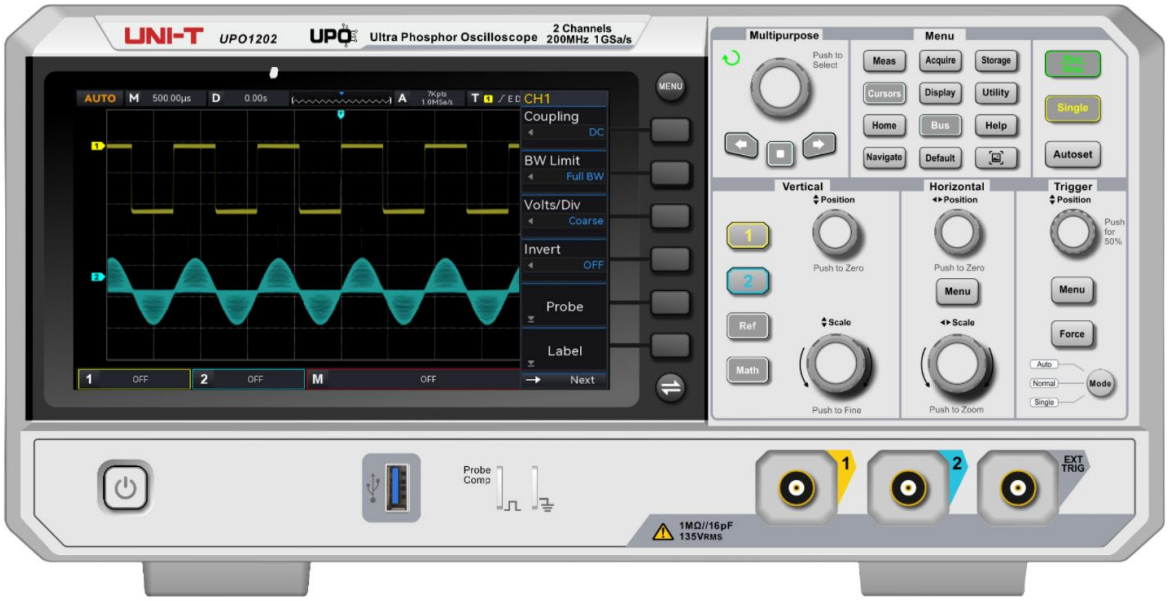
UNI-T®

Instruments.uni-trend.com



User's Manual

UPO1002 Series Digital Phosphor Oscilloscope

V1.1

2024.05

Foreword

Dear Users,

Hello! Thank you for choosing this brand new UNI-T instrument. In order to use this instrument safely and correctly, please read this manual thoroughly, especially the Safety Requirements part. After reading this manual, it is recommended to keep the manual at an easily accessible place, preferably close to the device, for future reference.

Warranty

If the product is proved to be defective within the warranty period, UNI-T reserves the rights to either repair the defective product without charging of parts and labor, or exchange the defected product to a working equivalent product. Replacement parts and products may be brand new, or perform at the same specifications as brand new products. All replacement parts, modules, and products become the property of UNI-T.

The “customer” refers to the individual or entity that is declared in the guarantee. In order to obtain the warranty service, “customer” must inform the defects within the applicable warranty period to UNI-T, and to perform appropriate arrangements for the warranty service. The customer shall be responsible for packing and shipping the defective products to the designated maintenance center of UNI-T, pay the shipping cost, and provide a copy of the purchase receipt of the original purchaser. If the product is shipped domestically to the location of the UNI-T service center, UNI-T shall pay the return shipping fee. If the product is sent to any other location, the customer shall be responsible for all shipping, duties, taxes, and any other expenses.

This warranty shall not apply to any defects or damages caused by accidental, machine parts’ wear and tear, improper use, and improper or lack of maintenance. UNI-T under the provisions of this warranty has no obligation to provide the following services:

a) Any repair damage caused by the installation, repair, or maintenance of the product by non UNI-T service representatives.

b) Any repair damage caused by improper use or connection to an incompatible device.

c) Any damage or malfunction caused by the use of a power source which does not conform to the requirements of this manual.

d) Any maintenance on altered or integrated products (if such alteration or integration leads to an

increase in time or difficulty of product maintenance).

This warranty is written by UNI-T for this product, and it is used to substitute any other express or implied warranties. UNI-T and its distributors do not offer any implied warranties for merchant ability or applicability purposes.

For violation of this guarantee, regardless of whether UNI-T and its distributors are informed that any indirect, special, incidental, or consequential damage may occur, UNI-T and its distributors shall not be responsible for any of the damages.

Trademark

UNI-T is the registered trademark of Uni-Trend Technology (China) Co., Ltd.

File Number

20240529-V1.1

Statement

- **UNI-T** products are protected by patent rights in China and foreign countries, including issued and pending patents.
- **UNI-T** reserves the rights to any product specification and pricing changes.
- **UNI-T** reserves all rights. Licensed software products are properties of Uni-Trend and its subsidiaries or suppliers, which are protected by national copyright laws and international treaty provisions. Information in this manual supersedes all previously published versions.
- Technical data are subject to change without prior notice.

1. Introduction

This manual includes safety requirements, installment and the operation of UPO1002 series oscilloscope.

2. Safety Requirements

This section contains information and warnings that must be followed to keep the instrument operating under safety conditions. In addition, user should also follow the common safety procedures.

Safety Precautions

Warning	**Please follow the following guidelines to avoid possible electric shock and risk to personal safety.**
	Users must follow the following conventional safety precautions in operation, service and maintenance of this device. UNI-T will not be liable for any personal safety and property loss caused by the user’s failure to follow the following safety precautions. This device is designed for professional users and responsible organizations for measurement purposes.
	Do not use this device in any way not specified by the manufacturer. This device is only for indoor use unless otherwise specified in the product manual.

Safety Statement

Warning	“Warning” indicates the presence of a hazard. It reminds users to pay attention to a certain operation process, operation method or similar. Personal injury or death may occur if the rules in the “Warning” statement are not properly executed or observed. Do not proceed to the next step until you fully understand and meet the conditions stated in the “Warning” statement.
Caution	“Caution” indicates the presence of a hazard. It reminds users to pay attention to a certain operation process, operation method or similar. Product damage or loss of important data may occur if the rules in the “Caution” statement are not properly executed or observed. Do not proceed to the next step until you fully understand and meet the conditions stated in the “Caution” statement.
Note	“Note” indicates important information. It reminds users to pay attention to procedures, methods and conditions, etc. The contents of the “Note” should be highlighted if necessary.

Safety Sign

	**Danger**	It indicates possible danger of electric shock, which may cause personal injury or death.
	**Warning**	It indicates that you should be careful to avoid personal injury or product damage.
	**Caution**	It indicates possible danger, which may cause damage to this device or other equipment if you fail to follow a certain procedure or condition. If the “Caution” sign is present, all conditions must be met before you proceed to operation.
	**Note**	It indicates potential problems, which may cause failure of this device if you fail to follow a certain procedure or condition. If the “Note” sign is present, all conditions must be met before this device will function properly.
	**AC**	Alternating current of device. Please check the region’s voltage range.
	**DC**	Direct current device. Please check the region’s voltage range.
	**Grounding**	Frame and chassis grounding terminal
	**Grounding**	Protective grounding terminal
	**Grounding**	Measurement grounding terminal
	**OFF**	Main power off
	**ON**	Main power on
	**Power Supply**	Standby power supply: when the power switch is turned off, this device is not completely disconnected from the AC power supply.
CAT I	Secondary electrical circuit connected to wall sockets through transformers or similar equipment, such as electronic instruments and electronic equipment; electronic equipment with protective measures, and any high-voltage and low-voltage circuits, such as the copier in the office.	
CAT II	CATII: Primary electrical circuit of the electrical equipment connected to the indoor socket via the power cord, such as mobile tools, home appliances, etc. Household appliances, portable tools (e.g. electric drill), household sockets, sockets more than 10 meters away from CAT III circuit or sockets more than 20 meters away from CAT IV circuit.	
CAT III	Primary circuit of large equipment directly connected to the distribution board and circuit between the distribution board and the socket (three-phase distributor circuit includes a single commercial lighting circuit). Fixed	

		equipment, such as multi-phase motor and multi-phase fuse box; lighting equipment and lines inside large buildings; machine tools and power distribution boards at industrial sites (workshops).
CAT IV		Three-phase public power unit and outdoor power supply line equipment. Equipment designed to “initial connection”, such as power distribution system of power station, power instrument, front-end overload protection, and any outdoor transmission line.
CE	**Certification**	CE indicates a registered trademark of EU.
	**Waste**	Do not place equipment and its accessories in the trash. Items must be properly disposed of in accordance with local regulations.
	**EFUP**	This environment-friendly use period (EFUP) mark indicates that dangerous or toxic substances will not leak or cause damage within this indicated time period. The environment-friendly use period of this product is 40 years, during which it can be used safely. Upon expiration of this period, it should enter the recycling system.

Safety Requirements

Warning	
Preparation before use	Please connect this device to AC power supply with the power cable provided; The AC input voltage of the line reaches the rated value of this device. See the product manual for specific rated value. The line voltage switch of this device matches the line voltage; The line voltage of the line fuse of this device is correct; Not use to measure the main circuit.
Check all terminal rated values	Please check all rated values and marking instructions on the product to avoid fire and impact of excessive current. Please consult the product manual for detailed rated values before connection.
Use the power cord properly	You can only use the special power cord for the instrument approved by the local and state standards. Please check whether the insulation layer of the cord is damaged or the cord is exposed, and test whether the cord is conductive. If the cord is damaged, please replace it before using the instrument.
Instrument Grounding	To avoid electric shock, the grounding conductor must be connected to the ground. This product is grounded through the grounding conductor of the power supply. Please be sure to ground this product before it is powered on.

AC power supply	Please use the AC power supply specified for this device. Please use the power cord approved by your country and confirm that the insulation layer is not damaged.
Electrostatic prevention	This device may be damaged by static electricity, so it should be tested in the anti-static area if possible. Before the power cable is connected to this device, the internal and external conductors should be grounded briefly to release static electricity. The protection grade of this device is 4 kV for contact discharge and 8 kV for air discharge.
Measurement accessories	Measurement accessories are of lower class, which are definitely not applicable to main power supply measurement, CAT II, CAT III or CAT IV circuit measurement. Probe assemblies and accessories within the scope of IEC 61010-031 and current sensors within the scope of IEC 61010-2-032 shall meet their requirements.
Use the input / output port of this device properly	Please use the input / output ports provided by this device in a properly manner. Do not load any input signal at the output port of this device. Do not load any signal that does not reach the rated value at the input port of this device. The probe or other connection accessories should be effectively grounded to avoid product damage or abnormal function. Please refer to the product manual for the rated value of the input / output port of this device.
Power fuse	Please use power fuse of specified specification. If the fuse needs to be replaced, it must be replaced with another one that meets the specified specifications by the maintenance personnel authorized by UNI-T.
Disassembly and cleaning	There are no components available to operators inside. Do not remove the protective cover. Maintenance must be carried out by qualified personnel.
Service environment	This device should be used indoors in a clean and dry environment with ambient temperature from 0 °C - 40 °C. Do not use this device in explosive, dusty or humid air.
Do not operate in humid environment	Do not use this device in a humid environment to avoid the risk of internal short circuit or electric shock.
Do not operate in flammable and explosive environment	Do not use this device in a flammable and explosive environment to avoid product damage or personal injury.
Caution	
Abnormality	If this device may be faulty, please contact the authorized maintenance

	personnel of UNI-T for testing. Any maintenance, adjustment or parts replacement must be done by the relevant personnel of UNI-T.
Cooling	Do not block the ventilation holes at the side and back of this device; Do not allow any external objects to enter this device via ventilation holes; Please ensure adequate ventilation, and leave a gap of at least 15 cm on both sides, front and back of this device.
Safe transportation	Please transport this device safely to prevent it from sliding, which may damage the buttons, knobs or interfaces on the instrument panel.
Proper ventilation	Poor ventilation will cause the device temperature to rise, thus causing damage to this device. Please keep proper ventilation during use, and regularly check the vents and fans.
Keep clean and dry	Please take actions to avoid dust or moisture in the air affecting the performance of this device. Please keep the product surface clean and dry.
Note	
Calibration	The recommended calibration period is one year. Calibration should only be carried out by qualified personnel.

Environmental Requirements

This instrument is suitable for the following environment:

- Indoor use
- Pollution degree 2
- In operating: altitude lower than 3000 meters; in non-operating: altitude lower than 15000 meters
- Unless otherwise specified, operating temperature is 0 to +40°C; storage temperature is -20 to +70°C
- In operating, humidity temperature below to +35°C, ≤90% relative humidity;
- In non-operating, humidity temperature +35°C to +40°C, ≤60% relative humidity

There are ventilation opening on the rear panel and side panel of the instrument. So please keep the air flowing through the vents of the instrument housing. To prevent excessive dust from blocking the vents, please clean the instrument housing regularly. The housing is not waterproof, please disconnect the power supply first and then wipe the housing with a dry cloth or a slightly moistened soft cloth.

Connecting Power Supply

The specification of input AC power.

Voltage Range	Frequency	Maximum Power
100-240 VAC（fluctuant: ±10%）	50/60 Hz	75 W
100-120 VAC（fluctuant:±10%）	400 Hz	

Please use the attached power cable to connect to the power port.

Connecting to service cable

This instrument is a Class I safety product. The supplied power lead has good performance in terms of case ground. This spectrum analyzer is equipped with a three-prong power cable that meets international safety standards. It provides good case grounding performance for the specification of your country or region.

Please install AC power cable as follows.

- Ensure the power cable is in a good condition.
- Leave enough space for connecting the power cord.
- Plug the attached three-prong power cable into a well-grounded power socket

Electrostatic Protection

Electrostatic discharge may cause damage to component. Components can be damaged invisibly by electrostatic discharge during transportation, storage and use.

The following measure can reduce the damage of electrostatic discharge:

- Testing in anti-static area as far as possible.
- Before connecting the power cable to the instrument, inner and outer conductors of the instrument should be briefly grounded to discharge static electricity.
- Ensure all the instruments are properly grounded to prevent the accumulation of static.

3. Introduction of UPO1002

UPO1002 series digital phosphor oscilloscope contains two models.

Model	Analog Bandwidth	Analog Channel	Sampling Rate
UPO1202	200 MHz	2	1 GSa/s
UPO1102	100 MHZ	2	1 GSa/s

UPO1002 series digital phosphor oscilloscope adopts innovative UNI-T 3D technique Ultra Phosphor 2.0 with new appearance upgrade and the function of deep storage, high waveform capture rate, real-time waveform recording and playback and 256-level grayscale display.

The series is equipped with the bandwidth of 100 MHz/200 MHz, real-time sampling rate up to 1 GSa/s, 2 analog channels, maximum storage depth of 56 Mpts, maximum waveform capture rate of 100,000 wfms/s, hardware real-time waveform uninterrupted recording and waveform analysis up to 120,000 waveform frames, support DVM module, rich trigger and bus decoding functions, and support full memory hardware real-time decoding.

It widely used in many fields, including communication, semiconductor, computer, IC design, instrumentation, industrial electronics, consumer electronics, automotive electronics, field maintenance, R&D and education.

4. Getting Started Guide

- General Inspection
- Before Use
- Front Panel
- Rear Panel
- Operation Panel
- User Interface
- Menu Symbol

This chapter is to introduce on using the oscilloscope for the first time, the front and rear panels, the user interface, as well as the built-in help system.

4.1 General Inspection

It is recommended to inspect the instrument follow the steps below before using the UPO1002 series for the first time.

(1) Check for Damages caused by Transport

If the packaging carton or the foam plastic cushions are severely damaged, please contact the UNI-T distributor of this product immediately.

(2) Check Attachment

Please check appendix for the list of accessories. If any of the accessories are missing or damaged, please contact UNI-T or local distributors of this product.

(3) Machine Inspection

If the instrument appears to be damaged, not working properly, or has failed the functionality test, please contact UNI-T or local distributors of this product.

If the equipment is damaged due to shipping, please keep the packaging and notify both the transportation department and UNI-T distributors, UNI-T will arrange maintenance or replacement.

4.2 Before Use

To perform a quick verification of the instrument’s normal operations, please follow the steps below.

(1) Connecting to the Power Supply

AC power specification of UPO1002 series digital storage oscilloscope refers to the section of Connecting Power Supply. Use the assembled power line or other power line that meets the local country standards to connect the oscilloscope. The power soft switch indicator in the left lower on the front panel is extinguished when the oscilloscope is not connect to the power supply. The power soft switch indicator in the left lower on the front panel is illuminated with red when the oscilloscope connects to the power supply. At this point, press the soft switch key to enable the oscilloscope.

(2) Boot Check

Press the soft power key and the indicator should change from red to green. The oscilloscope will show a boot animation, and then enter the normal interface.

(3) Connecting Probe

Use BNC of the port to connect to BNC of CH1 of the oscilloscope. Connecting the probe to the “probe compensation signal connection clip” and connecting the ground alligator clip to the “ground terminal” under the “probe compensation signal connection clip”. The output of probe compensation signal connection clip is the amplitude about 3 Vpp and the frequency defaults to 1 kHz.

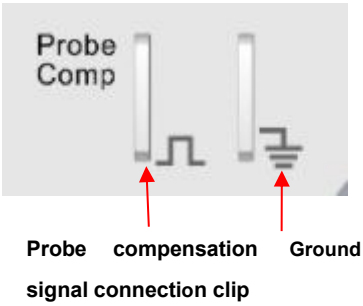


Figure 4-1 Probe Compensation Signal Connection Clip and Ground Terminal

(4) Function Check

Press the AUTO key, a square wave (amplitude of 3 Vpp, frequency of 1 kHz) should appear on the screen. Repeat the step 3 to check all channels.

(5) Probe Compensation

When the probe is connected to any input channel for the first time, this step should be adjusted to match the probe and the input channel. Probes that are not compensated may lead to

measurement errors or mistake. Please follow the following steps.

- Set the attenuation coefficient in the probe menu to 10x and the switch of the probe at 10x, and connecting the probe of the oscilloscope to CH1. If use the probe’s hook head, make sure it stably touch to the probe. Connecting the probe to the “probe compensation signal connection clip” and connecting the ground alligator clip to the “ground terminal” under the “probe compensation signal connection clip”. Open CH1 and press the AUTO key.
- View the displayed waveform, as shown in Figure 4-2.

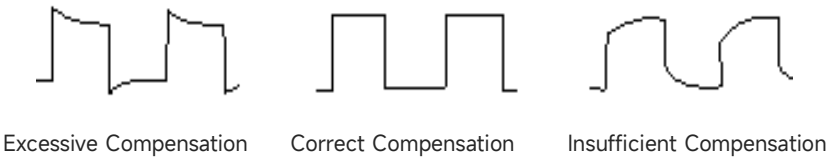


Figure 4-2 Compensating Calibration of Probe

- If the displayed waveform is look like the above “Insufficient Compensation” or “Excessive Compensation”, use a non-metallic screwdriver to adjust the probe’s variable capacitance until the display matches the “Correct compensation” waveform.

Warning: To avoid electric shock when using the probe to measure high voltage, please ensure that the probe insulation is in good condition and avoid physical contact with any metallic part of the probe.

4.3 Front Panel

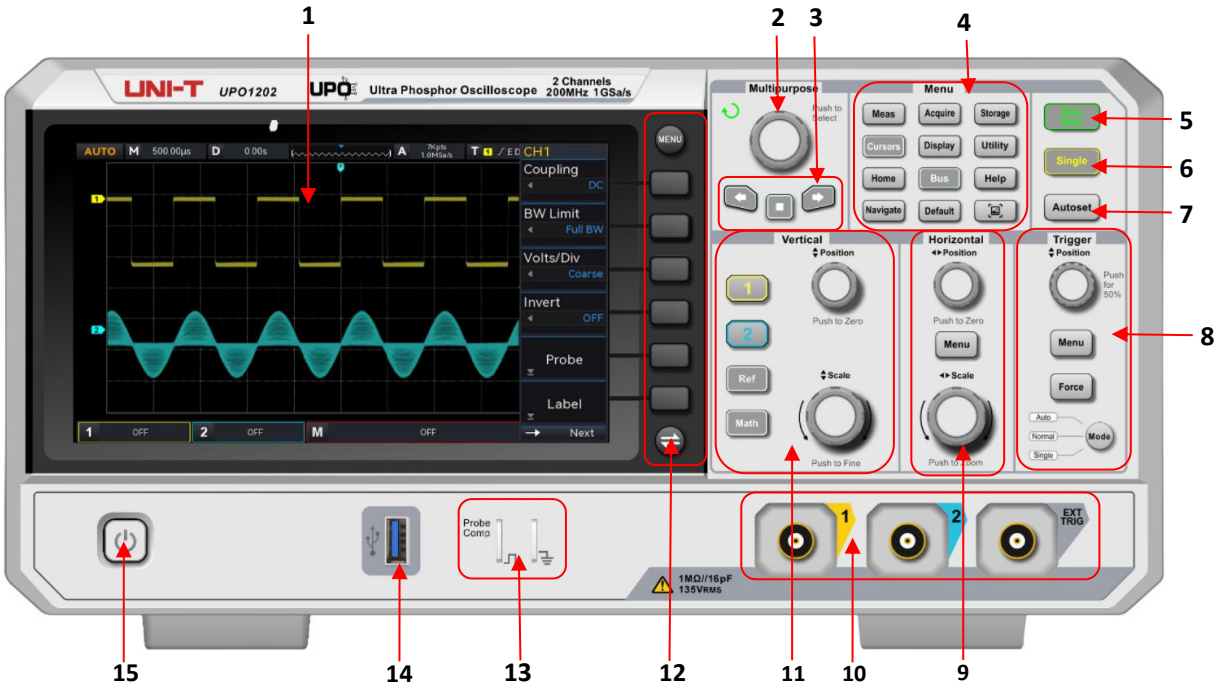


Figure 4-3 Front Panel

No.	Description	No.	Description
1	Screen display area	9	Horizontal control area (Horizontal)
2	Multipurpose rotary knob (Multipurpose)	10	Analog channel input port
3	Navigation function area	11	Vertical control area （Vertical）
4	Functional menu key	12	Menu control soft key
5	Run/Stop control key	13	Probe compensation signal connection clip and ground terminal
6	Single trigger control key	14	USB HOST interface
7	Auto setting control key	15	Power switch soft key
8	Trigger control area (TRIGGER)		

4.4 Rear Panel

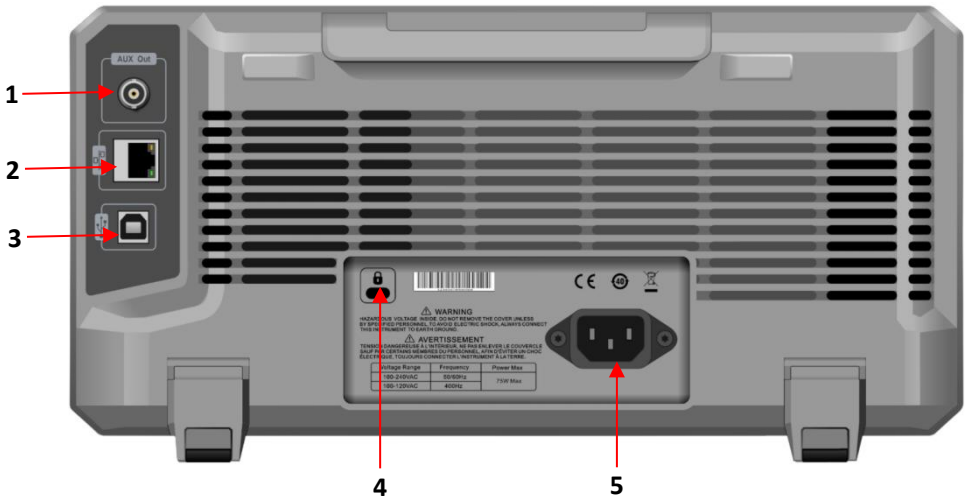
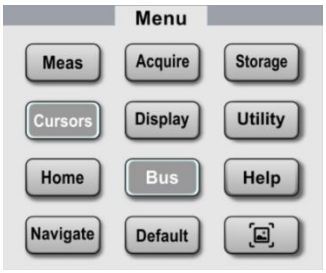


Figure 4-4 Rear Panel

1. OUT: AUX Out (output port)
2. LAN: Use this interface to connect the oscilloscope to local area network for remote control
3. USB Device: USB Device interface for the oscilloscope to communicate with PC
4. Safety Lock: Safety lock (sold separately) is used to lock the oscilloscope at fixed position.
5. AC Power Input Socket: AC power input port, use attached power cord to connect the oscilloscope to AC power, refer to Connecting Power Supply.

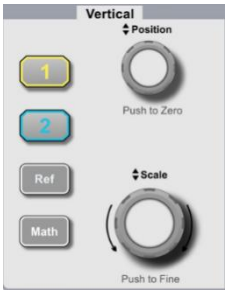
4.5 Operation Panel

(1) Function Key



- Measure: Press this key to enable the measurement setting menu. It can set the measurement source, all parameter measurement, user-defined parameter, measurement statistic, measure indicator, threshold setting and measurement window. Turn on user-defined, it has 36 types of parameter measurement. Press the Multipurpose rotary knob to quickly select parameter to measuring and the result will show on the bottom of the screen.
- Acquire: Press this key to enter the sampling setting menu. It can set the acquisition method, storage depth of the oscilloscope and support quick acquisition entrance.
- Cursor: Press this key to enter the cursor measurement menu. It can set time, voltage and screen parameter of cursor measuring waveform by manual.
- Display: Press this key to enter the display setting menu. It can set waveform display type, grid type, grid brightness, waveform brightness, backlight brightness, persistence time, color temperature, anti-color temperature, menu display and transparency of pop-up window.
- Storage: Press this key to enter the storage interface, the storage type includes setting, waveform, picture and recording convert to video. The storage can save in internal or external USB.
- Utility: Press this key to enter the auxiliary function setting menu. It can set self-calibration, system information, language setting, square output, output selection, delete data, IP, time and boot loading.
- Home: Press this key to enter the Home menu, this key can operate waveform recording, Pass/Fail test, frequency meter, DVM, automatic setting and self-test.
- Bus: Press this key to enter protocol decoding setting, it can set decoding RS232, I^2C and SPI.
- Help: Press this key to enter system help menu.
- Navigate: Press this key to enter the waveform navigation module, the channel waveform and recorded waveform can be marked and navigated.
- Default: Restore to the factory setting.
- : Press this key to quickly copy the screen waveform in .PNG format to USB.

(2) Vertical Control



- 1, 2: Analog channel setting keys respectively represents CH1, CH2. Two channel's label are identified by different colors and it also corresponding to the colors of waveforms on the screen and the channel input connectors. Press any keys to turn on the related channel menu (activate or disable the channel).
- Math: Press this key to open the mathematical operation menu for add, minus, multiply, divide, FFT, logic, digital filtering and advanced operations.
- Ref: Loading the reference waveform from "local or USB", it can be quickly reference the waveform of the activated channel at the current and compare the measured waveform with the reference waveform.
- Position: Vertical shifting rotary knob can move the vertical position of the current channel waveform and the vertical offset value  will display at the baseline cursor. Press this knob to return the channel display position back to the vertical midpoint.
- Scale: Vertical scale rotary knob is used to adjust the vertical scale of the current channel waveform, turn clockwise to decrease the scale, turn counterclockwise to increase the scale. The waveform's display amplitude will increase or decrease with the adjustment and the scale information  at the bottom of the screen will change in real time. The vertical scale step is 1-2-5. Press this key to adjust the vertical scale step through coarse tuning or fine tuning.

(3) Horizontal Control



- Menu: The horizontal menu key can display window extension, time base mode (XY/YT), Multi-Scopes and trigger holdoff.
- Position: Horizontal shifting rotary knob can move the trigger point to left or right relative to the center of the screen. During the process, all channel's waveform will move to left or right and the horizontal offset value  on the top of the screen will display in real time. Press this knob to return the channel display position back to the horizontal midpoint.
- Scale: Horizontal scale rotary knob is used to adjust the time base scale of all channel. During the process, user can see the waveform is compressed or extend in horizontal direction and the time base scale  at the bottom of the screen will change in real time. The time base step is 1-2-5. This key can be quickly step through main window and extension

window.

(4) Trigger Control



- Mode: Press this key to switch the trigger mode to Auto, Normal or Single, the indicator of the current trigger mode will be illuminated.
- Position: Trigger level rotary knob, turn clockwise to increase the level and turn counterclockwise to decrease the level. During the process, the trigger level 

on the top right corner of the screen will change in real time. Press this knob to quickly return the trigger level to 50% of trigger signal.

- Menu: Display the trigger operation menu, the details refers to "Trigger Setting System ".
- Force: Force trigger key, when trigger mode is normal and single, press this key to force to generate one trigger.

(5) Automatic Setting



The oscilloscope will automatically adjust the vertical scale, scanning time base and trigger mode to display the most suitable waveform according to the input signal.

Notes: When use the waveform automatic setting, if the measured signal is sine wave, it requires its frequency is no less than 20 Hz, the amplitude within 20 mVpp ~ 120 Vpp; Otherwise, the waveform auto setting function may be invalid.

(6) Run/Stop



Press this key to set the oscilloscope's operating state to "RUN" or "STOP".

In the "RUN" state, the key is illuminated in green.

In the "STOP" state, the key is illuminated in red.

(7) Single Trigger



Press this key to set the trigger mode of the oscilloscope to "Single", the key is illuminated in orange.

(8) Print Screen



Press this key to quickly copy the screen waveform in .PNG format to USB.

(9) Multipurpose Rotary Knob



Multipurpose: When in menu operation, press a menu soft key and rotate the rotary knob to select the submenu and then press the rotary knob (i.e. Select function) to confirm the selection. During time setting, Multipurpose indicator will be illuminated, rotate the rotary knob to change the time value, turn counterclockwise to decrease the value, turn clockwise to increase the value.

(10) Waveform Navigation



- : Press this key to move the waveform from right to left at a constant speed. Press this key again can set to move the waveform with 2 times speed. The fastest speed can be set 3 times.
- : During the waveform navigation, press this key to stop the function.
- : Press this key to move the waveform from left to right at a constant speed. Press this key again can set to move the waveform with 2 times speed. The fastest speed can be set 3 times.

4.6 User Interface

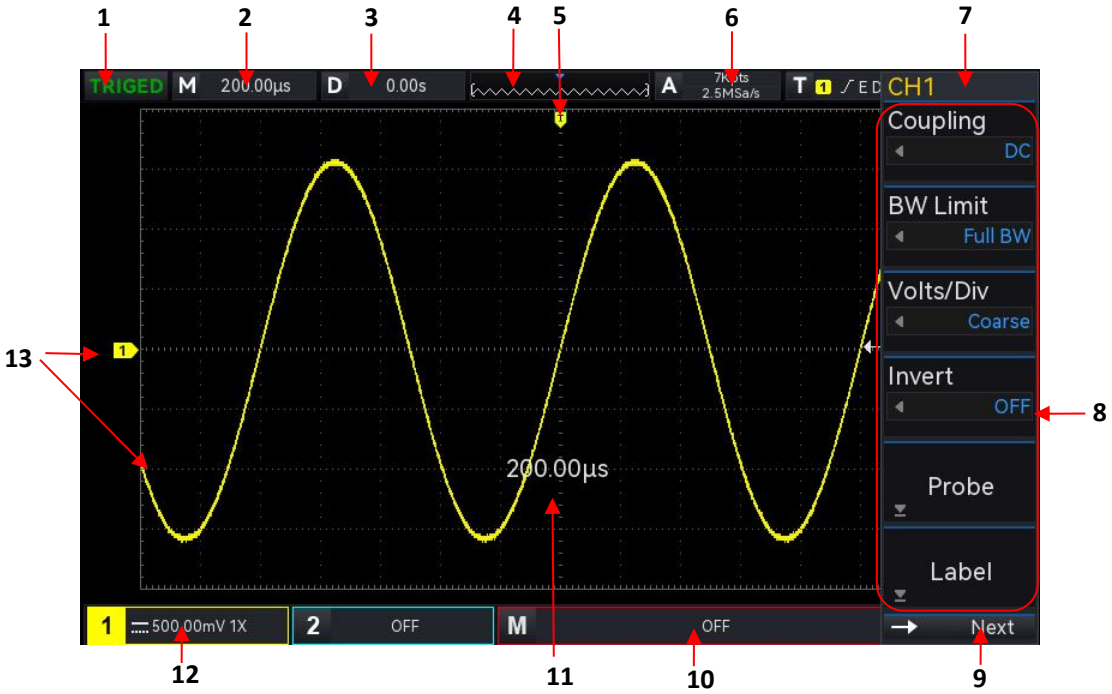


Figure 4-5 User Interface

(1) Trigger status label: TRIGED, AUTO, READY, STOP and ROLL

(2) Time base scale: Indicates the amount of time represented by one grid, which can be adjusted by press Scale (horizontal control area) key on front panel. When the time base scale changes, the time base scale will pop out on the screen.

(3) Horizontal offset: Display the horizontal offset of the waveform, which can adjusted by press the Position rotary knob in horizontal control area on the front panel to return the horizontal offset to 0.

(4) Waveform indicator

(5) Waveform trigger position: Display the trigger position of the current waveform.

(6) Sampling rate/storage depth: Display the sampling rate and storage depth of the current scale.

(7) Trigger status: Display the current state of trigger source, trigger type, trigger slope, trigger coupling and trigger level.

a. Trigger source: CH1 ~ CH2, AC Line and EXT. CH1 ~ CH2 will indicates different trigger state color by the channel's color.

b. Trigger type: Edge, pulse width, video, slope and advanced trigger. For example,  represents the trigger type is Edge.

c. Trigger edge: Rising, falling and random. For example,  represents rising edge trigger.

d. Trigger coupling: DC, AC, HF rejection, LF rejection and noise suppression. For example,  represents the trigger coupling is DC.

e. Trigger level: Displays the current trigger level value and corresponding to the right side of screen. The parameter can be changed by the rotary knob LEVEL in trigger control area on the front panel.

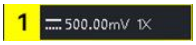
(8) Operation menu: Display the current operation menu. Press the corresponding key to change the operation menu. Press F1 ~ F6 can change the submenu.

(9) Next page: when the menu is hidden, this area displays system time, USB connecting icon, LAN connecting icon.

(10) Math vertical state icon: Display Math state, volts/div.

(11) Time base/ Volts/div popups: When volts/div and time base is changed, the popups displays the current volts/div and time base, this popups only appear 3s.

(12) CH1 vertical state icon: Display CH1 activation state, channel coupling, bandwidth limit, vertical scale and probe attenuation coefficient.

a. Channel's activation state: 

b. Bandwidth limit: When the bandwidth limit function is opened, a "B" icon will appear in CH1 vertical state label.

c. Vertical scale: Display the vertical scale of CH1. When CH1 is activated, the vertical scale can be changed by the rotary knob Scale in vertical control area on the front panel. When the volts/div is changed, a popups will display volts/div on the screen.

d. Probe attenuation coefficient: Display the probe attenuation coefficient of CH1, including 0.001X, 0.01X, 0.1X, 1X, 10X, 100X, 1000X, 2000X and user-defined.

e. Volts/div scale: When volts/div sets to fine tuning, a “” icon will appear in CH1 vertical state label.

(13) Analog channel label and waveform: Display the channel icon and waveform of CH1~CH2, the channel label is consistent with the waveform color.

4.7 Menu Symbol

Press any soft key to activate the corresponding menu, the following symbol may display in the menu.

This symbol represents use the multipurpose rotary knob on the front panel to select the parameter and adjust the parameter value.

This symbol represents the current menu have several options.

This symbol represents the current menu has a next level menu.

This symbol represents open the numerical keyboard to input the parameter.

Next This symbol represents the current page can be page up and page down.

This symbol represents use the rotary knob Multipurpose on the front panel or tap in the navigation menu to open the numerical keyboard to set the parameter.

4.8 Remote Control

UPO1002 series digital phosphor oscilloscope supports communication with computer via USB and LAN interfaces to realize remote control. The remote control is realized based on SCPI (Standard Commands for Programmable Instruments).

UPO1002 series digital phosphor oscilloscope supports three remote control methods.

(1) User-defined programming

The user can remote control the instrument by SCPI. For detailed instructions on commands and programming, please refer to the *UPO1002 series programming manual*.

(2) PC software (instrument manager)

The user can remote control the instrument by PC software. The instrument manager displays the interface that shown in the screen of the instrument in real-time, the oscilloscope can be controlled by clicking the mouse in instrument manager page. It is recommend to use the PC software provided by UNI-T. You can download this software on UNI-T official website

(https://www.uni-trend.com.cn/).

Operation steps

- Setup the communication between the instrument and computer
- Running the instrument manager and search the instrument source
- Right clicking to open the oscilloscope, operating the instrument manager to control the oscilloscope (for specific operation methods, please refer to the Instrument Manager Instruction.)

  This instrument supports communication with computer via USB and LAN interfaces to realize remote control, which based on SCPI.

(3) Web Control

When connecting to the network, you can open the Web page via IP. After logging in by user name and password, you can realize the control of the instrument. Web Control displays the interface that shown in the screen of the instrument in real-time. It supports logging in the web page on PC, cell phone and iPad, and the network supports remote control of the device using intranet and extranet. The user name and password is “admin” and “uni-t”.

5. Vertical Channel Settin

- Open/Activate/Close Analog Channel
- Channel Coupling
- Bandwidth Limit
- Volts/div
- Probe
- Reversed Phase
- Unit
- Bias Voltage
- Label

UPO1000X provides 2analog input channels, which is CH1 ~ CH2. The vertical system setup method is exactly the same for each channel.

This chapter is take 1 (CH1) as an example to introduce the vertical channel setting.

5.1 Open/Activate/Close Analog Channel

CH1 ~ CH2 analog channels includes three states open, close and activate.

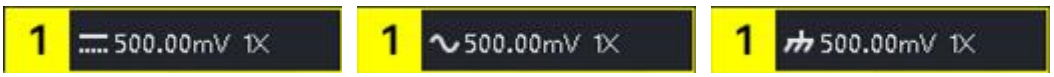
- Open: When the channel is closed, press any one of the channel 1, 2 can open the corresponding channel.
- Close: Not display the channel’s waveform. The channel is opened but not activated, press the corresponding channel key to close the channel.
- Activate: When multiple channel are enabled, only one channel can be activated (should be in open state). In the activation state, the vertical scale, vertical offset and channel setting can be adjusted. Any one of the channel that have been opened but not activated could be activated by press the corresponding channel key. When the channel is activated, the oscilloscope displays the channel’s menu.



Activation state Open but not activated Close state

5.2 Channel Coupling

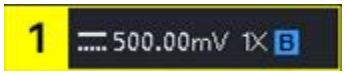
Channel coupling can set to DC, AC or ground.



DC AC Ground

5.3 Bandwidth Limit

Bandwidth limitation can set to 20 MHz or full bandwidth. When soft key menu sets to 20 MHz, the bandwidth of the oscilloscope is limit to about 20 MHz, the high frequency signal above 20 MHz in the attenuation signal is usually used to reduce the high-frequency noise in the signal when observing low-frequency signals. When the bandwidth limitation function selects 20MHz, a B icon will display in vertical state label.



B icon

5.4 Volts/div

Press the vertical Scale rotary knob can be quickly switch to volts/div scale, volts/div scale divided into the coarse and fine tuning. The range of volts/div scale is 500 uV/div ~ 20 V/div, step by 1 -2-5. In the coarse tuning, it adjusts the vertical unit by normal order; in fine tuning, it adjusts the current vertical position by 1% of step.

Notes: div represents the grid in the oscilloscope’s display area. /div represents each grid.

5.5 Probe

In order to set the attenuation coefficient of the probe, the coefficient needs to be set in the channel operation menu. If the probe attenuation coefficient is 10:1, the probe coefficient should be set to 10X to ensure the voltage reading is correct.

When the unit of channel is V, W, U, the probe can be set to 0.001X, 0.01X, 0.1X, 1X, 10X, 100X, 1000X, 2000X or user-defined.

When the unit of channel is A, it display as the current probe and can be set to 5 mV/A, 10 mV/A, 50 mV/A, 100 mV/A or user-defined.

When the probe is user-defined, it can set to 0.001X~20000X.

5.6 Reversed Phase

When reversed phase is turned on, the voltage value of waveform will be reversed and the reversed icon “—” will display in vertical state label (as shown in Figure 5-2)

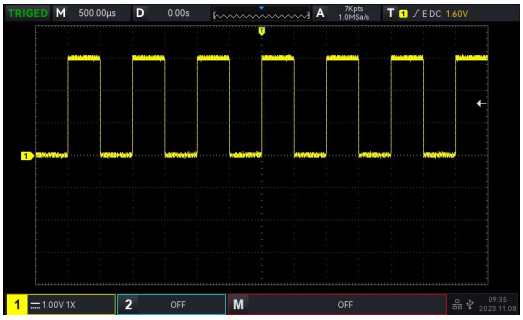


Figure 5-1 Reversed Phase Closed



Figure 5-2 Open Reversed Phase

5.7 Unit

Set the amplitude unit for the current channel. Unit should be set in channel, it can be set to “V”, “A”, “W” or “U” and the default unit is V.

When use the current probe, the unit should be switch to “A”. After the setting, the unit in vertical state label and the measurement unit will be changed accordingly.

5.8 Bias Voltage

Display the bias voltage of the current channel, the voltage value will be changed accordingly when move the waveform by vertical Position rotary knob. The bias voltage can be changed by Multipurpose rotary knob and numerical keyboard, the waveform will also be changed with the vertical movement.

5.9 Label

Set the display label for the current channel. The instrument uses the current channel as the label by default. Such as CH1, it also supports to set user-defined label.

Label state: Open, the channel label displays CH1, it can select the label name freely and it also supports to set user-defined label.

Label state: Close, not display the channel label.

6. Horizontal System Setting

- Horizontal Scale
- ROLL Mode
- Window Extension
- XY
- Multi-Scopes
- Trigger Holdoff

6.1 Horizontal Scale

Horizontal scale is also called horizontal time base, the time value represented by each scale in the horizontal direction of the display screen, it usually expressed as s/div. The horizontal scale can be adjust by the Scale in the HORIZONTAL control area and set it according to the step 1-2-5. That is 1 ns/div, 2 ns/div, 5ns/div, 10 ns/div, 25 ns/div... 500 s/div, 1ks/div. Turn clockwise to decrease the scale, turn counterclockwise to increase the scale. When adjusting the horizontal time base, the scale information in the top left corner of the screen (as shown in Figure 6-1) will be change in real time.

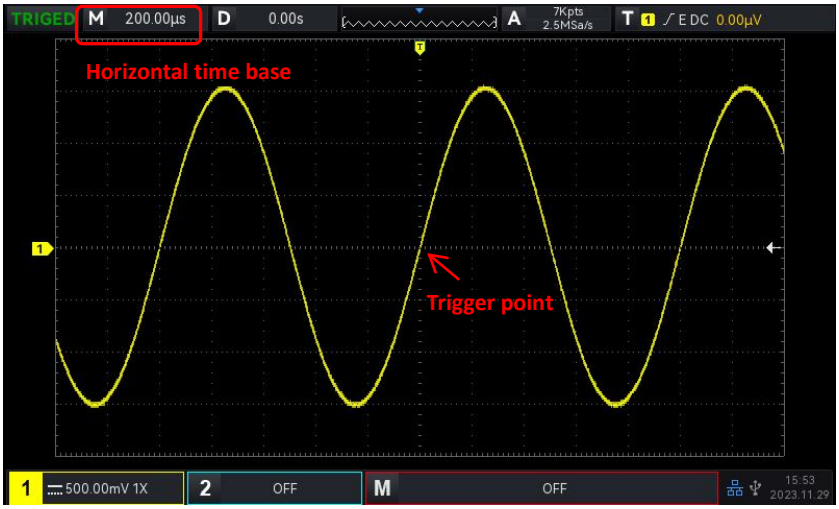


Figure 6-1

When the horizontal time base is changed, the waveform will be extend or compressed with the change of trigger point position.

6.2 ROLL Mode

When trigger mode is automatic, adjusting the Scale rotary knob in horizontal control area, if the horizontal scale of the oscilloscope is lower than 20 ms/div, the oscilloscope will enter ROLL mode. The oscilloscope will continuously draw a voltage-time trend of the waveform on the screen. In ROLL mode, the waveform is scrolled from right to left to refresh the display, and the latest waveform is drawn at the far right end of the screen, as shown in Figure 6-2.



Figure 6-2

Apply to slow sweep mode to observe low-frequency signal, it’s recommended to set the “channel coupling” to “DC”.

Notes: In ROLL mode, the function of “horizontal offset”, “protocol decoding”, “pass/fail test”, “recording waveform”, “waveform brightness”, “FFT” and “XY” cannot be used.

6.3 Window Extension

Window extension is used for magnifying a waveform to view the image detail. Open the window extension in horizontal menu, or press horizontal Scale rotary knob.

In window extension mode, the screen will be divided into two display area as shown in Figure 6-3.

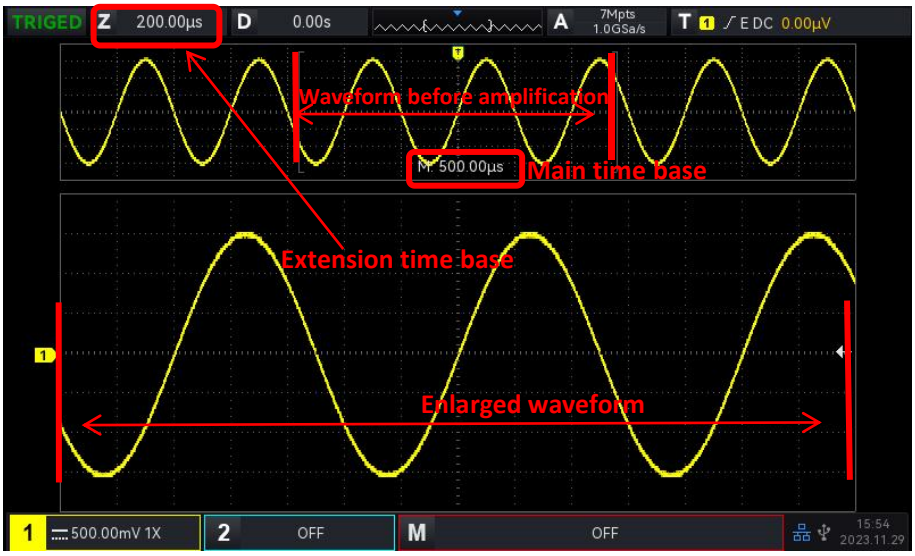


Figure 6-3

The waveform before amplification is shown in the square brackets on the upper part of the screen. It can move to right or left by horizontal Position rotary knob or adjusting the horizontal time base Scale to increasing or decreasing this area.

Enlarged Waveform

The enlarged waveform is displayed on the bottom part of the screen, window extension improves the resolution relative to the main time base.

Notes: Window extension requires that time base scale should at 20 ms/div ~ 1 ns/div.

6.4 XY

The waveform displayed in XY mode is also called the Lissajous curve. XY mode is also supports the cursor measurement, it can be quickly measure the phase difference between two channel’s signals as shown in Figure 6-5.

Time base mode

(1) YT: Display the voltage value on time (horizontal scale).

(2) XY: Display Lissajous curve, it can be quickly measure the phase difference between two channel’s signals with same frequency.

When X-Y menu sets to XY, input CH2 signal on the horizontal axis (X axis), and input CH1 signal on the vertical axis (Y axis).

In XY mode, if X axis channel is selected, use Position rotary knob in vertical control area to move XY figure on horizontal direction; if Y axis channel is selected, use Position rotary knob in

vertical control area to move XY figure on vertical direction.

The amplitude scale of channel can adjust by the Scale rotary knob in vertical control area. The time base scale can adjust by the Scale rotary knob in horizontal control area. The adjustment is for gaining the better display effect of Lissajous curve. The waveform display in XY mode as shown in Figure 6-4.

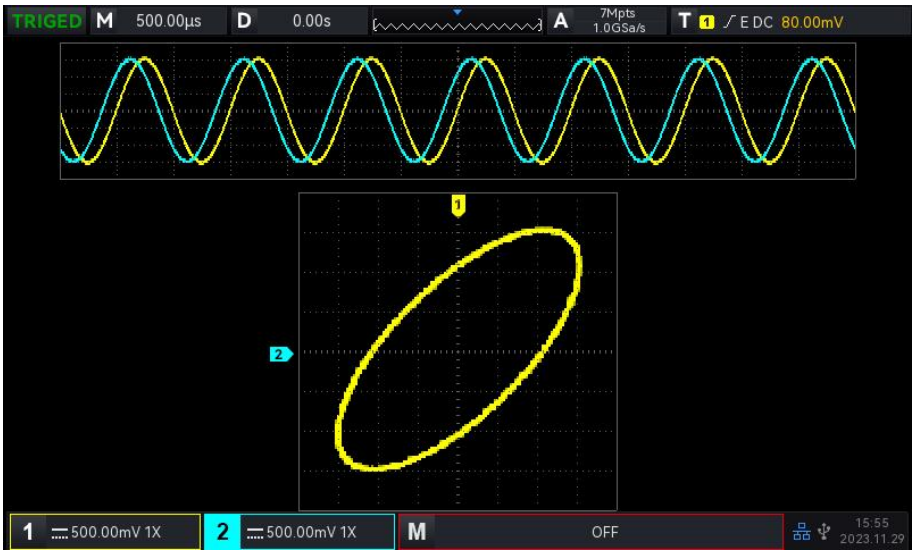


Figure 6-4

Press the Cursor function key as shown in Figure 6-5.

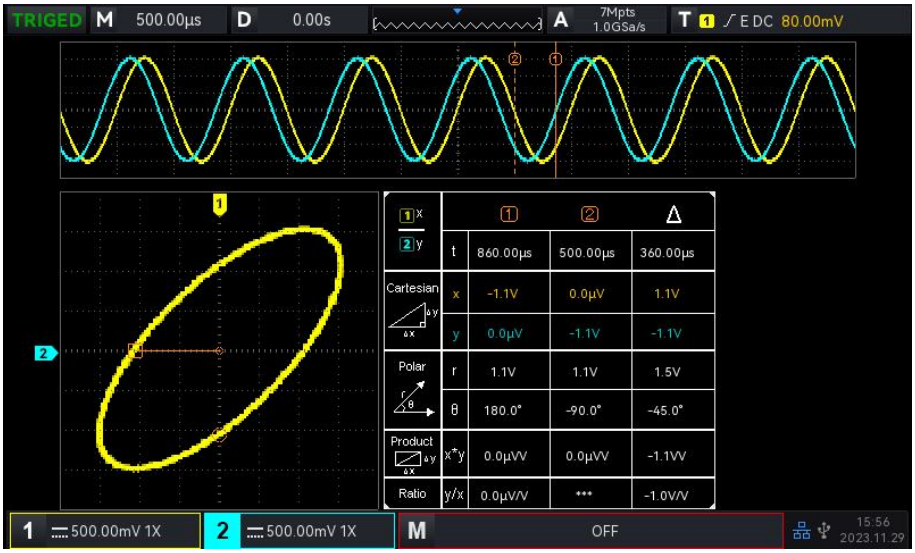


Figure 6-5

Time, rectangular coordinate, polar coordinate, product and proportion is below Cursor ① in sequence.

Time, rectangular coordinate, polar coordinate, product and proportion is below Cursor ② in sequence.

Delta (numerical difference between two cursors) is below △.

Application of XY Mode

Phase difference between in two signals with the same frequency can be easily observed through Lissajous curve, as shown in Figure 6-6. The following figure explains the observation schematic of the phase difference.

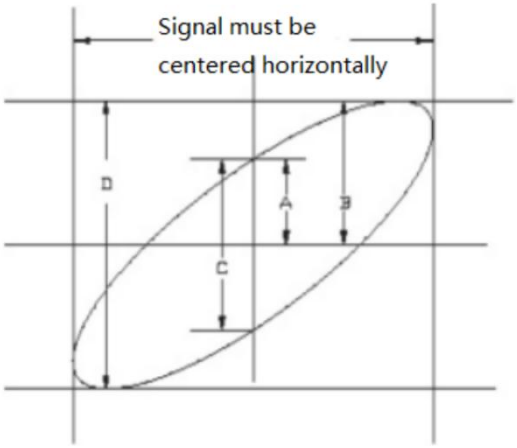


Figure 6-6

Based on sinθ=A/B or C/D, θ is the phase angle between channels, the definition of A, B, C, D see Figure 6-6. So the phase angle is θ = ± arcsin (A/B) orθ = ± arcsin (C/D).

If the main spindle of elliptical within **I, III** quadrant, then the acquired phase angle should within **I, IV** quadrant, that is within (0 ~ π/2) or (3π/2 ~ 2π).

If the main spindle of elliptical within **II, IV,** then the acquired phase angle should within (π/2 ~ π) or(π ~ 3π/2).

In addition, if the frequency or phase difference of the two signal to be measured are integer times, calculating the frequency and phase relation of the two signals based on the Figure 6-7.

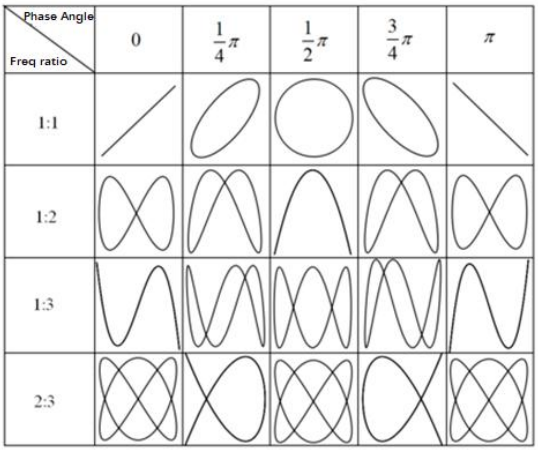


Figure 6-7

6.5 Multi-Scopes

In Multi-Scopes, CH1 ~ CH2 can set to different time base scale for observing the signal with different frequency at the same time. The Multi-Scopes interface is accessed via the horizontal menu.

Switching the state of Multi-Scopes to enter the Multi-Scopes mode as shown in the following figure. Each channel is set up with different frequencies, amplitudes, and types of waves, which can be stabilized and triggered under Multi-Scopes. Under Multi-Scopes, channels can be turned on, off, and activated separately. Channel’s time base, volts/div, horizontal offset, vertical offset and trigger can also set separately. Frequency meter, DVM, cursor measurement can turned on separately.

Multi-Scopes supports to split the current channel to the upper and lower screen, which is convenient to observe the waveform, as shown in Figure 6-8.



Figure 6-8

6.6 Trigger Holdoff

Trigger holdoff is used for viewing complicated waveform (such as pulse string). Holdoff time indicates the time that the oscilloscope waits to restart the trigger circuit. During trigger holdoff, the oscilloscope will not trigger until the end of holdoff time. For example, a group of pulse string, it requires that generate the first pulse string and the holdoff time can be set as width of pulse string, as shown in Figure 6-9.

In Horil Menu, the trigger holdoff time can be set by Multipurpose rotary knob and numeric keyboard.

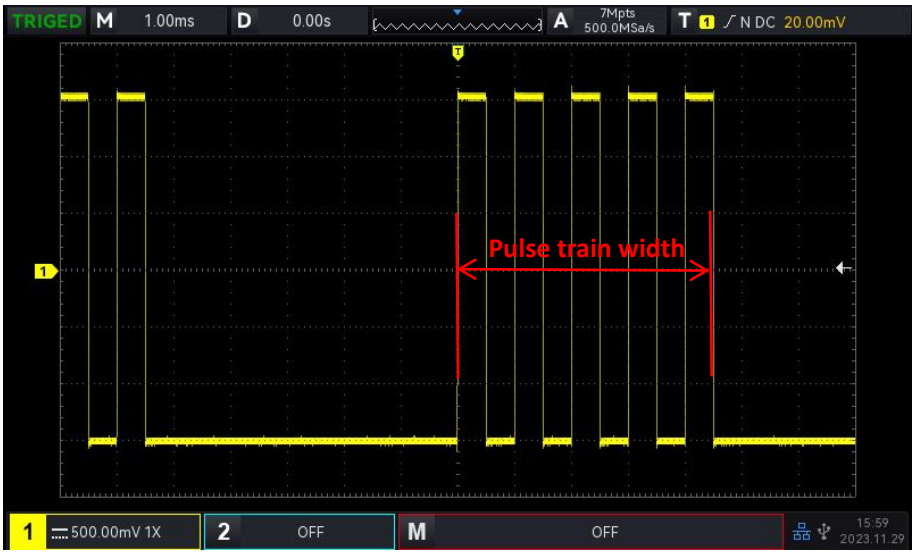

TRIGED
M
1.00ms
D
0.00s
A
7Mpts
500.0MSa/s
T
N DC
20.00mV
Pulse train width
1
500.00mV 1X
2
OFF
M
OFF
15:59
2023.11.29

Figure 6-9

7. Trigger System Setting

- Trigger System Noun
- Edge Trigger
- Pulse Width Trigger
- Video Trigger
- Slope Trigger
- Runt Pulse Trigger
- Over-amplitude trigger
- Delay Trigger
- Timeout Trigger
- Duration Trigger
- Setup&Hold Trigger
- Nth Edge Trigger
- Code Pattern Trigger
- RS232 Trigger
- I^2C Trigger
- SPI Trigger

Trigger determines when the oscilloscope starts to collect data and display waveform. Once the trigger is correctly set, it can convert unstable signals into meaningful waveform. In the beginning of data acquisition, it collects enough data to compose the waveform starting at the left of the trigger point, and continues until the trigger condition is met. When a trigger is detected, the oscilloscope will be continuously collect enough data to draw the waveform to the

right of the trigger point.

In this chapter, take two analog channels (UPO1202) as an example to introduce the vertical channel settings.

7.1 Trigger System Noun

(1) Trigger Source

A signal is used to generate a trigger. Trigger can obtain from a variety of sources, such as input channel (CH1, CH2), external trigger (EXT) and AC line.

a. Input channel: Select any one of the analog signal input terminal CH1~CH2 on the front panel of the oscilloscope as a trigger signal.

b. External trigger: Select EXT Trig (the input terminal of EXT) on the rear panel of the oscilloscope as a trigger signal. For example, the external clock can input to EXT Trig terminal to be a trigger source. The trigger level range of EXT signal trigger is -9V ~ +9V.

c. AC line: That is the main supply. It is used to observe AC line signal, such as the relationship between power signals such as lighting equipment and power supply equipment, so as to obtain stable synchronization.

(2) Trigger Mode

Trigger mode determines the behavior of the wave during a trigger event. This oscilloscope provides three kinds of trigger modes: auto, normal, and single trigger. Press the Mode key in trigger control area on the front panel to quickly select the trigger mode.

a. Auto trigger: When there is no trigger signal, the system will automatically collect data and display. When the trigger signal is generated, the system will automatically turn to trigger scanning and synchronize with the signal.

Auto trigger mode is suitable for

- Check DC signal or the signal with unknown level characteristic.

Notes: Auto trigger mode allows 50 ms/div or slower time shift without triggering signal in ROLL mode.

b. Normal trigger: The oscilloscope can only collect data when the trigger condition is met. The oscilloscope is stop collect data and be wait to trigger state when there is no trigger signal. The oscilloscope will refresh the waveform data when the trigger condition is met. Otherwise, the oscilloscope maintains the last triggered waveform.

Normal trigger mode is suitable for

- Only collect the particular event appointed by the trigger setting;
- Rare trigger event, use normal mode can prevent the oscilloscope from automatic trigger, so that the waveform can be stable display.

c. Single trigger: In single trigger mode, press the Single key one time to delete the waveform on the screen and the oscilloscope enters wait to trigger state. When the oscilloscope detects a trigger, the waveform will be sampled and displayed, and then the oscilloscope enters the STOP state. Press the Single key on front panel to the waveform on the screen and quickly enter single trigger mode.

Single trigger mode is suitable for

- Capture casual event or aperiodicity signal, such as up, down electrical waveform;
- Rare trigger event

(3) Trigger Coupling

Trigger coupling determines which part of the signal will be transmitted to the trigger circuit. The coupling type includes DC, AC, LF rejection, HF rejection and noise suppression.

a. DC: Let all the components of the signal pass through.
b. AC: Block the DC component of the signal.
c. HF rejection: Attenuate high frequency components over 40 kHz.
d. LF rejection: Attenuate low frequency components below 40 kHz.
e. Noise suppression: Suppress high frequency noise in the signal to reduce probability of touch error.

(4) Pretrigger / Delay Trigger

Collected data before/after a trigger event.

Trigger position is usually set at the horizontal center of the screen, user can observe 7 grids of pretrigger and delay trigger information. User can move the waveform horizontally to view more pretrigger information. By observing the pretrigger data, the waveform before generated can be observed. For example, capturing the glitch at the start of the circuit, observing and analyzing the pretrigger data to find out the cause of the glitch.

(5) Force Trigger

Press the Force key to force to generate a trigger signal.

If the waveform is not displayed on the screen in normal or single trigger mode, press the Force key to sampling signal baseline and ensure the sampling is performed properly.

7.2 Edge Trigger

The edge can be triggered by looking for the specific edge (rising edge, falling edge and random edge) on waveform and electrical level. Press edge trigger menu to set source, trigger coupling, trigger mode and edge type. Waveform can be stable generated when the condition is satisfied, as shown in Figure 7-1.

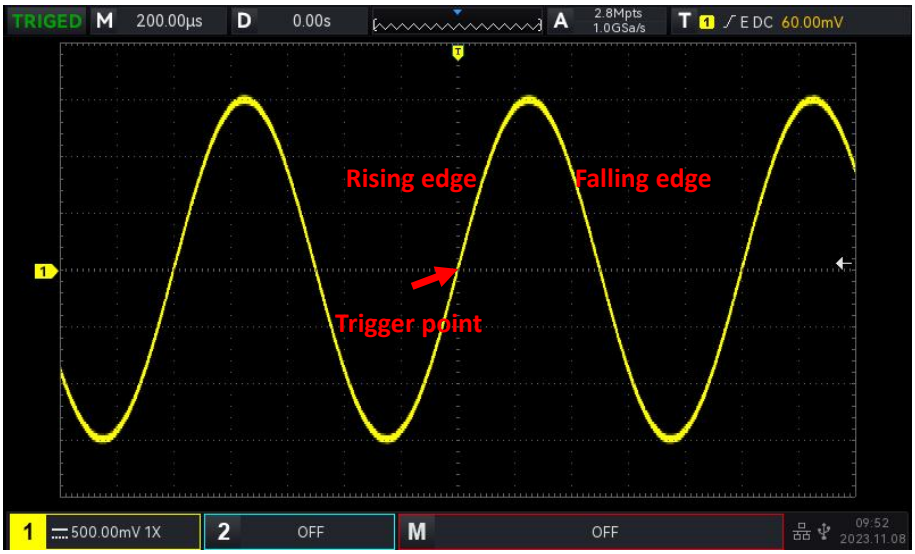


Figure 7-1

(1) Edge Type

a. Rising edge: Set to trigger on the rising edge of the signal.

b. Falling edge: Set to trigger on the falling edge of the signal.

c. Random edge: Set to trigger on the rising edge and the falling edge of the signal.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger supports the trigger coupling DC, AC, HF rejection, LF rejection or noise suppression.

7.3 Pulse Width Trigger

Pulse width trigger can set the oscilloscope at specific width and generated the positive pulse or negative pulse when the trigger condition is met. Pulse width trigger menu can set source, condition, the upper / lower limit of time, polarity of pulse width (positive and negative), trigger coupling and trigger mode, as shown in Figure 7-2.

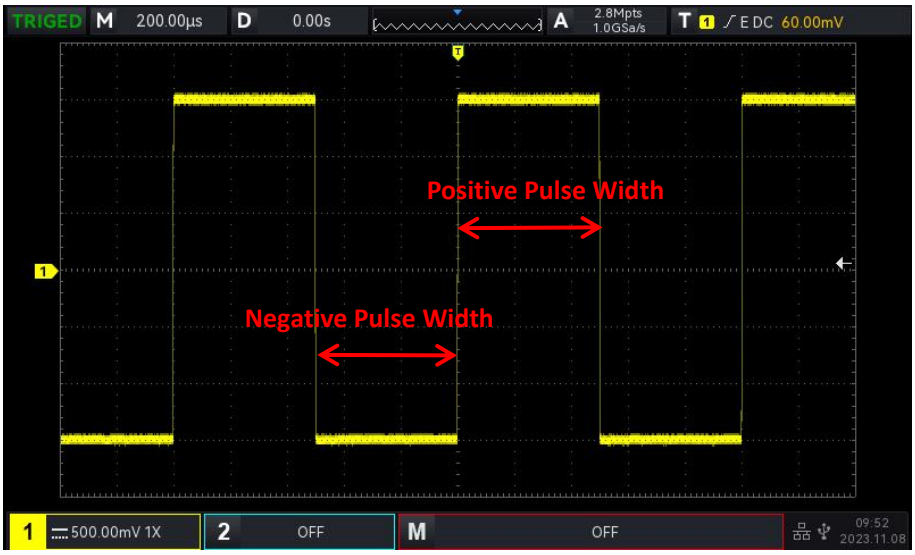


Figure 7-2

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu, in pull-down list, rotate the Multipurpose rotary knob to switch the menu options. In pulse width trigger menu, the lower limit of time, the upper limit of time can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the time value.

(1) Parameter Setting

1. Polarity of Pulse Width

To select the trigger generate on which polarity. It can be set to negative or positive.

2. Condition

Select trigger condition: “ > ”, “ < ”, “≤≥”.

a. > : It will be generated when the pulse width polarity time of the trigger signal is greater than the set time, and the lower limit of time can be set.

b. < : It will be generated when the pulse width polarity time of the trigger signal is smaller than the set time, and the upper limit of time can be set.

c. ≤≥: It will be generated when the pulse width polarity time of the trigger signal is basically similar to the set time, and the lower/upper limit of time can be set.

3. Upper/Lower Limit of Time

The set time value is compared with the time of signal pulse width polarity. The trigger will be generated when the condition is met. The range can be set to 2 ns ~1s.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

   Edge trigger only supports the trigger coupling DC or noise suppression.

7.4 Video Trigger

The video signal includes the image and the time sequence information, it has multiple standards and formats. UPO1002 provides the basic measurement functions, which can be triggered in the filed or line of NTSC (National Television Standards Committee), PAL (Phase Alternating Line) and SECAM (Sequential Couleur A Memoire), as shown in Figure 7-3.

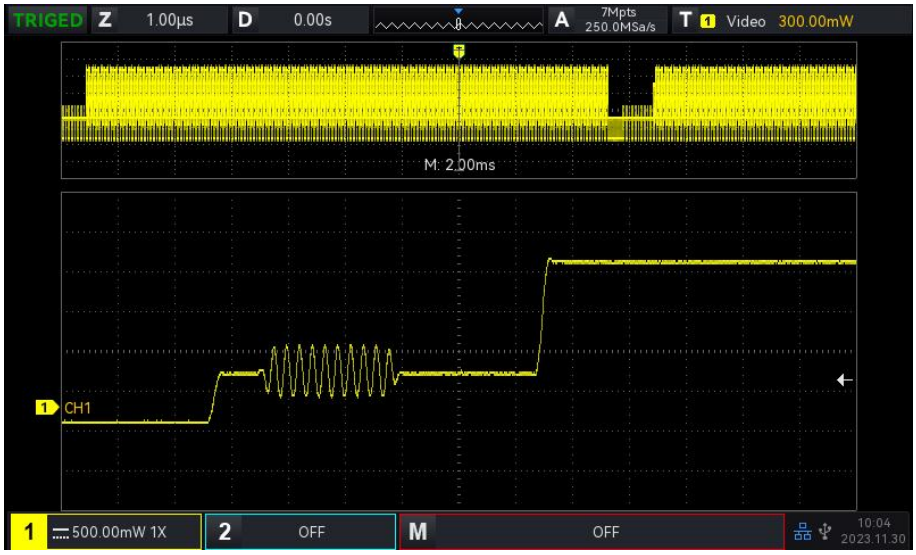


Figure 7-3

(1) Video Format

a. PAL: The frame frequency is 25 frames per second, the TV scan line is 625 lines, the odd field is in the front and the even field is in the rear.

b. NTAC: The field frequency is 60 fields per second, and the frame frequency is 30 frames per second. The TV scan line is 525 lines. The even field is in the front and the odd field is in the rear.

c. SECAM: The frame frequency is 25 frames per second, the TV scan line is 625 lines, interlaced scanning.

(2) Video Synchronization

a. Even field: Set to trigger and synchronize on the even field of the video signal.

b. Odd field: Set to trigger and synchronize on the odd field of the video signal.

c. All lines: Set to trigger and synchronize on the line signal of the video signal.

d. Specified line: Set to trigger and synchronize on the specified video line. When the specified line is selected, it can assign the line number. User can use the Multipurpose

rotary knob to adjust the line number. The range of line number is 1 to 625 (PAL/SECAM), or f 1 to 525 (NTSC).

Hints: In order to observe the waveform details in the video signal, user can set the memory depth a little bigger.

The UPO1000X series utilize the UNI-T original digital 3D technique, it uses a multi-level greyscale display function so that different brightness can reflect the frequency of different parts of the signal. Experienced users can be quickly judge the signal quality during the debugging process and find the unusual conditions.

7.5 Slope Trigger

Slope trigger refers to generate when the slope of rising or falling of signal conforms to the setting value. Slope trigger menu can set the source, trigger coupling, trigger mode, edge type (rising edge, falling edge), condition, the lower limit/ upper limit of time and level setting.

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu, in pull-down list, rotate the Multipurpose rotary knob to switch the menu options. In slope trigger menu, the lower limit of time, the upper limit of time can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the time value.

(1) Parameter Setting

1. Edge Type

a. Rising edge: Perform slope trigger by using the rising edge of the trigger signal

b. Falling edge: Perform slope trigger by using the falling edge of the trigger signal.

2. Condition

Select the trigger condition: “>”, “<”, “≤≥”.

a. >: It will be generated when the slope time of the trigger signal is greater than the set slope time, and the lower limit of time can be set.

b. <: It will be generated when the slope time of the trigger signal is smaller than the set slope time, and the upper limit of time can be set.

c. ≤≥: It will be generated when the slope time of the trigger signal is basically similar to the set slope time or within the slope time range, and the lower/upper limit of time can be set.

Notes: Slope time of trigger signal refers to the figure as shown in the following figure “slope

time of rising/ falling edge”.

3. Level Setting

   Level setting can set to low level, high level or high-low level. Press LEVEL knob on trigger control area to quickly switch the selection.

   a. Low level: Adjust the low level threshold of slope trigger by using LEVEL knob on trigger control area.

   b. High level: Adjust the high level threshold of slope trigger by using LEVEL knob on trigger control area.

   c. High-low level: Adjust the high-low level threshold of slope trigger by using LEVEL knob on trigger control area.

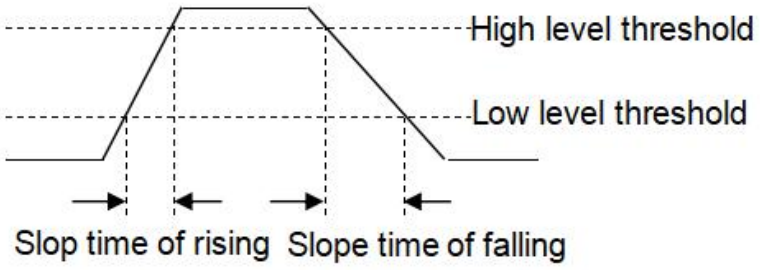
4. Upper/Lower Limit of Time

   Set the slope time, the range can be set to 8 ns ~1s.

Notes: In slope trigger, the set slew rate value will display in the left corner of the screen. The calculation formula of slew rate value:

(High level threshold - low level threshold) ÷ Time

For the set slew rate value, the time in here is the slope time value for the set slew rate.



(2) Trigger Setting

1. Trigger Mode

   Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

   Edge trigger only supports the trigger coupling DC or noise suppression.

7.6 Runt Pulse Trigger

The runt pulse trigger is used to trigger a pulse that has crossed one trigger level but not the other. In this oscilloscope, the positive runt pulse is the pulse that crosses the lower limit of the trigger level but does not cross the upper limit of the trigger level; the negative runt pulse is the pulse that crosses the upper limit of the trigger level but does not cross the lower limit of the trigger level, as

shown in Figure 7-4.

The runt trigger menu can set source, trigger coupling, trigger mode, polarity (positive, negative), condition (> < irrelevance, <, >, ≤≥), the lower/upper limit of time and level setting.

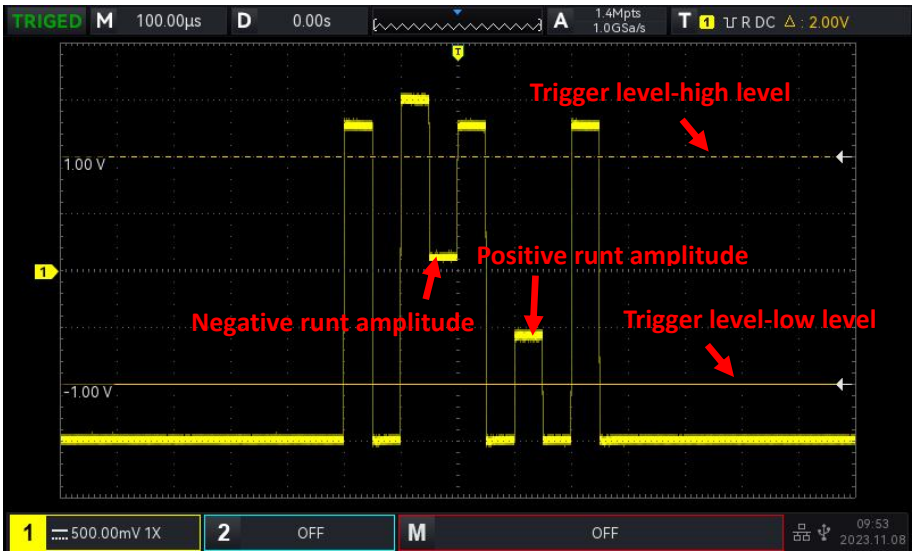


Figure 7-4

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu, in pull-down list, rotate the Multipurpose rotary knob to switch the menu options. In runt pulse trigger menu, the lower limit of time, the upper limit of time can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the time value.

(1) Parameter Setting

1. Polarity

   a. Positive pulse: Set to trigger on the positive runt pulse.

   b. Falling edge: Perform slope trigger by using the falling edge of the trigger signal.

2. Condition

   Select the trigger condition: “> <“(irrelevance), “>“, “<“, “≤≥”.

   a. > <: irrelevance, the set condition does not take effect.

   b. >: It will be generated when the runt pulse width is greater than the set pulse width time, and the lower limit of time can be set.

   c. <: It will be generated when the runt pulse width is smaller than the set pulse width time, and the upper limit of time can be set.

   d. ≤≥: It will be generated when the slope time of the trigger signal is basically similar to the set slope time or within the set pulse width time range, and the lower/upper limit of time

can be set.

Notes: Slope time of trigger signal refers to the figure as shown in the following figure “slope time of rising/ falling edge”.

3. Upper/Lower Limit of Time

The set pulse width of pulse is compared with the channel’s pulse width. The trigger will be generated when the condition is met. The range can be set to 8ns ~10s.

4. Level Setting

Level setting can set to low level, high level or high-low level. Press LEVEL knob on trigger control area to quickly switch the selection.

a. Low level: Adjust the low level threshold of runt pulse trigger by using LEVEL knob on trigger control area.

b. High level: Adjust the high level threshold of runt pulse trigger by using LEVEL knob on trigger control area.

c. High-low level: Adjust the high-low level threshold of runt pulse trigger by using LEVEL knob on trigger control area.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

7.7 Over-amplitude Trigger

When the over-amplitude trigger is selected, the over-amplitude trigger have one high level and one low level. The oscilloscope will be generated when the rising edge of the input signal crosses the high level or the falling edge of the input signal crosses the low level, as shown in Figure 7-5. Over-amplitude trigger menu can set source, coupling mode, trigger mode, over-amplitude type (rising edge, falling edge, random edge), position (enter, exit, time), trigger setting and level setting.

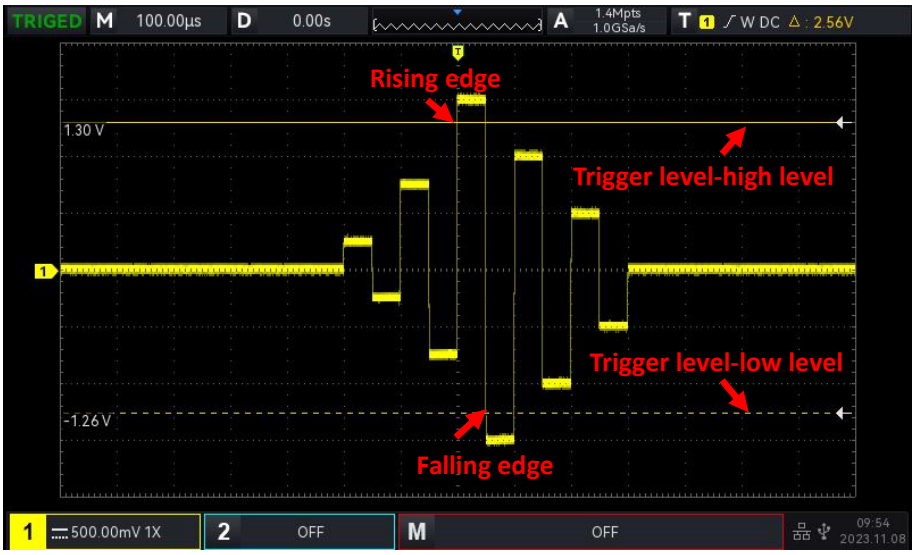


Figure 7-5

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu, in pull-down list, rotate the Multipurpose rotary knob to switch the menu options. In runt pulse trigger menu, the setting can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the time value.

(1) Parameter Setting

1. Over-amplitude Type

Select which edge that the input signal can be triggered. It can select rising edge, falling edge or random edge. The current over-amplitude type will display in top right corner of the screen.

a. Rising edge: It will be generated when the trigger on the rising edge of the input signal and the voltage level is higher than the set high level.

b. Falling edge: It will be generated when the trigger on the falling edge of the input signal and the voltage level is lower than the set low level.

c. Random edge: It will be generated when the trigger on the rising/falling edge of the input signal and the voltage level is within the set level.

2. Trigger Position

To select the position for trigger, it can select enter, exit or time. Select trigger position to confirm the timing of trigger.

a. Enter: It will be generated when the input signal enter the specified trigger level.

b. Exit: It will be generated when the input signal exit the specified trigger level.

c. Time: It will be generated when the over-amplitude entered, accumulated hold time is

greater than or equal to the set over-amplitude time.

4. Level Setting

Level setting can set to low level, high level or high-low level. Press LEVEL knob on trigger control area to quickly switch the selection.

a. Low level: Adjust the low level threshold of over-amplitude pulse trigger by using LEVEL knob on trigger control area.

b. High level: Adjust the high level threshold of over-amplitude pulse trigger by using LEVEL knob on trigger control area.

c. High-low level: Adjust the high-low level threshold of over-amplitude pulse trigger by using LEVEL knob on trigger control area.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

7.8 Delay Trigger

Delay trigger need to set trigger source 1 and trigger source 2. The oscilloscope will be generated when the time difference (△T) between the edge set by source 1 (edge 1) and the edge set by source 2 (edge 2) meets the preset time limit, as shown in Figure 7-6.

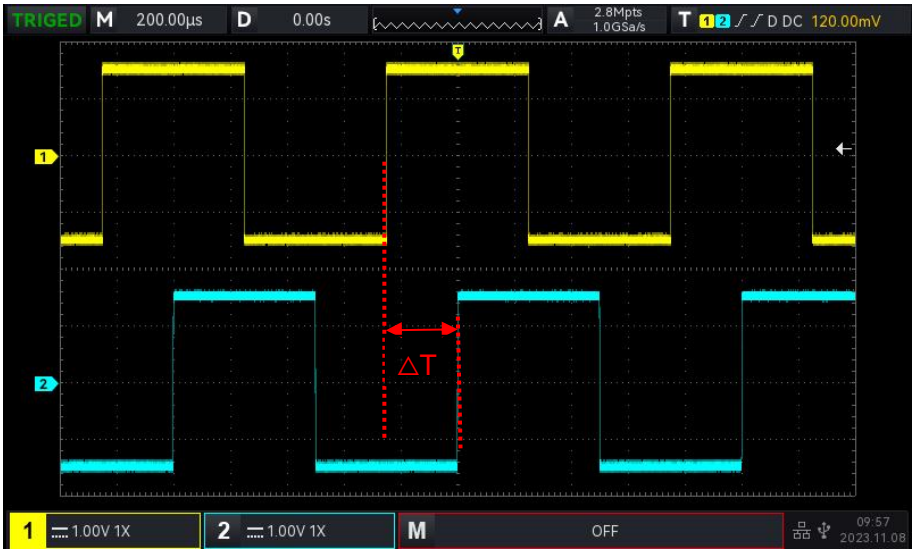


Figure 7-6

Edge 1 sets as rising edge, edge 2 is also sets as rising edge. △T is the area marked by red color,

as shown in Figure 7-6.

Notes: Edge 1 and edge 2 must be adjacent edges. Only the channel that has been connected to the signal can get stable trigger.

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu, in pull-down list, rotate the Multipurpose rotary knob to switch the menu options. In delay trigger menu, the lower limit of time, the upper limit of time can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the time value.

(1) Parameter Setting

1. Edge 1, Edge 2

   Set the comparative edge between two sources for delay trigger, it can set to rising edge or falling edge.

2. Condition

   Select the trigger condition :”> “, “<“, “≤≥”, “> <“(irrelevance).

   a. >: It will be generated when the time difference (△T) between the edge of source 1 and the edge of source 2 is greater than the set lower limit of time, it can set the lower limit of time.

   b. <: It will be generated when the time difference (△T) between the edge of source 1 and the edge of source 2 is smaller than the set lower limit of time, it can set the upper limit of time.

   c. ≤≥: It will be generated when the time difference (△T) between the edge of source 1 and the edge of source 2 is greater than or equal to the set lower limit of time and smaller than or equal to the set upper limit of time, it can set the upper limit and lower limit of time.

   d. > <: It will be generated when the time difference (△T) between the edge of source 1 and the edge of source 2 is smaller than the set lower limit of time or greater than the set upper limit of time. It can set the upper limit and lower limit of time.

3. Upper/Lower Limit of Time

   The set time is compared with △**T** , it will be generated when the condition is met. The range can be set to 8 ns ~10s.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

7.9 Timeout Trigger

Timeout trigger can generate the time interval of signal is greater than the set timeout, the signal is cross from the rising edge (or falling edge) of the input signal to the end of adjacent falling edge (rising edge) of the trigger level, as shown in Figure 7-7.

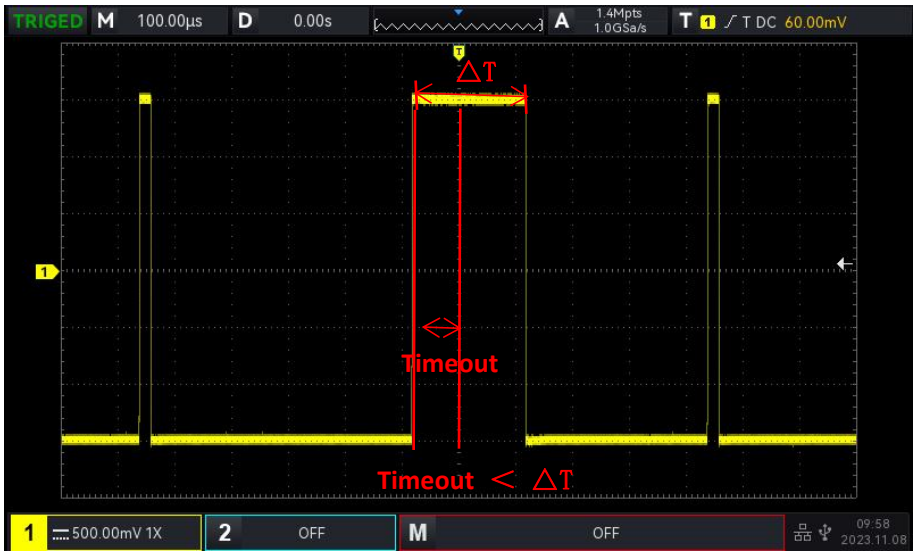


Figure 7-7

(1) Edge Type

Select which edge that the input signal can be triggered. It can select rising edge, falling edge, random rising. The current edge type will display in top right corner of the screen.

a. Rising edge: Set the timer to start when the rising edge of the input signal through the trigger level.

b. Falling edge: Set the timer to start when the falling edge of the input signal through the trigger level.

c. Random edge: Set the timer to start when the rising edge or the falling edge of the input signal through the trigger level.

(2) Timeout

The set timeout is compared with △T, it will be triggered when the condition is met. The range can be set 8 ns ~ 10s.

(3) Trigger Setting

1. Trigger Mode

   Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

   Edge trigger only supports the trigger coupling: DC.

7.10 Duration Trigger

When the duration trigger is selected, the oscilloscope identifies the trigger condition by looking for the duration of the specified codes. The code pattern is the combination of channel logic “AND”, and the value of each channel can be H (high), L (low), or X (ignored).It will be generated when the duration (△T) of the code pattern meets a preset time, as shown in Figure 7-8.

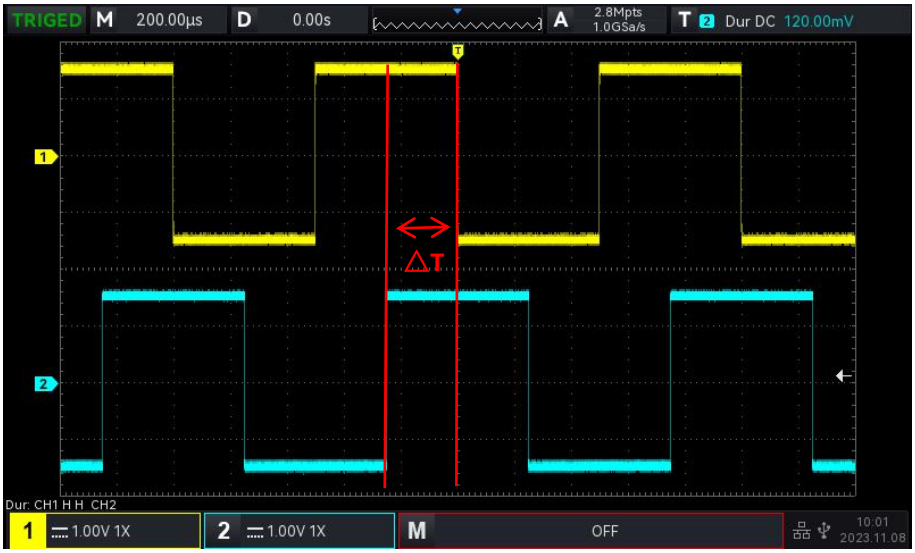


Figure 7-8

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu, in pull-down list, rotate the Multipurpose rotary knob to switch the menu options. In duration trigger menu, the lower limit of time, the upper limit of time can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the time value.

(1) Parameter Setting

1. Code Pattern

   Code pattern can be set to H, L or X. The pattern setting of each channel is displayed at the bottom of the screen, as shown in the above figure.

   a. H: Set the code pattern value of the selected channel to “High”, that is, the voltage level is

higher than the trigger level of the channel.

b. L: Set the code pattern value of the selected channel to “Low”, that is, the voltage level is lower than the trigger level of the channel.

c. X: Set the code pattern value of the selected channel to “Ignored”, that is, the channel is not part of the pattern. The oscilloscope will not be trigger if all channels in code pattern are set to “ignored”.

2. Condition

Select the trigger condition: “>“, “<“, “≤≥”.

a. >: It will be generated when the duration of code pattern is greater than the set time, it can set the lower limit of time.

b. <: It will be generated when the duration of code pattern is smaller than the set time, it can set the upper limit of time.

c. ≤≥: It will be generated when the duration of code pattern is smaller than or equal to the set time and greater than or equal to the set time, it can set the upper limit and lower limit of time.

3. Upper/Lower Limit of Time

The set time is compared with the duration of code pattern △**T** , it will be generated when the condition is met. The range can be set to 8 ns ~10s.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

7.11 Setup & Hold Trigger

In setup & hold trigger, the oscilloscope needs to set the data signal line and clock signal line. The setup time begins when the data signal crosses the trigger level and ends when the specified clock edge arrives. The hold time begins when the specified clock edge arrives and ends when the data signal crosses the trigger level again (as shown in Figure 7-9). The oscilloscope will be triggered when the setup time or the hold time is less than the preset time. It is mainly used to locate and find error code, and quickly find the signal that cannot meet setup & hold time.

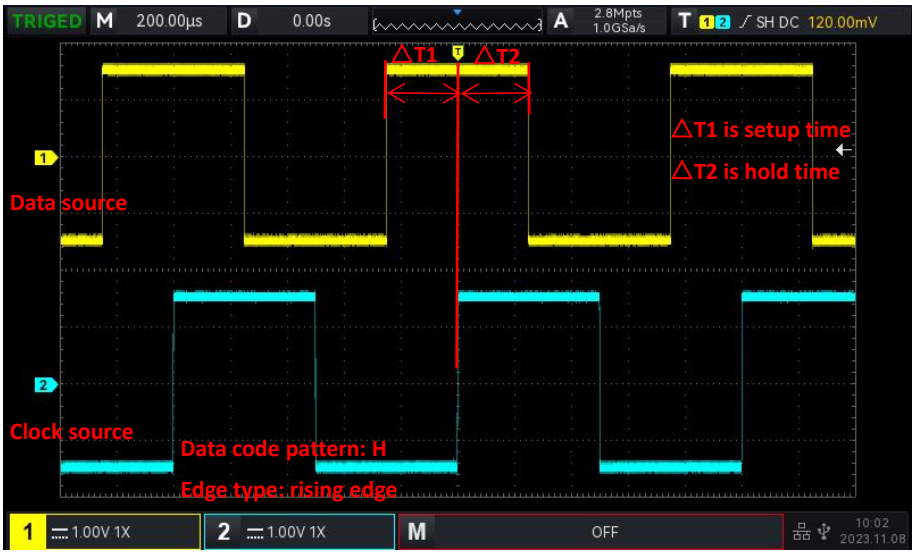


Figure 7-9

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu, in pull-down list, rotate the Multipurpose rotary knob to switch the menu options. In setup & hold trigger menu, the time can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the time value.

(1) Parameter Setting

1. Code Pattern

Code pattern can be set to H or L.

a. H: Set the valid code pattern of the data signal to high level.

b. L: Set the valid code pattern of the data signal to low level.

2. Edge Type

a. Rising edge: Set the clock edge type to rising edge.

b. Falling edge: Set the clock edge type to falling edge.

3. Hold Type

Hold type can set to hold or setup.

a. Setup: It will be generated when the setup time is small than the set value.

b. Hold: It will be generated when the hold time is small than the set value.

4. Time

The set time is compared with the code pattern setup, duration △**T**, it will be triggered when the condition is met. The range can be set 8 ns ~ 1s.

(2) Trigger Setting

1. Trigger Mode

   Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

   Edge trigger only supports the trigger coupling: DC.

7.12 Nth Edge Trigger

The Nth edge trigger is triggered on the Nth edge after assign the specified idle time. For example, the waveform as shown in the following figure, it is set to trigger on the 2nd rising edge after the specified idle time (the time between two adjacent rising edge), then set the idle time to P< idle time <M. M is the time between the 1st rising edge and the next rising edge, P is the maximum time between the counting rising edge, as shown in Figure 7-10.

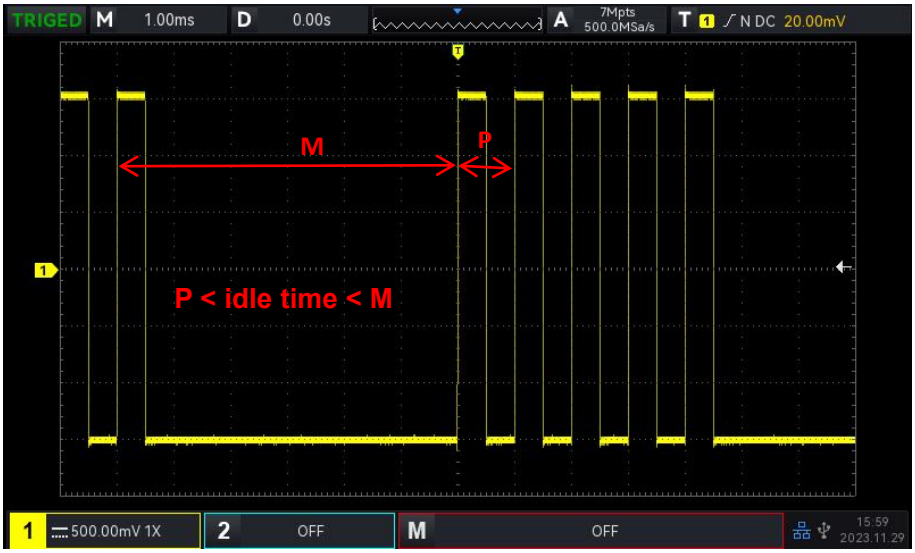


Figure 7-10

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu, in pull-down list, rotate the Multipurpose rotary knob to switch the menu options. In Nth edge menu, the lower limit of time, the idle time and edge value can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the time value.

(1) Parameter Setting

1. Edge Type

   Select which edge that the input signal can be triggered. It can select rising edge or falling edge. The current edge type will display in top right corner of the screen.

   a. Rising edge: Set to trigger on the rising edge of the signal.

b. Falling edge: Set to trigger on the falling edge of the signal.

2. Idle Time

The idle time is compared with the pulse time, it will be triggered when the condition is met. The range can be set 8 ns ~ 10s.

3. Edge Count

The number of edge means that the pulse string is triggered at which edge. The edge value can be set by the Multipurpose rotary knob, jog dial and numeric keypad. The edge value range can be set 1 ~ 65535.

(2) Trigger Setting

1. Trigger Mode

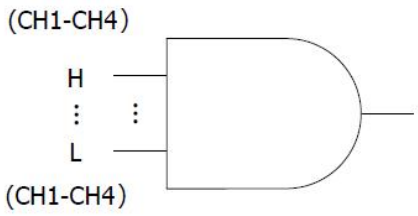
Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

7.13 Code Pattern Trigger

The pattern trigger identifies the trigger condition by looking for the specified patterns. The pattern trigger type is the combination of the channel logic "AND", each channel can be set to H (High), L (Low), X (Ignored). User can also specify a channel in code pattern as a rising edge or falling edge (only one edge can be specified). When the edge is assigned, if the code pattern of the other channels are judged "true" (i.e., the actual pattern is consistent with the preset pattern type), the oscilloscope will be triggered on the specified edge. If the edge is not assigned, the oscilloscope will be triggered at the last edge of the code pattern "true". If the pattern of all channels are sets to "ignored", the oscilloscope will not be triggered.



(1) Code Pattern

Code pattern can be set to H, L, X, rising edge or falling edge. The code pattern setting of

each channel is displayed at the bottom of the screen.

a. H: Set the code pattern value of the selected channel to "High", that is, the voltage level is higher than the trigger level of the channel.

b. L: Set the code pattern value of the selected channel to "Low", that is, the voltage level is lower than the trigger level of the channel.

c. X: Set the code pattern value of the selected channel to "Ignored", that is, the channel is not part of the pattern. The oscilloscope will not be trigger if all channels in code pattern are set to "ignored".

d. Rising edge: Set the code pattern to the rising edge of the selected channel.

e. Falling edge: Set the code pattern to the falling edge of the selected channel.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

7.14 RS232 Trigger

RS232 trigger supports the horizontal menu to set the parameter and trigger.

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu. In the pull-down list, rotate the Multipurpose rotary knob to switch the menu option and modify the value.

(1) Parameter Setting

1. Condition

Set the trigger condition, it can select to start frame, error frame, check error and data.

a. Start frame: The waveform will be triggered at the start bit of RS232 protocol. When user send a single string signal or send the same strings several times, this trigger can be used to see a stable signal waveform, and if the sent data changes, the corresponding waveform will also be change.

b. Error frame: If 0 is appeared in the stop state or data error occurs in the middle of data bits during the receiving.

c. Check error: RS232 protocol sets the parity bit to 0 or 1 according to the parity check rule. The parity rule is as follows.

Odd parity: If the number of bit 1 is odd in data bits and parity bits, then the transmission is correct.

Even Check: If the number of bit 1 is even in data bits and parity bits, then the transmission is correct.

Using this option, user can check the RS232 communication process and quickly find the transmission process of parity error, so that you can be easily locate the fault analysis.

d. Data: The trigger will be generated when the data acquired by the oscilloscope is the same as the 2 bits hexadecimal system set by the user. Using this option, user can be quickly find the transmission signal of the specific data that you are interested.

2. Data

It will be valid when the trigger condition is "Data", the range can set to 00 ~ FF (hexadecimal system). It can only adjusted by Multipurpose rotary knob.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

(3) Decoding Setting

Quickly enter the entrance of RS232 protocol decoding, refer to the section of “RS232 Decoding” in protocol decoding chapter.

7.15 I²C Trigger

I²C trigger supports the horizontal menu to set the parameter and trigger.

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu. In the pull-down list, rotate the Multipurpose rotary knob to switch the menu option and modify the value. In I²C decoding trigger menu, the data can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open virtual numeric keyboard to quickly set the data.

(1) Parameter Setting

1. Operating Direction

It can set to “write” or “read”.

a. Write: It will be triggered when the "read/write" bit in the I^2C protocol is "write".

b. Read: It will be triggered when the "read/write" bit in the I^2C protocol is "read".

2. Condition

Set I^2C trigger condition, including start, restart, stop, loss confirmed, address, data and address data.

a. Start: It will be triggered at the start time, that is, the SDA signal has a falling edge when the SCL is in high level.

b. Restart: It will be triggered at the restarting time, that is, after a start signal, and before it stops, the start signal appears again.

c. Stop: It will be triggered when the stop bit occurs, that is, the SDA signal jumps from low to high when the SCL is in high level.

d. Loss Confirmed: In I^2C protocol, each time an 8 bits message is transmitted, the data receiver needs to send an acknowledgement signal, which is the ACK bit in the above figure when the SCL is in high level, the SDA signal is low level. The loss will be triggered in ACK bit and when SCL and SDA is high.

e. Address: It will be triggered when the communication address is the same with the user-defined. It can help you to quickly locate the address transmission.

f. Data: The waveform will be triggered when the data acquired by I^2C is the same with the user-defined. It can help user to quickly find the specified data of transmission signal that you are interested.

g. Address & Data: It will be triggered when find the same address during the transmission and data relationship meets the condition. This trigger condition makes it easy to implement the specified address and data trigger of I^2C, and help user to analyze the transmission.

3. Address Bit Width

When the trigger condition is select "address" or "address data", it should set the address bit width of I^2C to 7 bits or 10 bits.

4. Address

It is valid when the trigger condition is select "address" or "address data". The range can be set 00 ~ 3FF (hexadecimal system).

5. Byte Length

It is valid when the trigger condition is select "address" or "address data". Set the data byte length for the specified data, the range can be set 1 ~ 5.

6. Data

It is valid when the trigger condition is select "address" or "address data". The range can be set 00 ~ FFFFFFFFFF (hexadecimal system). Press Multipurpose rotary knob to set the data.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

(3) Decoding Setting

Quickly enter the entrance of I^2C protocol decoding, refer to the section of "I^2C Decoding" in protocol decoding chapter.

7.16 SPI Trigger

SPI trigger supports the horizontal menu to set the parameter and trigger.

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu. In the pull-down list, rotate the Multipurpose rotary knob to switch the menu option and modify the value. In SPI decoding trigger menu, the idle time, data can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open virtual numeric keyboard to quickly set the data.

(1) Parameter Setting

1. Condition

a. Idle & data: It will be triggered when meets the idle time and at the edge where the data level jumps from invalid to valid.

b. Idle: Idle trigger is triggered at the start of a new segment of data after a certain idle time.

2. Idle Time

The idle time counter counts when the SCK is unchanged, and judges whether the count value exceeds the preset value at the SCK valid edge, if it exceeds, the oscilloscope will be triggered at the valid edge. The counter will be cleared at valid edge of each clock. The range can set to 80 ns ~ 1s.

3. Bit Width

To set the bit width of SPI signal for each frame, the range can be 4~32.

4. Frame Length

Set the length for data unit, it can be set when the trigger condition is “chip &data, idle &data”. The range can be set 1~ 32.

5. Data

Data setting is related to the frame length, the range can be set 0 ~ FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF.

(2) Trigger Setting

1. Trigger Mode

Edge trigger supports the trigger mode auto, normal and single trigger.

2. Trigger Coupling

Edge trigger only supports the trigger coupling: DC.

(3) Decoding Setting

Quickly enter the entrance of I^2C protocol decoding, refer to the section of “SPI Decoding” in protocol decoding chapter.

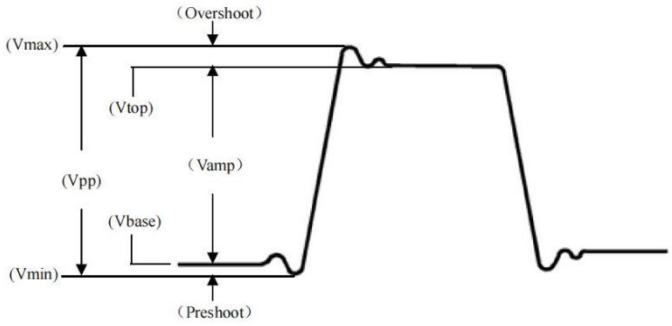
8. Automatic Measurement

- Parameter Measurement
- Automatic Measurement Menu
- All Parameter Measurement
- User-defined Measurement

8.1 Parameter Measurement

UPO1002 series digital phosphor oscilloscope can automatically measure 36 kinds of parameters. It includes voltage, time and other parameter.

- **Voltage**



Maximum (Max): The voltage from the highest point of the waveform to ground (GND).

Minimum (Min): The voltage from the lowest point of the waveform to ground (GND).

Top (High): The voltage value from the flat top of the waveform to ground (GND).

Bottom (Low): The voltage value from the bottom of the waveform to ground (GND).

Middle: Half of the sum of the voltage values at the top and bottom of the waveform.

Peak-to-peak (Pk-Pk): The voltage value from the highest point to the lowest point of the waveform.

Amplitude (Amp): The voltage value from the top to the bottom of the waveform.

Average (Mean): The averaged amplitude of the waveform within the screen.

Cycle average (CycMean): The averaged amplitude of the waveform in one cycle.

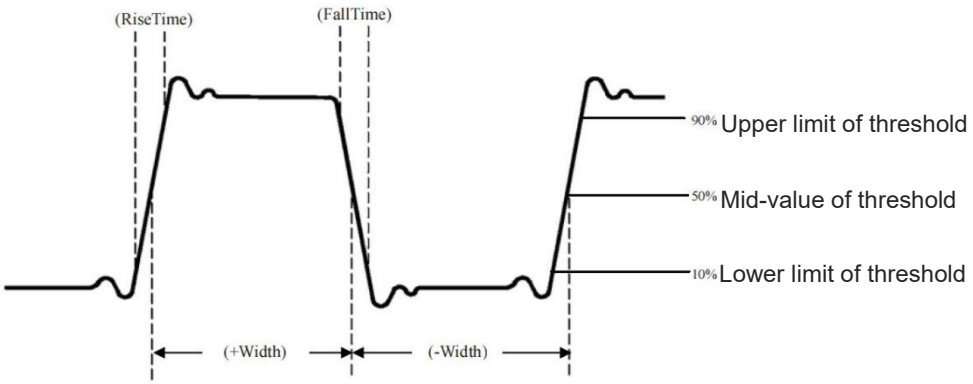
Root-mean-square value (RMS): The energy generated by the conversion of AC signal, it

corresponds to the DC voltage that generates equivalent energy.

Cycle RMS (CycRMS): The energy produced by the conversion of AC signal in a period, it corresponds to a DC voltage that generates equivalent energy.

AC RMS (AC RMS): The RMS value is the waveform which DC component has removed.

■ Time



Period: Time between two consecutive, same-polarity edge same mid-value of threshold in cross point of a repetitive waveform.

Frequency: The reciprocal of the period.

Rise time: Time needed for the waveform amplitude rising from the lower limit of threshold to the upper limit of threshold.

Fall time: Time needed for the waveform amplitude falling from the upper limit of threshold to the lower limit of threshold

Rise delay: The time difference between the rising edge of the main source and the rising edge of the secondary source in mid-value of threshold. Negative delay indicates the rising edge of the main source is appear after the rising edge of the secondary source.

Fall delay: The time difference between the falling edge of the main source and the falling edge of the secondary source in mid-value of threshold. Negative delay indicates the falling edge of the main source is appear after the falling edge of the secondary source.

+Width (positive width): The time difference between the rising edges of the pulse from the mid-value of threshold to the mid-value of the adjacent falling edge.

-Width (negative width): The time difference between the falling edges of the pulse from the mid-value of threshold to the mid-value of the adjacent rising edge.

FRFR: Time from the first rising edge of source 1 to the first rising edge of source 2 at the cross

point of mid-value of the threshold.

FRFF: Time from the first rising edge of source 1 to the falling edge of source 2 at the cross point of mid-value of the threshold.

FFFR: Time from the falling rising edge of source 1 to the rising edge of source 2 at the cross point of mid-value of the threshold.

FFFF: Time from the falling rising edge of source 1 to the falling edge of source 2 at the cross point of mid-value of the threshold.

FRLF: Time from the first rising edge of source 1 to the last falling edge of source 2 at the cross point of mid-value of the threshold.

FRLR: Time from the first rising edge of source 1 to the last rising edge of source 2 at the cross point of mid-value of the threshold.

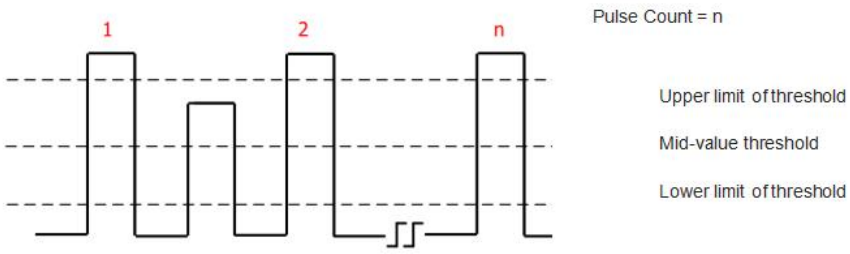
FFLR: Time from the first falling edge of source 1 to the last rising edge of source 2 at the cross point of mid-value of the threshold.

FFLF: Time from the first falling edge of source 1 to the last falling edge of source 2 at the cross point of mid-value of the threshold.

Notes: The definition of rising edge: the edge rising from the lower limit of threshold to the mid-value of threshold.

The definition of falling edge: the edge falling from the upper limit of threshold to the mid-value of threshold.

■ Other



+Duty (positive duty): The ratio of the positive pulse width to period.

-Duty (negative duty): The ratio of the negative pulse width to period.

Overshoot (OverSht): The ratio of the difference between the maximum value and the top value of a waveform to its amplitude.

Preshoot (PreSht): The ratio of the difference between the minimum value and the bottom value of a waveform to its amplitude.

Area: The algebraic sum of the product of voltage at all points and time on the screen.

Cycle area (CycArea): The algebraic sum of the product of voltage at all points and time in a cycle of waveform.

Phase: The phase difference between the rising edge of the main source and the rising edge of the secondary source in mid-value of threshold. It expresses in degree.

Pulse Count: The pulse count is the rising edge of the main source cross the mid-value of threshold and the upper limit of threshold to an adjacent falling edge cross to the upper limit of threshold and mid-value of threshold.

8.2 Automatic Measurement

Press the Measure key on the front panel to enter the automatic measurement menu.

(1) Primary Source

Set the first source for automatic measurement, it can select any one of CH1, CH2 and Math.

(2) Secondary Source

Set the other reference source for automatic measurement, it can select any one of CH1, CH2 and Math. It is mainly effective when measuring time and phase.

(3) All Parameter

In all parameter popups, it can check the measured results of all parameter, it can set to ON or OFF.

(4) User-defined

User-defined parameter can be set to display or hide. Press the user-defined key to pop up the message box and enter delete user-defined menu. User can set the customized display to ON/OFF in delete user-defined menu. In user-defined popups, rotating the Multipurpose rotary knob to switch the selection and pressing the knob to confirm and set the customized measurement parameter. The customized measurement parameter will be also display in the delete user-defined menu, so user can delete the unnecessary customized parameter.

User-defined menu supports to set 5 parameters at the same time, the parameter can be the parameter for different primary source. If the parameter is over 5, the defined parameter will be replace in sequence.

(5) Measurement Statistics

When the user-defined parameters are available, open the measurement statistics function to automatically count and display the current user-defined parameter, averaged value, the maximum, the minimum, standard difference, statistic count, it can set to ON or OFF.

(6) Indicator

Open the indicator to directly point out the physical meaning for the selection indicator parameter by the line. Select the parameter in selection indicator list, it can set to ON or OFF.

(7) Selection Indicator

Unfold the menu, select the parameter in 36 parameter of automatic measurement for the indicator by adjusting the Multipurpose rotary knob.

(8) Threshold Setting

Set the threshold range for a source, it will affect the measured results of time and edge. It can set threshold type, source and measurement range. The measurement range can set to low, middle and upper.

a. Threshold type: default, user-defined, 10%, 50%, 90%. User-defined: Set to the upper limit, mid-value, the lower limit according to your needs.

b. Source: threshold setting for the main source, it can set CH1, CH2, and MATH. The threshold setting can be set for one source or multiple sources at the same time.

c. Upper limit: Set the upper limit of reference level for waveform measurement, the range can be set 7%~95%.

d. Mid-value: Set the mid-value of reference level for waveform measurement, the range can be set 6%~94%.

e. Lower limit: Set the lower limit of reference level for waveform measurement, the range can be set 5%~93%.

(9) Measurement Window

Set the window range for automatic measurement in horizontal direction, it will affect all parameter measured results of automatic measurement. It can set the screen area and cursor area.

a. Screen area: full screen area

b. Cursor area: Horizontal time Cursor area, user can set the cursor position according to your needs and directly measure the results in cursor area (It is invalid in Cursor voltage measurement).

8.3 All Parameter Measurement

Open all parameter popups in Measure, measuring all parameter as shown in Figure 8-1.

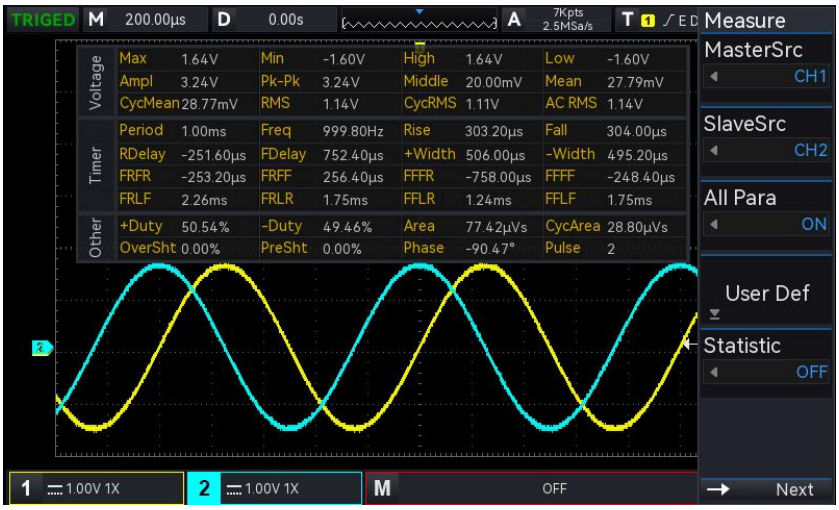


Figure 8-1

All parameter measurements are always marked with the color that consistent with the current measurement channel (the primary source).

If it displays “---”, it indicates that the current measurement source has no signal input or the measured results is not within the valid range (it’s too large or too small.)

8.4 User-defined Parameter

Open user-defined parameter popups in Measure, as shown in Figure 8-2.

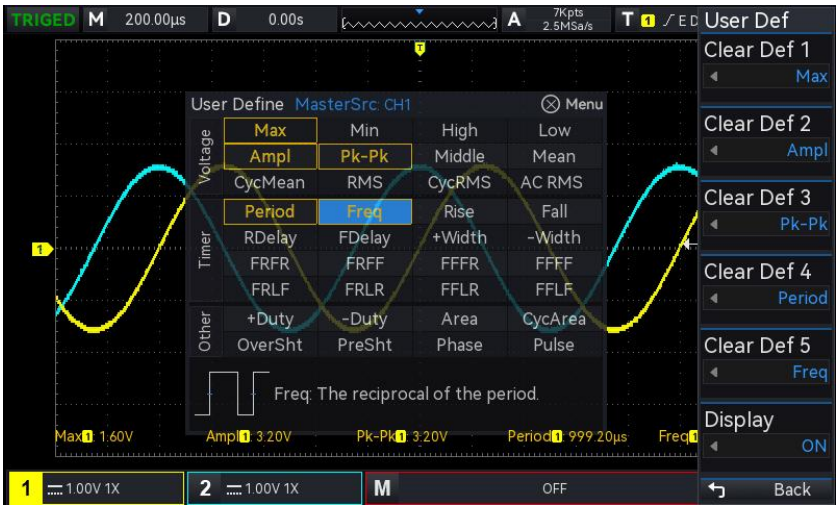


Figure 8-2

Rotating the Multipurpose rotary knob to select the parameter and press the knob to confirm. For every selected parameter, a * symbol will appear in front of the parameter. The user defined parameter will display on the bottom of the screen, it can measuring 5 parameters at the same time.

9. Cursor Measurement

- Time Measurement
- Voltage Measurement
- Screen Measurement

Cursor measurement is used to measure X axis (time) and Y axis (voltage) of the selected waveform, press the Cursor key on the front panel to enter the cursor measurement menu. It supports to measure the multiple channels at the same time and also supports to measure the loading waveform. It can set source, measurement type and mode.

(1) Source: set the source for the cursor measurement, it can set CH1~CH2, Math, Ref A~Ref B.

(2) Measurement mode: it supports three type time, voltage and screen.

(3) Mode: cursor movement mode, it can set independent and track.

(4) Horizontal unit: set the horizontal unit to s or Hz. After the horizontal unit is changed, time unit of X line in time measurement and screen measurement will display s or Hz according to the newest setting.

9.1 Cursor Measurement

Press the Cursor key to enter the cursor measurement menu, operating the time measurement after the type, mode, and source is selected, as shown in Figure 9-1.

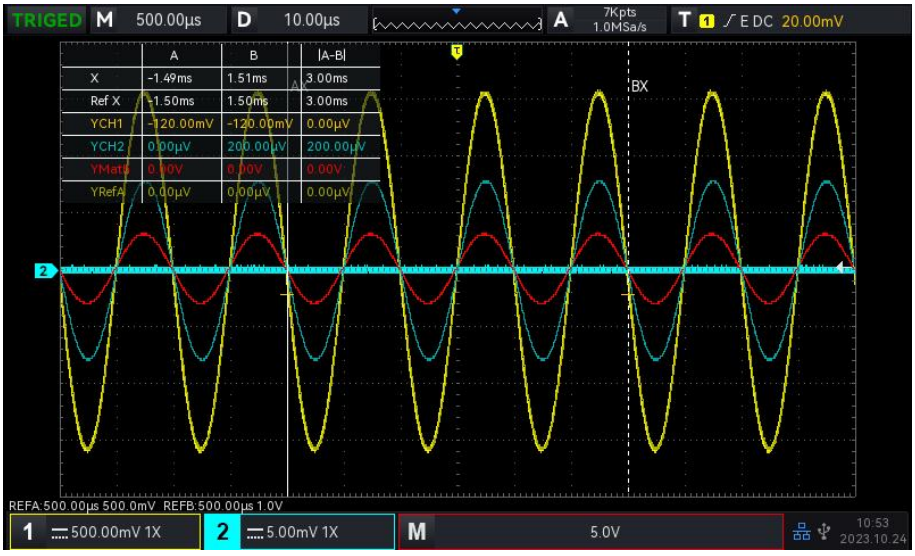


Figure 9-1

The cursor measurement display frame in top left corner: “X” indicates the time measurement

results of the channel; “Ref X” indicates the time measurement results of reference waveform. “Y” indicates the voltage measurement results at the intersection of the open channel and the cursor, adjusting the horizontal position of AX, BX cursor by the Multipurpose rotary knob to reach the time measurement.

9.2 Voltage Measurement

The setup method of cursor measurement is the same as time measurement, adjusting the cursor’s vertical position to measure the voltage of each source’s cursor.

Press the Cursor key to enter the voltage measurement menu, operating the voltage measurement after the voltage, mode, and source is selected, as shown in Figure 9-2.

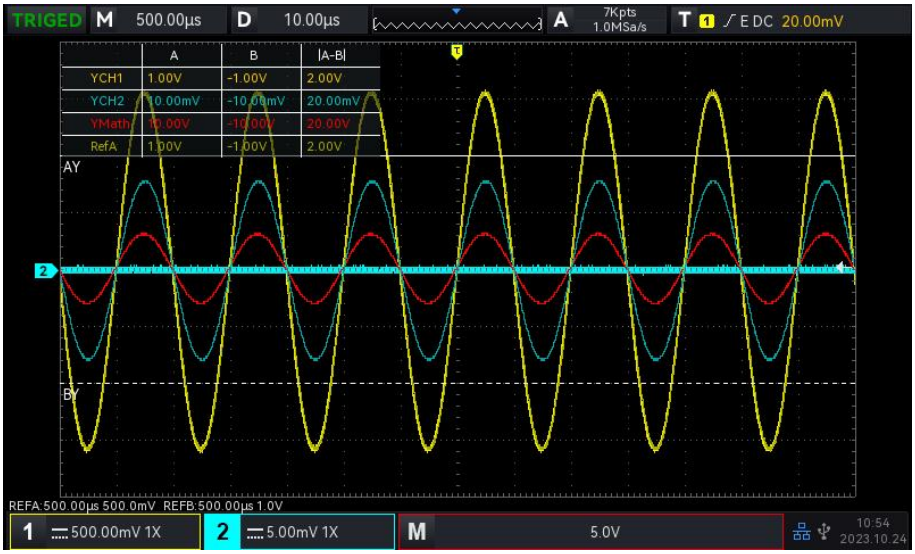


Figure 9-2

The cursor measurement display frame in top left corner: “Y” indicates the voltage measurement results, adjusting the vertical position of AY, BY cursor by the Multipurpose rotary knob to reach the voltage measurement.

9.3 Screen Measurement

Screen measurement supports to set the time cursor and voltage cursor and operate the time measurement and voltage measurement at the same time.

Press the Cursor key to enter the screen measurement menu, operating the screen measurement after the mode and source is selected, as shown in Figure 9-3.

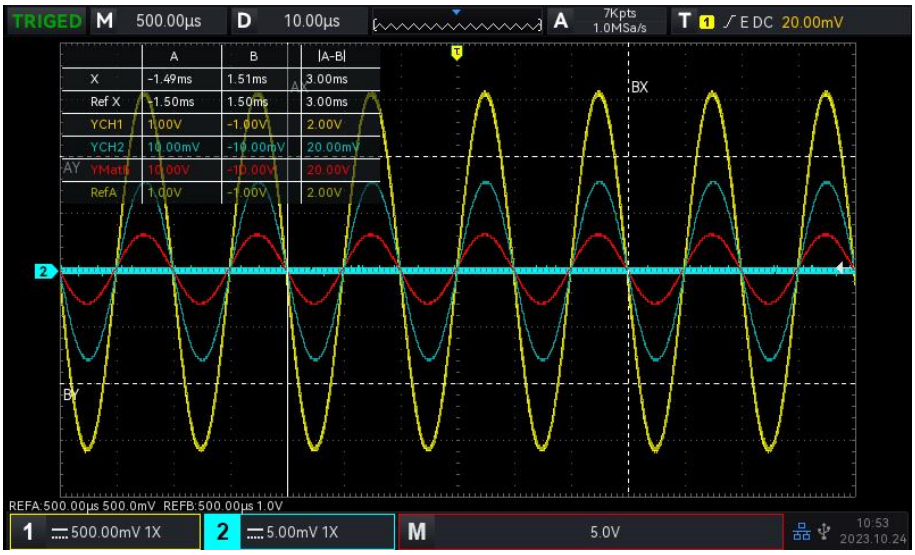


Figure 9-3

The cursor measurement display frame in top left corner: “X” indicates the time measurement results; “Ref X” indicates the time measurement results of reference waveform.

“Y” indicates the voltage measurement results, adjusting the vertical position of AX, BX, AY, BY cursor by the Multipurpose rotary knob to reach the time measurement and voltage measurement.

10. Sampling System

- Sampling Rate
- Acquisition Mode
- Storage Depth

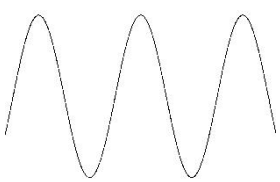
Sampling is the conversion of the signal from an analog input channel, through an analog-to-digital converter (ADC), into a discrete point.

Press the Acquire key to enter the sample menu on the front panel.

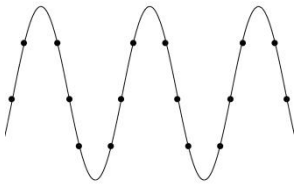
10.1 Sampling Rate

(1) Sampling and Sampling Rate

Sampling indicates that the oscilloscope is take a sample from the input analog signal and convert the sample to digital data, and then gathering the digital data to waveform records. The waveform records will save in the sampling storage.



Analog Input Signal



Sampling Point

Sampling rate indicates the time interval between two sampling points. The maximum sampling rate of UPO1002 series digital phosphor oscilloscope is 1 GS/s.

The sampling rate will be affected by the change of the timing scale and storage depth. The sampling rate is displayed in real-time in the status bar on the top of the screen. The horizontal time base can be adjust by the horizontal Scale rotary knob or change by adjust “Storage depth”.

(2) Effect of Low Sampling Rate

- Waveform Distortion: Due to low sampling rate, the details of the waveform might be missing, the sampled waveform might have large different than the actual signal, as shown in Figure 10-1.

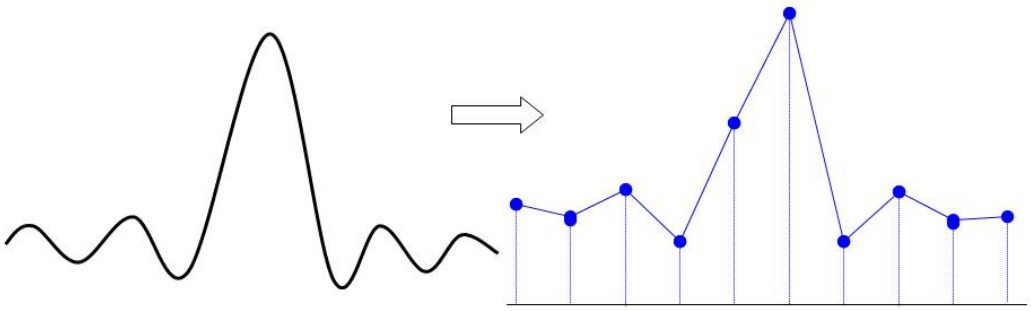


Figure 10-1

- Waveform Aliasing: Since the sampling rate is 2 times lower than the actual signal frequency (Nyquist frequency), the waveform frequency is less than the frequency of actual signal when sampling data is reconstructing, as shown in Figure 10-2.

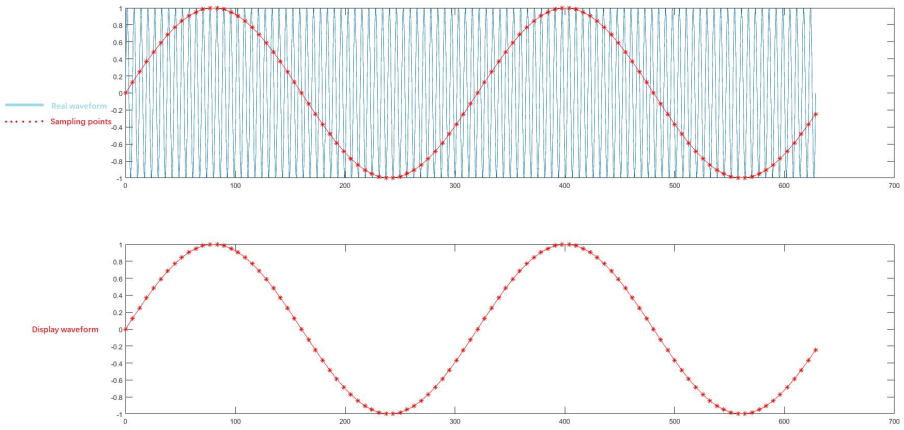


Figure 10-2

- Waveform Missing: Due to the low sampling rate, the waveform does not reflect all the actual signals, as shown in Figure 10-3.

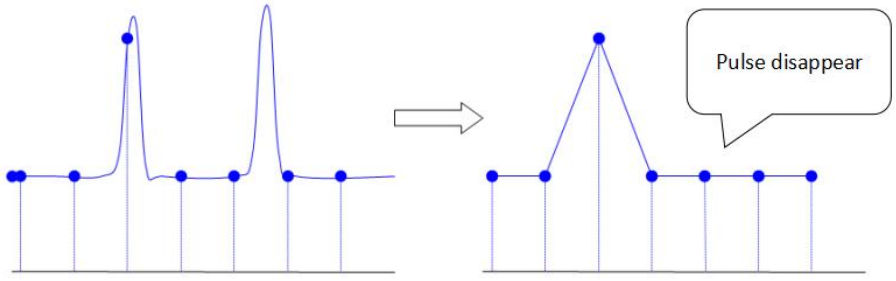


Figure 10-3

10.2 Acquisition Mode

Acquisition mode is used to control the oscilloscope to generate the waveform by the sampling point. Press Acquire Sampling Mode to select the acquisition mode.

(1) Normal Sampling

The oscilloscope samples the signal and reconstruct the waveform with equal time interval in normal mode. For the most of waveform, this mode can produce the optimal display effect.

(2) Peak Sampling

The oscilloscope finds the maximum and minimum of the input signal from every sampling interval and using these value to display the waveform. Thus, the oscilloscope can get and display the narrow pulse, otherwise, these narrow pulse will be missed in normal sampling. In this mode, the noise will also look larger.

(3) High Resolution

The oscilloscope averages the adjacent point of sampling waveform, it can reduce the random noise of input signal and generate a smoother waveform on the screen.

(4) Average

The oscilloscope obtains several waveforms and calculate its averaged value, and then display the final waveform. This mode can reduce the random noise.

To observe the waveform by changing the acquire method. If the signal contains large noise, the waveform does not averaged and the waveform adopts 32 times averaged as shown in the following figure.



Not Averaged Waveform Waveform of 32 Times Averaged

Notes: Average and high resolution uses different average methods. The former is multiple sampling averaged, the latter is single sampling averaged.

10.3 Storage Depth

The storage depth is the number of waveform that can be stored in the oscilloscope during a trigger acquisition. It reflects the memory storage capacity of the memorizer.

The relation of storage depth, sampling rate and waveform length should meet the calculating formula:

storage depth = sampling rate×horizontal time base×the number of grid of horizontal direction

The maximum storage depth of UPO1002 is 56 Mpts. In Acquire menu, user can freely to set the storage depth to auto, 7 k, 70 k, 700 k, 7 M, 28 M, 56 M. The default setting is auto.

11. Display System

Display can set the display type of waveform, display type of grid, grid brightness, waveform brightness, background brightness, persistence time, color temperature, anti-color temperature, menu display and transparency.

11.1 Display Type

In DISPLAY menu, it can select the waveform display in vector or point.

1) Vector: This mode provides the most realistic waveform in most cases and makes it easy to view the steep edges of the waveform (e.g. square wave)

2) Point: Displays sampling points directly.

11.2 Grid Type

The grid type can be set in DISPLAY menu, including full grid, grid, cross curve and frame.

11.3 Grid Brightness

The grid brightness can be set in DISPLAY menu, rotating the rotary knob to set the grid brightness. The default is 50%.

11.4 Waveform Brightness

The waveform brightness can be set in DISPLAY menu, rotating the rotary knob to set the background brightness. The default is 50%.

11.5 Background Brightness

The background brightness can be set in DISPLAY menu, rotating the rotary knob to set the background brightness. The default is 50%.

11.6 Persistence Time

The persistence time of waveform can be set in DISPLAY menu, the persistence time can set to

the minimum, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s , infinite persistence and DSO. The default value is the minimum.

11.7 Color Temperature

Open the color temperature in DISPLAY menu, it can be intuitively reflect the probability of the occurrence of waveform signals. The waveform with high frequency is displayed in warm color, and the waveform with low frequency is displayed in cold color.

11.8 Anti-color Temperature

Open the anti-color temperature in DISPLAY menu, it is the opposite of color temperature function.

11.9 Menu Display

Menu Display menu can set the display time of menu, it can set to 5 s, 10 s , 20 s, manual. The default set is manual.

11.10 Transparency

Set the transparency popups, it can set to ON or OFF. It’s valid for all popup. The default set is ON.

12. Storage and Recall

- Storage and Reload Settings
- Waveform Storage
- Reload Waveform
- Recording Convert to Video
- Picture Storage
- File System

With the storage function, user can save the oscilloscope's settings, waveforms, screen images and recording videos to the oscilloscope’s local or external USB storage devices, and the saved settings or waveforms can be load for use in any time. Press the Storage key to enter the storage function setting interface.

12.1 Storage and Reload Settings

Table 12-1 Storage Setting Menu

Function Menu	Setting	Description
Type	Setting	
File Path	Local	Press the save key, the setting will be saved in the oscilloscope’s local. (The saved path refers to File Management.)
	USB	Select to save in USB, press the save key, the setting will be saved in external USB. (The saved path refers to File Management.)
Filename		Press the filename soft key to pop out the virtual keyboard, adjusting the Multipurpose rotary knob to select letter and digit. The default filename is UNIT001. Rotating the Multipurpose knob to directly change its number.
Save		Executing the save operation and save the setting in .dat format to the specified storage location.
Reload		Enter the file management interface to select the file path and loading .dat file. Making the oscilloscope return to the previously saved setting state. (The saved path refers to File Management.)

12.2 Waveform Storage

Table 12-2 Waveform Storage Menu

Function Menu	Setting	Description
Type	Waveform	
Source	CH1, CH2	Set which channel waveform to be saved.
File Path	Local	Press the save key, the waveform will be saved in the oscilloscope’s local. (The saved path refers to File Management.)
	USB	Select to save in USB, press the save key, the waveform will be saved in external USB. (The saved path refers to File Management.)
File Type	.wav	Save the waveform file, the suffix is .wav. It can save to Local or USB.
	.csv	Save the waveform data, the suffix is .csv. It can save to Local or USB.
Filename		Press the filename soft key to pop out the virtual keyboard, adjusting the Multipurpose rotary knob to select letter and digit. The default filename is UNIT001. Rotating the Multipurpose knob to directly change its number. (The saved path refers to File Management.)
Save		Executing the save operation and save the waveform in .wav or ,csv format to the specified storage location.

After the waveform is saved, user can select the Ref key in vertical control area on the front panel to reload the waveform. Press the Ref key to enter the reload menu of reference waveform as the following.

12.3 Reload Waveform

Press the Ref key to enter waveform reloading.

Table 12-3 REF Waveform Load Menu

Function Menu	Setting	Description
Reference	Ref-A, Ref-B	Select any one of REF to reload waveform.
File Path	Local	Select the waveform file form the local, and press the REF key to reload the waveform from the internal of the oscilloscope. (The saved path refers to File Management.)
	USB	Select the waveform file form USB, and press the Load key to reload the waveform from the external USB. (The saved path refers to File Management.)
Reload		Press the REF key to pop out “File Management”, rotating the Multipurpose rotary knob to select the waveform file from the saved path. Press the “Load” key to reload the waveform display on the screen.
Delete		Close the waveform of current REF.

Quick Reference		Select the waveform of activated channel at the current to quickly perform reference reload, but not save the waveform data.
Clear All		Turn off all REF waveforms.

Reload Ref waveform as shown in Figure 12-1.

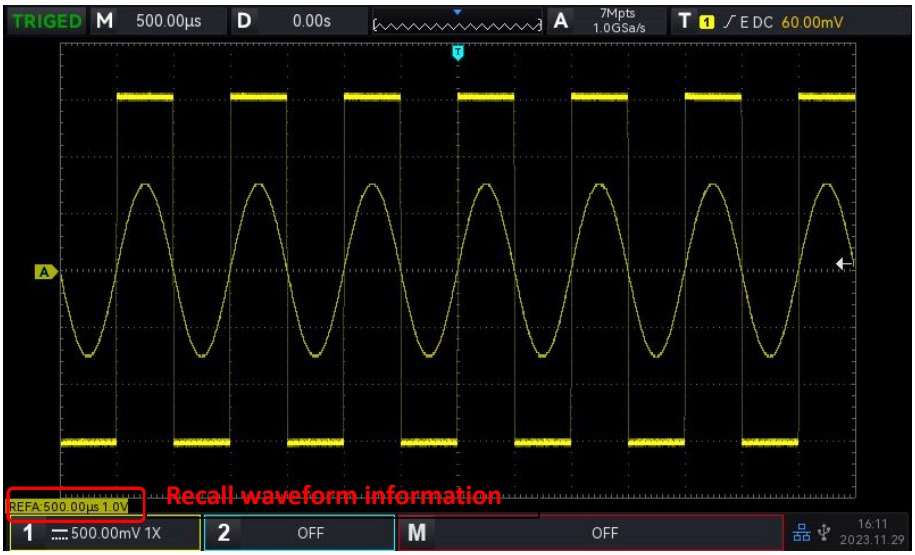


Figure 12-1

After reload the waveform, the Ref waveform status will be displayed in the left lower corner, including the time base scale and amplitude scale. User can use the rotary knob on VERTICAL and HORIZONTAL control area on the front panel to adjust the Ref waveform position, volts/div scale and the time base scale.

Remark

- Only when an external USB is connected to the oscilloscope, user can only select USB in saved path, and then save the settings to the USB. USB will display grey when USB is not connected.

12.4 Recording Convert to Video

When the recording waveform is completed, the recorded waveform can convert to video and save it to USB. If there are no recorded waveform, this function displays gray.

Table 12-4 Recording Convert to Video

Function Menu	Setting	Description
Type	Recording convert to video	Save the recorded waveform in .mp4 format to USB, it can display in PC directly.
Frame/s		Frames saved per second, rotating the Multipurpose knob or

		virtual numeric keyboard to set, the maximum can be set to 30.
Start Frame	Start the conversion of video	Start the conversion of video from a frame, rotating the Multipurpose knob or virtual numeric keyboard to set the start frame.
End of Frame	Stop the conversion of video	Stop the conversion of video from a frame, rotating the Multipurpose knob or virtual numeric keyboard to set the end of frame.
Saved Path	USB	Select USB in saved path, press the save key, the video will be saved in external USB and it can only save in USB. (The saved path refers to File Management.)
Filename		Press the filename soft key to pop out the virtual keyboard, adjusting the Multipurpose rotary knob to select letter and digit. The default filename is Video001. Rotating the Multipurpose knob to directly change its number.
Save		Executing the save operation and save the waveform to the specified storage location of USB.

12.5 Picture Storage

Table 12-5 Picture Preview Menu

Function Menu	Setting	Description
Type	Picture	
Mode	Original picture	Oscilloscope’s screenshot is saved in the color displayed on the oscilloscope interface.
	Save ink	Oscilloscope’s screenshot will turn the dark background into light color for storage, the purpose is saving ink to printing photos.
	Greyscale	Oscilloscope’s screenshot will turn the color picture to greyscale picture for storage.
	Save ink & greyscale	Oscilloscope’s screenshot will turn the dark background into light color, turn color picture to greyscale picture for storage.
Format	.bmp	Save the picture in .bmp format.
	.jpeg	Save the picture in .jpeg format.
	.png	Save the picture in .png format.
Filename		Press the filename soft key to pop out the virtual keyboard, adjusting the Multipurpose knob to select letter and digit. The default filename is UNIT001. Rotating the Multipurpose knob to directly change its number.
File Path	USB	Select USB in saved path, press the save key, the picture will be saved in external USB and it can only save in USB. (The saved path refers to File Management.)
Picture Preview	ON	Open the picture preview function, switch the picture in the current path by“Up”, “Next”. Press other function key to automatically turn off the

		picture preview function.
	OFF	Close and exit the picture preview.
File Path	USB	Select the file path for the picture preview, it can only preview the picture in the current path and not display the picture in submenu or the upper level.
Save		Executing the save operation and save the waveform according to the set mode and format to external USB.
Esc		Close the picture preview function.

12.6 File Management

Wen select “Storage path/File path”, the path popups will be displayed. It can freely select the saved path, file path and new file. User can save the file to local/USB root directory or select the specified directory or create a new file and rename it. Open file system popups to set disk selection, file type, new file and delete.

Table 12-6 Save File Management

Disk Selection	Local	Select to save in local, press the save key, the waveform will save to the local path of the oscilloscope.
	USB	Select to save in USB, press the save key, the waveform will save to external USB.
File Type	All file	Display all file type by default, “.wav, .csv, .dat, .bmp, .jpeg, .png, .mp4, .zip”
New File		Create a new file in the selected directory, the file can be rename in filename popups.
Delete		Delete the file or folder that is currently selected and highlighted by the cursor.
Confirm		Confirm the selected path and exit the file system.。

Table 12-7 Reload File Management

Disk Selection	Local	Select the local path and reload the file from the local path.
	USB	Select the USB path and reload the file from the file in USB.
File Type	.wav	In Ref (reload) function, select .wav by default and only display the file with .wav format. User can be freely select other formats, but they are view-only and do not support reload.
	.dat	In Ref (reload) function, select .dat by default and only display the file with .dat format. User can be freely select other formats, but they are view-only and do not support reload.
	.bmp/.jpeg/.png	In picture preview function, select .bmp/.jpeg/.png and only display the picture with .bmp/.jpeg/.png format. User can be freely select other formats, but they are view-only and do not support preview.
Reload		When Ref (reload), setting file is visible, that is loading the current file and exit the file management. (Press the Multipurpose rotary knob has the same

		effect.)
Confirm		When picture preview file is visible, that is confirm the file in the current path and exit the file management.

13. Auxiliary Function

- System Function
- System Update
- Web Access

Press the Utility key on the front panel to enter the auxiliary function setting menu.

13.1 System Function

(1) Automatic Calibration

Automatic calibration allows the oscilloscope to work optimally to obtain the most accurate measurements. This function can perform at any time, especially when the ambient temperature range reaches or exceeds 5°C. Before performing the automatic calibration operation, make sure that the oscilloscope is operating for more than 20 minutes. The automatic calibration operates for analog channel, the calibration time is 3~5 minutes.

(2) System Information

System Information can view the system information of the oscilloscope, including the manufacturer, model, serial number, software version number, hardware version number, logical version number, website, web user’s name and password.

(3) Language

Language can set system language. It displays the current setting by default.

(4) Square Output

Square Output can set the output frequency for the local square waveform, which can set to 10 Hz, 100 Hz, 1 kHz or 10 kHz. The default setting is 1 kHz.

(5) Output Selection

Output Selection can set AUX OUT port to output which signal, it can select “trigger”, “pass/fail test” and “DVM”. When “trigger” is selected, AUX OUT port outputs the trigger synchronizing signal; when “pass/fail test” is selected, AUX OUT port outputs the output signal that pass test; When “DVM” is selected, AUX OUT port outputs DVM alarm signal. The default setting is “trigger”.

(6) Delete Data

Delete Data can delete all waveform, setting file that save in the instrument.

(7) Network Setting

When the device is connected with available internet line, IP setting can set oscilloscope’s IP, subnet mask and default gateway.

a. Mode: In IP setting, IP can access by manual or automatic. The default setting is automatic.
Manual: Set IP address, subnet mask and default gateway by manual.
Auto: Only for checking IP address, subnet mask and default gateway.

b. IP Address: IP address format is nnn.nnn.nnn.nnn, the first nnn range is from 1 to 233, the other three nnn range is from 0 to 255. It is recommended that user can consult network administrator for an available IP address.

c. Subnet mask: The format is nnn.nnn.nnn.nnn, the nnn range is from 0 to 255. It is recommended that user can consult network administrator for an available subnet mask.

d. Gateway: The gateway format is nnn.nnn.nnn.nnn, the first nnn range is from 1 to 255, the other three nnn range is from 0 to 255. It is recommended that user can consult network administrator for an available gateway address.

(8) Time Setting

User can be independently set the year, month, date, time, minute, press the Time Setting key can switch the set item. After the set is completed, the oscilloscope’s time will display the set time.

(9) Boot-up Loading

Boot-up Loading can set whether to automatically set the settings before the shutdown when the oscilloscope starts up. It can set the last setting or the default setting.

- Last setting: Load all the settings before shutdown.
- Default setting: Restore the oscilloscope to the default factory setting before boot up.

13.2 System Update

This series uses USB update program to update, that is boot-up checking USB update.

The update step as the following.

a. Press Utility key to enter the auxiliary function menu, press system key to check the system information to find the model name, software and hardware version information.

b. Download the update file from UNI-T official website or ask UNI-T distributor to provide the update file. The update file is the same as the model and hardware version of the instrument, the software version is higher than the version of the instrument. Save the update file in the root directory of the USB.

c. When the instrument is in the shutdown state, insert USB and turn on the instrument, press soft boot-up key, self-checking and process the update.

d. The update process needs to wait for 5 minutes. After the update is completed, turn off the instrument and plug out USB.

e. Reboot the instrument to check whether the system information is same as the provided version. If it is the same that means the update is successful.

Notes: Please ensure that the power is not turned off during the entire upgrade process, it is to avoid failure to reboot due to incomplete system upgrade content.

13.3 Web Access

(1) Access Local Area Network

The computer and the oscilloscope should be under the same LAN. Check the IP address through the UTILITY menu of the oscilloscope, and then the browser accesses the oscilloscope by IP.

Example:

Computer IP: 192.168.42.3

Oscilloscope IP: 192.168.42.12

PC browser using 192.168.42.12 to access the oscilloscope

View the basic information, as shown in Figure 13-1.

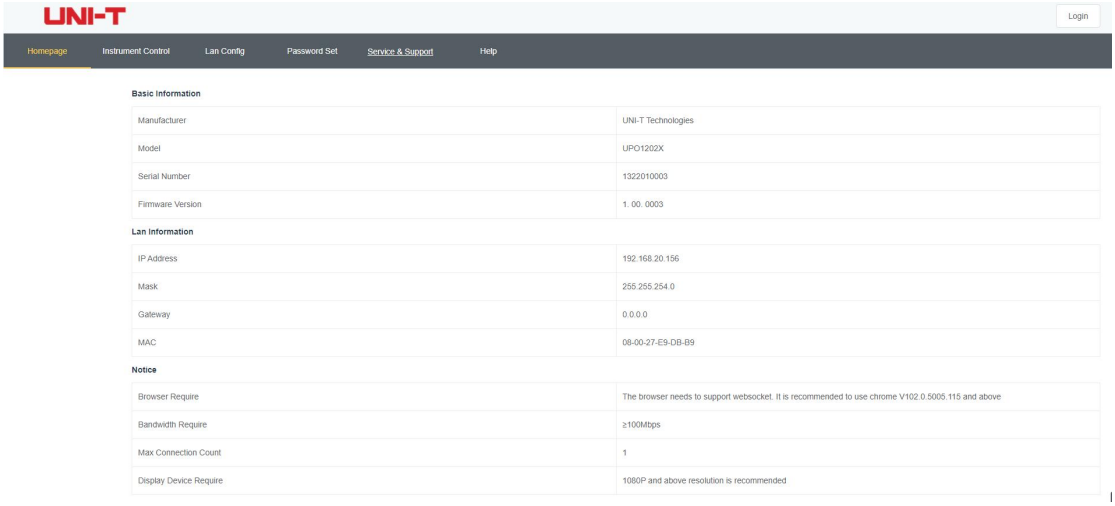


Figure 13-1

Log in to check the instrument setting, network setting and password setting. Web user name and password see Utility/System Information. View the waveform and control, as shown in Figure 13-2.

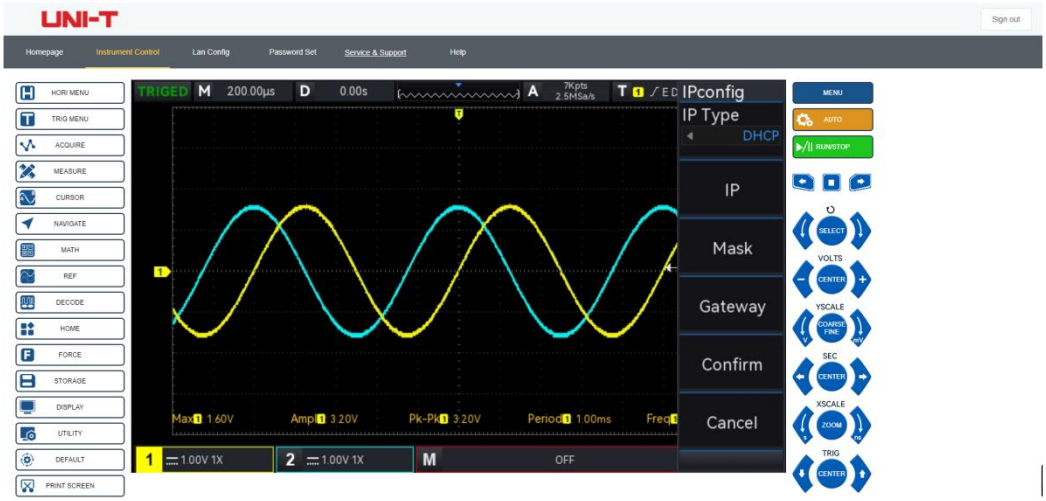


Figure 13-2

In Web page, click the corresponding key and knob to control the oscilloscope. Multiple operating can be set in screen of the oscilloscope, such as

a. Drag waveform cursor to adjust the vertical position of the waveform; drag the trigger position cursor to adjust the trigger position.

b. Click the channel to switch/turn on/off the current channel

c. Use mouse wheel to adjust the amplitude volts/div scale at the channel

d. Use mouse wheel to adjust the time base scale in time base position (M)

e. Slide to left and right to adjust the pretrigger position in D display area.

f. Click the menu to directly adjust the setting option.

Note: File system is not support operate by mouse, only Multipurpose rotary knob can be switch and select.

The network setting information of the oscilloscope, as shown in Figure 13-3.

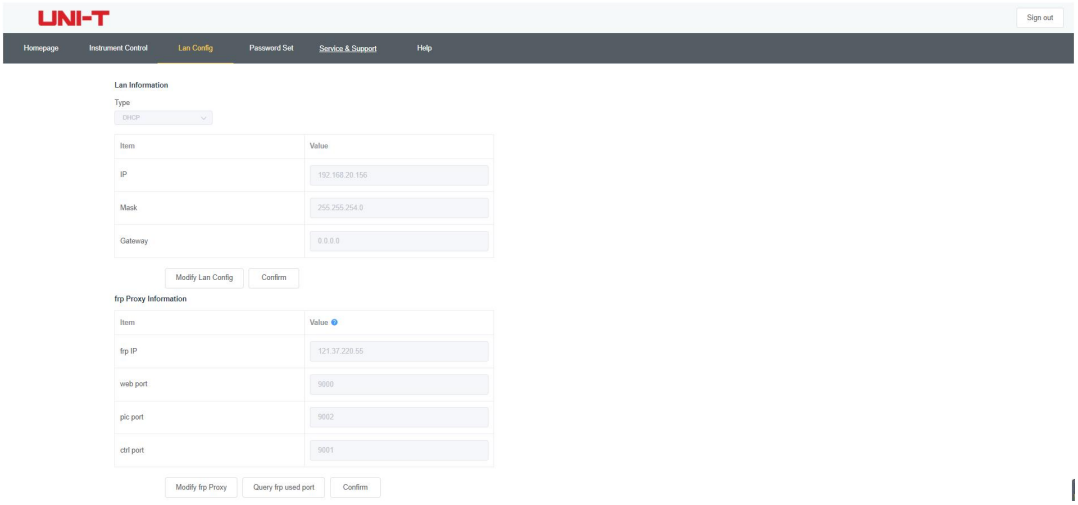


Figure 13-3

(2) Access Outer Network

a. Plug the network cable into the oscilloscope and the network can be access to internet.

b. Open frp proxy service on the server.

c. Configure the oscilloscope’s frp proxy IP and port

d. The browser can access the proxy IP: web_port, and the access interface is consistent with the above.

Notes: This oscilloscope uses frp intranet penetration way to achieve external network access. frp version is 0.34.0. This machine with frp-0.34.0 client, it need use with the server, the server needs to open frp server, the client connects to the frp server port is 7000, so the server needs to configure bind_port = 7000.

(3) Network Parameter Setting

a. Local area network setting

It should log in to access the network setting of the oscilloscope, web user name and password see Utility/System Information. The setting interface as shown in Figure 13-4.

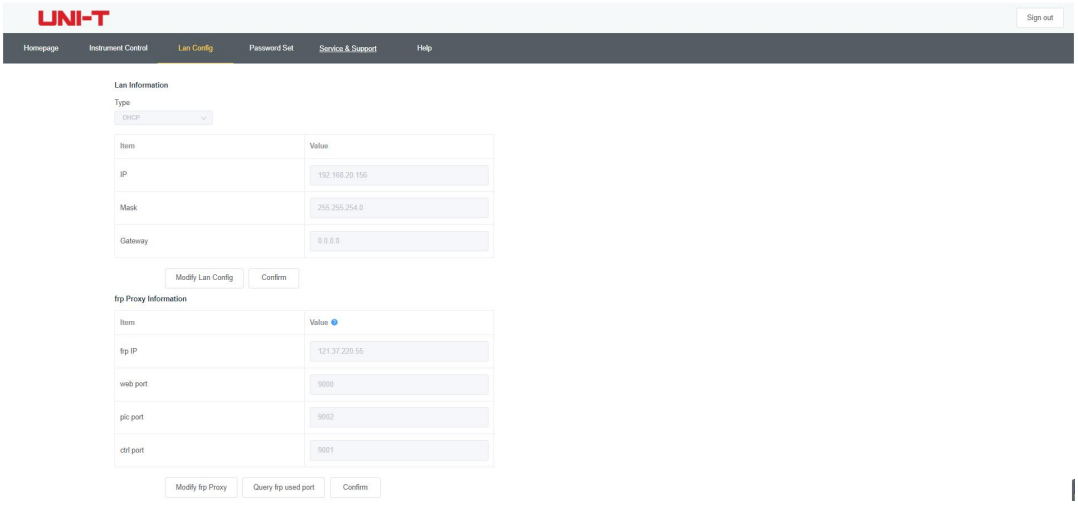


Figure 13-4

Internet information setting includes IP address acquisition method (dhcp/static), local IP address, subnet mask and gateway. If IP setting is DHCP, it not need to fill in the configuration IP address, subnet mask and gateway, click the confirmation directly. If IP setting is STATIC, it should fill in the correct IP address, subnet mask and gateway, and then click the confirmation, as shown in Figure 13-5.

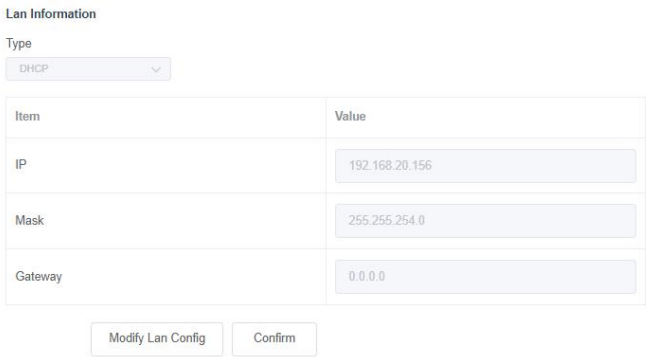


Figure 13-5

Click the confirmation after the input is completed, it can be continuously access according to the new modified IP address information (in correct configuration).

b. frp proxy network information setting

The setting interface setting as shown in Figure 13-6.

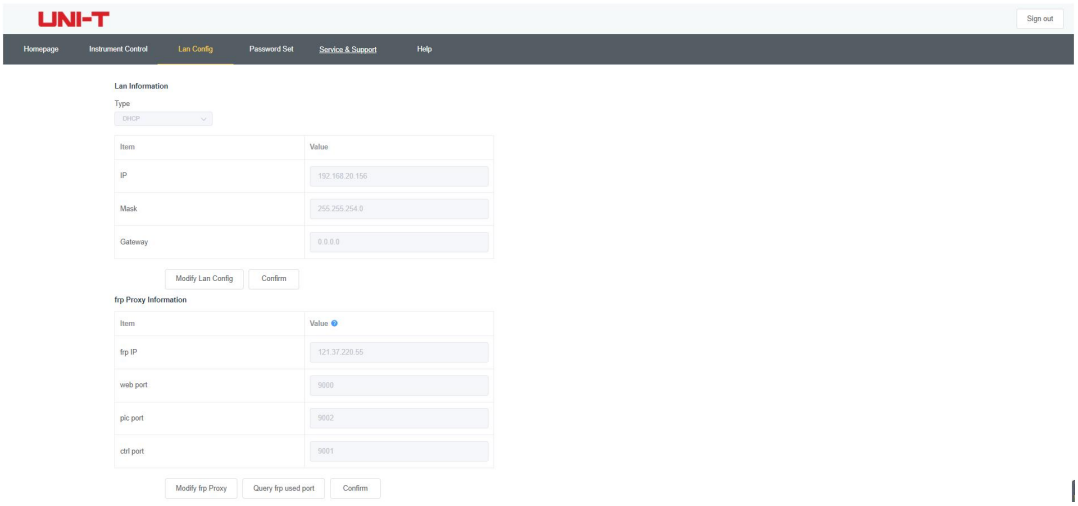


Figure 13-6

It includes frp proxy network server IP address, web_port, pic_port proxy port and ctrl_port proxy port. Click to change the frp setting, which is to edit proxy IP address, web_port, pic_port, ctrl_port, as shown in Figure 13-7.

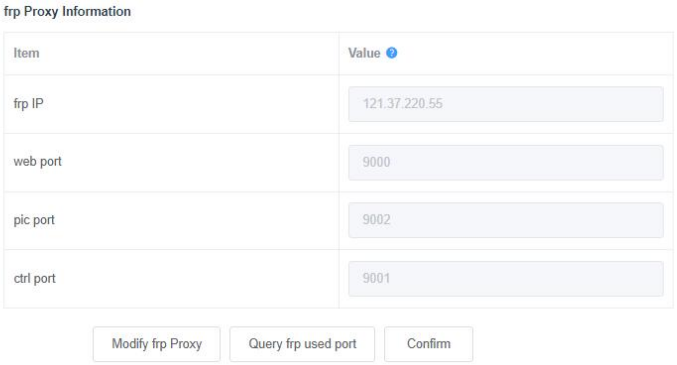


Figure 13-7

Click the confirmation after the input is completed, it can be continuously access according to the new modified frp proxy IP address information (in correct configuration).

Notes: If each oscilloscope is connect with the same frp server, then web_port, pic_port, ctrl_port of each oscilloscope should be consistent, otherwise, frp proxy fails and cannot access. When frp proxy is modified, it cannot access by local area network IP. If user need to recover the normal access, press the Default key on the oscilloscope panel to reset the configuration and then use IP to access.

(4) Password Setting

Password setting is for the user account to log in. After the user changes the login password, the user needs to use the new password for the next login. If you forget the password, reset the password by pressing the Default key on the oscilloscope panel.

(5) Service and Support

Click service and support can connect to UNI-T official website for more product’s information.

14. HOME

- Frequency Meter
- Waveform Recording
- Pass/Fail Test
- Digital Voltage Meter
- Help
- Automatic Setting
- Self-test

14.1 Frequency Meter

The state of Frequency Meter can set to ON or OFF. When it sets to ON, a Freq popups will display on the top of the screen, it displays the current frequency meter information of trigger source. When it sets OFF, a Freq popups will disappear. The default state is ON.

Frequency meter is the counter of trigger event frequency in trigger channel. It is a 6 digits hardware frequency meter.

14.2 Waveform Recording

Waveform Recording can set recording setting, Fast Acquire, recording, stop and playback.

(1) Recording Setting

Set the parameter setting for the waveform recoding, including recording interval, end of frame and play delay.

a. **Recording interval**: Set the time interval between each frame of waveform recording. Recording interval will not be valid when Fast Acquire is open.

b. **End of frame**: The waveform recording will be automatically stop when it reaches the end of frame.

c. **Playback delay**: Set the time interval between each frame of waveform playback.

(2) Recording

Start to record the waveform.

(3) Stop

Stop the waveform recording.

(4) Playback

Place back waveform, it can pause by Multipurpose rotary knob and play the specified frame.

(5) Fast Acquire

Quick recording, which is continuously recording waveform. It is for improving the capture rate of waveform. The waveform is not displayed on the screen during Fast Acquire mode. It can only be play backed after the recoding is completed. This mode can set ON or OFF.

14.3 Pass/Fail Test

Pass/Fail test can set the template and judgment condition to perform Pass/Fail test, which can set allow to test, output, source, operation, template setting and stop setting.

The Pass/Fail uses a template to detect whether the input signal within the range of the template requirements. If the input signal exceeds the limited range of the template, the test will be judged as failed.

(1) Allow to test

Allow to test is to select whether perform test or not.

ON: turn on to set and perform the test.

OFF: not allow to perform the test.

When allow to test function is opened, the test information will display on the top corner of the screen by default, test information as show in the following figure.



Total Wfs represents the total frame number that has tested;

Pass Wfs represents the frame number that has passed;

Fail Wfs represents the frame number that has failed.

(2) Output

Set which signal output by AUX port, it can set pass or fail.

a. Fail: Set the AUX port on the rear panel of the oscilloscope to output pulse when the test is “fail” and produce beeps.

b. Pass: Set the AUX port on the rear panel of the oscilloscope to output pulse when the test is “pass” and produce beeps.

(3) Source

The source is set to compare to the template. The source can only select the channel that is consistent with template reference waveform.

(4) Stop

Set the stop condition for the test. The test will be automatically stop when the stop condition is met.

Table 14-1 Condition Setting

Function Menu	Setting	Description
Stop Type	Pass count	Set the Pass Test function to automatically stop the test after the pass frame reaches to the pass count of the specified threshold.
	Fail count	Set the Pass Test function to automatically stop the test after the fail frame reaches to the fail count of the specified threshold.
Condition	>=, <=	Stop condition
Threshold		Adjusting the Multipurpose rotary knob to set the threshold of stop condition. The range can set 1~30000. The default value is 100.

(5) Template Setting

Template setting is to set the template for the test. CH1 is used as the reference waveform template by default when pass test function is enabled. If the waveform is within the template range, then the output is successful. If the waveform exceeds the template range, then the output is failed.

Table 14-2 Template Setting

Function Menu	Setting	Description
Reference Waveform	CH1,CH2	To specify a channel waveform from one of CH1 ~ CH2 and set it with reference waveform, horizontal and vertical tolerance to be the condition for creating the template.
Horizontal Tolerance	1 ~ 100	Adjusting the Multipurpose rotary knob to set the horizontal tolerance for the template. The default value is 5.
Vertical Tolerance	1 ~ 100	Adjusting the Multipurpose rotary knob to set the vertical tolerance for the template. The default value is 5.

(6) Operation

After all above setting is completed, press operation key to run the pass/fail test.

14.4 Digital Voltage Meter

UPO1002 series has built-in DVM (digital voltage meter), it can measure the voltage of effective 4 digits in any analog channel. DVM measurements are asynchronous with the acquisition system of the oscilloscope and are always operating the acquisition. User can set DVM setting, including voltage meter state, source, mode and limit setting.

(1) Digital voltage meter: set the voltage meter state to ON or OFF.

a. ON: open the voltage meter measurement, DVM popups will display in left top of the screen, it displays the measured results of DVM.

b. OFF: turn off the voltage meter measurement.

(2) Source: set the source for the digital voltage meter measurement, it can set CH1, CH2.

(3) Mode: DC, AC TRMS and AC&DC.

(4) Limit setting: it can set the limit of alarm, the limit condition, and the lower and upper limit of voltage

a. Limit of alarm: ON or OFF

ON: turn on the alarm function, the oscilloscope will sound an alarm if the measured results is met the condition; otherwise, the oscilloscope will not sound an alarm.

OFF: turn off the alarm function.

b. Limit condition: < , > , ≤ ≥, > < .

> : The oscilloscope will sound an alarm when the measured DVM value is greater than the lower limit of voltage. It supports set the lower limit of voltage.

< : The oscilloscope will sound an alarm when the measured DVM value is smaller than the upper limit of voltage. It supports set the upper limit of voltage.

≤ ≥: The oscilloscope will sound an alarm when the measured DVM value is greater than and equal to the lower limit of voltage and when the measured DVM value is smaller than and equal to the upper limit of voltage. It supports set the upper and lower limit of voltage.

> < : The oscilloscope will sound an alarm when the measured DVM value is smaller than the lower limit of voltage or greater than the upper limit of voltage. It supports set the upper and lower limit of voltage.

b. Upper/Lower limit of voltage

The voltage value is compared with measured value of DVM. The range can set -100V~100V.

14.5 Automatic Setting

Autoset （automatic setting/hold）

Hold: keep the previous settings

Automatic: not save the previous settings

(1) Acquisition setting: the acquisition mode and average time will not be changed in hold mode.

(2) Trigger source: the trigger source and trigger coupling will not be changed in hold mode. Other setting restores to edge trigger, automatic, rising edge.

(3) Activated channel: the switch state of the previous channel will not be changed in hold mode.

14.6 Self-test

Self-test includes screen test, button test and LED test, it mainly used to check the oscilloscope whether has color deviation, the respond of button and rotary knob is normal, indicator of partial key is illuminate and its electric or machinery faults.

(1) Button Test

Button test is used to find out if key or rotary knob on the front panel is no respond or insensitiveness. Press button test, the oscilloscope will enter the interface as shown in Figure14-1.

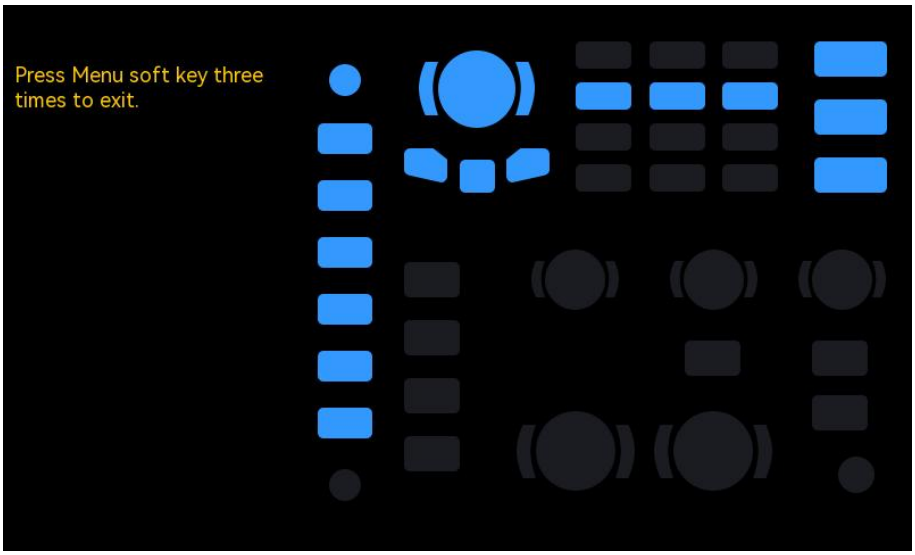


Figure14-1

Button test goes from up and down, left to right, rotating and pressing the rotary knobs to left or right in sequence to observe whether the corresponding knob on the figure is illuminated. Button test goes from up and down, left to right, pressing the key to left or right in sequence to observe whether the corresponding keys on the figure is illuminated.

After all buttons and rotary knobs are tested, press the “Menu” key three times to exit the button test according to the screen tips.

(2) LED Test

LED test is used to find out whether the key’s indicator is illuminate and the brightness is in good condition. Press LED test, the oscilloscope will enter the interface as shown in Figure14-2.

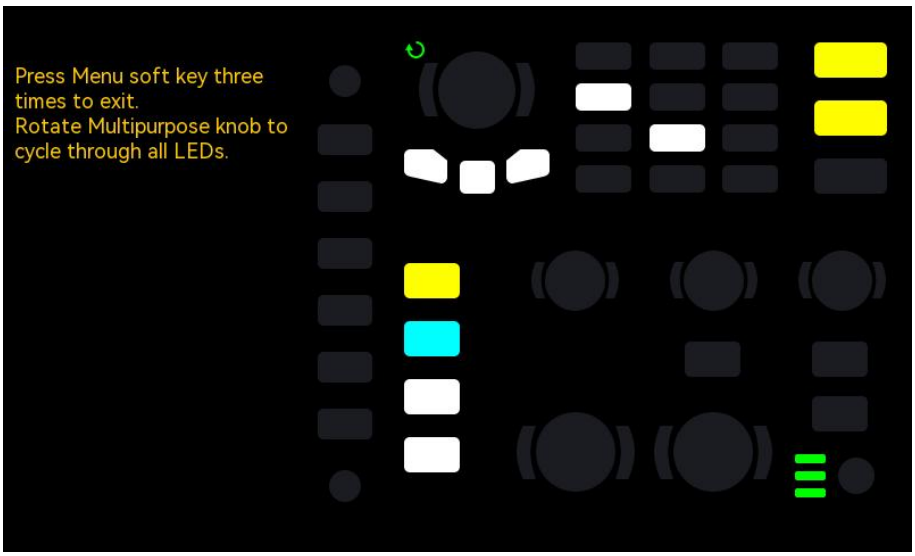


Figure14-2

Enter LED test, LED of the default RUN key will be illuminated, the first LED on the front panel will be illuminated and the corresponding position of the key on the screen will also be illuminated after rotating the Multipurpose rotary knob. Continue to rotating the Multipurpose rotary knob can switch to next LED. Follow the sequence to rotating the Multipurpose rotary knob until all key’s indicator are tested. Observing whether all LED on the front panel are illuminated in real-time. After the LED test is finished, press the “Menu” key three times to exit the LED test according to the screen tips.

(3) Screen Test

Screen test is used to find out whether the oscilloscope has serious color deviation, stain or screen scratch. Press screen test, the oscilloscope will enter the interface as shown in Figure 14-3, the screen is pure black.



Figure 14-3

Press arbitrary key to switch to red, green, blue or white screen display mode. To observe whether the screen has serious color deviation, stain or screen scratch in each color display mode. When the display mode switches to the white, press arbitrary key to exit screen test.

15. Protocol Decoding

- RS232 Decoding
- I²C Decoding
- SPI Decoding

15.1 RS232 Decoding

RS232 is asynchronous transmission standard interface established by Electronic Industries Association. It usually includes two application formats DB-9 or DB-25. It suitable for the communication that the data transmission rate within the range 0~29491200/s and it widely used in microcomputer interface.

The data to be transmitted are combined into a specified set of serial bits according to the protocol rules and send it in asynchronous serial way.

The data to be transmitted for each time, composing by the following rules:

Send one start bit at first, and send 5~8 data bits, and send optional parity check bit, and send one or two stop bits at last. The number of data bits is agreed by both communicating parties, it can be 5~8 bits, no parity check bit or odd parity check bit or even parity check bit, stop bit can be set to one bit or two bit. One data string transmission will be called a frame, as shown in Figure 15-1.

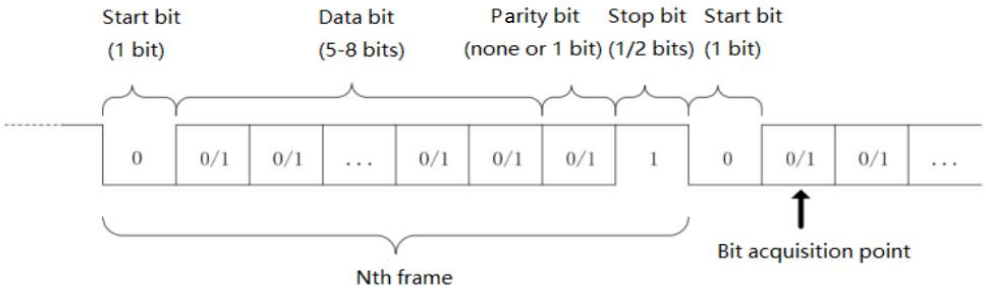


Figure 15-1

RS232 decoding supports the horizontal menu to set the parameter and data storage.

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu. In pull-down list, rotate the Multipurpose rotary knob to switch the menu option and modify the value. In RS232 decoding, the

user-defined baud rate can be adjusted by numerical keyboard or press  below Multipurpose rotary knob to open the numeric keyboard to quickly set the user-defined baud rate.

(1) Parameter Setting

1. Source

Select the trigger source to CH1, CH2. The selected source will display in right top corner of the screen.

Notes: Only the channel that has been connected to the signal and be trigger source can get stable trigger and correct decoding.

2. Baud Rate

In RS232 trigger, the communication is asynchronous transmission. During the transmission, no accompanying clock signal, so as to solve the judgment of data bits, the protocol rule requires that the baud rate should be agreed by both communicating parties. Generally, the definition of baud rate is the baud rate bit can be transmitted within 1s. For example, 9600 bps indicates 9600 bits can be transmitted within 1s. It's worth to note that the start bit, data bits, check bit and stop bit are all as the bit, so the baud rate is not directly equal to the effective data transmission rate.

The oscilloscope will sample bit according to the setting. Baud rate can select to 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, 128000 bps, 230400 bps, 460800 bps, 921600 bps, 1382400 bps, 1843200 bps, 2764800 bps or user-defined. The user-defined baud rate can be adjusted by Multipurpose rotary knob or numerical keyboard.

It's recommended that user sets RS232 according to the hardware and software. RS23S is subject to the basic model of the communication protocol, it usually used in short distance (below 20m) and low speed (below 1 Mbps) transmission occasions. Beyond the range, the communication is susceptible to interference and becomes unreliable.

3. Polarity

Rotate the Multipurpose rotary knob to select the polarity, it can be set to positive or negative.

a. Negative: Adverse logical level polarity, that is the high level is 0, the low level is 1.
b. Positive: Normal logical level polarity, that is the high level is 1, the low level is 0.

4. Bit Width

To appoint the data bit for RS232 signal to be decoding, it can select to 5 bits, 6 bits, 7 bits

or 8 bits.

5. Bit Sequence

To appoint the data bit for RS232 signal to be decoding whether the MSB (the most significant bit) in front or the LSB (least significant bit) in front. It can select to MSB or LSB.

a. MSB: MSB is transmitted first.

b. LSB: LSB is transmitted first.

6. Stop Bit

Set the stop bit for each data, it can set to 1 bit or 2 bits.

7. Check Bit

Set the parity check method for data transmission, it can select to no parity check bit, even parity check bit or odd parity check bit.

8. Bus Setting

a. Bus state: set decoding bus to ON or OFF.

b. Display format: set the display format for decoding bus, it can set hexadecimal system, decimal system, binary system and ASCII (only RS232).

c. Event list: Display the decoded data, line number, time, data, and check data in the list format for observing the longer decoded data.

d. Vertical position: Adjusting the Multipurpose rotary knob to change the bus display position, the range can set -160 ~ 160.

(2) Data Storage

Save decoded data: Save the decoded data in USB/Storage directory, support to save the setting filename, data in decimal system and support to open by Excel table. It is convenient for checking the decoded results when the decoded data is too much.

15.2 I^2C Decoding

I^2C trigger is usually used to connecting microcontroller and peripheral equipment, it's widely applied in micro-electronics area. This bus protocol has two lines to transmit, one line is serial data SDA, and another line is serial clock SCL. Use master-slave system to communication, which can both-way communication for master and slave computer. This bus is the bus of multiple master, preventing data corruption through conflict demodulation and arbitration mechanisms. It is worth to note that the I^2C bus have two address bit width, 7 bits and 10 bits, 10 bits and 7 bits address are compatible and can be used in combination. SCL and SDA in the I2C bus can both be connect to the positive power by pull-up resistor. When the bus is idle, both lines are high level. When any device

on the bus output the low level, it will make the bus signal become low, i.e., logical "Wire AND" between the signals of multiple devices. This special logical relation is the key to realize the bus arbitration. The protocol requires that the data SDA must remain stable while the clock line SCL is high, and the data is usually transmitted in MSB form, as shown in Figure 15-2.

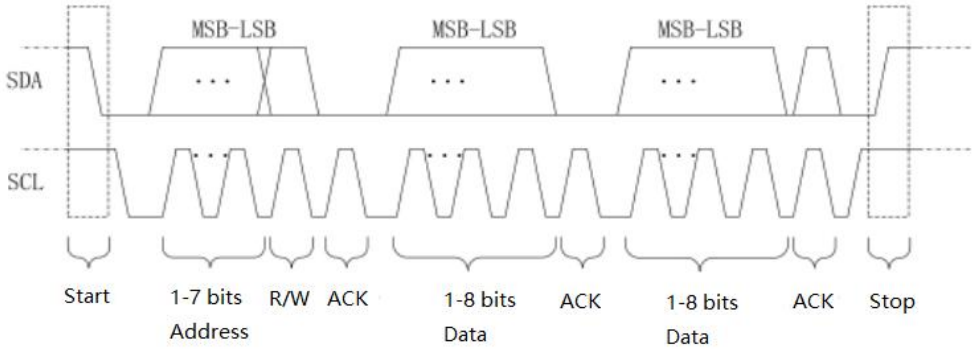


Figure 15-2

I^2C decoding supports the horizontal menu to set the parameter and data storage.

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu. In pull-down list, rotate the Multipurpose rotary knob to switch the menu option and modify the value.

1. SCL Source

   When SCL source is selected, it can set any one of CH~CH2 as the clock input of I^2C.

2. SDA Source

   When SCL source is selected, it can set any one of CH~CH2 as the clock input of I^2C.

3. Bus Setting

   a. Bus state: set decoding bus to ON or OFF.

   b. Display format: set the display format for decoding bus, it can set hexadecimal system, decimal system, binary system and ASCII (only RS232).

   c. Event list: Display the decoded data, line number, time, data, and check data in the list format for observing the longer decoded data.

   d. Vertical position: Adjusting the Multipurpose rotary knob to change the bus display position, the range can set -160 ~ 160.

(2) Data Storage

Save decoded data: Save the decoded data in USB/Storage directory, support to save the setting filename, data in decimal system and support to open by Excel table. It is convenient for checking the decoded results when the decoded data is too much.

15.3 SPI Decoding

SPI (serial peripheral interface) can connect the host with peripheral equipment in serial way to communication. It’s full duplex and synchronous communication bus.

It’s usually use 4 signal connecting lines.

MOSI: data output from master device, data input from slave device.

MISO: data input from master device, data output from slave device.

SCLK: clock signal is generated by master device.

CS: chip select enable signal from slave device.

SPI interface is mainly used for synchronous serial data transfer between the host and low-speed peripheral equipment. Under the shift pulse of the master device, the data is transferred bit by bit, the transmission format is MSB. SPI interface is widely used because it does not require slave address addressing, which is full duplex communication and the protocol is simple. SPI protocol transmission is shown in Figure 15-3.

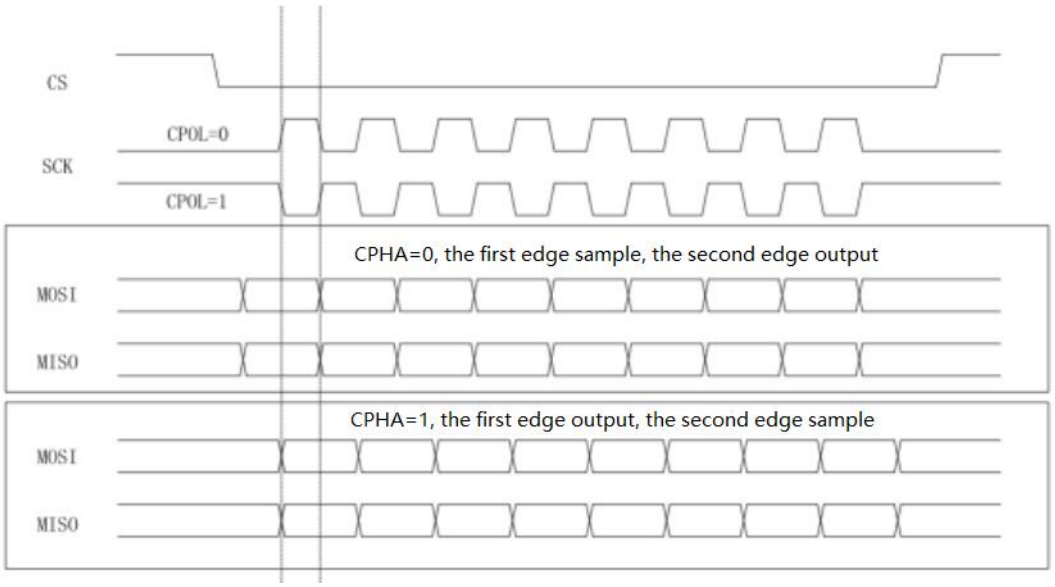


Figure 15-3

SPI decoding supports the horizontal menu to set the parameter and data storage.

Notes: In parameter setting popups, rotate the Multipurpose rotary knob can switch the menu, and press the Multipurpose rotary knob can select/extend the menu. In pull-down list, rotate the Multipurpose rotary knob to switch the menu option and modify the value.

(1) Parameter Setting

1. SCLK Source

Press SCL source key can select any one of CH1~CH2 as the clock input of SPI decoding signal.

2. Data Source

Press MOSI source key can select any one of CH1~CH2 as the data MOSI input of SPI decoding signal.

3. SCLK Polarity

Set the edge for clock signal to rising or falling edge.

a. Rising edge: It will be triggered on the rising edge of the clock signal.

b. Falling edge: It will be triggered on the falling edge of the clock signal.

4. Data Polarity

That is MOSI polarity, it can be set to positive or negative.

a. Positive: It is 1 when the set signal is greater than the threshold. Otherwise, it is 0.

b. Negative: It is 1 when the set signal is smaller than the threshold. Otherwise, it is 0.

5. Bit Sequence

To appoint the data bit for SPI signal whether the MSB (the most significant bit) in front or the LSB (least significant bit) in front.

a. MSB: MSB is transmitted first.

b. LSB: LSB is transmitted first.

6. Bit Width

To set the bit width of SPI signal for each frame, the range can be 4~32.

7. Bus Setting

a. Bus state: set decoding bus to ON or OFF.

b. Display format: set the display format for decoding bus, it can set hexadecimal system, decimal system, binary system and ASCII.

c. Event list: Display the decoded data, line number, time, data, and check data in the list format for observing the longer decoded data.

d. Vertical position: Adjusting the Multipurpose rotary knob to change the bus display position, the range can set -160 ~ 160.

(2) Data Storage

Save decoded data: Save the decoded data in USB/Storage directory, support to save the setting filename, data in decimal system and support to open by Excel table. It is convenient for checking the decoded results when the decoded data is too much.

16. Navigation Function

Navigation function includes time navigation, recording playback navigation and mark. The navigation control area is on the front panel, the combined navigation key as shown in Figure 16-1.



Figure 16-1

16.1 Time Navigation

After the data acquisition is stop, the combined navigation key can be used to quickly and continuously play the captured data waveform. Press the left arrow key to play the waveform to left, press the right arrow key to play the waveform to right, press the stop key to pause play. Press the left arrow key or the right arrow key multiple times to speed up the play, it can speed up to 3 times, so that to quickly locate the sampled data waveform.

Notes: Time navigation should open in “YT” mode and the operation state should be “STOP”.

16.2 Mark

Mark the midpoint in waveform area by the “Mark” key. The mark icon of midpoint is ▼, other point is marked by icon▽. When the point is marked, navigation indicator, will be illuminated, move a point on up (down) to midpoint by the navigation key.

a. Mark: mark the midpoint on waveform area.
b. Delete: press to delete the midpoint marker on waveform area.
c. Delete all: press to delete all mark points.

16.3 Segment

Open the waveform recording function after the recording is completed. Press the combined navigation key to play the recorded waveform, the play mode can set to manual or auto.

a. Manual: press the left arrow key or the right arrow key by manual, play the recorded waveform in reversed order or in sequence. It can only play single frame.

b. Auto: in auto mode, press the left arrow key  to reversed play the recorded waveform, press the right arrow key  to play the recorded waveform in sequence, press the pause key  to stop play.

Notes: The function is only available in recording waveform. It is grey when there no recorded waveform.

17. Mathematical Operation

- Mathematical Operation
- FFT
- Logical Operation
- Digital Filter
- Advanced Operation

UPO1002 series digital phosphor oscilloscope carries a variety of mathematical operations, including Math, FFT, logical operation, digital filter and advanced operation.

Enter the mathematical operation menu, adjusting Position or Scale knob in vertical control area to change the vertical position and the vertical scale of the waveform. The mathematical operation waveform cannot be independent adjust the horizontal time base scale. It will be automatically change with the horizontal time base scale of the analog input channel.

Mathematical operation cursor uses  icon to mark the results of a mathematical operation.

17.1 Mathematical Function

Use the operator “+”, “-”, “x”, “÷” to operating the channel waveform to get the final math waveform.

Operator

a. +: The waveform of source 1 and source 2 are added point by point.
b. -: The waveform of source 1 and source 2 are subtracted point by point.
c. x: The waveform of source 1 and source 2 are multiplied point by point.
d. ÷: The waveform of source 1 and source 2 are divided point by point.

17.2 FFT

Using FFT (Fast Fourier Transform) mathematical operations to convert the time domain signal (YT) to frequency domain signal. The following types of signals can be easily observed by using FFT.

- Harmonic content and distortion in measurement system
- Perform the noise feature in DC power supply

■ Vibration analysis

(1) Parameter Setting

1. Window Function

a. Rectangle: It has the best frequency resolution and the worst amplitude resolution, which is similar to the one with no window. It is suitable for measuring the following waveforms.

- Transient or short pulse, the signal level is almost equal to before and after
- Equal amplitude sine wave with very similar frequency
- Broadband random noise with a slowly changing spectrum

b. Hanning: Compared with the rectangle window, it has better frequency resolution, but poorer amplitude resolution. It is suitable for measuring sine, periodic and narrow-band random noise waveforms.

c. Hamming: The frequency resolution is slightly better than Hanning window. It is suitable for measuring transient or short pulse, and the waveform with great difference before and after the signal level.

d. Blackman: It has the best amplitude resolution, and the worst frequency resolution. It is suitable for measuring the single frequency signals or seeking higher harmonics.

e. FlatTop: It can be precisely measure the signal. It is suitable for measuring the signal that no precise reference substance and requires the precision measurement.

2. Vertical Unit

The unit of the FFT operation result can select **Vrms** and **dBV**. **Vrms** and **dBV** display the vertical amplitude size in a linear way and decibel volts way. If the FFT spectrum need to display in a large dynamic range, it is recommend to use **dBV**.

3. Count

Count of FFT operation, it can set to 8 k, 16 k, 32 k, 64 k, 128 k, 256 k, 512 k, 1 M.

4. Display Mode

a. Spilt screen: Display the source waveform and the FFT spectrum waveform in split screen, and extend to display the spectrum, as shown in Figure 17-1.

b. Full screen: The source waveform and FFT spectrum waveform are overlapping displayed in full screen. User can observe the spectrum more clearly and make more accurate measurements.

c. Independent: Only display FFT waveform and the coordinate. FFT waveform display in 10 grids as shown in Figure 17-2.

d. Waterfall curve 1: Spectrum, waterfall curve and waveform figure are separately display in 3 windows. Waterfall curve shows the time changing of dB value in spectrum. It has “record” function. Waterfall curve can only be selected when FFT is opened. The maximum record 200 spectrum which corresponds to waterfall curve.

e. Waterfall curve 2: Spectrum and waterfall curve split to two windows to display. Waterfall curve shows the time changing of dB value in spectrum. It has “record” function. Waterfall curve can only select when enhance FFT is opened. The maximum record 200 spectrum which corresponds to waterfall curve, as shown in Figure 17-3.

Segment selection: Using the Multipurpose rotary knob to select segment for observing the spectrum waveform in a certain time on waterfall curve. When segment is selected, the oscilloscope will enter “STOP” state.

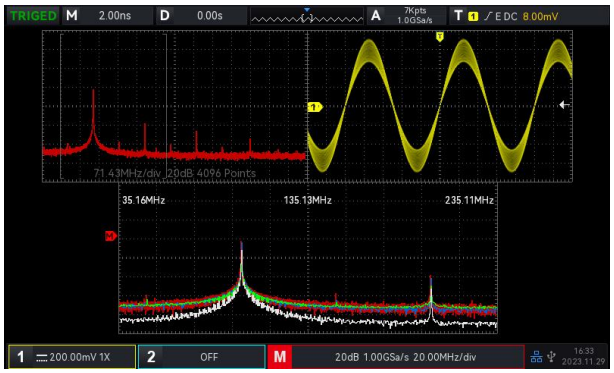


Figure 17-1



Figure 17-2

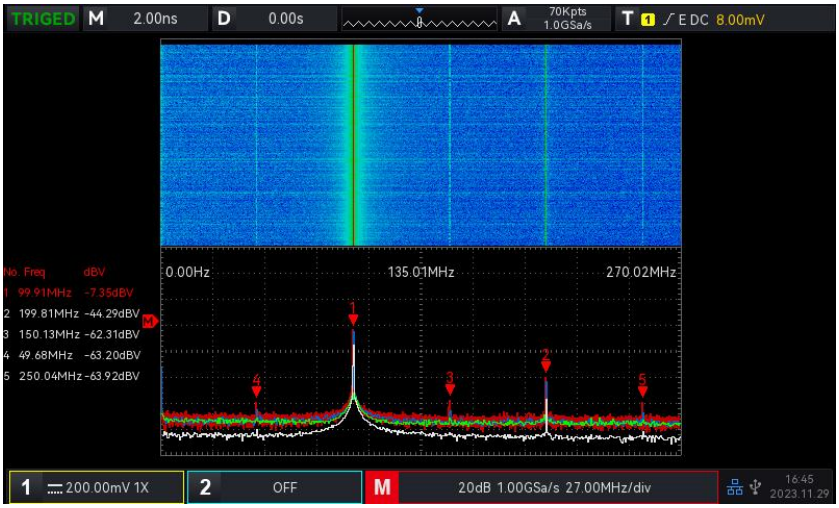


Figure 17-3

(2) Frequency Rang

1. Rang

■ Start frequency: Set the start sweep frequency for FFT. The resolution will recalculate according to the frequency bandwidth if the start frequency is changed.

- Stop frequency: Set the stop sweep frequency for FFT. The maximum of stop sweep frequency can set to “sampling rate/2”.
- Follow: Set the start frequency, stop frequency whether change with the current frequency difference, it can set ON or OFF.

2．Bandwidth

- Center frequency: Set the center frequency for FFT waveform and change with FFT waveform. The maximum of the center frequency can set to “sampling rate/2”.
- Bandwidth: Set the bandwidth for FFT sweep. The center frequency will change with the bandwidth. The maximum of bandwidth can set to “sampling rate/2”.

(3) Demodulation Mode

Set the extracting point method to display the original data after FFT operation. The mode can set to normal, average, maximum hold or minimum hold.

The extracting point method can set to +peak, -peak, average, sampling as shown in Figure 17-4.



Figure 17-4

Display Mode

a. Normal: the spectrum waveform displays all sampled values in real time, and the spectrum waveform is display with red.

b. Average: the spectrum waveform displays the averaged value from multiple extracting point within the sampling time interval, and the spectrum waveform is display with blue.

- Average time: set the number of the average calculation, when the average spectrum is enabled, the number of times can set to 2, 4, 8, 16, 32, 64, 128, 256, 512, or 1024. The

larger the number, the smoother the average spectrum.

c. Maximum hold: the spectrum waveform displays the maximum value among the multiple extracting point data, and the spectrum waveform is display with green.

d. Minimum hold: the spectrum waveform displays the minimum value among the multiple extracting point data, and the spectrum waveform is display with gray.

Extracting Point Method

a. OFF: turn off the demodulation wave display

b. +Peak: take the maximum value within the range of each sampling point to display

c. -Peak: take the minimum value within the range of each sampling point to display

d. Average: take the averaged value within the range of each sampling point to display

e. Sampling: take the first value within the range of each sampling point to display

Reset trace: refresh every spectrum data.

(4) Mark

To mark the point in spectrum and display the **frequency value** and **voltage value**. Mark mode includes auto, threshold and manual.

a. Auto

- Mark trace: Select spectrum wave as the mark source, which is the spectrum waveform generated by different demodulation types under the demodulation mode, it can set to normal, average, maximum hold and minimum hold.
- Maximum count: Set the maximum mark point. The range can set to 1~50.
- Event list: Display the information of the current mark point, which is serial number of point, frequency and voltage.

b. Threshold

- Mark trace: Select spectrum wave as the mark source, which is the spectrum waveform generated by different demodulation types under the demodulation mode, it can set to normal, average, maximum hold and minimum hold.
- Threshold: Set the threshold value as the comparative condition. Display the mark point when the peak is greater than threshold. Otherwise, it will not display the mark point.
- Mark list: Display the information of the current mark point, which is serial number of point, frequency and voltage.

c. Manual: Adjusting the Multipurpose rotary knob to move marker to any point on trace.

- Mark trace: Select spectrum wave as the mark source, which is the spectrum waveform

generated by different demodulation types under the demodulation mode, it can set to normal, average, maximum hold and minimum hold.

- Mark peak: Set manual mark trace mark to the maximum peak of sampling point by default.

(5) User-defined

Restore the FFT settings to the default settings.

FFT Operation Tips

Signals with DC components or deviations can cause errors or deviations in the FFT waveform components.

To reduce the DC component, the channel can be set to AC coupling.

To reduce the random noise and aliasing frequency components of the repetitive or single pulse, user can set the oscilloscope acquisition mode to average acquisition.

17.3 Logical Operation

(1) Expression

a. AND: The logical operation “AND” is performed on source 1 and source 2 point by point.

b. OR: The logical operation “OR” is performed on source 1 and source 2 point by point.

c. NOT: The logical operation “NOT” is performed on source 1 point by point and source 2 is not shown.

d. XOR: The logical operation “XOR” is performed on source 1 and source 2 point by point.

The waveform voltage value of source is performed the logical operation point by point and display the results. During the operation, if the voltage value of source channel is greater than the threshold, it is judged as logic "1", otherwise, it is logic "0". Convert the waveform to binary system and perform the logical operation. The four logical operations are listed in Table 17-1.

Table 17-1 Logical Operation

Source 1	Source 2	AND	OR	XOR		Source 1	NOT
0	0	0	0	0		0	1
0	1	0	1	1		1	0
1	0	0	1	1			
1	1	1	1	0			

(2) Reversed Phase

Reversed phase can set ON or OFF.

ON: reversed phase for the waveform of the logical operation.

(3) Threshold 1

Adjusting the Multipurpose rotary knob or keyboard to change threshold 1. If the voltage value of source channel is greater than the threshold 1, it is judged as logic "1", otherwise, it is logic "0".

(4) Threshold 2

Adjusting the Multipurpose rotary knob or keyboard to change threshold 2. If the voltage value of source channel is greater than the threshold 2, it is judged as logic "1", otherwise, it is logic "0".

17.4 Digital Filter

(1) Filter Type

a. Low pass: Only allow the signal that the source frequency is lower than the current “upper limit of frequency” to pass.

b. High pass: Only allow the signal that the frequency is higher the current “lower limit of frequency” to pass.

c. Band pass: Only allow the signal that the frequency is higher the current “lower limit of frequency” and the source frequency is lower than the current “upper limit of frequency” to pass.

d. Band Limited: Only allow the signal that the frequency is lower the current “lower limit of frequency” and the source frequency is higher than the current “upper limit of frequency” to pass.

(2) Lower Limit of Frequency

Adjusting the lower limit of frequency by the Multipurpose knob or numerical keyboard of frequency. In low pass, the lower limit of frequency is invalid and the menu is hidden.

(3) Upper Limit of Frequency

Adjusting the upper limit of frequency by the Multipurpose knob or numerical keyboard of frequency. In high pass, the upper limit of frequency is invalid and the menu is hidden.

Notes: The upper/lower limit range of frequency is related to the current horizontal time base.

17.5 Advanced Operation

User can be freely defined the operation for each signal of input channel to get different operation results of MATH waveform.

(1) Expression

Expression can be ON or OFF. Turn on to pop out the dialog frame as shown in Figure 17-5.

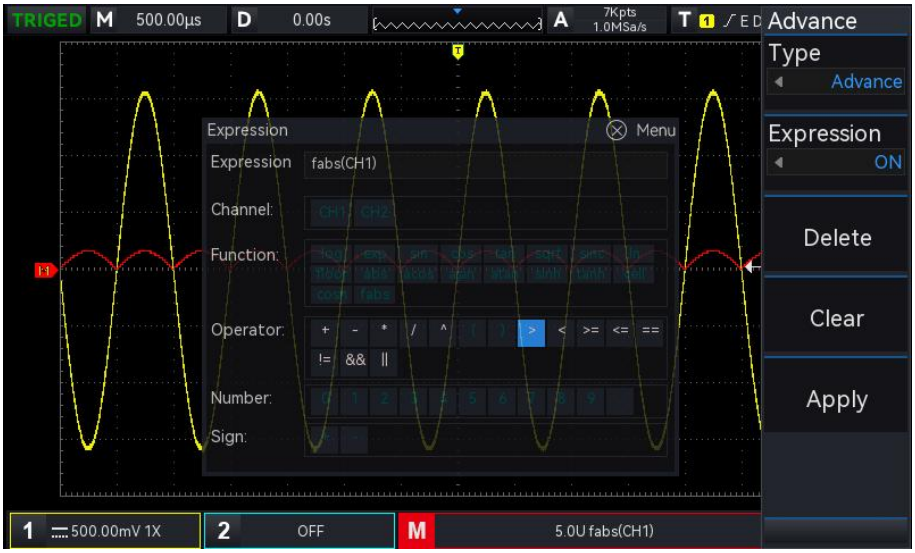


Figure 17-5

Adjusting the Multipurpose rotary knob to select “Channel”, ”Function”, ”Operation”, “Number”, and “Symbol”, then press the knob to display the options in the list after Expression.

During editing the expression, user can press the delete key to “delete", "clear" and "apply" the expression. After applying the expression, the oscilloscope performs operations according to the expression and display the results.

(2) Expression Dialog

a. Expression: It represents the formula is consist of channel, function, variation and operator. The length of expression cannot over 40 characters.

b. Channel: Channel can select to CH1, CH2.

c. Function: The function of each function item is listed in Table 17-2.

Table 17-2

Function Name	Description
sin	Calculating the sine of the selected source.
cos	Calculating the cosine of the selected source.
sinc	Calculating the normalization value of the selected source.
tan	Calculating the tangent of the selected source.
sqrt	Calculating the square root of the selected source.
exp	Calculating the exponent of the selected source.
log	Calculating the logarithm of the selected source.
ln	Calculating the logarithm of the selected source.

floor	The selected source is round down to an integer.
abs	The selected source take the absolute value (integer absolute value).
acos	Calculating the arccosine of the selected source.
asin	Calculating the arcsine of the selected source.
atan	Calculating the inverse tangent of the selected source.
sinh	Calculating the hyperbolic sine of the selected source.
tanh	Calculating the hyperbolic tangent of the selected source.
cosh	Calculating the hyperbolic cosine of the selected source.
ceil	The selected source is round up to an integer.
fabs	The selected source take the absolute value (floating number absolute value).

b. Opt: The function of each operator is listed in Table 17-3.

Table 17-3

Function Name	Description
+, -, *, /, ^	Mathematical operator: add, subtract, multiply, divide, exponent
( )	Parenthese is used to raise the priority of operations in parentheses.
< , > , > =, < = , ==, !=	Relation operator: greater than, less than, equal to, unequal to
|| , &&	Logical operator: OR, AND
0 ~ 9, .	Digital operation
+, -	Positive, negative

18. Help

Help provides built-in help document, it can set ON or OFF.

The content in Help supports to automatically locate a module function, such as open Help popups, press the Cursor key to automatically locate the cursor to Cursor module and press the Multipurpose rotary knob to extend Help to check the information, as shown in Figure 18-1.

When the content is more than one page, press the Multipurpose rotary knob to locate the cursor to the page, rotating the Multipurpose rotary knob to roll to check more contents; press the Multipurpose rotary knob again to exit the cursor to Help menu and continue to select other module.

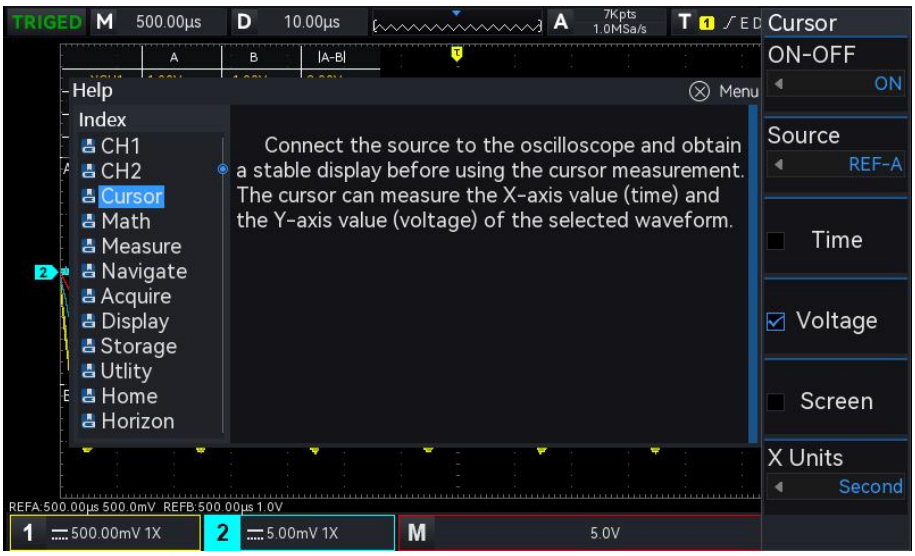


Figure 18-1

19. Additional Function Key

- Automatic Setting
- Run/Stop
- Factory Setting

19.1 Automatic Setting

Automatic settings will choose the appropriate time base scale, amplitude scale and trigger parameter according to the input signal so that the waveform will be automatically display on the screen. Press the Auto key to enable the automatic settings.

Automatic setting only applies to the following conditions.

a. Automatic setting is only suitable for simple single frequency signal. It is impossible to achieve effective automatic setting for complex combination waves.
b. The measured signal frequency is not less than 20 Hz, and the amplitude is not less than 20 mVpp; the duty cycle of square wave is greater than 5%.

19.2 Run/Stop

Use the Run/Stop key on the front panel to set. When press this key and the indicator with green, it indicates the RUN state. If the indicator with red after the key is pressed, then it is the STOP state. In the running state, the oscilloscope is continuously acquiring waveform and the upper part of the screen shows “AUTO”; in the stop state, the oscilloscope stops the acquisition and the upper part of the screen shows “STOP”. Press the Run/Stop key to switch the waveform sampling step through the run and stop states.

19.3 Factory Setting

Press the Default key on the front panel, the oscilloscope can be quickly restore to the factory setting. The factory settings of UPO1002 series digital phosphor oscilloscope are listed in Table 18-1.

Table 19-1

System	Function	Factory Setting
Vertical System	CH1	1 V/DIV
	Vertical offset	0 (vertical midpoint)
	Zero position	0 (vertical midpoint)
	Coupling	DC
	Bandwidth limit	Full bandwidth
	Volts/div scale	Coarse tuning
	Deflection factor of fine tuning	0
	Probe	1×
	Reversed phase	OFF
	Unit	V
	Label	OFF
	CH2	OFF
	MATH, REF	OFF
Horizontal System	Extension window	OFF
	Multi-Scope	OFF
	Mode	YT
	Horizontal time base	1 μs/div
	Horizontal offset	0 (horizontal midpoint)
Trigger System	Trigger mode	Edge
	Trigger polarity1	Rising edge
	Coupling mode	DC
	Trigger condition	Greater than
	Lower limit of time	2 ns
	Upper limit of time	4 ns
	Edge count	1
	Trigger line L position	0
	Trigger line H position	0
	Trigger mode	Auto
	Trigger holdoff	100ns
	Source 1	CH1
	Source 2	CH1
	Trigger polarity 2	Rising edge

	Video trigger	PAL
	Video trigger synchronization	EVEN
	Video trigger specified line	1
Display	Format	Vector
	Grid display	Full display
	Transparency of popup	ON
	Menu display	Manual
	Backlight brightness	50%
	Duration	Minimum
	Temperature color	OFF
	Anti-temperature	OFF
	Grid brightness	50%
	Waveform brightness	50%
MATH	Type	MATH
	Source 1	CH1
	Operator	+
	Source 2	CH1
	Probe magnification	x1
	FFT window function	Hamming
	FFT unit	Vrms
	FFT count	8 k
	FFT mark mode	Auto
	FFT split screen	Full screen
	FFT mark threshold	0
	Logical expression	AND
	Reversed phase	OFF
	Threshold	0V
	Digital filter type	Low pass
Measurement	Primary source of measurement	CH1
	All parameter measurement	OFF
	User-defined parameter	OFF
	Statistics	OFF
	Secondary source	CH1
	Indicator enable	OFF

	Threshold	Default
	Indicator	Maximum
	Display window	Screen area
Pass Test	Output	Fail
	Source	CH1
	Display	OFF
	Stop type	Fail count
	Stop condition	≥ Greater than or equal to
	Threshold	100
	Template waveform reference	CH1
	Horizontal position	5
	Vertical position	5
Bus Decoding	Decoding type	RS232
	Bus state	OFF
	Display format	16 (hexadecimal notation)
	Event list	OFF
	Bus position	160
	RS232 source	CH1
	RS232 polarity	Negative polarity
	RS232 baud rate	2400
	RS232 user-defined baud rate	1200
	RS232 bit width	5 bits
	RS232 bit order	MSB
	RS232 stop bit	1
	RS232 parity check bit	none
	RS232 trigger condition	Start frame
	RS232 data	0
	I^2C SCL	CH1
	I^2C SDA	CH1
	I^2C address bit width	7 bits
	I^2C address	0
	I^2C address mask	0
	I^2C operating direction	Write
	I^2C trigger condition	Start

	I^2C byte length	1
	I^2C data	0
	I^2C mask	0
	SPI CS	CH1
	SPI CLK	CH1
	SPI MOSI	CH1
	SPI CS polarity	Negative polarity
	SPI CLK polarity	Negative polarity
	SPI MOSI polarity	Negative polarity
	SPI bit order	LSB
	SPI bit Width	8 bits
	SPI idle time	80ns
	SPI frame length	1
	SPI MOSI data	0
Other System	Frequency meter	ON
	Square wave output	1 KHz
	IP type	Manual
	Language	The current setting
	Sampling mode	Normal sampling
	Average sampling time	2
	Storage depth	Auto
	Cursor type	OFF
	Cursor mode	Independent
	Cursor channel	CH1
	Current channel selection	CH1
	RUN/STOP	RUN

20. System Prompt and Troubleshooting

- System Prompt
- Troubleshooting

20.1 System Prompt

This chapter is to describe the system prompt, the detailed explanation is listed in Table 20-1.

Table 20-1

Adjusting is up to extremity!	It is prompt that the adjusting is up to extremity in the current status. It cannot be adjust. It will be prompt when the vertical scale rotary knob, time base rotary knob, horizontal offset, vertical offset and trigger level is up to extremity.
Loading, please wait…	It will be prompt when reload the setting file.
Data storage is successful.	It will be prompt when save the waveform, settings, recording convert to waveform, decoding file is completed.
Data storage is failed.	It will be prompt when save the waveform, settings, recording convert to waveform, decoding file is failed.
Storage is canceled!	It will be prompt when recording convert to video.
Loading file is successful.	It will be prompt when reload the setting file is completed.
Loading file is failed.	It will be prompt when reload the setting file is failed.
Factory setting is successful.	It will be prompt when restore to the settings to the default settings.
No signal has detected.	It will be prompt when no input signal after operating AUTO setting.
This function is forbidden in XY mode.	It will be prompt when open extension window, MATH, REF, BUS, pass test function in XY mode.
This function is forbidden in FFT function.	It will be prompt when open XY, pass test, REF, BUS, navigation in FFT mode.
This function is forbidden in recording waveform function.	It will be prompt when switching to the storage depth in recording waveform.
The recording is operating, please exit the recording function!	It will be prompt when changing the time base scale, volts/div scale, vertical offset, horizontal offset and trigger level, open extension time base, open/close channel in recording waveform.
USB check failed!	It will be prompt when save the waveform, setting, screenshot, decoding data or reload the waveform, setting, preview picture from USB, but USB is not insert to the device.
USB has inserted.	It will be prompt when the oscilloscope detects USB.
USB has removed.	It will be prompt when USB is plug out.

This function is forbidden in extension time base.	It will be prompt when open extension time base in FFT window display mode.
Print screen is successful!	It will be prompt when save the screenshot to USB.
Print screen is failed!	It will be prompt when failed to save the screenshot to USB.
Invalid expression!	It will be prompt when the advanced operation is invalid.
Automatically configure IP address, please wait…	It will be prompt when IP type switch to Auto.
Delete data is successful.	It will be prompt after the user data is delete.
Delete user-defined is successful.	It will be prompt when all user-defined parameter is delete.
The system is shutting down…	A prompt for shutting down.
This function is invalid in the stop state!	It will be prompt when switching acquisition method, storage depth, and open XY mode in the STOP state.
The navigation is invalid when the waveform is compressed.	It will be prompt when the waveform is compressed in navigation.
Automatic setting is completed.	It will be prompt when the automatic setting is completed.
Single trigger is stop.	It will be prompt after single trigger is stop.
Open reference channel.	It will be prompt when the channel template is not open in pass test function.
Open source channel.	It will be prompt when select the source is not open to be the test source in pass test function.
Open pass/fail test function.	It will be prompt when enter the template setting but the pass test function is closed.
Press RUN/STOP key to stop.	It will be prompt when operating the waveform navigation in RUN state.
Input parameter is invalid!	It will be prompt when numerical keyboard inputs invalid parameter.
Channel is not open!	It will be prompt when select the channel that not open to save the waveform file.
Exceed the maximum limit!	It will be prompt when the character length of user-defined label, STORAGE waveform filename and setting name is out of the limit.
No recorded waveform!	It will be prompt when operate the playback function but no recorded waveform.
No available parameter, please select the user-defined measurement parameter.	It will be prompt when open the measurement statistics but no user-defined parameter.
This function is forbidden in Multi-Scope.	It will be prompt when open independent time base, XY, extension window, BUS, MATH, waveform recording, pass/fail test, navigation, reference waveform reloading in Multi-Scope mode.
The keyboard is locked.	It will be prompt when connecting to the upper computer.
The keyboard is unlocked.	It will be prompt when disconnecting to the upper computer.
Please input the filename.	It will be prompt when pressing the confirmation key but not input any contents.

The file list is empty.	It will be prompt when pressing the confirmation key but no reload waveform and setting files.
This function is forbidden in roll mode.	It will be prompt when open extension time base, XY mode, save waveform, recording, pass/fail test function in ROLL mode.
This function is forbidden in pass/fail test function.	It will be prompt when open recording, extension window and XY mode in pass test function.
The key is invalid in DHCP mode.	It will be prompt when pressing the confirmation key in DHCP mode.
Self-calibration is failed.	It will be prompt when the self-calibration is failed.
Self-calibration is successful.	It will be prompt when the self-calibration is completed.
Self-calibration is canceled.	It will be prompt when the self-calibration is canceled
Disconnect all connection from the input.	It will be prompt when self-calibration is operating.
Exit the recording function.	It will be prompt when the recording waveform is completed, press RUN/STOP key to enter the self-calibration.
Recording is completed.	It will be prompt when the recording waveform is completed.
Cursor is not allow use in FFT function. Please use FFT mark function.	It will be prompt when open CURSOR in FFT mode.
This function is forbidden in FFT spilt mode.	It will be prompt when open extension window and XY in FFT mode.
Multi-Scope is loading, please wait…	It will be prompt when open the independent time base.
Multi-Scope is exiting, please wait…	It will be prompt when close the independent time base.
Maximum count of FFT is 64 k in waterfall curve mode.	It will be prompt when switching display waterfall curve 1/ waterfall curve 2.
The waterfall curve is forbidden!	It will be prompt when FFT count > 64k in waterfall curve mode.
USB is out of space!	It will be prompt when save the data that recording convert to video but USB is out of space.
Please input the channel’s label.	It will be prompt when editing the user-defined label but not input contents.
Time navigation is forbidden when Math channel is open.	It will be prompt when MATH is open.
Time navigation is forbidden when Ref channel is open.	It will be prompt when Ref is open.
Mark function is forbidden in Math channel!	It will be prompt when open navigation mark, delete mark, delete all in MATH function.
Mark function is forbidden in Ref channel!	It will be prompt when operating navigation mark, delete mark, delete all in Ref channel.
This function is forbidden in time navigation mode.	It will be prompt when open REF, XY and Multi-Scope in time navigation mode.
The file folder already exists, please re-enter the name!	It will be prompt when create a new file folder but the file name is duplicated.

The path is error, please choose the right path.	It will be prompt when save file but not select the right path.
File loading error, please choose the right file!	It will be prompt when loading the wrong setup file.
Measure cursor area is canceled!	It will be prompt when switch to voltage measurement while the cursor area is selected.
No decoding trigger, bus function is forbidden!	It will be prompt when open BUS but the trigger type is not decoding type.
No decoding data!	It will be prompt when save but no decoding data.
Saving parameter error!	It will be prompt when using SCPI save the recorded waveform but the start frame and end of frame are not conform to the actual.
Loading parameter error!	It will be prompt when using SCPI load waveform and setup file
Recording interval cannot be set under quick recording!	It will be prompt when set the record interval in quick recording.
Failed to acquire data from the internal memory in XY/ROLL mode!	It will be prompt when acquiring data from the internal memory in XY, ROLL mode.
CSV file can only save to USB, please plug USB!	It will be prompt when saving CSV file but no USB is plugged.
Select USB to save the CSV file!	It will be prompt when saving CSV file to local path.
Please plug USB to preview picture!	It will be prompt when open the preview picture but no USB is plugged.
No picture, please select other file	It will be prompt when the selected file has no picture to preview.
Please select USB file to preview picture!	It will be prompt when USB is not selected to preview the picture.
Please select USB to save picture!	It will be prompt when USB is not selected to save picture.
This function is forbidden when user-defined is closed!	It will be prompt when open measurement statistics.
Recording is not supported under averaging sampling.	It will be prompt when recording waveform in averaging sampling.
The version is not matched.	It will be prompt when reload setup file is not match to the current version.
Recording is not supported under single trigger	It will be prompt when recording waveform after the single trigger is stop.
The cursor only measures the current channel under independent time base!	It will be prompt when switching cursor source in independent time base.

20.2 Troubleshooting

(1) When press the button, the oscilloscope is black screen.

a. Check whether the power is correctly connected, power supply is normal or not.

b. Check whether the power switch is really on, press the front panel power key and confirm

green light and a relay sound is present.

c. If there is a relay sound, it indicates that the oscilloscope starts normally. Try the following operations: press the Default key, then press F1, if device returns to normal, it means backlight brightness is too low.

d. After completing the above steps, restart the oscilloscope.

e. If the product still does not work properly, contact the UNI-T service center for assistance.

(2) After signal acquisition, the waveform of the signal does not appear in picture.

a. Check whether the two ends of BNC line are connected properly.

b. Check whether the output channel of signal source is opened.

c. Check whether the input channel of the oscilloscope is opened.

d. Check whether the signal in signal source has DC offset.

e. Plug out the input signal, check whether the baseline is in the center of the screen (if the baseline is not in the center of the screen, it should be self-calibration.)

f. If the product still does not work properly, contact the UNI-T service center for assistance.

(3) The measured voltage amplitude value is 10 times larger or 10 times smaller than the actual value. Check whether the channel probe attenuation coefficient settings are consistent with the used probe attenuation rate.

(4) There is a waveform display but not stable.

a. Check the trigger settings in trigger menu whether is consistent with the actual signal input channel.

b. Check the trigger type: general signals should use "Edge" trigger. Only when the proper trigger type is used, the waveform can be displayed stably.

c. Try to change trigger coupling to HF rejection or LF rejection to filter out the high-frequency or low-frequency noise that interfere the trigger.

(5) No waveform display after press Run/Stop key.

a. Check whether the trigger mode in the trigger menu is on "Normal" or "Single" and whether the trigger level exceeds the waveform range.

b. If it exceeds, set the trigger level to the middle or set the mode to "Auto".

c. The above settings can be completed automatically by pressing the Auto key.

(6) Waveform refresh is very slow.

a. Check whether the acquisition method is average and the average times are large.

b. Check whether the storage depth is the maximum.

c. Check whether the trigger hold-off time is greater.

d. Check whether the trigger is normal and the current time base is slow.
e. All he above reasons will lead to slow refresh of waveform. It is recommended to restore the factory settings, and the waveform can be refreshed normally.

21. Appendix

21.1 Appendix A Maintenance and Cleaning

(1) General Maintenance

Keep the instrument away from the direct sunlight.

Caution

Keep sprays, liquids and solvents away from the instrument or probe to avoid damaging the instrument or probe.

(2) Cleaning

Check the instrument frequently according to the operating condition. Follow these steps to clean the external surface of the instrument:

a. Please use a soft cloth to wipe the dust outside the instrument.

b. When cleaning the LCD screen, please pay attention and protect the transparent LCD screen.

c. When cleaning the dust screen, use a screwdriver to remove the screws of the dust cover and then remove the dust screen. After cleaning, install the dust screen in sequence.

d. Please disconnect the power supply, then wipe the instrument with a damp but not dripping soft cloth. Do not use any abrasive chemical cleaning agent on the instrument or probes.

Warning

Please confirm that the instrument is completely dry before use, to avoid electrical shorts or even personal injury caused by moisture.

21.2 Appendix B Warranty Overview

If the use of this product has caused any inconvenience, if you in mainland China you can contact UNI-T company directly.

Service support: 8am to 5.30pm (UTC+8), Monday to Friday or via email. Our email address is infosh@uni-trend.com.cn

For product support outside mainland China, please contact your local UNI-T distributor or sales center. Many UNI-T products have the option of extending the warranty and calibration period, please contact your local UNI-T dealer or sales center.

To obtain the address list of our service centers, please visit our website at URL:

http://www.uni-trend.com