

**UNI-T**

# UPO7000L Series Digital Phosphor Oscilloscopes

10GSa/s | 2GHz | 1Gpts | 2,000,000wfms/s



**Data Sheet REV.2.1**

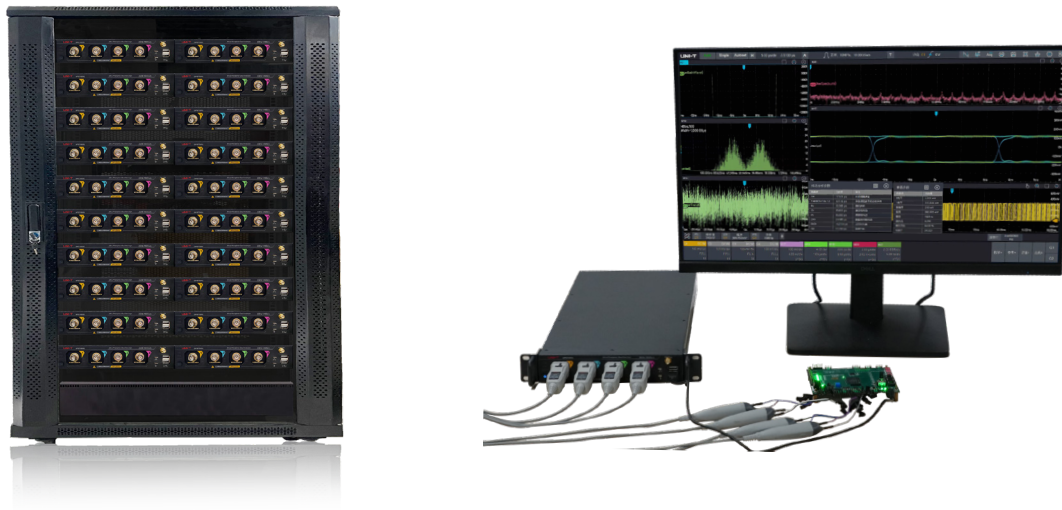
**November 2024**

# UPO7000L Introduction

## Compact Rack-Mounted Design for High-Density Integration: 214 mm (half-width) ×43 mm (1U) ×478 mm

UPO7000L series digital phosphor oscilloscopes feature a compact, rack-mounted structural design with a slim and lightweight body. 1U height is designed for multi-machine system integration, high-density rack setups, and remote system operations, making it ideal for various application scenarios. The system supports multi-unit synchronous triggering and can be expanded to accommodate up to 128 oscilloscopes. Each unit integrates 4 analog channels, 1 external trigger channel, and 1 function/arbitrary waveform generator channel. With a flat body design and machine feet pads, the oscilloscopes are easy to stack and organize. leveraging the 7000 series platform, it ensures a smooth transition for users familiar with 7000X operation. Additionally, an external touch display can be connected, enabling a responsive touch experience similar to that of the 7000X series.

For multi-machine integration, the series includes a rack-mounting kit for quick and straightforward installation right out of the box. Whether in system development, testing, or other demanding environments, UPO7000L excels in reliability and performance.



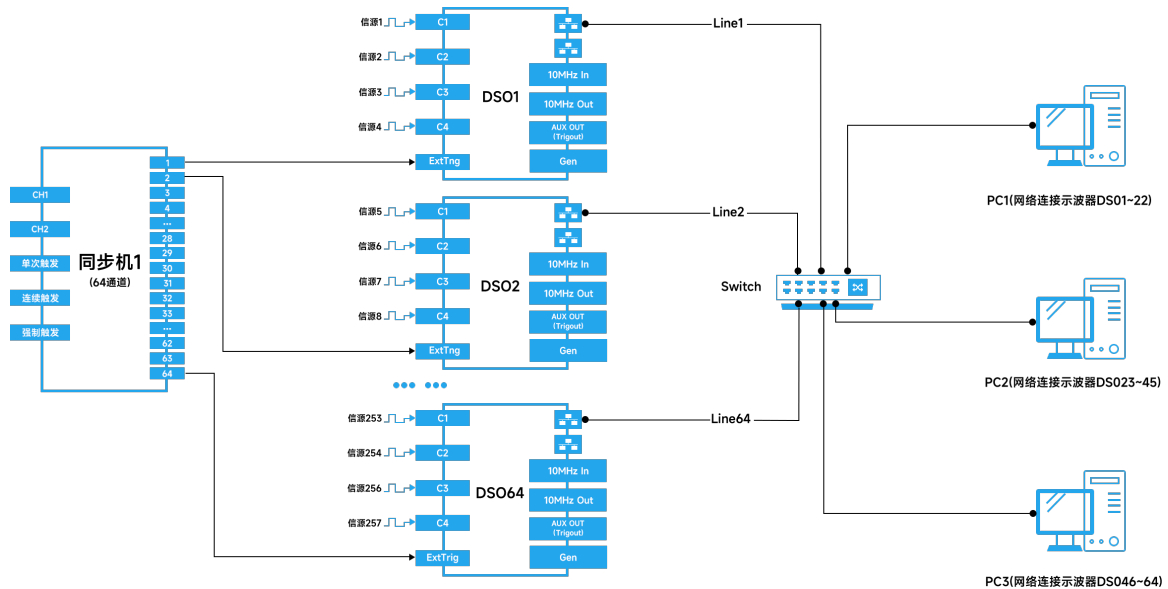
## Main Features

- Analog channel bandwidth: 1G/2GHz
- Maximum sampling rate: 10GSa/s
- Maximum storage depth: 1Gpts (Option)
- Wave capture rate:  $\geq 600,000$  wfms/s (UltraAcq<sup>®</sup> mode) ; 2,000,000 wfms/s (Sequence mode)
- Multiple triggering types: Edge, pulse width, slope, video, code pattern, timeout, runt, setup & hold, delay, duration, and Nth edge
- 11 kinds of serial protocol analysis: RS232/422/485/UART, I<sup>2</sup>C, SPI, CAN, CAN FD, LIN, FlexRay, SENT, MIL-STD-1553, ARINC 429, and AudioBus (I2S/LJ/RJ/TDM)
- Gathering 6 kinds of instrument functions: Digital oscilloscope, spectrum analyzer, function/arbitrary waveform generator, digital voltmeter, frequency meter, and protocol analyzer
- 48 kinds of parameter measurement, it supports histogram, trace, and tendency chart
- Multiple advanced measurement analysis functions: Power analysis (Option), jitter & eye diagram (Option), template test, histogram, and search navigation
- Built-in WebServer can access the instrument and observe the measurement on browser, supporting two styles of layout and operation of PC/smartphone, easy to realize cross-platform access
- Supports SCPI (Standard Command for Programmable Instrument)
- Various interfaces: USB Host & Device, LAN, HDMI, AUX Out, 10MHz Ref In/Out, and Audio
- 8-channel waveform operation, built-in frequency spectrum analysis and peak search function, supporting Matlab embedded programming and data presentation, and support enhanced resolution up to 3-bit
- Built-in function/arbitrary waveform generator with a bandwidth of 60MHz
- Features a 1U height, a compact, rack-mounted structural design with a slim and lightweight body
- Provides a software development package to support secondary development needs
- Supports multi-machine synchronization and can be expanded to accommodate up to 128 oscilloscopes for simultaneous data acquisition.

# Low Trigger Delay, Multi-Machine Synchronization Scheme

In the multi-level synchronization scheme for rack assembly, UPO7000L provides a clock synchronization port, an auxiliary output port, and an external trigger channel.

The external trigger jitter between instruments is 200psrms, effectively ensuring synchronization accuracy. With support from the Gigabit Ethernet interface, the SCPI response speed is deeply optimized, enhancing the stability and transmission efficiency of the data link. For users requiring multi-channel integrated solutions, UNI-T offers a synchronizer scheme that supports simultaneous data acquisition for up to 128 devices and can be expanded to up to 512 channels.



## Flexible Near-end/Far-end Platform

Connect an external display and control device

UPO7000L provides an HDMI port on the rear panel, allowing users to view the user interface on external monitoring devices such as monitors, televisions, and projectors. Additionally, the instrument features two USB HOST 2.0 interfaces and two USB HOST 3.0 ports on the front and rear panels, respectively. These interfaces support the connection of control devices such as Bluetooth mice and keyboards, effortlessly transforming the UPO7000L into a personal workstation.

WebServer Remote Control

UPO7000L features two Gigabit Ethernet ports on the rear panel, allowing users to connect the device to a local area network via network cables or Wi-Fi. By entering the instrument's IP address in a web browser, users can control and analyze the oscilloscope on personal mobile devices or PCs. Additionally, the WebServer supports online SCPI commands, enabling users to directly export waveform data, browse instrument manuals online, and perform various other operations. With network access, all oscilloscope functions can be easily used.



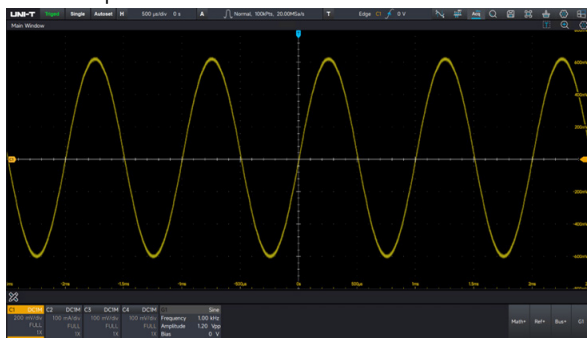
# UPO7000L Features

## Six-in-one Comprehensive Signal Measurement Instrument



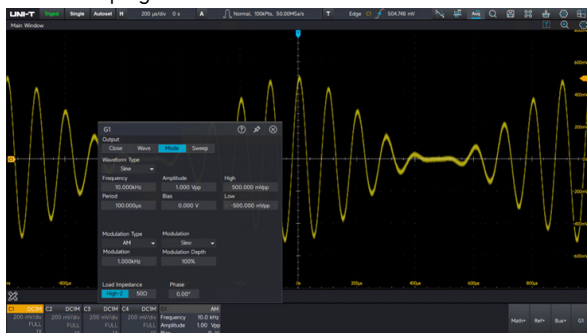
### Digital Oscilloscope

- 4 analog channels, 1 external trigger channel
- Sampling rate of 10GSa/s for all models in the series
- Equipped with UltraAcq® to enhance the waveform capture rate to 800,000wfms/s and 2,000,000wfms/s in sequence mode
- Memory depth of 1Gpts for a single channel and full channel of 250Mpts for all channels in the series, enabling the capture of more waveform details



### Function/Arbitrary Waveform Generator (Option)

- Maximum output frequency of up to 60MHz and sampling rate to 625MSa/s
- Vertical resolution: 16-bits
- Built-in various waveforms: Sine, square, pulse, slope, noise, and DC
- Built-in arbitrary waveforms: 200types
- Supports multiple signal modulation and frequency sweeping



### Digital Frequency Meter

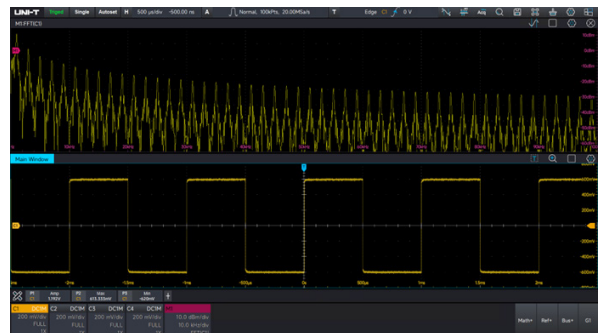
- 8-digit high precise hardware frequency meter

### Digital Voltmeter

- 4-digit DC/AC RMS/DC+AC RMS voltage measurement

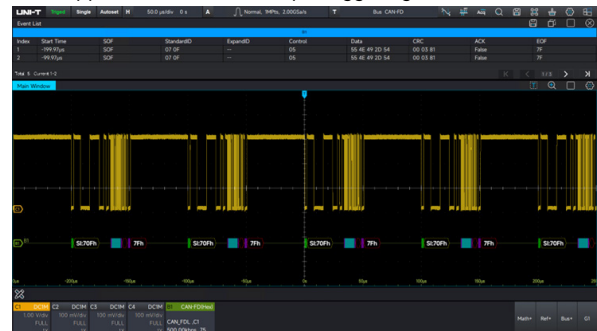
### Spectrum Analyzer

- Enhance FFT with a maximum of 1Mpts
- Frequency range: Oscilloscope's analog bandwidth
- Various spectrum types: Amplitude spectrum, power spectrum, power spectral density, real part, imaginary part, and phase spectrum
- Supports two simultaneous spectrum analysis windows with different window functions



### Protocol Analyzer (Option)

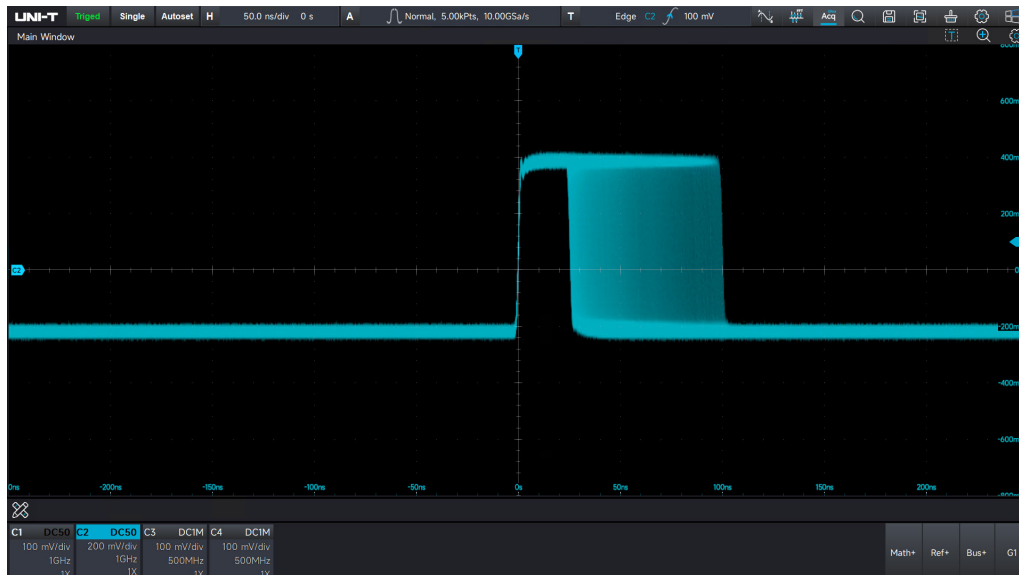
- Equipped with 5 serial protocols: RS-232/422/485/UART, I²C, SPI, CAN, and LIN
- Supports optional bus protocols: CAN-FD, FlexRay, SENT, I²S, LJ, RJ, TDM, MIL-STD-1553, and ARINC 429
- Supports event list and search function
- Supports data and envelope triggering



## UltraAcq® Technology by UNI-T

UPO7000L adopts UNI-T original UltraAcq® technology, which leverages multi-body cross-mapping technology and a segmented collaborative matrix processing architecture to achieve a waveform capture rate of up to 800,000wfms/s and 2,000,000wfms/s in sequence mode. Compared to traditional oscilloscopes with a maximum capture rate of 200,000wfms/s, the UPO7000L features a dead time of less than 1μs and can capture more than 1 million 200ps fast-edge signals per second.

With its information entropy-based intelligent detection technology for abnormal signals, the UPO7000L easily addresses the challenges posed by occasional or intermittent events often encountered by engineers during testing. This enables seamless acquisition of abnormal signals. Additionally, the new Ultra Phosphor 3.0 super-fluorescent display technology ensures that even escaped signals are visibly displayed.



## Mathematical Operation

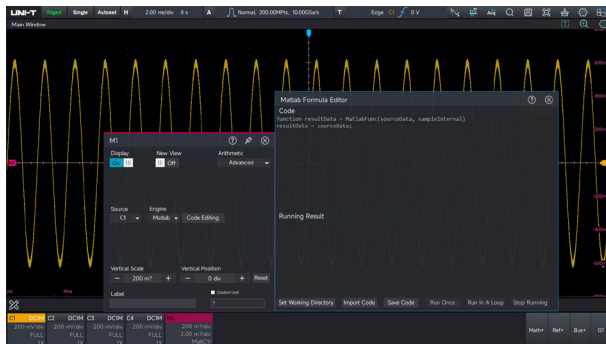
UPO7000L provides a system of algorithms for complex waveform operations, enabling users to further process waveforms and display the results directly on the oscilloscope.

- Enhanced FFT: Provides the spectrum view of time-domain, frequency-domain, and modulation-domain
- Filter: High pass, low pass, band pass, and band limit
- Enhanced resolution mode: Utilizes advanced filters to provide higher resolution. Each channel can be configured independently, with a maximum resolution enhancement of 3-bit. Filtering is the optimal approach when balancing resolution and bandwidth.
- User-defined function operation: Supports operations for digital channels, analog channels,

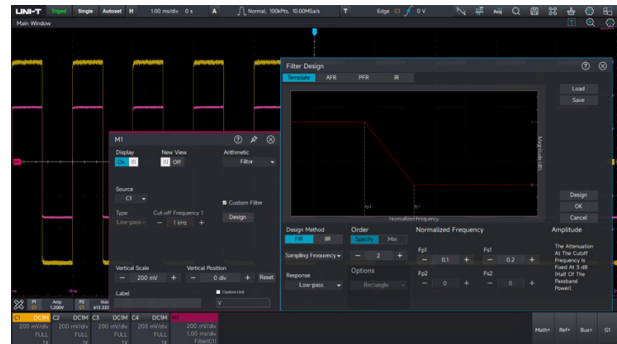


all channels, and reference channels.

- **Embedded Matlab:** Enables direct rendering of operational code to the oscilloscope.



Embedded MATLAB allows users to easily render and display code waveforms.



The user-defined advanced filter designer can be directly configured on the oscilloscope.



## Multi-aspect Dissection of Power Integrity-Power Analysis (Option)

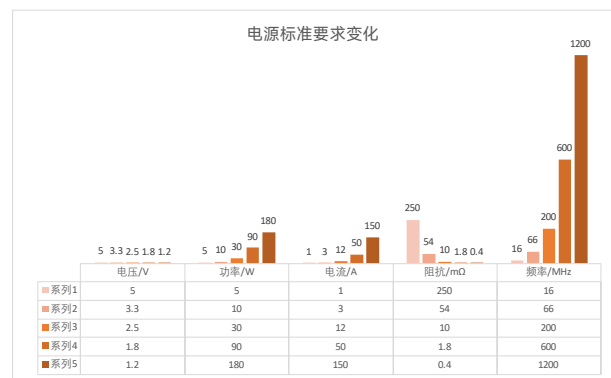
With the advancement of chip technology, the requirements for power supply systems have significantly increased. Small-voltage, high-current power supply networks have become the norm, especially for chips and power networks composed of precision components. This trend demands not only reliable power delivery and effective noise suppression across various circuit parts but also ensures the integrity of signal transmission between chips. These challenges have raised the bar for power supply testing. Designers are increasingly focused on energy-efficient power supplies and fast response times to ensure stable and clean power delivery.

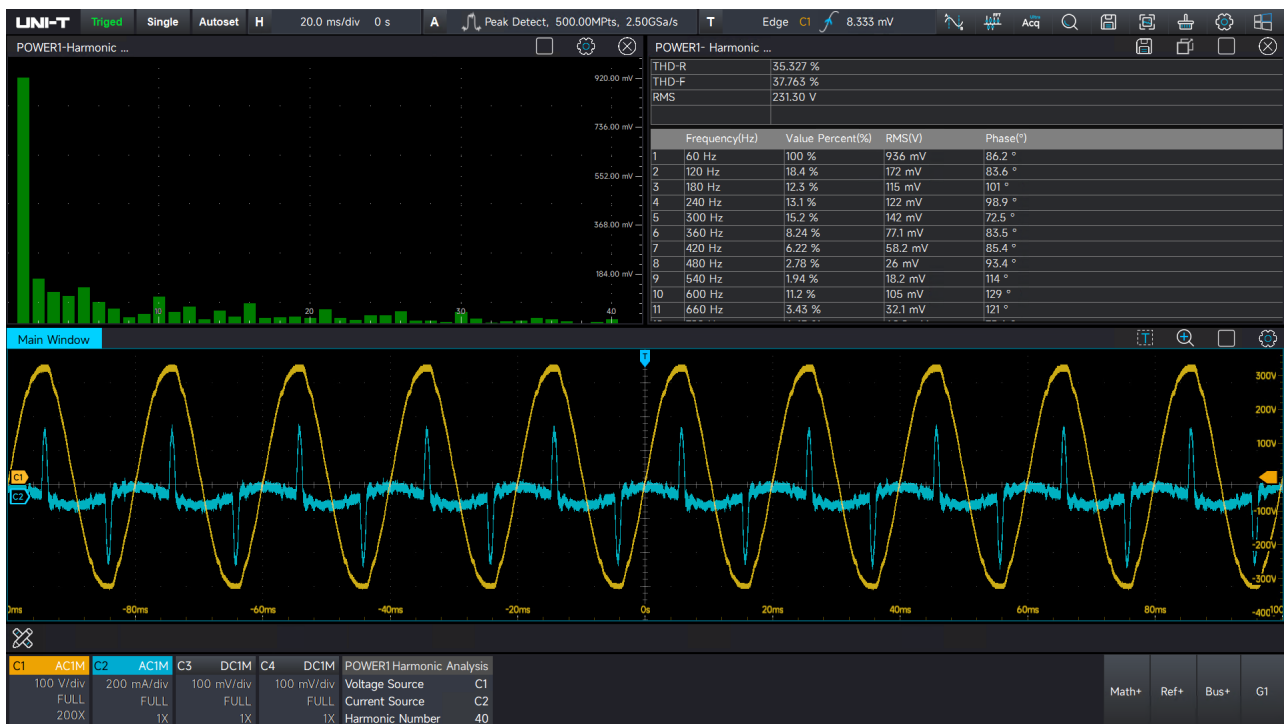
Given these trends, power integrity testing has become crucial. It directly impacts signal integrity, while signal quality, in turn, reflects power quality. Poor power quality can even lead to a cascade of electromagnetic interference (EMI) issues, posing significant challenges for designers. An oscilloscope with advanced power analysis capabilities is undoubtedly the most reliable tool to tackle these challenges and ensure optimal performance.

UPO7000L offers a comprehensive set of power analysis tools and evaluation capabilities. Simply select the desired analysis type, connect the voltage and current probes to the power system's test points or specified test fixtures (as illustrated in the diagram), and assign them to the desired observation

channel. Finally, perform any necessary fine-tuning to achieve the desired results.

- Wave Ripple Analysis
- Loop Analysis
- Safety Operation Area
- Power Quality
- Harmonic Analysis
- Switching Loss





## Visualization Analysis of Signal Integrity - Jitter and Eye Diagram Analysis (Option)

As signal rates continue to improve, interference factors during data transmission have become more prevalent, making links increasingly sensitive to signal loss. Designers must precisely identify the causes of signal degradation. Most signal jitter issues can be traced back to clock jitter caused by system failures in the transmission link, including power supply-induced clock jitter, discontinuities in the phase-locked loop (PLL), thermal and mechanical noise from crystals, intersymbol interference, and other fault sources. How can these faults be accurately located? UPO7000L series digital phosphor oscilloscopes provide an effective solution.

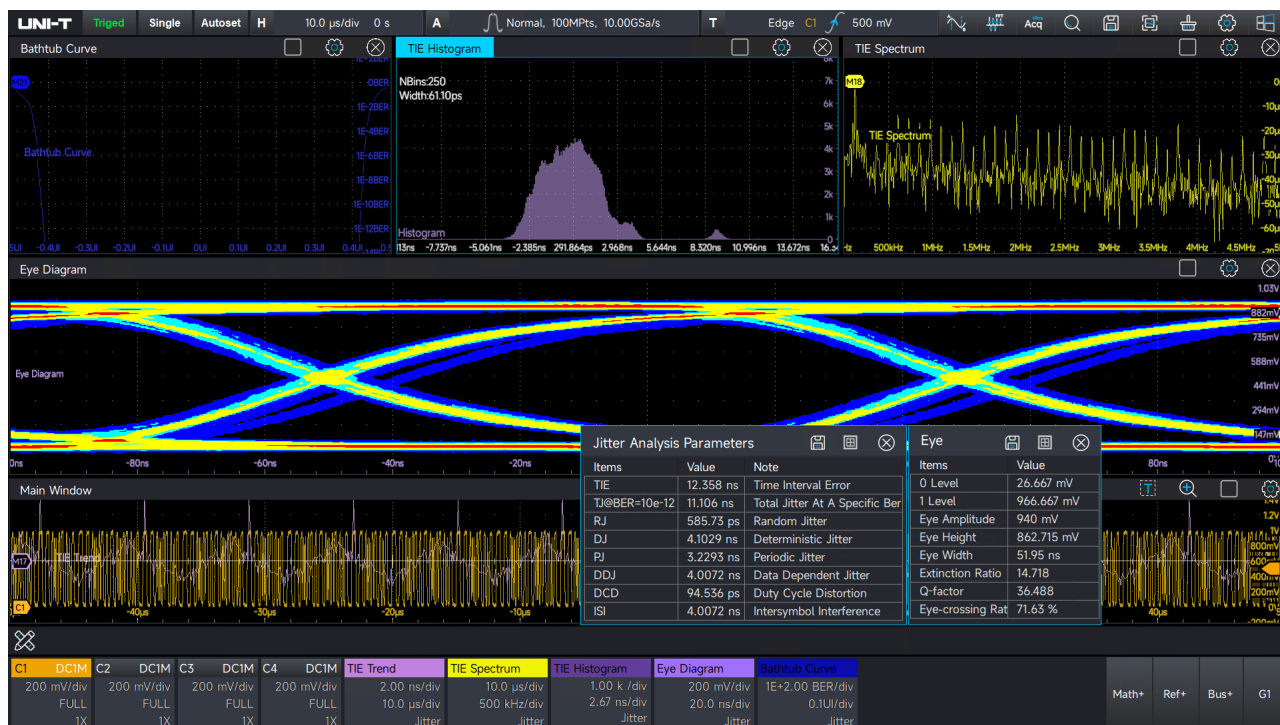
UPO7000L provides eye diagram analysis and jitter measurement functions with integrated clock recovery. Supported clock recovery methods include fixed frequency, first-order PLL, second-order PLL, and external clock. Without requiring additional settings, the oscilloscope can quickly generate eye diagrams for serial signals. It also supports standard or user-defined eye diagram templates to detect anomalies. Test results are presented directly in a parameter list.

TIE jitter is the most common jitter indicator. UPO7000L provides a comprehensive suite of jitter analysis tools that enable visual measurement. This includes TIE trend charts, TIE spectrograms, histograms, and bathtub curves. The oscilloscope can identify the distribution of jitters across

different domains such as time, frequency, and statistical domains. For example, RJ (Random Jitter) is Gaussian, and DJ (Deterministic Jitter) is bounded.

Measurement parameters for eye diagram: Eye amplitude, eye height, eye width, 1-level, 0-level, and Q factor.

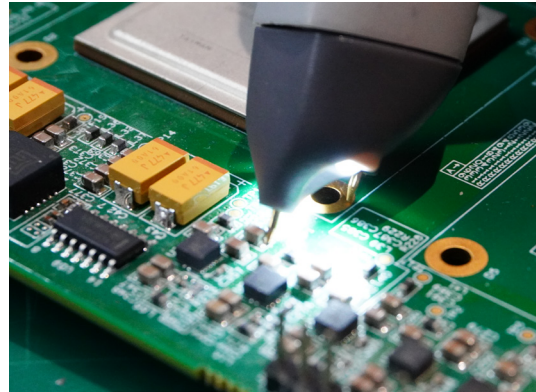
Measurement parameters for jitter: TIE (Time Interval Error), TJ@BER (Total Jitter at Bit Error Rate), RJ (Random Jitter), DJ (Deterministic Jitter), PJ (Period Jitter), DDJ (Data Dependent Jitter), and DCD (Duty Cycle Distortion).



# Probe

## UT-PA2000 Single-Ended Single Probe

UT-PA2000 is a single-ended active probe designed for high-frequency measurements. It integrates numerous features required by modern high-speed probes. Single-ended active probes are widely used in high-speed applications such as digital circuit analysis, bus analysis, and signal integrity analysis. UT-PA2000 enables precise and rapid acquisition of signal information within circuits, enhancing engineers' efficiency and measurement accuracy.



### Excellent

- 2GHz bandwidth: Accurately measure high-speed serial signals
- Rise time  $\leq 175\text{ps}$ : Extremely high signal fidelity
- Low load:  $1\text{M}\Omega$  input impedance,  $\leq 1.2\text{pF}$  input capacitance
- Dynamic range:  $\pm 4\text{V}$
- Offset range:  $\pm 4\text{V}$
- Transmission delay:  $\leq 7\text{ns}$
- Low power loss:  $0.5\text{W}$

### Accessibility

- Auto attenuation multiple
- Auto probe mode recognition
- Auto probe's serial number detection
- Auto scale and measured value adjustment





### Compatibility

- Probe headlight control
- Oscilloscope run/stop
- Clear display
- Forced trigger
- Compatibility UNI-T oscilloscope series: MSO7000X, MSO8000HD, and UP07000L


### Outstanding

- A compact probe head used for testing small circuit components
- Various accessories for flexible connection to the DUT (Device Under Test)
- A special probe headlight design

## Passive Probe

Model	Type	Description
<b>UT-P07</b> 	High-impedance probe	1X: DC to 8MHz 10X: DC to 500MHz Oscilloscope compatibility: All UNI-T series
<b>UT-P20</b> 	High-impedance probe	DC to 100MHz Probe attenuation factor 100:1 Maximum operating voltage: 1500Vrms Oscilloscope compatibility: All UNI-T series
<b>UT-V23</b> 	High-voltage probe	DC to 100 MHz Probe attenuation factor 100:1 Input resistance: 100MΩ±2% Maximum operating voltage: 2000Vpp Oscilloscope compatibility: All UNI-T series
<b>UT-P21</b> 	High-voltage probe	DC to 50MHz Probe attenuation factor 1000:1 Maximum operating voltage: DC 15kVrms, AC 10kV (Sine wave) Oscilloscope compatibility: All UNI-T series

## Current Probe

Model	Type	Description
<b>UT-P40</b> 	Current probe	DC to 100kHz Range: 50mV/A, 5 mV/A Current range: 0.4A to 60A Maximum operating voltage: 600Vrms Oscilloscope compatibility: All UNI-T series
<b>UT-P41</b> 	Current probe	DC to 100kHz Range: 100mV/A, 10mV/A Current range: 0.4A to 100A Maximum operating voltage: 600Vrms Oscilloscope compatibility: All UNI-T series
<b>UT-P42</b> 	Current probe	DC to 150kHz Range: 100mV/A, 10mV/A Current range: 0.4A to 200A Maximum operating voltage: 600Vrms Oscilloscope compatibility: All UNI-T series
<b>UT-P43</b> 	Current probe	DC to 25MHz Range: 100mV/A Maximum measuring current: 20A Rising time: 14ns Oscilloscope compatibility: All UNI-T series
<b>UT-P44</b> 	Current probe	DC to 50MHz Range: 50mV/A Maximum measuring current: 40A Rising time: 7ns Oscilloscope compatibility: All UNI-T series

**UT-P4030D**

Current  
probe

Bandwidth: DC to 100MHz

Range: 1X: 5A, 10X: 30A

Rising time:  $\leq 3.5\text{ns}$

Maximum continuous current: 30Arms

Resolution: 5A: 1mA, 30A: 10mA

Oscilloscope compatibility: All UNI-T series

**UT-P4150**

Current  
probe

Bandwidth: DC to 12MHz

Range: 10X: 30A, 100X: 150A

Rising time:  $\leq 29\text{ns}$

Maximum continuous current: 150Arms

Resolution: 30A: 10mA, 150 A: 100mA

Oscilloscope compatibility: All UNI-T series

**UT-P4500**

Current  
probe

Bandwidth: DC to 5MHz

Range: 10X: 75A, 100X: 500A

Rising time:  $\leq 70\text{ns}$

Maximum continuous current: 500Arms

Resolution: 75A: 10mA, 500A: 100mA

Oscilloscope compatibility: All UNI-T series

**UT-P4100A**

Current  
probe

Bandwidth: DC to 600kHz

Current range: Low scale 50mA to 10A, high scale 1  
A to 100A

Range sensitivity: Low scale 0.1V/A, high scale  
0.01V/A

Oscilloscope compatibility: All UNI-T series

**UT-P4100B**

Current  
probe

Bandwidth: DC to 2MHz





Current range: Low scale 50mA-10 A, high scale  
1A-100A

Range sensitivity: Low scale 0.1V/A, high scale  
0.01V/A

Oscilloscope compatibility: All UNI-T series



## High-Voltage Differential Probe

Model	Type	Description
<b>UT-P30</b>		
	High-voltage differential probe	<p>DC to 100MHz</p> <p>Probe attenuation factor 100:1, 10:1</p> <p>Input differential-mode voltage: <math>\pm 800\text{Vpp}</math></p> <p>Oscilloscope compatibility: All UNI-T series</p>
<b>UT-P31</b>		
	High-voltage differential probe	<p>DC to 100MHz</p> <p>Probe attenuation factor 1000:1, 100:1</p> <p>Input differential-mode voltage: <math>\pm 1.5\text{kVpp}</math></p> <p>Oscilloscope compatibility: All UNI-T series</p>
<b>UT-P32</b>		
	High-voltage differential probe	<p>DC to 50MHz</p> <p>Probe attenuation factor 1000:1, 100:1</p> <p>Input differential-mode voltage: <math>\pm 3\text{kVpp}</math></p> <p>Oscilloscope compatibility: All UNI-T series</p>
<b>UT-P33</b>		
	High-voltage differential probe	<p>DC to 120MHz</p> <p>Probe attenuation factor 100:1, 10:1</p> <p>Input differential-mode voltage: <math>\pm 14\text{kVpp}</math></p> <p>Oscilloscope compatibility: All UNI-T series</p>

**UT-P35**

High-voltage  
differential probe

DC to 50MHz

Probe attenuation factor 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, CATI

600Vrms, CATII

Oscilloscope compatibility: All UNI-T series

**UT-P36**

High-voltage  
differential probe

DC to 50MHz

Probe attenuation factor 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, CATI

1400Vrms, CATII

Oscilloscope compatibility: All UNI-T series

## Technical Specifications

All specifications are guaranteed, except those marked "Typical (Typ.)". The instrument must be operated continuously for at least thirty minutes at the specified operating temperature.

Specifications	UPO7204L	UPO7104L
Bandwidth (-3dB)@50 $\Omega$ * <sup>1</sup>	2GHz	1GHz
Bandwidth (-3dB)@1 M $\Omega$	500MHz	
Rising time: @50 $\Omega$ (Typ.)	175ps	350ps
Channel number	4+EXT	
Sampling rate* <sup>2</sup>	10GSa/s (Single channel), 5GSa/s (Dual-channel), 2.5GSa/s (All channels)	
Vertical resolution	8-digit (HD12-bit)	
Maximum memory depth	1Gpts (Single channel), 500Mpts (Dual-channel), 250Mpts (Four-channel)	
Maximum waveform capture rate* <sup>3</sup>	$\geq 2,000,000$ wfms/s	
Function/Arbitrary waveform generator (Option)	Maximum frequency of waveform: 60MHz, maximum sampling rate: 625MSa/s Supports arbitrary waveform and provides arbitrary waveform editor Supports modulation and frequency sweeping	
Digital voltmeter	4-digit, DC, AC RMS, DC+AC RMS	
Frequency meter	8-digit	
Serial protocol analysis	Standard: RS-232/422/485/UART, SPI, I <sup>2</sup> C, CAN, LIN Option: CAN-FD, SENT, FlexRay, AudioBus (I <sup>2</sup> S\LJ\RJ\TDM), MIL-STD-1553, ARINC429	
Measurement	Supports 48 types of automatic parameter measurements, parameter snapshots, statistical analysis, histograms, trend charts, and trace analysis	
Mathematical operation	Supports 8 mathematical operations Enhanced FFT, basic operation, filter, advanced formula editor, Matlab embedded programming operation and render, enhanced resolution	
Analysis tool	Histogram, regional histogram, tendency chart, trace figure	

Advanced analysis function	Power analysis (option), jitter and eye diagram analysis (option), limit template test, sequence mode	
Interface	USB Device, USB Host*4, LAN (10,100,1000Mb/s)*2, HDMI, AuxOut (Trigger synchronous output, pass/fail test result, AWG synchronous signal output), 10MHz Ref In, 10MHz Ref Out, Audio	
Display screen	HDMI connects to an external display	
<b>Analog Channel</b>	<b>UPO7204L</b>	<b>UPO7104L</b>
Channel number	4+EXT	
Bandwidth limit @50Ω (Typ.)	1GHz, 500MHz, 20MHz	500MHz, 20MHz
Bandwidth limit @1MΩ (Typ.)	20MHz	
Vertical input sensitivity range*4	1MΩ: 1mV/div to 10V/div 50 Ω: 1mV/div to 1V/div	
Input coupling	AC, DC, GND	
Input impedance	1MΩ ± 1% (15±3pF), 50Ω ± 2%	
DC gain accuracy *4	<b>50Ω:</b> ±1.5% (±2.0% when ≤ 5mV/div) ±1% of full scale (≤ 5mV/div: ±1.5% of full scale) <b>1MΩ:</b> ±1.2% (±1.5% when ≤ 5 mV/div) ±1% of full scale (≤ 5mV/div: ±1.2% of full scale)	
Offset	<b>1MΩ:</b> 1mV/div to 50mV/div: ±2V; 100mV/div to 500mV/div: ±20V; 1V/div: ±40V; 2V/div-10V/div: ±100V <b>50Ω:</b> 1mV/div to 100mV/div: ±2V; 200mV/div to 1V/div: ±5V	
DC offset accuracy	≤200mV/div (±0.1div ±2mV ±1.5% offset) >200 mV/div (±0.1div ±2mV ±1.0% offset)	
Probe attenuation factor	1X, 10X, 100X; user-defined: 0.001X to 1000X	
Maximum input voltage	1MΩ: ≤300Vrms, CAT I; 50 Ω: ≤5Vrms	
Channel isolation	≥500:1 (DC to 1GHz)	

- ★1: 2G bandwidth is only available in single channel mode.
- ★2: Dual-channel mode: Only C1 and C2 or C3 and C4 can be enabled simultaneously.
- ★3: The maximum capture rate is only available in sequence mode, which can be configured in single-channel mode.
- ★4: 1mV/div is a digital magnification of the 2mV/div. For calculating vertical accuracy, the 1mV/div vertical sensitivity should correspond to a full-scale range of 16mV based on the 2mV/div.

### Horizontal System

Time base	100ps/div to 1000s/div
Time base accuracy	$\pm (0.5+1 \times \text{the number of years since calibration})$ ppm
Time base delay	Pretrigger: $\geq 0.5$ screen width; post-trigger: $\leq 5000$ s
Interchannel offset range	$\pm 100$ ns, minimum step of 40ps
Interchannel synchronization precision	$\leq 100$ ps
Horizontal mode	Y-T, X-Y, ROLL

### Acquisition System

Peak	400ps (Capture the narrowest glitch)
High resolution mode	8 to 12bits
Average	2 to 65536
UltraAcq®	600,000wfms/s

### Triggering System

Trigger mode	Auto, normal, single
Trigger coupling	High frequency      Rejects high-frequency signals above

	rejection	40kHz
	Low frequency rejection	Rejects high-frequency signals below 40kHz
	Noise rejection	Trigger delay (ON/OFF)
	DC	DC coupling trigger
	AC	AC coupling trigger
Trigger holdoff	6.4ns to 10s	
Trigger sensitivity	Internal trigger: C1-C4	$\leq 5\text{mV}$ : 1div; $> 5\text{mV}$ : 0.5div
	External trigger	EXT:100mVpp DC to 100MHz, 150mVpp 100MHz to 200MHz EXT/5: 500mVpp DC to 100MHz, 750mVpp 100MHz to 200MHz
Trigger level	Internal trigger	$\pm 4$ grids from the center of the screen
	External trigger	EXT: $\pm 1\text{V}$ ; EXT/5 $\pm 5\text{V}$
	AC Line	Fixed at approximately 50% of line voltage
<b>Trigger Type</b>		
Edge triggering	Source	C1-C4, EXT/(EXT/5), mains supply
	Trigger edge	Rising edge, falling edge, arbitrary edge
Pulse width triggering	Source	C1-C4
	Polarity	Positive pulse width, negative pulse width
	Limit condition	Less than, greater than, within range
	Pulse width	3.2ns to 10s
Slope triggering	Source	C1-C4
	Slope	Rising, falling
	Limit condition	Less than, greater than, within range
	Time setting	3.2ns to 10s
Video triggering	Source	C1-C4

	Standard	NTSC, PAL
	Trigger condition	All lines, specified line, odd field, even field
Code pattern triggering	Source	C1-C4
	Code pattern	High, low, arbitrary, rising edge, falling edge
Timeout triggering	Source	C1-C4
	Edge type	Rising edge, falling edge, arbitrary edge
	Time setting	3.2ns to 10s
Runt-amplitude triggering	Source	C1-C4
	Polarity	Positive pulse width, negative pulse width
	Limit condition	Less than, greater than, within range, outside the range
	Time setting	3.2ns to 10s
Setup & hold triggering	Clock source	C1-C4
	Clock edge	Rising edge, falling edge
	Data source	C1-C4
	Condition	Setup, hold, Setup & hold
	Time setting	3.2ns to 10s
Delay triggering	Source	C1-C4
	Edge type	Rising edge, falling edge
	Delay type	Less than, greater than, within range, outside the range
	Delay time	3.2ns to 10s
Duration triggering	Source	C1-C4
	Code pattern	H, L, X
	Trigger condition	Less than, greater than, within range
	Duration	3.2ns to 10s



Nth edge triggering	Source	C1-C4
	Edge type	Rising edge, falling edge
	Idle time	3.2ns to 10s
	Edge count	1 to 65535
RS-232/422/485/UART triggering	Trigger mode	Start bit, parity check bit, data bit, stop bit
I <sup>2</sup> C triggering	Trigger mode	Start bit, restart, stop, response failure, address, data, address and data
SPI triggering	Trigger mode	Chip selection active, data
CAN triggering	Trigger mode	Start frame, frame type, ID, data, ID and data, end of frame, error
LIN triggering	Trigger mode	Start frame, ID, data, ID and data, checksum error
CAN-FD triggering (Option)	Trigger mode	Start frame, frame type, ID, data, ID and data, end of frame, error
SENT triggering (Option)	Trigger mode	Synchronous bit, start frame, data, CRC error
AudioBus triggering (Option)	Trigger mode	Data, synchronous bit
FlexRay triggering (Option)	Trigger mode	Frame header, indicating bit, ID, cycle number, data, ID and data, end of frame, error
MIL-STD-1553 triggering (Option)	Trigger mode	Command frame, data frame, state frame, CRC error
ARINC 429 triggering (Option)	Trigger mode	Start frame, source or destination identifier, data, indicating and state bit, CRC error

## Waveform Measurement

## Cursor Measurement

Source	C1-C4, Math, Ref, histogram
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Type	<p>Vertical cursor: Measures time and voltage (X, Y), reciprocal of <math>\Delta X</math> (Hz) (<math>1/\Delta X</math>), and <math>\Delta Y/\Delta X</math> (V/s).</p> <p>Horizontal cursor: Measures voltage (Y) <math>\Delta Y</math></p> <p>Supports automatic trace cursor</p>
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### Automatic Measurement

Vertical measurement parameters	Maximum value, minimum value, peak-to-peak, top value, bottom value, middle value, amplitude, average value, RMS, standard deviation, positive overshoot, negative overshoot, maximum period, minimum period, periodic RMS, periodic average, periodic peak-to-peak, periodic middle value, positive preshoot, negative preshoot
Horizontal measurement parameters	Period, frequency, rising time, falling time, positive pulse width, negative pulse width, positive duty ratio, negative duty ratio, time @Max, time @Min, rising time @Lv, falling time @Lv, period @Lv, frequency @Lv, pulse width @Lv, duty ratio @Lv, phase difference @Lv, RRD @Lv, FFD @Lv, RFD @Lv, FRD @Lv, offset, data count, setup time, hold time, periodic count
Other measurement parameters	Area, periodic area
Histogram parameters	$\mu \pm 1\sigma$ , $\mu \pm 2\sigma$ , $\mu \pm 3\sigma$ , mode, mean value, standard deviation, maximum value, minimum value, middle value, peak-to-peak, peak count, total sample size
Measurement source	C1-C4
Measurement items	48 types of automatic measurements, displaying up to 10 measurements simultaneously
Measurement range	Screen or cursor
Parameter snapshot	Displays 35 measurement items for the current measurement channel, with the source selectable
Measurement statistics	Current value, average value, maximum value, minimum value, standard deviation, number of measurements, histogram, trend chart, trace

### Waveform Operation

Function	8 (simultaneous display)
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Source	C1-C4, P1-P10, R1-R4	
Advanced operation	Embedded Matlab and data presentation	
Basic operation	Addition, subtraction, multiplication, division, AND, OR, NOT, XOR, average, absolute value, Exp10, exponential (Exp), differential, integral, natural logarithm (Ln), logarithm base 10 (Lg), square root, common mode, sine, cosine, tangent, correlation, convolution, extension, extraction, interpolation, maximum, minimum, and user-defined expressions (editable and capable of performing composite formula operations)	
Enhanced FFT	Function	Amplitude spectrum, power spectrum, Psd, real part, imaginary part, phase spectrum
	Window type	Rectangular window, Hanning window, Blackman window, Hamming window, Flat Top window
	Display	Full screen (Frequency spectrum), multi-window
	Vertical unit	Vrms, dBrms
	Digital filter	Low pass, high pass, band pass, band limit
Enhanced resolution	Enhanced bit: 0.5, 1, 1.5, 2, 2.5, 3bits	

### Measurement Analysis

Digital voltmeter	Source	C1-C4
	Mode	DC, AC RMS, DC+AC RMS
	Voltage resolution	4bits
Frequency meter	Frequency resolution	8bits
Pass/fail test	Source	C1-C4
	Test template	User-defined test template or load standard test template
	Test failure operation	Stop, save, alarm, test report
Histogram	Source	P1-P10

	Type	Horizontal, vertical, measurement
	Measurement item	$\mu\pm1\sigma$ , $\mu\pm2\sigma$ , $\mu\pm3\sigma$ , mode, mean value, standard deviation, maximum value, minimum value, middle value, peak-to-peak, peak count, total sample size
Jitter analysis (Option)	Source	C1-C4
	Clock recovery	Fixed frequency: Auto, user-defined PLL: First-order phase-locked loop, second-order phase-locked loop Display clock: External clock
	Figure	TIE histogram, TIE tendency chart, TIE frequency spectrum, bathtub curve
	Measurement parameter	TIE, TJ@BER, RJ, DJ, PJ, DDJ, DCD
Eye diagram (Option)	Source	C1-C4
	Clock recovery	Fixed frequency: Auto, user-defined PLL: First-order phase-locked loop, second-order phase-locked loop
	Measurement parameter	Eye-amplitude, eye height, eye width, 1-level, 0-level, Q factor
Power analysis (Option)	Analysis items	Power quality, harmonic analysis, switching loss, safe operating area, ripple analysis, loop analysis
Loop analysis (Option)	Start frequency	50Hz to 50MHz
	Stop frequency	60Hz to 50MHz
	Count	1 to 1000
	Output amplitude	High resistance: 20mVpp to 6Vpp 50 $\Omega$ : 10mVpp to 3Vpp

## Serial Bus Decoding

Number of decoding channels

2

RS-232/422/485/ UART decoding	Source	C1-C4
	Data width	5bits, 6bits, 7bits, 8bits
	Parity check	Parity check, even parity check, no check
	Stop bit	1bit, 2bits
	Polarity	Positive, negative
	Bit sequence	LSB, MSB
	Baud rate	2400bps, 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps, user-defined
I <sup>2</sup> C decoding	Source	C1-C4
	Signal	SCL, SDA
	Data width	7bits, 10bits
SPI decoding	Source	C1-C4
	Signal type	MISO, MOSI, M0MI
	Clock edge	Rising edge, falling edge
	Chip selection edge	High level, low level
	Bit sequence	LSB, MSB
CAN decoding	Source	C1-C4
	Signal type	CAN_H, CAN_L, send/receive, differential
LIN decoding	LIN protocol version	1.0, 2.0
	Source	C1-C4
	Baud rate	2400bps, 4800bps, 9600bps, 19200bps, user-defined
	Polarity	Positive, negative

	Number of bytes	1 to 8
CAN-FD decoding (Option)	Source	C1-C4
	SD signal rate	10kbps, 20kbps, 33.3kbps, 50kbps, 62.5kbps, 83.3kbps, 100kbps, 125kbps, 1Mbps, user-defined
	FD signal rate	1Mbps, 2Mbps, 3Mbps, 4Mbps, 5Mbps, 6Mbps, 7Mbps, 8Mbps, user-defined
SENT decoding (Option)	Source	C1-C4
	Baud rate	10kbps, 20kbps, 33.3kbps, 50kbps, 62.5kbps, 83.3kbps, 100kbps, 125kbps, 1Mbps, user-defined
	Data length	1Nibbles, 2Nibbles, 3Nibbles, 4Nibbles, 5Nibbles, 6Nibbles
	CRC	V2008, V2010
AudioBus decoding (Option)	Source	C1-C4
	Protocol type	I <sup>2</sup> S, LJ, RJ, TDM
	Channel type	Left channel, right channel
FlexRay decoding (Option)	Source	C1-C4
	Signal type	BP, BM, RX/TX, differential
	Baud rate	1Mbps, 5Mbps, 10Mbps, user-defined
MIL-STD-1553 decoding (Option)	Source	C1-C4
	Baud rate	1Mbps, 10Mbps, user-defined
ARINC 429 decoding (Option)	Source	C1-C4
	Signal type	Single-ended, differential
	Baud rate	12.5kbps, 100kbps, user-defined
	Decoding mode	19bits, 23bits

Function/Arbitrary Waveform Generator (Option)	
Channel number	1
Sampling rate	625MSa/s
Vertical resolution	16bits
Maximum frequency	60MHz
Standard waveform	Sine, square, pulse, slope, noise, DC
Operating mode	Continuous wave, modulation, sweep frequency
Built-in Wave	
Sine wave	Frequency range: 1μHz to 60MHz
	Frequency range: Typ. (sine wave, 0dBm) ≤30MHz: ±0.5dB; ≤60MHz: ±0.8dB
	Harmonic distortion: -40dBc
	Stray (non-harmonic): -40dBc
	Total harmonic distortion: 1% (DC to 20kHz, 1Vpp)
	SNR (Signal to Noise Ratio): 40dB
Square wave/Pulse wave	Frequency range: 1μHz to 25MHz
	Rising/falling time: <7ns
	Overshoot: <2% (1kHz, 1Vpp, 50Ω)
	Duty ratio: 0.01% to 99.99%
	Minimum pulse width: 20ns
	Jitter: 2ns
Slope wave	Frequency range: 1μHz to 1MHz
	Symmetry: 0.01% to 99.99%
	Linearity: <1% of peak output (Typ., 1kHz, 1Vpp, symmetry 100%)
Noise	Bandwidth: 60MHz (Typ.)
Arbitrary wave	Frequency range: 100MHz to 5MHz



Waveform length: 8 to 512k (point by point)

Type: Supports over 200 types of arbitrary waveforms, including Sinc, exponential rise, exponential decay, ECG, Gaussian, Lorentz, and half-sine

### Modulation

AM	Carrier wave	Sine, square, slope, arbitrary
	Source	Internal
	Modulation wave	Sine, square, slope, noise, arbitrary
	Modulation frequency	2MHz to 200kHz
	Modulation depth	0% to 120%
FM	Carrier wave	Sine, square, slope, arbitrary
	Source	Internal
	Modulation wave	Sine, square, slope, noise, arbitrary
	Modulation frequency	2MHz to 200kHz
	Frequency offset	DC to 30MHz
PM	Carrier wave	Sine, square, slope, arbitrary
	Source	Internal
	Modulation wave	Sine, square, slope, noise, arbitrary
	Modulation frequency	2MHz to 200kHz
	Phase offset	0° to 360°

### Frequency Sweep

Frequency sweep	Carrier wave	Sine, square, slope, arbitrary
	Type	Linear, logarithm
	Frequency sweep time	1ms to 500s
	Trigger source	Internal, external, manual

### Frequency Characteristics

Signal frequency	Accuracy: $\pm 0.5\text{ppm}$ , 25°C aging rate $\pm 1\text{ppm}$ temperature coefficient $< \pm$
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0.5ppm/°C

Resolution: 1μHz

**Output Characteristics**

Signal amplitude	Amplitude (50Ω)	≤30MHz: 10mVpp to 3Vpp
		≤60MHz: 10mVpp to 1.5Vpp
	Amplitude (High resistance)	≤30MHz: 20mVpp to 6Vpp
		≤60MHz: 20mVpp to 3Vpp
	Resolution: 1mV	
Accuracy: Typ. (Sine wave with 1kHz, 0V offset, > 20mVpp) ± (2% of the set value +2mVpp)		
DC offset	Range (Peak AC + DC)	±1.5V (50Ω)
		±3V (High resistance)
	Resolution: 1mV	
Offset accuracy: ±2% of the set offset ± 2% of the set amplitude ±2mV		
Waveform output	Impedance: 50Ω (Typ.)	
	Protection: Overvoltage protection (the waveform output is disabled when an overvoltage occurs, and a reminder is displayed on the main interface)	

**Display**

Display type	External monitor
Display resolution	1,920 × 1,080 (H*V ) HD
Zoom out	Supports horizontal and vertical zooming for all waveform figures
Grid	10 horizontal scale divisions × 8 vertical scale divisions
Brightness	256
Display mode	Point, vector
Waveform color	User-defined

Persistence	Off, auto, infinite
Language	Chinese Simplified, English, German, French, Spanish, Italian

### Host System

Processor	Inter® core™ i5-7200U (2.5GHz, 64-bit)
Operating system	Windows 10 IoT Ent LTSC (64-bit)
RAM	8GB
SSD	128GB

### Interface and Protocol

Video output	One HDMI port (rear panel)
USB host port	Four: Two USB Host 2.0 (front panel), two USB Host 3.0 (rear panel)
USB device port	One USB Device 2.0 (rear panel)
LAN port	Two Ethernet port 10/100/1000Mb/s (rear panel)
Probe compensation source	Square wave with 1kHz, 3Vpp
10MHz Ref In/Out	<p>IN/OUT can be enabled individually or simultaneously</p> <p>IN: The BNC connector on the rear panel serves as the reference clock for oscilloscope sampling.</p> <p>OUT: The SMA connector on the rear panel outputs its own 10 MHz reference clock, which can be used for clock synchronization between external instruments.</p>
Aux Out	<p>BNC connector (rear panel)</p> <ol style="list-style-type: none"> <li>1. Trigger synchronous output;</li> <li>2. Pass/fail test results;</li> <li>3. AWG trigger synchronous output</li> </ol>
EXT Trig	SMA connector (front panel)
Kensington lock	Kensington
Remote control	Built-in WebServer: Allows access to the oscilloscope's web interface by

entering its IP address in a web browser. This interface provides options to check the instrument's status, modify network settings, view the help and programming manuals, download drivers, save settings, and export waveforms or screenshots. It also supports real-time mouse and keyboard pass-through for remote instrument control

USB TMC	Supports USB TMC (USB Test and Measurement Class)
SCPI	Supports SCPI (Standard Commands for Programmable Instruments)

### Power

Power voltage	100V to 240VAC (fluctuation $\pm$ 10%) 50Hz/60Hz
Power	Maximum 200W
Fuse	3A, T-class, 250V

### Environmental Requirements

Temperature range	Operating: 0°C to +40°C; non-operating: -20°C to +70°C
Cooling method	Forced cooling by fan
Humidity range	Operating: Below +35°C, $\leq$ 90%RH.; non-operating: +35°C to +40°C $\leq$ 60% RH.
Altitude	Operating: Below 2000 meters; non-operating: Below 15000 meters

### Machinery Specification

Dimension (W×H×D)	214mm×43mm×500mm
Weight	< 3.5kg
Rack mounting	1U (Optional UPO7000L-RM rack mounting kit)

## Safety Regulation

Compliance with the 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	CISPR11/EN 55011
	Conducted emission CLASS B group1, 150kHz-30MHz
	Radiation disturbance CLASS B group 1, 30MHz-1GHz
	IEC 61000-4-2/EN 61000-4-2
	Electrostatic discharge (ESD) 4.0kV (contact), 8.0kV (air)
	IEC 61000-4-3/EN 61000-4-3
	Radiation disturbance: 0V/m (80MHz to 1GHz) 3V/m (1.4GHz to 2GHz) 1V/m (2.0GHz to 2.7GHz)
	IEC 61000-4-4/EN 61000-4-4
Safety specification	Electrical fast transient (EFT) 2kV (AC input port)
	IEC 61000-4-5/EN 61000-4-5
	Surge 1kV (live line to zero line); 2kV (live/zero to ground)
	IEC 61000-4-6/EN 61000-4-6
	Radiation disturbance 3V, 0.15-80MHz
	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
	UL 61010-1:2012 Ed.3+ R:19 Jul2019
	UL 61010-2-030:2018 Ed.2
	CSA C22.2#61010-1:2012 Ed.3+U1; U2; A1
	CSA C22.2#61010-2-030:2018 Ed.2

## Warranty and Calibration Service

Calibration interval	One year
Warranty period	The main unit is covered by a one-year warranty, excluding cables and accessories

## Order Information

### Product Model

UPO7204L	2GHz bandwidth, 10GSa/s maximum sampling rate Single channel: 10GSa/s; dual-channel: 5GSa/s; four-channel: 2.5GSa/s Four-channel oscilloscopes
UPO7104L	1GHz bandwidth, 10GSa/s maximum sampling rate Single channel: 10GSa/s; dual-channel: 5GSa/s; four-channel: 2.5GSa/s Four-channel oscilloscopes

### Accessories

UT-D14	USB2.0 cable x 1
UT-P07	Passive high resistance probe 500MHz x 4set
UT-L45	BNC-BNC direct-through line x2
--	National standard power cable x1
--	Calibration certificate

### Optional Accessories

UPO7000L-RM	Rack mounting kit
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### Option

UPO7000L-AWG	60MHz function/arbitrary waveform generator
UPO7000L-JITTER	Advanced jitter and eye diagram analysis
UPO7000L-PWR	Advanced power analysis
UPO7000L-CANFD	Automotive serial bus triggering and analysis (CAN-FD)
UPO7000L-FLEX	Automotive serial bus triggering and analysis (FlexRay)
UPO7000L-SENT	Automotive sensor bus triggering and analysis (SENT)
UPO7000L-AUDIO	Audio serial bus triggering and analysis (I <sup>2</sup> S, LJ, RJ, TDM)

UPO7000L-AREO	Aerospace serial bus triggering and analysis (MIL-STD-1553, ARINC 429)
UPO7000L-BND	Upgrade kit (JITTER, PWR, CANFD, FLEX, SENT, AUDIO, AERO)
<b>Probe</b>	
UT-PA2000	Single-ended active probe (2GHz; 10X)
UT-P07A	Passive high-impedance probe (1X:8MHz; 10X:500MHz)
UT-P20	Passive high-voltage probe (100MHz; Probe attenuation factor 100:1, 1.5kVrms)
UT-V23	Passive high-voltage probe (100MHz; 2kVpp)
UT-P21	Passive high-voltage probe (50MHz; Maximum operating voltage: DC 15kVrms)
UT-P40	Current probe (100kHz; 0.4A to 60A)
UT-P41	Current probe (100kHz; 0.4A to 100A)
UT-P42	Current probe (150kHz; 0.4A to 200A)
UT-P43	Current probe (25MHz; Maximum measuring current: 20A)
UT-P44	Current probe (50MHz; Maximum measuring current: 40A)
UT-P4030D	Current probe (100MHz; Maximum measuring current: 30A)
UT-P4150	Current probe (12MHz; Maximum measuring current: 150A)
UT-P4500	Current probe (5MHz; Maximum measuring current: 500A)
UT-4100A	Current probe (600kHz; Maximum measuring current: 100A)
UT-4100B	Current probe (2MHz; Maximum measuring current: 100A)
UT-P30	High-voltage differential probe (100MHz; $\pm 800V_{pp}$ )
UT-P31	High-voltage differential probe (100MHz; $\pm 1.5kV_{pp}$ )
UT-P32	High-voltage differential probe (50MHz; $\pm 3kV_{pp}$ )
UT-P33	High-voltage differential probe (120MHz; $\pm 14kV_{pp}$ )
UT-P35	High-voltage differential probe (50MHz; 1.3kV)
UT-P36	High-voltage differential probe (50MHz; 5.6kV)
Notes: Please order all hosts, accessories and options from your local UNI-T distributor.	



## Options Ordering and Installation

1. **Purchase options:** Based on your requirements, please purchase the specified function options from UNI-T Sales Personnel and provide the serial number of the instrument that needs the option installed.
2. **Receive certificate:** You will receive the license certificate based on the address provided in the order.
3. **Register and obtain license:** Visit the UNI-T official website license activation session for registration. Use the license key and instrument serial number provided in the certificate to obtain the option license code and license file.
4. **Install the option:** Download the option license file to the root directory of a USB storage device and connect the USB storage device to the instrument. Once the USB storage device is recognized, the Option Install menu will be activated. Press this menu key to begin installing the option.

## Limited Warranty and Liability

UNI-T guarantees that the Instrument product is free from any defect in material and workmanship within three years from the purchase date. This warranty does not apply to damages caused by accident, negligence, misuse, modification, contamination, or improper handling. If you need a warranty service within the warranty period, please contact your seller directly. UNI-T will not be responsible for any special, indirect, incidental, or subsequent damage or loss caused by using this device. For the probes and accessories, the warranty period is one year. Visit [instrument.uni-trend.com](http://instrument.uni-trend.com) for full warranty information.



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