

ZEEWEI

DS02512G

HANDHELD OSCILLOSCOPE



User's Manual

Designed by ZEEWELL

Buttons Function

1. Normal function

OK	1. When the menu is opened, it acts as the "OK" function. 2. Select the target to be moved by the up and down keys: waveform or trigger level.
Auto	Automatic adjustment.
Menu	Open or close the menu.
Run/Stop	Press once to stop sampling, click again to run.
Single	Press once to perform one sampling and stop after sampling one frame. If it is not triggered, it will always be in the "wait" state. Click "Stop" to terminate.
mV	Reduce “vertical sensitivity” (High priority channel).
V	Increase “vertical sensitivity” (High priority channel).
s	Increase “time base”.
ns	Reduce “time base”.
Power/50%	1. Long press as a power on/off function. 2. Short press as a "50%" options.
Save	1. Short press save current screenshot. 2. Long press enter the image view interface.
CH1/CH2	1. Short press to change the channel priority: CH1 high or CH2 high. 2. Long press to turn on/off CH2 channel.
F1	Open/close the square wave generator window. Click “Run/Stop” to set the value to 1KHz.
↕ / ⇄	Direction buttons, move waveform or switch menu.

Second function(Power + other buttons)

Power+OK	Turn on/off the XY mode.
Power+Auto	CH1 coupling: DC/AC.
Power+Menu	CH1 probe attenuation: 1X/10X/100X.
Power+Run	CH2 coupling: DC/AC.
Power+Single	CH2 probe attenuation: 1X/10X/100X.
Power+mV	Reduce “vertical sensitivity” (Low priority channel).
Power+V	Increase “vertical sensitivity” (Low priority channel).
Power+s	Turn on/off "horizontal cursor".
Power+ns	Turn on/off "Vertical Cursor".
Power+Save	Switch trigger edge: rising or falling edge. (short press)
Power+Save	Switch trigger mode: auto or normal. (long press)
Power+CH1CH2	Switch trigger source: CH1 or CH2.
Power+F1	Switch trigger level: automatic or manual.
Power + ⇕	Move the waveform up /down (Slowly) .
Power + ⇔	Adjust the trigger level up and down.

note:

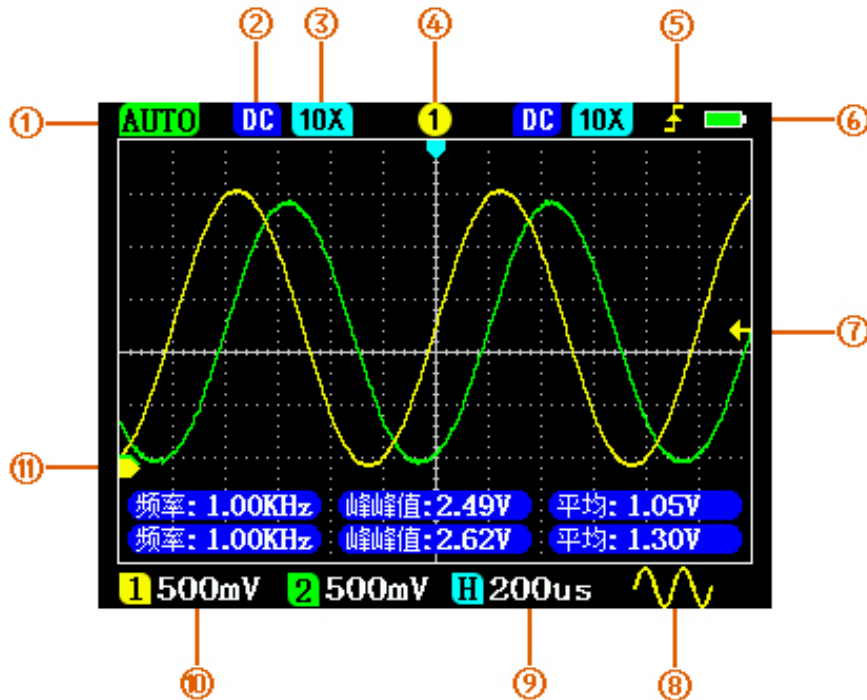
CH1 cannot be closed, CH2 can be opened or closed. **When it is not necessary to use dual channels, CH2 should be turned off to obtain a higher sampling rate and reduce power consumption.**

About cursor:

Use the direction buttons to move cursor 1, hold down the Power button and click the direction buttons to move cursor 2.

About trigger level:

The color of the trigger arrow indicates the trigger source: yellow=CH1, green=CH2.If you want to adjust the trigger level manually, you need to set the trigger level to "Manual" in the menu (you can also use Power+F1 to quickly switch between manual/auto). Use “Power + ⇔” to adjust the trigger level.



- ① Current trigger mode: Auto/Normal.
 - ② Coupling: DC/AC.
 - ③ Probe attenuation: x1/x10/x100.
 - ④ Circle 1 indicates that channel 1 has a high priority, and circle 2 indicates that channel 2 has a high priority.
 - ⑤ Trigger edge: rising/falling.
 - ⑥ Battery remaining power.
 - ⑦ The position of the trigger level.
 - ⑧ The waveform type of the generator. When it is closed, no display.
 - ⑨ Time base, which means the time of a grid in the horizontal direction. Click the “ns” and “s” buttons to adjust.
 - ⑩ Vertical sensitivity, which means the voltage of a grid in the vertical direction. Click the “mV” and “V” buttons to adjust.
 11. Zero voltage arrow. Indicates the position on the screen where the vertical voltage is zero.
- (When the related icon of channel 2 is gray, it means it is closed. If you don't need to use two channels at the same time, please keep channel 2 closed).

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1 Safety Precautions

Learn about the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid possible danger, be sure to use this product as specified.

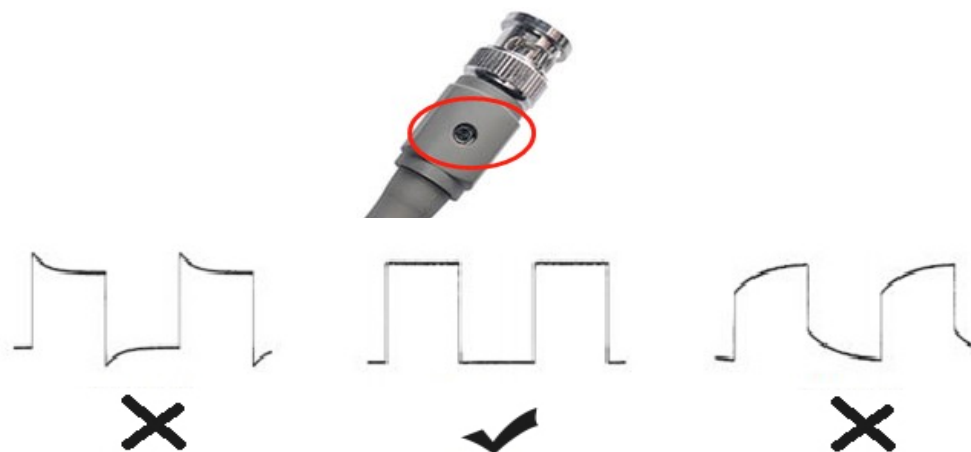
- **Only authorized personnel should perform maintenance procedures.**
- **Avoid fire and personal injury.**Use the probe correctly and ensure that the measured voltage does not exceed the maximum withstand voltage.
- **Connect the probe correctly.**Before measuring voltage greater than 40V, please switch the probe to the 10X position first.
- **Charge the battery correctly.**The charging voltage is 5V.
- **Do not operate in a humid environment.**
- **Keep the surface of the product clean and dry.**

2 Probes

2.1 Probe calibration

The probes delivered with this machine have been compensated. If you use another new probe before the first use, it must be calibrated before it can be used normally, otherwise the measurement will be inaccurate (only for the 10X/100X). The calibration method is as follows:

1. Switch the probe to X10.
2. Connect the probe to a 1KHz square wave with an amplitude of about 2V-3V. You can use the built-in generator(Refer to section 6.11).
3. Adjust the horizontal and vertical scales of the oscilloscope so that the waveform is displayed stably at a suitable position on the screen.
4. Use a screwdriver to rotate the adjustable capacitor on the probe until you get the waveform in the middle of the figure below. The left and right waveforms below are references for incorrect calibration.



2.2 Probe bandwidth

Because the 1X probe has a large input capacitance, the bandwidth of the 1X is usually within 5MHz; while the bandwidth of the 10X is the standard bandwidth of the probe.

2.3 Probe withstand voltage

The maximum withstand voltage of the probe is generally marked on the probe, which is usually 600Vpk.

2.4 Use tips

2.4.1 Large input capacitance

Because the probe 1X has a large input capacitance (usually more than 100 pf), it is not suitable for measuring some capacitively sensitive circuits. For example, when measuring a passive crystal of MCU, the large capacitor may cause the crystal to fail to vibrate. As for the output of a high-speed op amp, a capacitive load may cause the op amp to overshoot or oscillate. For circuits with large capacitances that are not suitable for measurement, please use 10X. The input capacitance of the 10X is usually several pf.

2.4.2 Measuring high voltage

The oscilloscope's measurement voltage range is -40V ~ + 40V (80Vpp). Please use the 10X probe to attenuate the signal by 10 times beyond this range. The measurable voltage range of 10X range is 600V(DC+AC). Please note that you must first switch the probe to the 10X position before connecting the high voltage signal, otherwise the high voltage may break down the internal circuit of the oscilloscope.

2.4.3 High bandwidth

Because the 1X probe has a large input capacitance, the bandwidth of the probe 1X is usually within 5MHz, so please use the 10X position when the measured signal bandwidth is greater than 5M.

Summary: 10X is usually used in most applications.

3 Vertical system

3.1 Vertical sensitivity

Oscilloscope vertical sensitivity refers to the voltage represented by a grid in the vertical direction of the screen. There are 8 divisions in the vertical direction of the oscilloscope. You can estimate the amplitude of the signal by observing how many divisions the waveform occupies on the screen. For example, if the vertical sensitivity is 1v/div, and the signal occupies 3 grids on the screen, you can know that the amplitude of the signal is 3V.



The scope's vertical sensitivity range is 10mV / div ~ 10V / div (1X probe). In

the oscilloscope button panel, the keys for adjusting the vertical sensitivity are 'mV' and 'V' button. Pressing the 'mV' button decreases the vertical sensitivity, which is used to measure signals with smaller voltage amplitude. Press the 'V' button to increase the vertical sensitivity for measuring signals with larger voltage amplitudes.

3.2 Vertical position

The method of moving the waveform up and down:

Directly press the up and down buttons to move the waveform up and down. The number 1 in the top circle indicates the movable channel 1. Click the "CH1CH2" button to switch the circle number to 2.

In addition: By default, the up and down keys move the waveform. If you need to move the trigger level, you need to press the "OK" key. The trigger level arrow appears on the top of the oscilloscope, and you can move the trigger level up and down. As shown below:



4 Horizontal system

4.1 Time base

The time base refers to the time represented by each grid in the horizontal direction on the oscilloscope screen. There are 12 grids in the horizontal direction of the oscilloscope. The sampling time that can be observed on the screen = "time base" * 12. The user can estimate the signal period by observing how many grids a waveform period occupies. For example, the current time base is 500us, and one cycle of the signal occupies 2 grids, so the signal period is 1ms (1KHz).

The oscilloscope time base range is 5ns ~ 10s. The buttons for adjusting the time base in the oscilloscope button panel are 'ns' and 's' button. When observing high-frequency signals, you should press the 'ns' button to decrease the time base. When observing low-frequency signals, you should press the 's' button to increase the base. The time base in the figure is 200us/div.



What you need to know is that the sampling process of the oscilloscope is:

"Sampling" >> "Processing" >> "Display"

When adjusted to a large time base, the screen waveform refresh will be slow due to the longer time taken by the oscilloscope to sample the waveform.

4.2 Horizontally moving waveform

In the **stop** mode, the user can move the waveform left and right.



5 Trigger system

About trigger

The oscilloscope will capture a frame of waveform only after the waveform meets the pre-set conditions. This action of capturing the waveform according to the conditions is the trigger.

What does trigger do?

1. Trigger can stabilize the waveform on the screen.
2. Capture the segment of the waveform you want to observe.

The trigger supported by the oscilloscope is edge trigger, including rising edge trigger and falling edge trigger.

5.1 Trigger level

In the edge trigger mode, the trigger condition appears only when the waveform crosses up or down the trigger level. The method to adjust the trigger level is as follows:

1. Change the "Trigger Level" to "Manual" in the menu (or use the key combination "Power+F1" to quickly switch between manual/auto).
2. Method 1:


Use the key combination "Power+↔" to quickly move.

Method 2:

Click the "OK" button, and a leftward arrow appears on the top of the oscilloscope. At this time, press the up and down keys to move the trigger level.



5.2 Adjust the trigger position

The default trigger position is in the middle of the screen. The user can move the trigger position by pressing the left and right keys in the running state. The trigger position is marked on the screen: 

6 Operation Guide

6.1 POWER

In the shutdown state, long press the "POWER" button to turn on the machine, and then release the button when the screen is on.

In the power-on state, long press the "POWER" button to shut down (about 4 seconds), and release the button after the screen goes out. You can also click the Power button and select OFF to shut down.

6.2 Charging

The upper right corner of the oscilloscope displays the current remaining power. When the power is insufficient, use a USB cable to connect a 5V/1A/2A/4A adapter for charging, computer or mobile phone adapter is the best choice. The charging current is about 700ma.

The LED at the bottom of the charging process is bright red, and the led turns green when fully charged (It takes about 7-8 hours).

6.3 Vertical sensitivity / Time base

When the priority of CH1 is high (Yellow circle 1), press the "mv" and "V" buttons to adjust the vertical sensitivity of ch1. Use "Power" + "mv"/ "V" to adjust the vertical scale of ch2.

When the priority of CH2 is high (Green circle 2), press the "mv" and "V" buttons to adjust the vertical sensitivity of ch2; Use "Power" + "mv"/ "V" to adjust the vertical scale of ch1.

Press the "ns" and "s" buttons to adjust the horizontal time base scale.

6.4 Trigger Level

Method 1:

Use the key combination "Power+  " to quickly move.

Method 2:

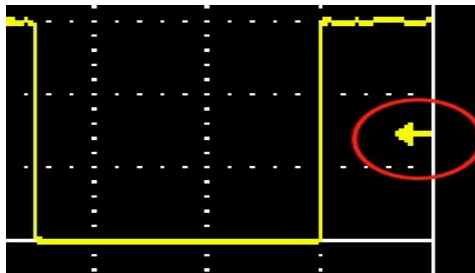
Click the "OK" button, and a small leftward arrow appears on the top of the

oscilloscope. Press the up and down keys to move the trigger level.



If the arrow is yellow, you can move the trigger level of ch1; if it is green, you can move the trigger level of ch2. Use "Power+CH1CH2" to switch the trigger source.

Note! ! If the trigger level is set to "Auto" in the menu, it cannot be adjusted manually at this time. You need to set it to "**manual**" to adjust ,or Use "Power+ F1" to switch between auto and manual.



6.5 Auto

The auto function is a more common function in the oscilloscope. After the user presses the "Auto" button, the oscilloscope will automatically adjust the time base and vertical sensitivity so that the waveform is displayed in the middle of the screen.

Beginners can try to press the "Auto" button when they don't know how to adjust.

6.6 Run/stop

In the running state, click the "Run/Stop" button to stop the oscilloscope. After stopping, the oscilloscope no longer performs sampling, and the user can observe the last sampling data retained in the memory. Click the "Run/Stop" button in stop mode to make the oscilloscope enter the running state. "AUTO" indicates that the current trigger mode is automatic, and "Normal" indicates that the trigger mode is normal.



6.7 50%

The function of 50% in the oscilloscope is to return the waveform to the middle, including vertical offset, trigger position, and trigger level.



6.8 Single

Single trigger means that after pressing the button, the oscilloscope samples a frame of waveform and then stops. That is, only one frame of waveform is acquired per click. It is important to note that there must be a trigger for this sampling. If there is no trigger, the oscilloscope displays “wait” in the upper left corner of the oscilloscope. This sampling is not completed until there is a waveform trigger.

6.9 Screenshot

Click the "Save" button to capture the current screen.

6.10 View images

Long press the "Save" button to enter the Image View window. In this window, the user can delete or browse historical screenshots.

Click the "Run/Stop" button to delete the current screenshots.

Click the "ok" button to zoom in on the waveform. After zooming in, click "ok" to return to the homepage.

Click the "Save or Menu" button to return to the oscilloscope window.

6.11 Signal generator

Click the "F1" button to call up the window of the signal generator, The signal amplitude is 2.5V, the maximum frequency of the sine wave is 10M, and the other waves are 2M.

Click the "Run/Stop" button to turn on/off the signal generator output.

Click the "Single" button to reset the number to: 1.00Khz, 50%

Click the "mV" and "V" keys to switch the output waveform: sine wave, square wave, triangle wave, etc.

Click "Ok" or "F1" to confirm and exit.

Square wave and triangle wave can adjust the duty cycle, other waveforms do not work.

Note: When the set frequency is greater than 1MHz, the square wave signal may show small horizontal jitter. When the frequency of the sine wave is 10MHz, the waveform will be a little distorted and the amplitude will be attenuated a little.



6.12 Single/dual channel

Long press the "CH1CH2" button to turn on/off CH2. CH1 can only be turned on and cannot be turned off. When you do not need to use two channels at the same time, please turn off CH2 to obtain a higher sampling rate and reduce power consumption. When using dual channel mode, click the "CH1CH2" button to switch the priority of CH1 and CH2. If CH1 has a high priority (yellow circle 1), the waveform of CH1 is moved by the up and down buttons, and the CH2 channel needs to be moved by the "Power" + up and down buttons. If CH2 has a high priority, the reverse is true.

6.13 Connect to PC

The screenshot pictures can be exported to a computer via a USB connection.

Operation method: Click "Menu" button to open the menu, switch to the "Set" menu, and then long press the "ns" button. At this time, connect the computer through the USB cable, and the computer will appear a U disk, which stores the user-stored waveform pictures.

If you want to return to the oscilloscope window, you need to disconnect the USB, and then **restart the machine**.

Warning:

This U disk is only for exporting pictures, please do not copy other files from the computer to the U disk.

6.14 Cursor

Hold down the Power button and then click the "s" button to turn on/off the horizontal cursor.

Press and hold the Power button and then click the "ns" button to turn on/off the vertical cursor.

Press the left and right direction buttons directly to move the horizontal cursor 1

Press and hold the Power button and then press the horizontal direction buttons to move the horizontal cursor 2. The same goes for the vertical cursor.

For the vertical cursor, the value of Y1 means: the voltage of the dotted line above. The value of Y2 means: the voltage of the dotted line below. $dY=Y1-Y2$ is the voltage difference between the two dotted lines.

The voltage cursor can only measure one channel (high priority channel), pay attention to the color change in the upper left corner after switching the priority.

6.15 AV video single output

The 3.5mm headphone jack at the bottom can output AV video signal and can be connected to TV or projector. Open Menu->Set, then long press "Run/Stop" to enable.

7 Menu introduction

7.1 Channel

The channel menu includes two options, "Coupling" and "Probe".

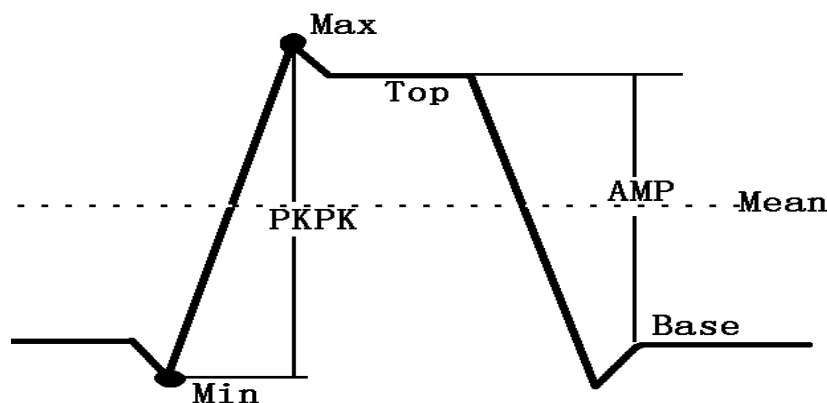
The coupling can be set "DC coupling" and "AC coupling". DC coupling passes the signal directly. AC coupling is equivalent to series connection with the capacitor.

Probes are available in "1X" / "10X" / "100X", this option corresponds to the oscilloscope probe. When the probe is switched to the 10X position, this option should be selected as "10X". The same goes for the 1X.

7.2 Measurement

There are 14 measurement options available, as shown below:

Frequency, Peak-to-Peak, Duty cycle, Amplitude, RMS, Average, Period, +Pulse width, -Pulse width, Max, Min, Top, Base, -Duty cycle.



The difference between peak-to-peak and amplitude(AMP) is shown in the figure above.

7.3 Trigger

There are four options in the trigger menu: "Trigger Mode", "Trigger Type", "Trigger level" and "Trigger source".

Trigger Mode can be selected from "Auto" and "Normal".

For "**Auto**" mode, if a waveform trigger is detected, the waveform will be used for triggering. At this time, the waveform can be displayed stably. If the oscilloscope cannot detect the trigger condition, it will automatically force the trigger to display the waveform, but because there is no suitable trigger condition, the waveform will not be displayed steadily.

For "**Normal**" mode, The oscilloscope will not refresh the display until there is a waveform trigger. Therefore, in this mode, the screen waveform may not refresh or there is no waveform. It is suitable for measuring discontinuous waveforms and

requires users to adjust the trigger level in advance.

Trigger type includes rising and falling edges. Rising edge trigger means that the waveform crosses the trigger level line upward, and a trigger condition occurs.

Trigger level include "automatic" and "manual".

"Auto" is suitable for trigger mode = auto, the oscilloscope detects the waveform in real time and automatically adjusts the trigger level.

"Manual" When the "single" is used or the trigger mode is "Normal", the "Manual" option should be used. Under this option, the trigger level can be manually adjusted by the user.

Trigger source indicates which channel's waveform is currently used for triggering. In the dual-channel mode, CH1 or CH2 can be selected. If the channel is used as the trigger source, its waveform can be stable. If the waveform frequencies of the two channels are different, the waveform of the other channel will be unstable.

7.4 Display

"Persistence" is to make the historical waveform remain on the screen for a while and then disappear. Optional persistence options are: None, 1s, Infinite. When Infinity is selected, the waveforms that have appeared on the screen will remain forever and will not disappear.

"roll" is to display the waveform while sampling. Only when the time base is greater than or equal to 200ms will the roll mode be entered. If roll is turned off, the waveform will be displayed after one screen is sampled, resulting in a long time before the screen is refreshed for large time base.

"XY" mode is a way that channel 1 is used as the X axis and channel 2 is displayed on the Y axis. It can be used to view Lissajous graphics etc.

In this menu, long press the run/stop button to turn on/off the high refresh rate.

7.5 Aux

There are two options of "Calibration" and "FFT" in the auxiliary menu.

When the probe is removed, if there is a significant deviation between the waveform position and the zero arrow position, it indicates that calibration is required.

Please remove the probe and USB cable before calibration, and then click the "OK" button. The oscilloscope then starts self-calibration. After completing the calibration, restart the oscilloscope.

(Unless you confirm that the oscilloscope does have a large zero offset, calibration is generally not recommended)

After the FFT option is turned on, it can perform FFT calculation on the screen waveform and display the waveform after FFT. FFT display mode can be selected as: "logarithmic", linear and "music" (music spectrum).

In this menu, long press the ↑ button to enter the overclocking mode (for measuring 100M-120M signal), and press ↓ to return to the normal mode.

7.6 Settings

1. In this menu, you can set whether to shut down automatically. If you choose to shut down automatically, the oscilloscope will automatically shut down 15 minutes after no button operation.
2. You can choose whether to turn on the sound.
3. Language selection: Chinese or English.
4. In this menu, long press the "ns" button to enter the usb connection state, long press "s" to change the background color of the measure.
5. In this menu, long press "Auto" to reset the oscilloscope settings (for beginners).
6. In this menu, long press "mV" to turn on/off the grid.

Parameters

Model	DSO2512G	Coupling	AC/DC
Channels	2	AUTO	Support
Screen size	2.8inch	Measurement	14 types
Resolution	320*240	Precision of V	$\pm 2\%$
Bandwidth	120M	XY mode	Support
Sampling rate	500M	Screenshot	Support
Rise time	<3ns	Frequency	$\pm 0.01\%$
Storage depth	128K	Single	Support
Impedance	1M Ω	FFT	Support
Time base	5ns – 10s	Wave out amp	2.5V \pm 0.05
Ver sensitivity	10mV/div-10V/div	Wave out freq	10MHz(sin) 2MHz(other)
Max voltae	$\pm 40V$ (x1) $\pm 400V$ (x10)	Shell size	width*hight* thickness 82 mm *137 mm *38mm
Trigger mode	Auto/Normal	Language	CN/EN
Trigger type	rise/fall	Charging	USB-5V 1A/2A/5A
Display mode	YT / Roll	Charge current	700mAh
Persistence	None/1s / ∞	Weight	286g

Q & A

0. I am a beginner, how do I reset the device to its initial state?

Answer: Open Menu->Set, and then long press the "Auto" button to reset.

1. What is the difference between probe 1X and 10X?

Answer: The 1X does not attenuate the signal, and the 10X attenuates the signal amplitude by 10 times. When the measuring voltage is higher than 40V, 10X is used. In addition, the bandwidth of 1X file can only reach about 5M. So generally we usually use 10X, and use 1X when the measured signal amplitude is less than a few hundred millivolts. Note: If the probe test lead is set to 10X, it must be set to 10X in the menu. 1X is the same. That is to keep the two consistent! !

2. When the timeBase is >50ms, the waveform refresh becomes slower?

Answer: The time base of 50ms means the time of "one grid". There are 12 grids in the horizontal direction. The time to perform one sampling= $50 \times 12 = 600\text{ms}$, so it is normal for the waveform refresh to be slow.

3. How to measure DC power voltage?

Answer: First, set the coupling to "DC", and adjust the probe to the 10X position (the oscilloscope menu should also be set to the same 10X as the probe). Connect the probe to the power output terminal, and then click the [Auto] key. Pay attention to the "Mean" value.

4. How to measure 220V mains?

Answer: First remove the USB cable (isolation), then adjust the probe to the 10X position, adjust the vertical sensitivity to 100V, and adjust the time base to 10ms, and then connect the probe to the neutral wire and the live wire (be careful!).

5. How to measure audio signal?

Answer: The coupling mode is set to "AC". The probe is set to the 10X position. The probe is connected to the audio output. The time base is adjusted to about 5-10ms, and the voltage sensitivity is adjusted to about 500mV (decided according to the volume).

6. How to measure main board communication signal or bus signal?

Answer: The probe is connected to the signal first. The coupling mode is set to DC, the probe is set to the X10 position (the menu should also be set to 10X), and then click the [Auto] button. If the correct waveform cannot be obtained, please manually click the [s]/[ns] button to adjust the time base.

7. How to measure power supply ripple?

Answer: Set the coupling mode to "AC" in the menu, and set the probe to the 1X position (the menu is also set to 1X). Adjust the time base to about 200us. First adjust the vertical sensitivity to 10mV. If the waveform exceeds the screen, click the [V] key to reduce it until all the ripples appear on the screen.