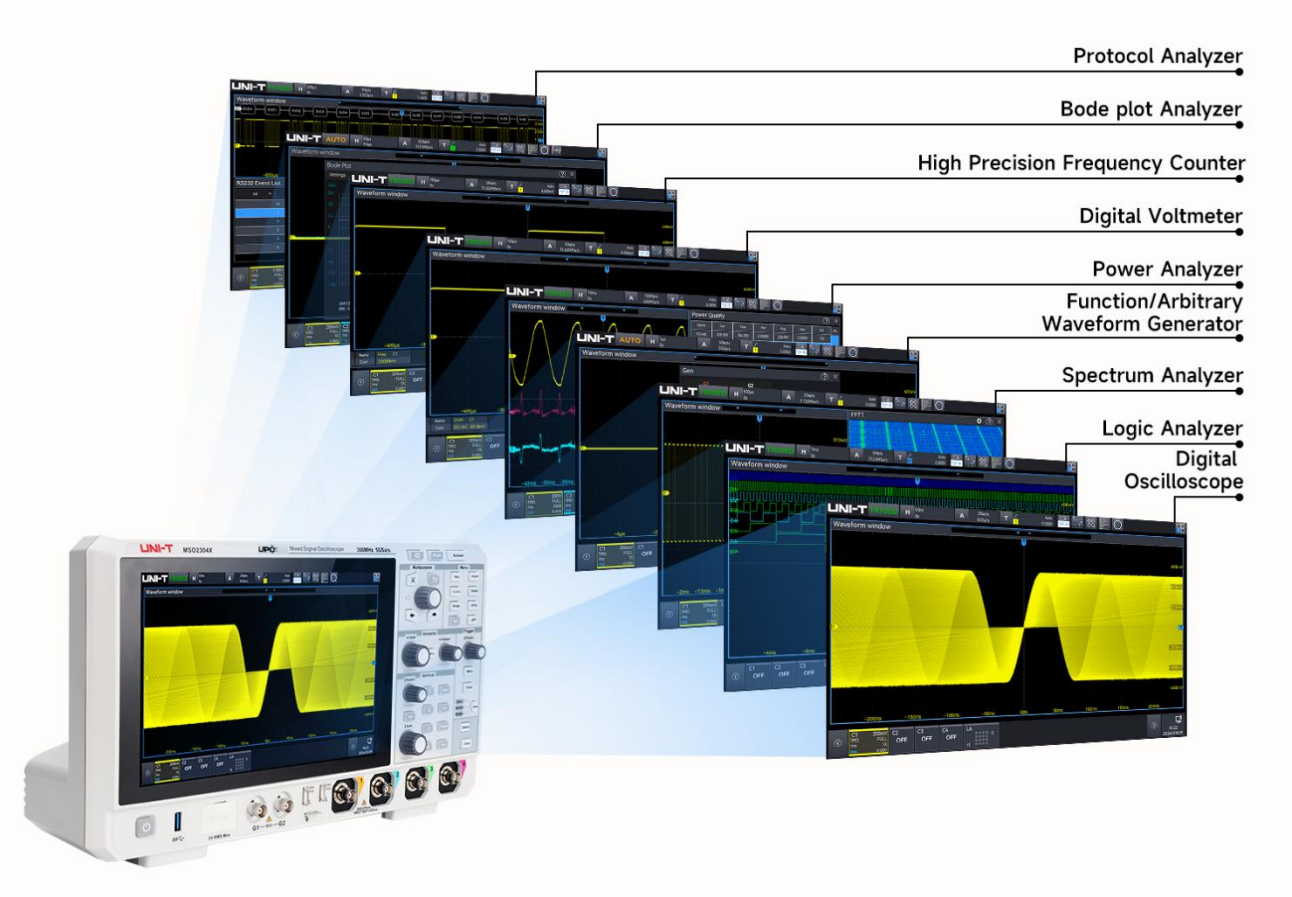
Features and advantage

- Analog channel bandwidth: 300 MHz/200 MHz/100 MHz
- Real-time sampling rate of the analog channel is up to 5 GSa/s. The maximum sampling rate of the digital channel is 1.25 GSa/s
- 4 analog channels, 16 digital channels, Maximum memory depth 100 Mpts
- The maximum waveform capture rate is 500,000 wfms/s (sequence mode: 2,000,000 wfms/s)
- 9 instrument functions: Digital Oscilloscope, Logic Analyzer, Function/Arbitrary Waveform Generator, Spectrum Analyzer, Digital Voltmeter, Frequency Counter, Protocol Analyzer, Bode Plot Analyzer and Power Analyzer
- Built-in 50 MHz equivalent performance dual channel function/arbitrary waveform generator, supporting load the oscilloscope on-screen data to Gen arbitrary waveform output in real time, and supporting multiple built-in arbitrary waveforms
- Bode plot loop test analysis to analyze the system stability
- Parameter measurement adds histogram and line graph display
- Up to 200,000 frames of uninterrupted hardware real-time waveform recording and analysis, with USB memory export support waveform recording and analyze
- Maximum 4 Mpts enhanced FFT, supporting the spectrum analyzer function of frequency setting, waterfall curve, detection setting and marker
- 54 kinds of parameter measurement
- Multi-channel 7-digit hardware frequency counter, supporting adjustable frequency refresh time and effective digit
- DVM: DC, ACRMS and DC+ACRMS
- Multiple trigger types: edge, pulse width, ramp, runt pulse, over-amplitude pulse, delay, timeout, duration, setup & hold, Nth edge and code pattern
- Protocol trigger and decoding function: RS232/UART, I2C, SPI, CAN, CAN-FD, LIN, FlexRay, AUDIO, SENT
- Zone triggering for capturing accidental signal and observing complicated signal
- Ultra Phosphor3.0 super phosphor display effect, up to 256 grey display
- 10.1 - inch 1280x800 HD capacitive multi-touch screen, supporting gesture control: click, slide, zoom, edit and drag
- Multiple peripheral interfaces: USB Host, USB Device, LAN, EXT Trig, AUX Out (Trig Out, Pass/Fail, DVM), Gen Out, HDMI
- SCPI (Standard Command for Programmable Instrument)
- Built-in WebServer for accessing and controlling the instrument through browser, supporting PC/Mobil phone device for cross-platform access the instrument

Design Features

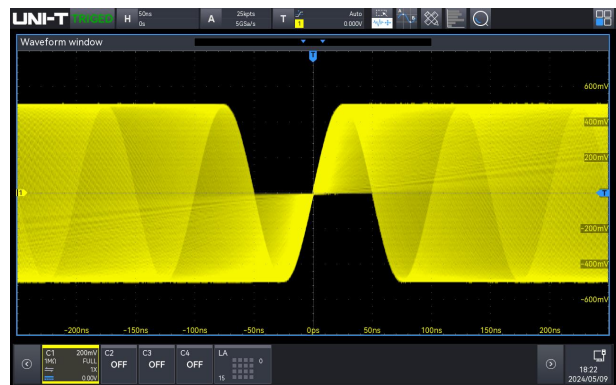
Cost-effective Nine-in-One integrated oscilloscope

MSO2000X series is integrated 9 instrument functions, which includes Digital Oscilloscope, Logic Analyzer, Function/Arbitrary Waveform Generator, Spectrum Analyzer, Digital Voltmeter, High-Precision Frequency Counter, Protocol Analyzer, Bode plot Analyzer and Power Analyzer. This is a cost-optimal oscilloscope for users.



Digital Oscilloscope

- Bandwidth: 100 MHz/200 MHz/100 MHz
- Maximum real-time sampling rate: 5GSa/s
- Maximum memory depth: 100 Mpts
- 4 analog channels, 1 external trigger channel



Logic Analyzer

- 16-channel logic analyzer can be used with purchase of a UT-M15 logic analyzer probe (option)
- Maximum sampling rate: 1.25 GSa/s
- Maximum memory depth: 100 Mpts
- Minimum detectable pulse width 800ps
- Digital probe provides high 8-bit and low 8-bit signal input port, it simplifies the connection of DUT. When connecting to a square pins, UT-M15 can be connected directly to 8x2 square pins 2.54 mm
- Logic analyzer probe UT-M15 has great electrical feature, the input impedance is $101 \Omega \pm 1\%$, but the capacitive load is only 9.0 pF



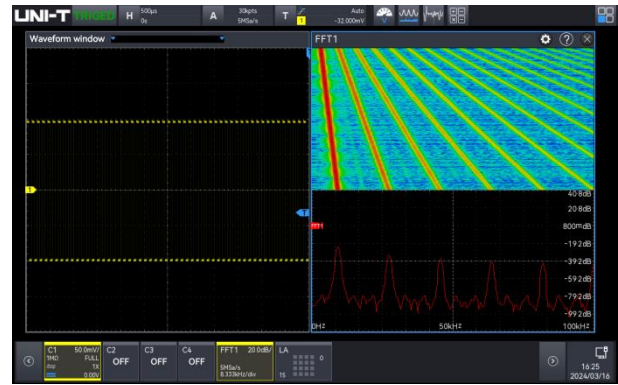
Function/Arbitrary Waveform Generator (option)

- 50 MHz equivalent performance dual channel output
- Sampling rate: 250 MSa/s
- Vertical resolution: 16-bit
- Built-in multiple standard waves: Sine, square, pulse, ramp, arbitrary, noise and DC
- AM, FM, ASK, FSK and sweep output



Spectrum Analyzer

- Standard enhanced FFT, up to 4 Mpts, 4 channels signal analysis
- Frequency range: 0 Hz~1 .25 GHz
- Waterfall curve
- 4 traces and 4 detections
- Mark type: Auto, manual and threshold
- Marker point list



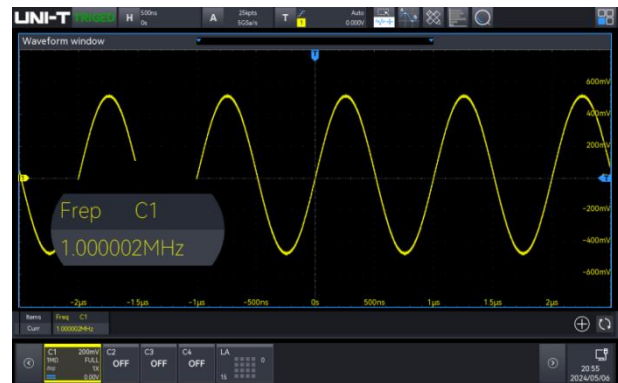
Digital Voltmeter

- 4-digit voltmeter
- DC/ACRMS/AC+DCRMS
- Limit alarm



High-Precision Frequency Counter

- 7-digit hardware frequency counter
- Adjustable frequency counter refresh time and effective digit
- Summary counter



Bode Plot Analyzer

- Built-in function/arbitrary waveform generator
- Frequency response analysis
- Loop stability analysis
- Filter analysis
- Amplifier analysis



Protocol Analyzer

- 9 kinds of trigger protocol and decoding, which including the field of computer, embedded serial bus, automobile, aerospace and audio
- Decoding can be operated in the pause and record modes
- Event list and search function



| Option name | Description | Option model | Standard/Option |
|---|---------------------|-----------------|-----------------|
| Computer serial bus triggering and decoding | RS-232/422/485/UART | - | Standard |
| Embedded serial bus triggering and decoding | I2C, SPI | - | Standard |
| Automobile serial bus triggering and decoding | CAN | MSO2000X-CAN | Option |
| Automobile serial bus triggering and decoding | LIN | MSO2000X-LIN | Option |
| Automobile serial bus triggering and decoding | CAN-FD | MSO2000X-CAN-FD | Option |
| Automobile serial bus triggering and decoding | FlexRay | MSO2000X-FLEX | Option |
| Automobile sensor bus triggering and decoding | SENT | MSO2000X-SENT | Option |
| Audio serial bus triggering and decoding | Audio | MSO2000X-AUDIO | Option |

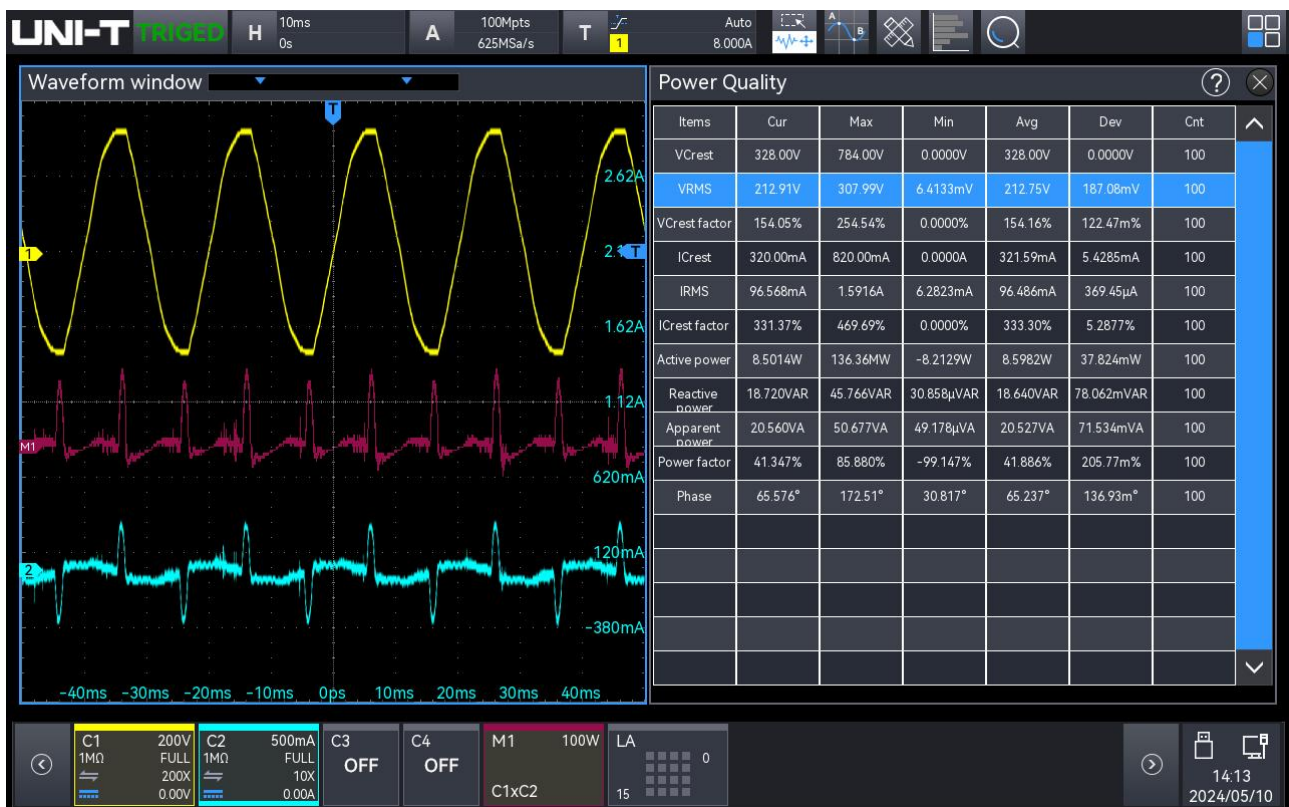
Power Analyzer

With the development of chip technology, the power supply system requirements are also increased. When the power supply network of small voltage and high current has been the trend, especially for the chip or the power supply network composed of precision components, the requirements of the various parts of the circuit reliable power supply and noise suppression, but also to ensure that the integrity of the signal transfer between the chip, the power supply test has ushered in a greater challenge. The designer is more concerned about the energy-saving power supply and the response speed to ensure that the power supply is stable and clean.

Based on the currently tendency, the power integrity testing is particularly important, it directly affects the signal integrity, and in turn the signal quality also reflects the power quality, and even power quality will cause a series of electromagnetic interference problems, which makes the designer more headaches. So having an oscilloscope that can analyze the power supply is undoubtedly your most correct choice.

MSO2000X provides a full range of power analysis tools and evaluation results, you only need to select the appropriate analysis type, connecting the voltage probe and the current probe to the test point of power system or specified test fixtures as shown in the diagram, connecting to the channel that you want to observe, and then finally make appropriate fine-tuning to get the results you want.

- Power quality
- Harmonic analysis
- Safety operation area*
- Ripple wave analysis
- Loop analysis

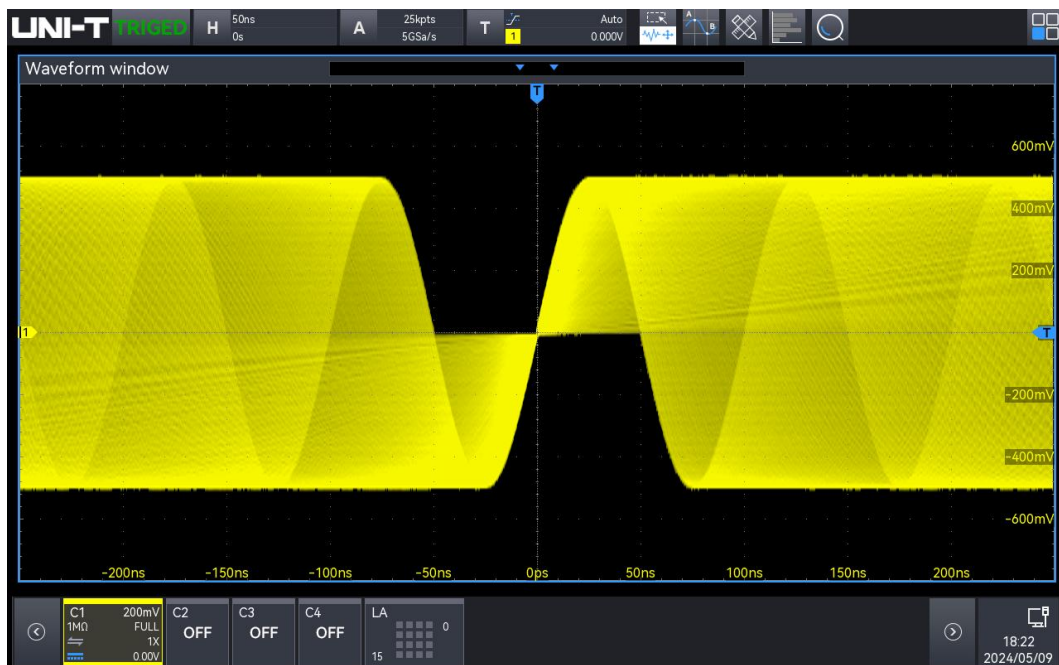


* Power analysis support is subject to the latest firmware on the official website.

Ultra Phosphor 3.0

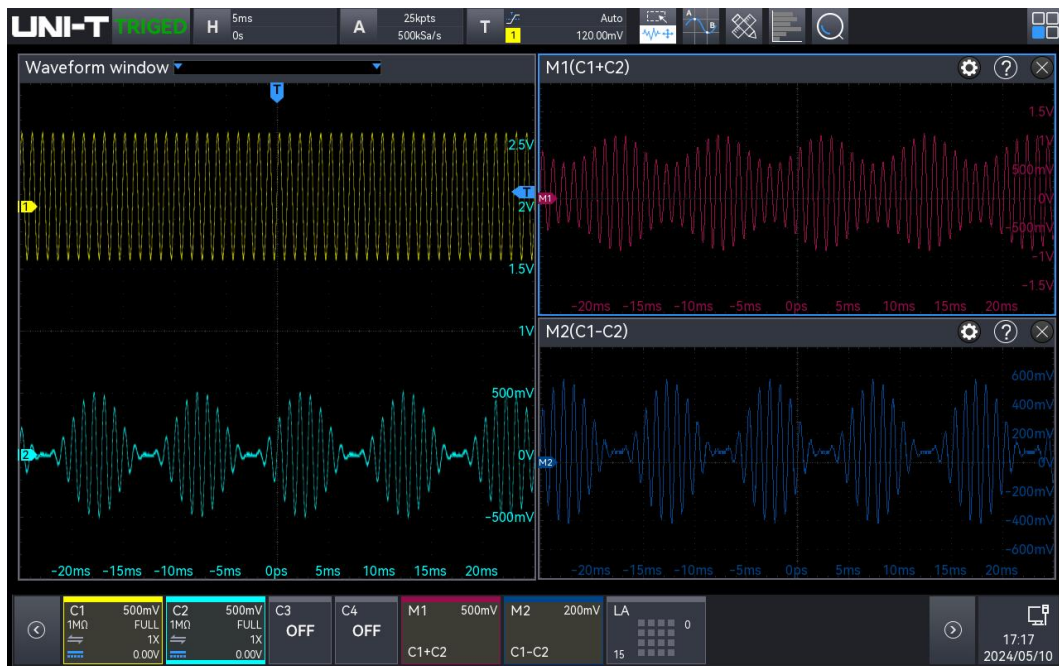
When you try to find and debug the occasional or intermittent anomalies in the signal, the waveform capture rate is a very important indicator. The capture rate of an oscilloscope is the ability to capture how many waveforms per unit of time, it reflects the oscilloscope speed of the process and analysis signal.

MSO2000X adopts advanced software and hardware architecture to achieve data processing that is 5~10 times higher than the previous version. It is equipped with Ultra Phosphor 3.0, which supports 8-channel parallel graph mapping, the processing rate is up to 20 Gbps, the waveform capture rate is up to 500,000 wfms/s, and up to 2,000,000 wfms/s in the sequence mode. Compared with the traditional oscilloscope, the dead time of MSO2000X can be $< 1\mu\text{s}$, that is, capture 1.17 ns fast edge signal of 2000,000 per second, so the accidental signal can be captured easily and correctly.



Multi-Windows

Multi-Windows can be freely dragged and extended.



Brand new quick Autoset strategy

Fuzzy control is an intelligent control method based on fuzzy set theory, fuzzy linguistic variables and fuzzy logic reasoning. The advantages of the algorithm are fewer iterations, faster speed, and better anti-interference ability.

In the past, the oscilloscope is performed Autoset to find the appropriate signal amplitude and frequency to display, but the response speed of oscilloscopes is very different due to different solutions adopted by each oscilloscope manufacturer, it affecting the experience of using oscilloscopes.

UNI-T redefines the execution of Autoset by adopting fast fuzzy algorithm based on analog signals and multi-channel parallel processing technology, combined with a 7 bits high-precision hardware frequency counter, which allows the oscilloscope to quickly find and process the amplitude and frequency of the unknown signals displayed when executing the Autoset strategy. It takes less than 1.5s to open the whole channel, and less than 1s to open a single channel, which greatly improves the working efficiency and reduces the risk of misuse for users who need to change test objects frequently and need to test quickly.

Multiple parameter measurements

The parameter measurement is a very important function for engineer when using an oscilloscope. MMSO2000X series provides 54 kinds of measurement parameters, and added 27 measurement parameter can be displayed at the same time. Each page of measurement statistics displays 9 measurement parameters, and it can be displayed in histogram and tendency chart. The histogram

can visually show the possibility distribution of the parameter. The tendency chart can reflect the parameter changing with time.

The parameter snapshot displays 39 kinds of test items for a single channel measurement. The parameter of parameter snapshot includes the measurement parameter of voltage and time in single channel, the measured result will be constantly refreshed during the process.

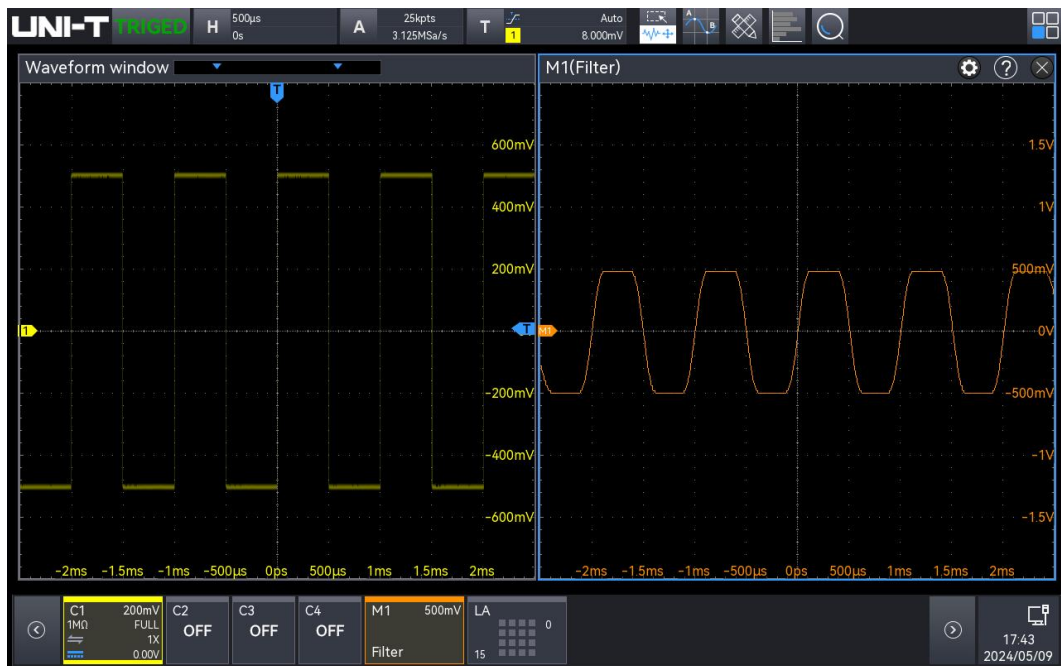
MSO2000X series adds a new strategy of amplitude calculation, top and bottom. It is convenient for the engineer to use the parameter measurement function. In addition, the added burst function of MSO2000X series can display the burst parameter, so that the channel measured data can be learned accurately and immediately.



Waveform math

MSO2000X provides a system of algorithms for complex waveform math that you can use to further process your waveforms and display the results directly on the oscilloscope.

- Basic operation: +, -, *, ÷
- Digital filter (high-pass, low-pass, band-pass and band-limit)
- Custom function operation: analog channel, reference waveform



Navigate and Search

The memory depth of MSO2000X series is upgraded to 100 Mpts, and the high memory depth can capture tens of thousands of waveforms in one capture. It takes a lot of time for engineers to search the waveform by themselves. The search condition can be customized, which is very useful for searching the sampled signal and finding the waveform of interest. With the analysis function, the event can be analyzed in detail, eliminating the time consuming and inconvenience of manual search.



Zone triggering

The function of the zone triggering is twofold, firstly, to isolate the occasional abnormal signal. Secondly, to stabilize the waveform display. Only a stable trigger can provide a stable waveform display. With this function, engineers can deal with complex and variable signals during debugging. The zone triggering function is easy to use, so engineers don't have to spend time learning how to use it, A rectangle drawing gesture can quickly separate a signal that to be observed. The waveform does not have to be completely stable to trigger when using the zone triggering function, the zone triggering function can capture a waveform that meets the condition and make it stable to trigger.



Various connection

MSO2000X series offers a wide range of connection with flexibility and convenience.

USB host ports on the front and rear panel that allow you to easily transfer screenshots, detailed instrument configuration information and waveform data to a storage device, and support USB, keyboard and mouse access for intuitive data entry and control.

USB device port on the rear-panel that allows you to remotely control the oscilloscope from a PC. The HDMI port allows the oscilloscope's high-resolution display to be projected in real time on other external monitors, ideal for teaching and teamwork.

WebServer

- SCPI for remote control
- Remotely check and control
- Export waveform file
- Browse user manual on-line
- PC/Mobil phone access



Performance Characteristics

All specifications are guaranteed, except those marked "typical".

Unless otherwise stated, all the Performance Characteristics are suitable for the probe that the attenuation switch set to 10x and MSO2000X series mixed signal oscilloscope.

To meet these specifications, the oscilloscope should first meet the following conditions.

- The instrument must be operated continuously for at least thirty minutes at the specified operating temperature.
- The self-calibration must be performed when the operating temperature reaches or exceeds 5 °C.

| Model | MSO2304X | MSO2204X | MSO2104X |
|---|--|----------|----------|
| Analog bandwidth | 300 MHz | 200 MHz | 100 MHz |
| Calculated rise time (10 to 90%) (typical) | ≤1.17 ns | ≤1.80 ns | ≤3.50 ns |
| Input/output channel number | 4 analog channels 16 digital channels 2-channel signal output | | |
| Sampling mode | Real-time sampling | | |
| Acquisition mode | Normal, peak detect, high resolution, averaging, sequential sampling | | |
| ERES | Enhanced bit : 1 , 1.5 , 2 , 2.5 , 3 , 4 (8~12-bit) | | |
| Maximum sample rate | Analog channel: 5 GSa/s (interweave mode) , 2.5 GSa/s (non-interweave mode) Digital channel: 1.25 GSa/s | | |
| Average | After all channels have reached N samples simultaneously, the number of N times can be selected from 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192. | | |
| Memory depth | Auto (limit to 10 Mpts), 25 kpts, 250 kpts, 500 kpts, 5 Mpts, 50 Mpts, 100 Mpts | | |
| Maximum waveform capture rate | 500,000 wfms/s 2,000,000 wfms/s (sequence mode) | | |
| Hardware real-time waveform recording and playing | 200,000 frames | | |

| | |
|---|--|
| Screen | 10.1 - inch 1280x800 HD capacitive touch screen |
| Vertical System (Analog channel) | |
| Input coupling | DC, AC, GND |
| Input impedance | (1 MΩ±2%) (16 pF±3 pF) |
| Probe attenuation factor | Voltage probe ratio: 0.001×, 0.01×, 0.1×, 1×, 10×, 100×, 1000×, Custom Current probe ratio: 5 mV/A, 10 mV/A, 50 mV/A, 100 mV/A, 200 mV/A, 500 mV/A, 1V/A, Custom |
| Maximum input voltage | 1MΩ: 400 V (DC+ACVpk) 135 V _{RMS} 50 Ω: 5 V _{RMS} Max |
| Vertical resolution | 8-bit |
| Vertical scale | 500 μV/div ~ 10 V/div (1 MΩ) 500 μV/div ~1 V/div (50 Ω) |
| Offset range | 500 μV/div ~ 50 mV/div: ±2 V (50 Ω and 1 MΩ) 100 mV/div ~ 1 V/div: ±5 V (50 Ω) 100 mV/div ~ 1 V/div: ±25 V (1 MΩ) 2 V/div ~ 10 V/div: ±250 V (1 MΩ) Vertical offset reading: V |
| Band limit (typical) | 50 Ω: 20 MHz , Full , Custom 1 MΩ: 20 MHz , Full , Custom |
| Low-frequency response | (AC coupling, -3 dB); ≤5 Hz (on BNC) |
| DC gain accuracy | <5 mV : ±3% full scale, ≥5 mV : ±2% full scale |
| DC offset accuracy | ± (2%+0.1 div+2 mV) |
| Unit | W, A, V and U, default: V |
| Channel-to-channel isolation(typical) | DC~ maximum bandwidth: >40 dB |
| Digital channel | |
| Threshold | 8-channel in one group |
| Threshold selection | TTL (1.4 V) 5.0 V CMOS (+2.5 V), 3.3 V CMOS (+1.65 V) 2.5 V CMOS (+1.25 V), 1.8 V CMOS (+0.9 V) ECL (-1.3 V) PECL (+3.7 V) LVDS (+1.2 V) 0 V |

| | |
|---|--|
| | Custom |
| Threshold range | ± 20.0 V, 20 mV stepping |
| Threshold accuracy | $\pm(100$ mV + threshold setting of 3%) |
| Dynamic range | ± 10 V + threshold |
| Input impedance | (101 k Ω \pm 1%) (9 pF \pm 1 pF) |
| Minimum voltage swing | 500 mVpp |
| Minimum detectable pulse width(typical) | 800 ps |
| Vertical resolution | 1 bit |
| Channel-to-channel skew range | ± 100 ns |

Horizontal System (Analog channel)

| | |
|---------------------------|--|
| Time base range | 100 MHz (5 ns/div ~ 1 ks/div) |
| | 200 MHz (2 ns/div ~ 1 ks/div) |
| | 300 MHz (1 ns/div ~ 1 ks/div) |
| | (simultaneously display the current sampling rate and memory depth) |
| Time base accuracy | ± 1 ppm (original accuracy); ± 1 ppm (the aging rate of first year); ± 3.5 ppm (the aging rate of ten years) |
| Timebase delay time range | Pre-trigger (negative delay) \geq 1 screen width Post-trigger (positive delay): 1 s ~ 7 ks |
| Time base mode | Y-T (default) |
| | X-Y (CH1-CH2, CH1-CH3, CH1-CH4, CH2-CH3, CH2-CH4, CH3-CH4) |
| | Roll, time base ≥ 50 ms/div, using the horizontal rotary knob to enter or exit Roll mode |
| | Scan, time base ≥ 50 ms/div, user can select Roll or Scan mode |

Trigger

| | |
|----------------------------|---|
| Trigger level range | Internal: ± 5 div from the center of the screen EXT: ± 7 V |
| Trigger modes | Auto, Normal, Single |
| Trigger holdoff range | 80 ns ~ 10 s |
| Trigger coupling (typical) | DC: all signal can pass AC: block DC component of input signal |

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|------------------------|--|
| | HF reject: suppress high-frequency components of signals above 40 kHz |
| | LF reject: suppress low-frequency components of signals below 40 kHz |
| Noise reject | Suppress the high-frequency noise of signal, to reduce the error-touched possibility |
| Zone Triggering | |
| Zone | 2 Zones; source: CH1~ CH4; feature: Intersect, Not Intersect |
| Edge | |
| Slope | Rising, Falling, Either |
| Source | CH1 ~ CH4, AC Line, EXT, D0 ~ D15 |
| Runt | |
| When | >, <, ≤, ≥, None |
| Polarity | Positive, Negative |
| Pulse width | 3.2 ns ~ 10 s |
| Source | CH1 ~ CH4, D0 ~ D15 |
| Window | |
| Polarity | Rising, Falling, Any |
| When | Enter, Exit, Time |
| Set | 3.2 ns ~ 10 s |
| Source | CH1 ~ CH4 |
| Nth edge | |
| Slope | Rising,Falling |
| Idle time | 3.2 ns ~ 10 s |
| Edge number | 1 ~65535 |
| Source | CH1 ~ CH4, D0 ~ D15 |
| Delay | |
| Edge type | Rising, Falling |
| When | >, <, ≤, ≥, > < |
| Delay time | 3.2 ns ~ 10 s |
| Source | CH1 ~ CH4, D0 ~ D15 |
| Timeout | |
| Slope | Rising, Falling, Any |
| Timeout | 3.2 ns ~ 10 s |
| Source | CH1 ~ CH4, D0 ~ D15 |
| Duration | |
| Code pattern | H, L, X |
| When | >, <, ≤, ≥ |

| | |
|-----------------------|---|
| Duration | 3.2 ns ~ 10 s |
| Source | CH1 ~ CH4, D0 ~ D15 |
| Setup and Hold | |
| Clock edge | Rising, Falling |
| Data type | H, L |
| Setup | 3.2 ns ~ 10 s |
| Hold | 3.2 ns ~ 10 s |
| Source | CH1 ~ CH4, D0 ~ D15 |
| Pulse width | |
| Polarity | Positive, Negative |
| When | >, <, ≤ ≥ |
| Pulse Width | 0.8 ns ~ 4 s |
| Source | CH1 ~ CH4, AC Line, EXT, D0 ~ D15 |
| Slope | |
| Slope | Positive, Negative |
| When | >, <, ≤ ≥ |
| Time | 3.2 ns ~ 1 s |
| Source | CH1 ~ CH4 |
| Video | |
| Standard | PAL, NTSC, SECAM, 525p/60, 625p/50, 720p/24, 720p/25, 720p/30, 720p/50, 720p/60, 1080i/25, 1080i/30, 1080p/24, 1080p/25, 1080p/30, 1080pfs/24 |
| Source | CH1 ~ CH4 |
| Pattern | |
| Code pattern | H, L, X, Rising, Falling |
| Source | CH1 ~ CH4, D0 ~ D15 |
| RS232/UART | |
| When | Start, FrameErr, CheckErr, Data |
| Baud rate | 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, custom |
| Data bit | 5 bits, 6 bits, 7 bits, 8 bits |
| Source | CH1 ~ CH4, D0 ~ D15 |
| I2C | |
| When | Start, Restart, Stop, Loss, Address, Data, Address & Data |
| Addr mode | 7 bits, 10 bits |
| Addr range | 0 ~77, 0 ~3 FF |

| | |
|-------------------|--|
| Byte length | 1 ~ 5 |
| Source | CH1 ~ CH4, D0 ~ D15 |
| SPI | |
| Mode | Timeout, CS |
| When | Start, Data |
| Timeout | 100 ns ~1 s |
| Data bit | 4 bits~32 bits |
| Source | CH1 ~ CH4, D0 ~ D15 |
| CAN | |
| Signal type | CAN_H, CAN_L |
| When | Start, Data Frame, Remote Frame, Error Frame, Over-Load, Identifier, Data, Identifier & Data, End of Frame, Missing Ack, Biterror |
| Data rate | 10kbps, 19.2kbps, 20kbps, 33.3kbps , 38.4kbps, 50kbps, 57.6kbps, 62.5kbps, 83.3kbps, 100kbps, 115.2kbps, 125kbps, 230.4kbps, 250kbps, 490.8kbps, 500kbps, 800kbps, 921.6kbps, 1Mbps, 2Mbps, 3Mbps, 4Mbps, 5Mbps, custom |
| Source | CH1 ~ CH4, D0 ~ D15 |
| CAN-FD | |
| Signal type | CAN_H, CAN_L |
| When | Start, Data Frame, Remote Frame, Error Frame, Over-Load, Identifier, Data, Identifier & Data, End, Lost, Biterror |
| Data rate | 10 kbps, 19.2 kbps, 20 kbps, 33.3 kbps , 38.4 kbps, 50 kbps, 57.6 kbps, 62.5 kbps, 83.3 kbps, 100 kbps, 115.2 kbps, 125 kbps, 230.4 kbps, 250 kbps, 490.8 kbps, 500 kbps, 800 kbps, 921.6 kbps, 1 Mbps, 2 Mbps, 3 Mbps, 4 Mbps, 5 Mbps, custom |
| FD data rate | 250 kbps, 500 kbps, 800 kbps, 1 Mbps, 1.5 Mbps, 2 Mbps, 4 Mbps, 6 Mbps, 8 Mbps, custom |
| Source | CH1 ~ CH4, D0 ~ D15 |
| LIN | |
| Trigger condition | Sync, Identifier, Data, Identifier & Data, Wake Frame, Sleep Frame, Error |
| Version | v1.x, v2.x, Either |
| Baud rate | 1.2 kbps, 2.4 kbps, 4.8 kbps, 9.6 kbps, 10.417 kbps, 19.2 kbps, 20 kbps, custom |
| Data length | 1 ~ 8 |
| Source | CH1 ~ CH4, D0 ~ D15 |
| FlexRay | |
| When | Start, Indicators, Identifier, Cycle, Heade, Data, Identifier & data, End frame, Error |

| | |
|------------------------|--|
| Polarity | BM, BDiff/BP |
| Baud rate | 2.5M bps, 5M bps, 10M bps |
| Source | CH1 ~ CH4, D0 ~ D15 |
| Audio | |
| When | Word, Left, Right, Either |
| Format | Standard, Left Aligned, Right Aligned, TDM |
| Source | CH1~CH4, D0~D15 |
| SENT | |
| When | Fast: Sync, Status, Data, CRC, STAT+Data, S&D +CRC, F_ CRC Error, CONT Pul Err Slow: Sync, Short ID, Short Data, Short CRC, Short ID & data, Enh ID, Enh Data, Enh CRC, Enh ID & data, SLO CH CRC error |
| Source | CH1~CH4, D0~D15 |
| Decoding | |
| Number of decodes | 4 |
| Decoding type | Standard: RS232/UART, I2C, SPI Option: CAN, CAN-FD, LIN, FlexRay, I2S, SENT |
| Parallel | Up to 18 bits parallel bus decoding, supports the combination of analog channel and digital channel and supports custom time setting |
| Source | CH1 ~ CH4 , D0 ~ D15 |
| Measurement | |
| Cursor | Voltage difference between cursors (ΔY) Time difference between cursors (ΔX) Reciprocal of ΔX (Hz) ($1/\Delta X$) Voltage and time of waveform point Display the cursor in the automatic measurement |
| Automatic measurements | Analog channel: 54 kinds of parameter Maximum, Minimum, Top, Base, Amplitude, Middle, Peak-Peak, Average, Average-Cycles, RMS, RMS-Cycles, AC RMS, AC RMS-Cycles, Area, Area-Cycles, +Area, -Area, +Area-Cycles, -Area-Cycles, +Overshoot, -Overshoot, +Preshoot, -Preshoot, Period, Frequency, Rise time, Fall time, +Width, -Width, +Duty, -Duty, +Pulse count, -Pulse count, Rising edge count, Falling edge count, Burst width, Burst Interval, Burst Period, Burst Per count, Ratio, Period Ratio, Setup time, Hold time, Setup & Hold Ratio, FRFR, FRFF, FFFR, FFFF, FRLF, FRLR, FFLR, FFLF, Phase(r-r), Phase(f-f) Digital channel: Frequency, Period, +Width, -Width, +Duty, -Duty, rising delay A→B, falling |

| | |
|------------------------|--|
| | delay A→B, phase A→B, phase B→A |
| Measurement mode | Common measurement and accuracy measurement (Full memory hardware measurements) |
| Measurement type | Simultaneously display 27 kinds of parameter measurement |
| Measurement range | Main time base, Zoom time base, Cursor area |
| Measurement statistics | Mean, Maximum, Minimum, Std Dev, Count, Tendency chart, Histogram |
| Frequency Counter | 7 bits hardware frequency counter Adjustable refresh time and effective digit |
| XY measurement | Time, Cartesian, Polar, Product, Ratio |
| Analysis | Frequency Counter, DVM, Pass/Fail , Waveform recording, Bode plot, Power Analysis |
| Math | |
| Waveform math | A+B, A-B, A×B, A÷B, advanced, Filter |
| Filter | Low pass, High pass, Band pass, Band stop |
| Operation | 0,1,2,3,4,5,6,7,8,9(+,-,*,/,^,>,<,&&, ,=,!=) |
| Function | sin, cos, sinc, tan, sqrt, exp, lg, ln, floor, abs, acos, asin, atan, sinh, tanh, ceil, cosh, fabs, intg, diff |
| FFT | |
| Channel number | 4 |
| Window types | Hanning, Hamming, Rectangle, Blackman |
| FFT count | Up to 4 Mpts |
| FFT vertical scale | Vrms, dB |
| | Waterfall: ON, OFF |
| FFT | Spectrum range: Start frequency, Stop frequency, Center frequency, Span |
| | Four traces: Normol, Average, Max Hold, Min Hold |
| | Marker: Marker type, Marker Points, Marker list |
| Storage | |
| Setting | Set Status(.set) |
| Waveform | Waveform data (*.dat) (*.csv) |
| Image | Image storage(*.bmp) (*.png) (*.jpg) |
| Report | Decoding Event List (*.csv) (*.pdf) (*.html) |
| Gen (Option) | |
| Channel | 2 |
| Sample rate | 250 MSa/s |

| | |
|------------------------|--|
| Vertical resolution | 16-bit |
| Maximum frequency | 50 MHz |
| Standard | Sine, Square, Ramp, Noise, DC and Arbitrary wave |
| Built-in arbitrary | 200 types including Sinc, ExpRise, ExpFall, Cardiac, Gauss, Lorentz, and HaverSine |
| Sine wave | Frequency range: 1 μ Hz~ 50 MHz |
| | Flatness: ± 0.5 dB (relative 1 kHz) |
| | Harmonic distortion: -40 dBc |
| | Non-harmonic suprious (typ): -40 dBc |
| | Total harmonic distortion: 1% (DC ~ 20 kHz, 1Vpp) SNR: 40 dB |
| Square wave/Pulse wave | Frequency range Square wave: 1 μ Hz ~ 15 MHz; Pulse wave: 1 μ Hz ~ 15 MHz |
| | Rising/falling time: <13 ns (typical 1kHz, 1Vpp, 50 Ω) |
| | Overshoot: typical 2% (1 kHz, 1 Vpp, 50 Ω) |
| | Duty ratio Square wave: 1% ~ 99%, adjustable; Pulse wave: 1% ~ 99%, adjustable |
| | Resolution of duty ratio: 1% or 10 ns (take the greater value of both) |
| | Minimum pulse width: 20 ns |
| | Resolution of pulse width: 10 ns Jitter: 2 ns |
| Ramp wave | Frequency range: 1 μ Hz ~ 400 kHz |
| | Linearity: 1% |
| | Symmetry: 0.1% - 99.9% |
| Noise | Bandwidth: 50 MHz (typical) |
| Arbitrary wave | Frequency range: 1 μ Hz ~ 5 MHz |
| | Waveform length: 8 k Internal save position: 200 |
| Frequency | Accuracy: 100 ppm (< 10 kHz); 50 ppm (> 10 kHz) |
| | Resolution: 1 μ Hz |
| Amplitude | Output range: 20 mVpp ~ 6 Vpp (high resistance); 10 mVpp ~ 3 Vpp (50 Ω) |
| | Resolution: 1 mV |
| | Accuracy: $\pm 5\%$ |
| DC offset | Range: ± 3 V (high resistance); ± 1.5 V (50 Ω) |

Resolution: 1 mV

Accuracy: offset set value $\pm 5\%$

AM

Carrier wave Sine, Square, Ramp, Arbitrary wave

Source Internal

Modulated wave Sine, Square, Rising ramp, Falling ramp, Noise, Arbitrary wave

Modulation frequency 2 mHz ~ 50 kHz

Modulation depth 0% ~ 120%

FM

Carrier wave Sine, Square, Ramp, Arbitrary wave

Source Internal

Modulated wave Sine, Square, Rising ramp, Falling ramp, Noise, Arbitrary wave

Modulation frequency 2 mHz ~ 50 kHz

Deviation 12.5 MHz (maximum)

ASK

Carrier wave Sine, Square, Ramp, Arbitrary wave

Modulated wave Square wave (Duty ratio 50%)

Modulation frequency 2 mHz ~ 50 kHz

FSK

Carrier wave Sine, Square, Ramp, Arbitrary wave

Modulated wave Square wave (Duty ratio 50%)

Modulation frequency 2 mHz ~ 50 kHz

Hopping frequency Any frequency within the range of the Carrier wave signal

Sweep

Mode Linear, Logarithmic and step

Sweep time 1 ms~500 s

Start and stop frequency Any frequency within the range of the waveform

Display

Screen 10.1 - inch multi-touch capacitive screen

Resolution 1280×RGB×800 vertical pixel

| | |
|---------------------|---|
| Color | 24-bit true colors |
| Persistence | Minimum, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 5 s, 10 s, 20 s, infinite, close |
| Display type | Point, Vector |
| Real-Time clock | Time and data (user-defined) |
| Waveform Intensity | 1%~100% (default 50%) |
| Grid Intensity | 0%~100% (default 50%) |
| Backlight Intensity | 1%~100% (default 50%) |
| Transparent | 0%~100% (default 50%) |

Bode plot (option)

| | |
|-----------------|--|
| Start frequency | 50 Hz ~ 50 MHz |
| Stop frequency | 60 Hz ~ 50 MHz |
| Count | 1 ~ 1000 |
| Amplitude | High resistance: 20 mVpp~ 6 Vpp 50Ω: 10 mVpp~ 3 Vpp |

DVM (typical)

| | |
|------------|---|
| Source | Analog channel |
| Mode | DC, AC+DC RMS, AC RMS |
| Resolution | 4-bit |
| Buzzer | Beeps when the specified limit values are reached or exceeded |

Interface

| | |
|------------------------|---|
| USB-Host 3.0 | 1 on the front panel, 2 on the rear panel |
| USB-Device 3.0 | 1 on the rear panel |
| LAN | LAN (VXI11), 10/100/1000 Base, RJ-45 |
| AUX Out | Trig Out, Pass/Fail, DVM |
| Gen Out | 2 on the front panel |
| 10MHz reference input | 50 Ω, amplitude 400 mVpp ~ 4.5 Vpp (-3.979 dBm, 17.044 dBm) , frequency 10 MHz ± 10 ppm |
| 10MHz reference output | 50 Ω, 1.65 Vpp square wave |
| HDMI ¹ | 1 port for external display or projector |

General technical specification

Probe compensator output

| | |
|----------------|--|
| Output voltage | 3 Vp-p |
| Frequency | 10 Hz ,100 Hz, 1 kHz (default), 10 kHz |

Power Source

| | |
|----------------------|---|
| Power source voltage | 100 V ~ 240 VAC (fluctuate: ±10%) , 50 Hz/60 Hz 100 V ~ 120 VAC (fluctuate: ±10%) , 400 Hz |
| Power consumption | 120 W Max |
| Fuse | 3 A, F-class, 250 V |

Environmental

| | |
|-----------------------|--|
| Temperature | Operating: 0°C ~ +40°C Non-operating: -20°C ~ +70°C |
| Cooling | Forced cooling by fan |
| Humidity | Operating: below + 35 °C, relative humidity ≤90%; non-operating: + 35 °C ~ + 40 °C, relative humidity ≤60% |
| Altitude | Operating: below 3,000 meters; non-operating: below 15,000 meters |
| Pollution degree | 2 |
| Operating environment | In-door |

Mechanical Specifications

| | |
|-------------------|----------------------|
| Dimension (W×H×D) | 378 mm×218 mm×120 mm |
| Weight | 3.83 kg |

Calibration interval

| | |
|----------------------|--------|
| Calibration interval | 1 year |
|----------------------|--------|

Safety Regulations

| | | | |
|-------------------------------|---|----------------------------|---|
| | Compliance with EMC directive (2014/30/EU), compliance with or superior to IEC 61326-1:2021/ EN61326-1:2021, IEC 61326-2-1:2021/ EN61326-2-1:2021 | | |
| Electromagnetic compatibility | Conducted disturbance | CISPR 11/EN 55011 | CLASS B group 1, 150 kHz-30 MHz |
| | Radiation disturbance | CISPR 11/EN 55011 | CLASS B group 1, 30 MHz-1 GHz |
| | (ESD) | IEC 61000-4-2/EN 61000-4-2 | 4.0 kV (contact) , 8.0 kV (air) |
| | Radio sensitivity | IEC 61000-4-3/EN 61000-4-3 | 0V/m (80 MHz to 1 GHz) ; 3V/m (1.4 GHz to 2 GHz) ; 1V/m (2.0 GHz to 2.7GHz) |
| | Electrical fast transient (EFT) | IEC 61000-4-4/EN 61000-4-4 | 2kV (AC input) |

| | | |
|---|---|--|
| Surge | IEC 61000-4-5/EN 61000-4-5 | 1kV (live to zero) 2kV (live/zero to ground) |
| Radio continuous sensitivity | IEC 61000-4-6/EN 61000-4-6 | 3V,0.15-80 MHz |
| Voltage dip and short-term interruption | IEC 61000-4-11/EN 61000-4-11 | Voltage dip: 0% UT during 1 cycle; 40% UT during 10/12 cycles; 70% UT during 25/30 cycles Short-term interruption: 0% UT during 250/300 cycles |
| Safety specification | EN 61010-1:2010+A1:2019 EN IEC61010-2-030:2021+A11:2021 BS EN61010-1:2010+A1:2019 BS EN IEC61010-2-030:2021+A11:2021 | |

Remarks

1: only support standard HDMI, not support other adapters.

Order information







| | Description | Order No. |
|----------------------|--|----------------------|
| Model | MSO2304X (300 MHz, 5 GSa/s, 4 analog channels) | MSO2304X |
| | MSO2204X (200 MHz, 5 GSa/s, 4 analog channels) | MSO2204X |
| | MSO2104X (100 MHz, 5 GSa/s, 4 analog channels) | MSO2104X |
| Standard accessories | National standard cable x 1 | |
| | USB3.0 cable x 1 | UT-D30 |
| | BNC-BNC direct-through line x 1 | UT-L45 |
| | BNC-red and black alligator connecting wire x 1 | UT-L02A |
| | Passive probe (300 MHz/200 MHz/100 MHz) x 4 | UT-P06/UT-P05/UT-P04 |
| Optional accessories | 100MHz Upgrade to 200MHz Bandwidth | MSO2000X-BW1MT2M |
| | 200MHz Upgrade to 300MHz Bandwidth | MSO2000X-BW2MT3M |
| | 100MHz Upgrade to 200MHz Bandwidth | MSO2000X-BW1MT2M |
| | All serial bus triggering and decoding options | MSO2000X-BND |
| | Automobile serial bus triggering and decoding option (CAN, CAN-FD, LIN, FlexRay, SENT) | MSO2000X-AUTO |
| | Automotive serial bus triggering and decoding option CAN | MSO2000X-CAN |
| | Automotive serial bus triggering and decoding option CAN-FD | MSO2000X-CAN-FD |
| | Automotive serial bus triggering and decoding option LIN | MSO2000X-LIN |
| | Automotive Serial Bus Trigger and decoding Option FlexRay | MSO2000X-FLEX |
| | Automotive sensor serial bus triggering and decoding option SENT | MSO2000X-SENT |
| | Audio serial bus triggering and decoding option Audio | MSO2000X-AUDIO |
| | Bode plot loop analysis | MSO2000X-BODE |
| | Dual channel function/arbitrary waveform generator | MSO2000X-AWG |
| | Power analysis | MSO2000X-PWR |
| | Isolation transformer | UT-ISOT |
| High voltage probe | UT-V23/UT-P21/UT-P20 | |





| | |
|---------------------------------|--|
| High voltage differential probe | UT-P30/UT-P31/UT-P32/ UT-P33/UT-P35/UT-P36 |
| Current probe | UT-P40/UT-P41/UT-P42/ UT-P43/UT-P44/UT-P403 0D/UT-P4150/UT-P4500/ P4100A/P4100B |
| 16-channel logic analyzer probe | UT-M15 |

Remarks: Please order all hosts, accessories and options from your local UNI-T distributor.



Oscilloscope's probe and accessory






Passive probe



| Model | Type | |
|---|-----------------------|--|
| UT-P01 | High resistance probe | 1X: DC ~ 8 MHz 10X: DC ~ 25 MHz Oscilloscope compatibility: all series of UNI-T |
|  | | |
| UT-P03 | High resistance probe | 1X: DC ~ 8 MHz 10X: DC ~ 60 MHz Oscilloscope compatibility: all series of UNI-T |
|  | | |
| UT-P04 | High resistance probe | 1X: DC ~ 8 MHz 10X: DC ~ 100 MHz Oscilloscope compatibility: all series of UNI-T |
|  | | |
| UT-P05 | High resistance probe | 1X: DC ~ 8 MHz 10X: DC ~ 200 MHz Oscilloscope compatibility: all series of UNI-T |
|  | | |
| UT-P06 | High resistance probe | 1X: DC ~ 8 MHz 10X: DC ~ 300 MHz Oscilloscope compatibility: all series of UNI-T |
|  | | |
| UT-P07A | High resistance probe | 10X: DC ~ 500 MHz Input resistance:10 MΩ Maximum of operating voltage: <600V pk Oscilloscope compatibility: all series of UNI-T |
|  | | |

| | | |
|--|------------------------------|--|
| <p>UT-P08A</p>  | <p>High resistance probe</p> | <p>10X: DC ~ 350 MHz Input resistance: 10 MΩ Maximum of operating voltage: <600V pk Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P20</p>  | <p>High resistance probe</p> | <p>DC ~ 100 MHz Probe coefficient 100:1 Maximum of operating voltage: 1500 Vrms Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-V23</p>  | <p>High voltage probe</p> | <p>DC ~ 100 MHz Probe coefficient 100:1 Input resistance: 100 MΩ±2% Maximum of operating voltage: 2000 Vpp Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P21</p>  | <p>High voltage probe</p> | <p>DC ~ 50 MHz Probe coefficient 1000:1 Maximum of operating voltage: DC 15 kVrms, AC 10kV (sine wave) Oscilloscope compatibility: all series of UNI-T</p> |




Current probe

| Model | Type |
|---|---|
| <p>UT-P40</p>  | <p>Current probe</p> <p>DC ~ 100 kHz Range: 50 mV/A, 5 mV/A Current range: 0.4 A ~ 60 A Maximum of operating voltage: 600 Vrms Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P41</p>  | <p>Current probe</p> <p>DC ~ 100 kHz Range: 100 mV/A, 10 mV/A Current range: 0.4 A ~ 100 A Maximum of operating voltage: 600 Vrms Oscilloscope compatibility: all series of UNI-T</p> |

| | | |
|--|-------------------------------------|--|
| <p>UT-P42</p>  | <p>Current probe</p> | <p>DC ~ 150 kHz Range: 100 mV/A, 10 mV/A Current range: 0.4 A ~ 200 A Maximum of operating voltage: 600 Vrms Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P43</p>  | <p>Current probe</p> | <p>DC ~ 25 MHz Range: 100 mV/A Maximum test current: 20 A Rising time: 14 ns Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P44</p>  | <p>Current probe</p> | <p>DC ~ 50 MHz Range: 50 mV/A Maximum test current: 40 A Rising time: 7 ns Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P4030D</p>  | <p>High-frequency current probe</p> | <p>Bandwidth: DC~100 MHz Rising time: ≤ 3.5 ns Range selection: 30 A/5 A Maximum test current: 30A Voltage of insulated line 300V CAT I Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P4150</p>  | <p>High-frequency current probe</p> | <p>Bandwidth: DC~12 MHz Rising time: ≤ 29 ns Range selection: 150 A/30 A Maximum test current: 150A Voltage of insulated line 600V CATII 300V CATIII Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P4500</p>  | <p>High-frequency current probe</p> | <p>Bandwidth: DC~5MHz Rising time: ≤ 70 ns Range selection: 500 A/75 A Maximum test current: 500 A Voltage of insulated line: 600V CATII 300 V CATIII Oscilloscope compatibility: all series of UNI-T</p> |

| | | |
|--|------------------------------------|---|
| <p>UT-P4100A</p>  | <p>Low-frequency current probe</p> | <p>Bandwidth: DC~ 600kHz Rising time: $\leq 583\text{ns}$ Maximum test current: 100A Range selection: 100A/10A Range sensitivity: 0.01V/A Common-mode voltage RMS: CATI 600V CATII 600V CATIII 300V Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P4100B</p>  | <p>Low-frequency current probe</p> | <p>Bandwidth: DC~ 2 MHz Rising time: $\leq 175\text{ ns}$ Maximum test current: 100 A Range selection: 100 A/10 A Range sensitivity: 0.01 V/A Common-mode voltage RMS: CATI 600V CATII 600V CATIII 300V Oscilloscope compatibility: all series of UNI-T</p> |

Active probe

| Model | Type |
|---|---|
| <p>UT-P30</p>  | <p>High voltage differential probe</p> <p>DC ~ 100 MHz Attenuation ratio 100:1,10:1 Input differential-mode voltage: $\pm 800\text{Vpp}$ Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P31</p>  | <p>High voltage differential probe</p> <p>DC ~ 100MHz Attenuation ratio 1000:1,100:1 Input differential-mode voltage: $\pm 1.5\text{ kVpp}$ Oscilloscope compatibility: all series of UNI-T</p> |
| <p>UT-P32</p>  | <p>High voltage differential probe</p> <p>DC ~ 50MHz Attenuation ratio 1000:1,100:1 Input differential-mode voltage: $\pm 3\text{ kVpp}$ Oscilloscope compatibility: all series of UNI-T</p> |

UT-P33



High voltage differential probe

DC ~ 120MHz
 Attenuation ratio 100:1,10:1
 Input differential-mode voltage: ± 14 kVpp
 Oscilloscope compatibility: all series of UNI-T

UT-P35



High voltage differential probe

DC ~ 50MHz
 Attenuation ratio 500:1,50:1
 Rising time: 7ns
 Accuracy: 2%
 Input differential-mode voltage:
 1/50:130(DC+peakAC)
 1/500:1300(DC+peakAC)
 Input common-mode voltage:
 100Vrms,CAT I
 600Vrms,CAT II
 Oscilloscope compatibility: all series of UNI-T

UT-P36



High voltage differential probe

DC ~ 50MHz
 Attenuation ratio 2000:1,200:1
 Rising time: 3.5ns
 Accuracy: 2%
 Input differential-mode voltage:
 1/200:560 (DC+peakAC)
 1/2000:5600 (DC+peakAC)
 Input common-mode voltage:
 2800Vrms,CAT I
 1400Vrms,CAT II
 Oscilloscope compatibility: all series of UNI-T

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